Semantic Web Fact Book

2005

[This is the preliminary edition of the FactBook. Full Semantic Web factbook will be published in late June 2006]

Table of Contents

Editorial

In our days I feel that for every technology-intensive evolution there are two different words that we must bring together. From the one hand the world of leading researchers, inspiring minds and excellent techno-people and from the other hand the world of people looking to feel the merit of the evolution in their life. While we are looking as citizens, businesses, society for services it is more than evident that the lifecycle for the technology adoption is directly related with the quality of knowledge that is disseminated in critical target groups.

In the Semantic Web evolution, we decided in AIS SIGSEMIS, to act as a (http://www.sigsemis.org) "Hub" for people from both worlds. We tried to bring together different disciplines and also to investigate the application of SW in specific contexts and industries.

This edition is just an effort to give some highlights on the Semantic Web Evolution in 2005. In one month the full edition of Semantic Web fact book will be available. We decided to post this limited edition available as the AIS SIGSEMIS Bulletin 3(1&2) 2006 and give the time to our group to formulate many more other submissions.

I have to say a great thank you to all the contributors, and to ask their understanding for the delay of the publication of the whole fact book [this will answer the question of many contributors why their submission is not available in this edition]. We are working very hard on this.

My greatest thank you to Tanja Sieber and Florian Brauch for their great support. They spend many hours and with their professionalism they developed this excellent quality edition.

I don't really have the time to author this short editorial. I think that in the full version of FactBook I will share with you my thoughts on Semantic Web Challenges for the next couple years. At the moment I feel that I have to share with you my personal vision. When we decided to establish AIS SIGSEMIS, we said that we will WORK and that we will try to make people GET INVOLVED. Semantic Web can not live in a close context of few 100s of people worldwide. We must open the SW to the society.

We do believe in OPEN EDITIONS, we do believe in the POWER OF THE COMMUNITY, and we have a vision. We want to make our OPEN RESEARCH SOCIETY, our new critical bet for the next years, a Non Government Organization promoting the vision for a better world based on knowledge and learning for all. We want you with us…

Dr. Miltiadis D. Lytras
AIS SIGSEMIS Leader

Introduction

Semantic Web - à la carte

Semantic Web - à la carte

Tanja Sieber and York Sure
University of Miskolc, University of Karlsruhe
Hungary, Germany
tanja.sieber@advan-ce.de, sure@aifb.uni-karlsruhe.de

Tanja Sieber, Hungary is a PhD student at the institute of information science at the University of Miskolc. Her research focuses on semantic technologies in combination with content management, engineering and processing. Besides, she is working as consultant and trainer in the field of technical documentation. She is lecturer at the Hochschule Karlsruhe - Wirtschaft und Technik, the Technische Akademie Esslingen, Germany and the University of Miskolc.

Dr. York Sure, Germany is an assistant professor at the Institute AIFB, University of Karlsruhe where he is lecturing master and bachelor courses in the areas of semantic web and computer science. His main research interests include semantic technologies and their application in industrial settings. He published over 60 papers on ontologies, semantic web and knowledge management. He is project leader for the AIFB in the EU integrated project SEKT and the EU network of excellence Knowledge Web where he is also appointed as research area manager. York is cofounder of the "Semantic Web Akademie" in Karlsruhe.

Abstract: For us one of the greatest pleasures in life is sharing good suggestions with other people. "Semantic Web - à la carte" aims to provide the very best virtual places in naturally combined atmosphere with modern and authentic webresources. All of our dishes are created artificially and selected carefully; these are seasonal and fresh and are the foundation of our cuisine.

Today's suggestion: Semantic Web Newcomer Pavillion.

SemWeb NC Pavilion

At SemWeb NC Pavilion, newcomers are not only accepted they are actively welcomed and have their own degustation menu with a choice of quality, freshly produced dishes. For that distinctive business luncheon or special dinner, the Pavilion takes you on the one side to the nowadays Web and on the other side forward to the Web of the 20s with its intelligence, privacy, and the very best of Semantic Web cuisine.

Cuisine
easy to digest

Menu
Appetizer
Creamy Cheese Layer
-- The Semantic Web Architecture

You will be served an image of the so-called semantic web architecture. You will find this layer-based architecture in several different contexts, when looking for more details on semantic web. The recipe for this phantastic cake: Combine Unicode, XML and RDF; beat well;add OWL and logic; mix well. Fold in whipped rules. Spread mixture over the cooled cream cheese layer. Chill well. You can add it just before serving. Cut into squares.

Served at:
W3C Talks 2000[1]

You pay:
1 minute of attention

Fish
Catch of the Day
-- The Semantic Web Vision
This dish is offered as either an intermediate course or a main course. You will be served an article of Tim Berners-Lee, James Handler and Ora Lassila about the new form of web content that will be meaningful for computers. The article is written in a narrative and easy-to-understand style and is an excellent first step for you to get common with the ideas of the semantic web.

Served at:
Scientific American .com[2]

You pay:
10 minutes of attention

Dessert
Warm German Apple Pie
-- A Visionary Application Scenario: SmartWeb

The menu culminates with a tasty, warm, german apple pie. You will be served an online video illustrating in an intuitive and easy-to-understand way how various technologies smartly interact in a fascinating and challenging scenario: the world soccer championship 2006, located in Germany. The dessert brings together ingredients from the areas mobile services, intelligent user interfaces, language and speech technology, information extraction and semantic web technologies.

Served at:
SmartWeb Platform[3]

You pay:
20 minutes of attention

[1] http://www.w3.org/2000/Talks/1206-xml2k-tbl/slide10-0.html
[2] http://www.scientificamerican.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21&catID=2
[3] http://www.smartweb-project.de/eng/SmartWeb_FlashDemo_eng_v09.exe

Country and Company Reports

SW@China
SW@Ukraine
SW@Spain
Poznan Report
SemDis Report
ISKP Group Report
BNN Technologies Report

SW@China

Gong Cheng and Han Xu

Gong Cheng is an undergraduate student in Department of Computer Science and Engineering at Southeast University in China. He will start his PhD program in September, 2006. His research focuses on SW, and currently on ontology matching and ontology partitioning. He has participated in K-CAP 2005 Workshop on Integrating Ontologies with his presentation and co-developed tool. His co-authored paper on ontology matching is to appear at the Semantic Web track of WWW 2006.

Han Xu, China is currently in charge of W3C-CHINA.ORG, an open organization dedicated to promoting the widespread deployment of W3C technologies in China. He received M.S. in Computer Software from Southeast University in 2005 and B.S from Nanjing University in 2001. His interests include Web Services, SOA and Semantic Web.

■ *Since Tim Berners-Lee outlined his vision for SW in a keynote session at XML 2000, a large number of researchers have gradually devoted themselves to this new area from all over the world, including People's Republic of China. While we Chinese researchers know much about the research in the Occident, many colleagues overseas know little about the status in China. Thus we consider that it is necessary to introduce the situation of SW research in our country to the entire world systemically.*

During the past five years, thousands of researchers from over 100 institutions in China have contributed their intelligence and wisdom to SW research. Although the upsurge in China started up a little later than in the Occident, our domestic colleagues have tried their best and close followed this onrushing flow. Especially since 2003, with the strong support from Chinese government, a few achievements on SW research from our country have appeared through some well-known international conferences and journals such as International Semantic Web Conference (ISWC), International World Wide Web Conference (WWW) and Journal of Web Semantics. Many international friends have got to know SW research in China and some of them have started to cooperate with us in research and development. Currently, in several major conferences and journals on SW or more general topics, it is common to see papers and researchers from China. SW research in China has become one of the forces that should not to be ignored in SW community.

However, SW is still relatively a new concept in China in general. Although the academic circle has showed a great interest, the industrial circle in China seems having not recognized its value. Except for a few companies, SW is still not widely adopted in China. Nevertheless, accompanied with the great development of Chinese SW education, it is possible that SW technologies would enter the lives of the common people in China one day.

Nanjing, China, 17.02.2006

1. SW Research in China

The hotspots of SW research always sparkle in the Occident, i.e., in Europe and America. Meanwhile, in China, many researchers close follow this trend and contribute their intelligence and wisdom to SW research, and most of them are keen on communicating with foreign colleagues for sharing achievements and gladness. According to our two-month investigation, almost each of the major Chinese universities holds one or more research groups on SW, so it is difficult to obtain the exact number of researchers. In Fig. 1, we show the major cities in China where some universities and institutions focusing on SW research are located.

Frankly speaking, lots of papers published in Chinese domestic journals primarily focus on the basic concepts of SW. But recently, being greatly supported by Chinese government, many profound papers and projects gradually appear from several institutions. As major contributors, some institutions are remarkable and somewhat known to international friends such as Shanghai Jiaotong University (in Shanghai), Institute of Computing Technology of Chinese Academy of Sciences (ICT of CAS, in Beijing), Southeast University (in Nanjing), Tsinghua University (in Beijing), Peking University (in Beijing), Fudan University (in Shanghai), Zhejiang University (in Hangzhou) and Renmin University of China (in Beijing).

On the other hand, the market demand for SW technologies seems very trivial in China. It is mainly because most companies in China know very little about what the Semantic Web is and what the Semantic Web can benefit. So Chinese SW industry is still in the cradle.

In the following sections, we will describe the contributions of Chinese SW researchers and the support from Chinese government. We will also introduce SW education and industry in China in detail.

Fig. 1. The geography distribution of SW researchers in China

2. Contributions of Chinese Semantic Web Researchers

As one of the conferences of the greatest influence in SW community, International Semantic Web Conference (ISWC) is considered one of the most important conferences for researchers. Since 2003, there is always one paper from Shanghai Jiaotong University appearing in each proceedings of ISWC. Further more, at least five papers have been presented in the workshops at ISWC, most of which come from Southeast University.

International World Wide Web Conference (WWW) is another important place to present works for SW researchers. However, only two papers from Chinese institutions have appeared in the proceedings of WWW on SW research, one from The Hong Kong University of Science and Technology at WWW 2003, and the other from Shanghai Jiaotong University at WWW 2005. Besides, over fifteen poster and workshop papers have been presented, most of which come from ICT of CAS, Tsinghua University, Southeast University, and some institutions in Taiwan. In addition, one paper on ontology matching from Southeast University is to appear at WWW 2006.

Besides at ISWC and WWW, ICT of CAS and Peking University have introduced their researches at Semantic Web and Databases (SWDB); Academia Sinica in Taiwan presented their works on domain ontology and query answering at International Joint Conference on Artificial Intelligence (IJCAI) Workshop on Information Integration on the Web in 2003; Southeast University participated in the International Conference on Knowledge Capture (K-CAP) Workshop on Integrating Ontologies with their tool for ontology matching in 2005. However, at International Workshop on Description Logics (DL), International Conference on Principles of Knowledge Representation and Reasoning (KR) and other famous conferences, it is infrequently to find papers from Chinese institutions.

Many Chinese researchers prefer to submit papers to journals rather than conferences. Both Southeast University and Tsinghua University have published papers in Journal of Web Semantics. And in three major journals on computer science in China, i.e., Chinese Journal of Computers, Journal of Software and Journal of Computer Research and Development, and some other important general journals, e.g., Chinese Journal of Electronics and Science in China, nearly twenty papers on SW research have been published, most of which come from Fudan University, Zhejiang University and so on. These papers mainly focus on the ontology-based search, Semantic Web Services and ontology query language. However, in contrast to other areas within computer science, the achievements of SW research in China are still small.

Meanwhile, a few books on SW have appeared lately in China. A First Step Towards the Semantic Web published by the Higher Education Press is one of the best representatives. Nevertheless, books on SW are still rare in bookstores in China. Thus many volunteers in W3CHINA.ORG, which is the most famous website promoting the widespread deployment of W3C technologies in China, spontaneously persist in translating foreign tutorials into Chinese for rookies.

3. Government Support for Research Programs on SW

Chinese government encourages and supports the research and development on SW. Many programs are approved and organized to gather strong expertise to launch innovation studies of major scientific issues, e.g., The National Natural Science Foundation of China (NSFC) and The National Basic Research Program (also called the 973 Program). In recent years, lots of researches and projects have been financed by these programs.

NSFC directs, coordinates and financially supports basic research and applied basic research, identifies and fosters scientific talents, promotes science and technology, and pushes ahead economic and social development in China. Since 2000, at least 40 NSFC Programs have been started on SW research in over 30 institutions. Most of these programs focus on the basic research on SW, or the related areas utilizing SW technologies.
A 973 Program titled "Fundamental

Theory, Model and Method on Semantic Grid" was started in 2003. This research endeavors to explore and develop fundamental theory, model, method and key technologies on Semantic Grid. This team aims at developing a series of theories and methods on multi-level semantic interconnection, intelligent clustering, and intelligent interconnection environment and tools for effective sharing and managing network resources, and applying to economy, culture, education, medicine, public services domains in order to realize effective use of information and knowledge resources among different domains.

Besides NSFC and the 973 Program, there are also many other programs supporting the research on SW in China. Chinese researchers obtain a great support and good scientific environment, which promotes the remarkable development of SW research in China.

4. Semantic Web Education in China

Accompanied with the great development of SW research in China, many researchers especially those professors in universities have started to set up some courses on SW for postgraduates and senior undergraduates. Peking University seems to be one of the earliest universities that set up the courses on SW in 2002 as a short-term course in the summer vacation. Other universities such as Southeast University also set up some seminars later. However, SW education is just launched recently. Many PhD students still have to study SW through Internet by themselves.

Online discussion is an important approach for students to study. The SW board of W3CHINA Web forum has attracted more than 5,100 registered members from at least 100 institutions since its establishment in October, 2003. In the past two years, nearly 2,000 topics have appeared in this board to talk about SW technologies, covering from the basic concepts of SW to the latest technologies.

Meanwhile, the number of theses on SW increases steeply, as depicted in Fig. 2. However, it is noticeable that more than 80% of the theses focus on utilizing ontologies or other SW technologies on related areas, e.g., information retrieval, electronic commerce, agriculture and biomedicine, while less than 20% of them focus on the fundamental theories.

5. Semantic Web Industry in China

Chinese SW industry is very immature. It is not easy to find out companies that have greatly invested in the research and development of SW technologies with the exception of the following.

IBM China Research Lab is a notable star in this field in China. Their Integrated Ontology Development Toolkit (IODT) is a joint project with Shanghai Jiaotong University. At the core of IODT is the EODM (EMF Ontology Definition Metamodel) model, which is derived from the ODM and implemented in EMF. The EODM parser supports RDF/XML syntax input/output. The EODM RDFS/OWL inference engines support RDFS entailment and a subset of OWL DL language. The toolkit aims at supporting ontology-driven development.

Besides, only a few domestic Chinese companies have showed their interests in SW. One of such companies is JustEP, which is famous for its Business Infrastructure Platform. The company aims at applying SW technologies to the development of Enterprise Information Systems and ultimately producing Semantic Information Systems. As they described, in their next line of product, OWL would be used to describe enterprise ontology, certain rule language would be used in rule description, and the Semantic Web Services would be used when describing enterprise business services.

Chinese SW industry is very expectant because of the huge market. Actually, more and more companies are preparing for entering this area.

6. Local Events on SW in China

Up to the completion of this article, there has not been any specific conference on SW in China. However, some general conferences often hold related sessions such as Asia Pacific Web Conference (APWeb) and International Conference on Web-Age Information Management (WAIM), which are both familiar to Chinese researchers.

In 2006, there will be many important regional conferences to be held

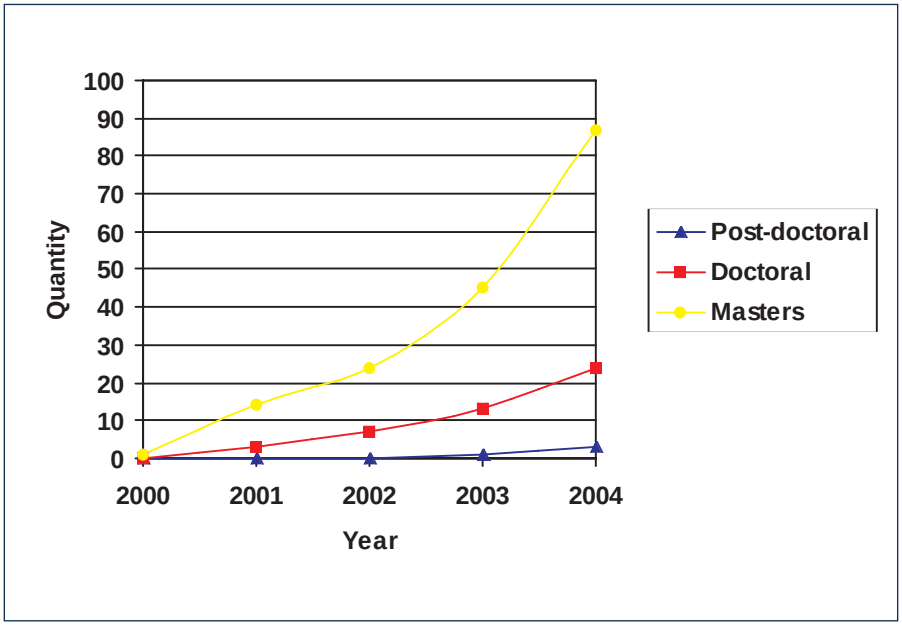


Fig. 2. The steep increase in quantity of theses on SW research in China. The data are supported by the database of Dissertations of China of WANFANG DATA, which is available at http://www.wanfangdata.com.

in China. The 1st Asian Semantic Web Conference (ASWC) will be held in Beijing in September, 2006. The 2006 Workshop on Semantic Web and Ontology (SWON) of China will be held in Nanjing in October, 2006. It is foreseeable that the coming year would be a great milestone in the history of SW research in China, and Chinese researchers would exhibit much more passion for this area.

Acknowledgements
The first author of this work is supported by the Natural Science Foundation of Jiangsu Province, China, under Grant BK2003001. We would like to thank Professor Yuzhong Qu from Southeast University for his valuable comments. We would also like to thank Dr. Shengping Liu from IBM China Research Laboratory and PhD student Peng Wang from Southeast University for their assistance in providing useful information.

Internet Reference Points

1. Apex Data & Knowledge Management Lab (at Shanghai Jiaotong University), http://apex.sjtu.edu.cn/, [17.02.2006]
2. China Knowledge Grid Research Group (at ICT of CAS), http://kg.ict.ac.cn/, [17.02.2006]
3. Cooperative Information and Systems Laboratory (at Fudan University), http://www.cit.fudan.edu.cn/CIS/, [27.01.2006]
4. Database and Information System Group of Peking University, http://db.cs.pku.edu.cn/, [17.02.2006]
5. DB & IIR Laboratory of Renmin University of China, http://202.112.113.162/index.jsp, [17.02.2006]
6. IBM China Research Lab, http://www-900.ibm.com/cn/ibm/crl/, [17.02.2006]
7. Intelligent Information Processing Laboratory (at Fudan University), http://www.iipl.fudan.edu.cn/, [17.02.2006]
8. Intelligence Science Lab (at ICT of CAS), http://www.intsci.ac.cn/, [17.02.2006]
9. Justep, http://www.justep.com/, [17.02.2006]
10. The Ubiquitous Computing Lab (at Peking University), http://www.uclab.org/, [10.12.2005]
11. Tsinghua University Knowledge Engineering Group, http://keg.cs.tsinghua.edu.cn/, [17.02.2006]
12. W3CHINA, http://www.w3china.org/, [17.02.2006]
13. XObjects Group (at Southeast University), http://xobjects.seu.edu.cn/, [17.02.2006]

SW@Ukraine

Vadim Ermolayev, Vagan Terziyan and Helen Kaykova

Vadim Ermolayev is the faculty member in the Department of IT at Zaporizhzhia National University (ZNU). He is the lead of the Intelligent Systems Research Group at ZNU and the independent research consultant for Cadence Design Systems, GmbH. His research focuses on the confluence of the Semantic Web, Semantic Web Services and agent technologies in knowledge management, distributed information retrieval, business process management, eBusiness. He is the (co-) author of more than 60 publications in these areas.

Vagan Terziyan, Ukraine is the Professor and the Head of Artificial Intelligence (AI) Department at Kharkov National University of Radioelectronics (KNURE). While on leave he is the Scientific Leader of Industrial Ontologies group and SmartResource Tekes Project at the University of Jyvaskyla (Finland). His profile is the design of distributed, intelligent and context-aware (adaptive) Web applications and services targeted to the needs of industry, which utilize the emerging Knowledge-, Agent-, Machine-Learning- and Semantic Web- based technologies and tools. He is the (co-) author of more than 100 publications.

Helena Kaykova, Ukraine is the Associate Professor and the Vice-Head on International Cooperation at the AI Department at KNURE. She is also the Director of Metaintelligence Laboratory and is leading the European

Curricula Development group at the AI Department. While on leave from KNURE she is conducting research and international networking in the frame of Smart Resourse project at the University of Jyvaskyla, Finland. She is the (co-) author of more then 20 publications.

■ *Executive Summary: The research in the Semantic Web domain in Ukraine is not established well enough so far if examined at the Nation-wide scale. However, some "springs" find their way to the surface of the maturity. 2005 was the year of more intensive uptakes in the area both in fundamental and applied research. The report outlines the whole picture and focuses on the presentation of the Ukrainian research groups which have already received international recognition by collaborating in the international projects, organizing international events in the Semantic Web area, publishing and presenting their results in international scientific journals and at the top conferences. The common feature of the presented teams is that their main emphasis in 2005 is the focus on the research and development in the uptakes funded by the European industrial sponsors. The main objective of the Industrial Ontologies Group at KNURE and Jyvaskyla University is to contribute to the faster adoption of the Semantic Web and the related technologies to local and global industries. It implies the research and development aimed to architect a Global Understanding Environment as the next generation of Web-based platforms by making heterogeneous industrial resources (files, documents, services, devices, business processes, systems, organizations, human experts, etc.) web-accessible, proactive and cooperative in a sense that they will be able to perform intelligent activities in an automated fashion. The focus of the Intelligent Systems Research Group at ZNU is the synergy of the Semantic Web, the Semantic Web Services, agent-based approaches and grids. This synergetic approach in 2005 has been successfully applied in the PSI project funded by Cadence Design Systems, GmbH. Though the government of Ukraine does not distinguish the Semantic Web research among the other important fields it pays substantial attention to it. Several actions of the Ministry of Education and Science of Ukraine and the leading research centers have been undertaken in 2005 to stimulate Semantic Web related research and development, to attract the attention of the local industry. The following two initiatives initiated and supervised by the Ministry may be mentioned: The launch of the Semantic Portal project for the Nation-wide network of Universities and Research Centers and the creation of the Working Group for the development of the Ukrainian Infrastructure for the Electronic Data Interchange among the Academic institutions of the country.*

Zaporizhzhia, Kharkov, 15.03.2006

1. Semantic Web Research in Ukraine

The research in the Semantic Web domain in Ukraine is not established well enough so far if examined at the Nation-wide scale. The major reason is the lack of the state and the international support of Science in general and the Computer Science and Engineering in particular. However, as one may see from the map in Fig. 1, some "springs" find their way to the surface of the maturity. 2005 was the year of more intensive uptakes in the area both in fundamental and applied research.

Two Ukrainian research groups have international recognition: the Industrial Ontologies Research Group (IOG) at the Department of AI of Kharkov National University of Radioelectronics led by Vagan Terziyan and the Intelligent Systems Research Group (ISRG) at the Department of IT of Zaporizhzhia National University led by Vadim Ermolayev. In addition to them several other research teams from The Institute of Software Systems of the National Academy of Sciences of Ukraine (Prof. Andon), Kherson State University (Prof. Spivakovskiy), Kharkov Karazin National University (Prof. Zholtkevych), Ternopil National Academy of Economy (Prof. Sachenko) have reported on their research and international cooperation in the Semantic Web related fields.

IOG was the most active in 2005 judging by the number of projects, funding raised, research contributions and cooperation nodes both in Ukraine and abroad. The activities of the group were substantially influenced by their industrial collaboration with the constellation of Finnish enterprises and organizations which resulted in the launch and the continuation of several research and R&D projects.
InBCT project (http://www.cs.jyu.fi/ai/OntoGroup/SemanticFacilitator.htm) resulted in the development of the semantic facilitator called the "Semantic Google" for Web Information Retrieval. Idea Mentoring I-II projects (http://www.cs.jyu.fi/ai/OntoGroup/IdeaMentoring1.htm) funded by Nokia and JSP studied the emerging applications for mobile phones based on Semantic Web technology. SCOMA ("Scientific Computing and Optimization in Multidisciplinary Applications") project (http://www.cs.jyu.fi/ai/OntoGroup/scoma.htm) funded by Tekes and Industrial partners developed the prototype of the Semantic Web portal that provides advanced publishing, sharing, and reuse of the mathematical tools, the expertise and the knowledge distributed among the heterogeneous SCOMA parties. SmartResource Tekes project continued the research and development of the large-scale environment for integration of industrial smart-devices, Web Services and human experts based on the Semantic Web, Peer-to-Peer and Agent technologies. The objective of the ASG project (Adaptive Services Grid, (http://asg-platform.org/cgi-bin/twiki/view/Public) is the development of an open platform for adaptive services, discovery, creation, composition, and enactment and the development of an open platform for the European telecommunication industry to faster the roll out of new services and new products. From a business point of view ASG aims to make processes and services more effective and efficient by using semantic information to reply to the user requests, by enabling services provisioning with service components from different platforms and suppliers, by enabling dynamic adaptive service composition and by providing high scalable platform using grid technologies. The approach used in this project is very close to that of the ISRG in RACING and UnIT-Net projects. In Ukraine the IOG took the scientific lead in the launch of the National Semantic Portal for the Network of all Ukrainian Universities and the Ministry of Education and Science of Ukraine (MONU). In 2005 the IOG continued to develop and extend its collaboration with the European nodes of the Semantic Web community: Vrije University of Amsterdam, Tampere University of Technology, Vaasa University and many others. In 2005 the members of the group organized the 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web (Jyvaskyla, 25-28 August, 2005,[1]).

The research and development activities of the ISRG in 2005 were focused to one National and two International projects. The RACING project (http://www.zsu.zp.ua/racing/) funded by the MONU was accomplished in 2005 and resulted in the development of the research prototype of the intelligent distributed information retrieval software based on software agents, Semantic Web Services and OWL ontologies for information resource description. The research activities in frame of the UnIT-Net project (http://www.unit-net.org.ua/) funded by the ETF (TEMPUS/TACIS) resulted in the development of the research prototype of the National Infrastructure for the Electronic Data Interchange (IEDI) comprising Semantic Web based

Fig. 1. The distribution of the research groups focusing on the Semantic Web research in Ukraine.

[1] http://www.cs.jyu.fi/ai/OntoGroup/IASW-2005/index.html

components and tools for processing semantic queries to the grid of the information resources of Ukrainian Universities. UnIT-Net project has been run in cooperation with the four Ukrainian teams from Kharkiv Karazin University, Kherson State University, Zaporizhzhia Humanitarian University, and the MONU. This collaboration also involved the active participation of the teams from the University of Nice - Sofia Antipolis and the Glasgow Caledonian University. One of the results of this activity was the establishment of the IEDI Working Group at the National scale. The research and development of the ISRG team in the industrial PSI project (http://ermolayev.com/ISRG/ISRG-projects-PSI.htm) funded by Cadence Design Systems, GmbH in 2005 focused on the development of the PSI family of OWL ontologies which are used in modeling and simulation of Dynamic Engineering Design Processes (DEDP). In PSI the ISRG collaborates with Cadence Design System, GmbH, Saint-Petersburg Institute of Informatics of the Russian Academy of Sciences, Czech Technical University, Certicon Corp.

The Semantic Web related research of the Ternopil node is led by Prof. Anatoliy Sachenko and Dr. Roman Pasichnyk from the Institute of Computer Information Technologies, Ternopil National Academy of Economy[1]. They cooperate with the researchers from the State University of New York (USA). Their focus in 2005 was in the study of Web Ontologies. The related ongoing research project funded by the Ukrainian Government is the "Development of Knowledge Base Architecture and Knowledge Discovery Methods for Intelligent Information Systems in Economy". The results will be used as the practical testing ground for the development of business oriented Web based knowledge resources, using recently developed ontology languages like OWL (http://web.njit.edu/~kh8/project/).

2. Contributions of Ukrainian Semantic Web Researchers

The main objective of the IOG is to contribute to the faster adoption of the Semantic Web and the related technologies to local and global industries. It implies the research and development aimed to architect a Global Understanding Environment (GUN) as the next generation of Web-based platforms by making heterogeneous industrial resources (files, documents, services, devices, business processes, systems, organizations, human experts, etc.) web-accessible, proactive and cooperative in a sense that they will be able to perform intelligent activities in an automated fashion. This intelligent capabilities comprise behavior planning, the monitoring and the correction of their own state, communication and negotiation with their peers as prescribed by their roles in a business process, utilization of the remote experts, Semantic Web Services, software agents, and various Web applications [4, 5]. Attacking this challenge in 2005 the IOG contributed by the development of the General Proactivity Framework (GPF). GPF is a means to describe the individual behaviors of the "smart" resources. It comprises the Resource Goal/Behavior Description Framework (RgbDF), the corresponding RgbDF-based domain ontology, the RgbDF engine and the family of the "Semantic Behavior Adapters" to transform the data from the variety of the existing behavior specification languages and formats to RgbDF and bakkwards [2, 3].

The focus of the ISRG is the synergy of the Semantic Web, the Semantic Web Services, agent-based approaches and grids. Group's contributions in 2005 were in the development, the adoption, the application of the Semantic Web frameworks and technologies in Distributed Information Retrieval and Engineering Design Process Management.

The main accomplishment of the ISRG in the agent-based information retrieval was the development of the formal framework to shape out agent negotiation strategies in meaning negotiations [6]. The framework is based on the Type Theory and uses presuppositions and propositional substitutions as the formal means to concede on the meaning of concepts. Several similarity measures are used to measure how close a concept in a certain context in the domain theory of the one party is close to the concept in the domain theory of the other party. The framework also employs the degree of the reputation of a party to adjust the ratio of its concession.

The activities of the group in the IEDI WG resulted in the prototyping of the intelligent mediator for querying distributed heterogeneous information resources annotated with OWL ontologies. The software is based on the mediator-wrapper architecture with the centralized mediator exploiting the common Mediator Domain Ontology (MDO). Information resource ontologies are mapped to the MDO in a semi-automatic way. However the queries in the terms of the MDO are processed totally automatically. Query processing comprises the steps of query formulation, query decomposition, partial query processing by resource wrappers, query results delivery. IEDI resource wrappers are implemented as the Web Services enhanced by semantic processing capabilities. The prototype also comprises the user-friendly graphical query formulation engine which uses the hyperbolic interface for ontology representation [7].
In DEDP managment the activities of the group were focused on the development of the family of OWL ontologies as the description suite for representing different facets of an engineering design process in its dynamics [8]. PSI modeling approach

[2] http://www.tanet.edu.te.ua/index_en.php

assumes that a design process is a weakly defined problem solving workflow comprising a Design Artifact (the object and the goal), an Actor (the subject) who may enter or leave a Design Team, a Software Tool (a means), an Activity and a Task (the configuration of actions).

3. Government Actions in Support of the Semantic Web Research Programs

The government of Ukraine does not distinguish the Semantic Web research among the other important fields. There is not a special subprogram or a special line for funding the Semantic Web related activities in the State Research Funding Program for 2004-2006. However, some projects were funded by the sub-program for the 'Novel Computer-based Means and Technologies for the Informatisation of the Society'.

The main funding sources for the currently performed projects of the Ukrainian Semantic Web researchers are the European frameworks and the industrial and the governmental sponsors abroad. It should be mentioned that the Ukrainian companies are still passive in initiating and conducting the R&D related to the Semantic Web. Some actions of the MONU and the leading research centers have been undertaken in 2005 to wake the industrial partners up.

At the fall of the 2005 the MONU hold the meeting of its top officials and several National experts in the Semantic Web area. The objective was to analyze the applicability of the SW Technologies to the management of Ukrainian Universities. The meeting resulted in the launch of the new initiative - the development of the National Semantic Portal for the Network of all Ukrainian Universities and Ministry of Education and Science. At the moment the project is funded by the MONU. The Vice-Minister Mikhailo Stepko supervises the project on behalf of the MONU. Kharkov National University of Radioelectronics is the main contractor with Prof. Vagan Terziyan as Principal Scientist and Prof., Vice-Rector Natalie Lesna as the project manager.

In 2005 the financial and planning division of the MONU also took part as the use case partner in the UnIT-Net project. The team led by Svitlana Danilenko provided their domain expertise for the design of the Information Resource ontologies for the IEDI.

4. Semantic Web Education in Ukraine

The Department of AI at KNURE is the first and only one in Ukraine offering a full 4+1 Master Degree Program in the area of the Semantic Web under the umbrella of Intelligent Decision Support Systems curriculum. The Semantic Web related part of the curriculum was developed and introduced in cooperation with the Artificial Intelligence Department of the Vrije University of Amsterdam and in line with the IEEE/ACM Computing Curricula recommendations. In particular, Semantic Web studies comprise the courses on 'Knowledge and Ontology Engineering', 'The Semantic Web', 'The Semantic Web Services', 'Intelligent Agents and Applications', 'Internet Technologies'.

The critically important part of the studies is the System Development Project organized in cooperation with the local and the European industrial and research partners. The Master Program also includes 1 to 4 semesters of studies abroad at one of the KNURE's partner - universities in Amsterdam, Jyvaskyla, Vaasa, Cergy (France), or Houston. Students are strongly encouraged and logistically supported to participate in European Summer Schools whenever the subjects are related to the Semantic Web, Ontologies, or Intelligent Agents. In addition to the Master Program AI Department offers the PhD studies in the Semantic Web and Ontologies. The first PhD research on Educational Ontologies was accomplished and publicly defended at the fall of 2005.

In 2005 AI Department staff members also gave the Semantic Web related courses in the Netherlands and in Finland (http://www.cs.jyu.fi/ai/vagan/courses.html).

The department of IT at Zaporozhye National University also offers several courses as the part of the Master curricula in Applied Mathematics and Informatics. In 2005 the following Semantic Web related courses were given by the members if ISRG: 'Knowledge Bases and Expert Systems', 'Ontology Engineering'. The course on 'Agent Technologies on the Semantic Web (http://ermolayev.com/ASW/)' was offered as the part of the program of the 15th Jyvaskyla Summer School. The members of ISRG also give tutorials at the international events. In 2005 a tutorial [9] has been taught at the 24th International Conference on Conceptual Modeling.

Internet Reference Points

[in this section provide urls of key SW reference points in [country]. Use Title, URL, Last Access date e.g.

1. Industrial Ontologies RG, Dept of AI, KhNURE, http://www.cs.jyu.fi/ai/ and http://ii.kture.kharkov.ua/index.html [21.01.2006]
2. Intelligent Systems RG, Dept of IT, ZNU, http://ermolayev.com/ISRG/ [10.03.2006]
3. UnIT-Net IEDI WG, http://unit-net.org.ua/Default.aspx?page=4&lng=2 [18.02.2006]
4. Ternopil …
5. The Ministry of Education and Science of Ukraine http://www.mon.gov.ua/ [10.03.2006]
6. SmartResource project: http://www.cs.jyu.fi/ai/OntoGroup/SmartResource_details.htm [13.03.2006]
7. ASG project http://asg-platform.org/cgi-bin/twiki/view/Public [13.03.2006]
8. SCOMA project http://www.cs.jyu.fi/ai/OntoGroup/scoma.htm [13.03.2006]
9. InBCT project http://www.cs.jyu.fi/ai/OntoGroup/SemanticFacilitator.htm [13.03.2006]
10. IdeaMentoring-I (Nokia) Project http://www.cs.jyu.fi/ai/OntoGroup/IdeaMentoring1.htm [13.03.2006]
11. IdeaMentoring-II (Nokia) Project http://www.cs.jyu.fi/ai/OntoGroup/IdeaMentoring2.htm [13.03.2006]
12. RACING project http://www.zsu.zp.ua/racing/ [10.03.2006]
13. UnIT-Net project http://www.unit-net.org.ua/ [10.03.2006]
14. 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web, Jyvaskyla, 25-28 August, 2005, http://www.cs.jyu.fi/ai/OntoGroup/IASW-2005/index.html [10.03.2006]
15. Agents on the Semantic Web. The course web site: http://ermolayev. com/asw/ [10.03.2006]

References

1. Bramer M., Terziyan V. (eds), Industrial Applications of Semantic Web, Proceedings of the 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web, Springer IFIP, Vol.188, 2005, ISBN: 0-387-28568-7, 340 pp.
2. Kaykova, O., Khriyenko, O., Naumenko, A., Terziyan, V. & Zharko, A., RSCDF: A Dynamic and Context-Sensitive Metadata Description Framework for Industrial Resources, http://www.cs.jyu.fi/ai/RSCDF-2005.doc, Eastern-European Journal of Enterprise Technologies, 3(2), 2005, 55-78.
3. Kaykova, O., Khriyenko, O., Terziyan, V. & Zharko, A., RGBDF: Resource Goal and Behaviour Description Framework, In: M. Bramer and V. Terziyan (Eds.): Industrial Applications of Semantic Web, Proceedings of the 1-st International IFIP/WG12.5 Working Conference IASW-2005 , August 25-27, 2005, Jyvaskyla, Finland, Springer, IFIP, 83-99.
4. Terziyan, V., Semantic Web Services for Smart Devices Based on Mobile Agents, International Journal of Intelligent Information Technologies, Idea Group, 1(2), 2005, 43-55.
5. Terziyan, V., Semantic Web Services for Smart Devices in a "Global Understanding Environment", In: R. Meersman and Z. Tari (eds.), On the Move to Meaningful Internet Systems 2003: OTM 2003 Workshops, Springer-Verlag, LNCS, 2889, 279-291.
6. Ermolayev,V., Keberle, N., Matzke, W.-E., Vladimirov, V.: A Strategy for Automated Meaning Negotiation in Distributed Information Retrieval. In: Y. Gil et al. (Eds.): ISWC 2005 Proc. 4th Int. Semantic Web Conference (ISWC'05; http://iswc2005.semanticweb.org/), 6-10 November, Galway, Ireland, LNCS 3729, pp. 201 - 215, 2005
7. Keberle, N., Ermolayev, V., Vladimirov, V., Dzhurinsky, E.: Visual Semantic Query Formulation and Execution in UnIT-NET IEDI. "Mathematical Modeling, IT, Automated Control Systems" series of the Herald of Kharkov National University, Vol. 703, 2005, 95-108
8. Ermolayev, V., Jentzsch, E., Karsayev, O., Keberle, N., Matzke, W.-E., Samoylov, V.: Modeling Dynamic Engineering Design Processes in PSI. In: J. Akoka et al. (Eds.): ER Workshops 2005, Proc. Seventh International Bi-Conference Workshop on Agent-Oriented Information Systems (AOIS-2005; http://www.aois.org/), Klagenfurt, Austria, October 24-28, Springer LNCS 3770, pp. 119 - 130, 2005
9. Ermolayev, V., Gorodetski, V., Jentzsch, E., Matzke, W.-E.: Modeling and Simulation of Dynamic Engineering Design Processes. In: J. Akoka et al. (Eds.): ER Workshops 2005, Klagenfurt, Austria, October 24-28, Springer LNCS 3770, pp. 470 - 472, 2005

SW@Spain

Oscar Corcho, Asunción Gómez-Pérez, Richard Benjamins, Mariano Fernández-López, José Angel Ramos-Gargantilla and Jesús Contreras

Dr. Oscar Corcho, United Kingdom is a Marie Curie fellow at the University of Manchester. His research activities include the Semantic Grid, the Semantic Web and ontology engineering, including ontology languages and tools, and the ontology translation. He has published the books "Ontological Engineering" and "A layered declarative approach to ontology translation with knowledge preservation", and over 30 journal and conference/workshop papers in these area**s**

Dr. Asunción Gómez-Pérez, Spain is the Director of the Ontological Engineering Group at Universidad Politécnica de Madrid. Her current research activities include, among others: Interoperability between different kinds of ontology development tools, Methodologies and tools for building and merging ontologies, Ontological Reengineering, Ontology Evaluation and Ontology Evolution, as well as Uses of ontologies in applications related with Semantic Web, e-commerce and Knowledge Management.

Dr Richard Benjamins, Spain is Director of Innovation and R&D at Intelligent Software Components(iSOCO) in Madrid. He has published over 100 scientific articles in books, journals and proceedings, covering areas such as knowledge technologies, artificial intelligence, human-computer studies, knowledge management, Semantic Web and ontologies.

Dr. Mariano Fernández-López, Spain is director of the Department of Software and Knowledge Engineering at the Technical School of Universidad San Pablo CEU, and he belongs to the Ontological Engineering Group at Universidad Politécnica de Madrid. His current research activities include, among others: methodologies for ontology development, ontological foundations and ontology mappings.

MSc. José Angel Ramos Gargantilla, Spain, is a PhD student in the Ontological Engineering Group (OEG) at UPM. His research interest is in Ontology Merging and Mapping. He participates in the projects OntoWeb, Knowledge Web, and Infraestructura tecnológica de servicios semánticos para la web semántica, and has participated in the organization of different events: EKAW02, SSSW03, SSSW04, and SSSW05.

Executive Summary: This report provides information about the current state of the art in Semantic Web research in Spain. The contents of this report are mainly based on the information that was gathered during the workshop "Ontologías y Web Semántica 2005", which was held in Santiago de Compostela in November 2005, and the contributions that members from most of the research groups working in Semantic-Web-related areas in Spain have provided.

The field of Semantic Web is quite widespread in Spain, with important groups developing methods, techniques and tools to support different areas: Ontological Engineering, semantic extraction and annotation from heterogeneous sources, semantic search engines, personalisation and Semantic Web Services.

Furthermore, there is an important community of users of the previous methods, techniques and tools, who act as Semantic Web application developers in the areas of e-commerce, e-Government, e-Science, e-learning, e-finances, e-Health, Software Engineering, Culture and technical regulations.

Besides academic research groups there are also research groups working in non-profit organisations and in industrial companies, what covers the whole range of stakeholders in the area.

As a proof of this active work, many publications in the area have seen the light during 2005. In this report we provide a list of them, classified into groups, so that interested readers can have references to the most important papers or books from these groups.

Local events in Spain cover the spectrum of workshops dedicated to specific areas of technology, as well as round tables and seminars organised by research groups and companies.

Technology uptake by industry in Spain is also a topic covered in this report. Several companies are currently creating technology in this area or providing their expertise as a service to their customers.

Finally, this report describes the current situation of education of Semantic Web related topics in Spain, both at the undergraduate and postgraduate levels. As a highlight of the importance of Semantic Web in edu-

cation in Spain, the first four editions of the Summer School on Ontological Engineering and Semantic Web have been organised in this country.

Manchester, United Kingdom, and Madrid,Spain, 15.03.2006

1. SW Research in Spain

Research groups working in the Semantic Web in Spain can be classified as follows:

1.**Developers of methods, techniques and tools**. In this category we can include groups that work in the following areas:

a.**Ontological Engineering**, including groups that work on methods, techniques and tools that give support to different activities of the ontology development lifecycle.

b.**Semantic extraction and annotation from heterogeneous sources**, such as structured sources (e.g., databases), semi-structured sources (e.g., Web pages dynamically generated, with tables), and unstructured sources (e.g., natural language texts).

c. **Semantic search engines**, including methods, techniques and tools to search Intranets and Extranets, using previously annotated sources or making ontology-based query expansion.

d.**Personalisation**, with methods, techniques and tools to personalise user interfaces, searches, application behaviours, etc., based on user models developed with Semantic Web technologies.

e.**Semantic Web Services**, with methods, techniques and tools to develop and execute Semantic Web Services, dealing with problems of discovery, mediation and invocation.

2.**Users** of the previous methods, techniques and tools, who build semantic applications in the areas of e-commerce, e-Government, e-Science, e-learning, e-finances, e-Health, Software Engineering, Culture and technical regulations.

2. Contributions of Spanish Semantic Web Researchers

Writing a section about the contributions of Spanish Semantic Web researchers to the state of the art in Semantic Web would have been difficult without the help of those researchers, and important ommissions would have been made if we had attempted to create such a list by ourselves. Consequently we decided to request from every research group in Spain (including Spanish researchers working abroad) a small list of the publications from their groups that they considered more relevant for this report.

We have classified this list of publications using the same structure than the previous section, with the main organisational blocks of Semantic Web technology developers and Semantic Web technology users.

2.1 Semantic Web technology developers

With respect to developers, we have grouped contributions in the following 5 areas:

Ontological Engineering. Among the most important contributions in this field we can cite a book and several papers in some of the most relevant conferences in the area. The following publications have to do with the state of the art in Ontological Engineering:

- Gómez-Pérez A, Fernández-López M, Corcho O. Ontological Engineering: with examples from the areas of knowledge management, e-commerce and the Semantic Web. Springer-Verlag. November 2003.
- Sánchez, DM., Cavero, JM., Marcos, E. "The Road Toward Ontologies". In "Ontologies in the Context of Information Systems". Eds. Rajiv Kishore, Ram Ramesh and Raj Sharman. Kluwer.

The following papers deal with some other aspects of Ontological Engineering, such as the selection of ontologies for the Semantic Web, given a set of characteristics (aka requirements) from them, the development of cooperative modelling systems and the development of ontology translation systems:

- Lozano-Tello A. y Gómez-Pérez A. "ONTOMETRIC: A Method to Choose the Appropriate Ontology". Journal Of Database Management. 15(2). pp 1-18, April-June 2004. 2004.
- Beydoun, G., Hoffmann, A., Fernández-Breis, J.T., Martínez-Béjar, R., Valencia-García, R., Aurum, A. (2005) Cooperative Modelling Evaluated. International Journal of Cooperative Information Systems, 14(1):45-71.

Fig. 1. The distribution of major institutions focusing on the Semantic Web research in Spain.

- Corcho O. A layered declarative approach to ontology translation with knowledge preservation. Frontiers in Artificial Intelligence and its Applications. Dissertations in Artificial Intelligence. IOS Press. January 2005

Semantic extraction and annotation from heterogeneous sources. Several groups are working in extraction and annotation from heterogeneous sources, including ontology learning. The following publications can be cited:
- Danger R, Berlanga R, Ruíz-Shulcloper J. "CRISOL: An approach for automatically populating a Semantic Web from Unstructured Text Collections". Database and Expert Systems, Lecture Notes in Computer Science 3180, pages 243-253, 2004.
- Navas I, Sanz I, Aldana JF, Berlanga R. "Automatic Generation of Semantic Fields for Resource Discovery in the Semantic Web". Database and Expert Systems, Lecture Notes in Computer Science 3588, 706-715, 2005.
- Sánchez D, Isern D, Moreno A. An agent-based knowledge acquisition platform. In: "Multiagent System Technologies". Eds: T.Eymann, F.Klügl, W.Lamersdorf, M.Klusch, M.Huhns. Lecture Notes in Artificial Intelligence 3550, pp. 118-129. Springer Verlag, 2005.
- Sánchez D, Moreno A. Web-scale taxonomy learning. Proceedings of the workshop "Learning and extending lexical ontologies by using Machine Learning methods", in the 22nd International Conference on Machine Learning (ICML05). Bonn, Germany, August 2005.
- Verdejo MF, Barros B, Read T, Mizoguchi R(2002)."Applications of a Collaborative Learning Ontology" MICAI 2002 (Mexican International Conference on Artificial Inteligence) LNAI (Lectures Notes on Artificial Intelligence), vol 2313,Springer-Verlag

Semantic search engines. Work in the development and application of semantic search engines, information retrieval engines and ontology-based query processing can be found in the following publications:
- Vallet D, Fernández M, Castells P. An Ontology-Based Information Retrieval Model. 2nd European Semantic Web Conference (ESWC 2005). Heraklion, Greece, May 2005. Springer Verlag Lecture Notes in Computer Science, Vol. 3532. Gómez-Pérez, A.; Euzenat, J. (Eds.), 2005, ISBN: 3-540-26124-9, pp. 455-470.
- Mena E, Illarramendi A, "Ontology-Based Query Processing for Global Information Systems", Kluwer Academic Publishers, ISBN 0-7923-7375-8, pp. 215, 2001. June 2001.
- Royo JA, Mena E, Bernad J, Illarramendi A, "Searching the Web: From Keywords to Semantic Queries", Third International Conference on Information Technology and Applications (ICITA'05), July 4-7, 2005, Sydney (Australia), IEEE Computer Society, ISBN 0-7695-2316-1, pp. 244-249, July 2005.
- Bagüés M, Bermúdez J, Illarramendi A, Tablado A, Goñi A. "Semantic Interoperation among Data Systems at a Communication Level". Journal on Data Semantics, Volumen: V 1-24. LNCS 3870. Springer 2006.
- Palacios J, Cremades J, Costilla C, Towards a Web Digital Archive Ontological Unification, in The Third International Conference on Information Technology and Applications (ICITA'05), Session: Agent, Datamining and Ontologies, ADO'05, Sydney, Australia, IEEE Computer Society, Los Alamitos, California, USA, pp. 221-226, July 2005.
- Lopez V, Pasin M, Motta E. AquaLog: An Ontology-portable Question Answering System for the Semantic Web. ESWC 2005 (European Semantic Web Conference), Creete, Grece.

Personalisation. Two groups work in personalisation for the Web and the Semantic Web, with relevant publications as follows:
- Castells P, Fernández M, Vallet D, Mylonas P, Avrithis Y. Self-Tuning Personalized Information Retrieval in an Ontology-Based Framework. 1st IFIP WG 2.12 & WG 12.4 International Workshop on Web Semantics (SWWS 2005), November 2005. Springer Verlag Lecture Notes in Computer Science, Vol. 3762. Meersman, R.; Tari, Z.; Herrero, P. (Eds.), 2005, ISBN: 3-540-29739-1, pp. 977-986.
- Lozano-Tello A., Macías M., Sánchez F., Sosa E., "Uso de Ontologías en Páginas Web para Mejorar su Accesibilidad a Invidentes", VIII Jornadas de Ingeniería del Software y Base de Datos (JISBD'03), pp 625-634. Alicante, SPAIN 2003.

Semantic Web Services. Publications related to Semantic Web Services include the following:
- Fuentes JM, Corella MA, Castells P, Rico M. Semi-automatic Web Service Generation. IADIS WWW/Internet Conference (ICWI 2005). Lisbon, Portugal, October 2005.
- Acuña C., Marcos E., Gómez J.M. and Bussler C. "Towards Web Portal Integration through Semantic Web Services". Int. conference on Next Generation Web Services Practices. Kuala Lumpur - Malasia. IEEE Computer Society, pp. 223-228, 2005
- Gómez-Pérez A, González-Cabero R, Lama M (2004): A Framework for Description, Composition, and Evaluation of Semantic Web Services. IEEE Intelligent Systems. Special Issue on Semantic Web Services.
- Arroyo S, Sicilia MA, López Cobo JM. "Patterns of Message Interchange in Decoupled Hypermedia Systems" Journal of Networks and Computer Applications. 2006

The following publications deal with the issue of trust and policy management in the Semantic Web:
- Staab S, Bhargava B, Lilien L, Rosenthal A, Winslett M, Sloman M, Dillon TS, Chang E, Hussain FK, Nejdl W, Olmedilla D, Kashyap V. The Pudding of Trust IEEE Intelligent Systems Journal, Vol. 19(5), pp. 74-88, Sep./Oct. 2004
- Gavriloaie R, Nejdl W, Olmedilla D, Seamons K, Winslett M, No Registration Needed: How to Use Declarative Policies and Negotiation

to Access Sensitive Resources on the Semantic Web 1st European Semantic Web Symposium, May. 2004, Heraklion, Greece

2.2 Semantic Web technology users

This group contains those groups that use Semantic Web technology to develop other types of technologies or applications in other areas.

In e-learning, the following publications have been selected:

- Alonso, A., García, I., Villar, J. R., Benavides, C., Rodríguez, F. J.; "A Framework for Integrating Control Engineering Knowledge in Computer Systems" in Preprints of the 7th IFAC Symposium on Cost Oriented Automation, COA 2004, Ottawa, Canada, June 2004
- Alonso, A., García, I., Villar, J. R., Benavides, C. y Rodríguez, F. J.; "Applying Knowledge Engineering Techniques In Control Engineering Education", in Proceedfings of the 6th FAC Symposium on Advances in Control Education ACE 2003, Oulu, Finland
- Amorim R, Lama M, Sánchez E, Riera A, Vila X A Learning Design Ontology based on the IMS Specification, Journal of Educational Technology & Society, 9(1):38-57, 2006.
- Mayorga JI, Barros B, Celorrio C, Verdejo MF (2005) "An Ontology-driven portal for a collaborative learning community", 12th International Conference on Artificial Intelligence in Education, Frontiers in Artificial Intelligence and Applications, vol. 125, pags. 872-874, IOS Press, ISBN 1-58603-530-4

The following publications refer to the use of ontologies for improving software engineering processes:

- Ruiz, F., Vizcaíno, A. et al. : An Ontology for the Management of Software Maintenance Projects. International Journal of Software Engineering and Knowledge Engineering. 14(3), 2004, 323-349.
- García, F., Bertoa, M.F., Calero, C., Vallecillo, A., Ruiz, F., Piattini, M. & Genero, M.: Towards a Consistent Terminology for Software Measurement. Information and Software Technology. In press (http://www.sciencedirect.com/science/journal/09505849)
- Calero, C., Ruiz, F., Baroni, A., Brito e Abreu, F. & Piattini, M.: An Ontological Approach to Describe the SQL:2003 Object-Relational Features. Computer Standards & Interfaces. In press; available in[1].
- Calero, C., Ruiz, F. & Piattini, M. (eds.): Ontologies for Software Engineering and Technologies. Springer (hardcover). To appear in 2006, 350 pages.

The following publications deal with the use of ontologies and Semantic Web technologies for the development and use of case-based reasoning (CBR) systems:

- Díaz Agudo, B. & González Calero, P.A. "An ontological approach to develop Knowledge Intensive CBR systems" 45 páginas. Ontology-driven Information Systems., R. Kishore, R. Ramesh, and R. Sharman, (Eds.), Springer-Verlag
- Recio-García, J.A., Díaz-Agudo, B. & González-Calero, P.A. "A Distributed CBR Framework through Semantic Web Services" The Twenty-fifth SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence pp. 88-101. Max Bramer, Frans Coenen & Tony Allen (Eds.), Springer- Verlag

The following publications deal with the use of ontologies and Semantic Web technologies for the development and use of planning systems:

- de la Asunción M, Castillo L, Fdez.-Olivares J, García-Pérez O, González A, Palao F. SIADEX: an interactive artificial intelligence planner for decision support in forest fire fighting*. Artificial Intelligence Communications (AIComm), vol. 18, n.4, 2005.
- de la Asunción M, Castillo L, Fdez.-Olivares J, García-Pérez O, González A, Palao F. Knowledge and plan execution management in planning fire fighting operations*. Planning, Scheduling and Constraint satisfaction: from theory to practice. IOS Press. Series "Frontiers in Artificial Intelligence and Applications" (117). ISBN 0922-6389.

The following publications describe applications of Semantic Web technologies in the news, financial, e-Government, e-Health, Law and e-commerce domains:

- Castells P, Perdrix F, Pulido E, Rico M, Benjamins R, Contreras J, Lorés J. Neptuno: Semantic Web Technologies for a Digital Newspaper Archive. 1st European Semantic Web Symposium (ESWS 2004). Heraklion, Greece, May 2004. Springer Verlag Lecture Notes in Computer Science, Vol. 3053. Davies, J.; Fensel, D.; Bussler, C.; Studer, R. (Eds.), 2004, XIII, ISBN: 3-540-21999-4, pp. 445-458.
- Castells P, Foncillas B, Lara R, Rico M, Alonso JL. Semantic Web Technologies for Economic and Financial Information Management. 1st European Semantic Web Symposium (ESWS 2004). Heraklion, Greece, May 2004. Springer Verlag Lecture Notes in Computer Science, Vol. 3053. Davies, J.; Fensel, D.; Bussler, C.; Studer, R. (Eds.), 2004, XIII, ISBN: 3-540-21999-4, pp. 473-487.
- Costilla C, Palacios J, Cremades J, Vila J. e-government: A Legislative Ontology for the 'SIAP' Parliamentary Management System, in E-Government: Towards Electronic Democracy, Proceedings of International Conference TCGOV 2005, Lecture Notes in Artificial Intelligence, LNAI 3416-0134, LNCS Series, ISBN 3-540-25016-6, Springer, Berlin, Germany, IFIP 2005, Bozen-Bolzano, Italy, pp. 134-146, March 2005.
- Tablado A, Illarramendi A, Bagüés MI, Bermúdez J, Goñi A. "An Intelligent System for Assisting Elderly People" Foundations of Intelligent Systems. ISMIS 2005. 466-474, Mayo-2005 LNAI 3488
- Vidal JC, Lama M, Bugarín A, Integrated Knowledge-based System for Product Design in Furniture Estimate, En: Integrated Intelligent Systems for Engineering Design, IOS Press, 2006.
- Casanovas P, Poblet M, Casellas N, Contreras J, Benjamins VR, Blázquez

[1] http://www.sciencedirect.com/science/journal/09205489

- Casanovas P, Poblet M, Casellas N, Contreras J, Benjamins VR, Blázquez M. Supporting newly-appointed judges: A legal knowledge management case study. Journal of Knowledge Management 9(5):7-27, 2005
- Benjamins VR, Casanovas P, Breuker J, Gangemi A. Law and the Semantic Web, an Introduction. Law and the Semantic Web, Springer, Vol. 3369, 2005: 1-17.
- García-Sánchez, F., Valencia-García, R., Martínez-Béjar, R. (2005) An integrated approach for developing e-commerce applications. Expert Systems with Applications, 28(2):223-235.

3. Government Actions (financial support) for Research Programs on SW

There are no specific support actions for the research on Semantic Web in Spain. However, Semantic Web projects are being funded under other more general disciplines as knowledge-based systems in the main R&D actions, such as CICYT and PROFIT projects.

A request for the creation of a Spanish thematic network on Semantic Web has been recently made to the Spanish Ministry of Education and Science

4. Local Events on SW in Spain

This report is based on the discussions of the workshop "Ontologías y Web Semántica 2005", held on November 14th, 2005, in conjunction with the Spanish Artificial Intelligence Conference (CAEPIA2005), in Santiago de Compostela. Other related events held in 2005 are the following:

- JSWEB 2005. I Jornadas Científico-Técnicas en Servicios Web. Granada, 13-14 September 2005. Workshop organised by the W3C Spanish office.
- "Gestión Inteligente de Contenidos: la Web Semántica". Barcelona, 30 November 2005. Seminar organised by iSOCO.
- "Gestión Inteligente de Contenidos: la Web Semántica". Madrid, 5 October 2005. Seminar organised by iSOCO.
- "Los Semantic Web Services - Futuro y aplicaciones industriales". Enrico Motta, Richard Benjamins. Madrid, 20 October 2005. Seminar co-organised by UPM and Fundación de la Innovación Bankinter.

It is also important to highlight that all the editions of the OntoWeb and KnowledgeWeb Summer School on Ontological Engineering and the Semantic Web (SSSW03, SSSW04, SSSW05 and SSSW06) have been held in Cercedilla, Spain, hosted by Universidad Politécnica de Madrid.

Finally, several conferences related to the area have taken place in Spain and/or being co-organised by Spanish researchers in the last years, as follows:

- 4th International Semantic Web Conference (ISWC2006). Galway, Ireland. November 6-10 2005. Richard Benjamins was the Industrial Track chair.
- 2nd European Semantic Web Conference (ESWC2005). Hersonissos, Crete, Greece. May 29 - June 1, 2005. Asunción Gómez-Pérez was the programme chair.
- 8th International Protégé Conference. Madrid, Spain. July 18-21 2005.
- International Conference on Web Engineering 2003 (ICWE 2003). Oviedo, Spain, July 14-18, 2003.
- 13th European Conference on Knowledge Engineering and Knowledge Management (EKAW 2002). Sigüenza, Spain, October 1-4, 2002.

5. Semantic Web Industry in Spain

As of 2005, 2006 the Semantic Web is increasingly attracting more interest from industry and the public at large. The Semantic Web effort in Spain started around early 2000 lead by the Universidad Politecnica de Madrid (UPM) and Intelligent Software Components, S.A. (iSOCO). Both organizations were involved in several pioneering European Research Projects, such as IBROW, MKBMEEM, Esperonto, Ontoweb and SWWS. Since then, activity has increased significantly.

From an industry point of view, there are two interesting trends happening: 1) industries are creating teams of experts in the Semantic Web to investigate the possibilities of this technology, and 2) early adopter industries are starting to begin pilot project with Semantic Web technology to solve business problems.

In the first category organizations include[1]:

- Private companies
o ISOCO (http://www.isoco.com/).
o Atos Origin (http://www.atosorigin.es/).
o Arcelor (http://www.arcelor.com/).
o Software AG (http://www.softwareag.com/es/default.asp).
o Ándago (http://www.andago.com/).
o Telefonica I+D (http://www.tid.es/).
o SHS Polar (http://www.polar.es/).
- Non-profit organisations and R&D centres:
o Robotiker (http://www.robotiker.com/).
o IBIT (Illes Balears Innovació Tecnològica, http://www.ibit.org/home/index.php).
o LABEIN-Tecnalia (http://www.labein.es/).
o CTIC (http://www.fundacionctic.org/).

In the second category organizations include:

- Bankinter (http://www.ftforum.org/).
- Residencia de Estudiantes (http://www.residencia.csic.es/).
- Real Instituto Elcano (http://www.realinstitutoelcano.org/default.asp).
- City of Zaragoza (http://www.ayto-zaragoza.es/).

6. Semantic Web Education in Spain

There are several Spanish universities that offer MSc and PhD courses on areas related to the Semantic Web, including topics like knowledge acquisition and representation, Ontological Engineering, Semantic Web Services, etc.

Below we provide a list of the courses available, together with some information about each of them:

[1] We have made our best efforts to provide a list that is as complete as possible, although there may be ommissions.

6.1 PhD courses

Universidad Autónoma de Madrid (UPM) offers a PhD programme in Computer Science and Telecommunication at the Polytechnical Engineering School, which includes a course on "Semantic Web"[2] . Started in 2001 with an average of 15 students, this course provides a thorough overview of Semantic Web technologies, including languages, tools, theories, and specialized areas.

Universidad Carlos III de Madrid (UC3M) offers a PhD programme on Communication Technology in its Polytechnical School. As part of this programme, a course on "Management of Multimedia Information in the Internet"[3] is taught, with 3 students on average, covering several areas of Ontological Engineering (ontology languages, KR formalisms) and the Semantic Web (annotation).

Universidad de Alcalá (UAH) offers a PhD programme on Information, Documentation and Knowledge[4] in the Computer Science School. As part of this programme, two courses are taught on SW-related disciplines: Personalization and Usability in Hypermedia and Automatic Composition of Web Services, where SW technologies for personalization and Semantic Web Services are explored respectively. Besides, a seminar is given on the introduction to description logics and the Semantic Web. Approximately 15 students attend these courses, which have been taught since course 2004/05.

Universidad de Extremadura (UEX) offers a PhD programme on Information Technology, Signals and Communications in its Polytechnical School. In the context of this programme, a course on "Ontological Engineering for the Semantic Web"[5] is taught, with 8 students on average. This course has been taught since 2003.

Universidad de Murcia (UM) offers a PhD programme in Computer Science at the Computer Science School, which incluces a course in knowledge technologies[6] , started in 2003 with an average of 8 students.

Universidad de Oviedo (UniOvi) has been offering a PhD degree titled "Advances in Computer Science" which contains a course on "Web Engineering" from 2002 with 12 students on average. That course contains topics on Web technologies and Semantic Web.

Universidad de Santiago de Compostela (USC) offers a PhD programme on Information Technology in its Faculty of Physics. As part of this programme, a course on "Knowledge Engineering"[7] is taught, with 5 students on average, covering areas like ontologies and problem solving methods.

Universidad de Valladolid (UVA) offers a PhD programme on "Computer Science", which includes a course on "Semantic Web" since 2004 with an average of 2 students.

Universidad de Zaragoza (UNIZAR) offers a PhD programme on System Engineering and Computer Science at the Polytechnical School, which includes a course on "Distributed Information Systems", started in 2000 with an average of 6 students. This course covers different areas concerning management and access to ontologies, description logics, web services, semantic web, etc.

Universidad del País Vasco (UPV-EHU) offers a PhD programme on "Web Information Systems", which includes a course on "Semantic Web Introduction", started in 2004 with an average of 7 students.

Universidad Nacional de Educación a Distancia (UNED) offers a PhD programme in Computer Science Languages and Systems in the Faculty of Computer Engineering. In it, a course called "Methods and Tools for Knowledge Representation"[8] is taught. This course, with 12 students on average, has been taught since 1992, contains topics related to Ontological Engineering.

Universidad Politécnica de Madrid (UPM) is offering SW-related PhD courses in two of its schools: Telecommunications and Computer Science. The course at the Telecommunications School, called "Arquitecturas de bases de datos web. Ontologías para la web semántica"[9] , has normally around 10-12 students. It contains topics about ontologies and Semantic Web languages, database interoperability and heterogeneous database integration and Semantic Grid. The course at the Computer Science School is taught in the context of the Artificial Intelligence Department. It is called "Ontologías y Web Semántica"[10] and it has normally around 15 students. It contains topics about Ontological Engineering, including methodologies, tools and languages, and also describes applications in the context of the Semantic Web. This last course has been taught since 1996.

Universidad Politécnica de Valencia (UPV) offers a PhD programme on "Declarative Programming and Programming Engineering", which includes a course on "Digital Libraries", started in 2005 with an average of 5 students.

6.2 MSc courses

Universidad de Granada (UGR) has recently proposed a MSc where there are two SW-related courses, on Ontologies and on Workflows and Semantic Web Services. This MSc is pending approval.

Universidad de Oviedo (UniOvi) has recently proposed a MSc titled "Web Engineering" with two courses called "Semantic Web" and "Advances in Semantic Web". The first course will be an introductory course with a practical approach, while the second one is more advanced and will cover research topics in Semantic Web. This MSc will start on October 2006.

[2] http://www.ii.uam.es/~castells/docencia/semanticweb
[3] http://www.uc3m.es/uc3m/gral/TC/ESDO/esdo08gimi.html
[4] http://www.uah.es/postgrado/PROGDOCTORADO/
[5] http://quercusseg.unex.es/adolfo/iows/
[6] http://www.um.es/informatica/estudios/programas/II/00CR.pdf
[7] http://www.dec.usc.es/doctorado/2005-2007/programa/per_docencia/s16.htm

Universidad de Zaragoza (UNIZAR) offer a MSc programme on "Web Services, Computer Science Security and Applications of E-Commerce" since 2003, with an average of 14 students. This MSc contgains a course on "Semantic Web.

Universidad Politécnica de Madrid (UPM) also offers SW-related MSc courses in the aforementioned schools, though none of these courses are exclusively focused on Ontologies and Semantic Web, but on more general aspects like databases[11] and Artificial Intelligence[12] respectively. Furthermore, the Technical Computer Science School offers a 3rd year course on Intelligent Agents[13] , which has been taught for three years with 20 students on average. This course contains topics like a basic introduciton to the Ontologies and the Semantic Web and a description of ontology markup languages.

Acknowledgements
We would like to give thanks to all the participants of the workshop "Ontologías y Web Semántica 2005" for the high-quality discussions that were held during that day and to all the members of the Semantic Web Spanish mailing list (semweb-spain@delicias.dia.fi.upm.es) for the provision of the information that has been used in the generation of this report.

[8] http://www.lsi.uned.es/doctorado/1101003.php
[9] http://sinbad.dit.upm.es/docencia/doctorado.html
[10] http://www.dia.fi.upm.es/doctorado/ia/asignaturas/ontologias_y_la_web_semantica.htm
[11] http://sinbad.dit.upm.es/docencia/grado.html
[12] http://www.dia.fi.upm.es/licenciatura/asignaturas96/inteligencia_artificial.htm
[13] http://www.sia.eui.upm.es/~jbarrasa/teaching/

Internet Reference Points
1. Ontologías y Web Semántica 2005. http://www-gsi.dec.usc.es/caepia05/workshop_OWS.html, [28.02.2006]
2. Proceedings of the workshop "Ontologías y Web Semántica 2005".
http://www.cs.man.ac.uk/~ocorcho/documents/ProceedingsWebSemantica2005.pdf, [28.02.2006]
3. Presentations at the workshop "Ontologías y Web Semántica 2005",
http://www.cs.man.ac.uk/~ocorcho/Workshops/CAEPIA2005/, [28.02.2006]
4. JSWEB 2005. http://www.w3c.es/Eventos/ServiciosWeb/, [28.02.2006]
5. Revista Novática, special edition on Semantic Web. Nov-Dec 2005.
http://www.ati.es/novatica/2005/178/nv178sum.html, [28.02.2006]
6. SSSW05. http://babage.dia.fi.upm.es/sssw05/, [28.02.2006]

Press releases
7. El País, 02.02.2005, José Manuel Alonso, W3C España: "La web semántica despegará en 2005",
http://www.elpais.es/articulo/elpportec/20050202elpepunet_1/Tes/, [28.02.2006]
8. El País, 28.04.2005, Ivan Herman: "La buscadores actuales buscan pero no entienden",
http://www.elpais.es/articulo/elpportec/20050428elpepunet_4/Tes/, [28.02.2006]
9. El País, 06.10.2005, Las empresas españolas comienzan su inmersión en la Web semántica,
http://www.elpais.es/articulo/elpportec/20051006elpepunet_2/Tes/, [28.02.2006]
10. El Heraldo de Aragón, 07.03.2006, La Web Semántica es una revolución, http://www.heraldo.es/ [15.03.2006]

Spanish Semantic Web mailing lists
- semweb-spain@delicias.dia.fi.upm.es [28.02.2006]
- web-semantica-ayuda@es.tldp.org [28.02.2006]

Poznan Report

Abramowicz, Filipowska, Kaczmarek, Kowalkiewicz and Zyskowski
Poznan University of Economics, Department of MIS
http://mis.ae.poznan.pl/

Short Company Presentation:

The Poznan University of Economics
- Founded in 1926
- Provides education in the fields of Economics, Management, Management Information Systems and Commodity Sciences
- Offers graduate studiers (full-time, evening and extramural)
- Offers postgraduate studiers including four MBA programs
- Cooperates with more than 50 foreign partners

Department of Management Information Systems
- Research focuses mainly on widely understood information and knowledge representation, processing and management.
- Study Programs at the Department meet Polish and European standards.
- At present we host undergraduate (more than 450 students), graduate (more than 120 students) and doctoral (47 students) programs. provide URLs to more info)
- 4 6 FP funded projects

Main Projects at a glance:

ASG Project - the goal of Adaptive Services Grid (ASG) is to develop a proof-of-concept prototype of an open development platform for adaptive services discovery, creation, composition, and enactment. Impact on a European level is supported by strong industry involvement in the areas of telecommunications and telematics.

USE-ME.GOV is an EU research and development project designed to support and encourage the access to new e-government services at any time and anywhere through the use of mobile communications and Internet technologies. Long term goal is to contribute to a Next-Generation Open Service Platform for mobile users that can be shared by networked authorities and institutions.

The enhanced Knowledge Warehouse (eKW) project is a web-service-based extension of a previous one called enhanced Data Warehouse (eDW). eKW is an agent-based system that allows the automatic filtering of information and knowledge from the Web to the data warehouse and transparent retrieval through the data warehouse.

F-WebS
The main aim of the F-WebS (Filtering of Web Services) project is to build a flexible and powerful system that will be filtering Web services according to the needs of its clients.

Poznan, Poland, 15.03.2006

1. General Company Information

The Poznan University of Economics (PUE) is a major academic institution in the western part of Poland. It is the biggest and oldest business university in the region of Wielkopolska. Its origins go back to 1926, when the Foundation of the Chamber of Commerce and Industry founded the College of Commerce. Presently, PUE specialises in educating economists, managers and specialists in quality management in all sectors of the economy. The main subjects of research range from various aspects of Poland's economic transformation to the preparation of Polish enterprises for competition within the European Union and the globalisation trends in the world economy. In terms of enrolment as well as scientific and academic potential, The Poznan University of Economics ranks among the leading economic universities in Poland. Since 2000, the University has come second in rankings published by such Polish magazines as Polityka, Rzeczpospolita, Perspektywy, Magazyn Businessman and Newsweek Polska.

The Poznan University of Economics in Semantic Web related projects is represented by the Department of Management Information Systems. The research in the department focuses on widely understood information and knowledge representation, processing and management. This comprises all activities connected with knowledge of the whole corporation and every individual working for it. Therefore much effort is put on enhanced information technologies, namely on filters capable of supplying a variety of information systems with relevant information acquired from the Web as well as on Semantic Web Services technology and ontology engineering. Currently Department of MIS in the area of Web Services and Semantic Web is involved in four EU FP6 projects.

2. MIS Internal Projects

eKW

The enhanced Knowledge Warehouse (eKW) project is a web-service-based extension of a previous one called enhanced Data Warehouse (eDW). eKW is an agent-based system that allows the automatic filtering of information and knowledge from the Web to the data warehouse and transparent retrieval through the data warehose.

FWebS

The main aim of the project is to build Web services filtering system. Web services technology is changing the Internet and way the business is done today. Dealing with Web services is mostly manual process, the web services environment is not machine friendly. The Web services description, provided today by WSDL documents or UDDI repository, is not good enough and that is why automatic searching, comparing, filtering or configuration is simply impossible. Moreover it does not allow us in many cases to do it

manually either. The goal of system F-WebS is to make it possible. The client of our system can be for example complex application, that consists of one or more components, which are Web services. These components are the best available (according to the user needs) at the moment. However, Web services market isn' t static and new Web services still emerge. The goal of application is to consist of the best available components so it has to replace old Web services to new, better ones, once they are found by our system. The main advantages: the application (the client of our filtering Web service) is always up-to-date, process is done automatically, improved Web service description.

3. Big R&D projects involved

ASG (Adaptive Services Grid)
ASG is an Integrated Project supported by the Sixth Framework Programme of the European Commission under the Information Society Technology Objective Open Development Platforms for Software and Services. ASG started on September 1, 2004, the duration of the project is two years. ASG involves 22 partners from seven countries.

The goal of Adaptive Services Grid (ASG) is to develop a proof-of-concept prototype of an open platform for adaptive services discovery, creation, composition, and enactment. To achieve its goal, ASG addresses dedicated scientific and technological issues making use of the knowledge and expertise of major European research institutions with significant contributions from the software, telecommunications, and telematics industry.

Public Available Deliverables
·Requirements Analysis on the ASG Service Specification Language
·Requirements Analysis on the ASG Service Interface
·Requirements Analysis for Service and Resource Matchmaking
·Service Description Language
·Requirements Analysis on Service Registries
·Requirements Analysis on Service Composition
·Reuse-oriented Requirements Technique
·Reference Architecture: Requirements, Current Efforts and Design[1]

USE-ME.GOV (Usability Driven Open Platform for Mobile Government)
USE-ME.GOV is a research and development project designed to support and to encourage the access to new e-government services at any time and anywhere through the use of mobile communications and Internet technologies. The project is based on co-operation between Public Administrations, ITC Companies and Universities.

The main goal of USE-ME.GOV is to contribute to a Next-Generation Open Service Platform for mobile users that can be shared by networked authorities and institutions (e.g. on a regional scale) in terms of technical infrastructure, information (content) as well as a framework for commercial exploitation.
The new open platform will support usability, openness, interoperability, scalability, thus facilitating service deployment and access, as well as attractive business models satisfying service providers, public authority and citizens.

Public Available Deliverables
·User Requirements Analysis
·Review of Available Business Models
·Service and Use Scenario Definition
·Review of State of the Art in User Interface Design for Mobile Applications
·Usability Requirements Definition for Selected Scenarios
·Usability-driven Design and Mock-Up Evaluation
·Open Platform for Mobile Services - State of the Art
·Platform Requirements Analysis
·Platform Architecture Design
·Meta Protocol of Service Types
http://www.usemegov.org

SUPER (Semantics Used for Process management within and between EnteRprises)
The major objective of Semantics Used for Process management within and between EnteRprises (SUPER) is to raise Business Process Management to the business level, where it belongs, from the IT level where it mostly resides now. The aim of the SUPER project is to combine Semantic Web Services Technology and Business Process Management, and develop one consolidated technology. Specifically, horizontal ontologies which describe business processes; vertical telecommunications oriented ontologies to support domain specific annotation for our chosen economic sector; and a suite of tools based on the results of the SEKT and DIP IPs will be created. Together with the other SDK1 projects this will further strengthen the global leadership of EU-funded technology development.
The project will start on 1st of April 2006.

TOWL (Time-determined ontology based information system for real time stock market analysis)
The objective of the TOWL project is to expand the current state of the art ontology languages (OWL, RDF-S, RDF) and their support for automated reasoning by adding the time dimension to enable real time context aware information analysis. This technology will provide ontology based (semantic) information systems to venture beyond a static world and add the concepts of time and change.

To demonstrate and objectively assess the quality of the project result a semantic stock broker

[1] http://asg-platform.org/cgi-bin/twiki/view/Public/Deliverables#deliverables

system will be developed based on a time determined ontology (TDO) of which the actual state depends on Reuters textual news messages and numerical market information. The system interprets these messages and adapts its ontology to better match the real world as described in the news.
The project will start on 1st of April 2006

4. Contact details

Department of Management Information Systems
The Poznan University of Economics
Al. Niepodleglosci 10
60-967 Poznan
POLAND
Phone: +48 61 854-33-81
Fax: +48 61 854-36-33
http://www.kie.ae.poznan.pl

Key Publications

Our research work has resulted in many conference papers, entries in book chapters and several books published by international publishers. Among them are:

Abramowicz Witold (ed.), Knowledge-Based Information Retrieval and Filtering from the Web, Kluwer Academic Publishers,

Abramowicz Witold, Kalczynski Pawel and Wecel Krzysztof, Filtering the Web to Feed Data Warehouses, Springer, London,

Abramowicz Witold, Zurada Jozef (Eds.), Knowledge Discovery for Business Information Systems, Kluwer Academic Publishers, Boston,

Abramowicz Witold, Gwizdala Julia, Jakubowski Tomasz, Kaczmarek Monika, Kliber Agata, Kowalkiewicz Marek, Zyskowski Dominik, A Survey of QoS Computation for Web Service Profiling, Proceedings of the ISCA 18th International Conference on Computer Applications in Industry and Engineering, Sergiu Dascalu - Hawaii : ISCA (International Society for Computers and their Applications), 2005. pp. 192-197, ISBN 1-880843-57-9

Abramowicz Witold, Kaczmarek Tomasz, Wecel Krzysztof, How Much Intelligence in the Semantic Web?, Piotr S. Szczepaniak, Janusz Kacprzyk, Adam Niewiadomski (Eds.). Advances in Web Intelligence - Springer Verlag, 2005. ISBN 3-540-26219-9 (Lecture Notes in Computer Science (LNCS))

Abramowicz Witold, Szymanski Jacek, Filipowska Agata, Ontological document filtering. Information Systems Technology and its Applications - Bonn: Gesellschaft fuer Informatik, 2005. ISBN 3-88579-392-X.

Abramowicz Witold, Karsenty Laurent, Olmstead Paul, Peinel Gertraud, Tilsner Dirk, Wisniewski Marek, USE-ME.GOV (USability-drivEn open platform for MobilE GOVernment). The Proceedings of the First European Conference on Mobile Government - Brighton: University of Sussex, 2005. pp. 72-83 ISBN 9763341-0-0.

Abramowicz Witold, Bassara Andrzej, Filipowska Agata, Wisniewski Marek. eVREst - Supporting Estimation of Real Estate Value. Cybernetics and Systems, An International Journal 2004 nr 7-8 - Taylor&Francis Group.

Abramowicz Witold, Kaczmarek Tomasz, Kowalkiewicz Marek, Supporting topic map creation using data mining techniques. AJIS Australian Journal of Information Systems, Special Edition 2004/10 - AJIS, 2004.

SemDis Report

Amit P. Sheth, Budak Arpinar, Krys Kochut and John A. Miller
http://lsdis.cs.uga.edu/

Amit P. Sheth, USA is a professor at the University of Georgia where he also directs the LSDIS lab. Earlier, he served in R&D in industry. He founded and managed companies Infocosm and Taalee (now Semagix) focused on workflow and semantic web platform, respectively. He is an IEEE Fellow. He has published over 200 papers and articles, given over 160 invited talks and colloquia including 21 keynotes, (co)-organized/chaired 20 conferences/workshops, and served on over 110 program committees. He is on several journal editorial boards and is the EIC of the International Journal on Semantic Web and Information Systems.

I. Budak Arpinar, USA is an assistant professor at the University of Georgia and faculty member of the LSDIS lab. He is currently working on semantic relatios /search/knowledge discovery and semantic composition of Web services. He has authored or co-authored over 45 publications, and the R&D he was involved has resulted in different commercial products (e.g. METEOR) or research prototypes. He is also a PC Member and organizer of various significant conferences and workshops including ICDE'06 and International Semantic Web Conference (ISWC'06).

Krys Kochut, USA is a Professor and the Head of Computer Science at the University of Georgia. He has extensive experience in designing and developing high performance, parallel and scalable data structures (indices) and

query processing systems. Key examples of these include distributed main memory semantic search engine used by Semagix Freedom (a commercial software) and BRAHMS main memory RDF storage and query processing system with associated support for SPARQL query language (a research software, made available for non-commercial use free of cost). His research spans software engineering and database management.

John A. Miller, USA is a Professor of Computer Science at the University of Georgia. His research interests include database systems, simulation, bioinformatics and Web services. He received his Ph.D. in Information and Computer Science from the Georgia Institute of Technology. Dr. Miller is the author of over 90 technical papers in the areas of database, simulation, bioinformatics and Web services. He is an Associate Editor for ACM Transactions on Modeling and Computer Simulation and IEEE Transactions on Systems, Man and Cybernetics as well as a Guest Editor for the International Journal in Computer Simulation and IEEE Potentials.

■ *Executive Summary: The LSDIS Lab focuses on Semantics and Services Science. This report provides a quick summary of the latest applications developed in our current research projects. These projects include Glycomics (Bioinformatics for Glycan Expression), METEOR-S (Semantic Web Services and Processes), and SemDis (Discovering Complex Relationships in Semantic Web).*
The applications we have developed and list here include: Efficient RDF storage, Visualization for results of Semantic Analytics techniques, Visualization for Glycomics ontologies, Tools for Semantic Web Services and Processes, Active Semantic Document for electronic health records, and Semantic Web Applications in Government such as Passenger Threat Analysis, the Document Access Problem of Insider Threat and Detection of Financial Inconsistency and Irregularity.
The various publications related to these applications provide additional details and include traditional publication venues (i.e., journal articles, conference papers) but also submissions to W3C and IBM alphaWorks.

Athens, Georgia, USA, March 19, 2006

1. General Project Information

The LSDIS Lab focuses on Semantics and Services Science. This report provides a quick summary of the latest applications developed in current research projects. Our aim is to illustrate how the various research projects of the LSDIS Lab have materialized on practical applications that go beyond the underlying theoretical contributions in their respective areas.

Scientific and Technical Coordinator
Prof. Amit P. Sheth

2. Partners Details

Our work gains from several academic-industry collaborations of the investigators. We have the opportunity to leverage commercial infrastructure such as use of Semagix Freedom for populating ontologies from trusted sources and ontology-driven metadata extraction from heterogeneous content. The researchers collaborate with industry, and the students often intern at collaborating industrial labs, such as Amazon, IBM and Oracle.

Our collaborators for the applications listed in section 3 are:

- University of Maryland, Baltimore County. The faculty members involved are: Anupam Joshi, Tim Finin and Yelena Yesha
- Computer Technology Associates, Contact Person: Philip Burns, http://www.cta.com
- Complex Carbohydrate Research Center (at UGA). The faculty members involved are: Dr. William S. York, Dr. Mike Pierce, Dr. Ron Orlando and Dr. Kelly Moremen
- IBM T.J. Watson Research Center, Contact Person: Richard Goodwin

3. Deliverables (Applications)

In various applications, we have investigated the following topics.

- Semantic Web Services and Processes (METEOR-S). Contact Person: Kunal Verma
http://lsdis.cs.uga.edu/~kunal/
- Active Semantic Document for electronic healthrecords, Contact Person, Jonathan Lathem
http://lsdis.cs.uga.edu/~jlathem/
http://lsdis.cs.uga.edu/projects/asdoc/
- Efficient RDF storage [JK'05]. Contact person: Maciej Janik
http://lsdis.cs.uga.edu/~mjanik/
- Semantic Visualization,
http://lsdis.cs.uga.edu/projects/semvis/

Semantic Web Applications in

- Visualization for Semantic Analytics [DSA'06]. Contact Person: Dr. Leonidas Deligiannidis
http://lsdis.cs.uga.edu/~ldeligia/
- OntoVista: Visualization for Glycomics ontologies. Contact Person: Christopher Thomas
http://lsdis.cs.uga.edu/~cthomas/
- SET: tracking and associating activities (events) of suspects in a Spatially Enriched Virtual Environment. Contact Person: Dr. Leonidas Deligiannidis
http://lsdis.cs.uga.edu/~ldeligia/

Government,
http://lsdis.cs.uga.edu /projects/gov/
- Passenger Threat Analysis [SAA+05]. Contact: Boanerges Aleman-Meza
http://lsdis.cs.uga.edu/~aleman/
- Need-To-Know: Document Access Problem of Insider Threat [ABEPS'05]. Contact Person: Boanerges Aleman-Meza
http://lsdis.cs.uga.edu/~aleman/
- Financial Irregularity: detection of financial inconsistency and irregularity. Contact Person: Amit P. Sheth
http://lsdis.cs.uga.edu/~amit/

4. Open Tools for public

The following are available at the project website, http://lsdis.cs.uga.edu/projects/semdis/

- SWETO is a large ontology with associated knowledge bases extracted from publicly available sources[1]
- GlycO is a large glycoproteomics domain ontology with an knowledge bases extracted from publicly available sources [STSYT'06][2]
- ProPreO is a process ontology (current downloadable version does not include an instance base due to significantly large size)[3]
- TOntoGen is a Test Ontology Generation Tool to generate large, high-quality data sets for testing semantic web applications (implemented as a Protégé plugin)[4]
- BRAHMS is a fast main-memory RDF/S storage, capable of storing, accessing and querying large ontologies (implemented in C++ for high performance and strict memory control)[5]
- METOR-S: Semantic Web Services and Processes[6]

5. Contact details

Prof. Amit P. Sheth; Large Scale Distributed Information Systems Lab; Department of Computer Science; the University of Georgia; 415 Boyd Graduate Studies Research Center;

- Radiant: Semantic Annotation and publication of Web Services
- Illumina: Semantic Web Service Discovery
- SAROS: Semantic Template based Process Designer

Athens GA 30602-7404; Email: amit at cs.uga.edu, URL: http://lsdis.cs.uga.edu/~amit or Google: sheth

[1] http://lsdis.cs.uga.edu/projects/semdis/sweto/
[2] http://lsdis.cs.uga.edu/projects/glycomics/glyco/
[3] http://lsdis.cs.uga.edu/projects/glycomics/propreo/
[4] http://lsdis.cs.uga.edu/projects/semdis/tontogen/
[5] http://lsdis.cs.uga.edu/projects/semdis/brahms/
[6] http://lsdis.cs.uga.edu/projects/meteor-s/wsdl-s/

Key Publications

[ABEPS'05] "An Ontological Approach to the Document Access Problem of Insider Threat," B. Aleman-Meza, P. Burns, M. Eavenson, D. Palaniswami, A. Sheth, IEEE Intl. Conference on Intelligence and Security Informatics (ISI-2005), May 19-20, 2005
http://dx.doi.org/10.1007/11427995_47 (publisher)
http://lsdis.cs.uga.edu/library/download/ABEPS05-ISI.pdf (author's copy)

[JK'05] "BRAHMS: A WorkBench RDF Store and High Performance Memory System for Semantic Association Discovery," M. Janik, K. Kochut; 4th International Semantic Web Conference (ISWC2005), November 2005, Galway Ireland, pp. 431-445
http://dx.doi.org/10.1007/11574620_32 (publisher)
http://lsdis.cs.uga.edu/projects/semdis/JK05-BRAHMS-ISWC2005.pdf (author's copy)

[SAA+05] "Semantic Association Identification and Knowledge Discovery for National Security Applications," A.P. Sheth, B. Aleman-Meza, I.B. Arpinar, C. Halaschek, C. Ramakrishnan, C. Bertram, Y. Warke, D. Avant, F.S. Arpinar, K. Anyanwu, K. Kochut; Journal of Database Management, 16(1):33-53, January-March 2005
http://www.igi-online.com/downloads/pdf/ITJ2672_aQVKbTJVJd.pdf (publisher)
http://lsdis.cs.uga.edu/lib/download/SAA+2004-PISTA.pdf (author's copy)

[DSA'06] "Semantic Analytics Visualization," L. Deligiannidis, A.P. Sheth, B. Aleman-Meza; (To Appear in) Proceedings of the IEEE International Conference on Intelligence and Security Informatics 2006 (ISI-2006), May 23-24, 2006, San Diego, CA, USA
http://lsdis.cs.uga.edu/library/download/DSA06-ISI.pdf (author's copy)

[STSYT'06] "Knowledge Modeling and its application in Life Sciences: A Tale of two Ontologies," S.S. Sahoo, C. Thomas, A.P. Sheth, W.S. York, S. Tartir; 15th International World Wide Web Conference, Edinburgh, Scotland, May, 2006
http://lsdis.cs.uga.edu/projects/glycomics/resources/p1088-sahoo.pdf (author's copy)

Intelligent Systems & Knowledge Processing

Meditskos, Kontopoulos, Bassiliades and Vlahavas
http://iskp.csd.auth.gr/

Short Company Presentation:

The Intelligent Systems and Knowledge Processing (ISKP) group belongs to the Department of Informatics, Aristotle University of Thessaloniki, Greece. The group's main research areas include Logic Programming, Knowledge Representation and Reasoning, Automated Planning, Intelligent Applications and, of course, the Semantic Web. Research on those fields has led to a significant number of publications (over 140), including 6 authored and edited books.
Nine people are currently associated with ISKP, including two faculty members, two associate researchers (postdoctoral), three PhD students and two external associates. The group is also collaborating with many distinctive researchers from Greek and international universities and research institutes.

ISKP has participated with success in a variety of research and development projects, funded by the European Union and the Greek Government, many of which are related to the Semantic Web.
Finally, ISKP is responsible for a number of under- and postgraduate taught courses at the Aristotle University of Thessaloniki, such as: Logic Programming, Artificial Intelligence, Knowledge Systems, Intelligent Autonomous Systems, Knowledge Management, Decision Support Systems, Intelligent Agents and the Semantic Web.

Main Products at a glance:

The research of the members of the ISKP group in the Semantic Web has mainly resulted in the "DEVICE application family", which is a number of systems, designed to meet practical SW user needs. This "family" includes the following systems:
- R-DEVICE: a deductive object-oriented Knowledge Base System for querying and reasoning about RDF metadata
- O-DEVICE: a deductive object-oriented Knowledge Base System for querying and reasoning over OWL documents
- DR-DEVICE: an Object-Oriented Knowledge Base System, capable of reasoning about RDF metadata over multiple Web sources using defeasible logic rules
- VDR-DEVICE: a visual integrated development environment for developing and using defeasible logic rule bases on top of RDF ontologies
- CG-Wrapper Studio is an evolving, multi-paradigm, web content extraction workbench. It uses Conceptual Graphs to encode extraction rules that are HTML/DOM aware and supports direct visual modeling, wrapper induction, cooperation and reuse.

Furthermore, the group is involved in a number of SW-related research projects whose outcome will be SW-related products:
- SWIM - Development of an Intelligent System for the Management of Semantic Web Services (funded by the Greek R&D General Secretariat - PENED2003)
- SWEL - Planning Systems in the Semantic Web for e-Learning (funded by the Greek Ministry of Education - PYTHAGORAS)

Thessaloniki, Greece, 14.03.2006

1. General Company Information

The Intelligent Systems and Knowledge Processing (ISKP) group belongs to the Programming Languages and Software Engineering (PLaSE) Laboratory[1] of the Department of Informatics, Aristotle University of Thessaloniki. ISKP is a sub-group of the Logic Programming and Intelligent Systems (LPIS) group[2] , containing members from the latter as well as new researchers.

Objectives

The group's objective is to perform research, develop products and offer specialized services in the areas of Knowledge Processing and Intelligent Systems. Its main research areas include Logic Programming, Knowledge Representation and Reasoning, Automated Planning, Intelligent Applications, and the Semantic Web. Research on those fields has led to a significant number of publications to scientific journals and international and Greek conferences (over 140), including 6 authored and edited books, in Artificial Intelligence, Knowledge Base Systems, Constraint Logic Programming, and Planning. Furthermore, the group has participated in quite a few national and international projects, where it has contributed in the development of practical and sophisticated systems. Furthermore, ISKP is also responsible for a number of under- and postgraduate taught courses at the Aristotle University of Thessaloniki, displaying the group's determination to offer services to education besides research.

ISKP's mother group, namely LPIS, was founded in 1990 and is also part of the PLaSE Lab at the Department of Informatics, Aristotle University of Thessaloniki. The LPIS group's research interests include the research interests of ISKP, paralleled with research on Machine Learning and Knowledge Discovery from Databases[3]. Twelve active researchers currently belong to LPIS, including 2 faculty members, 3 associate researchers (postdoctoral), and 7 PhD students. Furthermore, the group is collaborating heavily with 2 external associates. Finally, the LPIS group is an active node of the Hellenic Society for Artificial Intelligence and had organized the 2nd National Conference on Artificial Intelligence in Thessaloniki in 2002. It is also a member of the European Networks of Excellence PLANET and KDNET. The group has also organized the 2nd International Summer School on AI Planning in Halkidiki in 2002.

[1] http://plase.csd.auth.gr [2] http://lpis.csd.auth.gr [3] http://mlkd.csd.auth.gr

SW expertise
The emergence of the Semantic Web (SW) did not find ISKP unprepared; Logic Programming and Knowledge Representation & Reasoning are two of its major research interests, which were naturally extended to the SW area. Thus, research on the field of the SW soon began, with the results now being a number of relevant publications (see Section 5), a family of systems designed for the SW (see Section 2) and participation in a variety of national and international projects that hold great potential (see Section 4). Research on the Semantic Web is considered a challenging topic, especially nowadays with the emergence of Semantic Web Services, a combination of Semantic Web and Web Services. Semantic Web Services have attracted the interest of the scientific community and revitalized the need for new standards and methodologies, giving the researchers a new motivation. ISKP's main target is to continue research on the particular field, developing tools and ideas towards the notion of the Semantic Web, where machines would act on behalf of users, searching and finding information and services with the least possible human involvement.

The research of ISKP so far was focused on alternative mappings of SW-related data, namely XML, RDF, OWL documents, to object-oriented knowledge bases, so that these documents can be stored, maintained, queried and reasoned about inside such a knowledge base system, exploiting existing rule-based systems, such as CLIPS. Furthermore, the group has developed various RuleML-compatible rule languages for querying and reasoning about these documents.
Currently, the group's research is focusing on two directions:

·To develop useful SW applications using the XML/RDF/OWL object-oriented knowledge base systems developed by the group. The applications that we are currently aiming for are a) an intelligent system for composing Semantic Web Services, and b) an intelligent system for dynamically composing e-learning curricula from various web-based learning objects based on metadata.
·To further extend our SW reasoning systems into flexible, visual integrated development environments that facilitate the development of rule bases for SW applications.

Additionally, the ISK group investigates advanced knowledge based information retrieval techniques for Web documents. The research in this are has resulted in the use of the Conceptual Graphs knowledge representation and reasoning formalism to model information extraction wrappers. Conceptual Graphs naturally support both the wrapper induction and the wrapper evaluation tasks, through the generalization, specialization and projection operations, and resulting wrappers can be easily reused to create more complex wrappers.

2. Products Short Presentation
The SW-related products produced by the ISKP group belong to the "**DEVICE Application Family**". This "family" comprises of a number of systems, specifically destined for SW applications. The systems described next are indicative of the group's expertise on the area.

- R-DEVICE
R-DEVICE is a deductive object-oriented knowledge base system for querying and reasoning about RDF metadata. R-DEVICE, transforms RDF triples into objects and uses a deductive rule language for querying and reasoning about them. During this procedure, R-DEVICE imports RDF data into the CLIPS production rule system as COOL objects. The main difference between the RDF and our object model is that properties are treated both as first-class objects and as attributes of resource objects. In this way resource properties are gathered together in one object, resulting in superior query performance than the performance of a triple-based query model. Most other RDF storage and querying systems that are based on a triple model scatter resource properties across several triples and they require several joins to query the properties of a single resource. Furthermore, the descriptive semantics of RDF data may call for dynamic redefinitions of resource classes and objects, which are handled by R-DEVICE.

R-DEVICE features a powerful deductive rule language which is able to express arbitrary queries both on the RDF schema and data, including generalized path expressions, stratified negation, aggregate, grouping, and sorting, functions, mainly due to the second-order syntax of the rule language, i.e. variables ranging over class and slot names, which is efficiently translated into sets of first-order logic rules using metadata. Furthermore, R-DEVICE rules define views which are materialized and incrementally maintained. Finally, users can use CLIPS functions or can define their own arbitrary functions using the CLIPS host language.

- O-DEVICE
O-DEVICE is a deductive object-oriented knowledge base system for reasoning over OWL documents. O-DEVICE exploits the rule language of an existing production rule system, called CLIPS and transforms OWL ontologies into an object-oriented schema of the CLIPS Object-Oriented Language (COOL). O-DEVICE is an extension of R-DEVICE and it exploits the advantages of the object-oriented programming model by transforming OWL ontologies into classes, properties and objects of the OO programming language provided within CLIPS, called COOL. The system also features a powerful deductive rule language which supports inferencing over the transformed OWL descriptions. Users can either use this deductive language to express queries or a RuleML-like syntax.

- DR-DEVICE
DR-DEVICE is capable of reasoning about RDF metadata over multiple Web sources using defeasible logic rules. The system is implemented on top of CLIPS production rule system and also builds upon R-DEVICE. Rules can be expressed either in a native CLIPS-like language, or in an extension of the OO-RuleML syntax. The operational semantics of defeasible logic are implemented through compilation into the generic rule language of R-DEVICE.
The most important features of DR-DEVICE are the following:
·Support for multiple rule types of defeasible logic, such as strict rules, defeasible rules, and defeaters.
·Support for both classical (strong) negation and negation-as-failure.
·Support for conflicting literals, i.e. derived objects that exclude each other.
·Direct import from the Web of RDF ontologies and data as input facts to the defeasible logic program.
·Direct import from the Web of defeasible logic programs in an XML compliant rule syntax (RuleML).
·Direct export to the Web of the results (conclusions) of the logic program as an RDF document.

- VDR-DEVICE
VDR-DEVICE is a visual integrated development environment for developing and using defeasible logic rule bases on top of RDF ontologies. VDR-DEVICE integrates in a user-friendly graphical shell (a) DRREd (Defeasible Reasoning Rule Editor), a visual RuleML-compliant rule editor, which serves both as a rule authoring tool and as a graphical shell for the core reasoning system and (b) DR-DEVICE, the reasoning system, described above, that performs the RDF processing and inference and produces the results. The rule editor helps users to develop a defeasible logic rule base by constraining the allowed vocabulary after analyzing the input RDF ontologies. Therefore, it removes from the user the burden of typing-in class and property names and prevents potential semantical and syntactical errors. The visualization of rules follows the tree model of RuleML. Since the reasoning is based on DR-DEVICE, the system supports multiple rule types of defeasible logic, as well as priorities among rules. Furthermore, it supports two types of negation (strong, negation-as-failure) and conflicting (mutually exclusive) literals.

- CG-Wrapper Studio
CG-Wrapper Studio is an evolving, multi-paradigm, web content extraction workbench that is based on CG-Wrappers, that is, extraction rules encoded as Conceptual Graphs. CG-Wrappers combine features of diverse web content extraction approaches resulting in extraction rules that are HTML, DOM and regular expression aware, can be directly modelled or induced by training examples, have excellent visual representation, and strong potential for NLP support. The CG-Wrapper Studio includes a visual editor for direct manipulation of CG-Wrappers, a web browser supporting visual identification of training examples and extracted data inspection, a DOM tree analyzer and an executor for applying CG-Wrappers to web pages. It also supports extraction rule templates and wrapper cooperation and reuse.

3. Services Offered
As mentioned already, ISKP is responsible for a number of taught modules at the Department of Informatics, Aristotle University of Thessaloniki.

Undergraduate Courses:
Logic & Functional Programming
Artificial Intelligence
Decision Support Theory and Systems
Knowledge Systems
Intelligent Autonomous Systems
C Language and UNIX

Postgraduate Courses:
Semantic Web
Intelligent Agents
Planning and Scheduling
Knowledge Management
Intelligent Systems

ISKP is also willing to offer its expertise to interested companies and other parties, regarding the design and implementation of systems and software. It's worth mentioning that in the past various collaborations had been developed with universities, institutes and private companies. Indicatively, we can mention collaborations with Purdue University (USA), Aberdeen University (UK), Paris-Dauphine University (France), University of Nantes (France), Dept. of Computer Science (University of Crete, Greece), Institute of Computer Science of the Foundation for Research and Technology - Hellas (FORTH), Dept. of Informatics and Telecommunications (University of Athens), during the ExperNet project collaborations with Technical University of Madrid (Spain), TECHNOSOFT research institute (Ukraine), Glushkov Institute of Cybernetics (Ukraine), ML company (Hungary) and during the EUROCITIZEN project collaborations with International Centre for Digital Content (John Moores University, Liverpool, U?), Institute of Technoethics (Barcelona University, Spain), and with the companies Total Language Solutions (UK, Agentscape, Germany) and MLS MULTIMEDIA (Greece).

4. Big R&D projects involved
The following list displays the SW-related projects currently undertaken by ISKP:

- An Object-Oriented Knowledge Base System for Reasoning about OWL Ontologies (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Ukraine)

(Collaborating Organisations: International Software Technology Research Center "TECHNOSOFT")

This project proposal is about the development of a system for reasoning with and querying over semantic web ontologies, expressed as OWL-based documents. The development of this system will be based on extending the existing system,

called R-Device, which is a deductive object-oriented knowledge base system for querying and reasoning about RDF metadata. R-Device transforms RDF triples into objects of the CLIPS production system and uses a deductive rule language for querying and reasoning about them. This project will add value to the existing system by doing the following:

·Add necessary code (in CLIPS) for transforming appropriately OWL/RDF triples into COOL objects and classes, simulating the class hierarchy of OWL

·Extend the current rule base of R-Device, enabling it to handle the COOL classes and objects

·Extend the rule language of the system to enable queries and inferences over the objects

·Built a user interface for the final system. The interface can be either a locally installed software on the user's computer or a web-based application for distant use of the system

- SWIM - Development of an Intelligent System for the Management of Semantic Web Services (funded by the Greek R&D General Secretariat - PENED2003)

(Collaborating Organisations: Harokopion University (Athens, Greece), Singular Software S.A. (Greece), South - East European Research Center (SEERC) (Thessaloniki, Greece))

The aim of this project is the development of an intelligent Web services management system. This system will serve as a central node for automated discovery, collection, distribution, composition and control of Web services, whose characteristics will be described using ontologies or metadata according to the Semantic Web framework. The proposed system can potentially constitute the infrastructure for a variety of intelligent Web applications and services in the domains of e-commerce, e-learning and e-government. One of the main targets of the project is the development of a pilot e-commerce platform on top of the intelligent system, through which the usability of the latter will be evaluated.

The system will consist of six independent but cooperating subsystems, each of which will initially constitute a separate field of research and development by an equal number of PhD candidates. Subsequently, the six subsystems will be merged into a uniform system and the pilot e-commerce application will be developed. The six subsystems are the following: i) a Knowledge System for Ontology Management and rule-based reasoning, ii) a Management and Web services Composition System of Web services based on the model of similar Web services communities, iii) a Planning System for Web services composition, iv) an Intelligent Agent for searching and collecting information and metadata of Web services, v) a Machine Learning System for composition, control and improvement of the quality of Web services, vi) a Connectivity Model Simulating System of the Web and Web services composition.

- SWEL - Planning Systems in the Semantic Web for e-Learning (funded by the Greek Ministry of Education - PYTHAGORAS)

The current proposal aims at the study and development of an adaptive planning system for the automated and intelligent composition of educational resources in the Semantic Web. The purpose will eventually be the compilation of specialized e-Learning curricula, depending on the background and educational aims of each trainee. The primary goal of this proposal is the sophistication and expansion of the HAPRC planning system, which combines automated planning, machine learning and knowledge-based systems techniques. The HAP planner will be extended towards the following directions: (i) it will become more efficient, producing a better quality of plans in shorter periods of time, combining the aforementioned technologies in an optimum way, (ii) it will be able to handle XML/RDF meta-data from Semantic Web educational resources and (iii) it will be capable of representing and solving specialized e-Learning curricula composition problems, depending on the knowledge background and educational aims of each trainee.

The following list displays projects undertaken by ISKP in the past, which are somehow related, but rather remotely, to the SW:

EXPERNET - Development of a Distributed Expert System for the Management of a National Network (European Union under the INCO-COPERNICUS'96 program (Proposal No. 960114) for cooperation between EU countries and former Soviet Union/Central European countries.).

(Collaborating Organisations: LINK TECHNOLOGIES S.A., Dept. of Artificial Intelligence (Technical University of Madrid, Spain), ML Consultanting & Computing Ltd. (Budapest, Hungary) International Software Technology Research Center TECHNOSOFT (Kiev, Ukraine), Glushkov Institute of Cybernetics (Ukrainian Academy of Sciences, Kiev, Ukraine))

The main aim of this project is the development of a distributed expert system (called EXPERNET) for the management of the National Network of Ukraine. EXPERNET manages both the whole Ukrainian national network, as well as any of its sub-networks. It consists of a number of local expert systems attached to related network management nodes, that belong to one of the three network levels: national, regional and district, closely reflecting the structure of the Ukrainian WANs. The design of the expert system supports both general and node-specific network management knowledge, in order to develop one expert system that

can be easily adapted to the requirements of the specific node types. Furthermore, different interfaces between the expert system instances and the local WAN management software have been developed in order to facilitate the ease of information exchange between the two components of the local management software. The run-time aspects of EXPERNET include the exchange of information and resolution co-ordination between the physically and logically distributed local expert systems, based on global and local data and goals. The whole expert system is controlled either by data or goals by providing a possibility of selecting target modes dynamically for each node.

- RIMM-NET - Remote Intelligent Monitoring & Management for a Nationally Distributed NETwork (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Ukraine).

(Collaborating Organisations: International Software Technology Research Center TECHNOSOFT (Kiev, Ukraine))

This project is about providing remote intelligent monitoring & management for the various human administrators of a nationally distributed data network. This aim has been achieved by extending an existing distributed expert system (ExperNet, described before) for the management of a wide-area network, which has been developed in the past by the two partners. This project has added value to the existing system by doing the following:
·Build a new user-interface for the human administrator(s) of the system that allows them to monitor and manage the ExperNet system remotely through inexpensive software (web browsers). Currently monitoring is only allowed at the machine that hosts the network management software and the expert system.
·Add more knowledge to the expert system itself, involving the administration area of fault management. Currently, only a dozen of faulty network test cases are covered.
The above two extensions have twofold benefits:
·The web-based user-interface allows the easy administration and monitoring of the ExperNet system and the targeted network system on a remote host.
·The extension of the expert system's knowledge base makes the ExperNet system more useful, since it allows it to intelligently monitor, identify and resolve more faulty cases that can arise in a network, releasing the administrator from the low-level albeit time-consuming task of fault management.

CSPCONS - Development of a Logic Programming Platform for Building Distributed Constraint Applications (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Hungary)

(Collaborating Organisations: ML Consulting & Computing Ltd. (Budapest, Hungary))

This project is about the development of a logic programming system that offers the necessary facilities for building distributed constraint logic programming applications as well as agent based systems. A secondary aim of the project is the implementation of a distributed application using the proposed platform, in order to evaluate the product of the project. This application concerns the distributed construction of an inter-departmental schedule for courses and exams. The selected problem presents a number of interesting features like scheduling shared resources, co-ordination issues between the distributed solvers, etc. The pilot application serves for evaluating the strengths and weaknesses of the system and of course for debugging purposes.
A logic programming platform for such applications should support basically two features:
·Communication facilities for co-ordinating the teams of agents participating in the application environment.
·Constraint Solving Capabilities.
The proposed system is based on the existing CS Prolog II system developed by ML. CS-Prolog II is a system that offers:
·parallel program execution through sequential communicating Prolog processes
·real time features
·inter-process and network communication (TCP/IP)
·WEB based GUI
·an interface for accessing external data bases (PostgreSQL).

5. Open Tools for public

The following list displays the aforementioned tools together with the corresponding addresses. Users can find useful information about the systems with short tutorials and download links as well as simple examples for testing purposes. Please keep in mind that some of the tools are still under development and, therefore, there is no code to provide yet.
R-DEVICE
http://lpis.csd.auth.gr/systems/r-device.html
DR-DEVICE, VDR-DEVICE
http://lpis.csd.auth.gr/systems/dr-device.html
O-DEVICE (under development)
http://lpis.csd.auth.gr/systems/o-device/o-device.html

6. Contact details

Professor Ioannis P. Vlahavas,
Tel: +30-2310-998145
Fax: +30-2310-998362
Dept. of Informatics,
Aristotle University of Thessaloniki,
54124 Thessaloniki, Greece

ISKP members' details:
Professor Ioannis P. Vlahavas: vlahavas@csd.auth.gr
Dr. Nick Bassiliades, Assistant Professor: nbassili@csd.auth.gr
Dr. Dimitris Vrakas, post-doctoral: dvrakas@csd.auth.gr
Dr. Ilias Sakellariou, post-doctoral: iliass@csd.auth.gr

Fotis Kokkoras, PhD Student: kokkoras@csd.auth.gr
Efstratios Kontopoulos, PhD Student: skontopo@csd.auth.gr
Georgios Meditskos, PhD Student: gmeditsk@csd.auth.gr

Affiliated ISKP members:
Dr. Petros Kefalas, Assistant Professor, T.E.I. Thessaloniki
Dr. Athanasios Tsadiras, Assistant Professor, T.E.I. Thessaloniki

External Collaborators
Professor Grigoris Antoniou, Computer Science Department, University of Crete and Institute of Computer Science, FORTH, Greece: antoniou,@ics.forth.gr

Key Publications
An indicative list of the group's relevant-to-the-SW publications is the following:

G. Meditskos, N. Bassiliades, "O-DEVICE: An Object-Oriented Knowledge Base System for OWL Ontologies", Proc. 4th Hellenic Conference on Artificial Intelligence (to be presented), G. Antoniou, G. Potamias, D. Plexousakis, C. Spyropoulos (Ed.), Springer-Verlag, Heraclion, Crete, 2006.

N. Bassiliades, I. Vlahavas, "R-DEVICE: An Object-Oriented Knowledge Base System for RDF Metadata", International Journal on Semantic Web and Information Systems, Amit Sheth , Miltiadis D. Lytras (Ed.), Idea Group, Vol. 2, No. 2 (to appear), 2006.

D. Vrakas, F. Kokkoras, N. Bassiliades, I. Vlahavas, "Towards Automatic Synthesis of Educational Resources through Automated Planning", Proc. 4th Hellenic Conference on Artificial Intelligence (to be presented), Heraklion, Crete, 2006.

G. Meditskos, N. Bassiliades, "Towards an Object-Oriented Reasoning System for OWL", Int. Workshop on OWL Experiences and Directions, B. Cuenca Grau, I. Horrocks, B. Parsia, P. Patel-Schneider (Ed.), 11-12 Nov. 2005, Galway, Ireland, 2005.

N. Bassiliades, E. Kontopoulos, G. Antoniou, I. Vlahavas, "A Graphical Rule Authoring Tool for Defeasible Reasoning in the Semantic Web", 10th Panhellenic Conference on Informatics (PCI 2005), P. Bozanis and E.N. Houstis (Eds.), Springer-Verlag, LNCS 3746, Volos, Greece, 11-13 November, 2005.

N. Bassiliades, E. Kontopoulos, G. Antoniou, "A Visual Environment for Developing Defeasible Rule Bases for the Semantic Web", Proc. International Conference on Rules and Rule Markup Languages for the Semantic Web (RuleML-2005), A. Adi, S. Stoutenburg, S. Tabet (Ed.), Springer-Verlag, LNCS 3791, pp. 172-186, Galway, Ireland, 10-12 November, 2005.

N. Bassiliades, E. Kontopoulos, G. Antoniou, "VDR-DEVICE: A Visual Editor for a Defeasible Logic Rule-ML-compatible Rule Language", 4th International Semantic Web Conference (ISWC2005), Demo/ Poster Session, Edward Curry (Ed.), Galway, Ireland, 6-10 Nov. 2005.

G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "A Semantic Brokering System for the Tourism Domain", Journal of Information Technology & Tourism, special issue on "Semantic Web Technologies and Applications", Vol. 7, No. 3-4 (to appear), 2005.

N. Bassiliades, D. Anagnostopoulos, I. Vlahavas, "Web Service Composition Using a Deductive XML Rule Language", Distributed and Parallel Databases, Ahmed K. Elmagarmid (Ed.), Kluwer, Vol. 17, No. 2, pp. 135-178, 2005.

N. Bassiliades, "Semantic Web: Vision and Technologies", 2nd Int. Scientific Conf. on Computer Science, Plamenka Borovska, Sofoklis Christofordis (Ed.), IEEE Computer Society, Bulgarian Section, 30th Sep-2nd Oct 2005, Halkidiki, Greece, 2005

G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "A Deductive Semantic Brokering System", 9th International Conference on Knowledge-Based Intelligent Information and Engineering Systems (KES 2005), R. Khosla, R. J. Howlett, L. C. Jain (Ed.), Springer-Verlag, LNCS 3682, pp. 746-752, Melbourne, Australia, September 14-16, 2005.

F. Kokkoras, N. Bassiliades, I. Vlahavas, "Aggregator: A Knowledge based Comparison Chart Builder for e-Shopping", Intelligent Knowledge-Based Systems: Business and Technology in the New Millennium, C.T. Leondes (Ed.), Kluwer Academic Publishers, Vol. 1: Knowledge-Based Systems, Ch. 6, pp. 140-163, 2005.

G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "DR-BROKERING - A Defeasible Logic-Based System for Semantic Brokering", IEEE International Conference on E-Technology, E-Commerce and E-Service, W.K.W. Cheung, J. Hsu (Ed.), IEEE, pp. 414-417, 29/3 - 1/4/2005, Hong Kong, China, 2005.

N. Bassiliades, I. Vlahavas, "R-DEVICE: A Deductive RDF Rule Language", Third International Workshop on Rules and Rule Markup Languages for the Semantic Web (RuleML 2004), G. Antoniou, H. Boley (Ed.), Springer-Verlag, LNCS 3323, pp. 65-80, Hiroshima, Japan, 8 Nov. 2004.

N. Bassiliades, G. Antoniou, I. Vlahavas, "A Defeasible Logic Reasoner for the Semantic Web", Third International Workshop on Rules and Rule Markup Languages for the Semantic Web (RuleML 2004), G. Antoniou, H. Boley (Ed.), Springer-Verlag, LNCS 3323, pp. 49-64, Hiroshima, Japan, 8 Nov. 2004.

N. Bassiliades, G. Antoniou, I. Vlahavas, "DR-DEVICE: A Defeasible Logic RDF Rule Language", 3rd International Semantic Web Conference (ISWC2004), Demonstrations Program, Hiroshima, Japan, 7-11 Nov. 2004.

N. Bassiliades, G. Antoniou, I. Vlahavas, "DR-DEVICE: A Defeasible Logic System for the Semantic Web", Second International Workshop on Principles and Practice of Semantic Web Reasoning (PPSWR04), Sebastian Schaffert (Ed.), Springer-Verlag, LNCS 3208, pp. 134-148, St Malo, France, 6-10 Sept. 2004.

F. Kokkoras, N. Bassiliades, I. Vlahavas, "Modelling Information Extraction Wrappers with Conceptual Graphs", Proc. (2nd Volume) 3rd Panhellenic Conference on Artificial Intelligence (SETN'04), Zitis Publications, ISBN 960-431-910-8, 5-8 May 2004, Samos, Greece, 2004.

N. Bassiliades, I. Vlahavas, "Capturing RDF Descriptive Semantics in an Object Oriented Knowledge Base System", Proc. 12th Int. WWW Conf. (WWW2003), ACM, CDROM (Poster), Budapest, Hungary, May 2003.

N. Bassiliades, I. Vlahavas, D. Sampson, "Using Logic for Querying XML Data", Web Powered Databases, D. Taniar and W. Rahayu (Eds.), IDEA Group Publishing, Ch. 1, pp. 1-35, 2003.

N. Bassiliades, F. Kokkoras, I. Vlahavas, D. Sampson, "An Intelligent Educational Metadata Repository", Intelligent Systems, Techniques and Applications, C.T. Leondes (Ed.), CRC Press, Vol. 4, Ch.12, pp. 297-337, 2003.

N. Bassiliades, I. Vlahavas, "Intelligent Querying of Web Documents Using a Deductive XML Repository", Proc. 2nd Hellenic Conference on AI (SETN '02), I. Vlahavas, C. Spyrolpoulos (Ed.), Springer-Verlag, LNAI 2308, pp. 437-448, 2002.

I. Vlahavas, N. Bassiliades, I. Sakellariou, et al., "ExperNet: An Intelligent Multi-Agent System for WAN Management", IEEE Intelligent Systems, Vol. 17, No. 1, pp. 62-72, 2002.

BNN Technologies

Dean
http://www.bbn.com

Short Company Presentation:
Two MIT professors founded BBN Technologies in 1948 as an acoustics consulting firm. BBN's most notable accomplishments include, designing the acoustics for the U.N. General Assembly Hall; designing, developing and implementing the ARPANET, the forerunner of today's Internet; inventing person-to-person network email; providing the acoustical analysis of the Kennedy assassination and Kent State tapes; and developing the first Internet router and the first packet switch. Today, BBN is a leading provider of advanced research and development services and practical solutions for both government and commercial customers. Areas of expertise include: quantum information, speech and language processing, networking, information security, acoustics, and semantic web technologies.

www.bbn.com
www.daml.org
www.semwebcentral.org

Main Products at a glance:
SWeDE *- an open source Eclipse-based ontology editor*

DAML DB *- a highly scalable persistent Semantic Web store, now in its third generation*

Semantic Web Reference Application *- Downloadable, usable Semantic Web tutorial for developers*

Ocelot *- Web-based OWL Ontology viewer that provides overview information about an ontology along with a browseable class and property hierarchy.*

ObjectViewer *- Visual RDF graph browser.*

OWL Validator *- Tool for checking OWL content for a variety of potential syntax and logical errors.*

SWRL Validator *- Tool for checking SWRL content for syntax and logical errors.*

SweetRules *- Tools for semantic web rules and ontologies, including translation, inferencing, analysis and authoring (with MIT Sloan, et al).*

Arlington, Virginia, USA, 25 March 2006

1. General Company Information
Two MIT professors founded BBN Technologies in 1948 as an acoustics consulting firm. BBN's most notable accomplishments include, designing the acoustics for the U.N. General Assembly Hall; designing, developing and implementing the ARPANET, the forerunner of today's Internet; inventing person-to-person network email; providing the acoustical analysis of the Kennedy assassination and Kent State tapes; and developing the first Internet router and the first packet switch. Today, BBN is a leading provider of advanced research and development services and practical solutions for both government and commercial customers. Areas of expertise include: quantum information, speech and language processing, networking, information security, acoustics, and semantic web technologies.
BBN was the Integration and Transition contractor for the DARPA Agent Markup Language (DAML) program, a catalyst for the Semantic Web. BBN played a key role in the development and standardization of the OWL Web Ontology Language, now a World-Wide Web Consortium Recommendation alongside HTML and XML. In addition, BBN works with a variety of government customers to apply semantic technologies to data management problems. BBN has developed a number of open source tools for the semantic web community.

2. Products Short Presentation
N/A

3. Services Offered
BBN has been solving complex problems for government customers for over 50 years. Our government customers know they can rely on us because of our track record of launching new and successful technology solutions.

BBN provides both advanced research and custom, research-based solutions. Our research and development activities complement and verify each other, assuring that our customers always receive solutions that are both practical and state-of-the-art.

4. Big R&D projects involved
We were the Integration and Transition contractor for the DARPA Agent Markup Language (DAML) program, the major US Government contribution to the Semantic Web. We maintain www.daml.org and www.SemWebCentral.org.

We have subsequently led the development of a number of Semantic Web pilot applications for US Government customers.

5. White Papers / Reports
Dave Kolas, John Hebeler, Mike Dean. Geospatial Semantic Web: Architecture of Ontologies. Lecture Notes in Computer Science, Volume 3799/2005, pp. 183-194.[1]

6. Open Tools for public
Semantic Web Development Environment (SWeDE) - Extendable ontology development environment built on the Eclipse framework.[2]

Semantic Web Reference Application - Downloadable, usable Semantic Web tutorial for developers.[3]

[1] http://dx.doi.org/10.1007/11586180_13
[2] http://owl-eclipse.projects.semwebcentral.org/
[3] http://refapp.projects.semwebcentral.org/

Ocelot - Web-based OWL Ontology viewer that provides overview information about an ontology along with a browseable class and property hierarchy.[4]

ObjectViewer - Visual RDF graph browser.[5]

OWL Validator - Tool for checking OWL content for a variety of potential syntax and logical errors.[6]

SWRL Validator - Tool for checking SWRL content for syntax and logical errors.

Kazuki - Uses a set of OWL ontologies to generate a Java API for creating/editing OWL instance data.[7]

SweetRules - Tools for Semantic Web rules and ontologies, including translation, inferencing, analysis and authoring (with MITSloan et al).[8]

8. Contact details

Business:
Pete Pflugrath
Director, Program Management
BBN Technologies
1300 N. 17th St., Suite 400
Arlington, VA 22209
ppflugrath@bbn.com
+1 703-284-1329

Technical:
Mike Dean
Principal Engineer
BBN Technologies
3658 Wagner Ridge Ct.
Ann Arbor, MI 48103
mdean@bbn.com
+1 734-997-7439

[4] http://ocelot.semwebcentral.org
[5] http://objectviewer.semwebcentral.org
[6] http://owl.bbn.com/validator/
[7] http://projects.semwebcentral.org/projects/kazuki/
[8] http://sweetrules.projects.semwebcentral.org/

Key Publications

Mike Dean and Guus Schreiber, eds. OWL Web Ontology Language Reference. W3c Recommendation 10 February 2004. http://www.w3.org/TR/owl-ref/.

Ian Horrocks, Peter F. Patel-Schneider, Harold Boley, Said Tabet, Benjamin Grosof, and Mike Dean. SWRL: A Semantic Web Rule Language Combining OWL and RuleML. W3C Member Submission 21 May 2004. http://www.w3.org/Submission /SWRL/.

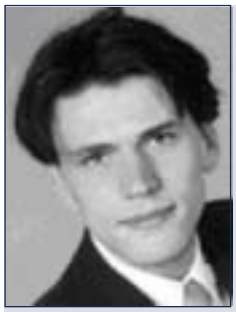
David Martin, Mark Burstein, Jerry Hobbs, Ora Lassila, Drew McDermott, Sheila McIlraith, Srini Narayanan, Massimo Paolucci, Bijan Parsia, Terry Payne, Evren Sirin, Naveen Srinivasan, Katia Sycara. OWL-S: Semantic Markup for Web Services. W3C Member Submission 22 November 2004. http://www.w3.org/Submission/OWL-S/.

Event Reports

TMRA 2005 Report
Semantic Web Days Report
Workshop PPSWR´05 Report
Reasoning Web 2005 Report
New Zealand Workshop Report
Semantic Technology Conference

Topic Maps Research and Applications

TMRA 2005 - "Charting the Topic Maps Research and Applications Landscape"
Lutz Maicher, Alexander Sigel and Lars Marius Garshol
http://www.informatik.uni-leipzig.de/~tmra



Lutz Maicher, Germany, is research assistant at the Department of Information Sciences at University of Leipzig. He has been working with Topic Maps since 2001. His research is focused on the usage of Topic Maps for information and knowledge integration in semantically heterogeneous environments. Lutz founded and chairs the TMRA series.

Alexander Sigel, Germany, is research and teaching assistant at the Department of Information Systems and Information Management at University of Cologne. He researches on Semantic Knowledge Networking, has published several articles on knowledge management and Topic Maps, and is co-chairing TMRA.

Lars Marius Garshol, Norway, is CTO at Ontopia, the leading Topic Maps software vendor. He has been working with Topic Maps since 1999, and has been active in Topic Maps standardization since 2000. He has created many Topic Maps-related technologies, is a well-known personality in the Topic Maps community, and co-chairs TMRA, too.

■ *TMRA - the international conference series on Topic Maps Research and Applications - is a scientific and industrial forum whose main objective is connecting the key players in the Topic Maps community. At TMRA you find researchers, users in government and industry, as well as the vendors, the luminaries, and the standards creators gathered for an exchange of ideas in a stimulating setting. TMRA is where new challenges in Topic Maps are identified and open issues tackled. TMRA 2005 was the first TMRA conference, and as indicated by its motto "Charting the Topic Maps Research and Application Landscape" its purpose was to chart the landscape of Topic Maps research. Together the attendees identified the primary open research issues. TMRA 2005 showed who is working on what and brought together researchers and application pioneers. TMRA 2005 stimulated the systematic tackling of such issues, and fostered the exchange of ideas in a non-commercial and challenging setting. Besides the scientific track, the open-space sessions were playgrounds for visionaries. A report on the open space-sessions is included in the proceedings.*

TMRA 2005 attracted fifty attendees from around the world to meet in Leipzig. In the keynote, Jack Park proposed a fruitful liaison of Topic Maps and Sowa's conceptual graphs. The outcome of TMRA 2005 is documented as volume number 3873 in Springer's LNAI series. The proceedings appeared as post-proceedings edited by Lutz Maicher and Jack Park. TMRA 2006, this year's follow-up event, will take place in Leipzig on October, 11th-12th, and its motto is "Leveraging the Semantics". TMRA is the melting pot where Topic Maps meets adjacent technologies. Researchers and application pioneers from related disciplines are explicitly invited to present their efforts towards the advancement of semantic technologies.

Leipzig, Germany, 28.02.2006

1. General Information about TMRA

This report is about TMRA, the international conference series on Topic Maps Research and Applications. TMRA is a scientific and industrial forum whose main objective is bringing together the key players in the Topic Maps community. At the conference you find researchers, users in government and industry, as well as the vendors, the luminaries, and the standards creators gathered for an exchange of ideas in a stimulating setting. TMRA is where new challenges in Topic Maps are identified and open issues tackled.

TMRA is also the melting pot where Topic Maps meets adjacent technologies. Researchers and application pioneers from related disciplines are explicitly invited to present their efforts towards the advancement of semantic technologies.

2. Theme and Topics covered at TMRA 2005

TMRA 2005 was the first conference in the series, held October, 6th-7th at the Westin hotel in Leipzig, Germany, under the motto "Charting the Topic Maps Research and Applications Landscape". It was organized by the Zentrum für Informations-, Wissens- und Dienstleistungsmanagement in conjunction with the University of Leipzig.

A key feature of Topic Maps is the ability to merge together disconnected pieces of information into a coherent whole, and it is ironic that so far Topic Maps research had been done in a vital but very loosely coupled community. The goal of TMRA 2005 was to bring this community together to form a common vision, and we believe the first conference was a successful effort in this direction. Researchers and application pioneers from all over the world, with backgrounds in academia,

business, and government contributing to the development of the emerging Topic Maps technologies joined TMRA 2005.

Topic Maps research addresses a broad spectrum of disciplines. The goal of TMRA 2005 was to bring together researchers from these diverse fields. Some examples, from a remarkably incomplete listing, are: markup languages, data modelling, artificial intelligence, natural language processing, cognitive science, philosophy and software engineering.

The challenges of TMRA 2005 were:

Charting the Research Landscape
The natural goal for the first academic conference on Topic Maps research was to map the current research topics, and contribute to a common understanding of the challenges and opportunities facing the community. The selection of papers demonstrates the breadth and scope of Topic Maps research, and also points out the challenges ahead.

Connecting Topic Maps Theory and Practice
Building the Topic Maps research community means bringing together research from different bakkgrounds. How can research results developed at universities be transferred to real-life projects? How can results from practice be investigated and reused in academic research? TMRA 2005 was the place where researchers from universities and industry met the vendors and users to start a fruitful discussion about the way ahead.

Topic Maps Visions
The vision of the Topic Maps community has famously been described as "Seamless Knowledge", which implies that topic maps should embody knowledge, allow knowledge from different sources to be stitched together into a coherent whole, and for web sites to turn from disconnected islands of chaos into a single space of "Seamless Knowledge." The papers extend this vision, and explore ways in which it might be enabled.

Initiating Projects
We expect that the result of TMRA 2005 - the research landscape charted during the workshop - will help bringing together people and ideas and thus aid funding of new research projects in which Topic Maps technologies are used. The open space sessions were especially fruitful in this regard.

Topics of TMRA 2005
As topics in interest were announced:
Standard related Topic Maps research
- Topic Maps standards - state of the art and further developments
- Query, update and constrain Topic Maps
- Topic Maps Applications (TMA) besides the TMDM
- Towards a general theory of scope. The next step.

Theoretic Topic Maps research
- Overview of current Topic Maps research efforts
- Coining the phrase "seamless knowledge" in detail
- Semantics in Topic Maps from a philosophical point of view
- Topic Maps and the absence of shared vocabularies
- Recommendations for the publishing of PSIs
- Topic Maps as part of the semantic web
- RDF/OWL, Topic Maps, and other means of knowledge representation
- Creating Topic Maps views of various data sources
- Connecting theories about the knowledge economy and Topic Maps

Applied Topic Maps research
- Overview of innovative Topic Maps applications
- Topic Maps driven portals and information environments
- Topic Maps visualization
- Topic Maps and web services
- Automatic generation of Topic Maps
- Topic Maps and business processes
- Knowledge management (distributed, mobile, etc.) and Topic Maps
- Distributed Topic Maps
- Enterprise information integration (EII) with Topic Maps
- Topic Maps and mobile environments

Open-Space Sessions
In addition to the presentation track, TMRA 2005 provided slots for open-space sessions, like brainstorming for research and business projects. A report on this very exciting part of TMRA 2005 is included in the proceedings.

3. Submissions and Papers Presented
We invited the submission of full papers and work-in-progress reports to be published in the proceedings and received more than 35 submissions. After a blind review process we accepted 22 submissions (17 full papers and 5 work-in-progress-reports). Additionally, the proceedings consist of two papers: one covering the keynote and one reporting on the open space sessions.

The post-proceedings were published in February 2006 in Springer's LNAI series as volume number 3873 (ISBN 3540325271), edited by Lutz Maicher and Jack Park. Publishing post-proceedings required a second editorial loop after the workshop, done by the editors. This process enhanced quality by allowing authors to put the latest insights from the conference into their papers. The proceedings consist of the following papers:

Keynote
Jack Park :
Topic Mapping - a view of the road ahead
This talk offered one view, among many possible views, of the road ahead for topic mapping. Jack proposed that the indexical and relational properties of topic maps offer opportunities well beyond the organization and presentation of information resources. Tenets of evolutionary epistemology suggest a particular area of inspiration, the potential marriage of topic maps with other knowledge technologies. The talk was intended to inspi-

re further discussion and research in this area, and animated the discussion with a sketch of a candidate composition between topic maps and conceptual graphs.

Jack Park, the keynote presenter, is currently employed as a research software developer at SRI International, in Menlo Park, California. Jack edited, produced, and co-authored the book XML Topic Maps: Creating and Using Topic Maps for the Web, published in 2002 by Addison-Wesley.

Frameworks and Engines
José Carlos Ramalho, Giovani Rubert Librelotto, Pedro Rangel Henriques: Metamorphis - a Topic Maps based Environment to Handle Heterogeneous Information Resources
Jakub Strychowski: Concept Glossary Manager - Topic Maps Engine and Navigator
Motomu Naito, Frederic Andres: Application Framework based on Topic Maps

Topic Maps Exchange
Lars Marius Garshol: TMRAP - Topic Maps Remote Access Protocol
Thomas Schwotzer, Agnes Cebulla : Replication of Published Subject Indicators as thesaurus by means of LDAP
Lutz Maicher: Topic Maps Exchange in the Absence of Shared Vocabularies

Modeling and Creating Topic Maps
Are D. Gulbrandsen: Conceptual Modeling of Topic Maps with ORM Versus UML
Martin Leuenberger, Silke Grossmann, Niklaus Stettler, Josef Herget: Using Topic Maps for Image Collections
Karsten Böhm, Lutz Maicher: Real-time Generation of Topic Maps from Speech Streams
Rolf Guescini, Dino Karabeg, Tommy Nordeng: A case for polyscopic structuring of information
Gabriel Hopmans, Peter-Paul Kruijsen, Roger Dols: Subject Centric IT in Local Government

Topic Maps Driven Interfaces
Jack Park, Adam Cheyer: Just For Me: Topic Maps and Ontologies
Kamila Olsevicova: Rebuilding Virtual Study Environments Using Topic Maps
Markus Ueberall, Oswald Drobnik: Collaborative Software Development and Topic Maps
Gabriel Hopmans, Peter-Paul Kruijsen, Leon Oud, Jelte Verhoeff, et al.: Topic Maps for European Administrative Nomenclature

Standards Related Research
Lars Marius Garshol: tolog - a topic maps query language
Robert Barta, Lars Heuer: A TMDM Disclosure Using T+
Lars Marius Garshol, Dmitry Bogachev: TM/XML - Topic Maps fragments in XML

Topic Maps in Library and Cultural Heritage Science
Salvatore Vassallo: Navigating through archives, libraries and museums: topic maps as a harmonizing instrument
Hyun-Sil Lee, Yang-Seung Jeon, Sung-Kook Han: MARCXTM: Topic Maps Modeling of MARC Bibliographic Information
Ralf Schweiger, Joachim Dudeck: Improving information retrieval using XML and Topic Maps
Lynne C. Howarth, Thea Miller: Visualizing Search Results from Metadata-Enabled Repositories in Cultural Domains

Open Space Sessions
Alexander Sigel:
Report on the Open Space Sessions

4. TMRA 2006 - "Leveraging the Semantics"
TMRA 2006 will take place in Leipzig on October, 11th-12th 2006. The motto of TMRA 2006 is "Leveraging the Semantics". Topic Maps has a rich semantic model that is well designed to support information retrieval in general, but also can be used for an almost unlimited range of other applications. How can the semantics of this model best be leveraged in practice? What are the main open issues for the use of Topic Maps? Where is the place of Topic Maps in the muddle of semantic technologies? Finding answers to these questions will be the challenge of TMRA 2006; you are invited to contribute your best efforts.

The TMRA conferences are the melting pot where Topic Maps meets adjacent technologies. Researchers and application pioneers from adjoining disciplines are explicitly invited to present their efforts in the advancement of semantic technologies. Some examples, from a remarkably incomplete listing, are: markup languages, data modeling, artificial intelligence, natural language processing, cognitive science, philosophy and software engineering. Mutual discussions of current efforts support to leverage the semantics in Topic Maps technologies.
In the Call for Papers, there is an impressive list of topics of interest, assigned to the following categories: Leveraging the Semantics, Standard related Topic Maps research, Theoretic Topic Maps research, and Applied Topic Maps research.

We invite original, high quality papers with substantial contributions. The proceedings of TMRA are foreseen to be published by Springer in the LNCS/LNAI series as post-proceedings. For the scientific track, we invite the submission of full papers to be published in the proceedings. For the industrial track, we invite the submission of short papers to be published in the proceedings or presentation proposals. In addition, posters and demonstrations can be submitted. The conference language is English. Submission deadline is June, 2nd 2006.

In addition to the presentation track, TMRA 2006 provides slots and locations for open-space sessions, like brainstorming for research and business projects.

The Call for paper is available at:[1]

[1] http://www.informatik.uni-leipzig.de/~tmra/2006/cfp.html/

Semantic Web Days 2005

Andrea Kulas, Tim Geisler and Dunja Ewinger
www.semantic-web-days.net

Andrea Kulas joined webXcerpt Software GmbH in Munich, Germany in 2004 and is responsible for Technology Transfer and Awareness for the Network of Excellence REWERSE.

Tim Geisler is CEO and founder of webXcerpt Software GmbH in Munich, Germany and coordinator of the working group Technology Transfer and Awareness of REWERSE.

Dunja Ewinger joined webXcerpt Software GmbH in Munich, Germany in 2004 and is team member of the working group Technology Transfer and Awareness of REWERSE.

■ *Executive Summary: In the following report we will give a short overview of the Semantic Web Days which took place in October 2005 in Munich, Germany.*
Semantic Web Days 2005 which took place in Munich October 6-7 offered a forum for innovative companies and research institutions with the strong desire to accelerate the uptake of Semantic Web technologies. A major goal of the two-day conference was to present the latest Semantic Web technologies which are very promising or already in use.
The international conference was organized by the EU Network of Excellence REWERSE (REasoning on the WEb with Rules and SEmantics) in cooperation with the EU Network of Excellence Knowledge Web (Realizing the Semantic Web).
Workshop presentations covered the topics Semantic Web for Life Sciences, Business Rules and Semantic Web, Semantic Web services and industrial applications of Semantic Web. Also the exhibition gave opportunity to have a look at existing Semantic Web applications. While keynote speaker Ivan Herman, Head of Offices at W3C, reported on current trends and standards of Semantic Web technologies, keynote speaker Hermann Friedrich from Siemens AG informed about first experiences with ontologies in pilot projects.

About 130 company representatives and researchers from all over Europe, as well as the US and Korea attended the conference. Overall, the organizers have been extremely happy with the success of the event. Their impression has been backed by the tenor of the participants, who wished to establish this conference so that developments and applications of Semantic Web technologies can be communicated between companies and research institutions in a timely manner.

Munich, Germany, 21.02.2006

1. General Information
Name: Semantic Web Days
Location: Munich, Germany
Organizers: Network of Excellence REWERSE, Network of Excellence Knowledge Web
Conference theme: Exchange forum for business and research on Semantic Web topics

2. Theme / Covered Topics
The conference offered a forum of exchange for innovative businesses and European research institutions that concentrate on Semantic Web tools and technologies. As a special industry-orientated event, a particular focus was on applications of ontology- and reasoning-based technologies for processing (Semantic) Web data. Application areas such as life sciences, knowledge management, publishing, natural-language processing, e-work, and e-business offered insight into practical application issues.

3. Submissions and Papers Presented
The Semantic Web Days were organized as an industry-focused event. A call for paper which is very usual in an academic context was not issued for the Semantic Web Days 2005. Instead, speakers were selected by invitation only. Prior to the conference those speakers submitted extended abstracts and presentations slides. While the presentation slides of keynote and workshop speakers are available for download at the website http://www.sematic-web-days.net, extended abstracts have been distributed to the conference participants solely in form of a CD.

4. Best Paper and Keynotes

1. Keynote
Questions and answers on the Semantic Web (by Ivan Hermann, Head of offices W3C)

The technical public, when hearing about the concepts of the Semantic Web, has a number of questions. These questions might come as the consequence of misunderstandings, of inadequate explanations, or of a lack of necessary information. This presentation tried to collect some of these 'general' questions and attempts to answer them. Topics that are touched upon were:
· Is the Semantic Web 'Artificial Intelligence on the Web'?
· Is this only a fancy research subject?
· Are there tools around?
· Isn't it too complex?
· What are the still open issues?

2. Keynote

Semantic Web Technologies at Siemens: where are we heading? - scenarios and applications (by Hermann Friedrich, Siemens AG)

Semantic Web and its technologies are getting more and more important for industrial companies like Siemens. This presentation shows approaches within Siemens AG to integrate Semantic Web technologies like Light Weight Ontologies for optimizing business processes and improving knowledge management. It will also be shown how Siemens products and solutions benefit from Semantic Web approaches.
A best paper award has not been nominated.

5. Event Report

Semantic Web Days 2005 which took place in Munich in October 2005 offered a forum for innovative companies and research institutions with the strong desire to accelerate the uptake of Semantic Web technologies. A major goal of the two-day conference was to present the latest Semantic Web technologies which are very promising or already in use.

The international conference with attendees from all over Europe, as well as the US and Korea, was organized by the EU Network of Excellence REWERSE (REasoning on the WEb with Rules and SEmantics) in cooperation with the EU Network of Excellence Knowledge Web (Realizing the Semantic Web). The event was sponsored by Hewlett-Packard (HP), Ontotext Lab, Siemens AG, France Telecom R&D and partially financed by the European Commission and the Swiss Federal Office for Education and Science within the 6th Framework Program.

One of the central questions of the two days focused on the degree of maturity of the technologies i.e. ontologies, reasoning, business rules, facing real needs in industry i.e. data integration. The message, which was also discernable in the concluding panel discussion, was that procedures to describe semantic coherences presently mainly exist in the form of pilot studies, but so far hardly in major industrial projects. Although only a limited number of projects are so far realized with Semantic Web technologies, the power of the Semantic Web approach as well as the need for catch-up became obvious at the Semantic Web Days. The more than 130 participants at the Semantic Web Days showed no doubt that there is high potential for Semantic Web technologies, on display in pilot projects presented in keynotes and workshops and tools at the exhibition.

At present, as the workshops at the Semantic Web Days demonstrated, established projects are focused on the development of corporate knowledge management, telecommunication applications, business integration for agile enterprises and health care. Furthermore, the exhibition with more than 12 companies and institutions organized in reference to the Semantic Web Days demonstrated that quite a number of SMEs already have products on the basis of Semantic Web technologies.

Keynote speaker Hermann Friedrich, who is among others responsible at Siemens AG for the development of the knowledge database used internally in the company, spoke about first experiences with Semantic Web: "We also have the possibility to classify documents in content management, but with ontologies it is possible to demonstrate more complex coherences."

Modeling complex causal coherences is also a focus for Thomas Syldatke, one of the panelists at the concluding panel discussion "Earning money with Semantic Web technologies - examples of best practice and outlook for promising projects of the future". He is responsible at Audi AG for the development of software for testing engines. "This is a very complex procedure, there are a lot of rules which we are integrating with ontologies which need to be considered", he noted. "10 percent of the rules have been integrated in the first pilot application which was finished in June 2005. We asked the system which should be the next control step for the engine and compared the result with the program which has been in use already," said the expert. 100 percent of the rules are supposed to be integrated with the ontology by December 2005.

Four workshops on the topics "Industrial Applications of Semantic Web Technologies", "Vocabularies and Rules for Enterprise Applications", "Semantic Web Services in Industry", and "Semantic Web for Life Sciences" as well as a presentation on "Geospatial Information Processing for the Web" demonstrated more in detail that there is high potential for semantic technologies such as ontologies and rules to provide better and faster solutions than conventional methods. Pilot projects presented at the Semantic Web Days proved those potential advantages.

Overall, the organizers have been extremely happy with the success of the event, and their impression has been backed by the tenor of the participants, who wished to establish this conference so that developments and applications of Semantic Web technologies can be communicated between companies and research institutions in a timely manner. Last but not least, the participants list of the Semantic Web Days demonstrated that the goal of exchange between business and research has been achieved as half of the participants came from companies while the other half came from research institutions. Qualified presentations, the participants themselves, nice surroundings, and many opportunities for social networking contributed to the success of the two days.

6. Next event

The second Semantic Web Days will take place in autumn 2007. For detailed information see:
www.semantic-web-days.net

Principles and Practice of Semantic Web Reasoning - PPSWR 2005

Uta Schwertel
University of Munich
http://rewerse.net/PPSWR05/

Uta Schwertel, Germany, is a member of the Institute for Informatics at the University of Munich, Germany. She is the project manager of the European Network of Excellence REWERSE (Reasoning on the Web with Rules and Semantics). Formerly, Uta Schwertel completed her PhD at the University of Zurich in the project Attempto. Her current research interests are using controlled natural language as a user-friendly interface language for Semantic Web applications

■ *Executive Summary:*
The third Workshop "Principles and Practice of Semantic Web Reasoning" (PPSWR'05) took place on Sept. 11-16, 2005 in Dagstuhl, Germany. It was coordinated by François Fages (Programme Chair) and Sylvain Soliman (Proceedings Chair).
The workshop PPSWR serves as a forum for discussing various forms of reasoning that are or can be used on the Semantic Web. Moreover, it addresses both reasoning methods for the Semantic Web and Semantic Web applications relying upon various forms of reasoning.
The fourth workshop PPSWR'06 will be co-located with the European Semantic Web Conference (ESWC) from June 10-11 in Budva, Montenegro.
The annual PPSWR workshops are supported by the European Network of Excellence REWERSE.

Munich Germany, 12.03.2006

1. General Information

The third Workshop "Principles and Practice of Semantic Web Reasoning" (PPSWR'05) took place within a Dagstuhl Seminar on Sept. 11-16, 2005 in Dagstuhl, Germany (cf. http://rewerse.net/PPSWR05/).

The workshop series PPSWR (http://rewerse.net/PPSWR/) consists of annual workshops supported by the European Network of Excellence REWERSE (REasoning on the WEb with Rules and SEmantics) (cf. http://www.rewerse.net). PPSWR serves as a forum for discussing various forms of reasoning that are or can be used on the Semantic Web. Moreover, it addresses both reasoning methods for the Semantic Web and Semantic Web applications relying upon various forms of reasoning.

The workshop PPSWR'05 was coordinated by François Fages (Programme Chair) and Sylvain Soliman (Proceedings Chair).

2. Theme / Covered Topics

Overview
The *Semantic Web* is a major endeavour aiming at enriching the existing Web with meta-data and processing methods so as to provide web-based systems with advanced (so-called "intelligent") capabilities, in particular *context-awareness* and *decision* support.

The advanced capabilities striven for in most Semantic Web application scenarios primarily call for *reasoning*. Reasoning capabilities are offered by Semantic Web languages currently being developed such as BPEL4WS, BPML, ConsVISor, DAML-S, JTP, Triple, and others. These languages, however, are developed mostly from functionality-centered (e.g. ontology reasoning or access validation) or application centered (e.g. Web service retrieval and composition) perspectives. A perspective centered on the *reasoning techniques* (e.g. forward or backward chaining, tableau-like methods, constraint reasoning, etc.) complementing the above-mentioned activities appears desirable for Semantic Web systems and applications. The workshop PPSWR is devoted to such a perspective.

Just as the current Web is inherently heterogeneous in data formats and data semantics, the Semantic Web will be inherently heterogeneous in its reasoning forms. Indeed, no single form of reasoning is adequate for all applications in the Semantic Web. For example, ontology reasoning in general relies on monotonic negation (for the meta-data often can be fully specified), while databases, Web databases, and Web-based information systems call for non-monotonic reasoning (e.g. one would not specify non-existing trains in a railway timetable); constraint reasoning is needed in dealing with time (for time intervals are to be dealt with), while (forward and/or backward) chaining is the reasoning of choice in coping with database-like views (where virtual data can be derived from actual data by operations such as join and projections).

The workshop on "Principles and Practice of Semantic Web Reasoning" is a forum for discussing various forms of reasoning that are or can be used on the Semantic Web. The workshop addresses both, reasoning methods for the Semantic Web and Semantic Web applications relying upon various forms of reasoning.

The first workshop in this series took place in 2003 in Mumbai, India, co-located with ASIAN, ICLP and FSTTCS. The second workshop took

place in 2004 in St.Malo, France, in conjunction with ICLP'04. The third works-

hop PPSWR'05 consisted of a regular Dagstuhl Seminar including the workshop with peer reviewed papers.

Topics of interest

Rule interchange formats and Rule markup languages , Reasoning paradigms for Web query languages , Query languages for ontology languages, Constraint reasoning on the Semantic Web, Default reasoning on the Semantic Web, Fuzzy reasoning on the Semantic Web, Inconsistency-tolerant reasoning on the Semantic Web, Formal methods in the Semantic Web, Applications of reasoning methods: e.g. Adaptive Web systems and applications, Web-based decision support, Policy specification and conformance, Bioinformatics, Semantic Web Services, Temporal and spatial reasoning, User-friendly interfaces to rules and reasoning on the Web (e.g. natural language, visualisation, etc.)

3. Submissions and Papers Presented

The proceedings of PPSWR'05 have been published by Springer in Lecture Notes in Computer Science Lecture Notes in Computer Science, Vol. 3703. The lecture notes also are available at:[1]

The acceptance rate for the workshop papers was 2/3. The following 12 papers have been accepted.

· P. Adjiman, P. Chatalic, F. Goasdoué, M.-C. Rousset, L. Simon, SomeWhere in the Semantic Web

· Patrick Lambrix and He Tan, A Framework for Aligning Ontologies

· Peter F. Patel-Schneider, A Revised Architecture for Semantic Web Reasoning

· Ian Horrocks, Bijan Parsia, Peter Patel-Schneider, James Hendler, Semantic Web Architecture: Stack or Two Towers?

· Riccardo Rosati , Semantic and Computational Advantages of the Safe Integration of Ontologies and Rules

· Jos de Bruijn, Enrico Franconi, Sergio Tessaris, Logical Reconstruction of RDF and Ontology Languages

· Tim Furche, François Bry, Oliver Bolzer, Marriages of Convenience: Triples and Graphs, RDF and XML in Web Querying

· Sacha Berger, Emmanuel Coquery, Wlodzimierz Drabent, Artur Wilk, Descriptive Typing Rules for Xcerpt

· José Júlio Alferes, Ricardo Amador, Wolfgang May, A General Language for Evolution and Reactivity in the Semantic Web

· Francesca A. Lisi, Principles of Inductive Reasoning on the Semantic Web: A Framework for Learning in -Log

· Hans Jürgen Ohlbach, Computational Treatment of Temporal Notions: The CTTN-System

· François Bry, Bernhard Lorenz, Hans Jürgen Ohlbach, Mike Rosner, A Geospatial World Model for the Semantic Web

In addition to the LNCS proceedings, results of the Dagstuhl PPSWR 2005 seminar have been published as "PPSWR 2005 Dagstuhl Seminar Proceedings 05371" at:[2]

4. Keynotes

The following invited talks were given.

· François Bry and Massimo Marchiori, Ten Theses on Logic Languages for the Semantic Web

· Stefan Decker, Use Cases for Reasoning with Metadata or What Have Web Services to Do with Integrity Constraints?

· Florian Sohler, Generating Contexts for Expression Data Using Pathway Queries

5. Next Event

The fourth workshop PPSWR'06 will be co-located with the European Semantic Web Conference (ESWC) from June 10-11 in Budva, Montenegro.

PPSWR 2006 Workshop co-ordinators

· Wolfgang May (Georg-August-Universität Göttingen, Germany)

· Uta Schwertel (Ludwig-Maximilians-Universität München, Ger many)

PPSWR Program Committee co-chairs

· José Alferes (Universidade Nova de Lisboa, Portugal)

· James Bailey (The University of Melbourne, Australia)

The PPSWR'06 workshop details can be accessed at:[3]

[1] http://www.springer.com/sgw/cda/frontpage/0,11855,1-40109-22-71438973-0,00.html/

[2] http://drops.dagstuhl.de/portals/05371/

[3] http://rewerse.net/PPSWR06/

International Summer School "Reasoning Web 2005"

Norbert Eisinger and Jan Maluszynski
http://reasoningweb.org/2005

Norbert Eisinger is a faculty member of the Institute for Informatics at the University of Munich, Germany. He is deputy coordinator of the workpackage "Education and Training" of the REWERSE Network of Excellence.

Jan Maluszynski is a professor at the Department of Computer and Information Science of Linköping University, Sweden. He coordinates the workpackage "Education and Training" of the REWERSE Network of Excellence.

■ *Executive Summary:*
Event report of the Summer School "Reasoning Web 2005" in Malta in July 2005, organized by the Network of Excellence REWERSE and targeted at advanced students, researchers, and professionals interested in the Semantic Web and Reasoning.

Munich (Germany) and Linköping (Sweden), 10 March 2006

1. General Information

International Summer School "Reasoning Web 2005", University of Malta, 25-29 July, 2005,[1]

Organizer: Network of Excellence "Reasoning on the Web with Rules and Semantics (REWERSE)",[2]

Objectives: Introduction into Semantic Web methods and issues, particular focus on reasoning.

2. Theme / Covered Topics

The lectures, given by leading researchers, provided competent coverage of methods and issues of the Semantic Web, ontology languages and their relation to description logics, Web query languages, XML, RDF, and topic maps, evolution and reactivity, personalization in the Semantic Web, rule modeling with UML, techniques in Web information extraction, and type checking for Web rule and query languages.

3. Submissions and Papers Presented

The target audience consisted of advanced students, researchers and professionals. Anyone interested in the Summer School could apply for participation by filling in an online form that asked for information about the applicant's research activities and interests. In addition, PhD students could offer a 30 minutes presentation of their PhD work. This application information was reviewed by a selection committee, which admitted about 40 participants and 8 PhD presentations. The acceptance rate was slightly over 50 per cent.

List of Lectures Presented

(in the order of presentation)
François Bry: A Perspective for Semantic Web Research and Development
Grigoris Antoniou, Enrico Franconi: Fundamentals of Semantic Web Ontology Languages
Michael Kifer: Programming with Logic and Objects
François Bry and James Bailey: Web and Semantic Web Query Languages: Standards, State of the Art, and Perspectives
Gerd Wagner: Rule Modelling and Markup
Matteo Baldoni, Nicola Henze: Personalization for the Semantic Web
Robert Baumgartner: Information Extraction for the Semantic Web
Wlodzimierz Drabent: Types in the Semantic Web
Wolfgang May, José Júlio Alferes: Evolution and Reactivity for the Web
Norbert E. Fuchs: Attempto Controlled English

Proceedings

Norbert Eisinger, Jan Maluszynski (Eds): Reasoning Web, First International Summer School 2005, Msida, Malta, July 2005, Tutorial Lectures. Lecture Notes in Computer Science, Vol. 3564, Springer. Berlin, Heidelberg, New York, Tokyo, 2005. ISBN 3-540-27828-1

Publisher information:[3]
Online Version:[4]

4. Next Event

Reasoning Web 2006, Lisbon, Portugal, 4-8 September 2006,[5]

[1] http://reasoningweb.org/2005
[2] http://rewerse.net
[3] http://www.springeronline.com/3-540-27828-1
[4] http://www.springerlink.com/openurl.asp?genre=issue&issn=0302-9743&volume=3564&issue=preprint
[5] http://reasoningweb.org

First New Zealand Workshop on Ontologies and the Semantic Web

David Parry
http://csrs1.aut.ac.nz/semantic_web/

David Parry is a Senior Lecture in the School of Computer and Information Sciences, Auckland University of Technology, Auckland New Zealand. Dave. parry@aut.ac.nz. Other authors are the programme Committee of the Workshop.

Executive Summary:
The first New Zealand Workshop on Ontologies and the Semantic Web attracted around twenty people to hear 11 presentations.

Presentations came from people involved in research from computer science and business.

It is proposed to continue these workshops every year. Themes that emerged during the day included the need to understand the mechanisms by which search engines select pages and the value of identifying niche applications or approaches that would be of value to the user community but also able to be studied and improved in the academic domain. The need for sharing information within the community of existing knowledge - of development tools, corpora and existing ontologies, was also highlighted. A number of potential joint projects were discussed and further means of communication - including organising a similar event at Waikato next year - were begun.

Auckland, New Zealand March 4th 2006
Munich Germany, 12.03.2006

1. General Information

The Workshop Was held on March 4th 2006 at Auckland University of Technology, Auckland, New Zealand

2. Theme / Covered Topics

The semantic web offers a vision of enormously increased value from documents and information stored on the current World Wide Web. Workers in areas such as text processing and information retrieval, artificial intelligence, Agent-based systems and knowledge representation all have vital roles to play in the development of theory and practice in this area. The aim of this workshop is to bring together interested parties to discuss this area, find common understandings and support collaboration both within New Zealand and Internationally. The workshop brought together workers in Computer Science, Information Sciences and Library Sciences to map out areas of shared interest along with applied researchers in this field.ning on the Semantic Web, Formal methods in the Semantic Web, Applications of reasoning methods: e.g. Adaptive Web systems and applications, Web-based decision support, Policy specification and conformance, Bioinformatics, Semantic Web Services, Temporal and spatial reasoning, User-friendly interfaces to rules and reasoning on the Web (e.g. natural language, visualisation, etc.)

Particular issues included, but are not limited to:
· Applications of the Semantic web in New Zealand.
· Ontology Research, production and use.

Programme Committee
David Parry AUT[1]
Dr. Russel Pears AUT
Dr. Stephen Cranefield University of Otago[2]
Professor Stephen Macdonell AUT[3]
Dr. Annika Hinze University of Waikato[4]
Associate Professor Brett Collins AUT[5]
Marcia Gottgtroy University of Auckland[6]
Dr. Andy Connor AUT[7]
Paulo Gottgtroy AUT[8]
Professor Wai Kiang (Albert) Yeap AUT[9]
Dr. Xiaoying (Sharon)Gao Victoria University of Wellington[10]

3. Submissions and Papers Presented

Twelve abstracts were submitted and all went trough a double blind reviewing process. The aim of the workshop was to build a community, so submissions fromall over the country were particularly welcome.
The following papers were presented :
- Fuzzification of a Standard Ontology David Parry (AUT)
- Use of Association Rule Mining to form a Digital Library Ontology - Russel Pears and Parikshit Basure (AUT)
- Ontology Visualization: A Biomedical Informatics case study - Paulo Gottgtroy (AUT)
- Analysing Gene Regulatory Network by means of Ontology and Computational Neurogenetic Modelling Paulo Gottgtroy (AUT)
- Ontology Driven Knowledge Discovery in Databases Paulo Gottgtroy (AUT)
- Improving Web Page Clustering with Global Document Analysis- Daniel Crabtree (Victoria University Wellington)
- Bridging the Gap Between the Model-Driven Architecture and Ontology Engineering -Stephen Cranefield (University of Otago)
- Web resources: Is it useful as an ontological information resource? - Kyongho Min (AUT)

[1] http://elena.aut.ac.nz/homepages/staff/Dave-Parry/
[2] http://www.business.otago.ac.nz/infosci/People/Staff/staff.htm?user=scranefield
[3] http://www.aut.ac.nz/schools/computer_and_information_sciences/our_staff/dr_stephen_macdonell/
[4] http://www.cs.waikato.ac.nz/%7Ehinze/
[5] http://www.aut.ac.nz/research/research_institutes/kedri/staff/
[6] http://staff.business.auckland.ac.nz/mgottgtroy

- Contextual Knowledge Based Relevance Feedback - Dillip Limbu (AUT)
- Event Notification for Semantic Web Documents using Distributed Authoring Annika Hinze and Reuben Evans(Waikato University)
- Investigating a Framework to Support the Adoption of Semantic Web in an E-Commerce Environment - Angela Lien And Dr. Marcia Gottgtroy University of Auckland
- The discussion between and after the papers was particularly valuable.

4. Best Paper and Keynotes

Keynote - Professor Albert Yeap (AUT) Natural language understanding - do ontologies have a role?

5. Next Event

It is planned to hold another workshop on this topic in 2007.

[7] http://www.aut.ac.nz/about/faculties/design_and_creative_technologies/serl/people/dr_andy_connor.htm
[8] http://www.aut.ac.nz/research/research_institutes/kedri/staff/
[9] http://www.aut.ac.nz/research/research_institutes/iitr/robotics/
[10] http://www.mcs.vuw.ac.nz/%7Exgao/

Semantic Technology Conference, SemTech 2005

Dave McComb
www.semantic-technology.com

Dave McComb, the President of Semantic Arts, is the author of Semantics in Business Systems, published by Morgan Kaufmann, and was program chair for SemTech 2005

■ *2005 was the inaugural year of the Semantic Technology Conference, which took place in San Francisco, CA.*

This conference is the premier, if not the only, event of its kind, where customers, developers and researchers converge to discuss the commercialization of Semantic Technologies. It's also the fast track to learning what Semantic Technologies are all about, and how to exploit them in your organization

The focus of the first year's sessions was how the semantic web will transform the Internet for researchers, academics, and business people.

San Francisco. CA, March 7-10, 2005

1. General Information

Semantic Technology 2005, San Francisco, CA.
Produced by Wilshire Conferences, Inc. and Semantic Arts, Inc.
Semantic Arts, Inc. is a Fort Collins, CO-based consulting firm that specializes in helping companies migrate to semantically-based Service Oriented Architectures.
Wilshire Conferences is a leading producer of technical conferences and seminars including the annual DAMA/Metadata Conferences.

Semantic Technology is a hot industry sector right now - a $2 billion per year market and projected to grow to over $50 billion by the year 2010. Leading analysts have estimated that 35-65% of our System Integration costs are due to Semantic issues. And in every sector of the market - software infrastructure and tools, methodology, internet based activity and support for implementation projects - both inside the enterprise, and across the Internet, our biggest software challenges come down to creating and resolving meaning. In other words: semantics.

2. Theme / Covered Topics

Business Vocabularies
Ontology and Taxonomy
Semantic Modeling
Semantic Brokers
Upper Models
Web Services
Semantic Queries
OWL and RDF
The Semantic Web
Knowledge Representation
Unstructured Data
Business Rules
Meta Data
Semantic Search
Data Warehousing

3. Submissions and Papers Presented

Submissions were accepted via email and a website. There were also 12 invited presenters. In addition to those 12 papers we selected 26 of 91 submissions, for a 29% acceptance rate.

- Bradley P. Allen; Semantic Search Using RDF Metadata
- Steve Ardire; Bringing Structure to Unstructured Information
- Geoff Brown; Semantic Web and Ontology Technologies in the Context of Emerging GRID Computing Infrastructures
- Fran Clark and Simon Robe; Building Better Enterprise Message Models with Semantics
- Greg Congleton, Eliezer Israel, Greg Robinson; A Tale of Two Models: From ER/UML to Semantics
- Kurt Conrad, Bo Newman, Bob Smith Embracing; Dynamic Semantics: A Case Study
- Joseph Busch and Ron Daniel; Introduction to the Dublin Core
- Mills Davis; The Business Value of Semantic Technology
- Christoph Bussler; Semantic Technology Research at the Digital Enterprise Research Institute (DERI)
- Jayne Dutra; Designing Controlled Vocabularies for Large Organizations: Taxonomy Development at NASA
- Harry Ellis; Removing Technical Bias from Semantic Conceptual Modeling
- JohnRobert Gardner; Semantic Web for the Front and Back Office
- Ed Green; Semantic Discovery in Semi-Structured Data
- James Hendler; Introduction to the Semantic Web
- James Hendler; The Policy Aware Web
- Dave Hollander; Implementing Canonical Models in Your Organization
- Ralph Hodgson; Semantic Technology and Model-Based Life-Cycle Support
- Dr. Epaminondas Kapetanios; MDDQL: Multi-lingual Query Language and System for Heterogeneous Data Sources
- Elisa Kendall, Dan Chang; The Model Driven Semantic Web: Emerging Technologies and Implementation Strategies
- Barbara LaRobardier; Taxonomy and Metadata at UPS
- Kevin Lynch; Governance and Synchronization of Enterprise Vocabularies
- David Martin; Semantic Web Services: Promise, Progress and Challenges
- Dave McComb; Semantics 101

- Adrian McKeon; Ontological Semantic Cognitive Data Measurement and Business Intelligence
- Henry Meeter, Christian Fillies; The Semantic Broker as e-Commerce Enabler
- Terry Moriarty; Semantic Web: Business Rules in Action
- Uche Ogbuji; XML Design for Semantic Transparency
- Stephen Pace; Semantics in Data Warehousing and Integration
- Adam Pease; Business Applications of the Suggested Upper Merged Ontology
- Jeff Pollock; Architecture Patterns for the Enterprise Semantic Web
- William Ruh; Semantic Web at Cisco
- Zvi Schreiber; Semantic Information Management
- Mark Sharp; Extracting a Practical Drug Ontology from the UMLS
- Amit Sheth; Semantic Technology in the Real World: Enterprise Semantic Applications
- Ronald Yager; Providing Semantics Using Fuzzy Set Methods

You can order a CD-ROM of the 2005 Conference Proceedings here:[1]

4. Keynotes

Doug Lenat - Keynote: Six Degrees of Semantics

If software is ever going to be able to effectively inter-operate (in ways that were not explicitly preconceived and engineered), it will be because applications share enough of the semantics of their data elements. But, ironically, "semantics" means different things to different people. This keynote looked at several different layers of semantic sharing, and in particular how the Semantic Web, as currently envisioned, will need to be extended with layers of shared implicit content (consensus reality knowledge) and explicit metadata specification of content.

Eric Miller - Opening Keynote: The Semantic Web is Here

"This is about connecting the data to its definition and context." "We're moving from a Web of documents to a Web of data." The W3C's Miller devoted much of his keynote address to existing examples of Semantic Web technologies being developed or rolled out by major companies.

Nokia, for example, maintains long-standing Semantic Web activity of its own and has made its Semantic Web toolkit, known as Wilbur, available on the SourceForge.net open-source development site. Miller hailed the way Nokia has used Semantic Web specifications, particularly RDF, or Resource Description Framework, in some of its products and in its developers' forum.

He also cited other examples, including HP's use of Semantic Web technologies in its work building an online education resource for the government of Singapore; the IBM Internet Technology Group's development of Semantic Web applications, especially those in the life sciences; and Adobe's addition of RDF-based XMP (Extensible Metadata Platform) in its Creative Suite, which Adobe says sits on more than 700,000 computers.

Peter Norvig - Keynote: The Future of Search

Google's 8 billion-plus Web document index may not multiply, but its search engine will learn to better divide the data.

That was part of the message from Peter Norvig, Google's director of search quality. Norvig highlighted several research projects the company is developing to help classify data and improve the relevance of search results.

Those projects focus on adding new clustering capabilities for search results, providing suggestions for related searches, personalizing listings, and returning factual answers to specific questions, Norvig said.

Norvig also demonstrated Keyhole, Google's satellite mapping service. He said that over time, the company will greater integrate its maps and local information on businesses and places. "It's important to deliver information about the real world as people carry devices around," he said.

5. Next Event

The second annual Semantic Technology Conference will be held in San Jose, CA March 6 - 9, 2006. It will include a full day of tutorials, over 70 presentations, plus labs and product demos. Here's the link for more information:[2]

[1] http://www.regonline.com/Checkin.asp?EventId=18014
[2] http://www.semantic-conference.com/default.html

Project Reports

SEED Report
REWERSE Report
Dart Grid Report
ASG Report
SemDis Report
Glycomics Report
Meteor-S Report
ASP-SW Report
EPOS Report

SEED, SEmantic E-tourism Dynamic packaging

Jorge Cardoso and Jorge D. Fernandes
http://seed.expedita.com.pt/

Jorge Cardoso joined the University of Madeira (Portugal) in March 2003. He previously gave lectures at University of Georgia (USA) and at the Instituto Politécnico de Leiria (Portugal). Dr. Cardoso received his Ph.D. in Computer Science from the University of Georgia in 2002. In 1999, he worked at the Boeing Company on enterprise application integration. His research interests are in the areas of business processes, workflow management systems, semantic Web, and related fields.

Jorge Dias Fernandes works at Expedita (Portugal - Madeira), a tourism-specialized IT company, since 1999. He is responsible for research & development. During various years he was an invited teacher at the University of Madeira. Previously, he participated in several D.A.I. and tourism-related research projects coordinated by the Instituto Superior Técnico (Lisbon) and the Faculdade de Ciências. Jorge received his MSc in Electrical and Computer Engineering in 1997 from Instituto Superior Técnico. His research interests are in the areas of business processes, tourism reservation systems and knowledge representation..

■ *Tourism is one of the sectors of the World economy with the best outlook. The World Tourism Organization predicts a 200% increase in tourist arrivals around the world by 2020. This is due to factors such as the increase in time for leisure activities and its social importance. According to Carl H. Marcussen from the Centre for Regional and Tourism Research of Denmark, the European online travel market size has increased from 2,5 Billion Euros in 2000 to 18,2 Billion Euros in 2004, and a further growth to 23,4 Billion Euros in 2005 and 28,5 Billion Euros in 2006 is expected.*

The rapid growth of the Internet and the continual adoption of innovative technology have led to serious changes in the travel industry during. Due to the constantly changing business environment, one of the latest concepts of the tourist industry is "Dynamic Packaging". We can define dynamic packaging as the ability of a system to combine different tourism products in order to create a package This ability will offer advantages for the tourist, because creating packages he can obtain products with lower prices. Another advantage is that the tourist only has to introduce his personal data, like name, address, credit card, etc, only one time to buy all the products in a package.

The SEED project was started with the objective of developing a new way to implement dynamic packaging systems. To create dynamic packages, systems must integrate different tourism data sources. This data sources can have a very different data formats and can be accessed by very different forms. To deal with the heterogeneity of the tourism data sources, we will use the Semantic Web technology. The use of Semantic Web technology will help us in the integration of the data sources. By creating a semantic model of the tourism domain and associating this model with each one of the data sources, we can more easily integrate them.

Funchal, Portugal, 25.02.2006

1. General Project Information

Objectives

The main objective of our project is helping the travel industry to take full advantage of the latest Internet technologies, i.e. Web services, Web processes, and semantics. In this context, we are implementing a semantic architecture for dynamic packaging applications. The architecture integrates tourism data systems in order to allow the creation of dynamic packages.

Main Deliverables

At the end of the project we expect to deliver the following items:
· Data Extraction System
· Data Model Mapping Application (Syntactic/Semantic)
· An Ontology for e-tourism
· Dynamic Packaging System
· Application for defining business rules for e-tourism

Scientific and Technical Coordinator

The project is coordinated by Jorge Cardoso, assistant professor at the University of Madeira, and by Jorge Fernandes, administrator of Expedita, an organization whose main activity is the development of systems for the tourism industry.

2. Partners Details

There are two main Partners in the project:
· The University of Madeira participates in the project through the Mathematics and Engineering Department. The PI is Prof. Jorge Cardoso. Currently, 3 master students (Miguel Gouveia, Jorge Sousa and Lisete Escórcio) and 3 senior students (Bruno Silva, Pedro Rosa and Toni Rodrigues) are involved in the project. Past contributors included Tobias Schmeing, from the University of Essen - Germany.
· Expedita - Arquitectura e Gestão de Sistemas de Informação Lda. is an IT

organization that develops several projects for the tourism industry. The company participates in the project through is administrator, Jorge Fernandes. He is the co-PI of the project.

3. WorkPlan Overview

The workplan for the project is divided into five sections. This division is necessary because five different teams are developing five different parts of the project.

Tourism Data Sources Integration System workplan:

· Web page development and study of ontologies and semantic (September 2005)
· Study extractor/wrappers technology and tools (October and November 2005)
· Architecture development (December 2005)
· Usage scenario description and study of related work (January 2006)
· Write a paper about Semantic Data Extraction for B2B Integration (February 2006)
· Implementation phase (March 2006)
· Testing and Optimization phase (May 2006)
· Integration and testing phase and write the final report (June 2006)

Data Model Mapping Application workplan:

· Getting familiar with several concepts related with the SEED project (September 2005)
· State of Art - Studying mapping and Semantic Web tools already available (October 2005)
· Preliminary technology evaluation (November 2005)
· Testing code as concept-proof for transforming XML to OWL using XSLT (November 2005)
· Requirement Analysis (December 2005)
· Design (January and February 2006)
· Implementation - Domain & Persistence (March and April 2006)
· Implementation - User Interface (April to June 2006)
· Final Report (June 2006)

Ontology for e-tourism workplan:

· Study the domains in which ontologies and semantic are being used (September 2005)
· Study the use of ontologies and semantic (October 2005)
· Study RDF, RDFS and OWL Languages (November 2005)
· Define the ontology vocabulary (November 2005)
· Install Protégé and use it to build a small ontology for e-tourism (November 2005)
· Study the different methodologies to build ontologies (December 2005)
· Write a survey describing the different ontology tools (January 2006)
· Identify ontology instances (February 2006)
· Building and develop a new methodology to build ontologies (March 2006)
· Build an ontology according to the proposed methodology (April 2006)
· Write the thesis (July 2006)

Semantic Rules workplan:

· Study First Order Logic (September 2005)
· Study rules reasoner (September 2005)
· Study the use of RuleML and SWRL rule languages (October 2005)
· Study Bossam Language (November 2005)
· Select the best rule language for the project (December 2005)
· Study the different kind of business rules (January 2006)
· Identify the different categories of business rules that can be applied to the tourism domain (February 2006)
· Identify the different rules in each categories (February 2006)
· Specify the rules in SWRL (March 2006)
·Write the Thesis (July 2006)

Dynamic Package System workplan:

· Study of data sources systems and extractor systems that can be integrated to the dynamic package system (September and October 2005)
· Define the integration of the data sources with the dynamic package system (November and December 2005)
· Analyze the possible query languages to use in the system (January 2006)
· Define the main modules of the architecture (February 2006)
· Detailed each one of the modules (March 2006)
· Implementation of the defined architecture (April to June 2006)
· Integration of all the modules and testing the system (July 2006)
· Write the Thesis (August and September 2006)

4. Deliverables

The architecture will be composed by components that can be grouped into packages to possibly be used and installed individually:

· Data Extractor: Component that allows the dynamic integration of different information sources and channel data. Besides handling different data types, the component is able to manage data sources, connect to remote and local data sources, knows how, and where, to get specific information, respond to data retrieval queries and handle queries and exceptions. In the global architecture, it has the responsibility to retrieve the information that is in the tourism systems and that is requested to build the dynamic packages.

· Data Model Mapping: Implements a user-friendly interactive mapping tool that allows users to map syntactic data in a XML format to concepts of an OWL ontology. In the context of the global architecture, this component must generate mapping rules that, once defined, allow converting any XML structure to instances of a global shared data ontological model.

· Ontology for e-tourism: An ontology that defines the concepts that are present in the e-tourism domain. The ontology will be developed by taking in consideration the traveler's point of view. It defines the global shared data model for the architecture and will be used in

the integration of the different information sources and in the definition of packaging rules.

· Semantic Rules: A component that allows the definition of rules based on a specific ontology. It will include an engine to validate and manage rules. It is used in the dynamic pakkage architecture to define the rules for the creation of dynamic packages. Using this component, we can separate dynamic packaging logic from dynamic packaging applications.

· Dynamic package system: The final system, composed by all the components that are necessary to create the dynamic packaging system. It has the responsibility of integrating all the other components and guarantee that processes are executed in order to build the dynamic pakkages.

5. Workshops/sponsored Events

IWDDS 2006. International Workshop on Dynamic Distributed Systems (IWDDS 2006), In conjunction with the ICDCS 2006, The 26th International Conference on Distributed Computing Systems July 4-7, 2006 - Lisbon, Portugal.

SDWP 2006. The 3rd International on Semantic and Dynamic Web Processes (SDWP 2006), In conjunction with the 2005 IEEE International Conference on Web Services (ICWS 2006), September 18-22, 2006, Chicago, USA.

6. Open Tools for public

In the end of the project we intend to provide the following tools and modules:

· Data Extractor: A tool to extract information for different data sources and integrate them trough XML Schemas and OWL representing a specific domain model. It can respond to queries based in the XML Schemas and returns information respecting the same data schemas.

· Data Model Mapping: A tool for mapping XML data to OWL data. Returns a XSD document that defines the transformation of XML data to OWL data. This tool allows storing the mapping rules for future editing.

· Ontology for e-tourism: An ontology that defines the concepts presented in the e-tourism domain.

·Semantic Rules: A tool to define and manage semantic rules.

· Dynamic Package Application: A system for creating dynamic packages. The packages are created using the information of data sources integrated in the system, by an ontology for the e-tourism and by specific rules defined using the ontology concepts.

All these tools will be freely available in the SEED Web site:
http://seed .expedita.com.pt/
Besides these tools, the SEED Web site contains a lot of useful information related to the project, such as work plans, the technology that is being used, analyses of similar systems, problems and rational about the decisions taken, etc.

7. Contact details

Jorge Cardoso
Department of Mathematics and Engineering
University of Madeira
9050-078 Funchal - Portugal
jcardoso@uma.pt
Tel: +351 291 705 156
Fax: +351 291 705 309

Jorge Fernandes
Caminho da Penteada
Polo Científico e Tecnológico da Madeira, Piso 2
9000-390 Funchal - Portugal
jfernandes@expedita.com
Tel: + 351 291 723 410
Fax: +351 291 723 411

Key Publications

Cardoso, J., Sheth, Amit (Eds.), "Semantic Web Services, Processes and Applications". Springer (scheduled for March 2006)

Cardoso, J. "Developing Dynamic Packaging Applications using Semantic Web based Integration", Semantic Web Technologies and eBusiness: Virtual Organization and Business Process Automation, A. F. Salam and Jason Stevens (Eds.), Idea Group, Inc. (scheduled for March 2006)

Cardoso, J. and Lange, C., "Strategies and Technologies for Dynamic Packaging Applications in e-Tourism", Information Technology & Tourism Journal, Cognizant, USA (scheduled for July 2006).

Cardoso, J. "Developing Dynamic Packaging Systems using Semantic Web Technologies", Transactions on Information Science and Applications, Vol. 3(4), April 2006, pp. 729-736, ISSN:1970-0832

Reasoning on the Web with Rules and Semantics, REWERSE

François Bry and Uta Schwertel
University of Munich
http://rewerse.net

François Bry, Germany, (PhD in 1981) is currently investigating methods and applications emphasizing XML, RDF, query answering, reactivity and reasoning on the Web. Since 1994, he is a full professor at the Institute for Informatics, University of Munich. Formerly, he worked with the industry research center ECRC in Munich. He is scientific coordinator of the European Network of Excellence REWERSE on Reasoning in the Semantic Web

Uta Schwertel, Germany, is a member of the Institute for Informatics at the University of Munich, Germany. She is the project manager of the European Network of Excellence REWERSE (Reasoning on the Web with Rules and Semantics). Formerly, Uta Schwertel completed her PhD at the University of Zurich in the project Attempto. Her current research interests are using controlled natural language as a user-friendly interface language for Semantic Web applications.

■ *Executive Summary:*
REWERSE is a research Network of Excellence on "Reasoning on the Web with Rules and Semantics" which is funded by the European Commission and Switzerland within the Sixth Framework Programme (FP6) as part of the IST objective "Semantic-based knowledge systems", contract number 506779.

For the full exploitation of the Semantic Web it is necessary not only to describe meta-data but also provide languages and methods to query and to automatically reason over these data, i.e. to derive new not explicitly stated information from existing data using various forms of rules.

The main objective of the EU Network of Excellence REWERSE is to network and structure a scientific community (i) to develop a set of inter-operable rule-languages supporting various forms of Web reasoning, (ii) to provide support tools for reasoning on the Web like rule modelling, verbalization, visualisation, explanation tools and (iii) to test these reasoning tools and technologies on various Semantic Web application domains, e.g. reasoning with business-rules, policies, Bioinformatics Semantic Web, personalisation, temporal and spatial reasoning. Moreover, REWERSE aims at bringing the proposed languages and their prototype processors to the level of open pre-standards. To foster durable impact REWERSE also develops Education and Training activities targeted at Universities as well as Technology Transfer and Awareness activities targeted at the European industry on reasoning languages for Web systems and applications.

REWERSE started on 1st March 2004 and is scheduled to run for four years. The EC and Switzerland will support REWERSE with more than 5 million Euro. REWERSE, co-ordinated by François Bry from the University of Munich, involves 27 European research and industry organisations from 14 European countries and about 100 computer science researchers and professionals playing key roles in applied reasoning.

Munich, Germany, 12.03.2006

1. General Project Information

REWERSE is a research Network of Excellence on "Reasoning on the Web with Rules and Semantics" which is funded by the European Commission and Switzerland within the Sixth Framework Programme (FP6) as part of the IST objective "Semantic-based knowledge systems", contract number 506779 (cf. http://rewerse.net).

The objective of REWERSE is to establish Europe as a leader in the area of reasoning languages for advanced (also called Semantic) Web systems and applications - a major current endeavour worldwide in Information Technologies. The goal of these systems and applications is to strengthen a person-centred everyday use of the Web by capturing the semantics of Web data and by automatically reasoning over the data. Reasoning requires the availability of adequate reasoning languages. REWERSE aims at developing a coherent and complete, yet minimal, collection of reasoning languages and prototype processors for these languages for advanced Web systems and applications. The focus lies on application-independent reasoning languages functioning as generic building stones for Web systems and applications. Striving for tangible outcomes REWERSE is testing these languages and their prototype implementations on adaptive Web systems and Web-based decision support systems. Finally, REWERSE aims at bringing the proposed languages and their prototype processors to the level of open pre-standards. Furthermore, REWERSE develops Education and Training activities targeted at Universities as well as Technology Transfer and Awareness activities targeted at the European industry on reasoning languages for Web

systems and applications.

REWERSE started on 1st March 2004 and is scheduled to run for four years. The EC and Switzerland support REWERSE with more than 5 million Euro. REWERSE, co-ordinated by François Bry from the University of Munich, involves 27 European research and industry organisations from 14 European countries and about 100 computer science researchers and professionals playing key roles in applied reasoning.

2. Partners Details

REWERSE has 27 partners consisting of European research and industry organizations from 14 European countries:

- Munich; Ludwig-Maximilians-Universität München; Germany
- Bucharest; Institutul National de Cercetare-Dezvoltare in Informatica; Romania
- Edinburgh; Heriot-Watt University, Edinburgh; United Kingdom
- Cottbus; Brandenburg University of Technology at Cottbus (BTU Cottbus); Germany
- Göttingen; Universität Göttingen; Germany
- Hannover; Universität Hannover and Learning Lab Lower Saxony; Germany
- Heraklion; Foundation for Research and Technology - Hellas; Greece
- Freiburg; Albert-Ludwigs-Universität Freiburg; Germany
- LibRT; LibRT B.V., Amsterdam; Netherlands
- Linköping; Linköpings Universitet; Sweden
- Lisbon; Universidade Nova de Lisboa; Portugal
- Dresden; Technische Universität Dresden; Germany
- Malta; University of Malta; Malta
- Manchester; The University of Manchester; United Kingdom
- Nancy; INRIA - Unité de Recherche Lorraine (LORIA); France
- Naples; Università di Napoli; Italy
- Paris; INRIA Rocquencourt; France
- Skövde; Högskolan i Skövde; Sweden
- St. Gallen; Universität St. Gallen; Switzerland
- Tekniker; Fundación Tekniker, Eibar; Spain
- Telefonica; Telefónica Investigación y Desarrollo, Madrid; Spain
- Turin; Università degli Studi di Torino; Italy
- Venice; Università Ca' Foscari Venezia; Italy
- Vienna; Technische Universität Wien; Austria
- Warsaw; Instytut Podstaw Informatyki Polskiej Akademii Nauk; Poland
- webXcerpt; webXcerpt Software GmbH, München; Germany
- Zurich; Universität Zürich; Switzerland

3. WorkPlan Overview

The network REWERSE focuses on three core work areas:

· Research on Web reasoning languages and their processing,
· Advanced Web applications requiring reasoning, and
· Knowledge dissemination activities spreading the results to a broader audience.

A tight synergy between the different work areas is taking place.

Work Area: Web Reasoning Languages and Their Processing

REWERSE contains five research oriented working groups on Web reasoning languages and their processing. These groups address all areas important for advanced Web-based systems: syntax and syntax-driven rules, system specifications, software system realization, data retrieval, and data updating. More concretely, a group on "**Rule Modeling and Markup (I1)**" addresses unifying the markup and the development tools of Web reasoning languages. The "**Policy Languages and Systems (I2)**" group aims at designing policy languages and policy-driven systems that enhance user-privacy, Web service usability and protection, and improve user control on the applied policies. The group integrates novel work on using controlled natural language for policy specifications, an approach that increases human readability and thus the acceptance of the systems. "**Composition and Typing (I3)**" develops the foundations of a composition and typing technology for Web application components that ensure reusability and thus save costs in constructing Web applications. "**Reasoning Aware Querying (I4)**" aims at integrating Web query and transformation languages with powerful but easy to use reasoning capabilities thus facilitating efficient and effective access to distributed and heterogeneous data on the standard Web and the Semantic Web. The group "Evolution and Reactivity (I5)" defines declarative languages and tools for specifying and dealing with evolution, reactivity and propagation of changes, issues characteristic for the Web.

Work Area: Advanced Web Applications

REWERSE integrates three working groups on Web applications focusing on adaptive Web systems and Web-based decision support systems. The applications function as test-beds for the reasoning languages developed in the research oriented working groups. A group on "**Event and Location (A1)**" investigates common sense forms of reasoning (like reasoning with events, time and location) that are relevant to most advanced and adaptive Web systems. A group on "**Bioinformatics Semantic Web (A2)**" works on using rules and reasoning for annotating and extracting biological data, an area that - due to the explosion of online accessible data and systems - would highly profit from an integration of the systems using reasoning techniques. Finally, "**Personalized Information Systems(A3)**" optimizes the access to Web data and information according to the needs and requirements of each end user, a promising current application area.

Work Area: Knowledge Dissemination
REWERSE contains Activities groups that aim at the dissemination of knowledge. Their goal is to spread excellence throughout the European region and outside of it in a way that guarantees a durable effect. REWERSE contains four activities: "University Education and Training", "Technology Transfer and Awareness", "Presentation, Reviewing and Assessment" and "Standardisation".
The main objective of the group on "**Education and Training (ET)**" is to initiate and foster a durable education on Semantic Web issues. The group focuses on three action lines: running a yearly Summer School (cf. http://reasoningweb.org/), developing and publishing Web based courses, and developing Web based graduate curricula.
The goal of the technology transfer group "**Technology Transfer and Awareness (TTA)**" is to increase the awareness of REWERSE's results and research topics in industry. More generally, the group also aims at increasing the awareness of Semantic Web topics in general. The activities include in particular the organization of awareness events and promotional material targeted at industry and the general creation of a technology transfer infrastructure within REWERSE. Furthermore, the group works - in co-operation with ET - on industry education, e.g. Web based courses, on Semantic Web issues. In 2005, the activity group TTA has organized the first "Semantic Web Days", a major industry awareness event that took place in Munich on October 6-7, 2005 (cf. http://www.semantic-web-days.net/).
The activity group "**Presentation, Reviewing and Assessment (PRA)**" is devoted to internal monitoring and assessment of the REWERSE results. Furthermore, the group's goal is the presentation of REWERSE to the scientific and IT professional communities as well as to a wide audience of potentially interested people. This includes in particular maintenance of the REWERSE Website for external and internal use and the REWERSE publication server (http://rewerse.net/publications.html).
Since November 2005 REWERSE has a dedicated standardisation task force. The standardisation group "**Standardisation (STD)**" promotes REWERSE research outcomes within standardisation organisations, influences the development of REWERSE related standards, and strengthens the contacts to the industry. Currently, the group is strongly involved in the W3C Rule Interchange Format Working Group (http://www.w3.org/2005/rules/Overview.html). Furthermore, since October 2005, REWESE holds a consortium membership at W3C.

4. Deliverables
The list of all completed REWERSE deliverables is available at http://rewerse.net/deliverables.html. All public deliverables are free for download.

5. Workshops/sponsored Events
Major Events in 2005
Summer School "Reasoning Web" 2005
July 25-29, 2005
Valletta, Malta
http://reasoningweb.org/2005/

Industry Awareness event "Semantic Web Days"
October 6-7, 2005
Munich, Germany
http://www.semantic-web-days.net/

Workshop PPSWR 2005 ("Principles and Practice of Semantic Web Reasoning")
Workshop and Dagstuhl seminar
September 11-16, 2005
Dagstuhl, Germany

http://rewerse.net/PPSWR05/

Major events in 2006
· Summer School "Reasoning Web 2006": Lisbon, September 4-8, 2006
· Workshop PPSWR'06 "Principles and Practice of Semantic Web Reasoning": Budva, June 10-11, 2006, co-located with ESWC 2006
Links to all major project events are available at:
http://rewerse.net/project_events.html

6. Open Tools for public
Information about REWERSE related demos and tools is available at http://rewerse.net/downloads_demos/.
In November 2005 the Personal Publication Reader (http://www.personal-reader.de) developed by the REWERSE working group A3 has been awarded 3rd price in the Semantic Web Challenge 2005 (cf. http://challenge.semanticweb.org/)

8. Contact details and further information
REWERSE Web Site
http://rewerse.net

Working Groups
http://rewerse.net/working-groups.html
Technology Transfer
http://rewerse.net/tta/
Education and Training
http://rewerse.net/et/
Publications and Deliverables
http://rewerse.net/publications.html
Press
http://rewerse.net/press_releases.html
Demos and Downloads
http://rewerse.net/downloads_demos/

Contact
http://rewerse.net/contact.html
Co-ordinator: Dr. François Bry, Professor
Manager: Dr. Uta Schwertel
Institute for Informatics
University of Munich
Oettingenstr. 67
D-80538 Munich, Germany

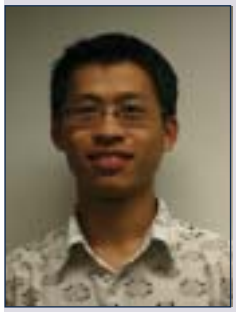
Key Publications

At the end of its second year REWERSE members have contributed to over 230 internationally reviewed REWERSE related publications. This shows that REWERSE's focus is perfectly targeted to current research needs. A list of all publications with abstracts is available at http://rewerse.net/publications.html.

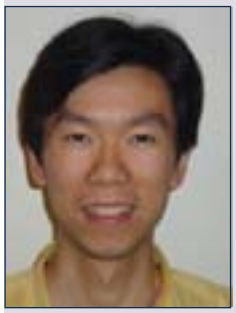
Semantic-based Database Grid, DartGrid

Yuxin Mao, Zhaohui Wu and Huajun Chen
Research Center for Grid Computing, College of Computer Science, Zhejiang University, Hangzhou 310027, China

Zhaohui Wu is a professor, doctoral postgraduate supervisor and vice head of the College of Computer Science at Zhejiang University. Wu's research interests include distributed artificial intelligence, semantic grid and services, ubiquitous embedded system and real-time system.



Yuxin Mao is a PhD student in the College of Computer Science at Zhejiang University. His research interests include grid computing, semantic web, and problem solving.



Huajun Chen is an assistant professor in the College of Computer Science at Zhejiang University. His research interests include grid computing, semantic web, grid computing and biometric computing.

■ *According to a latest interview with Tim Berners-Lee, the Semantic Web aims to provide a common semantic framework that aims at the data which currently is in relational databases, XML documents, spreadsheets, and proprietary format data files, and all of which would be useful to have access to as one huge database.*

The DartGrid is a semantic-based platform that mainly aims to resolve problem of heterogeneous database integration in a specific VO (virtual organization). The system combines the Grid and Semantic Web technologies together to provide a uniform semantic query interface to sets of distributed and heterogeneous relational data sources. What we mainly contribute is at the semantic service level. The services at this level are mainly designed for semantic-based relational schema mediation and semantic query processing by using semantics of RDF ontology.

In order to integrate rich semantics at the semantic service level and apply the DartGrid to solve practical problems in the Traditional Chinese Medicine (TCM) domain, we have been building the world's largest TCM ontology, which is called Traditional Chinese Medical Language System (TCMLS). The TCMLS is compatible with other formats supported by the Semantic Web and we can directly transform the TCMLS into RDF ontologies for database integration.

A set of semantic-based toolkits, as well as some documents and publications about the project has been generated for public.

Hangzhou, China, 15.03.2006

1. General Project Information

Objectives

According to a latest interview with Tim Berners-Lee, the Semantic Web aims to provide a common semantic framework that aims at the data which currently is in relational databases, XML documents, spreadsheets, and proprietary format data files, and all of which would be useful to have access to as one huge database. As the backbone of the Semantic Web, the Resource Description Framework (RDF) represents web information in a minimally constrained, flexible, but meaningful way so that web data can be exchanged and integrated without loss of semantics. Most of existing data, however, is stored in relational databases. Therefore, to realize the vision drawn by Tim for the Semantic Web, great efforts are required to offer methods and tools to support integration of heterogeneous relational databases using the RDF model.

Main Deliverables

1. The DartGrid toolkit (both the sourcecode and executables);
2. A web application for using TCMLS;
3. An on-line tutorial for beginners;
4. An on-line document for both users and developers;
5. Some publications and presentations about the project.

Scientific and Technical Coordinator

Pro. Zhaohui Wu is the chief scientific and technical coordinator of the project. Wu received his PhD degree of Computer Science from Zhejiang University in China and Kaiserslautern University in Germany, 1993. He is now a professor, doctoral postgraduate supervisor and vice head of the College of Computer Science at Zhejiang University. He invented the first KB-system developing tool, ZIPE in China, 1990. He proposed the first coupling knowledge representing model, Couplingua, which embodies rule, frame, semantic network and nerve cell network and supports symbol computing and traditional data processing computing. Wu's research interests include distributed artificial intelligence, semantic grid and ser-vices, ubiquitous embedded system and real-time system.

2. Partners Details

China Academy of Traditional Chinese Medicine (CATCM), founded on December 19, 1955, is the national center for research, health care and education in traditional Chinese medicine (TCM) under the direction of the Ministry of Public Health and the State Administration of TCM of the People' s Republic of China. The Academy is comprised of 11 research institutions, 5 clinical institutions, 8 national specialized departments of TCM, and 2 national bases of clinical pharmacology.

3. WorkPlan Overview

The DartGrid is designed and developed as a two-layer service architecture: basic service layer and semantic service layer (as the following figure).

The layered structure of the DartGrid

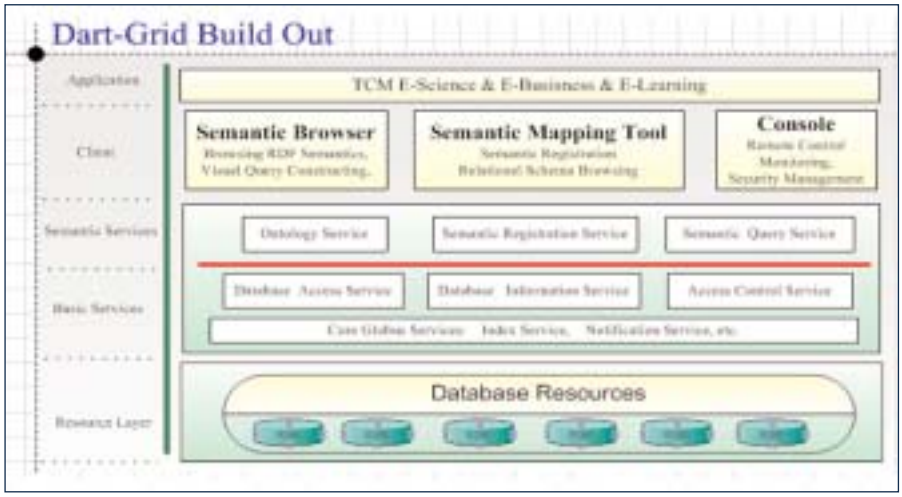
Three services are implemented at the basic layer:

1. **Database Access Service**. It supports the typical remote operations on database contents, including query, insertion, deletion, and modification.
2. **Database Information Service**. It supports inquiring about the meta-information (e.g., relational schema definition) of databases.
3. **Access Control Service**. The service is developed for access control in DartGrid. It provides the service of authorizing or authenticating a grid user to access specific database resource.

What we mainly contribute is at the semantic service level. The services at this level are mainly designed for semantic-based relational schema mediation and semantic query processing.

1. **Ontology Service**. This service is used to expose the shared ontologies that are defined using RDF/OWL languages. The ontologies are used to mediate heterogeneous relational databases.
2. **Semantic Registration Service**. Semantic registration establishes the mappings from source relational schema to mediated RDF ontologies. The service maintains the mapping information and provides the service of registering and inquiring about this information.
3. **Semantic Query Service**. This service accepts RDF semantic queries, inquires of Semantic Registration Service to determine which databases are capable of providing the answer, then rewrites the RDF queries in terms of relational schema, namely, the RDF queries will be ultimately converted into a set of SQL queries. The results of SQL queries will be wrapped by RDF/OWL semantics and returned as RDF triples.

In collaboration with the China Academy of Traditional Chinese Medicine (CATCM), we have taken more than 5 years in building the world's largest TCM ontology, which is called Traditional Chinese Medical Language System (TCMLS). The TCMLS has been developed in several branches of the CATCM as 16 relatively independent local-ontologies, with each corresponding to a sub-domain of TCM (see figure 1). There are more than 20,000 concepts and 100,000 individuals defined in current knowledge base and the ontology under development is still part of the TCMLS, so there exists rich semantics in each local-ontology. The TCMLS is compatible with other formats supported by the Semantic Web and we can directly transform the TCMLS into RDF ontologies, which can be used by semantic services of DartGrid



4. Deliverables

A semantic-based platform for database integration: DartGrid (both the sourcecode and executables) as well as a semantic-based client: Semantic Browser can be download freely on our website.

A web application for using TCMLS: users can access it in web browser to browse and query TCMLS ontology.

An on-line tutorial is available for DartGrid users to get start with DartGrid. An on-line document for both DartGrid users and developers and some publications about the project are also available.

5. Workshops/sponsored Events

The 6th International Conference on Web-Age Information Management (http://waim-05.inf.ed.ac.uk/)

6. Open Tools for public

The DartGrid is a opensource toolkit for non-commercial use and users can download both the sourcecode and executables from the project website by the following link:[1]

The TCMLS ontology can be accessed through a web application by the following link:[2]

8. Contact details and further information

Project Leader:
Pro. Zhaohui Wu (wzh@zju.edu.cn)
Contact:
Dr. Huajun Chen (huajunsir@zju.edu.cn)
Yuxin Elwin Mao (maoyx@zju.edu. cn)

[1] http://ccnt.zju.edu.cn/projects/dartgrid/form.php
[2] http://sharelab.cintcm.com/tcmls/jsp/ProjectSelect.jsp

Key Publications

Huajun Chen, RDF-based Relational Database Integration and its Application in Traditional Chinese Medicine, The 22nd International Conference on Data Engineering, Atlanta, GA, 2006.

An Ontology and Context based Client Model for Dart Information Grid, Int. J. High Performance Computing and Networking, vol. 3, No. 4, 2005

Zhaohui Wu et al, DartGrid II: A Semantic Grid Platform for ITS, IEEE Intelligent Systems, vol.20, No.3, Jun. 2005.

Huajun Chen, Zhaohui Wu, Guozhou Zheng, Yuxing Mao, RDF-Based Schema Mediation for Database Grid, 5th IEEE/ACM International Workshop on Grid Computing (Grid Computing 2004), Pittsburgh, USA, Nov. 2004.

Xuezhong, Zhou, Zhaohui Wu et al, Ontology Development for Unified Traditional Chinese Medical Language System, Journal of Artificial Intelligence in Medicine, vol.32, issue 1, pages 15-27, Sep. 2004.

Huajun Chen, Zhaohui Wu, Yuxing Mao, Q3: A Semantic Query Language For Dart Database Grid, Lecture Notes in Computer Science 3251: 372-380, 2004.

Zhaohui Wu, Yuxin Mao, Huajun Chen, Semantic View for Grid Services, 2004 IEEE International Conference on Services Computing (SCC 2004), Shanghai, China, Sep. 2004.

Zhaohui Wu, Huajun Chen, Chang Huang et al, DartGrid: Semantic-based Database Grid, 4th International Conference on Computational Science (ICCS 2004), Kraków, Poland, Jun. 2004.

Yuxin Mao, Zhaohui Wu, Huajun Chen, SkyEyes: A Semantic Browser for the KB-Grid, Lecture Notes in Computer Science 3033: 752-759, 2004.

Huajun Chen, Zhaohui Wu, Jiefeng, Xu, Knowledge Base Grid: A Generic Grid Architecture for Semantic Web, Journal of Computer Science and Technology 18 (4): 462-473 Jul, 2003.

Lican Huang, Zhaohui Wu, Yunhe Pan, Virtual and Dynamic Hierarchical Architecture for E-science Grid, International Journal of High Performance Computing Applications 17 (3): 329-347 FAL, 2003.

Adaptive Services Grid, ASG

Witold Abramowicz, Marek Kowalkiewicz and Agata Filipowska
http://www.asg-platform.org/

Witold Abramowicz, Poland, is currently the chair of Department of Information Systems at The Poznan University of Economics, Poland. His particular areas of interest are Information Filtering to MIS, Information Retrieval, and Applications of Knowledge Discovery in MIS. He received his Ph.D. from The Wroclaw Technical University, Poland and habilitation from The Humboldt University Berlin, Germany. He worked for three universities in the Switzerland and Germany for twelve years. He is an editor or co-author of fifteen books and 112 articles in various journals and conference proceedings. He chaired ten scientific international conferences and was a member of the program committees of 106 other conferences. Currently Professor Abramowicz is involved in 3 research projects in the 6th Framework Program.

Marek Kowalkiewicz, Poland. MSc in Business Information Systems, is a Teaching and Research Assistant at the Poznan University of Economics, Department of Management Information Systems.

Agata Filipowska, Poland. MSc in Business Information Systems, is a Teaching and Research Assistant at the Poznan University of Economics, Department of Management Information Systems.

■ *Executive Summary:*
ASG is an Integrated Project supported by the Sixth Framework Programme of the European Commission under the Information Society Technology Objective Open Development Platforms for Software and Services. ASG started on September 1, 2004, the duration of the project is two years. ASG involves 22 partners from seven countries.

Vision
The goal of Adaptive Services Grid (ASG) is to develop a proof-of-concept prototype of an open platform for adaptive services discovery, creation, composition, and enactment. To achieve its goal, ASG addresses dedicated scientific and technological issues making use of the knowledge and expertise of major European research institutions with significant contributions from the software, telecommunications, and telematics industry.

Poznan, Poland, 15.03.2006

1. General Project Information

The Adaptive Services Grid (ASG) is an Integrated Project supported by the Sixth Framework Programme of the European Commission under the Information Society Technology Objective - Open Development Platforms for Software and Services. Its goal is to develop an open development platform for adaptive services discovery, creation, composition, and enactment. In order to achieve its goal, ASG addresses scientific and technological issues with utilization of the knowledge and expertise of leading research institutions and software and telecommunications industry. One of main outcomes of the ASG project will be an ASG platform that will allow companies to register services they provide through standardized interfaces. Then based on semantic descriptions of services requested by service customers, ASG will discover appropriate services, compose complex process services and generate software to create new application services on demand. Subsequently, application services will be provided through the underlying computational grid infrastructure based on adaptive process enactment technology.

Moreover, because of strong involvement of industry partners ranging from big companies to small and medium-sized enterprises in the ASG project the ASG project will exploit and demonstrate its technical developments in a variety of application areas. Therefore a range of business-oriented usage scenarios has been developed e.g. attraction booking scenario, travel planer scenario, buddy list scenario.

The Project is coordinated by the University of Potsdam (Germany) - technical coordinator and Hasso Plattner Institute for IT-Systems Engineering at the University of Potsdam (scientific coordinator).

2. Partners Details

ASTEC Sp. z o.o. (Poland)

DaimlerChrysler (Germany)

FH Furtwangen (Germany)

Fraunhofer IESE (Germany)

HPI at University Potsdam (Germany)

Marketplanet (Poland)

NIWA (Austria)

NUIG (Ireland)

Polska Telefonia Cyfrowa (Poland)

The Poznan University of Economics (poland)

Rodan Systems (Poland)

Siemens AG (Germany)

Swinburne University (Australia)

Telekommunikacja Polska (Poland)

Telenor Communications II AS (Norway)

Transit (Germany)

University of Innsbruck (Austria)

University Jyväskylä (Finland)

University of Koblenz-Landau (Germany)

University of Leipzig (Germany)

University of Potsdam (Germany)

Additionally, the project has a physical partner, Erik Lillevold, who comes from Norway and is a former Senior Consultant at Telenor.

3. WorkPlan Overview

Constantly monitoring the progress is a high-ranking objective in ASG. To be able to measure and validate progress of the ASG project a set of milestones was defined. Milestones are described in terms of expected results and achievements. The deliverables are detailed in the detailed implementation plan.

Milestone M6

In this early phase, we see requirements analysis in the specific areas of research as well as testbed evaluation and monitoring and analysis of industry developments.

Milestone M12

Milestone 12 builds on M6. It is characterized by first conceptual project results, as detailed in the work component specifications. In this phase, deliverables are typically research reports on the results, including requirements analysis results and initial conceptual results in the topics addressed.

Milestone M18

Milestone 18 finalizes the work as specified in the detailed implementation plan. The most important conceptual results have been prototypically implemented in tools, some of which have already integrated to build the core ASG platform. Deliverables of this milestone include research reports but also prototypical tool implementations and scenarios that we plan to implement using the ASG platform.

Milestone M24

We expect that the integration of the tools to an initial proof-of-concept prototype of the ASG platform is available at M24. Based on this platform, sample scenario-specific services, their provision and execution under the supervision of adaptive process management is available. The rational behind M24 is to have a running prototype of the ASG platform to show its validity in specific sample scenarios.

4. Deliverables

ASG Project will document its work in 49 key deliverables and 55 internal deliverables. Table below summarizes only the deliverables that are publicly available.

Public Available Deliverables:[1]

[1] http://asg-platform.org/cgi-bin/twiki/view/Public/Deliverables#deliverables

Milestone	Public Deliverable title
6	Requirements Analysis on the ASG Service Specification Language
6	Requirements Analysis on the ASG Service Interface
6	Requirements Analysis for Service and Resource Matchmaking
12	Service Description Language
12	Requirements Analysis on Service Registries
12	Requirements Analysis on Service Composition
12	Reuse-oriented Requirements Technique
12	Reference Architecture: Requirements, Current Efforts and Design
18	Implementation of the service interface
18	Implementation of Service Matchmaking for the Grid
18	Service composition language
18	ASG platform development process
18	Reference architecture Design
24	Initial implementation of customer interface
24	Design of the customer request specification tool
24	Implementation of a distributed Grid Service Registry
24	Service composition component
24	Model Driven ASG Approach

5. Workshops/sponsored Events

· ASG Service Composition Workshop at the Semantics 2005, November 23-25, 2005 Vienna, Austria

· 2nd International Conference on Grid Services Management and Engineering (GSEM 2005) co-located with the 6th International Conference Net.ObjectDays, September 21-22, 2005 Erfurt, Germany

· ASG PhD Session at the 6th International Conference Net.ObjectDays, September 22, 2005 Erfurt, Germany

· Workshop for WWW Service Composition with Semantic Web Services (wscomps05) with special ASG Session hosted by The 2005 IEEE/WIC/ACM International Joint Conference on Web Intelligence (WI 2005) and Intelligent Agent Technology (IAT 2005), September 19, 2005, Compiegne University of Technology, France

· Semantic Web Services Week 2005, June 6-10, 2005 Innsbruck, Austria

· PhD-Session at 8th International Conference on Business Information Systems (BIS 2005), April 20-22, 2005 Poznan, PolandASG

6. Contact details and further information

Department of Management Information Systems
The Poznan University of Economics
Al. Niepodleglosci 10
60-967 Poznan
POLAND
Phone: +48 61 854-33-81
Fax: +48 61 854-36-33
http://www.kie.ae.poznan.pl

Key Publications

Kuropka, D.; Weske, M.: Semantik in dienstbasierten Architekturen. In: ERP Management, 1/2006, pp. 31 - 35

Kuropka, D.; Weske, M.: Die Adaptive Services Grid Plattform: Motivation, Potential, Funktionsweise und Anwendungsszenarien* In: Emisa Forum, issue 26/1, January 2006

Laures, G.; Meyer, H.; Breest, M.: An Engineering Method for Semantic Service Applications, In: _Proceedings of the First International Workshop on Design of Service-Oriented Applications (WDSOA'05), ICSOC, Amsterdam, The Netherlands, December 2005.

Naumenko A., Nikitin S., Terziyan V., Veijalainen J.: How Does UDDI Fit Semantic Needs, In: M. Bramer and V. Terziyan (Eds.): Industrial Applications of Semantic Web, Proceedings of the 1-st International IFIP/WG12.5 Working Conference, August 25-27, 2005, Jyvaskyla, Finland, Springer, pp. 141-159

Löser, C. Tempich, B. Quilitz, W.-T. Balke, S. Staab, W. Nejdl.: Searching Dynamic Communities with Personal Indices, In: Proc. of ISWC-2005 - International Semantic Web Conference, Galway, Ireland, Springer, LNCS, November 2005

Jos de Bruijn, Holger Lausen, Axel Polleres, and Dieter Fensel: The WSML Rule Languages for the Semantic Web, In: Proceedings of the W3C Workshop on Rule Languages for Interoperability, Washington DC, USA, April 2005. Position paper.

F.Wolff, D. Oberle, S. Lamparter, S. Staab: Economic Reflections on Managing Web Services Using Semantics, In: EMISA-2005 - Enterprise Modelling and Information Systems Architectures, October 24-25, 2005

Ioan Toma, Brahmananda Sapkota, James Scicluna, Juan Miguel Gomez, Dumitru Roman, and Dieter Fensel: A P2P Discovery mechanism for Web Service Execution Environment, In: Proceedings of the 2nd International WSMO Implementation Workshop (WIW 2005), Innsbruck, Austria, June 2005.

Technical Reports

Meyer, M.; Kuropka, D.: Requirements for Service Composition* Technical Report of the Hasso-Plattner-Institute, 11 (2005), ISBN 3-937786-81-3

Meyer, M.; Kuropka, D.: Survey on Service Composition* Technical Report of the Hasso-Plattner-Institute, 10 (2005), ISBN 3-937786-78-3, ISSN 1613-5652

D. Oberle, S. Lamparter, A. Eberhart, S. Staab.: Semantic Management of Web Services, Technical Report, Uni Koblenz-Landau, 2005.

Semantic Discovery: Discovering Complex Relationships in Semantic Web, SemDis

Amit P. Sheth, Budak Arpinar, Krys Kochut and John A. Miller
http://lsdis.cs.uga.edu/projects/semdis/

Amit P. Sheth, USA is a professor at the University of Georgia where he also directs the LSDIS lab. Earlier, he served in R&D in industry. He founded and managed companies Infocosm and Taalee (now Semagix) focused on workflow and semantic web platform, respectively. He is an IEEE Fellow. He has published over 200 papers and articles, given over 160 invited talks and colloquia including 21 keynotes, (co)-organized/chaired 20 conferences/workshops, and served on over 110 program committees. He is on several journal editorial boards and is the EIC of the International Journal on Semantic Web and Information Systems.

I. Budak Arpinar, USA is an assistant professor at the University of Georgia and faculty member of the LSDIS lab. He is currently working on semantic relatios /search/knowledge discovery and semantic composition of Web services. He has authored or co-authored over 45 publications, and the R&D he was involved has resulted in different commercial products (e.g. METEOR) or research prototypes. He is also a PC Member and organizer of various significant conferences and workshops including ICDE'06 and International Semantic Web Conference (ISWC'06).

Krys Kochut, USA is a Professor and the Head of Computer Science at the University of Georgia. He has extensive

experience in designing and developing high performance, parallel and scalable data structures (indices) and query processing systems. Key examples of these include distributed main memory semantic search engine used by Semagix Freedom (a commercial software) and BRAHMS main memory RDF storage and query processing system with associated support for SPARQL query language (a research software, made available for non-commercial use free of cost). His research spans software engineering and database management.

John A. Miller, USA is a Professor of Computer Science at the University of Georgia. His research interests include database systems, simulation, bioinformatics and Web services. He received his Ph.D. in Information and Computer Science from the Georgia Institute of Technology. Dr. Miller is the author of over 90 technical papers in the areas of database, simulation, bioinformatics and Web services. He is an Associate Editor for ACM Transactions on Modeling and Computer Simulation and IEEE Transactions on Systems, Man and Cybernetics as well as a Guest Editor for the International Journal in Computer Simulation and IEEE Potentials.

■ *Executive Summary: The SemDis project focuses on semantic technologies for discovery and processing of complex relationships, which we call semantic associations. These semantic associations are discovered from large ontologies. The research outcomes include formal definition of semantic associations. We created a large ontology with population base extracted from publicly available sources. We have explored efficient RDF storage optimized for discovery of semantic associations. Various algorithms for discovery of semantic associations have proven useful, such as subgraph discovery. The resulting semantic associations require novel ranking techniques. We have investigated two lines of research for ranking. Additionally, we have explored issues of discovery of semantic associations in a Peer-to-Peer environment.*

The SemDis project is a collaborative project with University of Maryland, Baltimore County. Our collaborators have explored issues of semantic association in provenance for national security applications. Additionally, we have jointly addressed several research problems, the most recent was efficient utilization of semantic analytics for the problem of detection of conflict of interest. This approach utilized semantics to bring together a semantic web social network (FOAF) and an underlying collaboration network from the DBLP dataset.

SemDis is an NSF-funded project. Two students have finished their master's degree in this project and over five Ph.D. students have their research topic very related with this project. The students of this project often intern at collaborating industrial labs, such as IBM and Oracle.
The publications that are direct out-

come from this project include four journal articles, five conference papers (three in WWW conferences), three papers at workshops and related presentations and demos.

Athens, Georgia, USA, March 19, 2006

1. General Project Information

Objectives

The SemDis project focuses on new techniques and improving effectiveness of techniques to identify semantic associations and knowledge discovery for analytical applications by exploiting a large knowledge base. Additional scientific and engineering challenges we address include those related to the scale of storing and complex query processing of large metadata sets, with corresponding more complex data structures to represent entities and relationships, the need to select relevant subsets of metadata to process, and new techniques that use information provenance and trust in discovery and analytics. These challenges call for a fresh look at indexing, query processing, ranking, as well as tractable and scalable graph algorithms that exploit heuristics.

Main Deliverables

Our effort seeks broader impact beyond the education and training of graduate students, and the publication of research findings. Results from our research have been integrated with courses we teach, both existing and new. We have successfully achieved participation of students from under-represented groups. Datasets we are developing for our own evaluations and some of the targeted tools have been made public (see the project web site). In particular, we created a large ontology with associated knowledge bases extracted from publicly available sources to enable meaningful evaluation of the techniques and provide a test-bed for evaluation, comparison and benchmarking for other researchers.

Scientific and Technical Coordinator

Prof. Amit P. Sheth

2. Partners Details

The SemDis project is a collaborative project with University of Maryland, Baltimore County. The faculty members involved are: Anupam Joshi, Tim Finin and Yelena Yesha. The graduate students involved are: Li Ding and Pranam Kolari. The UMBC-SemDis project website is at http://semdis.umbc.edu/.

Our work gains from several academic-industry collaborations of the investigators. We have the opportunity to leverage commercial infrastructure such as use of Semagix Freedom for populating ontologies from trusted sources and ontology-driven metadata extraction from heterogeneous content. The researchers collaborate with industry, and the students often intern at collaborating industrial labs, such as IBM and Oracle.

3. Deliverables

Throughout the project, we have investigated the following topics.

- Definition of semantic associations [AS'03]. Contact person: Kemafor Anyanwu
http://lsdis.cs.uga.edu/~anyanwu/
- Discovery of subgraphs of semantic associations [RMPS'05]. Contact Person: Cartic Ramakrishnan
http://lsdis.cs.uga.edu/~cartic/
-Ranking of semantic associations [AHARS'05, AMS'05]. Contact person: Boanerges Aleman-Meza
http://lsdis.cs.uga.edu/~aleman/
Kemafor Anyanwu
http://lsdis.cs.uga.edu/~anyanwu/
- Efficient RDF storage for semantic association queries [JK'05]. Contact person: Maciej Janik
http://lsdis.cs.uga.edu/~mjanik/
-Aviation safety applications [SAA+05]. Contact: Boanerges Aleman-Meza
http://lsdis.cs.uga.edu/~aleman/
- Semantic Analytics on Social Networks [A+'06]. Contact person: Boanerges Aleman-Meza
http://lsdis.cs.uga.edu/~aleman/
-Semantic Visualization [DSA'06]. Contact Person: Dr. Leonidas Deligiannidis
http://www.cs.uga.edu/~ldeligia/

4. Open Tools for public

The following are available at the project website for non-commercial research use at:
http://lsdis.cs.uga.edu/projects/semdis/
- SWETO is a large ontology with associated knowledge bases extracted from publicly available sources
- TOntoGen is a Test Ontology Generation Tool to generate large, high-quality data sets for testing semantic web applications (implemented as a Protégé plugin)
- BRAHMS is a fast main-memory RDF/S storage, capable of storing, accessing and querying large ontologies (implemented in C++ for high performance and strict memory control)

5. Contact details

Prof. Amit P. Sheth
Large Scale Distributed Information Systems Lab
Department of Computer Science, the University of Georgia
415 Boyd Graduate Studies Research Center, Athens GA 30602-7404
Email: amit at cs.uga.edu,
URL: http://lsdis.cs.uga.edu/~amit or Google: sheth

Other (current) students in the SemDis project are:
- Angela Maduko
http://lsdis.cs.uga.edu/~maduko/
- Matt Perry
http://lsdis.cs.uga.edu/~mperry/
- Samir Tartir
http://www.cs.uga.edu/~tartir/
- Bilal Gonen
http://lsdis.cs.uga.edu/~bilal/

Key Publications

[AS'03] "?-Queries: Enabling Querying for Semantic Associations on the Semantic Web," K. Anyanwu, A.P. Sheth; 12th International World Wide Web Conference, Budapest, Hungary, May 2003, http://doi.acm.org/10.1145/775152.775249 (publisher)
http://lsdis.cs.uga.edu/lib/download/AS03-WWW.pdf (author's copy)

[AHARS'05] "Ranking Complex Relationships on the Semantic Web," B. Aleman-Meza, C. Halaschek-Wiener, I.B. Arpinar, C. Ramakrishnan, A.P. Sheth; IEEE Internet Computing, 9(3):37-44, May/June, 2005
http://doi.ieeecomputersociety.org/10.1109/MIC.2005.63 (publisher)
http://lsdis.cs.uga.edu/library/download/AHARS05-Ranking-IC.pdf (author's copy)

[AMS'05] "SemRank: Ranking Complex Relationship Search Results on the Semantic Web," K. Anyanwu, A. Maduko, A. Sheth; 14th International World Wide Web Conference, Chiba Japan, May 2005, http://doi.acm.org/10.1145/1060745.1060766 (publisher)
http://lsdis.cs.uga.edu/library/download/AMS05-WWW2005.pdf (author's copy)

[JK'05] "BRAHMS: A WorkBench RDF Store and High Performance Memory System for Semantic Association Discovery," M. Janik, K. Kochut; 4th International Semantic Web Conference (ISWC2005), November 2005, Galway Ireland, pp. 431-445
http://dx.doi.org/10.1007/11574620_32 (publisher)
http://lsdis.cs.uga.edu/projects/semdis/JK05-BRAHMS-ISWC2005.pdf (author's copy)

[RMPS'05] "Discovering Informative Connection Subgraphs in Multi-relational Graphs," C. Ramakrishnan, W.H. Milnor, M. Perry, A.P. Sheth; SIGKDD Explorations, 7(2):56-63, December 2005,
http://doi.acm.org/10.1145/1117454.1117462 (publisher)
http://lsdis.cs.uga.edu/library/download/SIGKDD-FinalCameraBWLatest.pdf (lab's copy)

[SAA+05] "Semantic Association Identification and Knowledge Discovery for National Security Applications," A.P. Sheth, B. Aleman-Meza, I.B. Arpinar, C. Halaschek, C. Ramakrishnan, C. Bertram, Y. Warke, D. Avant, F.S. Arpinar, K. Anyanwu, K. Kochut; Journal of Database Management, 16(1):33-53, January-March 2005
http://www.igi-online.com/downloads/pdf/ITJ2672_aQVKbTJVJd.pdf (publisher)
http://lsdis.cs.uga.edu/lib/download/SAA+2004-PISTA.pdf (author's copy)

[A+'06] "Semantic Analytics on Social Networks: Experiences in Addressing the Problem of Conflict of Interest Detection," B. Aleman-Meza, M. Nagarajan, C. Ramakrishnan, L. Ding, P. Kolari, A. Sheth, I. B. Arpinar, A. Joshi, and T. Finin; 15th International World Wide Web Conference, Edinburgh, Scotland, May 23-26, 2006
http://lsdis.cs.uga.edu/library/download/AN06-WWW.pdf (author's copy)

[DSA'06] "Semantic Analytics Visualization," L. Deligiannidis, A.P. Sheth, B. Aleman-Meza; (To Appear in) Proceedings of the IEEE International Conference on Intelligence and Security Informatics 2006 (ISI-2006), May 23-24, 2006, San Diego, CA, USA
http://lsdis.cs.uga.edu/library/download/DSA06-ISI.pdf (author's copy)

Bioinformatics for Glycan Expression: Integrated Technology Resource for Biomedical Glycomics

Amit P. Sheth, William S. York, Krys Kochut and John A. Miller
http://lsdis.cs.uga.edu/projects/glycomics/

Amit P. Sheth, USA is a professor at the University of Georgia where he also directs the LSDIS lab. Earlier, he served in R&D in industry. He founded and managed companies Infocosm and Taalee (now Semagix) focused on workflow and semantic web platform, respectively. He is an IEEE Fellow. He has published over 200 papers and articles, given over 160 invited talks and colloquia including 21 keynotes, (co)-organized/chaired 20 conferences/workshops, and served on over 110 program committees. He is on several journal editorial boards and is the EIC of the International Journal on Semantic Web and Information Systems.

William S. York, USA is an associate professor at Department of Biochemistry and Molecular Biology, The University of Georgia and faculty member of the Complex Carbohydrate Research Center. Dr. York has developed an interactive database containing the proton-NMR spectra of a wide range of xyloglucan subunit oligosaccharides.He has also designed several tools to aid, for example, in the analysis of spectral data (CARBOMASS: Computer-Assisted Analysis of Mass Spectra of Complex Carbohydrates and their Derivatives), and distribute conformational information over the Internet. Full publications: 74.

Krys Kochut, USA is a Professor and the Head of Computer Science at the University of Georgia. He has extensive experience in designing and developing high performance, parallel and scalable data structures (indices) and query processing systems. Key examples of these include distributed main memory semantic search engine used by Semagix Freedom (a commercial software) and BRAHMS main memory RDF storage and query processing system with associated support for SPARQL query language (a research software, made available for non-commercial use free of cost). His research spans software engineering and database management.

John A. Miller, USA is a Professor of Computer Science at the University of Georgia. His research interests include database systems, simulation, bioinformatics and Web services. He received his Ph.D. in Information and Computer Science from the Georgia Institute of Technology. Dr. Miller is the author of over 90 technical papers in the areas of database, simulation, bioinformatics and Web services. He is an Associate Editor for ACM Transactions on Modeling and Computer Simulation and IEEE Transactions on Systems, Man and Cybernetics as well as a Guest Editor for the International Journal in Computer Simulation and IEEE Potentials.

■ *Executive Summary: The overarching objective of the glycomics project is to build a semantic framework for integration, sharing, storage and retrieval of vast amount of data, generated by high-throughput glycomics experiments, in a "relevant" manner. Glycomics is the study of glycans (modifications of sugar molecules) expressed by an organism and which plays a critical role in the life functions of the organisms. This project forms the bioinformatics component of the biomedical glycomics research resource center at the Complex Carbohydrate Research Center (CCRC), our partners in this NIH-NCRR funded Integrated Technology Resource program.*

As part of the semantic framework, we have developed two large ontologies namely GlycO (a glycoproteomics domain ontology with extremely fine granularity) and ProPreO (a process ontology with comprehensive modeling of glycoproteomics experimental lifecycle). We have proposed and implemented an XML-based standard for representation of glycan structures called GLYDE (Glycan Data Exchange) standard. GLYDE is being seriously considered for adoption by the international glycomics community for data exchange. As part of the informatics structure for management of high-throughput analysis of data, we have implemented a Web Services based workflow to completely automate the identification of glycopeptides using mass spectrometry. We are implementing a Semantic provenance scheme using Universal Resource Identifiers (URI), in conjunction with ProPreO ontology, called SemURI. All the semantic informatics tools being developed are being made available for community-wide use through the glycomics web portal.

One PhD student has received his degree in this project and two Ph.D. students and a masters student have their research topic closely related with this project. The publications that are direct outcome from this project (including WWW conference) are at the LSDIS lab on-line library.

Athens, Georgia, USA, March 23, 2006

1. General Project Information

Objectives

The aim of glycomics project is to leverage Semantic technologies to provide critical informatics solutions to enable optimal use of vast amount of data generated by modern high-throughput experimental protocols to guide current and future research. This involves modeling of domain knowledge into formal structures i.e. an ontology. The ontologies are intended to be used for creating the requisite infrastructure namely, semantic annotation of experimental glycoproteomics data, implementation of a semantic provenance model to enable consistent reasoning over annotated information resources and a Semantic Web Services based environment to process, store, retrieve and query data. Also, one of the project initiatives includes the implementation of a comprehensive suite of schema, tools and integration method for seamless transfer and sharing of glycomics data between multiple research groups irrespective of data representation format, storage solutions and geographical location.

Main Deliverables

Consistent with the main objective of the project, we have made available the two ontologies for public use. We are also working towards making the populated versions of these ontologies publicly available. In addition, we are making the bioinformatics tools being developed, including the analytical glycomics workflow and its constituent Web Services for community-wide usage. Using the glycomics web portal Stargate, we have implemented a Web Services registry (Semantic Biological Web Services Registry) to enable glycobiology research groups to publish their informatics tools for public usage. The Web Services registry also enables users to search and discover available relevant Web Services for use in their research. A visualization tool customized for glycomics domain is being released for semantic browsing of domain model (OntoVista). We also aim to soon make the semantic provenance model available for use by the community.hmarking for other researchers.

Scientific and Technical Coordinator

Prof. Amit P. Sheth

2. Partners Details

Our partners at the Complex Carbohydrate Research Center provide the domain specific research expertise, data, experimental protocols, techniques and related resource. The faculty members involved are (in addition to Dr. William S. York) Dr. Mike Pierce, Dr. Ron Orlando and, Dr. Kelly Moremen. The post graduate scholar involved is: Dr. James Atwood III and graduate student is: Lin Lin. The CCRC-Glycomics project website is at:[1]

3. Deliverables

As part of the project we are working on the following initiatives.

- GLYDE glycan structure representation standard [STSHY'05]. Contact Person: Satya Sanket Sahoo
http://lsdis.cs.uga.edu/~satya/satya.html
- Glcyoproteomics domain ontology, GlycO [STSYT'06]. Contact person: Christopher Thomas
http://lsdis.cs.uga.edu/~cthomas
- Glycoproteomics process ontology, ProPreO [STSYT'06]. Contact Person: Satya Sanket Sahoo
http://lsdis.cs.uga.edu/~satya/satya.html
- Semantic Web Services based analytical glycomics workflow [SSYM'05]. Contact person: Satya Sanket Sahooo
http://lsdis.cs.uga.edu/~satya/satya.html
- Semantic Biological Web Services Registry and Stargate glycomics web portal [SHSY'05]. Contact person: Satya Sanket Sahoo, Blake Hunter
http://lsdis.cs.uga.edu/~satya/satya.html
-OntoVista: Semantic glycomics domain visualization tool.Contact: Ravi Pavagada, Christopher Thomas
http://lsdis.cs.uga.edu/~cthomas
-Semantic URI based provenance scheme. Contact person: Satya Sanket Sahoo
http://lsdis.cs.uga.edu/~satya/satya.html

4. Open Tools for public

The following are available at the project website,
http://lsdis.cs.uga.edu/projects/glycomics/
- GlycO is a large glycoproteomics domain ontology with an knowledge bases extracted from publicly available sources
- ProPreO is a process ontology (current downloadable version does not include an instance base due to significantly large size).
- GLYDE standard XML schema, DTD and format conversion tools.

6. Contact details

Prof. Amit P. Sheth
Large Scale Distributed Information Systems Lab
Department of Computer Science, the University of Georgia
415 Boyd Graduate Studies Research Center, Athens GA 30602-7404
Email: amit at cs.uga.edu,
URL: http://lsdis.cs.uga.edu/~amit
or Google: sheth

[1] http://cell.ccrc.uga. edu/world/glycomics/glycomics.php

Key Publications

[STSHY'05] "GLYDE-an expressive XML standard for the representation of glycan structure" Sahoo S. S., Thomas C., Sheth A., Henson C, York W. S. Carbohydr Res. 2005 Dec 30;340(18):2802-7. Epub 2005 Oct 20. PMID: 16242678 http://www.sciencedirect.com/science (publisher)

[STSYT'06] " Knowledge Modeling and its application in Life Sciences: A Tale of two Ontologies " Sahoo S. S., Thomas C., Sheth A., York W.S. and Tartir S., 15th International World Wide Web Conference, Edinburgh, Scotland May, 2006 http://lsdis.cs.uga.edu/projects/glycomics/resources/p1088-sahoo.pdf (author's copy)

[SSYM'05] "Semantic Web Services for N-glycosylation Process" Sahoo S. S., Sheth A. P., York W. S., Miller J. A., International Symposium on Web Services for Computational Biology and Bioinformatics, VBI, Blacksburg, VA, USA, May2005.

[SHSY'05] "Semantic Biological Web Services Registry ", Sahoo S. S., Hunter B., Sheth A., York W. S., Annual Symposium on Computational and Systems Biology, Athens, GA USA Nov, 2005
(poster presentation)

METEOR-S: Framework for dynamic and adaptive Web processes

Amit P. Sheth and John A. Miller
http://lsdis.cs.uga.edu/projects/meteor-s/

Amit P. Sheth, USA is a professor at the University of Georgia where he also directs the LSDIS lab. Earlier, he served in R&D in industry. He founded and managed companies Infocosm and Taalee (now Semagix) focused on workflow and semantic web platform, respectively. He is an IEEE Fellow. He has published over 200 papers and articles, given over 160 invited talks and colloquia including 21 keynotes, (co)-organized/chaired 20 conferences/workshops, and served on over 110 program committees. He is on several journal editorial boards and is the EIC of the International Journal on Semantic Web and Information Systems.

John A. Miller, USA is a Professor of Computer Science at the University of Georgia. His research interests include database systems, simulation, bioinformatics and Web services. He received his Ph.D. in Information and Computer Science from the Georgia Institute of Technology. Dr. Miller is the author of over 90 technical papers in the areas of database, simulation, bioinformatics and Web services. He is an Associate Editor for ACM Transactions on Modeling and Computer Simulation and IEEE Transactions on Systems, Man and Cybernetics as well as a Guest Editor for the International Journal in Computer Simulation and IEEE Potentials.

■ *Executive Summary: The research objective of the METEOR-S project is to create and evaluate semantic frameworks for dynamic configuration and adaptation of Web processes. This includes Web service annotation, Service publication and discovery, Capturing QoS metrics, dynamic configuration of Web processes, data mediation and service execution. The research emphasizes the need to add semantics to current SOA standards and specifications like WSDL, UDDI, WS-BPEL and WS-Agreement. Current research focuses on extending the framework to support autonomic Web processes.*

The key contributions of the METEOR-S project are the idea of semantic template driven process configuration, adaptation and execution and WSDL-S. WSDL-S specification for adding semantics to Web services is an acknowledged member submission to the W3C. We have also released open source tools as eclipse plug-ins for Web process design (Saros), Service annotation (Radiant) and service discovery and publication (Illimina). We also have extended Apache Axis 2.0 to support dynamic configuration and adaptation of Web processes.

Over the past three years eight masters' students have written their thesis addressing various issues related to the METEOR-S framework. We have three Ph.D students with research topics defined in the area of dynamic and adaptive Web process frameworks. We have more than twenty five publications in various conferences, workshops and journals including ICSOC, ICWS WWW and JITM. Some of our papers close to 100 citations in Google Scholar and Citeseer. Students in the METEOR-S project have interned with research labs like IBM TJ Watson research center, interacting closely with people involved in SOA specifications.

Athens, Georgia, USA, March 23, 2006

1. General Project Information

Objectives

The objective of the METEOR-S project is to create and evaluate frameworks for dynamic adaptation and configuration of Web processes. Our philosophy to extend the current standards and specifications forms the central theme of the METEOR-S project. The core contributions of this research effort are a) template driven process configuration and adaptation and b) WSDL-S submission to the W3C for adding semantics to Web service standards.

We categorize the semantics for the complete lifecycle of SOA as data, functional, non-functional and execution semantics. This allows us to identify the various issues that arise in adding semantics to SOA and create frameworks addressing each one of them. Users can capture their data, functional and non-functional requirements for various partners using semantic templates. For process configuration, we use a multi-paradigm constraint analysis approach based on Integer Linear Programming and Horn logic to select services that satisfy user requirements as well as the inter-service dependencies that may exist. The SWAPS framework allows for semantic WS-Agreement matching. We also provide extensions to Axis 2.0 to support dynamic configuration and adaptation of Web processes.

Main Deliverables

In the METEOR-S project, we have made available a variety of tools and API's. The METEOR-S suite comprises of the Saros Template Driven BPEL Editor, Radiant WSDL

Annotator and Illumina semantic Web services discovery and publication engine. All the above mentioned tools are available as eclipse plug-ins and are open source. We also have WSDLS4J API tool kit to create and manage WSDL-S files. We plan to release modules for Axis 2.0, which would allow users to execute dynamically configurable Web processes. We currently are in the process of designing and developing a standalone SOAP/JMS middleware to execute dynamically configurable Web processes. Also we are working on a Web 2.0 based platform for process design and annotation.

Scientific and Technical Coordinators
Prof. Amit P. Sheth and Prof. Dr. John A. Miller

2. Partners Details
We collaborate with researchers at IBM Research at Almaden and T.J Watson. Collaborative efforts are the WSDL-S specification, which includes authors from both the METEOR-S project at LSDIS and IBM, sending students for summer internships and funding through eclipse innovation grant.

3. Deliverables
As part of the project we are working on the following initiatives.
- WSDL-S. Contact Person: Kunal Verma (verma@cs.uga.edu)
- SWS Discovery and Publication. Contact person: Kunal Verma
- SWS Annotation . Contact Person: Kunal Verma
- Autonomic Web Processes. Contact person: Kunal Verma and Prashant Doshi
-METEOR-S Execution Environment. Contact person: Karthik Gomadam (karthik@cs.uga.edu)
- WSDLS4J api. Contact: Karthik Gomadam, Zixin Wu
- Web based tools for annotation and composition: Karthik Gomadam and Jon Lathem

4. Open Tools for public
The following are available at the project Website,[1]
- Saros is an open source eclipse application for creating template driven Web processes
- Radiant is an open source eclipse plug-in for creating and annotating WSDL-S.
- Illumina is an open source eclipse application for SWS publication and discovery.
- We also have time, RosettaNet and SUMO finance ontologies for download.

5. Contact details
Prof. Amit P. Sheth
Large Scale Distributed Information Systems Lab
Department of Computer Science, the University of Georgia
415 Boyd Graduate Studies Research Center, Athens GA 30602-7404
Email: amit at cs.uga.edu,
URL: http://lsdis.cs.uga.edu/~amit
or Google: sheth

[1] http://lsdis.cs.uga.edu/projects/meteor-s/downloads

Key Publications

Semantic Annotation

Abhijit A. Patil, Swapna A. Oundhakar, Amit P. Sheth, Kunal Verma: Meteor-s Web service annotation framework. WWW 2004: 553-562

Rama Akkiraju, Joel Farrell, John A. Miller, Meena Nagarajan, Marc T. Schmidt, Amit P. Sheth, Kunal Verma, Position Paper for the W3C Workshop on Frameworks for Semantics in Web Services, W3C Workshop.

Kaarthik Sivashanmugam, Kunal Verma, Amit P. Sheth and John A. Miller, Adding Semantics to Web Services Standards,ICWS 2003: 395 - 401

Web Service Discovery

Kunal Verma, Kaarthik Sivashanmugam, Amit Sheth, Abhijit Patil, Swapna Oundhakar and John Miller, METEOR-S WSDI: A Scalable Infrastructure of Registries for Semantic Publication and Discovery of Web Services,Journal of Information Technology and Management, Special Issue on Universal Global Integration, Vol. 6, No. 1 (2005) pp. 17-39

Process Configuration and Execution

Kunal Verma, Karthik Gomadam, Jon Lathem, Amit P. Sheth and John A. Miller, Semantics enabled Dynamic Process Configuration, LSDIS Technical Report 2006.

Karthik Gomadam, Kunal Verma, Amit P. Sheth, John A. Miller: Demonstrating Dynamic Configuration and Execution of Web Processes. ICSOC 2005: 502-507

QoS

Nicole Oldham, Kunal Verma, Amit P. Sheth, Farshad Hakimpour ,Semantic WS-Agreement Partner Selection,15th Int. World Wide Web Conference (WWW2006)

Rohit Aggarwal, Kunal Verma, John A. Miller, William H. Milnor, Constraint Driven Web Service Composition in METEOR-S, IEEE-SCC 2004.

Autonomic Web Processes

Kunal Verma, Amit P. Sheth: Autonomic Web Processes. ICSOC 2005: 1-11

Answer Set Programming for the Semantic Web

Thomas Eiter, Giovambattista Ianni, Roman Schindlauer and Hans Tompits
http://www.kr.tuwien.ac.at/staff/roman/asp_sw

Thomas Eiter, Austria is a full professor in the Faculty of Informatics at Vienna University of Technology and head of the Institute of Information Systems. He is a PC co-chair of RuleML 2006, and co-chaired in the past KI 2001, LPNMR 2001, FOIKS 2002, and ICDT 2005. He is on the advisory boards of the Journal of Artificial Intelligence Research (JAIR) and the Journal on Theory and Practice of Logic Programming (TPLP), and a former associate editor of the IEEE Transactions on Knowledge and Data Engineering (TKDE).

Giovambattista Ianni, Italy is Assistant Professor at University of Calabria, Italy. He is responsible of the design and implementation of some of the peculiar language extensions of DLV, one of the major Answer Set Programming systems. He has been organizing co-chair of JELIA 2002 and LPNMR 2005, as well as editor of the JELIA 2002 proceedings. He served and serves in several program committees such as ECAI 2006, RuleML 2006, WI/IAT 2005/06, NMR 2004, AGP 2003.

Roman Schindlauer, Austria, graduated in electrical engineering at the Vienna University of Technology in 2002 and is currently finalizing his PhD studies at the same place, under supervision of Prof. Thomas Eiter. His doctorate studies concentrated on the applicability of nonmonotonic reasoning, in particular answer-set programming, in the Semantic Web domain.

Hans Tompits, Austria is associate professor in the Computer Science Department of the Vienna University of Technology, Austria, since 2002 and has been a faculty member since 1995. He studied physics and mathematics at the University of Vienna and received his Ph.D. in computer science at the Vienna University of Technology in 1998. His research interests focus on logics in artificial intelligence, logic programming, Semantic-Web reasoning, preference handling, complexity, and knowledge representation in general. Dr. Tompits has over 60 publications and worked in several international and national projects involving different topics of declarative knowledge representation and reasoning.

■ *Executive Summary: The goal of this project is to research methods for providing advanced reasoning services in the context of the Semantic Web, using declarative knowledge representation and reasoning techniques. In particular, we investigate the use of logic programming under the* ***answer set semantics*** *for realizing languages and tools which extend the capabilities of current approaches, in order to support reasoning aware querying of the Web.*

The Answer Set Programming (ASP) Paradigm is a declarative programming paradigm with its roots in Knowledge Representation and Logic Programming. Systems and languages based on ASP are good candidates for solving a variety of issues which have been delegated to the Rule/ Logic Layers in the Semantic Web vision. ASP systems are scalable, allow to mix monotonic with nonmonotonic reasoning, permit to combine rules with ontologies, and can interface external reasoners. Moreover, ASP is especially tailored at solving configuration and matchmaking problems involving reasoning with preferences by featuring easy to use, fully declarative soft & hard constraint specification languages. The problems dealt with in the project are:

***Interfacing between the Ontology and the upper layers**. Ontologies with their own semantics are embedded in a rule based framework. The two layers are separate, but can communicate with bidirectional flow of information. Decidability is preserved, despite the fact that **rules, nonmonotonic reasoning, nondeterminism** are allowed.*

***Efficient Evaluation**. Design constraints such as full declarativity and the inherent computational complexity of ASP are faced and solved.*

***Divulgation of the Answer Set Para-digm**. Although not well known, Answer Set Programming features several appeal-ing characteristics that might be of interest to the SW field, such as full declarativity, nonmonotonic constructs, weak & soft constraint programming constructs.*
***Knowledge exchange**. A RuleML format for Answer Set Programming is under development.*

Vienna, Austria, 21.03.2006

1. General Project Information

Objectives

The goal of this project is to research methods for providing advanced reasoning services in the context of the Semantic Web, using declarative knowledge representation and reasoning techniques. In particular, we investigate the use of logic programming under the answer set semantics for realizing languages and tools which extend the capabilities of current approaches, in order to support reasoning aware querying of the Web.

The Answer Set Programming (ASP) Paradigm is a declarative programming paradigm with its roots in Knowledge Representation and Logic Programming. Systems and languages based on ASP are good candidates for solving a variety of issues which have been delegated to the Rule/Logic Layers in the Semantic Web vision. ASP systems are scalable, allow to mix monotonic with nonmonotonic reasoning, permit to combine rules with ontologies, and can interface external reasoners. Moreover, ASP is especially tailored at solving configuration and matchmaking problems involving reasoning with preferences by featuring easy to use, fully declarative soft & hard constraint specification languages. The main goals of the project are:

Interfacing between the Ontology and the upper layers. Ontologies with their own semantics are embedded in a rule based framework. The two layers are separate, but can communicate with bidirectional flow of information. Decidability is preserved, despite the fact that rules, nonmonotonic reasoning, nondeterminism are allowed.

Towards the integration of rules and ontologies in the Semantic Web, we proposed a combination of logic programming under the answer set semantics (and, also, under the well-founded semantics) with the description logics SHIF(D) and SHOIN(D), which underly the Web ontology languages OWL Lite and OWL DL, respectively. This combination allows for building rules on top of ontologies but also, to a limited extent, building ontologies on top of rules. We introduced dl-programs, which consist of a description logic knowledge base L and a finite set of description logic rules (dl-rules) P.

Such rules are similar to usual rules in logic programs with negation as failure, but may also contain queries to L, possibly default-negated, in their bodies. We define Herbrand models for dl-programs, and show that satisfiable positive dl-programs have a unique least Herbrand model. More generally, consistent stratified dl-programs can be associated with a unique minimal Herbrand model that is characterized through iterative least Herbrand models. We then generalized the (unique) minimal Herbrand model semantics for positive and stratified dl-programs to a strong answer set semantics for all dl-programs, which is based on a reduction to the least model semantics of positive dl-programs. We also defined a weak answer set semantics based on a reduction to the answer sets of ordinary logic programs. Strong answer sets are weak answer sets, and both properly generalize answer sets of ordinary normal logic programs.

We then gave fixpoint characterizations for the (unique) minimal Herbrand model semantics of positive and stratified dl-programs, and show how to compute these models by finite fixpoint iterations. Furthermore, we gave a precise picture of the complexity of deciding strong and weak answer set existence for a dl-program.

Dl-Programs have been then extended introducing HEX programs, which are nonmonotonic logic programs admitting higher-order atoms as well as external atoms, and we extended the well-known answer-set semantics to this class of programs. Higher order features are widely acknowledged as useful for performing meta-reasoning, among other tasks. Furthermore, the possibility to exchange knowledge with external sources in a fully declarative framework such is nowadays important, in particular in view of applications in the Semantic-Web area. Through external atoms, HEX programs 1) can model important extensions to ASP, 2) are a useful KR tool for expressing various applications, 3) allow bidirectional interfacing with external reasoners.

Efficient Evaluation. Design constraints such as full declarativity and the inherent computational complexity of ASP are faced and solved, by developing algorithmic techniques which prove practical feasibility of the approach.

Indeed the Semantic Web vision needs formalisms for the Rule Layer that guarantee transparent interoperability with the Ontology Layer, clear semantics and full declarativity. Full declarativity, decidability, nondeterminism, nonmonotonicity, non-finite universe of individuals, smooth interfacing with the Ontology layer are the features HEX programs foster. It can be argued that these features enforce some design constraint that would compromise the practical adoption of this formalism in its full generality. To this end, although keeping desirable advantages, we identified classes of HEX programs feasible for implementation. A general method for combining and evaluating subprograms belonging to arbitrary classes has been introduced, thus enlarging the variety of programs whose execution is practicable. Implementation activity on the current prototype is currently ongoing.

Divulgation of the Answer Set Paradigm. Despite the current and potential advantages of the Answer Set Semantics as building block for the three uppermost layers of the Semantic Web, (namely, the Rule,

Logic and Proof layers), the Answer Set Programming field is currently not widely known to the Semantic Web Community. The project aims at devoting some dissemination effort in order to extend the knowledge of this important field, to foster the mutual understanding and enable more fruitful combinations of ASP in Semantic Web Applications.

Knowledge exchange. Sharing and exchanging knowledge in a standardized format is one of the cornerstones of the Semantic Web idea. RuleML is the most prominent effort towards providing a general syntax for rule-based languages by means of a modularized, extensible architecture. We introduced an extension to RuleML for Answer Set Programs incorporating most of the features that current Answer Set Programming variants provide. Applying semantics to these features can be accomplished by means of existing reasoners. Furthermore, a complete conversion tool for the specific dialect of HEX-programs is available.

Main Deliverables

- T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. Effective Integration of Declarative Rules with External Evaluations for Semantic Web Reasoning. ESWC 2006, to appear.
- T. Eiter, T. Lukasiewicz, R. Schindlauer, and H. Tompits. Combining Answer Set Programming with Description Logics for the Semantic Web. KR2004, Whistler, Canada, pp. 141-151.
- T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. A Uniform Integration of Higher-Order Reasoning and External Evaluations in Answer Set Programming. IJCAI 2005, pp. 90-96, Edinburgh, UK.
- T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. Nonmonotonic Description Logic Programs: Implementation and Experiments. In F. Baader and A. Voronkov, editors, LPAR 2004, pages 511-517.

Scientific and Technical Coordinator

Prof. Thomas Eiter, Institute for Information Systems, Vienna Technical University.

2. Partners Details

Technical University of Vienna. The main contractor of the project is the Institute for Information Systems at the Technical University of Vienna. The DBAI and KBS groups of TU-WIEN are internationally renowned for their expertise in knowledge representation, in logic-based data and knowledge bases, in particular with respect to rule-based formalisms and languages, as well as in non-monotonic reasoning, specifically in preference-based reasoning, and in respective computational foundations and systems.

University of Calabria. The Department of Mathematics at University of Calabria collaborates very strictly in the project. The group is well known for the development of advanced knowledge-based systems and, particularly, the DLV system, which is the state-of-the-art implementation of disjunctive deductive databases and one of the major Answer Set Programming systems. Its members bring to the project the competence on modeling and implementing large systems exploiting computational logic technologies.

The project includes also collaborations with the **University of Rome "La Sapienza"**, the **University of Naples "Federico II"**, and the **Free University of Bozen/Bolzano**.

3. Workshops/sponsored Events

T. Eiter, G. Ianni, A. Polleres. Tutorial on Answer Set Programming for the Semantic Web. To be held at ESWC 2006 (3d European Semantic Web Conference, Budva, Montenegro).

4. Open Tools for public

So far the project produced two working system prototypes:
NLP-DL (http://www.kr.tuwien.ac.at/staff/roman/semweblp) and
dlvhex (http://www.kr.tuwien.ac.at/staff/roman/dlvhex). The former implements Answer Set Semantics with DL-atoms. A DL-atom is a special construct aimed at interfacing, with bi-directional flow of information, the reasoning engine at hand with an external ontology. The latter is a generalization of the former. dlvhex introduces higher order atoms, aimed at facilitating meta-reasoning, and external atoms. An external atom allows dlvhex to interoperate with a variety of external reasoners for RDF & OWL-DL semantics. Also related to the project is DLT (http://www.gibbi.com) which features higher order reasoning, frame based syntax and modularity. DLT works as a pre-parser and can be coupled with dlvhex or with the DLV system.

5. Contact details

Thomas Eiter
eiter@kr.tuwien.ac.at
http://www.kr.tuwien.ac.at/staff/eiter

G. Ianni
ianni@mat.unical.it
http://www.gibbi.com

R. Schindlauer
roman@kr.tuwien .ac.at
http://www.kr.tuwien. ac.at/staff/R.

H. Tompits
tompits@kr.tuwien.ac.at
http://www.kr.tuwien.ac.at/staff/tompits

Key Publications

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. Effective Integration of Declarative Rules with External Evaluations for Semantic Web Reasoning. ESWC 2006, to appear.

T. Eiter, T. Lukasiewicz, R. Schindlauer, and H. Tompits. Combining Answer Set Programming with Description Logics for the Semantic Web. KR2004, Whistler, Canada, pp. 141-151.

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. A Uniform Integration of Higher-Order Reasoning and External Evaluations in Answer Set Programming. IJCAI 2005, pp. 90-96, Edinburgh, UK.

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. dlvhex: A System for Integrating Multiple Semantics in an Answer-Set Programming Framework. 20th Workshop on Logic Programming
Vienna, Austria. February 22-24, 2006

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. dlvhex: Dealing with Semantic Web under Answer-Set Programming. In 4th International Semantic Web Conference (ISWC 2005), 2005. System poster.

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. NLP-DL: A KR System for Coupling Nonmonotonic Logic Programs with Description Logics. In 4th International Semantic Web Conference (ISWC 2005), 2005. System poster.

T. Eiter, G. Ianni, R. Schindlauer, and H. Tompits. Nonmonotonic Description Logic Programs: Implementation and Experiments. In F. Baader and A. Voronkov, editors, Proceedings 12th International Conference on Logic for Programming, Artificial Intelligence and Reasoning (LPAR 2004), number 3452 in LNCS, pages 511-517. Springer, 2005.

R. Schindlauer. Nonmonotonic Logic Programs for the Semantic Web. In M. Gabbrielli and G. Gupta, editors, Proceedings of the 21st International Conference on Logic Programming (ICLP 2005), number 3668 in LNCS, pages 446-447. Springer, 2005.

G. Antoniou, M. Baldoni, C. Baroglio, R. Baumgartner, F. Bry, T. Eiter, N. Henze, M. Herzog, W. May, V. Patti, S. Schaffert, R. Schindlauer, and H. Tompits. Reasoning Methods for Personalization on the Semantic Web. Annals of Mathematics, Computing and Teleinformatics, 2(1):1-24, 2004. ISSN 1109-9305. Invited paper.

T. Eiter, T. Lukasiewicz, R. Schindlauer, and H. Tompits. Well-founded Semantics for Description Logic Programs in the Semantic Web. In G. Antoniou and H. Boley, editors, Proceedings RuleML 2004 Workshop, ISWC Conference, Hiroshima, Japan, November 2004, number 3323 in LNCS, pages 81-97. Springer, 2004.

T. Eiter, M. Fink, R. Schindlauer, and H. Tompits. Answer Set Programming for Intelligent Web Services. ÖGAI Journal (J. of the Austrian Society for AI), 22(2):17-22, 2003. Project-Report.

An Experimental Prototype for an Ontology based Search in a multi agent system, EPOS

Bernd Müller, Amir Pour-Heidari and Heinrich Faßbender

Müller, Bernd is graduand in informatics at the faculty of electronical engineering and information technology of the University of Applied Sciences Aachen, Germany.

Pour-Heidari, Amir graduated in 2005 as computer scientist at the faculty of electronical engineering and information technology of the University of Applied Sciences Aachen, Germany. Since then he has worked as developer for Accenture Technology Solutions GmbH in Frankfurt, Germany.

Heinrich Faßbender, professor of computer faculty of electronical engineering and information technology of the University of Applied Sciences Aachen, Germany.

■ *Executive Summary: At the university of applied sciences Aachen within the scope of a scientific research project an experimental prototype was developed to show up new technologies for the web portal of the city council of Aachen. For this purpose an ontology was created to represent demonstratively the available information on the existing web portal of the city council. Algorithms were implemented to access, modify and search the developed ontology. The ontology is distributed with different instances on a peer-to-peer (hereafter P2P) network with agents as nodes. The prototype demonstrates how the two technologies ontologies and P2P networks can be used to make information available to the users on the Internet. In particular this paper shows how ontologies and P2P systems can be combined in a search engine. It describes the ontology, the search algorithms and how different versions of the ontology are shared in a multi agent system.*

Aachen, Germany, 10.03.2006

1. General Project Information

Users are dependent on functionalities to search to access the information on the Internet for their wanted benefit. Accepted search engines on the Internet usually collect data about documents on indices. But the replies do not give precise answers according to the user's needs because it is not possible to give contexts in the users' requests. A possibility to increase the search precision is to give meta information on indexed information. That can be done by using ontologies that represent information in semantic contexts. Although the indexed data is stored statically on one server. It is refreshed periodically by crawling documents on available websites. An improved scenario would be to search directly on the peers by using P2P networks to connect the websites itself. In distributed systems there exists the problem of marshaling and unmarshaling. This means how to interchange data in a network without any loss of information. By using ontologies this problem does not exist anymore because the data is in a given format and the programmer has no longer the problem how to interchange the data between different nodes in a network. Ontologies also describe meta information about data and semantics can be involved. Ontologies are data about data.

Acceptable technologies in networking areas like Internet and Intranet architectures usually consist of client-server systems with central orientated structures. A service provider is known by all clients in the network and it is connected by the clients to offer a certain service. The implementation of such systems is embossed by a continuous control structure. The control structure is exchanged between client and server. The respective control structure in an object oriented environment is an object request broker. There exists an object request broker for the client and the server. So the programmer of a client-server system has to consider every eventuality of the change of the control structure (shown in illustration 1).

In opposite, every node in a P2P system represents an equal good unit in a P2P system. A node does not take over the role of a server or a client. It is a higher abstraction level because the control structures are not implemented linear. Each node is an autonomic unit and is implemented as that. The communication does not exist as request-answer scenario but every node is able to send a request, a reply or a simple information on the same time. Such an autonomic unit as node of a P2P system can be implemented as an agent.

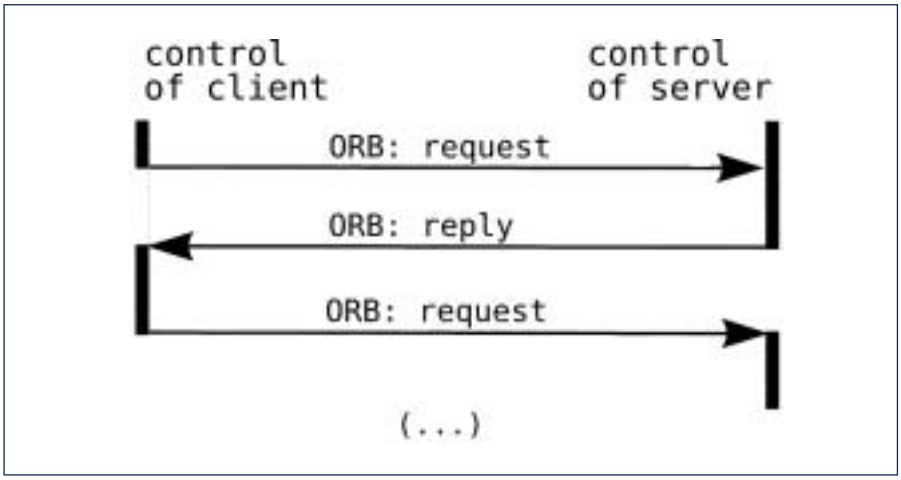


Illustration 1 Orb control structure

1.1 Objectives

In our research project we decided to use existing tools and frameworks for combining the two technologies ontologies and P2P architectures. We used Protégé[1] to design the ontology and the JADE[2] framework to implement the multi agent system. The JADE addon AgentOWL[3] was used to access and infere the ontology. AgentOWL itself depends on the JENA[4] framework. We developed the experimantal prototype for combining the two technologies ontologies and P2P architectures. First we designed an example of an ontology that can be used for searching. This main ontology is splitted in two different parts: The service ontology for representing the data in a semantical context and the search ontology for searching the data with its context. After developing the main ontology for search we used the JADE framework for deploying the ontology on agents.

1.2 Main Deliverables

During the development of the prototype a little ontology was designed to show exemplarily the basic properties of a search ontology. The ontology was created in OWL-format. The topics that are represented in the ontology are quotations of the city council that are available to citizens. The quotations were modeled as services to categorize the topics. The ontology is divided into two parts:

- The search ontology
- The service ontology
- Relations of the ontology

There exists different types of agents as nodes in the P2P architecture. A user phrases his search request through a user interface that was implemented as java frame. The agents were implemented with JADE. The user interface contacts the broker agent via XMLRPC and submits the search terms. The broker agent creates and RDQL-query message and sends it to the different query agents. The query agents work on the same ontology but they have different instances in the classes of the ontology.

The agent memory was implemented with Jena by using the library AgentOWL. Each ontology agent queries its memory with the submitted RDQL-query and sends the results back to the search agent. The search agent purifies the results and sends them back to the user interface. The topology is shown in Illustration 2.

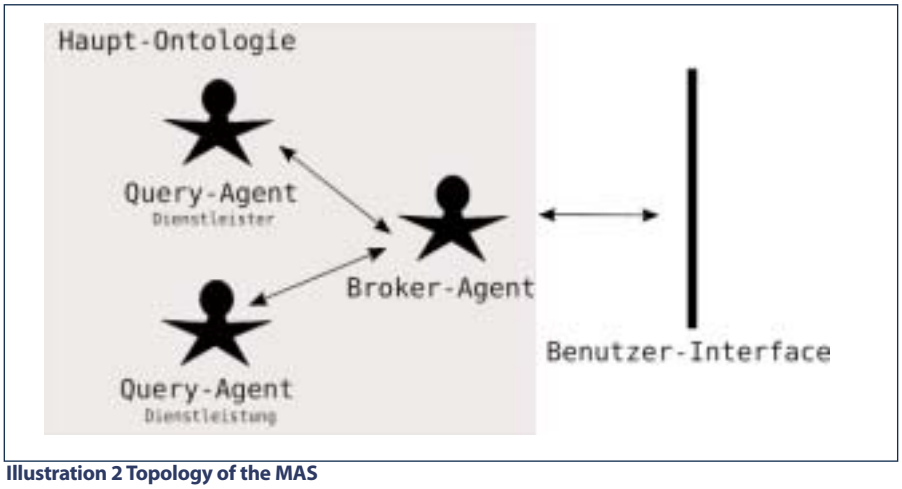


Illustration 2 Topology of the MAS

1.3 Scientific and Technical Coordinator

The project took place at the University of Applied Sciences Aachen as two diploma thesis coordinated by Prof. Dr. rer. nat. Heinrich Faßbender.

2. Partners Details

Partner of the project is the city council of Aachen.

3. Conclusion

It is possible to represent very complex topical application areas by using ontologies to describe semantical contexts. It is not necessary to take care of architecture dependent implementation of the developed data structures. The nodes as agents in this P2P architecture are autonomous units. They are designed and implemented as autonomous components of the system. Each agent has its own control structure instead of regarding the control structure of the whole system. So the architecture is very scalable by adding and removing any ontology agents. The experimental prototype shows how those two new technologies, **agents** and **ontologies**, can be combined. The ontologies of the ontology agents can be exchanged with different version of the used instances. But

1 http://protege.stanford.edu/
2 http://jade.tilab.com
3 http://ups.savba.sk/\%7Emisos/AgentOWL/doc/index.html
4 http://jena.sourceforge.net/

the algorithm for generating the RDQL-queries depends on the used main ontology. So this main ontology cannot be changed. The relations of the ontology are needed for getting correct instances throughout each generated query. A possibility for further development is to design similar main ontologies who can be searched by another search agent. So the other search agent searches in different similar ontologies and it does not only work on one ontology. Afterwards a main search agent has to be created that runs the search while using the different other search agent. The other search agents themselves query their ontology agents. The different similar ontologies are combined under a domain ontology. So the conclusion to run a main search agent on other search agent will build a search system in one domain ontology. The next step is to run the search system on different domain ontologies. A research group at the MIT has developed the design tool DOME[5] for creating relations between domain ontologies. Maybe such developed relations between domain ontologies can be used for a search system. Our prototype shows a first step for such a development.

4. Contact Details

The authors can be reached via email for further information:

Bernd Müller
bernd@kirx.de

Amir Pour-Heidari
amir.pour-heidari@accenture.com

Heinrich Faßbender
fassbender@fh-aachen.de

5 http://dome.sourceforge.net

Articles and Abstracts

Ontology-centric Multi-agent Systems
Change Detection and Management
OntoMedia
SW Query
XChange
PhD Thesis: SWA
PhD Thesis: Digital Rights Management

Ontology-centric Multi-agent Systems in 2005

Peter Bloodsworth and Sue Greenwood
Department of Computing, Oxford Brookes University
Wheatley Campus, Wheatley, Oxford, U.K.
pbloodsworth/sgreenwood @ brookes.ac.uk

Peter Bloodsworth is a Research Student within the Department of Computing at Oxford Brookes University. His research focuses on multi-agent systems, the Semantic Web, information extraction and decision support systems

Sue Greenwood is a Principle Lecturer within the Department of Computing at Oxford Brookes University. Her main research interests are, multi-agent systems, intelligent solutions, the Semantic Web.

■ ***Abstract:*** *This article reports progress in the development of ontology-centric multi-agent systems during 2005. In this approach, rules, heuristics and statistical attributes that define agent behaviour are included in an ontology-layer. By placing Semantic Web technologies at the heart of a multi-agent system it is possible to create a system in which agent behaviours and internal representation are abstracted from coding. Each agent in the system uses this layer, in addition to instances, to form a knowledge base defining its behaviour. The ontology-layer is a mixture of domain specific and generic ontologies, which structures the behaviour of a multi-agent system. Such a level of abstraction makes editing the behaviour of agents more convenient, requiring only the altering of domain specific ontologies without any major changes to the coding of the system. This ontology-centric approach encourages re-use, allowing the system to move from one problem domain into another by creating an ontology layer defining the new environment and system behaviour. These features make the future possibilities of such methods exciting.*

1. Introduction

1.1 Background

During 2005 the Semantic Web has progressed in many significant and exciting ways. An area that is benefiting from recent advances is the use of Semantic Web technologies in the engineering and structuring of complex intelligent distributed systems. As agent-based systems continue to grow in complexity novel design and implementation techniques become increasingly important. In this article we will present a review of some research that is ongoing within the Computers Agents People (CAP) research group at Oxford Brookes University.

1.2 Previous Work

Previous research in this area falls into two main categories, multi-agent systems that use ontologies heavily [1,2,3,4] and largely theoretical models that aim to define system behaviours in an ontology [5,6,7]. An example of the first class of system is Ontobroker [2], which makes substantial use of ontologies. It uses formal ontologies to extract, reason and generate metadata from the web. By formally describing the information that is to be extracted in a domain specific ontology, the system avoids the creation of demanding wrappers. Ontologies also allow reasoning on the data that has been extracted and are used in tandem with an inference engine to produce the required metadata. This example shows that powerful results can be achieved by using domain specific ontologies widely within systems. Recent work by Isto and Korhonen [6] presented an ontology-based system which uses ontologies for a range of purposes. In order to achieve this there are three primary agent types: entity agents that manage the different subsets of data, query agents provide query services using entity agents to access the required data and insert agents that append new data into the database using the entity agents. An ontology is used in the preparation and execution of queries and structures the collection and integration of the required data.

By making the maximum use of ontologies within the design and structuring of systems, the editing process is simplified. The following example illustrates this, describing a multi-agent system that uses ontologies to provide negotiation protocols. Work by Blacoe et al [7] has demonstrated that an ontology can be used to define an approach to negotiation. In this case a negotiation protocol is not hard-coded within the agent's structure, but is expressed in a common ontology that is used by every agent when participating in a negotiation session. The ontology, which defines the negotiation protocol, is generic enough to support a wide range of market mechanisms. These properties allow the system to function in many problem domains including electronic commerce as well as

modelling the negotiation structure within auctions. Relevant too is the work of Becker and Smith in their development of Ozone [8]. A central part of Ozone is its ontology for scheduling. The ontology was used to define generic concepts and approaches, which can be used to solve scheduling problems.

These examples have shown that making full use of ontologies within multi-agent systems can provide powerful design and flexibility benefits. They also demonstrate that ontologies can be usefully employed in the structuring of system behaviour. Ontobroker makes excellent use of them for accomplishing individual tasks and obviously provides strong ontology access support. It is a weakness that this support is not fully utilized within the system. Other examples demonstrate it is possible to define agent communication and actions within an ontology. With these two thoughts in mind the ontology-centric approach is a means of incorporating the best of both types of system. By making the maximum use of ontologies within the design and structuring of agents, the editing process is simplified. It is certainly easier to edit a knowledge base rather than re-coding parts of the system which makes it more user friendly.

2 Ontology-centric Multi-agent Systems

2.1 The Challenges

There are some issues that require addressing before such an approach is truly possible. Designing agents with the ability to reference and use ontologies requires robust ontology interfaces. The ontology-layer is at the heart of the system therefore any errors there could have dramatic effects. It is also clear that strong methods for representing and the specifying of rules, heuristics, actions and domain environments are also necessary. Another potential problem is the overheads that an ontology-centric approach may impose on systems, especially within time constrained domains. These need to be minimized so that system performance is not adversely affected by the constant accessing of ontological information. Tightly coupled with this problem is the issue of error handling, obviously there must be sufficient error handling to provide protection against the system becoming deadlocked when access to the ontology layer is disrupted or errors occur. To achieve both of these aims it is necessary for agents to configure themselves using the ontology layer and then carry their own copy of vital information with them.

2.2Ontology-centric Design

DNA functions as a form of construction manual that specifies how a human grows and develops. It determines how tall someone will be and what colour eyes they will have. All human DNA results in the creation of a human being but subtle variances in the genetic coding allow for the uniqueness of every person. For example some people are equipped to be sporty whilst others are academic. In this way DNA could be said to have generic components that nearly everyone has and then a group of person specific genes. This role is similar to an ontology-centric approach, using what could be likened to a form of semantic DNA the subtle variances are specified that allow an agent to handle a particular job in a certain domain. Whilst all agents inherit their specific role, semantic DNA determines exactly how this is to be accomplished. Ontologies and instances are used to define the agent and what action it will take to complete its tasks.

When developing multi-agent systems in the past, the architecture was created first and then an ontology or group of ontologies was created later. These were then used to define concepts and common terms to facilitate standard communication within the system. An ontology-centric approach reverses this process. The ontology layer is created whilst the architecture is being designed. It is placed at the heart of the system with ontologies featuring where possible. Each agent is designed to have a specific purpose within the system but is designed in

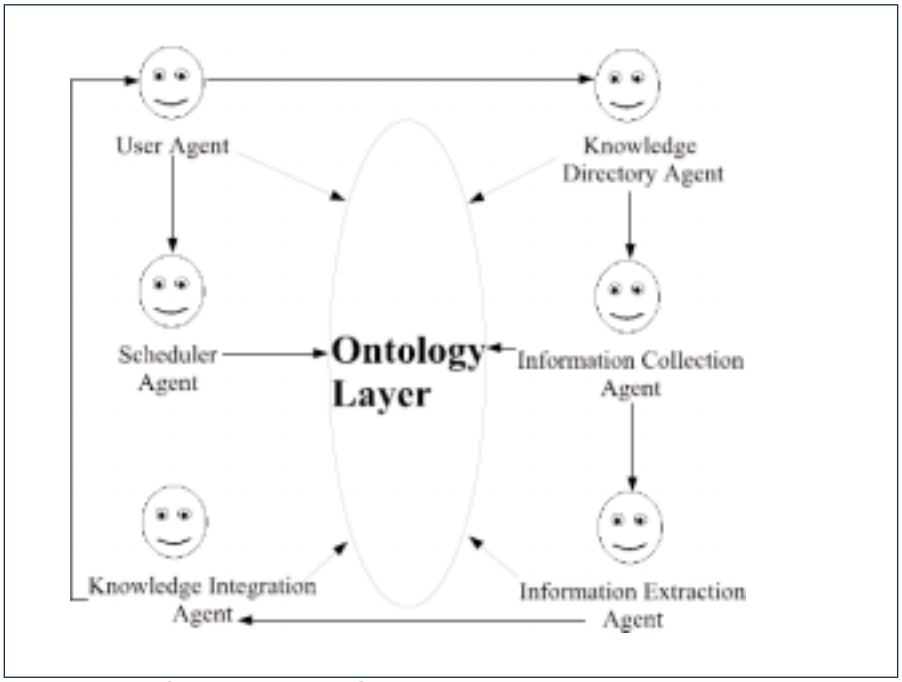


Figure 1: An Ontology-centric Approach

a generic manner. Rules, heuristics and statistical attributes that define the domain specific parts of the agent are defined in the ontology layer itself. Each agent in the system uses this ontology layer and instances of the ontologies to construct a knowledge base, which specifies its behaviour. In order to achieve this agents need to be created with the ability to use the knowledge base at run-time to construct their behaviours.

Creating a level of abstraction between coding and agent behaviour makes editing systems more convenient. By editing the ontology layer and the instances thereof the system can be altered without requiring any major changes to the coding of the individual agents. This encourages re-use, allowing systems to move from working within one problem domain to another. Only a new ontology layer with instances defining the domain environment and agent behaviour is required to achieve this. Developing detailed ontologies that support re-use requires that they are generic enough whilst at the same time still being usable. In order for the ontology layer to function correctly it needs the correct balance of generic and domain specific ontologies. Should this balance be incorrect then there is a danger the potential for re-use is lost or a system is produced that is too general and does not adequately perform its roles. This being said, it makes sense to produce generic ontologies where it is possible to do so as they promote reusability within different problem domains. In order to achieve these design aims it is necessary to consider the requirements that are placed on the expressiveness of the ontology layer.

2.3 An Appropriate Level of Ontological Representation

It is clear that having the adequate level of ontological representation is vital for the success of an approach that relies so heavily on ontologies. This Section will consider three ways in which the ontology-layer can be used within ontology-centric multi-agent systems. Firstly, an ontology can be used to structure data, that is to set out how data relates to each other and how concepts build upon individual concepts. Secondly, the ontology can be combined with instances to form a knowledge base. Knowledge bases are becoming increasingly important in generating intelligent behaviour in agent systems. Thirdly, ontologies define the cardinality, type and optionality of data items. This is especially important when trying to recognise types of data. All of these ways are equally important to the overall success of the design, with each being used at different points within the system.

Using ontologies to structure data and set out how concepts relate to each other is currently their most common application. The majority of multi-agent systems make use of this function in order to standardize the concepts that are used in communication. By relating concepts to each other it becomes possible to derive new information from old; something that is vital when it comes to producing powerful multi-agent systems. This ability is also important when extracting information from heterogeneous data sources. By understanding the relationships between data sets it becomes easier to extract the correct information. Creating instances of ontology concepts in order to form a knowledge base provides a convenient method of getting actual data into the ontology thus adding more knowledge than having the ontology alone. Instances can be used to determine the behaviour of agents, for example an agent can load a set of rules into its knowledge base that are defined as instances of an ontology. Instances are also useful in describing domain specific concepts; this allows the system to function more effectively in its environment. By making use of instances in the ways outlined it becomes possible to edit system behaviour at a later stage, since it is far easier to edit an instance than change agent coding.

It is important to make use of the extra information ontologies supply about data such as cardinality, data type and optionality. Once again this information can be used to aid the extraction process by providing another layer of information that is used to hone the recognised information and narrow down the search for patterns. Optionality adds flexibility to the collection process. It determines whether a piece of information is required or not. This in turn improves the accuracy and range of results that are generated. Such information is also important in order to produce robust error checking. The more information regarding data that is known the greater the range of checks that can be performed. On consideration of the current range of ontology languages that are available it becomes clear that the vast majority are expressive enough for these needs. In fact new ontology languages such as OWL exceed the level of expressiveness that is required. It even becomes challenging to make use of all the features that are supplied. This trend of increasing abilities to express concepts in greater detail may continue as ontology languages develop in the future. As these changes occur it is important to make the maximum utility of these advancements.

3 Implementing Ontology-centric Methods

In order to provide proof of concept, two prototype systems have been designed and selectively implemented. The problem domains chosen were that of disaster response co-

ordination and the management of an open-source data repository. The main aim of this process was not the development of novel prototype systems themselves. Rather the domains were chosen as vehicles in which to thoroughly evaluate the work that has been developed thus far. The design process was also considered to be as important to the success of the overall work as the implementation itself. This is because it was important to ensure that the approach worked well within the wider design phase and that it did not overly constrain the systems that were produced.

COSMOA was the first prototype multi-agent system to be created using ontlogy-centric methods. It supports the decision-making during the medical response to a large-scale disaster. The constant updating of information and regenerating of emergency plans in response to even the slightest changes in operational detail is beyond any one person or team of people. These features make it an ideal prototyping application area for the model and corresponding architectures. CORD or the Ontology-Centric Data Repository was the second system to be developed. The idea behind this prototype was to produce a tool that can monitor the Internet and other sources of dynamic data that were necessary. It would then schedule the downloading of the required software at off-peak times to a central data repository from which users could update their systems locally at a later date. CORD therefore is a more directly consumer facing application than COSMOA.

Such problem domains were chosen because they contrasted well with each other. For example in the CORD system the user agents represent the many individual users, but in COSMOA they represent far fewer but more complicated hospitals. There is also a differing degree of system complexity within the scheduling process itself. CORD has only basic scheduling tasks to handle whereas COSMOA has far more difficult problems to solve that require a greater amount of co-ordination and agreement between agents. CORD potentially needs access to a wider range of heterogeneous information feeds than COSMOA which has a smaller number of more structured information feeds. It is therefore felt for the reasons previously stated that COSMOA and CORD represent the different ends of the models application spectrum.

The prototypes have demonstrated that ontology-centric design is feasible and can be implemented using existing tools. The Protege API and graphical editing environment provide extremely robust tools for the creation of ontology-centric systems. Prior experimentation with early versions of the Jena framework were not so successful and this is why Protege was chosen, although Jena [10] has now become more stable and could be used in future work. The integration of a Jess rule-engine within Jade agents is the key to the creation of ontology-based agents [9]. The resulting agents have proven to be remarkably robust and highly scalable. One issue that remains to be completely addressed is that of error trapping and handling which can become difficult especially within rule-engines. Whilst steps have been taken to improve this aspect of the design, further work will be necessary in the future.

It has to be said that designing a system within the framework of the ontology-centric approach is initially difficult as it requires a change of mindset. This is especially the case when deciding on the structure of the ontology layer that will be used. It is also often difficult to design the ontologies in such a way that they represent the required concept in a usable manner. This often requires a trial and error approach. Once the initial work has been carried out to develop the system, it becomes much easier to edit agent's behaviours to change environmental representation without resorting to large amounts of agent re-coding. In fact the prototypes have shown that the ontology-centric approach has many previously undiscovered benefits. These include the potential for real-time reconfiguration as well as the foundations of a toolkit for multi-agent creation based purely on an ontology layer.

4 The Future of Ontology-centric Design

The prototype implementation provides a basis for the development of a toolkit for multi-agent system construction based on an ontology layer. Since an ontology can be used to represent a domain environment, it must also be possible to use it to define and specify the architecture, structure and behaviour of a multi-agent system. This will build on the previous work that is described in this article and will attempt to extend the role of the ontology layer. It is thought that a user could design an ontology layer representing the multi-agent system with the required behaviour and architecture using a tool such as Protege. A coding engine would then extract the multi-agent system architecture and construct individual agents to produce a multi-agent system from the specified ontology layer. Constructing multi-agent systems even using existing toolkits demands a high-level of programming expertise. For this reason it is considered that designing an ontology layer is generally easier than coding a multi-agent system from scratch. It is therefore hoped that the proposed toolkit will be of use to a wide audience of developers and researchers.

In truly ontology-centric systems the ontology layer would perfectly describe the nature of the individu-

al agents. This makes further advances possible; for example consider an agent needing to locate another that can provide a particular service. It could query the ontology layer looking for an agent type that has the desired capability. Once this has been accomplished the agent simply has to search the platform for an agent of the desired class and request the necessary service. The ontology layer thus provides a transparent representation of the capabilities and internal structure of all the individual agents within the system. This provides a convenient means of coordinating large-scale multi-agent systems, which operate in open environments. When a new agent enters an open system it might be possible for it to use the ontology layer of the other agents in the system to automatically configure its communication. It could also determine its place within the agent hierarchy should one exists. Other agents would likewise use the new agent's ontology layer to perform the same task.

The final and perhaps most interesting impact of ontology-centric principles is the possibility for real-time reconfiguration of multi-agent systems. This is feasible because of the link between an agent and the ontology layer. If the agent was coded to constantly refer to the layer then changes made to it would take effect in real-time. This could allow for the manipulation of a system without requiring a complete restart of an agent. In domains where availability is of key concern, this is something that would be vital.

References

1. V.I .Gorodetski, L.J .Popyack, I.V .Kotenko, and V.A .Skormin. Ontology-based multiagent model of an information security system. Lecture Notes In Computer Science,
1711:528-532, 1999.

2. D .Fensel, S .Decker, M .Erdmann, and R .Studer. Ontobroker in a nutshell. Lecture Notes In Computer Science, 1513: 663-664, 1998.

3. V .Gorodetski, O .Karasayev, and V .Samoilov. Multi-agent data fusion systems: Design and implementation issues. In 10th International Conference On Telecommunication Systems, volume 2, pages 762-774, 2001.

4. R.J .Bayardo et al. Infosleuth: Agent-based semantic integration of information in open and dynamic environments. In Proceedings of ACM SIGMOD, volume 26, pages 195-206, 1997.

5. Sean Luke, Lee Spector, David Rager, and James Handler. Ontology-based web agents. In W.L Johnson and Barbara Hayes-Roth, editors, Proceedings of the First International Conference on Autonomous Agents (Agents'97), pages 59-68. ACM Press, Marina del Rey, CA, USA, 1997.

6. Pekka Isto and Jarmo Korhonen. Practical experiences in developing ontology-based multi-agent system. In Proceedings of Business Information Systems 2003 (BIS 2003), 2003.

7. I .Blacoe, I .Dickinson, V .Tamma, and M .Wooldridge. An ontology based approach to automated negotiation. Lecture Notes In Computer Science, 2531: 219-237, 2002.

8. S. Smith and M. Becker. An ontology for constructing scheduling systems. In Working Notes of 1997 AAAI Symposium on Ontological Engineering, volume 1, pages 120-129. AAAI Press, 1997.

9. Fabio Bellifemine, Agostino Poggi, and Giovanni Rimassa. Jade - a fipa-compliant agent framework. In Proceedings of PAAM'99, volume 1, pages 97-108, 1

10. Dickinson et al. Jena: Implementing the semantic web recommendations. In Proceedings of the 13th International World Wide Web Conference, volume 1, pages 74-84. ACM Press, 2004.

Change Detection and Management for the Semantic Web

Li Qin
Western New England College
1215 Wilbraham Road, Springfield, MA 01119
lq274250@wnec.edu

Dr. Li Qin is an Assistant Professor of Computer Information Systems in the Department of Marketing and Computer Information Systems at Western New England College. She completed her Ph.D dissertation titled "Change Detection and Management for the Semantic Web" at Rutgers University in May 2005. Her research focuses on Semantic Web, information security and web-based information systems. She has served as the Chair of the Semantic Web track at 2006 Information Resources Management Association (IRMA) International Conference and program committee member for Canadian Semantic Web Working Symposium (CSWWS) 2006.

Abstract: *The Semantic Web raises a number of research challenges in the area of change detection and management of data instances and ontologies. This dissertation has made research contributions on detecting changes to data instances, proposing an access control model that enables elimination of undesired inference, detecting semantic changes to ontologies and evaluating the validity of data instances and dependent ontologies against ontology evolution.*

Today, the World Wide Web has become one of the major sources of information and services. It is decentralized, constantly changing in its structure and contents, and gigantic with unchecked growth. However, the full potential of the current web remains untapped because the information on the web is rendered solely for human consumption. In recent years, the notion of the Semantic Web has been introduced to define a machine-interpretable web targeted for automation, integration and reuse of data across different applications. Data instances on the Semantic Web are enriched with metadata, defined as concepts and properties from ontologies, which are formal, explicit specifications of shared conceptualizations of a given domain of discourse.

Detecting changes to data objects has become essential for data warehousing, knowledge archival applications, and search engines. The Semantic Web raises a number of research challenges in the area of change detection and management of data instances and ontologies. By presenting the underlying data semantics, ontologies empower automated inference over ontologies, data instances as well as their changes. This dissertation has made the following research contributions.

First, this dissertation proposed an ontology-guided methodology for detecting changes to data instances. It relies on the fact that changes to certain data instances imply changes to other semantically related data instances.

Second, inferring changes of data instances from others may pose a threat to the confidentiality since ontologies enable the inference of sensitive information from unclassified information. Therefore, one must take into account the inference relationships and carefully assign the access permissions. By considering various inference patterns, this dissertation proposed an access control model that enables elimination of undesired inference.

Third, this dissertation developed methodologies to detecting semantic changes to ontologies. It proposed the notion of isosems to identify the partitions that carry uniform semantics, which is then employed to analyze how semantic changes to one concept imply semantic changes to other semantically related concepts.

Fourth, changes to an ontology may invalidate its data instances and dependent ontologies. This dissertation proposed approaches to evaluate the validity of data instances and dependent ontologies.

L. Qin and V. Atluri. Ontology-Guided change detection to the semantic web data. In Proceedings of the 23rd International Conference on Conceptual Modeling (ER 2004), pages 624-638.
L. Qin and V. Atluri, "An Ontology-guided Approach to Change Detection of the Semantic Web Data", Journal on Data Semantics V, LNCS 3870, pp.130-157, 2006.
L. Qin and V. Atluri. Concept-level access control for the semantic web. In ACM Workshop on XML Security, held in conjunction with the 10th ACM Conference on Computer and Communications Security, October 2003.
L. Qin and V. Atluri. SemDiff: An Approach to Detecting Semantic Changes to Ontologies. Submitted.
L. Qin and V. Atluri. Securing the Semantic Web Data from Inference. Working paper.
L. Qin and V. Atluri. Evaluating the Validity of Data Instances against Ontology Evolution over the Semantic Web. Working paper.

Ontomedia - Semantic Multimedia Metadata Integration and Organization

Bodo Hüsemann
Informationsfabrik GmbH
Scheibenstraße 117, 48153 Münster, Germany
bhuesemann@informationsfabrik.com

Gottfried Vossen
European Research Center for Informationsystems (ERCIS)
University Muenster, Leonardo Campus 3, 48149 Muenster, Germany
vossen@uni-muenster.de

Bodo Hüsemann, Germany is an IT consultant at Informationsfabrik GmbH (IN-FAB). He was a staff member at the European Research Center for Information Systems and got his Ph.D. in the database group of Prof. Vossen. In his dissertation he developed a novel ontology design methodology based on the traditional database design phase model, a multimedia reference ontology, and the Semantic Multimedia Information System OntoMedia.

Gottfried Vossen, Germany is a professor of computer science at the University of Münster and a director of the European Research Center for Information Systems. His research focuses on databases and information systems, the Semantic Web, knowledge management and e-learning, with more than 120 publications in these areas. He also serves as the European Editor-in-Chief of Elsevier's Information Systems journal, now in its 31st year

Abstract: *Digital multimedia devices for private usage have nowadays left their analogous counterparts behind. The capacity of digital storage devices provides enormous space at affordable prices to save all this digital information into a giant personal multimedia archive. Conventional database systems don't use semantic schema descriptions to provide semantic query processing which is common to Semantic Web technology. In this demo paper, we describe the multimedia information system Onto Media that will show how Semantic Web technology can be used for semantic query processing possibly incorporated by future database systems*

Overview

We have developed OntoMedia with two main goals in mind:

· Automatic extraction and semantic integration of multimedia metadata should be supported.
· Organisation and search of multimedia documents based on semantic metadata is a necessity.

The enabling technology to integrate, process and query metadata for multimedia is delivered by current languages and tools of the Semantic Web. In contrast to existing multimedia database applications, our main focus lies on the semantic integration of metadata based on standardized languages of the Semantic Web. We use a multimedia ontology to describe all metadata attributes and their semantic connection to enable semantic metadata search processes. The whole information is stored in a semantic database system using non-proprietary Resource Description Format (RDF) which allows for easy information-exchange with other applications. Furthermore the database includes search facilities which feature semantic reasoning capabilities using ontologies to support the user while searching for relevant attributes of the database.

In Figure 1 we see the schematic evaluation of a user query searching for an instance of concept "person" where the OntoMedia Core Ontology is used to determine semantic relationships to similar concepts in multimedia metadata or the Semantic Web. Basically, this kind of semantic inference is used by OntoMedia to find files related to semantic queries given by the user.

2. OntoMedia from a User's Perspective

In this section we will use the main user interface of OntoMedia for a guided tour to the functionality of

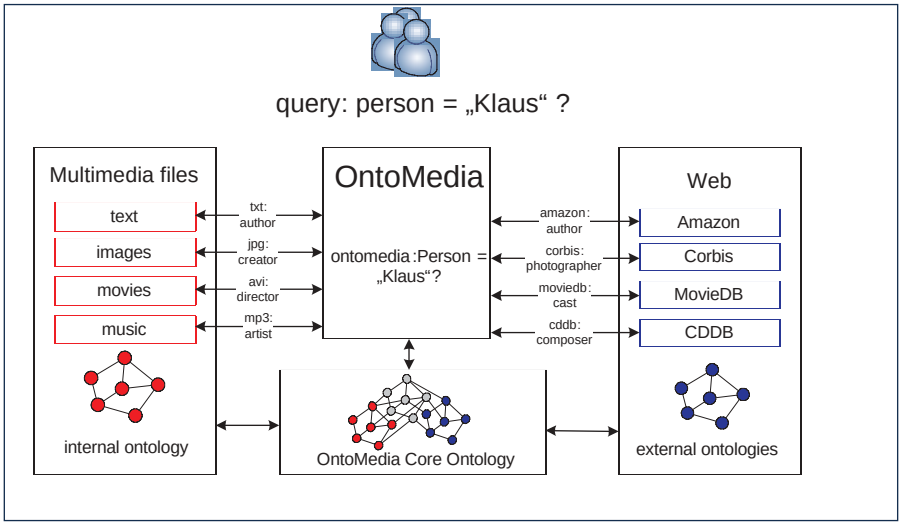


Fig. 1. Semantic metadata integration with the OntoMedia Core Ontology.

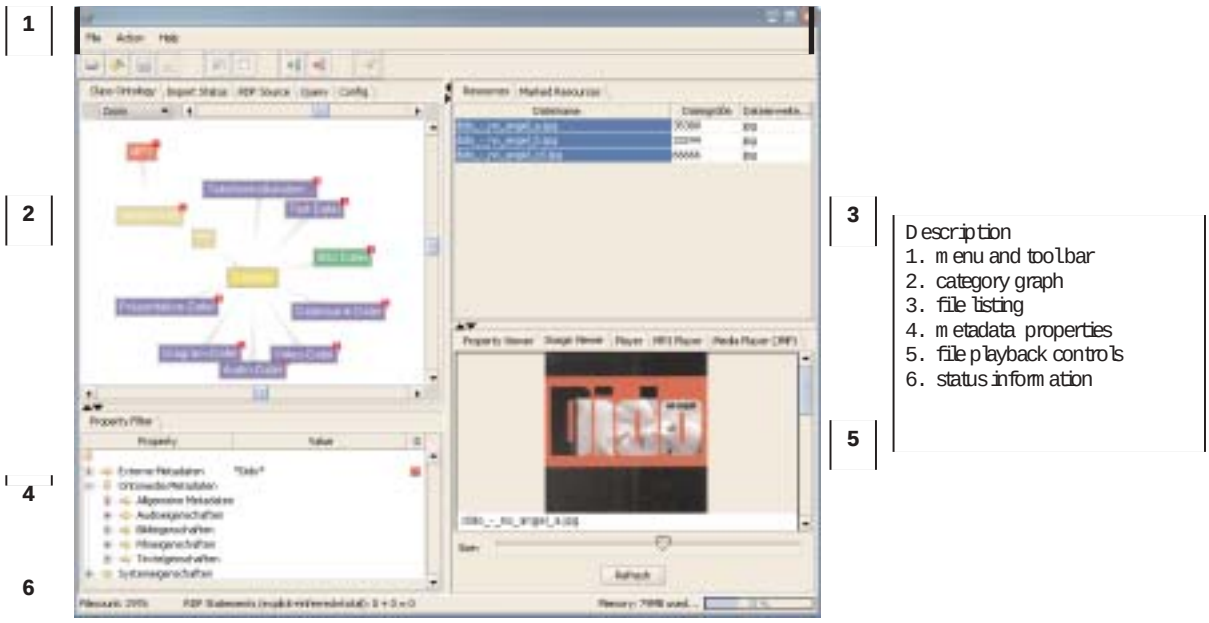


Fig. 2. OntoMedia - an overview of the user interface.

the application. The user interface of OntoMedia is divided into six different parts which are shown in Figure 2.

The main part of the user interface between status and menu bar is divided into four different areas where the left half shows schema information of the current ontology and the right half shows instance data about indexed documents in the database. The left hand side shows the category graph (area 2), and the metadata properties (area 4) of the OntoMedia database. The category graph is a visualization of the class hierarchy to categorize files with OntoMedia. The user can navigate, select and modify the category graph in order to search or organize document collections. The different colors of categories denote different select modes. In area 4 (below the category graph) users can define metadata based search criteria using the displayed metadata property tree. The user can navigate all metadata properties available in the database and define search criteria to filter the results of a search request.

On the right hand side the user interface shows a tabular listing of files (the file browser) in the database (area 3), and a playback panel with further file specific details (area 5). The file listing contains all files relevant to the current select of categories and defined filter criteria. The File Viewer area contains different panels to display all metadata about a selected file, display a set of images, or playback audio/ video files selected in the File Browser/Basket.

The menu and toolbar at the top of the user interface (cf. area 1 in Figure 2) provides access to the main functionality concerning data import/ export, organization, and search commands available to the user. The user can export the database in RDF/XML format or import any RDF data to the current database. Thus it is possible to include any RDF based information which is useful, e.g., to import external databases to OntoMedia. The status bar contains information about the current size of the database, and the memory resources used by OntoMedia.

3. Summary

We have presented the application "OntoMedia" which uses Semantic Web technology to implement an ontology driven personal multimedia information system. Compared to competitive systems, OntoMedia provides the following core advantages:

· Semantic metadata integration using standardized ontology languages to define semantic mappings between different ontologies and proprietary formats.

· Semantic query evaluation using inference techniques based on RDFS semantics.

· An innovative graphical user interface using poly hierarchies to organize categorization structures which provide multiple classifications based on standardized RDFS semantics.

· An overall extensible platform independent architecture which allows for easy data exchange interfaces using RDF as an extensible base for both semantic schema information and instance data.

OntoMedia was built using platform independent Java Technology which provides an easy test ride of the application without complicated installation procedures using the Java WebStart access point at http://www.ontomedia.de/webstart

The Web and Semantic Web Query Language Xcerpt

Sacha Berger, François Bry, Tim Furche and Benedikt Linse
Institute for Informatics, University of Munich
Oettingenstraße 67, 80538 München, Germany
Sacha.Berger@ifi.lmu.de, Francois.Bry@ifi.lmu.de, Tim.Furche@ifi.lmu.de, Benedikt.Linse@ifi.lmu.de

Sebastian Schaffert
Salzburg Research Forschungsgesellschaft
Jakob Haringer Str. 5/II, 5020 Salzburg, Austria
Sebastian.Schaffert@salzburgresearch.at

Sacha Berger holds a master's degree from the University of Munich, Germany (2003). He is currently employed as a teaching and research assistant at the Institute for Informatics, University of Munich. His research interests are schema languages and type systems for Web query languages and visual Web querying.

François Bry (PhD in 1981) is currently investigating methods and applications emphasizing XML, RDF, query answering, reactivity and reasoning on the Web. Since 1994, he is a full professor at the Institute for Informatics, University of Munich. Formerly, he worked with the industry research center ECRC in Munich. He is scientific coordinator of the European Network of Excellence REWERSE on Reasoning in the Semantic Web.[1]

Tim Furche holds a master's degree from the University of Munich (2002). He is currently employed as a researcher at the University of Munich, co-coordinating the REWERSE working group on "Reasoning-aware Querying".[2] His research interests are XML and semi-structured data, in particular query evaluation and optimization, and advanced Web systems.

Benedikt Linse holds a master's degree in Computer Science from the University of Munich, Germany (2006), where he is currently employed as a research and teaching assistant. His present research interests include versatile query languages for the (Semantic) Web, automatic translation between XQuery and Xcerpt,reasoning and efficient rule chaining in Xcerpt, and efficient query evaluation.

Sebastian Schaffert holds a PhD in Computer Science from the University of Munich, Germany (2004). He is currently employed as a senior researcher at "Salzburg Research Forschungsgesellschaft", Austria. His research interests are in semantic web technology, knowledge representation and reasoning, social and educational software, and programming languages. He has contributed to many scientific conferences as author and program committee member and has authored several publications on the rule-based Web query language Xcerpt and related topics.

Abstract: *Access to Web data has become an integral part of many applications and services. In the past, such data has usually been accessed through human-tailored HTML interfaces. Nowadays, data is more and more served in (syntactically and semantically) richer data formats such as XML and RDF that can be conveniently accessed and processed with Web query languages. However, ordinary Web query languages such as XQuery, XSLT, and SPARQL focus on a single Web format. Xcerpt goes beyond these languages and provides versatile access to data in different Web formats within the same query. This article highlights Xcerpt's essential principles and features.*

1. Introduction

Web querying has been recognized in recent years as a convenient means to access data on the Web, in particular with the increase of Web data in (syntactically and semantically) richer data formats than HTML. Numerous XML or RDF query languages have been proposed from both industry and academia, culminating in recent standardization activities at the W3C on the XML query languages XSLT and XQuery and the RDF query language SPARQL.

These conventional query languages, however, focus only on one of the different data formats available on the Web. Integration of data from different sources and in different formats becomes a daunting task that requires knowledge of several query languages and overcoming the impedance mismatch between the query paradigms in the different languages. For instance, bibliography management applications already access (in varying combinations) book data from Amazon, Barnes & Noble, and other vendors, citation data from CiteSeer, PubMed, ACM's digital library, etc., topic and researcher classifications in RDF format by crawling or from syndication sites, and keywords, abstracts, or table of contents from DocBook representations of articles. We argue that for such applications

[1] http://rewerse.net/
[2] http://rewerse.net/I4/

Web query languages need to be versatile [BFB05], i.e., to be able to access data in different Web representation formats.

Xcerpt [SB04, Sch04] addresses this issue by garnering the entire language towards versatility in format, representation, and schema of the data following principles laid down in [BS02, BFB04, BFB05]. It is a semi-structured query language, but very much unique among such languages (for an overview see [BBFS05]):

1) In its use of a graph data model, it stands more closely to semi-structured query languages like Lorel than to recent mainstream XML query languages.
2) In its aim to address all specificities of XML, it resembles more mainstream XML query languages such as XSLT or XQuery.
3) In using (slightly enriched) patterns (or templates or examples) of the sought-for data for querying, it resembles more the "query-by-example" paradigm than mainstream XML query languages using navigational access. Patterns and data are matched with a novel unification algorithm, called simulation unification [BFSS05]
4) In offering a consistent extension of XML, it is able to
incorporate access to data represented in richer data representation formats. Instances of such features are element content, where theorder is irrelevant, and non-hierarchical relations.
5) In providing (syntactical and semantical) extensions for querying, among others, RDF [FBB05, Bol05], Xcerpt becomes a versatile query language.
6) In its strict separation of querying and construction, it makes query authoring and query evaluation easier.
7) In its rule-based nature, it makes basic forms of reasoning possible as part of query programs and enables transparent mediation and integration of data by logical views. The rule layer of Xcerpt follows principles described in [BM05].

Xcerpt is currently being further developed and refined at the University of Munich and as part of the activities of the Working Group on "Reasoning-aware Querying" in the EU Network of Excellence REWERSE ("Reasoning on the Web with Rules and Semantics"), cf. http://rewerse.net/. For more information, including a prototype implementation, on Xcerpt refer to http://xcerpt.org/ and:
http://rewerse.net/I4/

2. Xcerpt Basics

2.1 Data as Terms

Xcerpt uses terms to represent semi-structured data. Data terms represent XML documents, RDF graphs, and other semi-structured data items. Notice that subterms (corresponding to, e.g., child elements) may either be "ordered" (as in an XHTML document or in RDF sequence containers), i.e., the order of occurrence is relevant, or "unordered", i.e., the order of occurrence is irrelevant and may be ignored (as in the case of RDF statements). In the term syntax, an ordered term specification is denoted by square brackets [ ], an unordered term specification by curly braces { }. Terms may contain the reference constructs ^id ("referring" occurrence of the identifier id) and id @ t ("defining" occurrence of the identifier id). Using reference constructs, terms can form (possibly cyclic, but rooted) graph structures. Term attributes are denoted in round parentheses ( ). Terms are similar to ground functional programming expressions and logical atoms. A non-XML syntax has been chosen for Xcerpt to improve readability, but there is a one-to-one correspondence between an XML document and a data term.

2.2 Queries as Terms

Following the "query-by-example" paradigm, queries are merely examples or patterns of the queried data and thus also terms, annotated with additional language constructs. Xcerpt separates querying and construction strictly. Query terms are (possibly incomplete) patterns matched against Web resources represented by data terms. In many ways, they are like forms or examples for the queried data, but also may be incomplete in breadth, i.e., contain 'partial' as well as 'total' term specifications: A term t using a partial term specification for its subterms matches with all such terms that **(1)** contain matching subterms for all subterms of t and that **(2)** might contain further subterms without corresponding subterms in t. Partial term specification is denoted by double (square or curly) brackets. Query terms may further be augmented by variables for selecting data items, possibly with "variable restrictions" using the ? construct, which restricts the admissible bindings to those subterms that are matched by the restriction pattern. They may contain query constructs like position matching, subterm negation using without, optional subterms, regular expressions for namespaces, labels, and text, and conditional or unconditional path traversal using **desc.** Finally, they may contain further constraints on the variables in a so-called condition box, beginning with the keyword **where**.

Construct terms serve to reassemble variables (the bindings of which are gained from the evaluation of query terms) so as to construct new data terms. Again, they are similar to the latter, but augmented by variables (acting as place holders for data selected in a query) and the grouping construct all (which serves to collect all instances that result from different variable bindings). Occurrences of all may be accompanied

```
article_66_cicero_wax @ article{
    authors[ ... ],
    title[ "Space- and Time-Optimal Data Storage on Wax Tablets" ],
    within[ scrolls[ "1-94" ], ^journal_adm ],
    content[
      body[
        contributions @ h1[ "Contributions" ],
        h1[ "A History of Data Storage: From Stone to Parchment" ],
        p[ "Despite ", cite[ ^article_66_scaurus_qumran ], "..." ],
        ol[
           li[ em[ strong[ "Homeric" ], " Age:" ], "..." ],
           li[ em[ "Age of the ", strong[ "Kings" ], ":" ], "..." ]
        ], ...
        tachygraphy @ h1[ "Challenges for Tachygraphy on Wax" ],
        p[ "Though conditions for writing on wax tablets are adverse ",
          "to tachygraphy, systems as described in ",
          a[ href[ ^tiro ], "Section 2" ], "..." ]
      ]
    ]
  }
```

by an optional sorting specification. achieve both of these aims it is necessary for agents to configure themselves using the ontology layer and then carry their own copy of vital information with them.

2.3 Rules and Programs

Query and construct terms are related in rules which themselves are part of Xcerpt programs. Rules have the form:

CONSTRUCT construct-term
FROM and { query-term **or** { query-term ... } ... } **END**

Rules can be seen as "views" specifying how to obtain documents shaped in the form of the construct term by evaluating the query against Web resources (e.g. an XML document or a database). Xcerpt rules may be chained like active or deductive database rules to form complex query programs, i.e., rules may query the results of other rules. More details on Xcerpt's language constructs, syntax, and semantics can be found in [Sch04, SBF05, FBS06].

3. Data Access in Bibliography Management: A Use Case for Xcerpt

Inbibliography management, applications more and more access Web sources to complete bibliographic information, to find citations, author affiliations, abstracts, related articles, etc. Xcerpt is exceptionally well suited for such data access, as it allows access to different kinds of Web data formats in the same query program, e.g., to DBLP-like article information published according to some XML schema, to articles marked up according to the DocBook format, and to RDF ontologies over topics, institutions, conferences, and/or authors mentioned in the article information. The following Xcerpt data term gives an excerpt of an already integrated view on articles with DBLP-like information and DocBook article content.

From such information, Xcerpt queries can extract information, e.g., as shown in Figure 1, articles that are at least partially covering a given topic or a table of content for an article. Often the information can be represented in varying ways, either due to schemata such as DocBook or due to different sources using different schemata. Such cases call for the powerful pattern matching constructs of Xcerpt such as **descendant** (qualified or unqualified) to traverse arbitrary length paths in the data, **optional** to express that certain parts of a query should be matched if occurring in the data, but may also be missing, or subterm negation (expressed using **without**) that requires that certain parts of a query do not occur in the data.

4. Current Research Activities

Currently, research around Xcerpt is focused on five core issues:

- The language constructs and syntax is continuously being refined based on growing experience with use cases [BBF05] and applications from various domains, e.g., bioinformatics [DFBS05]. For first results and remaining open issues refer to [FBS06].
- Efficient evaluation and optimization techniques are studied along an abstract machine for Xcerpt. The optimizations combine traditional complexity study and operator order optimizations from databases (cf. [BSFL06, Lin06, Sch05] for first results on their application to Xcerpt) with techniques from com-

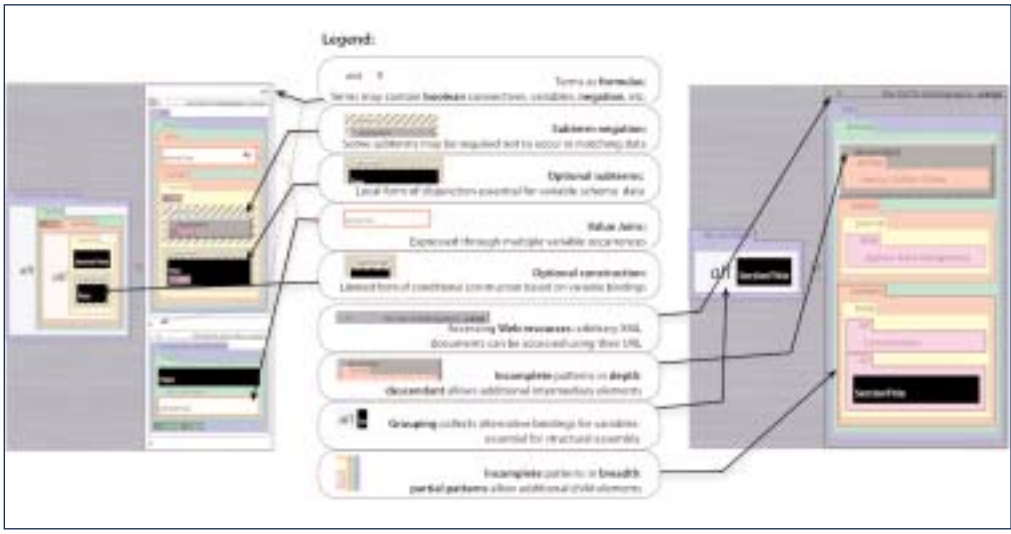


Figure 1: Visual (visXcerpt) Patterns for Xcerpt Queries

piler construction.
- Both for optimization and query authoring, type checking and type information is helpful and sometimes even essential. Type systems for Xcerpt [BCDW05] are under development as part of the REWERSE working group on "Composition and Typing".
- A reactive companion language for updates and event processing, called XChange [BPS04, BEP06], is under development in Munich.
- For visual rendering and authoring of data and query, a visualization of Xcerpt, called visXcerpt [BBS03, BBB04], has been developed and demonstrated at several international conferences.

In addition to these issues, Xcerpt's integration with current advances in Web service description and deployment, a revised API for interfacing Xcerpt with general (object-oriented) programming languages similar to XQJ, the use and tighter integration of Xcerpt with rule-based policy languages for Web and Semantic Web applications, and the automated composition of Xcerpt programs are investigated.

Biography

[BBB04] Sacha Berger, François Bry, Oliver Bolzer, Tim Furche, Sebastian Schaffert, and Christoph Wieser, Xcerpt and visXcerpt: Twin Query Languages for the Semantic Web, Proc. Int'l. Semantic Web Conf., 2004.
http://rewerse.net/publications.html#REWERSE-RP-2004-43

[BBF05] Oliver Bolzer, François Bry, Tim Furche, Sebastian Kraus, and Sebastian Schaffert, Development of Use Cases, Part I: Illustrating the Functionality of a Versatile Web Query Language, Deliverable I4-D3, REWERSE, 2005.
http://rewerse.net/publications.html#REWERSE-DEL-2005-I4-D3

[BBFS05] James Bailey, François Bry, Tim Furche, and Sebastian Schaffert, Web and Semantic Web Query Languages: A Survey, Reasoning Web Summer School 2005 (Jan Maluszinsky and Norbert Eisinger, eds.), Springer-Verlag, 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-14

[BBS03] Sacha Berger, François Bry, and Sebastian Schaffert, A Visual Language for Web Querying and Reasoning, Proc. Workshop on Principles and Practice of Semantic Web Reasoning, LNCS, vol. 2901, Springer-Verlag, 2003.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2004-23

[BBSW03] Sacha Berger, François Bry, Sebastian Schaffert, and Christoph Wieser, Xcerpt and visXcerpt: From Pattern-Based to Visual Querying of XML and Semistructured Data, Proc. Int'l. Conf. on Very Large Databases, 2003.
http://www.pms.ifi.lmu.de/publikationen/#PMS-FB-2003-2

[BCDW05] Sacha Berger, Emmanuel Coquery, Wlodek Drabent, and Artur Wilk, Descriptive Typing Rules for Xcerpt, Proc. of Workshop on Principles and Practice of Semantic Web Reasoning, LNCS, vol. 3703, Springer-Verlag, 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-39

[BCD05] François Bry, Fatih Coskun, Serap Durmaz, Tim Furche, Dan Olteanu, and Markus Spannagel, The XML Stream Query Processor SPEX, Proc. Intl. Conf. on Data Engineering, IEEE, 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-1

[BEP06] François Bry, Michael Eckert, and Paula-Lavinia Patrânjan, Reactivity on the Web: Paradigms and Applications of the Language XChange, Journal of Web Engineering 5 (2006), no. 1, 3-24.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2006-3

[BFB05] François Bry, Tim Furche, Liviu Badea, Christoph Koch, Sebastian Schaffert, and Sacha Berger, Querying the Web Reconsidered: Design Principles for Versatile Web Query Languages, Journal of Semantic Web and Information Systems 1 (2005), no. 2.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-3

[BFPS04] François Bry, Tim Furche, Paula-Lavinia Patrânjan, and Sebastian Schaffert, Data Retrieval and Evolution on the (Semantic) Web: A Deductive Approach, Proc. Workshop on Principles and Practice of Semantic Web Reasoning, LNCS, vol. 3208, Springer-Verlag, 2004.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2004-13

[BFSS05] François Bry, Tim Furche, Sebastian Schaffert, and Andreas Schröder, Simulation Unification, Deliverable I4-D5, REWERSE, 2005.
http://rewerse.net/publications.html#REWERSE-DEL-2005-I4-D5

[BM05] François Bry and Massimo Marchiori, Ten Theses on Logic Languages for the Semantic Web, Proc. of W3C Workshop on Rule Languages for Interoperability, W3C, 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-7

[Bol05] Oliver Bolzer, Towards Data-Integration on the Semantic Web: Querying RDF with Xcerpt, Diplomarbeit/Master thesis, University of Munich, 2005.
http://www.pms.ifi.lmu.de/publikationen#DA_Oliver.Bolzer

[BPS04] François Bry, Paula-Lavinia Patrânjan, and Sebastian Schaffert, Xcerpt and XChange: Logic Programming Languages for Querying and Evolution on the Web, Proc. Int'l. Conf. on Logic Programming, LNCS, Springer-Verlag, 2004.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2004-11

[BS02] François Bry and Sebastian Schaffert, The XML Query Language Xcerpt: Design Principles, Examples, and Semantics, Proc. Int'l. Workshop on Web and Databases, LNCS, vol. 2593, Springer-Verlag, 2002.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2002-7

[BSFL06] François Bry, Andreas Schroeder, Tim Furche, and Benedikt Linse, Efficient Evaluation of n-ary Queries over Trees and Graphs, Submitted for publication, 2006.

[DFBS05] Andreas Doms, Tim Furche, Albert Burger, and Michael Schroeder, How to query the GeneOntology, Symposium on Knowledge Representation in Bioinformatics (KRBIO'05), 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-15

[FBB05] Tim Furche, François Bry, and Oliver Bolzer, Marriages of Convenience: Triples and Graphs, RDF and XML, Proc. Intl. Workshop on Principles and Practice of Semantic Web Reasoning, LNCS, vol. 3703, Springer-Verlag, 2005.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2005-38

[FBS06] Tim Furche, Francois Bry, and Sebastian Schaffert, Initial Draft of a Language Syntax, Deliverable I4-D6, REWERSE, 2006.
http://rewerse.net/publications.html#REWERSE-DEL-2006-I4-D6

[FBS04] Tim Furche, François Bry, Sebastian Schaffert, Renzo Orsini, Ian Horrocks, Michael Krauss, and Oliver Bolzer, Survey over Existing Query and Transformation Languages, Deliverable I4-D1, REWERSE, 2004.
http://rewerse.net/publications.html#REWERSE-DEL-2004-I4-D1

[Lin06] Benedikt Linse, Automatic Translation between XQuery and Xcerpt, Diplomarbeit/Master thesis, Institute for Informatics, University of Munich, 2006.
http://www.pms.ifi.lmu.de/publikationen#DA_Benedikt.Linse

[OFB04] Dan Olteanu, Tim Furche, and François Bry, An Efficient Single-Pass Query Evaluator for XML Data Streams, Data Streams Track, Proc. Symposium of Applied Computing, ACM, 2004.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2004-1

[SB04] Sebastian Schaffert and François Bry, Querying the Web Reconsidered: A Practical Introduction to Xcerpt, Proc. Extreme Markup Languages, 2004.
http://www.pms.ifi.lmu.de/publikationen#PMS-FB-2004-7

[SBF05] Sebastian Schaffert, François Bry, and Tim Furche, Initial Draft of a Possible Declarative Semantics for the Language, Deliverable I4-D4, REWERSE, 2005.
http://rewerse.net/publications.html#REWERSE-DEL-2005-I4-D4

[Sch04] Sebastian Schaffert, Xcerpt: A Rule-Based Query and Transformation Language for the Web, Dissertation/Ph.D. thesis, University of Munich, 2004.
http://www.pms.ifi.lmu.de/publikationen#PMS-DISS-2004-1

[Sch05] Andreas Schroeder, An Algebra and Optimization Techniques for Simulation Unification, Diplomarbeit/Master thesis, Institute for Informatics, University of Munich, 2005.
http://www.pms.ifi.lmu.de/publikationen#DA_Andreas.Schroeder

XChange: Rule-Based Reactivity for the Web

François Bry, Michael Eckert and Paula-Lavinia Patrânjan
Institute for Informatics, University of Munich
Oettingenstr. 67, 80538 München, Germany
bry,eckert,patranjan@pms.ifi.lmu.de

François Bry (PhD in 1981) is currently investigating methods and applications emphasizing XML, RDF, query answering, reactivity and reasoning on the Web. Since 1994, he is a full professor at the Institute for Informatics, University of Munich. Formerly, he worked with the industry research center ECRC in Munich. He is scientific coordinator of the European Network of Excellence REWERSE on Reasoning in the Semantic Web.[1]

Michael Eckert received his master's degree in computer science from the University of Munich in 2005, where he is now working as researcher and teaching assistant. He is investigating issues relating to reactivity on the Web, particularly reactive rules and querying of event streams.

Paula-Lavinia Patrânjan holds a PhD in computer science from the University of Munich, Germany (2005). She works as standardization coordinator for REWERSE.[1] Her research interests are in (Semantic) Web systems with reactive capabilities. She is one of the organizers of the workshop Reactivity on the Web[2] at the Int. Conf. on Extending Database Technology 2006.

Abstract: *Reactivity on the Web is an emerging research issue covering: updating data on the Web, exchanging information about events (such as executed updates) between Web sites, and reacting to combinations of such events. Reactivity plays an important role for upcoming Web systems such as online marketplaces, adaptive Web and Semantic Web systems, as well as Web services and Grids. This article introduces the paradigms upon which the high-level language XChange for programming reactive behavior and distributed applications on the Web relies and gives a flavor of its syntax.*

1. Introduction

Many resources on the Web and Semantic Web are dynamic in the sense that they can change their content over time as new information comes in or information becomes out-of-date. Often, changes must be mirrored by other Web resources by propagating updates.
Reactivity on the Web is the ability of Web sites to detect happenings, or events, of interest that have occurred on the Web and to automatically react to them through reactive programs. Events may have various levels of abstraction ranging from low-level, such as insertions into XML or RDF documents, to high-level application-dependent ones. For example, in a tourism application, events of interest include delays or cancellations of flights, and new discounts for flights offered by an airline. Reactions to such events include notifying colleagues about delays, looking for and booking another flight, or booking flights from an airline..

This article presents the reactive, rule-based language XChange [1 - 6], which provides the following benefits over the conventional approaches of using general-purpose programming languages to implement reactive behavior on the Web:
(1) XChange reactive rules are highly declarative. They allow programming on a high abstraction level, and are easy to analyze for both humans and machines.
(2) The various parts of a rule all follow the same paradigm of specifying patterns for XML data, thus making XChange an elegant, easy to learn language.
(3) Both atomic and composite events can be detected and relevant data extracted from events. Composite events, temporal combinations of events, are an important requirement in composing an application from different services.
(4) XChange embeds an XML query language, Xcerpt [7], allowing to access and reason with Web resources.
(5) XChange provides an integrated XML update language for modifying Web resources.
(6) XChange reactive rules enforce a clear separation of persistent data (Web resources) and volatile data (events). The distinction is important for programmers: the former relates to state, while the latter reflects changes in state.
(7) XChange's high abstraction level and its powerful constructs allow for short and compact code.
The remainder of this article is structured as follows. We first introduce the paradigms driving the design of XChange (Section 2). Next we give a flavor of XChange programs (Section 3). We conclude the article with an outlook on future research directions (Section 4).

[1] http://rewerse.net/
[2] http://rewerse.net/I4/
[3] http://www.pms.ifi.lmu.de/webreactivity/
[4] http://www.edbt2006.de/

2. Paradigms

Clear paradigms that a programming language follows provide a better language understanding and ease programming. This section introduces the paradigms upon which XChange is designed.

2.1 Event vs. Event Query

An event is a happening to which each Web site may decide to react in a particular way or not to react at all. In order to notify Web sites about events and to process event data, events need to have a data representation. In XChange, events are represented as XML documents.

Event queries are queries against event data; they serve a double purpose: detecting events of interest and (through composite event queries) temporal combinations of them and selecting data items from the representation of events.

2.2 Volatile vs. Persistent Data

XChange reflects the novel view over Web data that differentiates between volatile data (event data communicated on the Web between XChange programs) and persistent data (data of Web resources such as XML or HTML documents). This clear distinction between volatile and persistent data aims at easing programming and avoiding the emergence of a parallel "Web of events."

3. A Flavor of XChange

An XChange program is located at one Web site and consists of one or more (re)active rules of the form Event query - Web query - Action. Every incoming event is queried using the event query (introduced by keyword ON). If an answer is found and the Web query (introduced by keyword FROM) has also an answer, then the specified action (introduced by keyword DO) is executed.

Rule parts communicate through variable substitutions. Substitutions obtained by evaluating the event query can be used in the Web query and the action part, those obtained by evaluating the Web query can be used in the action part.

```
ON
  xchange:event {{
      flight-cancellation {{
          flight-number[var N],
          passenger{{ name {"Christina Smith"}  }}  }}  }}
FROM
  in { resource { "http://www.example.com/lufthansa.xml", "xml" },
      flights {{
          flight {{ number { var N } }}  }}  }
DO
  xchange:event [
      xchange:recipient [ "http://sms-gateway.org/us/206-240-1087/" ],
      text-message [ "Your flight", var N, "has been cancelled." ]
  ]
END
```

Example. The site http://airline.com has been told to notify Mrs. Smith's travel organizer by SMS of delays or cancellations of flights she travels with. This can be expressed as the following XChange rule. Note that both data from the event (number of the canceled flight) and an XML document on the Web are accessed. We now look closer at the three parts of an XChange rule, starting for ease of presentation with Web queries in the condition part.

3.1 Web Queries

The condition part of XChange rules queries data from Web resources such as XML documents or RDF documents. Such Web queries are expressed in Xcerpt, a Web and Semantic Web query language. Xcerpt has query patterns, called query terms, for querying Web resources, and construction patterns, called construct terms, for reassembling data selected by queries into new data items. Only query terms are used in the condition part of XChange ECA rules; however, XChange programs can contain deductive rules expressed as such

```
CONSTRUCT construct-term FROM query-term END
```

deductive rules are similar to views in relational databases, and data derived by them can "feed" into other deductive rules and into the condition part of ECA rules.

For conciseness, XChange and Xcerpt represent data, query patterns, and construction patterns in a term-like syntax. The following depicts an XML document with information about flights, its representation as data term, and a query extracting a flight number.

```
<flight-cancellation>          flight-cancellation [      flight-cancellation {{
   <number>UA917</number>          number ["UA917"],          number [ var N ]
   <date>2006-02-20</date>         date ["2006-02-20"]     }}
</flight-cancellation>         ]
```

In the term syntax, square brackets denote that the order of the children of an XML element is relevant, curly braces denote that the order is not relevant.

Both partial (i.e. incomplete) or total (i.e. complete) query patterns can be specified. A query term t using a partial specification denoted by double brackets or braces) for its subterms matches with all such terms that (1) contain matching subterms for all subterms of t and that (2) might contain further subterms without corresponding sub-

terms in t. In contrast, a query term t using a total specification (denoted by single square brackets [ ] or curly braces { }) does not match with terms that contain additional subterms without corresponding subterms in t. Query terms contain variables for selecting subterms of data terms that are bound to the variables.

The results of a query are bindings for the free variable in that query. In the example, there is only one binding for N, "UA917".

3.2 Event Queries

Events are represented as XML messages in XChange, and these event messages are exchanged between Web sites. Each Web site monitors the incoming event messages to check if they match an event query of one of its XChange rules.

Atomic event queries detect occurrences of single, "atomic" events. They are query patterns for the XML representation of the events. This means that the same pattern-based approach is used to query Web data and data in atomic events.

Often, situations that require a reaction by a rule are not given by a single atomic event, but a temporal combination of events, leading to the notion of composite events and composite event queries. Support for composite events is very important for the Web: In carefully developed applications, designers have the freedom to choose events according to their goal. They can thus often do with only atomic events by representing events which might be conceptually composite with a single atomic event. In the Web's open world, however, many different applications which have not been engineered together are integrated and have to cooperate. Situation that require a reaction might not have been considered in the original design of the applications and thus have to be inferred from many atomic events.

A composite event query consists of (1) a connection of (atomic or composite) event queries with event composition operators and (2) an optional temporal range limiting the time interval in which events are relevant to the composite event query.

Composition operators are denoted with keywords such as and (both events have to happen), andthen (the events have to happen in sequence), or (either event can happen), without (non-occurrence of the event in a given time frame). Limiting temporal ranges can be specified with keywords such as before (all events have to happen before a certain time point), in (all events have to happen in an absolte time interval), within (all events have to happen within a given length of time).

3.2 Actions

The Web is a dynamic, state-changing system. To act in this world, XChange rules support the following primitive actions: executing simple updates to persistent Web data (such as the insertion of an XML element) and raising new events (i.e., sending a new event message to a remote Web site or oneself). To specify more complex actions, compound actions can be constructed as from the primitive actions.

Updating Web Data. An XChange update term is a (possibly incomplete) pattern for the data to be updated, augmented with the desired update operations. An update term may contain different types of update operations: An insertion operation specifies an Xcerpt construct term that is to be inserted, a deletion operation specifies an Xcerpt query term for deleting all data terms matching it, and a replace operation specifies an Xcerpt query term to determine data terms to be modified and an Xcerpt construct term as their new value.

The following example updates the flight timetable at http://airline.com (in reaction to the flight cancellation event seen earlier). The variable N is already bound to the flight number of the cancelled flight.

```
in { resource { "http://airline.com" },
     flights {{
          last-change { var L replaceby "2006-02-20" },
          flight {{
               number { var N },
               delete departure-time {{ }},
               delete arrival-time {{ }},
               insert news { "Flight has been cancelled!!" }   }}   }}   }
```

Raising New Events. Events to be raised are specified as (complete) patterns for the event messages, called event terms. An event term is simply an Xcerpt construct term restricted to having a root labelled event and at least one sub-term recipient specifying the URI of the recipient.

The following is an example of an event term to notify a passenger on his PDA about the flight cancellation:

```
xchange:event {
     xchange:recipient {"http://www.johnqpublic.com/pda/"},
     cancellation-notification { var N }
}
```

Specifying Complex Actions. The primitive actions described by update terms and event terms alone do not let you do very much; only in their combination they can become powerful. XChange hence allows specifying complex actions

as combinations of (primitive and complex) actions. Such combination of actions is to be executed in a transactional all-or-nothing manner.

Actions can be combined with disjunctions and conjunctions. Disjunctions specify alternatives, only one of the specified actions is to be performed successfully. (Note that actions such as updates can be unsuccessful, i.e., fail). Conjunctions in turn specify that all actions need to be performed. The combinations are indicated by the keywords or and and, followed by a list of the actions enclosed in braces or brakets.

The list of the actions can be ordered (indicated by square brackets []) or unordered (indicated by curly braces {}). If the actions are ordered, their execution order is specified to be relevant. If the actions are unordered, their execution order is specified as irrelevant, thus giving more freedom for parallelization.

3.3 Putting It All Together: An Example

Having seen the three parts of an XChange rule, events, conditions, and actions, we now look at an example of a whole XChange rule. The rule below reacts upon the flight cancellation (event), extracts as a query to Web data the affected passengers (condition), and notifies the affected passengers (event raising action) as well as placing them on a waiting list (update action).

```
ON
     flight-cancellation {{
          number [var N]    }}
FROM
     in { resource { "http://airline.com/passengers.xml" },
          passengers {{
               booked-for { var N },
               name { var P },
               contact { var C}    }}    }
DO
     and {
          in { resource { "http://airline.com/waitinglist.xml"},
               waitinglist {{
                    flight {{
                         replaces { var N },
                         insert all passenger{ var P }    }}    }}    },
          xchange:event {
               all xchange:recipient { var C },
               message ["Your flight ", var N, "has been cancelled. ",
                    "You have been placed on the waiting list."],
               waitinglist {"http://airline.com/waitinglist.xml"}    }
     }
END
```

4. Conclusions

This article has presented the high-level language XChange for realizing reactivity on the Web. XChange introduces a novel view over the Web data by stressing a clear separation between persistent data (data of Web resources, such as XML or HTML documents) and volatile data (event data communicated on the Web between XChange programs). XChange's language design enforces this clear separation.

XChange is an ongoing research project [8]. The design, the core language constructs, and the semantics of XChange are completed and a proof-of-concept prototype has been implemented. An implementation of use cases with XChange indicates the language's applicability and relative ease of use [6].

Issues deserving further attention in XChange are automatic generation of ECA rules (e.g., from data dependency specifications), efficient evaluation of rule sets and in particular event queries, visual rendering of XChange programs, and means to structure and organize large rule programs.

Acknowledgements

This research has been funded by the European Commission and by the Swiss Federal Office for Education and Science within the 6th Framework Programme Project REWERSE number 506779 (http://rewerse.net).

References

1. Bailey, J., Bry, F., Eckert, M., Patrânjan, P.-L., Flavours of XChange, a Rule-Based Reactive Language for the (Semantic) Web, Proc. Int. Conf. on Rules and Rule Markup Languages for the Semantic Web, Galway, Ireland, 2005.

2. Bry, F., Eckert, M., Patrânjan, P.-L., Querying Composite Events for Reactivity on the Web, Proc. Int. Workshop on XML Research and Applications, Harbin, China, 2006.

3. Bry, F., Eckert, M., Patrânjan, P.-L., Reactivity on the Web: Paradigms and applications of the language XChange, Journal of Web Engineering, Vol. 5, No. 1, Rinton Press, 2006

4. Eckert, M., Reactivity on the Web: Event queries and composite event detection in XChange, Master's thesis, Inst. for Informatics, Univ. of Munich, Germany, 2005.

5. Patrânjan, P.-L., The language XChange: A declarative approach to reactivity on the Web, Ph.D. thesis, Inst. for Informatics, Univ. of Munich, Germany, 2005.

6. Romanenko, I., Use cases for reactivity on the Web: Using ECA rules for business process modeling, Master's thesis, Inst. for Informatics, Univ. of Munich, Germany, 2006.

7. Schaffert, S., Bry, F. Querying the Web reconsidered: A practical introduction to Xcerpt, Proc. Extreme Markup Languages, 2004.

8. XChange Web site. http://www.pms.ifi.lmu.de/projekte/xchange/.

PhD Thesis: Agents negotiating in a Semantic Web Architecture

Rosa Gil
GRIHO, Universitat de Lleida
Jaume II 69, Lleida, Spain
rgil@diei.udl.es

Rosa Gil is researcher in GRIHO, a Human-Computer Interaction research group at Universitat de Lleida. Her research focuses on Human-Computer Interaction, Semantic Web and Image Schemas.
http://rhizomik.net/~rosa

1. Extended Abstract

The main issue of this work is to discover and face new challenges in negotiation over the World Wide Web network, concretely over the Semantic Web because it provides a new paradigm not only in language expression but also in its manipulation.

The first step has been to design an architecture allowing agents, which are modelled using Multi-Agent Systems, to negotiate in the Semantic Web. This architecture was tested inside the IPR (Intellectual Property Rights) context, concretely in the NewMARS and AgentWeb projects.

As a result, a heterogeneous architecture is provided (with different Multi-agent Systems) and IPR knowledge is formalized in an IPR ontology (IPROnto). This ontology was submitted to MPEG-21 standardization process as a valuable tool to enable Multi-agent Systems IPR negotiation in the Semantic Web. Nowadays, information must be available when it is required. This means that agents, in order to efficiently exploit information, have to know about the other agents and their environments. Ontologies have been used to model agents' knowledge. However, information is missing. What does it happen in the case of an agent is looking for something that is not related to any prior knowledge?

How is it possible to create this relation and embrace new knowledge? In order to provide a model of the Semantic Web as real as possible, a deep statistical analysis of it has been made. It reveals that the Semantic Web behaves as a complex system and shares some properties with them. This can be used to study new ways of designing semantics-enabled applications. In this sense, Semantic Web can be modelled as a whole system and macroscopic behaviour can be established. Thus, environment and agents can be analysed statistically and get new knowledge from their interactions. Then, what can we do with it? The quick answer is to build new ontologies and to store all this information in a database. However, concepts classification could not be as objective as we expect.

To clarify this question a new research line, which goes deeper in the process of how an agent can learn in the Semantic Web, is explored. It was born from the effort that Semantic Web community is doing to establish a shared knowledge base for common understanding (upper ontologies). The contribution relates it to the physical domain (space-time), which is exemplified in the negotiation process.

PhD Thesis: A Semantic Web Approach to Digital Rights Management

Roberto García
UsabiliLAB
Jaume II 69, Lleida, Spain
roberto@rhizomik.net

Roberto García is a researcher in the UsabiliLAB, a Human-Computer Interaction laboratory associated with the Universitat de Lleida and the GRIHO research group. His research focuses on Human-Computer Interaction, Semantic Web and Digital Rights Management.
http://rhizomik.net/~roberto

1. Extended Abstract

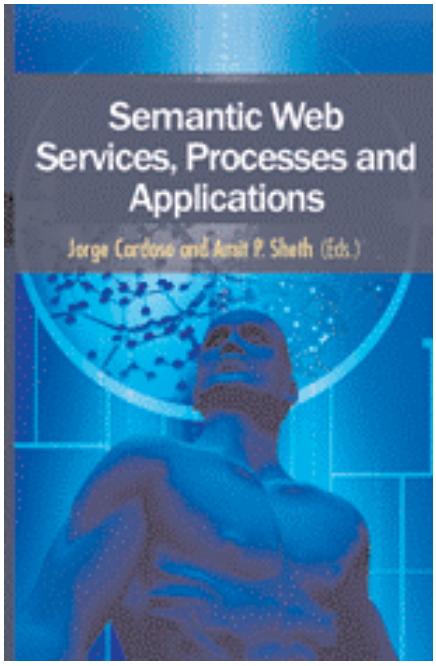
In order to improve the copyright management in the Internet, known as Digital Rights Management, there is the need for a shared language for copyright representation. Current approaches are based on purely syntactic solutions, i.e. a grammar that defines a rights expression language. These languages are difficult to put into practice due to the lack of explicit semantics that facilitate its implementation. Moreover, they are simple from the legal point of view because they are intended just to model the usage licenses granted by content providers to end-users. Thus, they ignore the copyright framework that lies behind and the whole value chain from creators to end-users.

The contribution of this PhD thesis is to apply a semantic approach based on web ontologies to Digital Rights Management. The main contribution is the development of a copyright ontology that puts this approach into practice. It models the copyright core concepts for creations, rights and the basic kinds of actions that operate on them. Altogether allows building a copyright framework for the complete value chain. The set of actions operating on content are the building blocks that combined cope with the complexity of the copyright domain. At the same time, their simplicity guarantees a high level of interoperability and evolvability. The resulting copyright modelling framework is flexible and complete enough to model many copyright scenarios, not just those related to the economic exploitation of content.

Additionally, the ontology design and the selection of tools result in a straightforward implementation. Rights and action patterns are modelled as classes, while concrete actions are modelled as instances. Then, to check if some right or license grants an action is reduced to check for class subsumption and instance classification, which are the main functionalities of Description Logic reasoners. These checks are guided by the modal operators implicit in some of the case roles used in the ontology.

An additional contribution is to apply the same approach to the main rights expression languages, which are based on syntactic solutions. For each of these initiatives, a web ontology has been developed that captures the language grammar but also formalises its implicit semantics. Thus, it is easier to develop tools for these languages and they can be integrated in the general framework of the Copyright Ontology, which produces benefits in both directions.

Books



Jorge Cardoso and Amit Sheth, Eds.

Semantic Web Services, Processes and Applications

This book series brings together forward looking research and technology that will shape our world more intimately than ever before as computing becomes an extension of human experience. It covers all aspects of computing that is very closely tied to human perception, understanding and experience. It brings together computing that deal with semantics, perception and experience.
Series Editors: **Ramesh Jain and Amit Sheth**

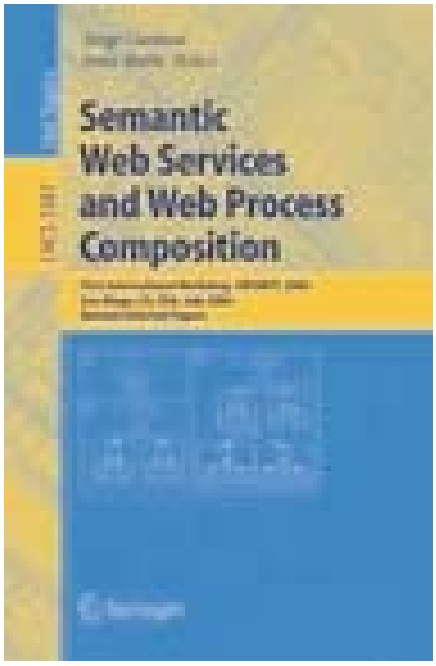
"This book explains concepts and methods used to develop Semantic Web Services and Processes, and also presents innovative applications from several domains. For researchers, teachers and students who want to learn about these emerging technologies, this book provides an overview of the core aspects; for practitioners, the case studies provide insight into the application of this new technology."
Christoph Bussler, Cisco Systems, Inc., USA

"Research and business interest in Semantic Web has spilled over from the focus on information resources to services and processes. This timely book is an excellent source of knowledge for a researcher as well as a practitioner to cover most major topics on Semantic Web Services and Processes. Practitioners will highly benefit from the case studies involving Semantic Web Services. Lecturers will find plenty of insightful material to demonstrate the value of Semantic Web Services to their students."
Steffen Staab, Institute for Computer Science, University of Koblenz, Germany

"Key contributors to Semantic Web Service specifications are amongst the authors of this book. Thus, readers of the book will get first hand information... I intend to use several of the chapters in this book in my course related to this topic."
Frank Leymann, Institute of Architecture of Application Systems, University of Stuttgart, Germany

2006, Approx. 400 p. Hardcover
Semantic Web and Beyond: Computing for Human Experience, Volume 2: Ramesh Jain & Amit Sheth, Eds.
ISBN 0-38730239-5 • **$ 89.95**

Special Bulk Discount Price Available for Course Adoption:
contact jcardoso@uma.pt or amit@cs.uga.edu
URL:
http://dme.uma.pt/jcardoso/Books/Semantic-Web-Services-Processes-and-Applications/ for content, material for instructors and self study, and more.



Jorge Cardoso and Amit Sheth, Eds.

Semantic Web Services and Web Processes Composition

About this book
This book constitutes the thoroughly refereed postproceedings of the First International Workshop on Semantic Web Services and Web Process Composition, SWSWPC 2004, held in San Diego, CA, USA in July 2004.

The 9 revised full papers presented together with an introduction by the volume editors, a panel summary and the extended abstract of an invited talk were carefully selected during two rounds of reviewing and improvement.

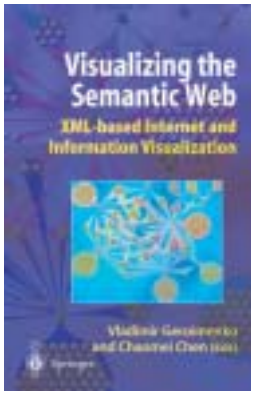
Web services and Web processes promise to ease several current Web infrastructure challenges, such as the integration of data, applications and processes. Web services are truly platform independent and allow the development of distributed loosely coupled applications, a key characteristic for the success of dynamic processes.

Written for:
Researchers and professionals

Keywords:
OWL, Web service composition, Web services, data semantics, e-business protocols, machine learning, ontologies, semantic Web, semantic Web processes, semantic Web service, trust negotiation, web portals, web service annotation.

Semantic Web Services and Web Process Composition
First International Workshop, SWSWPC 2004, San Diego, CA, USA, July 6, 2004, Revised Selected Papers
Series: Lecture Notes in Computer Science, Vol. 3387
Cardoso, Jorge; Sheth, Amit (Eds.)
2005, VIII, 147 p., Softcover
ISBN: 3-540-24328-3 • **$ 47.00**

URL: http://www.springer.com/sgw/cda/frontpage/0,11855,4-153-22-40224677-0,00.html



Vladimir Geroimenko and Chaomei Chen (Eds.)

Visualizing the Semantic Web

XML-based Internet and Information Visualization

Visualizing the Semantic Web: XML-based Internet and Information Visualization is the first book dealing specifically with visualization of the Second-Generation Web. It presents the state-of-the-art research in this area and focuses on key topics such as:
* The nature of the Semantic Web and its relationship to Information Visualization * Visualization of semantic and structural information and metadata * Ontology-based and Topic Maps visualizations * Visual interfaces for retrieving, browsing and mapping semantic information * SVG/X3D as new visualization techniques for the semantic web * Methods used to construct high quality metadata / metadata taxonomies * Recommender systems, interface issues related to filtering and recommending on the Web * A comparative analysis of web services and the semantic web * Semantic-oriented use of existing visualization methods * Semantically enhanced solutions for the medical community.
The design of semantically and graphically enriched interfaces for e-commerce and information retrieval and presentation is currently a challenging area of practical Web development. Most of the techniques and methods discussed can be applied now, making this book essential reading for visualization researchers as well as XML and Web developers.

2006, ISBN 1-85233-976-4, Hardcover **€ 74.95 | £ 49.95 | US$ 89.95**
http://www.springer.com/1-85233-976-4

Steffen Staab, University of Koblenz, Germany; Heiner Stuckenschmidt, University of Mannheim, Germany (Eds.)

Semantic Web and Peer-to-Peer

Decentralized Management and Exchange of Knowledge and Information

Just like the industrial society of the last century depended on natural resources, today's society depends on information and its exchange. Staab and Stuckenschmidt structured the selected contributions into four parts: Part I, "Data Storage and Access", prepares the semantic foundation, i.e. data modelling and querying in a flexible and yet scalable manner. These foundations allow for dealing with the organization of information at the individual peers.
Part II, "Querying the Network", considers the routing of queries, as well as continuous queries and personalized queries under the conditions of the permanently changing topological structure of a peer-to-peer network. Part III, "Semantic Integration", deals with the mapping of heterogeneous data representations. Finally Part IV, "Methodology and Systems", reports experiences from case studies and sample applications. The overall result is a state-of-the-art description of the potential of Semantic Web and peer-to-peer technologies for information sharing and knowledge management when applied jointly.

2006, ISBN 3-540-28346-3, Hardcover **€ 69.95 | £ 54.00 | US$ 79.95**
http://www.springer.com/3-540-28346-3

Daniel Oberle, University of Karlsruhe, Germany

Semantic Management of Middleware

Current middleware solutions, e.g., application servers and Web services, are very complex software products that are hard to tame because of intricacies of distributed systems. Their functionalities have mostly been developed and managed with the help of administration tools and corresponding configuration files, recently in XML.Though this constitutes flexibility for developing and administrating a distributed application, the conceptual model underlying the different configurations is only implicit. To remedy such problems, Semantic Management of Middleware contributes an ontology-based approach to support the development and administration of middleware-based applications. The ontology is an explicit conceptual model with formal logic-based semantics. Its descriptions may therefore be queried, may foresight required actions, or may be checked to avoid inconsistent system configurations. This book builds a rigorous approach towards giving the declarative descriptions of components and services a well-defined meaning by specifying ontological foundations and by showing how such foundations may be realized in practical, up-and-running systems.

2006, ISBN 0-387-27630-0, Hardcover **€ 79.95 | £ 61.50 | US$ 89.95**
http://www.springer.com/0-387-27630-0

Jorge Cardoso, Universidade da Madeira, Funchal, Portugal; Amit Sheth, University of Georgia, Athens, GA, USA (Eds)

Semantic Web Services and Web Process Composition

First International Workshop, SWSWPC 2004, San Diego, CA, USA, July 6, 2004, Revised Selected Papers

This book constitutes the thoroughly refereed postproceedings of the First International Workshop on Semantic Web Services and Web Process Composition, SWSWPC 2004, held in San Diego, CA, USA in July 2004. The 9 revised full papers presented together with an introduction by the volume editors, a panel summary and the extended abstract of an invited talk were carefully selected during two rounds of reviewing and improvement. Web services and Web processes promise to ease several current Web infrastructure challenges, such as the integration of data, applications and processes. Web services are truly platform independent and allow the development of distributed loosely coupled applications, a key characteristic for the success of dynamic processes.

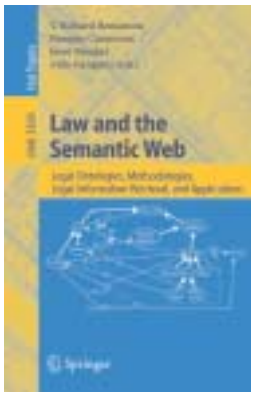
2005, ISBN 3-540-24328-3, Softcover **€ 34.00 | £ 26.00 | US$ 47.00**
http://www.springer.com/3-540-24328-3

Norbert Eisinger, LMU Munich, Germany; Jan Maluszynski, University of Linköping, Sweden (Eds.)

Reasoning Web

This book presents thoroughly revised tutorial papers based on lectures given by leading researchers at the First Summer School on Reasoning Web in Msida, Malta, in July 2005. The objective is to provide a coherent introduction into Semantic Web methods and issues with a particular focus on reasonning. The ten tutorial papers presented provide competent coverage of methods and issues of the Semantic Web, ontology languages and their relation to description logics, Web query languages, XML, RDF and topics maps, evolution and reactivity, personalization in the Semantic Web, rule modeling with UML, techniques in Web information extraction, employing ontologies to ease construction of software applications, and type checking for Web rule and query languages.

2005, ISBN 3-540-27828-1, Softcover **€ 48.00 | £ 37.00 | US$ 67.00**
http://www.springer.com/3-540-27828-1



Bran Selic, IBM Rational Software, Kanata, Canada; Richard Benjamins, Intelligent Software Components, Madrid, Spain; Pompeu Casanovas, Autonomous University of Barcelona, Spain; Aldo Gangemi, Laboratory for Applied Ontology, Rome, Italy (Eds.)

Law and the Semantic Web

Legal Ontologies, Methodologies, Legal Information Retrieval, and Applications

This book presents 15 thoroughly refereed revised papers on topics from The International Workshop on Legal Ontologies and Web-Based Legal Information Management held in Edinburgh, UK in June 2003, and the International Seminar on Law and the Semantic Web, held in Barcelona, Spain in November 2003 relevant for law and the Semantic Web. The book is structured into three parts. Part I sets the scene by introducing the relevant concepts, describing some of the users (legal professionals), and putting into historical context how legal professionals think about the use and application of law. Part II presents theoretical aspects related to the construction of legal ontologies, both from a legal and a methodological point of view. Part III collects descriptions of various applications of Semantic Web technology to the legal domain.

2005, ISBN 3-540-25063-8, Softcover **€ 42.00 | £ 32.50 | US$ 58.00**
http://www.springer.com/3-540-25063-8

Max Bramer, University of Portsmouth, UK; Vagan Terziyan, University of Jyvaskyla, Finland (Eds.)

Industrial Applications of Semantic Web

Proceedings of the 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web, August 25-27, 2005 Jyvaskyla, Finland

2005, ISBN 0-387-28568-7, Hardcover **€ 128.00 | £ 98.50 | US$ 149.00**
http://www.springer.com/0-387-28568-7

Y. Gil, E. Motta, V.R. Benjamins, M. Musen (Eds.)

The Semantic Web - ISWC 2005

4th International Semantic Web Conference, ISWC 2005, Galway, Ireland, November 6-10, 2005, Proceedings

2005, ISBN 3-540-29754-5, Softcover **€ 98.00 | £ 75.50 | US$ 129.00**
http://www.springer.com/3-540-29754-5

Asuncion Gómez-Pérez, Jerome Euzenat (Eds.)

The Semantic Web: Research and Applications

Second European Semantic Web Conference, ESWC 2005, Heraklion, Crete, Greece, May 29--June 1, 2005, Proceedings

2005, ISBN 3-540-26124-9, Softcover **€ 80.00 | £ 61.50 | US$ 112.00**
http://www.springer.com/3-540-26124-9

Asaf Adi, Suzette Stoutenburg, Said Tabet (Eds.)

Rules and Rule Markup Languages for the Semantic Web

First International Conference, RuleML 2005, Galway, Ireland, November 10-12, 2005, Proceedings

2005, ISBN 3-540-29922-X Softcover **€ 42.00 | £ 32.50 | US$ 58.00**
http://www.springer.com/3-540-29922-X

Christoph Bussler, Val Tannen, Irini Fundulaki (Eds.)

Semantic Web and Databases

Second International Workshop, SWDB 2004, Toronto, Canada, August 29-30, 2004, Revised Selected Papers

005, ISBN 3-540-24576-6 Softcover **€ 42.00 | £ 32.50 | US$ 58.00**
http://www.springer.com/3-540-24576-6

François Fages, Sylvain Soliman (Eds.)

Principles and Practice of Semantic Web Reasoning

Third International Workshop, PPSWR 2005, Dagstuhl Castle, Germany, September 11-16, 2005, Proceedings

2005, ISBN: 3-540-28793-0 Softcover **€ 42.00 | £ 32.50 | US$ 58.00**
http://www.springer.com/3-540-28793-0

Semantic Web Fact Book 2005
© SIGSEMIS
Layout & Artwork
© advan-ce
www.advan-ce.com