SIGSEMIS
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Semantic Web & Information Systems

Bulletin

The Official Quarterly Newsletter of AIS Special Interest Group on Semantic Web and Information Systems

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Editor in Chief Dr. Miltiadis Lytras

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Editorial

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The Official Quarterly Newsletter of AIS Special Interest Group on Semantic Web and Information Systems

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Dear friends,

One year now AIS SIGSEMIS has become a reference point for the Semantic Web and it serves the Information Systems, the Computers Science and the Semantic Web Community.

During the last year your continuous support was the key motive to provide a number of dissemination channels concerning Semantic Web and Information Systems:

1. We started the Bulletin Edition, (this is the fourth issue) with an established rate of 5500 average downloads per issue.

2. We designed and launched the International Journal on Semantic Web and Information Systems (EIC Prof. Amit Sheth), it IDEA Group Publishing (*http://www.idea-group.com/journals/details.asp?id=4625*). Already two issues have been published and the 3rd issue is in production. I think this is a great addition to your journals portfolios. Feel free to recommend it to your library from http://www.idea-group.com/recommend.asp?ID=4625

3. We undertook a number of Special Issues in well-known international journals aiming at a multilevel awareness campaign on semantic web. In this issue we provide the table of contents of the Special Issue on *Digital Libraries in the Knowledge Era: Knowledge Management and Semantic Web Technology* that was recently finalized at the Library Management Journal of Emerald (EIC Steve O'Connor). Additionally in this issue you can find three AIS SIGSEMIS sponsored special issues:

   a. IJ on Semantic Web and Information Systems, Special Issue on "***Semantic Web and Healthcare Information Systems Interoperability***", Guest Editors: Vipul Kashyap, Asuman Dogac

   b. British Journal on Educational Technology, Special Issue on "***Advances of Semantic Web for E-learning: Expanding learning frontiers***", Guest Editors: Ambjorn Naeve, Miltiadis Lytras, Wolfrang Nejdl, Joseph Harding, Nicolas Balacheff.

   c. IEEE Transactions on Knowledge and Data Engineering, Special Issue on "***Knowledge and Data Engineering in the Semantic Web Era***", Guest Editors: Gottfried Vossen, Miltiadis Lytras, Nick Koudas

   d. Electronic Government: An international Journal, Special Issue on "***Exploiting Knowledge Management for Ubiquitous E-Government in the Semantic Web Era***", Guest Editors: Miltiadis Lytras, Lakhsmi Iyer, Athanassios Tsakalidis

4. We support and sponsor a number of Tracks in IS conferences as well as workshops:
   a. ECIS Track on Semantic Web and Information Systems: http://www.ecis2005.de/semantic.html
   b. AMCIS Track on Semantic E-Business http://www.ist.unomaha.edu/amcis2005/minitrack_description.php?minitrack_id=29
   c. FOMI 2004: Formal Ontologies Meet Industry http://fandango.cs.unitn.it/fomi/

5. We co-organize the **MSR'05:First on-Line conference on Metadata and Semantics Research: Approaches to Advanced Information Systems.** Consider it as a key event for your SW planned publications. Find more info at http://www.metadata-semantics.org/

6. Our membership has increased. We have 75 officially registered members and a GREAT thank you belongs to all of you.

In the recent disaster of Tsunami in SE Asia we decided from the limited reserves of our SIGSEMIS to donate 270$ in the American Redcross International Disaster Fund. A great thank you to all the AIS SIGSEMIS Board

Thank you very much for your tax-deductible donation to the American Red Cross. Your generous support means the most to the families who rely on Red Cross to help them through some of the most difficult times of their lives. Together, we can save a life.

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Name/Occasion:	**AIS, SIG on Semantic Web and Information Systems**

members who supported this decision. Our souls and hearts are close to the people in SE Asia.

In this issue we have the honor to host two excellent interviews. Professor William R. King (the Founding President of Association for Information Systems as well as professor Richard Watson, President of AIS provide me two excellent interviews. I encourage you read them. I would like to thanks them and to wish from the bottom of my heart all the best to them.

In this issue there are several interesting pieces of news:

- A n excellent article by Amit Sheth, Director of LSDIS, University of Georgia, Co-Founder and CTO of Semagix, and EIC of IJSWIS on " Why are we still pushing the Semantic Web? "
- An interesting article by Jorge Cardoso, on Semantic Web Services: Progress in 2004 and trends for 2005
- An update on our IJ on Semantic Web and Information Systems

- News from AIS SIGSEMIS activities (Call for papers in special issues, sponsored minitracks and workshops)
- Two research articles
- Our regular columns and a brand new column that will be of interest for many of you. I would like to thank our new columnist Heiner Stuckenschmidt, Vrije Universiteit Amsterdam, that will be the columnist of "RDF Technologies – Foundations, Applications and Developments"regular column.
- A special section related to the EU call for Semantic Web Knowledge Systems that is open. I think it is interesting for all of our readers around the worlds to check the priorities of the European Union to this topic.

I invite you to join our SIG and be part of an exciting community: (http://www.sigsemis.org/sig/membership/document_view). In your renewal of AIS subscription consider SIGSEMIS as an interesting option.

Looking forward for your comments, ideas, participation and inquiries. AIS SIGSEMIS is not a close club. It is an open forum. Be part of this exciting community.

Semantic Web technology is here to stay. Looking forward to "see" you in one of the forthcoming AIS SIGSEMIS activities.

On behalf of SIG SEMIS Board

Dr. Miltiadis D. Lytras
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Please provide any comments, inquiries, ideas, etc to Dr. Miltiadis D. Lytras at lytras@ceid.upatras.gr

" Why are we still pushing the Semantic Web? "

Amit Sheth
Director, LSDIS Lab at the University of Georgia; CTO/Co-founder, Semagix, Inc.

Why are we still pushing the Semantic Web?

This was the question a panelist asked at the W3C Advisory Committee meeting that I attending at the beginning of December 2004. In other words, the panelist and others discussing this question were wondering, why is it taking so long for the industry to get it (its importance)? Or that, by now, we would have expected it to have seen much wider adoption, a clear indication that the Semantic Web is here for good, transforming the Web into its next logical incarnation.

I had a chance to respond to the question. The essence of my comment was that the progress is quite robust and pervasive, and there are prominent signs that the Semantic Web is not just a fad, that this time, semantics as applied to information (which predates the Semantic Web as defined today) is indeed likely to have deep impact on businesses as well as common Web user in less than 5 years time frame. Here is a perspective on the adoption of the Semantic Web, which also incorporates the discussions we had at the dinner involving some of the Semantic Web technology/product vendors who are members of the W3C (such as Semagix) and the W3C Semantic Web team members (Eric Miller and others).

Research: Although funding from NSF, DARPA and other US research funding agencies have waned, DAML program gave excellent and timely impetus to the Semantic Web research in the US. Follow on to Guha's MCF work had already primed work on RDF. The funding advantage moved with Europe with Framework V, and is firmly entrenched with Framework VI. The number of new conferences and the attendance at these conferences, sessions related to the Semantic Web in older and more established conferences, number of published papers and new scientific journals devoted to the Semantic Web (such as Web Semantics, Applied Ontology and Semantic Web & Information Systems) all point to broad and increasingly entrenched interest in this new area.

Standards: An important thing that has benefited our area is *timely* standards activity. It is helpful to have basic standards before the area matures and before industry interest peaks, reducing the chances of clashes between the entrenched interests. Not having activities being taken to competing standards bodies, as is the case in Web Services area, helps too.

Technology and Products: One of the most exciting things to have happened in our area is the number of technologies commercialized from academic research (Taalee's MediaAnywhere A/V Semantic Search and Semagix's Freedom from University of Georgia's SCORE technology, Network Inference's relationship with University of Manchester, Ontoprise's relationship with Karlshrue, to name a few). Now, at least twenty vendors claim to use or support Semantic Web technologies, and the list is growing quite rapidly. And perhaps most importantly, scientific and business communities are building targeted (i.e., with clear purpose) and large ontologies at an impressive pace.

Industry Recognition: I just returned from W3C 10th anniversary celebrations (http://www.w3.org/2004/09/W3C10-Program.html) and the follow on W3C Advisory Committee meetings. The panel on the "Web of Meaning" helped showed how the thought leaders and industry executives buy into the vision of the Semantic Web. Panelists Tim O'Reilly (O'Reilly Media, talk) talked about

the emergence of new industry leaders and the architectural context where the Semantic Web technologies has an important play. Bill Ruh (Cisco Systems, talk) presented a fairly encouraging perspective on applications of the Semantic Web technologies for important and growing business application areas such as Regulatory Compliance, B2B Exchange, Workflow and BPM, and Business Intelligence. What is interesting is that some of these are "selling aspirin" rather than "selling vitamins", something that does better in low to moderate economic growth environments.

At the industry events, such as those organized by TopQuadrant and MITRE, or the user group initiated events, such as those for US's Department of Defense or the Life Science Community, 100 to 300+ people have shown up, which indicated fairly high level of industry and user group interest.

Industry Deployment and Early Successes: Since some very early deployment examples that were discussed at the WWW2004 Developer's day, there are now increasing number of examples of deployments both in Enterprises (e.g., see my KMWorld talk) or for more "common" web users. It is this topic what garnered the main attention during our dinner discussions (mentioned above). One exciting observation that came up is the stealth inclusion of the Semantic Web technologies in applications. Eric Miller gave the example of Creative Common's used of RDF (also see Shelly Parker's earlier article). This is an example of simpler SW applications involving embedding license metadata and validating it in the definition of Creative Common's license terms so millions of content items would in essence be using at least limited Semantic Web technology for enforcing licenses! Another example is that of semantic annotation of syndicated contents and Web Services (e.g., the WSDL-S semantic proposal/tool for annotation of Web Services). Such applications can quickly lead to a wide spread and pervasive use of RDF in a fairly short time. What is interesting is that some of the applications are not being deployed by early adoptors; instead the SW technologies have been part of the pain killer types of main-stream IT applications and solutions (such as Anti-Money Laundering, compliance and risk management)!

One perspective that some in the community, particularly Tim Berners-Lee, seem to promote it that Semantic Web is "not interesting in the smaller scale". As more and more things connected by a "semantic way" it becomes more and more important. This makes sense from the perspective of global scale Web and non-enterprise applications. But from industry perspective, I believe Semantic Web is equally interesting at the intra- and inter-Enterprise scales, and for Enterprise applications. This view is the same as the adoption and importance of Web technologies in Intranets. If at all, given the ability to constrain or limit the domain, deeper domain semantics can be put to use, agreements to build ontologies can be reached faster, industry specific metadata standards can be readily used, and facts and knowledge to populate ontologies can be obtained more easily. Today's enterprises have millions of documents, and access to massive amounts o high-quality or targeted syndicated contents and data (e.g., through Lexis-Nexis, ChoicePoint, NewsML and RSS News Feeds, and so on). The ontologies developed to support targeted enterprise scale Semantic Applications are currently exploiting ontologies with millions to tens of millions entity and relationship instances. And yes, the promise of scaling these Enterprise and industry scale islands by interconnecting them (and achieve what Tim Berners-Lee called network effect) exists anyways.

Amit Sheth, Director, LSDIS Lab at the University of Georgia; CTO/Co-founder, Semagix, Inc.

Semantic Web Services: Progress in 2004 and trends for 2005

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Progress in 2004

In 2004, the Semantic Web Services Initiative (SWSI), an initiative of academic and industrial researchers – from Europe, Asia and the United States – has been composed to create infrastructure that combines Semantic Web and Web services to enable the automation in all aspects of Web services. In addition to providing further evolution of OWL-S, SWSI will also be a forum for working towards convergence of OWL-S with the products of the SWWS/WSMO/WSML/WSMX research effort, which supplies Web service providers with a core set of constructs for describing the properties of their Web services in computer-interpretable form.

Ongoing projects, such as OWL-S, LSDIS METEOR-S, and DERI SWWS studied important aspects related to the lifecycle of semantic web processes. Industrial researchers have also been deeply involved in the definition of standards assuring the real world implementation and use of Semantics, Web services, and Web processes. Ongoing work on standards included the Business Process Execution Language for Web Services (BPEL4WS, or simply BPEL) (from Microsoft, IBM, BEA), WSCL (from HP), BPML (from Microsoft), WSCI (from SUN, BEA, Yahoo, and other), XLANG (from Microsoft), and WSFL (from IBM).

Trends for 2005

According to analysts, the Semantic Web, which will understand human language, will replace the current Web by 2005. The progresses made are slow but steady. Therefore, we believed that this milestone will be more likely pushed to 2010.

Important aspects of research that need to be further explored include functional and behavioral descriptions of Web services and Web processes.

Nowadays, there are few commercial products available that have successfully implemented a semantic layer alongside robust a Web services infrastructure, this despite significant industrial support which exists for standards such as WSDL, BPEL, and UDDI. Many vendors seem to be taking a "wait-and-see" approach while the emerging standards converge.

In 2005, the hesitation shared by most commercial vendors will not be shared by many industrial research groups – IBM, HP, France Telecom, and Fujitsu have will further apply semantics to Web services for innovative, discovery-driven use cases. Leadership from DERI and the W3C have each expressed a strong interest in converging the best of each specification – vendors will no doubt wait for this alignment, which could occur in 2005, prior to implementing either on their own.

An Interview with Prof. William King

University Professor, Katz Graduate School of Business, University of Pittsburgh, Founding President of AIS

"Leading scholars is like "herding cats."

1. *Miltiadis: Dear Prof King we are delighted that you agreed to this interview. Let's start by asking you to provide me with some info about the foundation of AIS. You were its founding President and First Executive Director. How difficult was it to set it up and what was your ultimate objective?*

   Although there was strong dissent from those who felt that existing organizations served their own needs, I found that very senior people in IS generally agreed on the need for a professional organization to speak for, and to, IS academics. So, I concluded that, rather than debate or study it further, I'd just do it. AIS is quite successful, but it's not yet truly "global," as about 70% of members are from North America. We need to work on that.

2. *Miltiadis: Several people claim that the IS field has reached a significant maturity. AIS has grown, several journals, etc. What are the next milestones for the evolution of the discipline? Do you feel that they are related to the concept of the Knowledge Society?*

   From a pragmatic point of view, we need more publication opportunities in "A" journals. The ratio of "A" journal papers published each year to the total AIS membership is ridiculously low. E-journals such as the Journal of AIS seem to be the only economic solution. Of course, in a "knowledge society," print will be more and more minimal, but that hasn't happened easily and naturally as is reflected by the current status of JAIS. We need to proactively change that.

3. *Miltiadis: I think that it is an extremely difficult task to chair a leading association. Throughout your career, you have managed to serve as the chair/president of AIS and INFORMS. How difficult has it been to lead a whole research community? - esp. knowing that the critical bet is to lead the community beyond any well-known boundaries.*

   Leading scholars is like "herding cats." But it's important. I have set high goals and then not been too disappointed when they sometimes weren't fully realized. The "boundaries" notion that you bring up is also important. I find that scholars are quite willing to accept and adapt to change, but they are less willing to initiate it. So, that becomes the role of a "leader of scholars."

5. *Miltiadis: We are experiencing the beginning of the new century. Semantic Web, Mobile and Ubiquitous technologies create a new context for the perceived borders of IS. What is the new context for IS research? Do we have to face new problems?*

   The field of IS changes every day and I think it attracts people who know that and enjoy it. I'm no better able to forecast the future than anyone else, but IS people will, I am confident, create it and cope with it as the boundaries of technology expand. Although IS is in a "low" period now, so long as we continue to address the opportunities provided by evolving technology we'll prosper.

6. *Miltiadis: What do you consider to be the top challenges for the MIS field? Do you believe that we are still looking for the IT artifact?*

I'm not an "IS artifact" fan. I believe in pluralism, especially in such a dynamic field. The top challenge is to remain relevant and not let rigor totally dominate. (I believe that this is a potential problem with the top journals; not necessarily with "lesser" ones.)

7. *Miltiadis: Lately it seems that we are moving away from the hard-core quantitative experimental research into the area of qualitative research. Do you believe this new approach has the ability to address properly the current issues in IS research?*

   Qualitative research complements, but certainly cannot replace, quantitative approaches. The two can coexist and increasingly, the same researchers will be using both approaches. I think the "third paradigm" of Design Science holds many opportunities as well.

8. *Miltiadis: I have a myopic point of view, driven by my personal interest in learning and knowledge management. How would you evaluate knowledge sharing in our research communities? Should we adopt new technologies and innovative ideas in order to achieve more effective knowledge representation and exploitation?*

   E-journals, as I noted earlier, are a part of the answer. Print journals have page quotas and high marginal costs. An expanding field needs high-quality e-journals because they have almost zero marginal costs. For instance, JAIS has excellent editors and is sponsored by AIS, but as yet, it has not attracted enough of the best research to warrant an "A" rating. We need to collectively make that happen. Senior scholars should be willing to help JAIS along by submitting their best work there. Junior scholars probably should not take the risk until journals like this are recognized to be top quality.

9. *Miltiadis: You have an excellent record on KM and a special interest to the topic. How would you judge the evolution of KM? What is it all about? A big bubble?*

   It's very faddish, but that isn't all bad. Most new ideas go through a faddish phase and then they get integrated into routine operations. For instance, when "quality" was faddish, there were vice presidents of quality; now quality is integrated into everything and because few people have "quality" in their title, some think it was just a fad. In fact, it's a key part of everything that organizations do. KM will go through the same lifecycle.

10. *Miltiadis: Given your extraordinary interest in teaching and postgraduate studies, I would like you to share with us your teaching paradigm. Personally, I am excited about your propositions on Andragogy.*

    Andragogy, as opposed to pedagogy (which means "child learning"), puts more responsibility on the student for every part of the learning process. It is based on quite different assumptions than those on which pedagogy is based. I've tried various ways to implement this; some have been very successful and some have not.

11. *Miltiadis: Things seem to evolve rapidly within the IS field. Do you believe that we have experienced any major paradigm shift? Should we be looking forward to it?*

    I think that we're overly introspective in this field. Good ideas are widely distributed among professionals. Our major central task should be to facilitate communications and provide outlets for good ideas. I don't believe in trying to "standardize" anything-paradigms, artifacts, research methods or anything else.

12. *Miltiadis: Within the IS research community we seem to believe that there is a gap between practitioners and researchers. Do you think we can benefit from each other? What are your thoughts on that?*

There is not enough exchange between the two groups. Many IS academics have good personal ties with practitioners and the research centers certainly help, but we need to do more, especially to help young researchers develop such ties.

13. *Miltiadis: Technology versus information versus people. What would you consider the main challenge to be?*

    I don't think "versus" is the right term. An IS involves all three. Some researchers will focus primarily on one, but ignoring the others is a recipe for failure or irrelevance.

14. *Miltiadis: I am sure that you have thought several times about collaboration in International Associations. Many intangible assets, enthusiasm, a shared vision, multi-culture etc, a whole world in a snapshot. How difficult is it to exploit all these synergies towards the common wealth? In other words, what is the role of International associations in the new Era of Globalization?*

    They obviously should become more and more important. I'm not a revolutionary, but for professional purposes, the era of the nation is over.

15. *Miltiadis: Bill, next year you are co-chairing our leading international conference, ICIS 2005. Would you like to share with us your vision for this conference?*

    First, we'd like to maintain the high level of research quality — i.e., "Do no harm." Then, we'd like to encourage innovation and creative thinking. We've got a track devoted to that and we plan to continue the Senior Scholars "experiment" that was so successful in Washington, DC. In general, I'd like to refocus ICIS back toward it roots — a conference for top-quality research. Now that we have AMCIS, ECIS and PACIS to serve a broader set of purposes, that's feasible.

16. *Miltiadis: We have started informing the IS community about the importance of Semantic Web. What is your general understanding on the "concept" of Semantic Web?*

    Creating greater "web intelligence" is an important goal. The Semantic Web is one approach to that, but there are many issues to face and problems to solve for it to achieve its potential.

17. *Miltiadis: What are your plans for the next couple of years? I am more than impressed from your activities. Only your posts in ISWORLD from time to time show a very active researcher. Is it a life motive?*

    I'm so delighted to be alive after being told that I was going to die and then surviving three major surgeries, two of which were liver transplants. When I got the Leo "lifetime achievement" award at ICIS 04, I told them that I was now starting out on a "second life" and have the goal of earning a second Leo in twenty years or so.

18. *Miltiadis: Bill what is your opinion about the so-called next generation IS research? Is there any milestone that you consider to be of critical importance for its evolution?*

    The field has been evolving toward better use, and creation of, theory that can help in solving practical problems. I think, and hope, that will continue.

19. *Miltiadis: Any thoughts that you would like to share about the formation of the New Special Interest Group on Semantic Web and Information Systems on AIS?*

    It's a very positive development. As I noted earlier, there's great promise with the Semantic Web and a Special Interest Group should facilitate progress.

20. *Miltiadis: Dear Bill, thank you for your time. It was an excellent talk. Would you like to share any parting thoughts with our readers?*

I hope that every academic in IS will consider how privileged we all are. We get to work on problems that we are interested in; not on those which others direct us to do. We get to set our own schedules for the most part. We teach subjects that we love to young people who, if we are wise, help us to stay "forever young." It's harder not to be able to teach from last year's notes, but it's also invigorating. We get paid for doing things that we'd do for nothing. I've come to work everyday of my career excited about what good works I might do and what I might learn that day. I wish that for everyone and I hope I can keep that outlook as long as possible.

BIOGRAPHICAL SKETCH

WILLIAM R. KING

William R. King holds the title University Professor in the Katz Graduate School of Business at the University of Pittsburgh.

He was the Founding President and the first Executive Director of the Association for Information Systems (AIS)--a global organization of 4100 Information Systems (IS) academics. He has also served as President of The Institute of Management Sciences (now INFORMS) -- a then 8000 member international professional organization, as Editor-in-Chief of the *Management Information Systems Quarterly*--the core research journal in the IS field--and twice as General Chair or Co-chair of the International Conference on Information Systems (ICIS)--the premier research conference in the field (1987 and 2005).

Dr. King has published more than a dozen books that have been translated into numerous languages and has authored more than 300 papers in the leading journals of management science, strategic management, and information systems. His coauthored book, *System Analysis and Project Management*, won the McKinsey Foundation Award as a "significant contribution to the literature of management" and his coedited book, *Project Management Handbook*, was named as "Book-of-the-Year" by the Institute of Industrial Engineers. He has received numerous other awards for his scholarly contributions including being named an Inaugural Fellow of the Institute for Operations Research and Management Science (INFORMS) and the Association for Information Systems (AIS) and a Fellow of the American Association for the Advancement of Science and the Decision Sciences Institute. Recently, he was given a Leo Lifetime Exceptional Achievement Award by AIS.

As a consultant to a wide variety of international business firms, such as Lockheed and Westinghouse (U.S.), Sulzer (Switzerland), and IBM (Australia), Dr. King has had significant impact on management practice and policy. As a senior staff member representing Senator Sam Nunn on the U.S. Senate Committee on the Budget, he performed studies which have had major impact on governmental policy. He travels widely and has spent periods of time in residence in Australia, Brazil, England, Hong Kong, Korea, Singapore, Switzerland and New Zealand while lecturing and consulting.

In his leadership roles in TIMS, Dr. King motivated major change including conceiving and implementing a joint merger planning process between TIMS and the Operations Research Society of America that resulted, in 1994, in the creation of INFORMS--a 15,000 member global organization. Similarly, he put ICIS on a sound financial and administrative basis for the first time, and led activities involved in conceiving, developing, funding, implementing and selecting the first editor for *Information Systems Research*, which has become a premier research journal in the IS field.

At the University of Pittsburgh, Dr. King redesigned, obtained faculty approval for, and implemented a new doctoral program that grew substantially in size and quality under his leadership. That program is now regarded as one of the finest in the world. He was instrumental in the award of a multi-million dollar grant to the University of Pittsburgh by IBM Corporation for research and curriculum development in the management of information systems. An innovative double degree, MBA-MS in MIS, "techno MBA" program was established as a result. This program is ranked as one of the best such programs in the world. Dr. King has also been the recipient of research grants from the National Science Foundation and numerous other sources. He has led the development of three areas of research and instruction at Katz--management science, information systems and strategic management--and founded and directed the Strategic

Management Institute. He has also been active in University-wide planning and was instrumental in the development of a new multi-school graduate program in Telecommunications.

Dr. King received his Ph.D. from Case Institute of Technology (now Case Western Reserve University) after completing a BS with honors in Industrial Engineering at the Pennsylvania State University and a MS from Case. He has previously served on the faculty of Case Institute of Technology and the Air Force Institute of Technology (active military duty). He has been married to the former Fay Eileen Bickerton for more than 40 years and is the father of three children. He is a licensed private pilot, certified scuba diver and sailing captain and enjoys boating, skiing, and gardening.

(Further biographical information is available in editions of *Who's Who in America* published since 1980).

AIS SIGSEMIS ACTIVITIES

By SIG Board

International Journal on Semantic Web and Information Systems: On-AIR

By Miltiadis Lytras

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EDITORIAL PREFACE:

"International Journal on Semantic Web & Information Systems"

Amit Sheth, Editor-in-Chief, University of Georgia & Semagix, Inc., USA

Editor-in-Chief, Amit Sheth, explains the efforts of addressing various issues, sharing fundamental research and theories, providing studies of effectiveness and the many other efforts to develop a high-quality journal. In particular, three refereed papers are introduced in this second issue.

RESEARCH PAPERS

PAPER ONE:

Querying the Web Reconsidered: Design Principles for Versatile Web Query Languages

Franηois Bry, University of Munich, Germany
Christoph Koch, Vienna University of Technology, Austria
Tim Furche, University of Munich, Germany
Sebastian Schaffert, University of Munich, Germany
Liviu Badea, Nat. Institute for Research and Development in Informatics,
Bucharest, Romania
Sacha Berger, University of Munich, Germany

A decade of experience with research proposals as well as standardized query languages for the conventional Web and the recent emergence of query languages for the Semantic Web call for a reconsideration of design principles for Web and Semantic Web query languages. This paper argues that a new generation of versatile

Web query languages is needed for solving the challenges posed by the changing Web. It also suggests that well-known referential transparency and novel answer-closedness are essential features of versatile query languages. The paper mentions that the decentralized and heterogeneous nature of the Web requires incomplete data specifications (or incomplete queries) and incomplete data selections (or incomplete answers); the form-like query can be specified without precise knowledge of the queried data, and answers can be restricted to contain only an excerpt of the queried data.

To obtain a copy of the entire article, click on the link below.
http://www.idea-group.com/articles/details.asp?id=4889

PAPER TWO:

A Layered Model for Building Ontology Translation Systems

Oscar Corcho, Intelligent Software Components, Spain
Asunciσn Gσmez-Pιrez, Universidad Politιcnica de Madrid, Spain

In this paper, the authors present a model for building ontology translation systems between ontology languages and/or ontology tools, where translation decisions are defined at four different layers: lexical, syntax, semantic, and pragmatic. As part of this model, the authors propose a method that guides in the process of developing ontology translation systems according to this approach. The method identifies four main activities: feasibility study, analysis of source, and target formats, design, and implementation of the translation system, with their decomposition in tasks, and recommends the techniques to be used inside each of them.

To obtain a copy of the entire article, click on the link below.
http://www.idea-group.com/articles/details.asp?id=4890

PAPER THREE:

A Survey on Ontology Creation Methodologies

Matteo Cristani and Roberta Cuel
Universitὺ di Verona, Italy

In this paper, the authors provide a framework for analyzing the existing methodologies that compares them to a set of general criteria. In particular, they obtain a classification based upon the direction of ontology construction; bottom-up are those methodologies that start with some descriptions of the domain and obtain a classification, while top-down ones start with an abstract view of the domain itself, which is given a priori. The resulting classification is useful not only for theoretical purposes but also in the practice of deployment of ontologies in Information Systems, since it provides a framework for choosing the right methodology to be applied in the specific context, depending also on the needs of the application itself.

To obtain a copy of the entire article, click on the link below.
http://www.idea-group.com/articles/details.asp?id=4891

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For full copies of the above articles, check for this issue of International Journal on Semantic Web and Information Systems (IJSWIS) in your Institution's library.

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Note: For only $18.00, purchase an IJSWIS article or any of the 606 single journal articles available electronically by visiting www.idea-group.com/articles.

IJSWIS CFP Special Issue on "Semantic Web and Healthcare Information Systems Interoperability"

Call for Papers
Special Issue of the International Journal on the Semantic Web and Information Systems on
"Semantic Web and Healthcare Information Systems Interoperability"
Issue editor: Vipul Kashyap (vkashyap1@partners.org) and Asuman Dogac (asuman@srdc.metu.edu.tr)
Submissions due date: TBD
Scheduled Publication date: TBD

The rising cost of healthcare is a great concern in the recovering US, European and Global economies. There is an important and pressing need to
reduce costs of delivering healthcare and information technology is being viewed as a key enabler for introducing efficiencies into the healthcare system.
The issue of building out a National Health Information Infrastructure is gaining a lot of attention, with the approach being to encourage linking up of
local healthcare delivery networks across institutional, regional and health boundaries. We invite original, high quality and complete research papers
that explore the role of semantics in general and semantic web technologies in particular in addressing problems in the Healthcare IT industry. Topics
of interest, including but not limited to below are:

- Semantics and Computerized Physician Order Entry Systems
- Semantics-based Electronic Patient Record
- Semantics-based representation of Clinical Guidelines
- Controlled Terminologies, Ontologies and Information Models
- Semantics-based Clinical Decision Support
- Issues related to Translational Medicine and Clinical Genomics, including
  - Mapping the Genotype to the Phenotype
  - Data Models for storing combined Genomic and Clinical Data
- Clinical Knowledge Management, including Portals, etc.
- Semantics-based representation of Clinical Order Sets and Catalogs
- Semantic approaches for Enterprise Master Patient Indices
- Role of semantics in improving healthcare quality and improving patient outcomes

The time line for the special issue is as follows:
- Manuscript submission deadline: April 1, 2005*
- Notification of review evaluation: June 1, 2005
- Author revision due by: July 1, 2005
- Notification of acceptance: August 1, 2005
- Accepted manuscripts due for editorial review: September 1, 2005
- Tentative publication date: First issue of 2006

*We may accept delayed submissions (contact guest editors) which if accepted after normal review process will be published in a regular issue later

Researchers are invited to submit original, high-quality, and complete research papers that provide in-depth technical discussion of one or more of the above topics. Submissions (in PDF or WORD format) should be emailed to Vipul Kashyap (vkashyap1@partners.org) AND Asuman Dogac (asuman@srdc.metu.edu.tr)

IJSWIS Regular CFP

CALL FOR PAPERS

International Journal on Semantic Web and Information Systems
Editor-in-Chief: Amit Sheth, Ph.D., University of Georgia, USA and Semagix, Inc., USA
Executive Editor: Miltiadis D. Lytras, Academic Research Computer Technology Institute & Computers Engineering and Informatics Department, University of Patras, Greece

ISSN: 1552-6283, E-ISSN: 1552-6291
Published: Quarterly
Institutional: US $195.00, Individual: US $85.00
Electronic Only: Institutional US $145.00

Key Points:

· Communicates high-quality research findings in the leading edge aspects of Semantic Web and Information Systems convergence

· Discusses the Semantic Web as an indissoluble whole of new generation of technologies, frameworks, concepts and practices for supporting intelligent, innovative, and effective global and networked information systems

· An official publication of the Information Resources Management Association

Complimentary Inaugural Issue http://www.idea-group.com/journals/free.sample.asp?ID=4625

Library Recommendation Form http://www.idea-group.com/recommend.asp?ID=4625

Description:
The **International Journal on Semantic Web and Information Systems** promotes a knowledge transfer channel where academics, practitioners and researchers can discuss, analyze, criticize, synthesize, communicate, elaborate, and simplify the promising vision of the Semantic Web in the context of information systems. **IJSWIS** establishes value-adding knowledge transfer and personal development channels in three distinctive areas: academia, industry, and government.

Submissions:
Interested contributors are asked to submit their manuscripts as an email attachment in Microsoft Word or RTF (Rich Text Format) to mdl@eltrun.gr or lytras@ceid.upatras.gr. Very soon an on-line submission system will be available. The main body of the e-mail message should contain the title of the paper and the names and addresses of all authors. Manuscripts must be in English. The author' s name should not be included anywhere in the manuscript, except on the cover page. Manuscripts must also be accompanied by an abstract of 100-150 words, precisely summarizing the mission and object of the manuscript The publisher will publish the journal in both print and electronic formats.

For more information on how to submit, go to www.idea-group.com/ijswis <http://www.idea-group.com/ijswis>. All submissions and inquiries should be directed to the attention of:

Dr. Miltiadis Lytras
Email: mdl@eltrun.gr or lytras@ceid.upatras.gr

Papers of the following areas are invited:

Full Research Papers
Reviews should focus on the following guidelines when submitting full research papers: The key objective is the presentation of research outcomes and the length should be 4,000-8,000 words. The evaluation factors include 20% theoretical background, 40%significance of propositions, 20% quality of writing, and 20% discussion of implications.

Research Papers Progress
The key objective is to outline interesting future research outlets, while keeping the length from 3,000-3,500. The evaluation factors include 30% theoretical background, 30% methodology outlined, 20% quality of writing, and 20% research problem description.

Case studies
Reviewers should focus on the objective: discussion of real world implementations, while keeping it at the length of 4,000-5,000 words. Evaluation factors include: Research Issues (30%), Promotion of theory & Practice (30%), Discussion of outcomes (20%), and Quality of writing (20%).

Literature Review Papers
When submitting literature review papers, please focus on the main objective: Intensive Critiques of literature / Gaps for possible research. The evaluation factors will include: theoretical background (40%), critical thinking (20%), discussion of gaps in theory (20%), and quality of writing (20%).

Critique of Clusters of SW projects
Please keep the key objective as the evaluation of outcomes when submitting a 5,000-7,000 word critique. The evaluations factors will include: methodologies used (50%), discussion of performance gaps (30%), and the quality of writing (20%).

Vision papers
Please keep the key objective as crafting roadmaps for the future when submitting a 4,000-6,000 word paper. The evaluation factors will include: innovation (50%), theory and technology exploitation (20%), and the quality of writing (20%).

Coverage:
·Semantic Web issues, challenges and implications in each of the IS research streams
·Real world applications towards the development of the knowledge society
·New semantic Web enabled tools for the citizen, learner, organization, business
·Semantic Web enabled business models, ROI matrices and measures, technology effectiveness, case studies, etc.
·Semantic Web enabled information systems, esp. involving ontologies and knowledge bases
·Integration with other disciplines: Semantic Web and Service Oriented Architectures (e.g., Semantic Web Services)
·Standards, Methodologies, Tools, Techniques and Architectures enabling realization of Semantic Web
·Semantics enabled business intelligence, e-services, e-commerce
·Multidisciplinary approaches to realize Semantic Web (e.g, involving Information Retrieval, Linguistics, Knowledge Management, AI, database management, library sciences)

·Beyond Semantic Web, e.g., extending meaning with perception and experience

Associate Editors
·Gottfried Vossen, University of Muenster, Germany
·Ram Ramesh, SUNY at Buffalo, USA

Pls contact Miltiadis D. Lytras at mdl@eltrun.gr or Lytras@ceid.upatras.gr for further inquiries. We would be happy to receive abstracts of potential contributors for guidance.

MTSR' 05 First on-Line conference on Metadata and Semantics Research

[http://www.metadata-semantics.org

MTSR'05

First Online Metadata and Semantics Research Conference

Approaches to Advanced Information Systems

21-30 November 2005

Latest news: *selected papers will be considered for journal special issues. More information in the call for papers section.*

The First on-Line conference on **Metadata and Semantics Research (MTSR'05)** aims at bringing together researchers and practitioners that share a common interest in **metadata**, its representation, its **semantics** and its diverse applications to **Information Systems**.
Concretely, a focus is given to four interconnected research areas: **Semantic Web** and Information Systems, **Reusable Learning Objects** applications, **Knowledge Management** approaches in Information Systems and concepts, and **Cultural Heritage Metadata** applications and schemas. The topics covered by the conference are not limited to these four areas, but other "metadata and semantics"-related topics are also of interest.
The on-line format of the conference encourages demonstration of systems and prototypes and it enables the provision of artifacts that are important for discussion like schemas, ontologies, learning objects or sample metadata records. The commitment of authors to share their artifacts or implementations with conference participants will be supported by the on-line conferencing system.
The Conference will publish on-line pre-proceedings to maximize the possibilities of virtual interaction and discussion. Post-proceedings including all presented papers, extended to include the eventual results of discussion, will be published by an international editor. In addition, best papers will be selected for publishing extended versions at several International Journals covering the diversity of topics of the Conference.

MR'05 is sponsored by AIS SIGSEMIS and AIS SIGRLO (members will benefit from reduced registration fees).

Call for Papers

The First on-Line conference on **Metadata and Semantics Research (MTSR'05)** focuses on four metadata research areas:

- Semantic Web (**SW**) applications to Information Systems.
- Learning Objects (**LO**) concepts and applications.
- Knowledge Management (**KM**) approaches to Information Systems
- Cultural Heritage (**CH**) issues, schemas and applications.

Selected papers will be considered for inclusion in topical special issues in The Electronic Library and Online Information Review journals.
Important dates:

25th July, 2005	Submission of papers
25th September, 2005	Notification of acceptance/rejection
15th October, 2005	Final papers for pre-proceedings due

The dates for the publication of book post-proceedings will be announced later.
Subtopics related to each of the areas include (but are not limited to) the following:
Semantic Web area topics:

- Metadata-intensive applications of Semantic Web technologies.
- Annotation of Web resources.

- Metrics and mining of Semantic Web metadata.
- Ontologies for the annotation of particular kinds of resources.
- Service architectures for Semantic Web applications.
- Semantic Web approaches to Information Systems.

Learning Objects area topics:

- Learning object metadata studies.
- Semantic Web approaches to learning objects.
- Learning object metadata for Information Systems teaching and curricula.
- Ontologies and learning technology.
- Learning object quality and reusability.
- Learning object selection and composition.
- Web Services and learning objects.
- Learning Objects and Organizational Learning.

Knowledge Management area topics:

- Ontologies and ontology-based KM systems.
- Metadata and ontologies for competency description.
- Metadata-intensive organizational learning and KM approaches.
- Case studies on metadata approaches to KM.
- Management of metadata assets as Knowledge resources.

Cultural heritage area topics:

- Metadata and schemas for cultural heritage.
- Ontologies and cultural heritage.
- Semantic Web approaches to cultural heritage.
- Case studies on metadata creation and management for cultural heritage.

Working Principles

The First on-Line conference on **Metadata and Semantics Research (MTSR'05)** is an on-line conference aimed at a different type of interaction than that provided by conventional conferences.

The papers submitted to the conference will undergo the standard blind peer-review procedure, and after that, accepted papers will be included in on-line proceedings. On-line proceedings will be available prior to the conference to maximize opportunities for discussion.

Authors of accepted papers will have the responsibility to present their papers and answer questions in virtual sessions, with asynchronous communication, during the days of the conference. The discussions will be recorded and used as a source for improving the papers presented, which will later be published in post-proceedings after the conference.

Program Committee

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Danae Tsotra, Univ. of Missouri, St. Liouis, USA

The Program Committee of MTSR'05 is still being updated.

ECIS 2005 Semantic Web and Information Systems Track

[http://www.ecis2005.de/semantic.html]

The 13th European Conference on Information Systems will be held in Regensburg, Germany. It is organized by the Institute for Management of Information Systems at the University of Regensburg. The ECIS will take place from May 26 to 28, the Doctoral Consortium from May 23 to 25.
[more info: http://www.ecis2005.de/index.html]

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Gottfried Vossen, University of Münster, Germany
Miltiadis Lytras, Athens University of Economics and Business, Greece

Track Committee
Richard Benjamins (Intelligent Software Components), William Grosky (University of Michigan), Lakshmi S. Iyer (The University of North Carolina at Greensboro), Henry Kim (York University), Kinshuk (Massey University), Ralf Klischewski (University of Hamburg), Shiyong Lu (Wayne State University), Ambjorn Naeve (Royal Institute of Technology-KTH), Demetrios Sampson (University of Piraeus), Amit Sheth (CTO Semagix, University of Georgia), York Sure (University of Karlsruhe), Kim Veltman (Maastricht McLuhan Institute), Gerd Wagner (Eindhoven University of Technology), Lina Zhou (University of Maryland)

Call For Papers
The Semantic Web (SW) poses new challenges to Information Systems. A first observation concerning the current situation is that the field of SW is dominated by rather technical approaches exhibiting a lack of multidisciplinary contributions and insights. From this perspective this track attempts to fill this gap, with a special emphasis on demystifying the Semantic Web and revealing novel opportunities for value exploitation. With the common practice of considering the Semantic Web as a technology-driven phenomenon, we will contribute to a scientific debate, which reveals the practical implications and the research challenges of SW in the context of Information Systems. Our approach should go beyond the traditional research agenda of Information Systems and critical themes will be analyzed through a Semantic Web perspective in horizontal and vertical pillars. The main objective is to communicate high quality research findings in the leading-edge aspects of Semantic Web and Information Systems convergence. This statement distinguishes this track from traditional SW tracks: Traditionally, the Semantic Web is treated as a technological phenomenon with the main emphasis on technologies, languages and tools without similar attention given to theoretical constructions or linkages to multidisciplinary references: Our focus is on the Information Systems Discipline and we are working towards the delivery of the main implications that the Semantic Web brings to Information Systems and the Information/Knowledge Society.

Suggested topics:
- Semantic Web Issues, Challenges and Implications in each of the IS research streams
- Towards the development of the Knowledge society
- New Semantic Web enabled Tools for the citizen/ learner/ organization/ business
- New Semantic Web enabled Business Models
- New Semantic Web enabled Information systems and knowledge repositories
- Integration with other disciplines
- Intelligent Systems
- Standards
- Semantic enabled business intelligence
- Enterprise Application Integration
- Metadata-driven (bottom-up) versus ontology-driven (top-down) SW development

BEST PAPER will be invited for publication in AIS SIGSEMIS official peer reviewed journal: International Journal on Semantic Web and Information Systems.

AMCIS 2005 Semantic E-business Track

[http://baefac.uncg.edu/lsiyer/AMCIS/CFP_semantic_e-business_amcis_2005.htm]

Call for Papers for the Mini Track

Semantic e-Business

Sponsored by AIS SIGSEMIS

Americas Conference on Information Systems (AMCIS)

August 11th-15th, 2005, Omaha, NE, USA

The emergence of collaborative processes as an effective means for organizations to deliver their value propositions to their customers, and ultimately to consumers, places an increased onus on organizations to develop systems incorporating emergent technologies. These systems should support the seamless availability of information and knowledge, content and know-how, among partners in the organizations' value chains. Rapidly increasing volume of available information and growing competition in the digital economy are forcing organizations to find efficient ways to gain valuable information and knowledge to improve the efficiency and effectiveness of their business processes.

The realization of representing these knowledge-rich processes is possible through the broad developments in the 'Semantic Web' initiative of the World Wide Web Consortium. But significant amount of research is needed to understand how conceptualizations that comprise business processes can be captured, represented, shared and processed by both human and intelligent agent-based information systems to create transparency in service and supply chains. The developments in on-demand content and business logic availability through technologies such as web-services offer the potential to allow organizations to create content-based and logic or intelligence driven information value chains enabling the needed information transparencies for semantic e-business processes.

Developments on these dimensions are critical to the design of knowledge-based and intelligence driven processes in the digital economy. Research is needed in the development of business models that can take advantage of emergent technologies to support collaborative, knowledge-rich processes in the digital economy. Equally important is the adaptation and assimilation of emergent technologies to enable business processes that contribute to organizations' value propositions. This mini track invites original research contributions that investigate the development of innovative business models to support knowledge-rich business models that enhance collaborations in the digital economy.

Possible topics for papers (theoretical or empirical) submitted to the special issue include but are not limited to:

- models explicating the various forms of knowledge-based processes in the digital economy and their value to the competitiveness of organizations
- the realization of the potential of emergent technologies in supporting knowledge-rich processes required for semantic e-business.
- initiatives for knowledge representation using ontologies and intelligent Agents for semantic processing of cross-enterprise business processes over heterogeneous systems.
- collaborative relationships in the digital economy, enabled and supported by emergent technologies
- the facilitation, initiation, nurturing, development and maintenance of various forms of knowledge-based exchange relationships in the digital environment
- competitive advantage afforded by knowledge-rich processes in semantic e-business
- agents and collaborative systems for intelligent knowledge sharing
- web enabled knowledge transfer and sharing

This mini-track is sponsored and endorsed by AIS SIGSEMIS.

A special issue of *International Journal on Semantic Web and Information Systems* (IJSWIS) is scheduled for publication. Best papers from the Semantic eBusiness mini-track may be fast-tracked to this special issue. Lakshmi Iyer, Rahul Singh and Al Salam are the guest editors for the special issue.

Guidelines for Submission

- Submit abstracts via email to the Mini-track chair, Lakshmi Iyer at lsiyer@uncg.edu by February 1, 2005. This is an important step to ensure that you have submitted your paper to the correct mini-track.
- Final papers will be submitted via the AIS Review System. See the conference website for details: http://amcis2005.isqa.unomaha.edu/
- *Copyright Information*: Submission of a paper to the conference represents the author's agreement to allow AIS to publish the paper in any written or electronic format for distribution to all interested parties in perpetuity with or without compensation to AIS and without compensation to the author. The parties understand that the author is granting a nonexclusive license and all copyrights remain the property of the author.

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Formal Ontologies Meet Industry – FOMI 2005

http://www.loa-cnr.it/Files/fomi
http://fandango.cs.unitn.it/fomi/
June 9-10, 2005, Lazise, Lake of Garda, Verona (Italy)

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This event is jointly organized by:

- University of Verona
- Creactive Consulting S.r.l., Affi
- Laboratory for Applied Ontology, ISTC-CNR, Trento

and supported by

- Knowledgeboard
- Knowledgeweb

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Description

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Modeling corporate knowledge is one of the most attractive themes in applied research and it has been an important motivation for several areas of investigations like distribute systems and knowledge management. Clearly, the business world considers this issue of strategic relevance and keeps paying particular attention to it because many theoretical results have already been proved
effectiveness in real applications like data warehouse construction, information infrastructure definition, and all processes and applications of knowledge management.

These knowledge models in industry aim at providing a framework for information and knowledge sharing, reliable information exchange, meaning negotiation and coordination between distinct organizations or among members of the same one.

With the application of new methodologies and techniques in the everyday practice and the accessibility of new theoretical results in this area, developing new tools based on more sophisticated frameworks has become a common need. This is an important reason for
the increasing interest in the employment of formal ontologies in fields like medicine, engineering, financial and legal systems, and other business practices.

Objectives

==========

The workshop is a forum to meet and discuss problems, solutions, perspectives and research directions for researchers and practitioners. We welcome papers or project descriptions that aim at
applying formal ontologies in industry. In particular,

- theoretical studies on formal ontologies committed to provide sound bases for industrial applications and to allow formal representation of corporate knowledge;
- business experiences on case studies that single out concrete problems and possible solutions; the experience analysis should provide useful insights on social and strategic aspects that might
be relevant in the creation and deployment of formal ontologies as well as useful criteria or methods to evaluate ontologies and their effectiveness in applications.

Proceedings
A selection of the best papers accepted at the workshop will be reconsidered for publication in a special track of the international journal 'Applied Ontology'

Topics of Interest
Topics of interest include (but are not limited to):

- ontology methodologies in business practice;
- ontologies and corporate knowledge;
- ontologies adaptation within organizations;
- formalization of the know-how;
- representation of artifacts and design;
- representation of functionalities;
- representation of knowledge and business processes;
- linguistic representation in organizational knowledge;
- linguistic problems in organizational standard code and codification processes;
- enterprise modeling;
- ontology evaluation;
- ontology changes and developments within organizations;
- representation of business services;
- ontologies and electronic catalogs;
- ontologies and e-commerce;
- ontologies and marketing;
- ontologies in the practice of engineering;
- ontologies in the practice of medical sciences;
- ontologies in finance.

We also encourage submissions which relate research results from close areas connected to the workshop topics.

Important dates
Workshop: June 9-10, 2005
Deadline for paper submissions: March 4th, 2005
Notification of acceptance: April 4th, 2005
Camera ready submission: May 2nd, 2005

Submission and Proceedings
We invite two types of submissions in any of the topics of interest
to the workshop:

1. Technical papers
   Maximum 10 pages, excluding title page and bibliography.

2. Short position papers
   Maximum 4 pages, excluding title page and bibliography.

Submitted papers will be peer-reviewed and selected on the basis of technical quality, relevance of the described experiences (depending on the type of submission), and clarity of the presentation for for the workshop. In particular, we insist the paper to be written for a wide audience. Accepted papers will be presented at the workshop, and published as proceedings.

All papers should be electronically submitted in PDF format toRoberta Cuel at: cuel@sci.univr.it
If electronic submission is not possible, please contact Roberta Cuel at ph +39-045-802-7908 (or at

cuel@sci.univr.it) for further instructions.

Program Committee (to be completed)
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Please do not hesitate to contact any of the Organizing Committee members for further details.

ESWC2005 Workshop on Voice, Natural Language and Semantic Web Technologies (VNLSW2005)

http://www.isoco.com/workshops/VNLSW2005/

In this workshop we want to bring together researchers and practitioners from the R&D areas of *Voice Recognition and Generation*, of *Natural Language Processing* and of *Ontologies* and the *Semantic Web*. The main objective is to have discussions about how these different but complimentary technologies can be integrated together so

ESWC2005 Workshop on "MULTIMEDIA AND THE SEMANTIC WEB"

Call for papers: One day workshop, 29 May 2005

http://www.acemedia.org/ESWC2005_MSW

to be held as part of the 2nd European Semantic Web Conference, Heraklion, Crete
http://www.eswc2005.org/ , 29 May to 1 June 2005

This one day workshop on Multimedia and the Semantic Web aims to bring together researchers and practitioners in the multimedia and Semantic Web domains in order to assist in forming bridges between the communities for mutual benefit. European Commission part-funded projects such as aceMedia are already investigating means to draw benefits from both domains in order to enable advances in multimedia processing from use of Semantic Web techniques, and to create new multimedia applications in order to enhance the value of the Semantic Web. In addition, programmes such as the SDK project cluster are investigating the application of semantic web technology to knowledge management, web services and eBusiness. It is therefore timely to bring together researchers and practitioners from these two complementary and closely related areas.

The workshop will include invited papers and peer-reviewed papers received from this Call for Workshop

Papers.

Papers are invited on subjects including (but not limited to):

- Knowledge driven multimedia content analysis and understanding Semantic media creation and processing tools
- Semantic browsing, indexing and retrieval of multimedia content
- Knowledge based inference for semantic media annotation
- User adaptation and relevance feedback
- Language extensions for multimedia
- Multimedia ontologies
- Reasoning on multimedia data
- Knowledge driven multimedia applications and systems
- User evaluations of intelligent multimedia applications
- User Interface design for knowledge driven multimedia applications and systems

Paper submission details

IMPORTANT DATES

11 March 2005: Paper submission
11 April 2005: Notification of acceptance 30 April 2005: Camera-ready paper submission
29 May 29 2005: Workshop date

SUBMISSIONS

We invite technical papers (maximum 8 pages) in any of the topics listed above. Submitted papers will be peer-reviewed and selected on the basis of these reviews. Accepted papers will be presented at the workshop. Demonstrations of applications and systems are also welcome. All submissions should be made electronically, by email attachment in Word or PDF format.

Please send submissions to paola.hobson@motorola.com or ikom@iti.gr

Although not required for the initial submission, we recommend to follow the format guidelines of ESWC (Springer LNCS), as this will be the required format for accepted papers.

- **Organizing Committee**

Paola Hobson - Motorola (workshop co-ordinator) Yiannis Kompatsiaris - CERTH/ITI John Davies - BT Ant Miller - BBC

Local Arrangements

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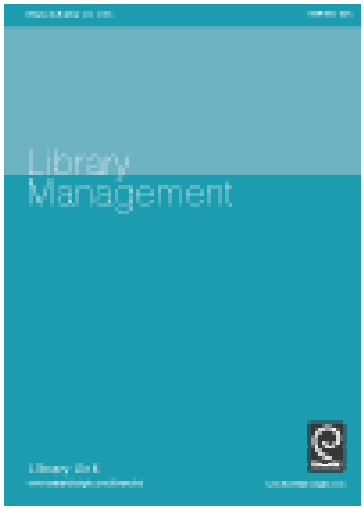
Special Issue on

Digital Libraries in the Knowledge Era: Knowledge Management and Semantic Web Technologies

At Library Management Journal Vol 26(4/5) 2005

Official Publication Date 27 May 2005

http://www.emeraldinsight.com/lm.htm



Editor in Chief: Steve O' Connor Steve O'Connor

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Special Issue Guest Editors
Miltiadis Lytras, Research Academic Computer Technology Institute, and AIS SIGSEMIS
Miguel-Angel Sicilia, University of Alcalá, Spain
John Davies, BTExact Next Generation Web Research, UK
Vipul Kashyap, Partners HealthCare System, Clinical Informatics R&D, USA

Note: We finalized the Special issue in January. Through a balanced peer review and invitations strategy a high quality issue has been developed. We are grateful to the Editor in Chief, Steve O' Connor, for his support and TRUST. I invite you consider Library Management Journal as a nice addition to your Journals portfolio. For sure digital libraries will be in the next years in the agenda of AIS SIGSEMIS research.

Many thanks to all the contributing authors. Without their great support this issue could not be delivered. We provide a TOC of the special issue

Miltiadis Lytras, Miguel-Angel Sicilia, John Davies, Vipul Kashyap, ***Digital Libraries in the Knowledge Era: Knowledge Management and Semantic Web Technologies*** (editorial)

Kevin Parker, Philip Nitse, Kay Flowers, "***Libraries as Knowledge Management Centers"***, Idaho State University,

York Sure and Rudi Studer , "***Semantic Web Technologies***", Institute AIFB, University of Karlsruhe

Paul Warren, "***Applying Semantic Technology to a Digital Library: a case study***", BT Exact, UK,

Nuria Ferran, Enric Mor and Julia Minguillon, "***Towards personalization in digital libraries through ontologies"***, from the Open University of Catalonia,Spain

Hao Ding, "***Integrating Semantic Metadata in P2P-based Digital Libraries***", Information Management Group at Norwegian Univ. of Science &Technology, Norway

Wei Xing, Marios D. Dikaiakos, Hua Yang, Angelos Sphyris and George Eftichidis, "***Building a Distributed Digital Library for Natural Disasters Metadata with Grid Services and RDF***"

Ioannis Papadakis, Agapios Avramidis and Vassilis Chrissikopoulos, "***Reasoning against a semantic digital library framework based on grid technology***"

The next three papers are related to more advanced issues.

Xiaohua Hu "***Mining Novel Connections from Large Online Digital Library Using Biomedical Ontologies***", College of Information Science and Technology at Drexel University, USA

Francesco Bellomi, Matteo Cristani and Roberta Cuel, "***A cooperative environment for the negotiation of term taxonomies in digital libraries",*** from Dipartimento di Informatica at Università di Verona, Italy,

Nenad Stojanovic, "***On the Conceptualisation of the Query Refinement Task***" , AIFB at University of Karlsruhe, Germany

Special Issue on
Exploiting Knowledge Management for Ubiquitous E-Government in the Semantic Web Era.

Electronic Government, an International Journal

ISSN (Online): 1740-7508 - ISSN (Paper): 1740-7494

Editor in Chief : Prof. Binshan Lin, Dept of Management & Marketing, College of Business Administration, *Louisiana State University, USA*

Special Issue Editors

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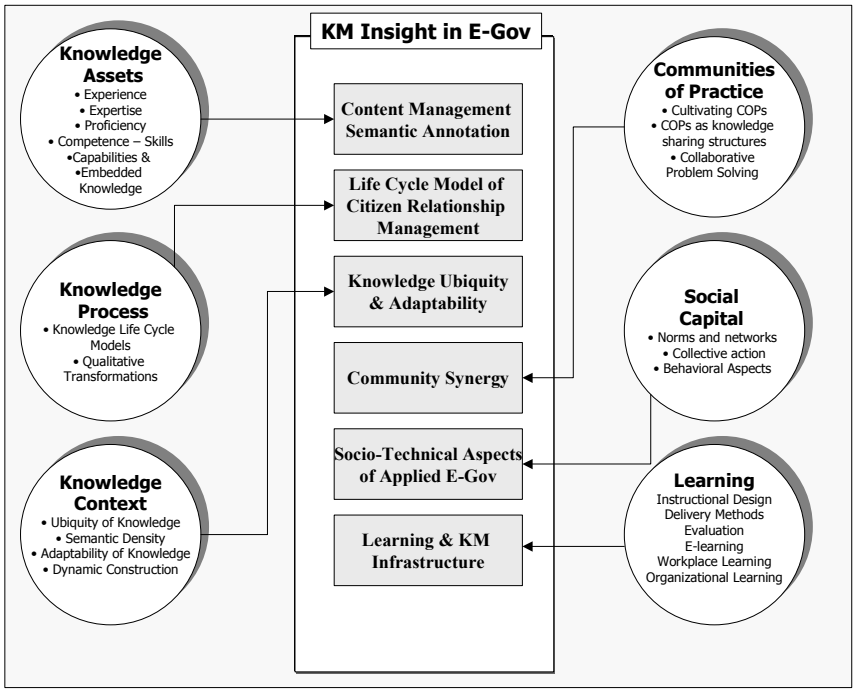
Call for Papers

Focus

A common obstacle in the transformation of government policy to services for the public and citizens is the difficulty to establish communication channels that exploit knowledge and support services. In a both push and pull consideration of flows and requests, knowledge management literature explains in detail the critical role of the management of artifacts, communication, collaboration and behaviour. In the wide area of knowledge management several pillars can be identified that potentially promote the e-government. In figure 1, six critical variables are highlighted:

[Special issue Sponsored by: AIS Special Interest Group on Semantic Web and Information Systems]

Figure 1: Knowledge Management insights in E-government



The 6 pillars mentioned can help the formulation of our Knowledge Management Insight in E-government. The basic idea is that six Performance Factors based on the six pillars provide the basis for the Ubiquitous Knowledge Management for E-government. In parallel the evolution of Semantic Web poses new challenges for each of these pillars.

Intended Topics

The topics of the special issue would cover the application and integration of Knowledge Management and Semantic Web technologies and infrastructures to e-Government. These topics include:

- Knowledge Management Strategies for E-government.
- Knowledge flows and implications to E-government
- Communities of Practices and provision of E-government services
- Semantic Web-enabled resource retrieval in E-Government.
- Social Capital and Ubiquitous E-Government.
- Managing artifacts through ontologies.
- Approaches to annotation of resources for Effective E-government.
- Regulatory ontologies: implications for E-government.
- Scientific knowledge organization and ontologies.
- New roles and competencies of E-government taskforce in Semantic, metadata-intensive institutions.

Important Dates

Submission Deadline	February 28, 2005
Review results to authors	April 15, 2005
Final version of papers	May 30, 2005
Publication	January 2006 (Volume 3, Issue 1)

Send manuscripts to Lytras@ceid.upatras.gr

Style and Author Guidelines

Author guidelines are available at:https://www.inderscience.com/papers/about.php

Special Issue on

Advances of Semantic Web for E-learning: Expanding learning frontiers.

British Journal of Educational Technology

Edited by: Nick Rushby , **Print ISSN:** 0007-1013, **Online ISSN:** 1467-8535

URL: http://www.blackwellpublishing.com/journal.asp?ref=0007-1013

Special Issue Editors

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Joseph Harding, SAKAI Project Chair and University of Michigan, USA

Nicolas Balacheff, CNRS, Kaleidoscope Network of Excellence, France

[very soon a detailed CFP will be announced]

Important Dates

Send manuscripts to Lytras@ceid.upatras.gr and cc: amb@nada.kth.se

30th April 2005	Submission of manuscripts
15th June 2005	Notification to authors
15th September 2005	Final versions due
Early 2006	Publication

Style and Author Guidelines

Author guidelines are available at:
http://www.blackwellpublishing.com/submit.asp?ref=0007-1013

Special Issue Sponsors

AIS SIGSEMIS Semantic Web & Information Systems

CALL FOR PAPERS
IEEE Transactions on Knowledge and Data Engineering
"Knowledge and Data Engineering in the Semantic Web Era"
Special Issue Early 2007

IEEE Transactions on Knowledge and Data Engineering seeks original manuscripts for a Special Issue on Semantic Web and Information Systems scheduled to appear in **an early 2007 issue.** The Semantic Web vision has evolved in the last years as a blueprint for a knowledge-based framework aimed at crossing the chasm from the current Web of unstructured information resources to a Web equipped with metadata and oriented to delegation of tasks to software agents. Ontologies are the key piece of this framework in that they provide shared semantics to metadata, thus enabling a degree of semantic interoperability. The requirements of large-scale deployment and interoperability of the Semantic Web vision represent a major challenge to data and knowledge engineering, which raises a number of issues and requirements regarding how to represent, create, manage and use both ontologies as shared knowledge representations, but also large volumes of metadata records used to annotate Web resources of a diverse kind. The special issue aims at helping in communicating and disseminating relevant recent research in knowledge and data engineering as applied to the context of Information Systems. The scope of the call includes Knowledge Engineering for organizational applications, Semantic Web approaches to Information Systems and Ontology-Based Information Systems research, as well as the diverse underlying Database and Knowledge Representation aspects. Papers dealing with aspects that touch both aspects are especially sought. This is intended to initiate a dialog between the organizational and more technical views of the field. Topics include, but are not limited to, the following:

- Knowledge-based tools and techniques for or enabled by Semantic Web applications.
- How semantic mapping is achieved in databases and knowledge representations.
- Engineering of ontologies for Information Systems and their associated data management requirements.
- Algorithms and representations for Semantic Web approaches to Knowledge management.
- Knowledge integration through ontologies, semantic metadata and databases of annotations.
- Design and modeling of Semantic Web repositories and distributed knowledge-based systems.
- Semantic Web and metadata query languages and implementation frameworks.
- Management of semantic metadata.

Submitted articles must not have been previously published or currently submitted for journal publication elsewhere. As an author, you are responsible for understanding and adhering to our submission guidelines. You can access them by clicking on http://www.computer.org/mc/tkde/author.htm. Please thoroughly read these before submitting your manuscript. Please submit your paper to Manuscript Central at http://cs-ieee.manuscriptcentral.com/. Please feel free to contact the Peer Review Manager, Suzanne Werner at swerner@computer.org or the guest editors at Lytras@ceid.upatras.gr if you have any questions.

Please note the following important dates.

Important dates:

Submission Deadline: 15-Sep-05
Completion of First-Round Reviews: 15-Dec-05
Revised Papers (after Minor Revisions): 19-Jan-05
Publication Materials Due: 23-Jun-06
Publication: in an Early 2007 issue.

Please address all other correspondence regarding this special issue to Guest Editors **G. Vossen, M. Lytras, N. Koudas**

GUEST EDITORS		
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An Interview with Richard Watson

President of the Association for Information Systems

"If IS research has a context for this century, it should be to tackle the problems that matter to everyone"

1. *Miltiadis: Dear President Watson, I am delighted that you agreed to this interview. Let me start with sharing a memory with you. A couple of years ago, I had a discussion with a University Professor. I still remember a phrase: "Do you know how difficult is it to lead a whole scientific community?" You are the right person to ask this same question: What does it really mean to lead a discipline? What are the critical issues?*

   President Watson: I don't think it is feasible to think of leading a discipline or a scientific community. Indeed, such an idea is counter the idea of a community. Rather, I think the role of the President of AIS is mainly a task of facilitation. I try to identify issues of importance to AIS members and structure means of addressing them in a participative and open manner.

2. *Miltiadis: Let me try to summarize your inspired leadership in the next questions. Undoubtedly, you and the AIS council work very hard on the International Character of AIS. What are your key priorities or the most important concerns towards this milestone?*

   President Watson: Priorities are often set by circumstances. In the last six months or so, circumstances have dictated a focus on financial issues, and this is where Council has spent most of its energy. Besides financial concerns, my priorities are to help scholars improve their productivity and expand the global community of IS scholars. I have worked on internationalization for some years and am currently writing a document laying out my ideas for improving productivity.

3. *Miltiadis: Dear President, we were really surprised by the financial difficulties of AIS, which you communicated from the beginning of your presidency. The way you managed the issue seemed to me not only wise but also with a long-term strategic perspective. What can we do, as AIS members to help with this problem?*

   President Watson: AIS Council needs its members' understanding that financial problems usually result in solutions that disappoint some members. For example, social events are likely to be modest at future AMCIS and ICIS meetings. Thus, members can help by accepting that some changes are necessary. In a very direct way, members can help by encouraging their libraries to subscribe to JAIS and CAIS and encouraging non-members to join AIS.

4. *Miltiadis: From time to time I hear from many researchers worldwide that the access "publication opportunities" to top IS journals is difficult. What do you think of the fact that each year we have a couple of hundreds articles in top IS journals? Is this enough for the evolution of the IS discipline?*

   President Watson: I think we need more outlets for IS scholarship, and the project that I mentioned earlier addresses this issue as one element of a system-wide improvement in the academic publication system.

5. *Miltiadis: Dear President, AIS has grown in the last years. Several chapters, SIGs, publications, etc. How difficult is it for an International Association to promote its contribution to our society? What is the role of AIS within the context of Knowledge Society?*

   President Watson: AIS, through its journals and conferences, has the task of fostering IS research. I think it does this well, as demonstrated by the popularity of its conferences and journals. It also has a role in influencing IS education, particularly for non-IS students. We have gained recognition from AACSB as the voice for IS scholars, though I suspect our voice is not as strong as other fields. However, AIS's influence outside the US, though AACSB is international, is limited. It is very much the role of local chapters to establish themselves as a voice for IS scholars in their country.

   Within the broader IS profession, AIS has little immediate influence. The information services (e.g., Gartner) and consulting companies have far more impact on practice than scholars in the short-term. However, through the many students we teach, we can influence practice, but it takes time.

6. *Miltiadis: What do you consider the top challenges for the MIS field?*

   President Watson: I think our research is too far removed from wealth creation and cutting edge problem solving. I would like to see IS professors spinning off companies to market their new ways of solving IS problems. I don't think our current model of acceptable research favors such action, and I believe that we should get closer to the action.

7. *Miltiadis: It's really true that AIS brings together people from all over the world. A whole community, enormous knowledge exchanges. One of your key priorities, stated in your last letter to the IS community, is related to a new information and knowledge infrastructure for members. What is your vision on this?*

   President Watson: I am still working on writing a paper describing this vision.

8. *Miltiadis: Many members consider AIS to be a solid academic association. Do you share the opinion of some people who claim that AIS must further exploit the synergies with the business world? Is this something that you consider important?*

   President Watson: AIS has limited resources and needs to focus on core academic activities (i.e., journals and conferences) to best serve its members. Given more resources, AIS could enlarge its roles, but it would first need to determine members' priorities. Some might argue that AIS could do more for undergraduates (e.g., an honors society). There is always a case for doing more, but at present I think AIS has its hands full with its journals and conferences.

9. *Miltiadis: You have a personal research interest in u-business, open source, topics in the leading edge of technologies and strategies. Do all these brand new approaches provide a new context for IS research in the beginning of the new century?*

   Well, like most of my colleagues, I hope I am studying important topics. However, I am, to my shame, ignoring the great problems of this century – global climate change, environmental degradation, and diminishing biodiversity, as well as the persistent problems of poverty and intolerance. If IS research has a context for this century, it should be to tackle the problems that matter to everyone.

10. *Miltiadis: Dear President, recently a lot of criticism was expressed against the required time for the completion of a PhD in IS. What skills and competencies do you consider important enough to be pursued through PhD programs in IS?*

    President Watson: PhD programs are about learning to think, and academic life is about learning to be a better thinker. Surprisingly, it takes a lot of time to learn to think well, and I am still working on it. My current thinking is that a PhD program is about the right length. There are a lot of skills to be mastered to be a good thinker and much practice is required. You need to be able to think about a problem in multiple ways to truly understand it before you can think about multiple solutions.

11. *Miltiadis: Recently I had a conversation with a colleague who serves as CEO in a big IT company. He told me something that is typical of practitioners: In few words, he emphasized the gap between theoretical propositions and business practice. Do you share this opinion?*

    President Watson: Business is theory in practice. Practitioners act based on their implicit theories of how customers, competitors, etc. will react to their actions. We live and act in a world of causal predictions based on our beliefs (i.e., theories) about how others behave and react. The problem is that many times the theories we use lead to poor predictions. If there is a gap, it is the gap between the theory applied and the right theory to apply. Academics need to help practitioners to close this gap.

12. *Miltiadis: Dear President, how do you evaluate the cooperation of AIS with other leading associations like IEEE, INFORMS etc? Do you think that in the next years we will experience closer collaboration?*

    President Watson: My priorities would be to develop more AIS chapters and ensure closer collaboration between AIS and its chapters and among chapters. I think we need to build out our community to embrace all IS scholars.

13. *Miltiadis: Dear President, from Australia to USA, with an excellent career and academic record. How do you view the benefits of globalization? Do we have to be more socially concerned, especially for continents such as Africa or Latin America where IS as a field is still in its developing stage?*

    President Watson: I teach a course called "Globalization and IT" that generally has a positive view on globalization because of my belief in the power of markets to allocate scarce resources and limit the power of politicians. In some ways we don't have enough of the free trade on which globalization rides. If the US and Europe ceased their massive subsidies of agriculture, many of the developing countries would have an opportunity to grow richer through agricultural exports.

    AIS has had a policy for some years of offering its e-library without charge to scholars in the non-rich countries. We also give a significant membership discount to IS scholars in these countries.

    I have for some time thought that we should work on developing a pairing system of matching scholars in different countries to encourage the flow of knowledge between the developed and undeveloped regions. A few years ago, I tried to get the US Congress to fund an electronic peace corps to implement this idea. Unfortunately, the senator who agreed to sponsor the idea died.

14. *Miltiadis: Lately, a lot of discussion concerned the decision to change the hosting of ICIS 2006. To be honest, I think that there were some differences in the way of thinking between Europeans and USA located IS researchers. What are the key actions towards a "shared vision and language" for the IS community worldwide?*

President Watson: A community is not a like a business, I think it would be dangerous to have a single vision of IS. In fact, as I have spoken to different chapters, I have encouraged them to develop a distinctive IS identity and approach to IS research. In a world of continually changing problems, diversity is an asset.

15. *Miltiadis: Lately we can see initiatives for extensive knowledge sharing in several communities. E.g. the Open Knowledge Initiative, SAKAI projects in US, Networks of Excellence in Europe etc. Is it possible to see such movements initiated by AIS in the next years?*

    President Watson: I think projects of this level are beyond AIS's resources. However, AIS should probably take action to ensure that its members are aware of these initiatives (e.g., a panel at ICIS or a special issue of JAIS).

16. *Miltiadis: Dear President, you are supporting a number of conferences and workshops worldwide. You were in Tunisia last year. Is this a critical bet towards the expansion of our community? Do you see any virtual opportunities for e-learning initiated by AIS worldwide?*

    President Watson: As I said earlier, I think it is important that we build the global IS community over the next few years. Hence, last year I visited six continents and on most of my visits sought opportunities to encourage the formation of chapters and involvement in AIS.

    AIS is in the e-learning sector for academics with ISWorld, the ISWorld listserv, and e-library. We make it possible for our members to learn from each other and support the accumulation of knowledge. We have probably done more than most academic societies in this regard, and so we should as we are IS scholars.

    I see some new opportunities to further develop e-learning for academics but my thoughts need further work.

17. *Miltiadis: Dear President, would you like to share with our readers a book or an article that you recently read and made a great impact on you?*

    President Watson: My elder daughter is working on a PhD in developmental biology, and I have been reading quite a lot in this area of the last few years. Mainly, because she gives me as gifts books that she wants to read. I found Steven Pinker's "The Blank Slate" very useful for understanding human information processing. As a result, I think there is a need to link IS and evolutionary biology to gain a deeper understanding of how humans process information and the features of the information systems they build.

18. *Miltiadis: European IS community versus American IS community. Do you believe there are areas and issues that differentiate these two communities?*

    President Watson: I certainly hope that there are areas and issues differentiating these communities and IS communities within each of these regions. Monocultures are dangerous, especially for academics, because they constrain thinking and innovation. My observation from at least 20 visits to Europe is that there is no imminent threat of a monoculture.

19. *Miltiadis: Any thoughts you would care to share on the formation of the New Special Interest Group on Semantic Web and Information Systems on AIS?*

    President Watson: SIGs in general have been a key development of AIS over the last few years. I think the SIG on Semantic Web and Information Systems exemplifies the energy and vitality of many SIGs. The SIGs are key action and innovation centers in AIS. They are organizing new conferences, tracks in existing conferences, web sites, newsletters, and globally connecting

scholars of similar interests.

20. *Miltiadis: Dear President, thank you for your time. It was an excellent talk. Any parting thoughts you would like to share with our readers?*

    President Watson: Thanks for creating this opportunity to share my thoughts on some important issues with your readers. It is always a privilege to have someone else want to read what you think.

Short Bio

Richard Watson *is the J. Rex Fuqua Distinguished Chair for Internet Strategy and Director of the Center for Information Systems Leadership in the Terry College of Business, the University of Georgia. He has published in leading journals in several fields as well as authored books on data management and electronic commerce. His current research focuses primarily on electronic commerce and IS leadership. He has given invited seminars in more than 20 countries for companies and universities. He is President of AIS, a visiting professor at Agder University College, Norway, Fudan University, China, and a consulting editor to John Wiley & Sons. He has been a co-chair of ICIS and a senior editor for MIS Quarterly.*

RESEARCH PAPERS IN THIS ISSUE

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Bernstein A., Kaufmann E. and Fuchs N. [*], *Talking to the Semantic Web –A Controlled English Query Interface for Ontologies*
[*] Department of Informatics, University of Zurich, Switzerland

Sengupta A. *, Kim H. **, *SWAP - A Framework for Ontology Support in Semantic Web Applications*

* Indiana University, Kelley School of Business, USA
** York University, Schulich School of Business, Canada

Talking to the Semantic Web – A Controlled English Query Interface for Ontologies

Abraham Bernstein, Esther Kaufmann, Norbert E. Fuchs
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Abstract

The semantic web presents the vision of a distributed, dynamically growing knowledge base founded on formal logic. Common users, however, seem to have problems even with the simplest Boolean expression. As queries from web search engines show, the great majority of users simply do not use Boolean expressions. So how can we help users to query a web of logic that they do not seem to understand?

We address this problem by presenting a natural language front-end to semantic web querying. The front-end allows formulating queries in Attempto Controlled English (ACE), a subset of natural English. Each ACE query is translated into a discourse representation structure – a variant of the language of first-order logic – that is then translated into the semantic web querying language PQL. As examples show, our approach offers great potential for bridging the gap between the semantic web and its real-world users, since it allows users to query the semantic web without having to learn an unfamiliar formal language.

1. Introduction

The semantic web presents the vision of a dynamically growing knowledge base that should allow users to draw on and combine distributed information sources specified in languages based on formal logic. Common users, however, were shown to have problems even with the simplest Boolean expressions. Experience in information retrieval, for example, demonstrates that users are better at understanding graphical query interfaces than simple Boolean queries [Spoerri 1993]. As queries from web search engines reveal, the great majority of users simply do not use Boolean expressions. *So how can we bridge the gap between the logic-based semantic web and real-world users, who are at least ill at ease and, oftentimes, unable to use formal logic concepts?*

We address this problem by *presenting a natural language front-end to the semantic web*. In its current form the front-end provides users with a controlled natural language interface to formulate queries. The controlled natural language used, Attempto Controlled English (ACE) [Fuchs et al. 2003; Fuchs et al. 2004], is an unambiguous subset of English, which is translated *automatically* [Bonin 2004] into the semantic web query language PQL [Klein et al. 2004] providing users with an almost natural language interface to the semantic web. As experience with controlled languages has shown, they are much easier to learn by end-users than formal languages like logic. We, therefore, believe that the approach presented here has great potential in bridging the gap between the semantic web and its end-users and becoming a major enabler for the growth of the semantic web.

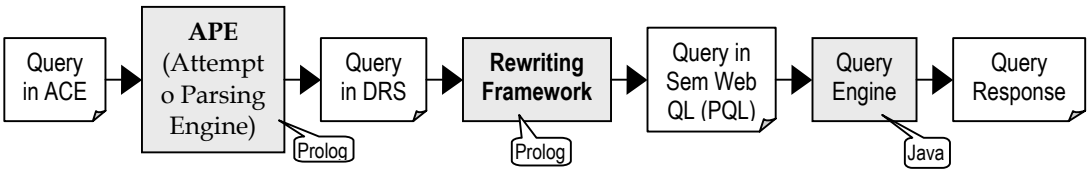

Figure 1: Overall data flow of the controlled English query front-end

The rest of this paper closely follows the data flow of the query front-end (Figure 1). Section 2 introduces Attempto Controlled English (ACE) and the Attempto Parsing Engine (APE). APE translates ACE texts into a discourse representation structure (DRS), a variant of the language of first-order logic introduced by Kamp and collaborators [Kamp et al. 1993]. Section 3 introduces the rewriting framework that translates the DRS to

the semantic web query language PQL. PQL queries are evaluated by a standard query engine that we do not discuss in this paper. In section 4 we provide a first assessment of the approach posing some real-world queries to the knowledge base. We close with a discussion of the current limitations as well as related and future work.

2. Attempto Controlled English as a Query Language

Our query front-end automatically processes queries expressed in Attempto Controlled English (ACE), a controlled natural language originally designed for requirements specifications and knowledge representation [Fuchs et al. 2003; Fuchs et al. 2004]. ACE is a subset of English meaning that each ACE sentence is correct English, but not vice-versa. ACE's grammar is specified by a small set of construction and interpretation rules. The construction rules allow users to build simple sentences (e.g. "John sells books."), composite sentences (e.g. "If John sells books and John's business does not fail then he is content."), and queries (e.g. "Which books does John sell?"). The interpretation rules eliminate syntactic and semantic ambiguities, for which natural languages are highly notorious, hereby also reducing the computational complexity of processing ACE sentences. As such, ACE avoids the major disadvantages of full natural language processing, while maintaining the ease of use for end-users and allowing the translation of all ACE sentences to first-order logic.

Though ACE appears completely natural, it is in fact a formal language and its small set of construction and interpretation rules must be learned. As an example, consider the sentence "A man sees a girl with a telescope." In full English this sentence is ambiguous since the prepositional phrase "with a telescope" can either modify the verb phrase "sees", leading to the interpretation that the man has the telescope, or the noun phrase "a girl", meaning that the girl has the telescope. In ACE, however, the sentence is unambiguous since an interpretation rule limits the meaning to the first alternative "sees with a telescope". To express the second alternative "a girl with a telescope" one could, for instance, write "A man sees a girl that has a telescope." making use of another – complementary – interpretation rule. Thus ACE's interpretation rules eliminate ambiguity without reducing expressability.

DRS	First-order Logic
A B	$\exists$ A B : customer(A) $\wedge$ book(B) $\wedge$ buy(A, B)
customer(A) book(B) buy(A, B)	

Figure 2: DRS and first-order logic representation of "A customer buys a book."

The Attempto Parsing Engine (APE) – implemented in Prolog as a Definite Clause Grammar – translates a – possibly multisentential – ACE text into a discourse representation structure (DRS) that logically represents the information of the text [Kamp et al. 1993]. DRSs are a powerful means to adequately capture linguistic phenomena, for instance anaphoric references. A DRS consists of discourse referents, i.e. quantified variables representing the objects of a discourse, and of conditions for the discourse referents. The conditions can be logical atoms or complex conditions built from other DRSs and logical connectors (negation, disjunction, and implication). As an example, the translation of the sentence "A customer buys a book." is shown in its typical box-styled DRS representation in Figure 2 on the left. The two discourse referents, A and B, are shown at the top and the three conditions derived from the sentence are listed below. Figure 2 shows on the right the first-order formula equivalent to the DRS. [1]

3. From DRS to the Semantic Web Query Language PQL

As the next step, the rewriting framework (an extension of [Bonin 2004]) translates the DRS produced by APE into the semantic web query language PQL, which is then used to query an ontology. As an exemplary ontology we chose the *MIT Process Handbook* [Malone et al. 1999] that describes organizational processes. The Process Handbook treats a real-world domain that everybody can relate to, has a large number of instances (>5000), and has been used in a number of semantic web projects. Each process (object) of the ontology enters a variety of relationships to attributes, sub-processes, exceptions, etc. and has a detailed textual description. The process query language (PQL) presented in [Klein et al. 2004] allows to pose queries which are then evalu-

[1] To emphasize the principle of the translation we radically simplified the DRS. As will be seen later, real DRSs are more complex to adequately represent a wide range of linguistic phenomena.

ated against the process ontology. PQL essentially allows the composition of process fragments that result in a query-by-example style specification of the sought after processes. PQL's two major statement types are ATTRIBUTE and RELATION. ATTRIBUTE statements query literal properties of objects in the ontology, whereas RELATION statements match properties of objects whose range are again objects (for an example see Figure 3). As such, any PQL query can be mapped to a standardized RDF-QL statement. Consequently, none of our findings are limited to the Process Handbook and PQL. They apply analogously to other semantic web query languages such as, for instance, SquishQL [Miller et al. 2002].

Full-text and Keywords	PQL
"Find all processes that sell books over the internet." *Keywords:* "sell book internet"	(ATTRIBUTE "Name" OF ?process INCLUDES "sell") ∧ (ATTRIBUTE "Name" OF ?process INCLUDES "book") ∧ (RELATION ?process USES-MECHANISM ?mechanism) ∧ (ATTRIBUTE "Name" OF ?mechanism INCLUDES "internet")

Figure 3: An example full-text query with its corresponding keywords and derived PQL query

In order to translate the DRS generated by APE into PQL queries, we developed rewriting rules for the typical DRS structures. Each structure is first matched against a set of *ontology-model specific keyword rules* that – when they apply – result in a constraint between objects, i.e. a RELATION statement. If none of these rules applies, then a set of *general-vocabulary rules* is tried, typically resulting in the comparison with a literal value, i.e. an ATTRIBUTE statement.

The *ontology-model specific keyword rules* apply if one of the keywords of the ontology – including its morphological or syntactic variants – appears in the DRS to be translated. For example, the expression "has a specialization" in the query "Which process has a specialization?" is identified as the ontology-model relationship HAS-SPECIALIZATION and, hence, translated into the following PQL statement:

RELATION ?process HAS-SPECIALIZATION ?specialization

A limitation of this approach is the choice of the vocabulary when building the ontology. In some cases we, therefore, had to include synonyms of the ontology-keywords in the rewriting rules.

Elements of the DRS not handled by the ontology-model specific keyword rules are passed to the *general-vocabulary rules.* Simple sentence structures, i.e., sentence structures not containing relative sentences, adverbs, or prepositional phrases, can now be interpreted as simple literal values. For example, the verb "sell" in a query like "How does somebody sell consumer electronics?" is represented in the DRS as "predicate(D,event,sell,A,C)". It is treated as a literal value and translated into:

ATTRIBUTE "Name" OF ?process INCLUDES "sell"

Complex structures initiate a search in the ontology-model for corresponding relationships. As an example, consider the query "How does somebody sell consumer electronics over the internet?" Here, the prepositional phrase "over the internet" indicates that a good is sold using the internet as an instrument, which is noted in the sentence's DRS (see also Example 2). As instruments, or rather their synonym "mechanisms", are included in the Process Handbook ontology-model as the USES-MECHANISM relationship or property, we can translate the phrase "over the internet" into the following PQL statement:

RELATION ?process USES-MECHANISM ?mechanism
ATTRIBUTE "Name" OF ?mechanism INCLUDES "internet"

If the search in the ontology-model results in no corresponding relationships, then the structure is reduced to a simple structure by treating the modifiers as literals resulting in an ATTRIBUTE statement.

A full discussion of all rewrite rules is beyond the space limitations of this paper. Even so, we will try to convey the extent of the rules discussing three realistic query examples. For each example we show the ACE query, its DRS generated by APE, and the resulting PQL query. Example 1 shows the application of the simple general-vocabulary rules. Here the lexical elements "consumer", "electronics", and "sell" are treated as literal

values. Note that the rewriting framework splits the compound "consumer electronics" into its constituents to improve recall. Example 2 illustrates the combination of simple and complex structures treated by the general-vocabulary rules. Finally, Example 3 uses a combination of ontology-model specific keyword rules and both types of general-vocabulary rules. Here "Which sales process…" results in the first two statements of the PQL query, which can be interpreted as "Find all processes which are sales processes and which have a subtask that…" Note that the straightforward ontology-based translation of ACE queries to PQL queries allows the user to directly grasp the system-inherent logic rather then having the system "guess" the user's intention based on some heuristics.

ACE	DRS	PQL
How does somebody sell consumer electronics?	A B C D structure(A, dom) object(C, **consumer_electronic**, object) structure(C, atomic) quantity(C, cardinality, count_unit, B, eq, 1) predicate(D, event, **sell**, A, C) modifier(D, manner, none, **how**) query(D, **how**)	(ATTRIBUTE "Name" OF ?process INCLUDES "sell") ∧ (ATTRIBUTE "Name" OF ?process INCLUDES "consumer") ∧ (ATTRIBUTE "Name" OF ?process INCLUDES "electronic")

Example 1: Transformation of "How does somebody sell consumer electronics?"

ACE	DRS	PQL
How does somebody sell consumer electronics over the internet?	A B C D structure(A, dom) object(B, **consumer_electronic**, object) predicate(C, event, **sell**, A, B) object(D, **internet**, object) modifier(C, instrument, **over**, D) modifier(C, manner, none, **how**) query(C, **how**)	(ATTRIBUTE "Name" OF ?process INCLUDES "sell") ∧ (ATTRIBUTE "Name" OF ?process INCLUDES "consumer") ∧ (ATTRIBUTE "Name" OF ?process INCLUDES "electronic") ∧ (RELATION ?process **USES-MECHANISM** ?mechanism) ∧ (ATTRIBUTE "Name" OF ?mechanism INCLUDES "internet")

Example 2: Transformation of "How does somebody sell consumer electronics over the internet?" [2]

ACE	DRS	PQL
Which sales process informs its customers over the internet?	A B C D query(A, **which**) object(A, **sales_process**, object) object(B, **customer**, person) predicate(C, event, **inform**, A, B) object(D, **internet**, object) modifier(C, instrument, **over**, D)	(ATTRIBUTE "Name" OF ?process INCLUDES "sale") ∧ (RELATION ?process **HAS-PART** ?part) ∧ (ATTRIBUTE "Name" OF ?part INCLUDES "inform") ∧ (ATTRIBUTE "Name" OF ?part INCLUDES "customer") ∧ (RELATION ?part USES-MECHANISM ?mechanism) ∧ (ATTRIBUTE "Name" OF ?mechanism INCLUDES "internet")

Example 3: Transformation of "Which sales process informs its customers over the internet?"

4. Validation – Query Performance of a Non-trivial Example

For the implementation of the validation prototype we combined Prolog and Java components, as APE and the rewriting framework are programmed in SICStus Prolog, and the user interface and the query engine are programmed in Java (see Figure 1). Currently, ACE queries are entered into the user interface and then passed to APE using the "Jasper" Java-to-Prolog bridge. The resulting DRSs are forwarded to the rewriting framework that generates the PQL queries. These are then evaluated by the query engine that passes the result back to the user interface.

Using the prototype we executed a number of real-world queries – including all examples in this paper – and compared its retrieval performance with two keyword-based retrieval approaches: one using a TFIDF-style ranking [Salton et al. 1983], the other one searching for the conjunction of keywords. Both of those approaches have a proven track record of being suitable for end-users. We then hand-coded the database to find the correct results for the natural language queries.

ACE	DRS	PQL
Which sales process	A B C D E F G H	

[2] Unprocessed DRS conditions such as *structure* and *quantity* are omitted in all further DRSs to improve readability.

informs its customers over the internet and avoids unwanted solicitations with an opt-out list?	query(A, **which**) object(A, **sales_process**, object) object(B, **customer**, person) predicate(C, event, **inform**, A, B) object(D, **internet**, object) modifier(C, instrument, **over**, D) object(E, **solicitation**, object) property(F, **unwanted**, E) predicate(G, event, **avoid**, A, E) object(H, **opt_out_list**, object) modifier(G, instrument, **with**, H)	(ATTRIBUTE "Name" OF ?process INCLUDES "sale") ∧ (RELATION ?process HAS-PART ?part) ∧ (ATTRIBUTE "Name" OF ?part INCLUDES "inform") ∧ (ATTRIBUTE "Name" OF ?part INCLUDES "customer") ∧ (RELATION ?part USES-MECHANISM ?mechanism) ∧ (ATTRIBUTE "Name" OF ?mechanism INCLUDES "internet") ∧ (RELATION ?part HAS-EXCEPTION ?exception) ∧ (ATTRIBUTE "Name" OF ?exception INCLUDES "unwanted") ∧ (ATTRIBUTE "Name" OF ?exception INCLUDES "solicitation") ∧ (RELATION ?exception IS-AVOIDED-BY ?handler) ∧ (ATTRIBUTE "Name" OF ?handler INCLUDES "opt-out") ∧ (ATTRIBUTE "Name" OF ?handler INCLUDES "list")

Example 4: Transformation of "Which sales process informs its customers over the internet and avoids unwanted solicitations with an opt-out list?"

For the non-trivial query presented in Example 4 the database contained four correct answers. Our NLP query interface found three correct answers, missing one. The TFIDF-ranking found the correct answers at the 2nd, 35th, 47th, and 183rd positions. The simple keyword matcher returned no answers as the conjunction of all keywords overconstrained the query. This example indicates that our approach – while maintaining natural language simplicity – provides a performance akin to logic-based retrieval engines that usually outperform precision and recall of keyword engines.

5. Limitations of Our Approach, Future Research, and Related Work

We can think of three limitations to the work presented in this paper. First, the use of a controlled language imposes a cost on the user since the language has to be learned. Users might be discouraged from employing a language they have to learn, but experience with ACE – and with other controlled languages such as Boeing Simplified English [Wojcik 2004] – has shown that learning a controlled language is much easier than learning logic, and takes only a couple of days for the basics and 4-6 weeks for full proficiency. Furthermore, some researchers are currently developing query interfaces that will help people to write correct controlled English sentences by guiding them as they write [Schwitter et al. 2004].

Second, our current prototype requires some manual adaptation of the rewrite rules when using it with a new ontology or new knowledge base. Given our experience with hand-adaptation, we found that most of the time an inspection of the meta-model was sufficient, and we believe that the rules could be automatically generated based on the ontology structure.

Last but not least, the exemplary evaluation shown in this paper is clearly limited and can only provide an idea of the potential of this approach. Consequently, the approach needs to be thoroughly evaluated. This evaluation should include giving people retrieval tasks and comparing their performance using our front-end with respect to other semantic web query tools based on plain logic, query by example, etc. Furthermore, we would have to investigate how people's retrieval performance is related to their background.

We did not find any other application of controlled natural language querying of semantic web content. Furthermore, we found that work on natural language interfaces to data bases (not ontologized knowledge bases) has largely tapered off since the 80's [Androutsopoulos et al. 1995], even though the need for them has become increasingly acute. The most closely related work we found is the PRECISE project [Popescu et al. 2003] that proposes a natural language interface to relational databases. PRECISE uses a data-base augmented tokenization of a query's parse tree to generate the most likely corresponding SQL statement. It is, consequently, limited to a sublanguage of English, i.e. the language defined by the subject area of the database. In contrast, our approach limits the possible language constructs and not the subject domain. Obviously, our front-end will not return any useful answers when none can be found in the ontology. It will, however, be able to generate an appropriate PQL statement. We hope to be able to include an empirical comparison between the two approaches in our future work.

The approach presented in this paper is clearly in its infancy. While ACE has been under development for many years, the ontology-based transformation rules are very new. Nevertheless, we believe that people's familiarity with natural languages might be the key to simplify their interaction with vast ontologies and that our approach, therefore, has the promise to provide an important step in bridging the gap between the semantic web and its users.

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SWAP - A Framework for Ontology Support in Semantic Web Applications

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Abstract
We present SWAP (Semantic Web Application Pyramid), a framework for incorporating ontologies in data-oriented semantic web applications. We have implemented this framework with a measurement ontology for a quality management web service. This quality management web service is built on top of a set of XML web services implementing agents representing quality management clients, quality management servers and vendors. SWAP facilitates data exchange between these web services with vendor data stored in databases, and the processing of the data using a combination of RuleML and SQL. The testbed implementation demonstrates the feasibility and scalability of the framework for any type of three-tier ontology-based semantic web applications involving low to moderate data exchange. We discuss methods for improving this framework for high data exchange volumes as well. The primary contribution of this framework is in the component-based implementation of real world semantic web applications.

1 Introduction

The semantic web, introduced by Berners-Lee [1] opens the door to intelligent web applications. The concept of the semantic web is still evolving, and needs the integration of several key technologies such as databases, XML web services, and rule processing. We present SWAP (Semantic Web Application Pyramid) - a framework with a three-tier architecture for developing semantic web applications, with or without agent technology, and possible integration to databases. To demonstrate the applicability of this framework, we use a measurement ontology to create a quality management web service for the semantic web using this framework. Thus this paper serves the dual purpose of presenting the SWAP framework as well as its prototypical application. The rest of this paper is organized as follows: in Section 2 we explore some background in quality management, measurement ontologies and semantic web architectures. Section 3 presents the measurement ontology that we use. Section 4 presents the SWAP framework and the process of integrating databases into the framework. Section 5 describes experiments with the framework, in particular our testbed application using the presented measurement ontology. Finally we conclude in Section 6.

2 Background and Literature Review

Because of the length restriction, a full-length literature review is not included in this article. The primary background of this paper is in software development protocols, and not simply ontology mediation, so here we summarize some of the current efforts in software development protocols for the semantic web, and on the development of quality measurement ontologies.

Application protocols for semantic web is not a highly researched topic. The most important problem in this domain which is actively researched is metadata management. Shah and Seth [10] propose a model for managing metadata in a distributed environment. Interoperation across ontologies is also heavily researched and implemented (see e.g., [9]). We concentrate on a framework for appropriately and meaningfully distributing both data and meta-data in SWAP, thereby creating a full environment where distributed semantic web applications can be developed. OWL (Ontology Web Language) [11] is the culmination of W3C

and other researchers' efforts at developing a standardized ontology language for the semantic web. SWRL (Semantic Web Rule Language) [6] combines the frame-based approach to knowledge representation of OWL with the rule-based approach of RuleML (Rule Markup Language) [2] for the semantic web. Unfortunately, automatic inference engines explicitly for these ontology languages are not as well-developed as XML query engines [8], thus making the use of a hybrid approach such as SWAP pragmatic.

Though not specifically designed for the semantic web, there are ontologies that support day-to-day business decisions such those made for quality control. These ontology-based enterprise modeling projects are the Enterprise [12] and TOVE [3] projects. The Enterprise Ontology is comprised of ontologies of activity, time, organization, strategy, and marketing. A "building block" approach is taken in the TOVE project to construct ontologies of higher-level core concepts such as product, activity, state, causality, and time, resource collectively called the activity-state ontology [4]. A fundamental domain necessary to execute ontology-based web services is measurement, and a measurement ontology is built from the TOVE core ontologies. Though other measurement ontologies do exist (e.g., [5]), they are not developed to support enterprise activities as would be required for quality management web services.

3 The TOVE Measurement Ontology

For the purpose of our quality management case, we use the TOVE measurement ontology [7]. The TOVE measurement ontology is designed explicitly with quality control in mind, rather than only the basic process of measurement. A complete discussion of the ontology is out of the scope of this paper, here we only present some of the most important terms and axioms.

	Expression	Description
Term-1	$quality\_requirement(Qr)$	Qr is a quality requirement
Term-2	$measured\_attribute(At)$	At is a measured attribute
Term-4	$has\_sample\_sizing(At, Sz)$	Measured Attribute At has sample sizing plan Sz
Term-8	$has\_unit\_of\_measurement(At, U)$	At is measured using unit U
Term-9	$measuring\_resource(R)$	Measurement performed by resource R
Term-10	$primitive\_measure(A)$	A is a primitive measure activity
Term-11	$measure(A)$	A is primitive or collection of primitive measure activities
Term-12	$inspect\_and\_test(A)$	A is an inspect and test activity
Term-13	$measurement\_pt(Rt, At, Mp, Tp)$	Attribute At of a batch Rt measured using measurement point Mp at time point Tp
Term-14	$conformance\_pt(Q, Rt, At, Tp)$	measurement of attribute At of a batch Rt taken at time Tp shows that the batch conforms to the quality requirement Q.
Term-15	$nonconformance\_pt(Q, Rt, At, Tp)$	as above, does not conform
Term-16	$conforming\_quality(X, Qr)$	X has a quality requirement Qr

Table 1: TOVE Measurement ontology - salient terms and axioms

TOVE Measurement Ontology terms are defined with propositions (or boolean terms) from the TOVE Core Ontologies. The TOVE measurement ontology consists of 19 core terms, 16 terms and 3 axioms. Table 1 shows some of the main terms and their descriptions.

4 The SWAP Framework

One of the most crucial parts of a semantic web application is the automation of the processing of ontologies. We now present an architecture that supports one way of processing ontologies in a semantic web application. This framework also has a three tier structure as shown in Figure 1.

1. The top tier is the client tier, consisting of clients or client agents, which are capable of sending requests to the next tier. Clients can be users interacting with a user interface, or automated intelligent software agents (ISAs). At this tier, clients pose queries using client ontologies and submit them to the next tier.

2. The next tier is the ontology processing tier. This tier uses the ontology, as well as any available mapping techniques to process the queries coming from the client tier. All rules and axioms are available at this layer for processing. Facts are retrieved as needed by sending appropriate queries to the data layer. The retrieved facts can then be processed for the purpose of answering the client queries.
3. The data layer consists of all the facts included in the knowledge base. The ontology processing layer decides on which facts need to be retrieved, and sends appropriate queries to the data layer. The queries are processed at the data layer using any necessary mapping methods, and resulting facts are sent back to the ontology processing layer.

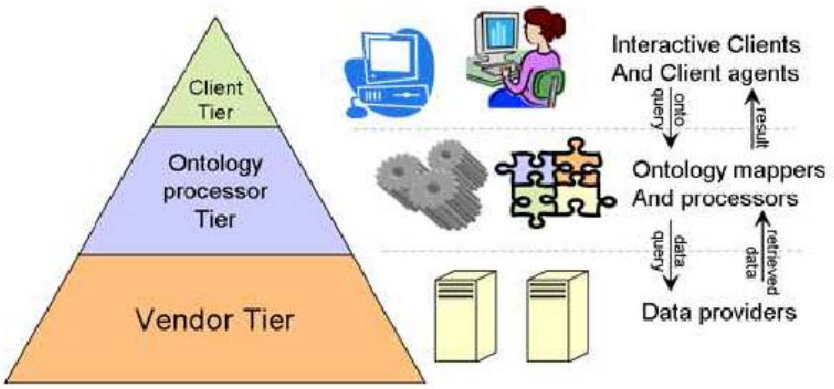

Figure 1: The SWAP pyramid showing the client, ontology and data layers, and the quality management

As an illustration of the above framework, let's consider a simple ontology for processing family trees. This sample ontology consists of a single class Person, having properties hasSex, and hasChild. Represented in a prolog-like format, a sample set of facts and rules in this ontology are shown in Figure 2:

```
Person('Joe').
hasSex('Joe', 'male').
Person('Jill').
hasSex('Jill', 'female').
hasChild('Joe', 'Mike').
hasChild('Jill', 'Mike').
Person('Mike').
hasSex('Mike', 'male').
hasChild('Joe, 'Lucy').
hasChild('Jill', 'Lucy').
Person('Lucy').
hasSex('Lucy', 'female').
Person('Tim').
hasSex('Tim', 'male').

Father(X,Y) :- hasChild(X, Y), hasSex(X, 'male').
Mother(X,Y) :- hasChild(X, Y), hasSex(X, 'female').
Spouse(X,Y) :- hasChild(X, Z), hasChild(Y, Z).
ancestor(X,Y) :- hasChild(X,Y).
ancestor(X,Y) :- hasChild(X,Z), ancestor(Z, Y).
descendant(X,Y) :- ancestor(Y,X).
```

Figure 2: A simple Family Tree Facts and Rules

In our framework, the client will issue a query such as ancestor(X,'Mike'), and would expect a response from the ontology processor returning all possible substitution for the variable X. The ontology processor has all the rules, and the data tier has all the facts. During the processing of the rules at the ontology processor, whenever facts are needed, they are retrieved from the data tier. For example, in processing the above query, the system will need to send the following fact queries to the data layer: (i) hasChild(X,'Mike'), (ii) hasChild(X, 'Joe') and (iii) hasChild(X, 'Jill').

4.1 Integrating Databases

In the above discussion, we have not made any specific assumption about the data tier. Typically organizational data is stored in relational databases, and agents in this tier would need to translate the fact retrieval queries into SQL. This process is fairly trivial, since a fact retrieval can be translated into SQL by simply placing constants in the query in the WHERE clause of the SQL statement. For example, in the above example, a fact retrieval such as hasChild(X,'Mike') translates to the SQL query SELECT * from hasChild WHERE col2='Mike' (assuming that the database has the hasChild stored in a table hasChild with columns col1 and col2).

Integrating databases into the data tier enables the use of database query optimization techniques to speed up the retrieval of the facts, which helps in the overall performance of the system in general. As shown in the measurement ontology case above, the use of multiple agents at one or more levels also increases the scalability of the system. Databases can be distributed over different agents and can be merged during the post retrieval process. All of these advances are possible because of the separation of the different tiers, enabling a form of data independence in semantic web applications.

5 Experiments with the SWAP Framework

We have implemented the SWAP Framework on several ontology-based applications, including test applications like the simple family tree ontology above, as well as a complex quality management web service using the measurement ontology discussed above. Here we describe our primary prototype case with a quality management web service.

5.1 A Quality management web service using SWAP

A prototype application for simulated quality mediation between organizations has been developed, completely using SWAP. The readers should note that the functionality of the mediation system was less critical than the applicability of SWAP in its development, and as a generalized semantic web application development protocol. In this section, we present a scenario that explains how the ontology and data queries flow between the different layers. In the prototype system, we implemented all the SWAP layers using agents implemented using J2EE web services, with two independent producer agents comprising the data tier, the customer agents at the client tier, and the QM agent is at the ontology tier.

Information flow between SWAP Layers First the customer agent sends the quality requirements for a receiving product to the Quality Management (QM) agent. The QM agent then classifies and stores these requirements along with other customers. The QM agent can then play the role of a third-party responsible for independent quality auditing, assurance, and control for the customer, automatically working with producer agents to ensure compliance to quality requirements. The following provides a detailed excerpt of this scenario.

1. The customer agent, org1, sends its quality requirements to the QM agent, qm0:
   `agent_sends(org1,qm0,q_requirement_bundle_from_org1).`
   `q_requirement_bundle_from_org1` is a pointer to a hierarchy of quality sub-requirements.

2. *The QM agent represents a hierarchy of requirements in the following exemplar way:*
   `quality_requirement(q_requirement_bundle_from_org1),`
   `has_requirement(q_requirement_bundle_from_org1,qreq1),`
   `has_requirement(q_req1,q_req1_1).`

3. If a requirement has no sub-requirements, e.g. q req1 1, then the QM agent translates the contents of the requirement in the following exemplar way
   `primitive_requirement_measures_attribute(q_req1_1,widget_length),`
   `has_standard_value(widget_length,15),`
   `has_specification_set(widget_length,[14.5,15,5]),`
   `has_unit_of_measurement(widget_length,cm).`
   Standard value is akin to mean; specification set, tolerance specifications.

4. These requirements are sent to producer agents, and results of their quality control measurements are sent back to the QM agent:
   `measurement_point(batch22,widget_length, 14.8,10)`, where 14.8cm is the value of the measurement and 10s the time of measurement.

5. Each measurement point is assessed by the QM agent as a conformance or nonconformance point, *e.g.* `conformance_pt(q_req1_1,batch22,widget length, 10)`. Reports of conformance are sent to the customer agent for immediate action or periodic reporting.

6 Conclusion and Future Work

As shown in the quality management web service, the framework can be easily augmented with agents to automate the process of exchange and retrieval. These experiments show the applicability of this framework as a generalized method for implementing semantic web applications, with or without major data retrieval tasks. We believe a generalizable framework for ontology and data-oriented semantic web applications is a basic necessity for efficient and organized development, and SWAP is an ideal step towards that direction. The SWAP layers can be extended and merged to fulfill most multi-tiered business applications using ontologies and web service integration. Detailed analysis of merging layers in SWAP for different business needs is part of the ongoing and future research. We intend to develop other testbed applications using SWAP, and run empirical studies to determine its effectiveness.

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IST Priority

Strategic Objective 2.4.7:
Semantic based Knowledge and Content Systems

An overview of the current call. Further information, including PPT presentation, overview of ongoing projects etc. at http://www.cordis.lu/ist/directorate_e/kmcc/index.htm

Editors Note:

Since in Europe this period is open the relevant to SW call, we decided instead of presenting a SW center, to provide for the international SW research community the Technical Document of the relevant IST Call for R&D projects.

Many thanks to Roberto Cencioni, Head of division, INFSO/E.2, Knowledge and Content Technologies

email: roberto.cencioni@cec.eu.int

Dear Roberto I am wishing you all the best from my soul and also wish the final selection of projects to promote the European Vision for the Semantic Web.

Best

Miltiadis

Technical background

1. Knowledge and Content Technologies in the EU's sixth Framework Programme

Knowledge and content technologies are intertwined research themes covered under the *Semantic-based Knowledge and Content Systems* Strategic Objective (SO) of the Information Society Technologies (IST) Priority, a major component of the sixth Framework Programme (FP6).

Council Decision adopting a specific programme for research, technological development and demonstration: "Integrating and strengthening the European Research Area):

(iv) Knowledge and interface technologies

The objective is to improve usability of IST applications and services and access to the knowledge they embody in order to encourage their wider adoption and faster deployment. Integration issues related to multimedia research technologies will also be addressed.

– Knowledge technologies and digital content: The objective is to provide automated solutions for creating and organising virtual knowledge spaces (e.g. collective memories, digital libraries) so as to stimulate radically new content and media services and applications. Work will focus on technologies to support the process of acquiring and modelling, navigating and retrieving, representing and visualising, interpreting and sharing knowledge. These functions will be integrated in new semantic-based and context-aware systems including cognitive and agent-based tools. Work will address extensible knowledge resources and ontologies so as to facilitate service interoperability and enable next-generation semantic web applications. Research will also address technologies to support the design, creation, management and publishing of multimedia content, across fixed and mobile networks and devices, with the ability to self-adapt to user expectations.

2. Current status within IST

Broadly speaking, the **IST Work programme for 2005-6 aims to continue the main research lines** of WP 2003-4, albeit with some **focusing of activities**, yet driving the ongoing convergence of knowledge, semantic and digital media technologies. This SO will call for project proposals under the 4th IST call. Successful submissions are likely to lead to contracts effective from January 2006.

The first two IST calls for Knowledge and Content RTD yielded 33 projects totalling around €137M (EU funding). The first projects began work in January 2004. Many will continue until the end of 2007, while others will deliver results towards the end of 2005. Most of the projects from the second call were underway by October 2004, with a typical duration of 3-4 years. Refer to http://www.cordis.lu/ist/directorate_e/kmcc/index.htm for more details regarding the projects and the research topics they address.

It is expected that the calls launched in 2005-6 will lead to fewer, more ambitious endeavours. The SO budget envelope for the 4th call is in the region of €110-120M.

New proposals should avoid repeating the tasks of **ongoing projects** and aim to progress beyond, or at least complement, topics covered in projects resulting from the first two calls of FP6.

Considering the comprehensive portfolio of projects likely to result from FP6 calls, significant progress in the field is expected by the end of the decade.

3. Work Programme 2005-6 - Consultation process and update

In the IST Work programme for 2003-4, knowledge and content related research themes were presented under the SOs '*Semantic based Knowledge Systems*' and '*Cross-media Content for Leisure and Entertainment*'. To prepare for the second phase of the implementation of the IST priority, it was decided to re-assess the work programme, based on progress to date in terms of response to calls for proposals, an assessment of possible changes to market conditions and requirements, as well as the progress of ongoing scientific research. The work programme was assessed with the help of external experts in a broad consultation process addressing all IST SOs.

The recommendation of the consultation was that the Knowledge SO be fine-tuned, with emphasis on **(i) knowledge acquisition and modelling and (ii) knowledge sharing and use**. Particular emphasis was placed on

a. **achieving a higher level of analytical and interpretative capability across all content types** (text, still and moving images, audio, n-dimensional objects…), and

b. semantic-based systems facilitating inter-organisation knowledge sharing and collaboration.

Thus, the proposed directions for the second phase of FP6 would ensure a high degree of continuity with regard to ongoing actions arising from the earlier calls, while stimulating ambitious proposals to address even more advanced S&T challenges.

With regard to Content RTD, a **longer-term paradigm** addressing **intelligent, self-descriptive, user/context aware and adaptive content objects** was identified as being very promising. This will drive the move towards radically **new, all-digital forms of content** (video, audio, n-dimensional, etc.), **for all media and contexts of use.**

As content and knowledge are clearly inextricably linked, it was subsequently decided to merge the Knowledge and Content SOs into **a single SO**, '*Semantic-based Knowledge and Content Systems*'. The 2005-6 Work programme text for the combined SO is closely based on the outcome of the above-mentioned consultation.

4. European perspective

Semantic-based systems cut across many socio-economic domains and are fundamental to **knowledge intensive sectors**, which include some of Europe's key industries – manufacturing, including automotive and aerospace, engineering, chemical and process industries, pharmaceuticals, financial sectors, media and telecoms as well as other important areas such as scientific Research, eGovernment, eHealth etc. There is clearly a window of opportunity to exploit knowledge technologies in these sectors where Europe already has a leading position, in order to gain a real **competitive advantage** and improve the **quality of life** for Europe today and in the future.

EU funded research aims to leverage Europe's skills and vast wealth of knowledge resources and to encourage European industries to play a full and competitive part in developing knowledge-based services. The added-value in European research is typically in stimulating technologies and systems which are suited to the multi-cultural and multi-lingual European markets, and to the high expectations of European users.

In Europe there is a further need to promote a **critical mass of interdisciplinary research**, to avoid the risk of over-fragmentation. Collaborative efforts will help to create new alliances in Europe in key emerging areas like advanced Web services and semantic-based infrastructures. In this respect, the participation of **industrial stakeholders –** technology providers, ICT suppliers and integrators, content providers and especially **leading edge users** is vital.

5. Research aims and focus for 2005-6

The Semantic-based Knowledge and Content Systems SO is aimed at the **intersection of WWW, Multimedia, Semantic Web and Web Services domains.** Semantic-based methods are seen as a means for providing complex and yet flexible, interoperable services and applications.

The overall objective is to develop semantic-based and context-aware systems to acquire, organise, share and use the knowledge embedded in web and multimedia content, information holdings of all media types, or processes which are driven or supported by ICT systems.

Research will aim to maximise **automation** of the knowledge lifecycle and to achieve **semantic interoperability** between **heterogeneous information resources and services**, **across content types** (such as text, still and moving images, music) **and natural languages**. The intention is to dramatically improve access to, sharing and use of information **by humans** as well as **by and between machines.**

Moreover, a visionary, strategically important opportunity exists to pioneer **intelligent content**, which will be self-describing, adaptive to context, and exhibit a seamless interaction with its physical and digital surroundings, and the user. Challenges relating to the ongoing **convergence of content and knowledge** with metadata based systems and processes for all-digital content creation and management will also be addressed.

5.1 Approach

This SO is mostly centred around **medium- to long-term research with relatively short-term by-products**. Emphasis is on

a) **enabling technologies and middleware**, and

b) **application platforms and architectures** which are portable across domains.

Foundational research ***is also recognised as being extremely important and is expected to target, for example, formal theories, models and languages for networked knowledge representation and reasoning, modelling of context, and the intelligent content paradigm.***

The strategy, therefore, is to undertake the necessary foundational and component-level research on the one hand, and to test and prove technology and components in representative demonstrators and broadly based test-beds, addressing functionality and usability, robustness and complexity, scalability and ease of customisation on the other. **Emphasis should be placed on the user** (enterprise, institutional), particularly with regard to **hiding complexity** and developing intuitive information interfaces. These large-scale, though relatively short-term (3-4 year) efforts must demonstrate the effective deployment of semantic technologies in support of demanding users, using realistic, large-volume data sets from information bound sectors including (e-)business, manufacturing, digital media, e-science as well as other economically important fields with high growth potential.

Test-beds will play a critical role in proving the technical feasibility and socio-economic / organisational impact of knowledge systems in the provision of adaptable and context-aware services in support of planning and problem solving, automated diagnosis and decision-making. The tools and methods developed should likewise help to promote semantic interoperability and exchange between systems and services and shift focus towards dynamic knowledge and active content. They are expected to provide a solid basis for further integration and customisation to functional systems in support of **e-commerce (B2B), information / content management, enterprise application integration, decision support in business and scientific discovery.**

5.2 Research themes

The research focus is on three main themes:

a) Knowledge acquisition and modelling,

b) Knowledge sharing and use,

c) Exploring and bringing to maturity the intelligent content vision.

5.2.1 Knowledge acquisition and modelling

Knowledge acquisition and modelling, capturing knowledge from raw information and multimedia content in webs and other distributed repositories to turn poorly structured information into machine-processable knowledge. Instruments: IPs, NoEs, STREPs

The first research theme of this SO deals with new ways to model and formally represent knowledge about real-life objects and processes. This theme encompasses basic research, knowledge infrastructure (especially ontologies) and automated information / content analysis techniques. It addresses the capture of knowledge from raw information and multimedia content in webs and other distributed repositories, adding semantics to turn information into machine-processable knowledge.

Emphasis is placed on progressing towards a **comparable level of analytical and interpretative capability within and across content types** (still and moving images, music and broadcast news, n-dimensional objects e.g. 3D) as currently exists for text. In an expanding European Union with additional languages and cultural preferences**, cross-lingual approaches** are highly important.

The emphasis of this research theme is not just on semantic web(s). In this context, however, it should be noted that the favoured approach is to target **sectoral semantic webs –** i.e. collective knowledge spaces within a given domain or community – as opposed to a grand, universal Semantic Web. Likewise, the emphasis is on useable solutions, even if these may be 'imperfect'.

Foundational research will typically address formal models and languages for representing static and dynamic knowledge, including the semi-automatic creation of ontologies and their maintainability, extensibility and evolution, emphasising data-driven approaches, as well as interoperable ontologies.

Component level research will address methods and tools aimed at higher levels of information harvesting, including automated knowledge discovery, metadata extraction, annotation and summarisation, concept based and contextual retrieval of all types of digital content, paying due attention to cross-media and cross-lingual aspects. Pushing the boundaries **beyond text-based analysis** will pave the way for e.g. seamless cross-media search. Where appropriate, work should build on and re-use existing technology, improving and recoding where necessary, with a view to **integrating project results within larger systems and applications.**

Considering the emphasis placed on integration within larger / complete systems, priority will be given to open architectures or alternative approaches ensuring seamless **interworking between components or across sub-systems.** In the interests of maximising the impact of the research programme as well as driving the adoption of the technology, consortia must commit to making project results (architectures, tools and interfaces) widely available – including as open source, via appropriate licensing agreements – as part of a well-defined **dissemination and exploitation plan**.

5.2.2 Knowledge sharing and use

Knowledge sharing and use, combining semantically enriched information with context to provide actionable meaning, applying inferencing and reasoning for decision support and collaborative use of trusted knowledge between organisations. Instruments: IPs, NoEs, STREPs, SSAs

The second research line covers knowledge sharing and use within collaborative systems and workflows, combining **semantically enriched information** with context to provide **actionable meaning** and related problem solving/decision support functionalities. Such systems will apply inferencing, reasoning and machine learning techniques for decision support and the collaborative use of trusted knowledge between organisations. Research will aim to allow improved (smarter, faster, more accurate) access to information of all sorts for and by **humans** as well as for and by **machines.**

Adding semantics to data will allow improved integration of data interoperation between information systems – including 'legacy' data – **within distributed communities and between organisations**. An additional challenge is to develop models for representing and handling evolving (i.e. non-repetitive) **processes, workflows and contexts,** moving **from static to dynamic knowledge** and to actionable meaning.

Current** Web Services **require interaction between humans and computers. Semantic-based methods and techniques, e.g. adding semantics to assist with service description and discovery, are seen as a means for delivering complex yet flexible, automated services. Likewise, semantic-based methods are also seen as a scaleable and cost effective solution to the problem of enterprise application integration.
*Possible application areas **include improved access to and use of corporate content, digital libraries and audio-visual repositories, business intelligence and product data, scientific experimentation and discovery.***

Foundational research will address the semantics of evolving, dynamic processes and computational models for context of use with the aim of progressing **from mere data interoperability to flexible service-level interworking**. Research will help advance the state of the art in the fields of reasoning, inferencing and machine learning over large volumes of distributed, incomplete and often conflicting data. Research will address how to extract and exploit knowledge in processes, as well as modelling the process itself. Processes might include routine operations between different systems within an organisation as well as more complex, bespoke operations involving specification, negotiation, contracting, invoicing etc. within and between organisations.

Component- and system-level research will help to bring existing and emerging technologies to maturity, integrating them to create **semantic-based collaborative services**, and leading to scaleable platforms to manage, search, share, personalise, present and exploit complex knowledge spaces that cross the boundaries between organisations or communities. Work will include new strategies and innovative combinations of components which challenge, complement or improve established approaches.

While this research theme makes room for foundational research, it is primarily geared towards **integrative scenarios (test-beds)** intended to address issues such as performance, reliability, scalability and user acceptance, as well as data- and service- level interworking between organisations and communities. The

overall aim is to stimulate **cross-disciplinary partnerships** leading to **large scale experimentation** demonstrating technical and organisational feasibility as well as cost effectiveness and replicability.

Clearly, this emphasis on integrative scenarios means that **several or all research themes of the SO can be covered by the most ambitious projects.** The desired result is robust, scaleable solutions which are portable across key application domains in industry, trade, science and society at large.

5.2.3 Exploring and bringing to maturity the intelligent content vision

Exploring and bringing to maturity the intelligent content vision, whereby multimedia objects integrate basic content with metadata and knowledge about users and contexts. These objects will learn to react to different stimuli and pro-actively interact with agents, devices and networks, and with each other. They will have the ability to seamlessly aggregate to create new content and services tailored to user needs. Instruments: IPs, STREPs, SSAs

The third research theme provides a visionary (beyond 2010) path towards **radically new forms of content** of all types (audio, video, n-dimensional etc.), **for all media and contexts of use** (commercial, organisational, educational etc.) whereby multimedia objects integrate content proper with metadata and semantic descriptors as well as knowledge about users and possible contexts.

These **self-describing objects** will learn to react to different stimuli and pro-actively interact with agents, devices and networks and with each other. They will communicate with the user as well as with digital and physical surroundings. They will have the ability to seamlessly aggregate to create new content and services for which the traditional boundaries of different media cease to exist. Knowledge will be created while content is created, within a **unifying framework** suitable for a variety of scenarios (e.g. multimedia corporate content as opposed to commercial audio-visual assets).

Research issues include processors for intelligent content objects; systems that can be used to model and execute complex workflows including content of any type; content rendering engines capable of presenting a movie or a CAD object in a single environment.

Foundational research will focus on content representation and architectures and how such objects can be: created, including collaborative authoring and automated generation / extraction of metadata as content is created; managed e.g. combined by means of automated workflows; personalised and rendered for different users and multiple platforms; exchanged and traded with adequate efficiency and trust. Consideration will be given to user control as well as to content protection. *Component-level research* will provide proof-of-concept methods and tools for creating, aggregating and communicating such objects, within a unifying framework supporting different content types, across heterogeneous platforms and networks, in representative domains.

A prerequisite for the intelligent content paradigm is rich, 'annotated' content. The overall aim is indeed to trigger a content / knowledge convergence process by investigating and pushing further 'smarter' content, to progress toward object based workflows.

System-level work should therefore focus on **metadata based systems and processes** aimed at realising content adaptable to different users and formats. Promising scenarios include full digital audio-visual production technologies and processes for interactive digital broadcasting including digital cinema and next-generation television, as well as programming adaptable to different audiences, formats and delivery channels. The creative re-use and exploitation of audio-visual resources beyond the original purpose is also included. In particular, priority will be given to research addressing the move from temporal to data based content production, and to novel approaches to user control as well as digital asset and production management.

5.3 Types of research

As already mentioned, three broad categories of activity are encouraged: *foundational research; component-level research and development; system-level integration and validation.*

All research and development work should address issues such as modelling of user information behaviours and how to** hide complexity **from the non-expert user. Projects should maximise cross-fertilisation between approaches and disciplines, promote** open architectures **and help build** shared infrastructures **for research and training purposes, as well as for technology assessment and benchmarking.

Work must also promote **consistent stacks of standards** for semantic interoperability between Web services, and for data and process descriptions, bringing closer together multimedia coding, metadata and semantic Web standards and protocols.

Broadly-based ***foundational research*** **is expected mainly under research themes 1 and 3** and will aim at advancing new formal models, methods and languages for knowledge representation and reasoning under uncertainty, to make them more powerful, flexible and durable. Methods and techniques should ensure interoperability or mapping between ontologies, including multi-lingual and multi-cultural aspects and how natural languages can be mapped to ontologies, as well as catering for semi-automatic creation, extensibility and long-term maintenance of ontologies (the ontology lifecycle).

Foundational research will be measured on the basis of its innovation and degree of uptake by the research community, where the metrics of the scientific peer system will apply. Infrastructure research will be measured in terms of its contribution to enabling (a) new, advanced applications and (b) broader collaborative research endeavours.

Component-level research **is also most relevant to research themes 1 and 3** and should address the functionality of semantic-based systems by developing a new generation of component technologies for supporting the knowledge/content lifecycle, i.e. for operations needed to acquire and represent, analyse, annotate, (re-)organise, browse, filter, process and visualise objects and resources of all media types.

A long-term, but critical, objective is to achieve the same level of functionality across different data and media types, improving access to information – for humans and machines alike – and the functionality of content 'search and categorisation' applications.

Components should be task-oriented and should break new ground, for example in the media types and formats they address, and be scaleable in their degree of sophistication. Components must be able to fit into broader reference architectures and/or be easily integrated into diverse application scenarios.

STRPS which develop specific components in support of more ambitious efforts undertaken by IPs (cf. section 6. below) would be welcomed. Likewise IPs which develop components to be integrated into scaleable platforms, demonstrators, working systems are also foreseen. In some cases it will be appropriate to exploit components as open-source shareware packages or as development toolkits available to related projects and the wider research community.

Component-level research will be measured in engineering terms by comparison with the state-of-the art. Tools developed will need to perform significantly better than their predecessors (i.e. faster, more exhaustive, more cost-effective, robust and flexible) and have a high potential for wide-scale integration into operational systems.

System-level integration **is intended mainly – though not exclusively – for research theme 2** and will aim to tie together methods and components into innovative (i.e. beyond the state of the art) end-to-end systems and services, with a view to demonstrating their technical feasibility, usefulness and impact in real-life environments.

Research will address performance and effectiveness issues, including ease of integration into the working environment, degree of customisation and impact on information flows and work processes. User acceptability and the need for training of users will also be addressed. Where appropriate, projects will tackle the problem of managing a principled migration from 'legacy' methods and techniques.

They will stress collaborative methods for knowledge acquisition, management and use, smart portals and other approaches for supporting networked organisations and virtual communities of practice. Target applications will have a strong **multi-sectoral potential** and cater for **leading-edge users**.

Regardless of the application sector, system test-beds and demonstrators should target a **specific user profile** – either the executive, the engineer, the scientist, the analyst or the content/media producer. **Proposers should clearly indicate which profile they address.**

Test-beds will prove the successful integration of component technologies into robust, performant and scalable systems in representative domains, which are readily transferable to other key sectors. Such test-beds should be:

- ambitious, yet realistic, and address solutions to challenging problems,
- based on highly representative and potentially transferable sectors,

- feature leading-edge user organisations in the consortium to ensure strong user drive and feedback,
- include an in-depth user requirements phase,
- use real or very representative, realistic data for validation purposes,
- be intuitive, operating seamlessly and transparently, and hiding complexity,
- deal with more than one content type e.g. text and images,
- address a complete end-to-end system or process, or a meaningful subset thereof,
- ensure interoperability with widely accepted industry standards to cater for legacy data and existing popular platforms,
- clearly demonstrate technical feasibility and commercial / operational benefits.

System-level research will need to show outcomes beyond the scientific and technical results, typically in its practical impact on the target user groups and wider sectors of industry and society. What direct effect does it have on users? Is user acceptability and usability higher? Potential economic or social impact? Ease of integration and customisation, enhanced functionality – leading to improved efficiency and productivity gains? Will it demonstrate the benefits – and therefore contribute to widespread acceptance and take-up – of semantic-based approaches?

5.4 Specific supporting activities

The above RTD work will need to be supported by a set of measures, either (a) dedicated Specific Support Actions (SSAs) supporting the Strategic Objective's research programme as a whole or (b) within individual projects. They will essentially aim at:

- **standards** and their take-up: monitoring and critically assessing existing and emerging standards at the intersection of Multimedia, WWW, Semantic Web and Web Services areas, providing guidance on the most appropriate set(s) for the purpose of designing and implementing complex systems,
- **convergence**: monitoring, exploiting and where appropriate driving convergence with other research areas such as Grid technologies, where there is scope to develop common approaches, standards and architectures,
- **user aspects**: broad user issues including awareness and user/supplier dialogue, usability guides and best practice, training of leading-edge users, data protection and privacy, etc.,
- **market factors:** identifying and understanding drivers and inhibitors for the uptake and deployment of new technologies, market trends and technology foresight, new business and revenue models, opportunities for global co-operation.

Note, however, that opportunities for SSAs will be limited.

6. Relating research efforts to Instruments

Specific Targeted Research Projects (STRPS) are particularly suited to **high-risk endeavours**, breaking new grounds, with high potential rewards. They are also appropriate for component-level research for particular domains.

Integrated Projects (IP) are the preferred instruments for **system-oriented efforts** and medium-term activities. IPs are expected to encompass all stages of the research and development lifecycle, where appropriate cutting across research themes and addressing system-level integration and validation in realistic scenarios.

Networks of Excellence (NOE) are expected to be used for the longer-term activities e.g. related to new research topics where a **critical mass of research** does not yet exist. NoEs should build communities focusing on longer-term, cross-disciplinary research related to knowledge representation and reasoning, and understanding of non-textual information.

Specific Targeted Research Projects should target **single research problems**, especially the development of truly innovative techniques and new approaches to challenging research problems for the medium to long term. **Consortia of 5-8 partners** are likely to comprise partners mainly from academia and public/private research laboratories. Ultimately, however, the skills mix should be dictated by the scientific and technical challenges being addressed.

STRPS are expected to make project results, including source code where appropriate, widely available (e.g. as open source or via appropriate licensing arrangements) especially to organisations and consortia undertaking further research in the area. This is intended to ensure the optimum exploitation (in the broadest sense) of project results and ensure a solid basis for future work.

STRPS are also suitable for the development of system components and domain specific tools, possibly in support of a complementary IP or STRP – including running projects arising from previous calls. Such STRPS would typically be driven by industry, including SMEs.

In general, **STRP projects are expected to be in the €2-4M range of EU funding,** and to last up to 3 years. Larger STRPs may be accepted where a large, focused effort would clearly have particularly high impact. The likely impact and exploitation prospects should be very clearly elaborated in the proposal.

Proposals conceived as part of a complementary set of proposals should make clear reference to each other and specify clearly the expected benefits and synergies of co-operation and especially how such a co-operation would be implemented and managed in practice.

Networks of Excellence **are expected to be in the range of €3-4 M of EU funding**, with a duration of up to 3 years. The favoured approach is to drive integration of somewhat scattered research communities by focusing on a number of specific, longer-term research problems – i.e. engaging in **joint integrative research.** This instrument is potentially a very powerful one, but probably also presents the greatest management challenges. Therefore, a **maximum consortium size of 10-12 partners**, of which 5-6 are the core partners driving the initiative, coupled with a **task-based programme of work** is recommended to ensure the necessary focus.

NoEs will generally be driven by academic research communities but will also cater for **industry and user requirements.** Experience so far has shown that industry is reluctant to participate fully in NoEs. However, all the most promising NoEs in this SO to date do have an industrial advisory board. It is recommended that NoE proposers adopt this approach. NoEs will be inter-disciplinary and include facilities for exchanging and testing both human and knowledge resources (e.g. ontologies, tools and reference architectures, evaluation metrics and data).

Integrated Projects are clearly the most appropriate instrument for **large scale demonstrators** and test-beds. IPs should take on board several, if not all the research types mentioned, plus supporting activities if need be. **IPs are expected to be in the range of €6-12M of EU funding** over a 3-4 year period, without ruling out the possibility of more ambitious endeavours. Larger IPs would have to show very clearly that they will make a definite impact in their target area.

In general, consortia should not be greater than 12 partners, with up to 15 where justified. Smaller scale (i.e. in terms of consortium, duration or funding) IPs can be appropriate in some cases, provided that they are clearly focused on achieving their objectives within a time window which is dictated by outside circumstances e.g. market opportunities.

IPs will bring together a highly complementary mix of researchers with industrial developers as well as SMEs. Typical consortia will include a central core of 4-6 key partners, who are fully committed to achieving and exploiting project objectives. The core partners would probably be involved in all work packages and would demonstrate their commitment by allocating 2-3 full time equivalents (FTE) per year to the project. Additional partners bringing specific skills and complementary expertise or addressing particular issues (technical, exploitation, socio-economic…) are of course welcome.

IPs will necessarily include leading-edge user organisations for user drive and feedback.

Given that many of the challenges surrounding semantic-based systems are as much related to technology adoption as pure S&T issues, **IPs should cover much more than RTD tasks** and should address user requirements, test and demonstration, exploitation and dissemination, resulting in a functional 'system'. IPs should be active in training both within and outside the consortium (e.g. training integrators and launching users), organising dedicated training days, seminars and conference tutorials.

IPs are expected to be highly proactive with a professional approach to achieving a high level of **public awareness** for the project from the outset. They should actively promote and promulgate reference architectures built around coherent stacks of standards.

IPs should focus heavily on **impact and exploitation** of project results acting as catalysts for the wider uptake and deployment of the technology. This includes proactively making project results available within and

outside the consortium – including via open source or by licensing agreements. As a minimum, an IP should make publicly available the proven, system architecture and the outcome of field trials and user feedback.

Overview

Research themes	IP	STRP	NOE	SSA	CA
a) Acquisition and modelling (indicative budget: 35-40 M€)	Yes	Yes	Yes	No	No
b) Sharing and use (45-50 M€)	Yes	Possible	Yes	Yes	No
c) Intelligent content (30-35 M€)	Yes	Yes	No	Yes	No

7. Maximising the impact – Synergies with other projects

Proposals are expected to **complement and/or extend the existing portfolio of projects** funded under this SO, especially those funded under the first and second IST-FP6 calls (see http://www.cordis.lu/ist/directorate_e/kmcc/index.htm), as well as in other closely related Strategic Objectives.

Proposals which intend to cooperate with existing projects to build-on, complement and support ongoing efforts in a genuine effort to improve the overall impact of the research will be welcomed. Similarly, **clusters of complementary proposals** will be considered. Such proposals should explain clearly their expected contribution to sister proposals and detail the implications of such cooperation both in terms of results, impact and resources as well as well as clearly describing the practicalities of managing the cooperation.

In the case of **overlapping consortia** there should be no doubt that the organisations have the necessary human, technical and financial resources to tackle all work proposed. In any case, each proposal will be considered on its own merits and there is no guarantee that all proposals in a suggested cluster would be retained for funding.

8. Who should be involved?

The SO constituency is broad and multi-disciplinary. The added value lies precisely in **cross-fertilisation** between a number of different areas, including knowledge and Web engineering, agent and database technology, multimedia and audio-visual technologies, natural language and image processing, etc.

Software houses, system integrators, user organisations active in knowledge-intensive sectors are expected to be involved in projects aimed at applicative platforms and test-beds. Content creators and aggregators, broadcasters, mobile and broadband operators, equipment manufacturers are likewise expected to participate from the content and media sectors.

Private and public information holdings, digital libraries, scientific databases and audio-visual repositories will all provide rich data sources.

New participants to the programme from academia, research, ICT industry and user organisations are especially welcome. **SMEs and participants from the new Member States** are encouraged to participate in all instruments, and are expected to contribute by using their expertise to bridge the gap between technical solutions and commercial opportunities.

Nevertheless, quality of the proposal (idea, implementation, exploitation etc.) and excellence of the participants will remain the key requirements. Each proposal must illustrate clearly the contribution of each partner in the consortium.

9. Practical information

Which Call for proposals?	Fourth IST Call. **Closing 17.00 hrs 22 March, 2005** http://fp6.cordis.lu/fp6/call_details.cfm?CALL_ID=174
Which area of the Call?	2.4.7 "Semantic-based Knowledge and Content Systems"
IST 2005-6 Work programme	http://fp6.cordis.lu/fp6/call_details.cfm?CALL_ID=174
Application forms and guides	http://fp6.cordis.lu/fp6/call_details.cfm?CALL_ID=174
Proposal evaluation procedure and Model contract	http://www.cordis.lu/fp6/find-doc.htm#evalproc
Ongoing IST projects	http://www.cordis.lu/ist/projects/projects.htm
INFSO.E2 Web site and Call related documentation	http://www.cordis.lu/ist/directorate_e/kmcc/index.htm
EC staff	General enquiries and pre-proposals to: Brian.Macklin@cec.eu.int
Information session and bilaterals with EC staff	Luxembourg, 20 January 2005 Jean Monnet conference complex http://www.cordis.lu/ist/directorate_e/kmcc/index.htm

ANNEX

IST Workprogramme 2005-2006, p. 22-23

2.4.7 Semantic-based Knowledge and Content Systems

Objectives

To develop *semantic-based and context-aware systems* to acquire, organise, personalise, share and use the knowledge embedded in web and multimedia content. Research will aim to maximise *automation* of the knowledge lifecycle and to achieve *semantic interoperability* between heterogeneous information resources and services, across content types and natural languages. To pioneer *intelligent content*, which will be self-describing, adaptive to context and user information needs, and exhibit a seamless interaction with its surroundings and the user.

Focus

1. *Knowledge acquisition and modelling*, capturing knowledge from raw information and multimedia content in webs and other distributed repositories to turn poorly structured information into machine-processable knowledge.

   Foundational research will address formal models and languages for representing static and dynamic knowledge, and develop the methodological and technical base of interoperable ontologies for semantic webs, in sectors as diverse as e.g. manufacturing, e-business, science or geo-spatial information, emphasizing maintainability, extensibility and data-driven approaches. Component level research will address methods and tools aimed at higher levels of information harvesting, including automated knowledge discovery, metadata extraction, annotation and summarisation, concept based and contextual retrieval of *all types of digital content,* paying due attention to cross-media and cross-lingual aspects. Priority will be given to open architectures or alternative approaches ensuring seamless interworking between components and their integration within complete systems.

   Instruments: IPs, NoEs, STREPs

2. *Knowledge sharing and use*, combining semantically enriched information with context to provide actionable meaning, applying inferencing and reasoning for decision support and collaborative use of trusted knowledge between organisations.

   Foundational research will address in particular the semantics of evolving processes and computational models for context of use. Component- and system-level research will yield knowledge and data / application integration technologies enabling semantic-based collaboration services and processes, leading to scaleable platforms to manage, search, share, personalise, present and exploit complex knowledge spaces that *cross the boundaries between organisations or communities*. The overall aim is to develop powerful and yet flexible solutions that are portable across key application domains in industry, trade, science and society at large.

   Instruments: IPs, NoEs, STREPs, SSAs

3. *Exploring and bringing to maturity the intelligent content vision*, whereby multimedia objects integrate basic content with metadata and knowledge about users and contexts. These objects will learn to react to different stimuli and pro-actively interact with agents, devices and networks, and with each other. They will have the ability to seamlessly aggregate to create new content and services tailored to user needs.

   Foundational research will focus on how such objects can be: *created*, including collaborative authoring and extraction of metadata as content is created; *managed* e.g. combined by means of automated workflows; *rendered* for different users and platforms; *exchanged and traded* with adequate efficiency and trust. Due consideration will be given to user control as well as to content protection. Component-level research will provide proof-of-concept methods and tools for creating, aggregating and communicating such objects, within a *unifying framework* supporting different content types, across heterogeneous platforms and networks, in representative use scenarios. System-level work will focus on metadata based systems and processes aimed at realising content adaptable to different users and formats, with a view to enhancing both effectiveness and flexibility.

   Instruments: IPs, STREPs, SSAs

RTD work should address issues such as modelling of user information behaviours and how to hide complexity from the non-expert user. Projects should maximise cross-fertilisation between approaches and disciplines, promote open architectures and coherent stacks of standards, and help build shared infrastructures for research, training and technology evaluation. Ambitious test-beds will demonstrate the successful integration of component technologies into robust, high performance and scalable systems in representative domains, which are readily transferable to other knowledge-intensive sectors.

Instruments: IPs are expected to encompass all stages of the research, where appropriate cutting across the above research lines, and to address system-level integration in realistic scenarios. Foundational and component-level research and discrete solutions for particular domains may also be the subject of STREPs. NoEs should build communities focusing on longer-term, cross-disciplinary research related to knowledge representation and reasoning or understanding of non-textual information. SSAs should address case studies and best practices, and more generally drivers and inhibitors for the deployment of new technologies by early adopters.

Indicative budget: IPs, NoEs: 70%; STREPs, SSAs: 30%

Call information: IST Call 4

REGULAR COLUMNS

In this Issue:

- **Semantic Search Technology Technologies** *by Dr. Peter Alesso*
  In this issue: ***Swoogle: A Semantic Web Search Engine***

- **Semantic Web Technologies** *by Dr. Jessica Chen Burger*
  In this issue: ***A Set of Collaborative Tools for the Semantic Era***

- **[NEW COLUMN] RDF Technologies – Foundations, Applications and Developments** *by Heiner Stuckenschmidt*
  In this issue: ***RDF is not Re-inventing the Wheel***

REGULAR COLUMNS

Semantic Search Technology Technologies by Dr. Peter Alesso

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Computer Science Department,
Ohlone College, CA

BOOKS:

- "Building Semantic Web Services," A.K. Peters Ltd., 2004.
- "The Intelligent Wireless Web," Addison-Wesley, Dec. 2001.
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- "Wealth Insurance," Compton's NewMedia, Inc., 1989.
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Column Description

SCOPE

Articles and news covering explanations, examples, and advances in emerging semantic search applications including: semantic search technology, latent semantic indexing, ontology matching, semantic search agents and semantic data clustering. In addition, we will include current development, algorithms, inference applications and development software tools.

DESCRIPTION

Search engine's, such as, Google with its 300 million hits per day and over 4 billion indexed Web pages are a vital part of today's World Wide Web. The prevaling attitude of surfers on the Web is: When you have a question - fire up Google.

Current commercial search technologies has been based upon two approaches: human directed search and automated search. In general, human directed search engine technology utilizes a database of keyword concepts and references. A great deal of existing search engine technology uses keyword searches to rank pages, but this often leads to irrelevant and spurious results. Some specific types of human-directed search engines, such as Yahoo!, use topic hierarchies to help to narrow the search and make search results more relevant. These topic hierarchies are human created. Because of this, they are costly to produce and maintain in terms of time, and are subsequently not updated as often as the fully automated systems.

The automated form of Web search technology is based on the Web crawler, spider, robot (bot), or agent which follows HTTP links from site to site and accumulates information about Web pages. This agent-based search technology accumulated data automatically and is continuously updating information.
As Semantic technologies become more powerful, it is reasonable to ask for better search capabilities which can truly respond to detailed requests reducing the amount of irrelevant results. A semantic search engine seeks to find documents that have similar 'concepts' not just similar 'words'. However, most semantic-based search engines suffer performance problems from the scale of a very large semantic network. In order for the semantic search to be effective in finding responsive results, the network must contain a great deal of relevant information. At the same time, large network must process many paths to a solution.

In this column, we will explore semantic search applications including: semantic search technology, latent semantic indexing, ontology matching, semantic search agents and semantic data clustering. In addition, we will include current development, algorithms, inference applications and development software tools.

AUDIENCE
Web Service developers, Web site developers, Semantic Web specialists, and search technology researchers will all benefit from this exposition of semantic search technology supporting automatic Web services.

Swoogle: A Semantic Web Search Engine

by H. Peter Alesso , for Jan-March 2005 AIS SIGSEMIS Bulletin.

Swoogle: A Semantic Web Search Engine Swoogle is a crawler-based indexing and retrieval system for Semantic Web documents in RDF or OWL. It is being developed by the Computer Science and Electrical Engineering Department of the University of Maryland Baltimore County. It extracts metadata and computes relations between documents. Discovered documents are also indexed by an information retrieval system to compute the similarity among a set of documents and to compute rank as a measure of the importance of a Semantic Web document.

The Semantic Web, currently in the form of RDF and OWL documents, is essentially a parallel universe to the Web of online HTML documents. A Semantic Web document (SWD) is known for its semantic content. Since no conventional search engines can take advantage of semantic features, a search engine customized for SWDs, especially for ontologies, is necessary to access, explore and query the Web's RDF and OWL documents.

A prototype Semantic Web search engine called Swoogle, facilitates the development of the Semantic Web, for finding appropriate ontologies, and helping users specify terms and qualify type (class or property) (see Figure 1). In addition, ranking mechanism sorts ontologies by their importance.

In order to help users to integrate Semantic Web data distributed on the Web, Swoogle enables querying SWDs with constraints on the classes and properties. By collecting meta-data about the Semantic Web, Swoogle reveals interesting structural properties such as how the Semantic Web is connected, how ontologies are referenced, and how an ontology is modified externally.

Swoogle is designed as a system that will scale up, in order to handle millions of documents. Moreover, Swoogle also enables rich query constraints on semantic relations. The Swoogle architecture consists of a database that stores metadata about the SWDs. Two distinct web crawlers discover SWDs and components to compute semantic relationships among the SWDs. Also, an indexing and retrieval engine, a simple user interface for query and agent/web service APIs provide useful services.

The algorithm, Ontology Rank, inspired by Google's Page Rank algorithm is used to rank search results. This algorithm takes advantage of the fact that the graph formed by SWDs has a richer set of relations. In other word, the edges in this graph have explicit semantics. Some are defined or derivable from the RDF and OWL languages and others by common ontologies (e.g.,FOAF).

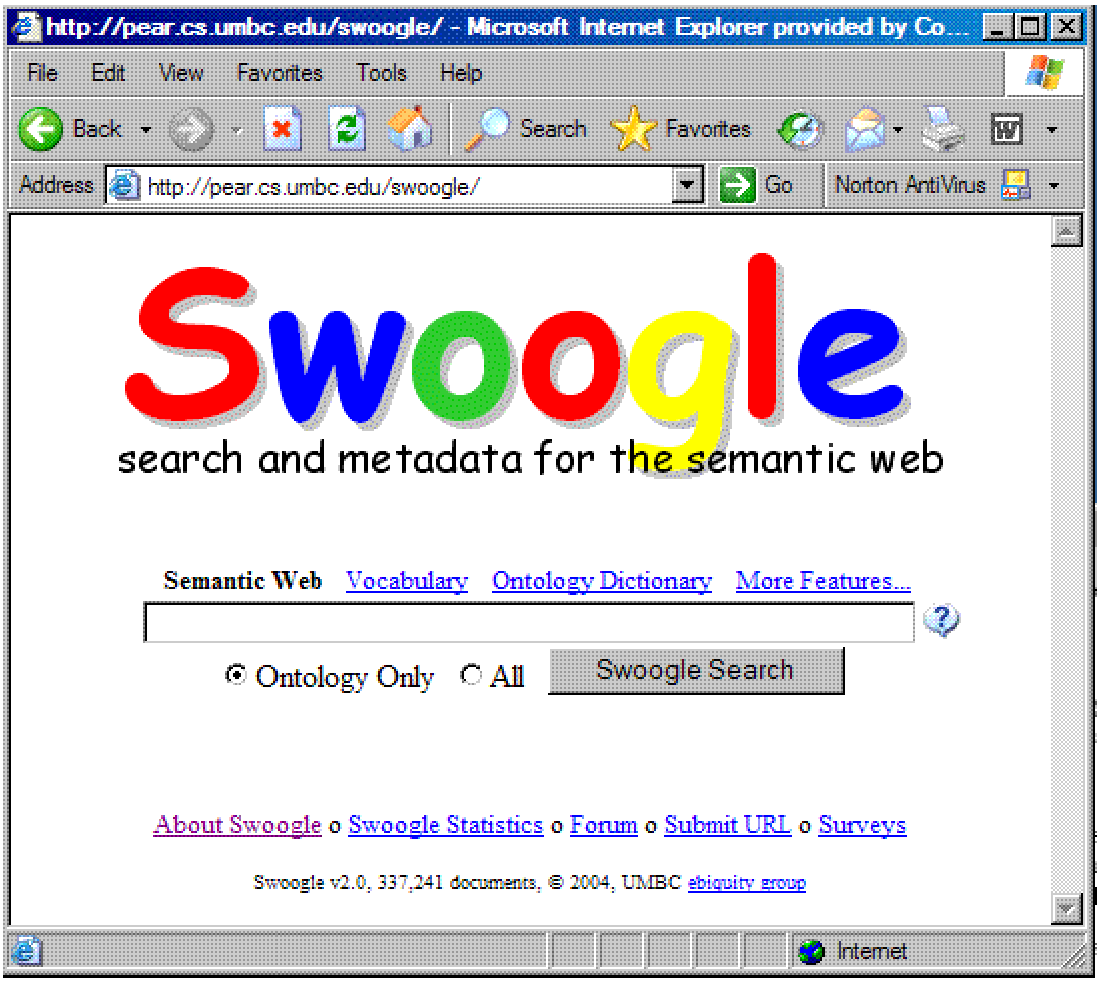

Figure 1 A prototype Semantic Web search engine called Swoogle

Semantic Web Documents

Semantic Web languages based on RDF allow one to make statements that define general terms (classes and properties). A Semantic Web Document (SWD) is a document in a semantic Web language that is accessible to software agents. A SWD is an atomic information exchange object in the Semantic Web.

Two kinds of documents form Semantic Web ontologies (SWOs) and Semantic Web databases (SWDBs). A document is a SWO when a significant proportion of the statements it makes, define new terms (e.g., new classes and properties) or extends the definition of terms defined in other SWDs by adding new properties or constraints. A document is considered as a SWDB when it does not define or extend a significant number of terms. A SWDB can introduce individuals and make assertions about them or make assertions about individuals defined in other SWDs. For example, the SWD http://xmlns.com/foaf/0.1/index.rdf is considered a SWO in that its 466 statements (i.e. triples) define 12 classes and 51 properties but introduces no individuals. The SWD http://umbc.edu/~finin/foaf.rdf is considered to be a SWDB since it defines or extends no terms but defines three individuals and makes statements about them.

Swoogle Architecture

Swoogle's architecture can be broken into four major components: SWD discovery, metadata creation, data analysis, and interface. This architecture is data centric and extensible. These components work independently and interact with one another through a database.

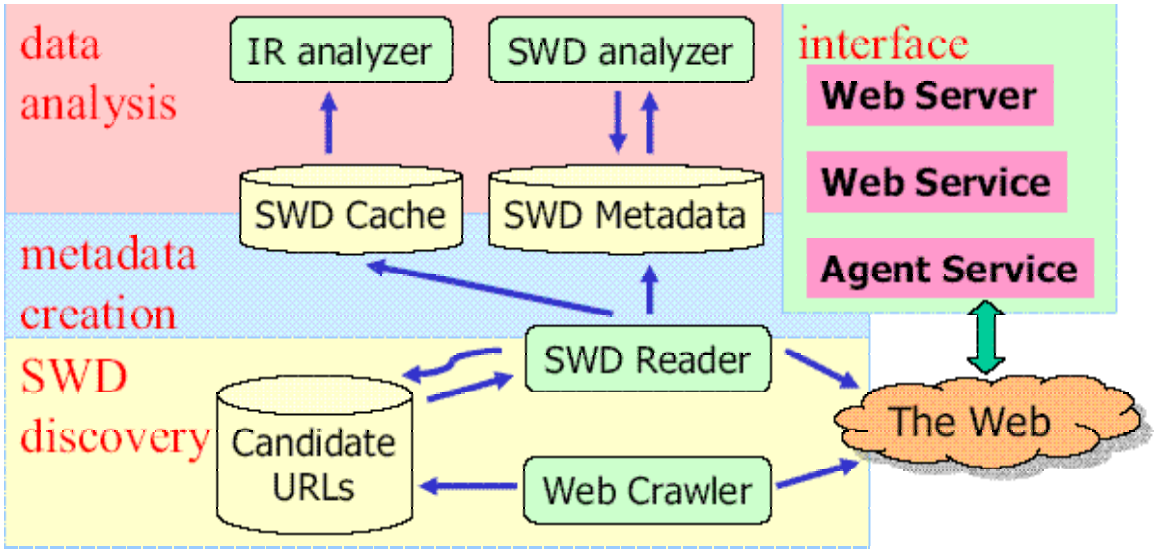

Figure 2 Swoogle Architecture

.The SWD discovery component discovers potential SWDs throughout theWeb. The metadata creation component caches a snapshot of a SWD and generates objective metadata about SWDs at both the syntax level and the semantic level. The data analysis component uses the cached SWDs and the created metadata to derive analytical reports, such as classification of SWOs and SWDBs, rank of SWDs, and the Information Retreival (IR) index for the SWDs. The interface component focuses on providing data service.

Finding SWDs

Finding URLs of SWDs is a straightforward approach to search through a conventional search engine. It is not possible for Swoogle to parse all documents on the Web to see if they are SWDs, however, the crawlers employ a number of heuristics for finding SWDs starting with a Google crawler which searches URLs using the Google Web Service.

Relations among SWDs

Looking at the entire Semantic Web, it is hard to capture and analyze relations at the RDF node level. Therefore, Swoogle focuses on SWD level relations which generalize RDF node level relations.

Google PageRank

Google introduced PageRank evaluates the relative importance of Web documents. Given a document

A, A's PageRank is computed by equation:
PR(A) = PRdirect(A) + PRlink(A)

PRdirect(A) = (1 ¡ d)
PRlink(A) = d ³PR(T1)
C(T1) +...+PR(Tn)
C(Tn) ´

where T1,..., Tn are Web documents that link to A; C(Ti) is the total outlinks of Ti; and d is a damping factor, which is typically set to 0:85. The intuition of PageRank is to measure the probability that a random surfer will

visit a page. Equation 2 captures the probability that a user will arrive at a given page either by directly addressing it via PRdirect(A), or by following one of the links pointing to it via PRlink(A).

Ranking SWDs

Given SWDs A and B, Swoogle classifies inter-SWD links into four categories: (i) imports(A,B), A imports all content of B; (ii) uses-term(A,B), A uses some of terms defined by B without importing B; (iii) extends(A,B), A extends the definitions of terms defined by B; and (iv) asserts(A,B), A makes assertions about the individuals defined by B.

These relations should be treated as a surfer observes imports(A,B) while visiting A, follow this link because B is semantically part of A. Similarly, the surfer may follow extends(A,B) relation because it can understand the defined term completely only when it browses both A and B. Therefore, the assigned weight is different which shows the probability of following that kind of link, to the four categories of inter-SWD relations. The RDF node level relations to SWD level relations, counts the number of references. The more terms in B referenced by A, the more likely a surfer will follow the link from A to B.

Based on the above, given SWD a, Swoogle computes its raw rank using:

$$rawPR(a) = (1-d) + d \sum_{x \in L(a)} rawPR(x) \frac{f(x,a)}{f(x)}$$
$$f(x,a) = \sum_{l \in links(x,a)} weight(l)$$
$$f(x) = \sum_{a \in T(x)} f(x,a)$$

where $L(a)$ is the set of SWDs that link to a, $T(x)$ is the set of SWDs that x links to.

Then Swoogle computes the rank for SWDB and SWO using equation

$$PR_{SWDB}(a) = rawPR(a)$$

$$PR_{SWO}(a) = \sum_{x \in TC(a)} rawPR(x)$$

where TC(a) is the transitive closure of SWOs imported by a.

Figure 3 Swoogle Rank Algorithm

The hypothetical Rational Random Surfer(RRS) retain PageRank's direct visit component; the rational surfer can jump to SWDs directly with a certain probability d. However, in the link-following component, the link is chosen with unequal probability {f(x;a)/f(x)}, where x is the current SWDB.

Indexing and Retreiving SWDs

Central to a Semantic Web search engine is the problem of indexing and searching SWDs. It is useful to apply IR techniques to documents not entirely markup. To apply search to both the structured and unstructured components of a document it is conceivable that there will be some text documents that contain embedded markup.

Information retrieval techniques have some value characteristics, such as researched methods for ranking matches, computing similarity between documents, and employing relevance feedback. These compliment and extend the retrieval functions inherent in Swoogle.

Currently, the most popular kinds of documents are FOAF files and RSS files. Swoogle is intended to support services needed by software agents and programs via web service interfaces. Using Swoogle, one can find all of the Semantic Web documents that use a set of properties or classes.

Conclusion

Currently Google does not work well with Semantic Web Documents, since they are expect documents to contain unstructured text composed of words. Google can't take advantage of the Semantic Web because it doesn't utilize its structure. Powerful search and indexing systems are highly needed by the Semantic Web researchers to help them find and analyze SWDs.

Swoogle is a prototype crawler-based indexing and retrieval system for the Semantic Web Documents, i.e., web documents written in RDF or OWL. It runs multiple crawlers to discover SWDs through meta-search and following links, analyzes SWDs and produce metadata as well as computes ranks.

One of the interesting properties computed for each semantic web document is its rank, a measure of the documents importance on the SemanticWeb. The current version of Swoogle has discovered and analyzed over 11,000 semantic web documents. A second version has been designed and partially implemented that will also capture more metadata on classes and properties and is designed to support millions of documents.

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Semantic Web Technologies by Dr. Jessica Chen Burger

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An Over-Arching Description for the Semantic Web Technologies Column

For SIGSEMIS: Semantic Web and Information Systems

http://www.sigsemis.org/columns/technologiesColumn/

For this bi-monthly Semantic Web Technologies Column, I plan to cover various advanced technologies that is relevant to the field of semantic web technologies.

Research topics cover but not limited to:

- Knowledge Management techniques;
- Advanced Knowledge technologies;
- Grid Computing technologies, esp. Semantic Grid technologies;
- Enterprise Modelling and its applications in assisting the development of semantic web and knowledge management;
- Verification and validation techniques that is applicable to semantic web/rich technologies;
- Collaborative systems and their cooperative operations based on semantic web/rich technologies;
- Workflow systems that understand, manipulate and execute semantics rich information;
- Web services as well as over-arching architecture that holds different web services together;
- Advancements in process modelling and workflow technologies, esp. their relations to the semantic web;
- Applications based on advanced semantic web/rich technologies, e.g. advancements in the bio-informatics;
- Development and applications of ontology technologies; e.g. mapping, evolution, negotiation and the use of ontologies;
- Advanced information technologies, e.g. information extraction, knowledge capture, natural language generation/presentation based on information captured using IE, etc.
- Knowledge portal applications;
- Evaluation and critique of current semantic web/rich technologies and their applications;
- A combination of some of the above technologies.

While some/most columns will be entirely contributed on my own, guest authors may be sometimes invited to contribute to the content of the column, when appropriate. Guest authors may also be different each time. This is an attempt to provide in-depth knowledge to the column as well as broaden its views. In order to acknowledge their efforts, their name may appear as a co-author, when appropriate. The responsibilities for the make-up of the column, however, entire rest on myself.

A Semantic-based Workflow Management for Virtual Organisations

Yun-Heh Chen-Burger (columnist) [1] , Kit-Ying Hui [2] , Alun D. Preece [3] , Peter M. D. Gray [3], Austin Tate [1]

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Keywords: Virtual Organisation, Constraint Satisfaction, Business Process Modelling, Business Modelling, Ontology, Semantic Web.

1 Introduction

Modern organisations are virtual entities composed of heterogeneous resources that span across much different geographical space. People working in such organizations often locate in different places but need to work collaboratively with each other to achieve common organisational goals. The tasks they perform are within a larger organizational process that requires communication with, agreement and assistance of agents of other parts of the organisation. Specialised expertise and tools with specific functions are deployed normally as part of daily work. The need to provide automatic methods that smoothly connect the distributed knowledge and streamline workflow practice to achieve effective collaboration and common goals is paramount. A prominent solution is to provide workflow systems that support such needs. However, such efforts may be obstructed by several reasons that exist in different phases of system development and deployment:

- The gap between design and implementation phases: cross organisational process are often sketched out at the design phase - and to make sure that it is suitable forthe organisation, typically a process modelling consultant together with business personnel and representative software personnel are involved. Those designs arethen used as a requirements used by software engineers to create workflow systems. This approach in itself may not necessarily present an issue, if the original process model was understood correctly and implemented accordingly. The only problem that may arise is that there is a gap where interpretation of the original model must take place in order to bridge designs to the actual system that may be subject topersonal understanding, abilities and deployment of ad-hoc solutions, etc, and misconceptions and errors may be introduced at this stage;
- – The gap between design and deployment phases: once a workflow system is in place, an organisational's demand may change over time and they often result in changes in work practice. A direct way to support this transition is to modify the software without going back to the original design. This approach although is timesaving, it is destructive in the long-term, especially if the changes are frequent andnot properly documented. The rationale for the initial design may be lost and becomes obsolete, in addition, new rational for the required modification may alsobe lost and may become incompatible with the original design. One solution is to refer back and update the original documents as changes are made, however, this is time-consuming and sometimes impossible without appropriate tool support;
- – The compelling need for businesses to adapt the state of the art technologies: this is the last but not least point, businesses today has becoming much more technicallyaware and technology-pull than the more traditional approach of deploying technologies only as needed basis. This trend encourages business to accept and use new tools as well as updating them in a comparably much shorter period. Twomain consequences of this approach: new systems often come with their own sets of work practices and computational methods that they may be incompatible with current organisational practice and in addition they may conflict with existing software systems. It is important that such incompatibilities and conflictions are properly dealt with and resolved; in particular, when legacy software systems are kept in use alongside new practice and systems. This, however, is not a simple task except for a very simple problems domain. This problem may be discussed in two different aspects:
- – The incompatibility of technical methods used in different tools: as mentioned early, adopting new tools often requires accepting new work practice as well as adjustments to new technical methods

either by personnel or system involved. Such new technical methods are sometimes incompatible with existing systems that considerable efforts must be put into it to enable smooth transitions;

- – The differences of the representations used in different systems: this includes the different forms and shapes of information used by personnel as well as the underlyingrepresentations used by different systems. They may not be easily mapped with each other and could potentially cause severe communication barrier. A solution is to find an appropriate medium that is acceptable and reusable for all (systems). The question is which is the optimum communication medium. Is there one that is suitable for all tools? The answer to this question is not necessarily easy, as many representations are designed in such a way that they directly support in a system's internal reasoning mechanism. This characteristic often poses a barrier for deep/full integration of systems of very different or conflicting natures.

SemanticWeb technologies provide a promising solution for solving interoperability problems for knowledge sharing. Under this framework, neutral semantic-based communication medium are used that provides format as well as standard mark-up tags for labelling knowledge content [2]. This approach allows a better understanding of the knowledge used thus promoting a smoother communication and collaboration between different systems. This also helps when new systems are introduced into an existing environment. In parallel, a key and well-recognised technology for promoting and achieving effectiveness and efficiency in coordinating distributed organisational operations is business process model based workflow management (BPM-WM) [3]. When combined with the semantic web technology, semantic-based BPM-WM would provide the advantages of presenting a clearer semantics of information content upon which workflow operates. This would greatly improve the transparency of conventional workflow system where data objects are often hidden and explicit knowledge about them is difficult to obtain. On the other hand, logic-based BPM-WM gives a declarative description of its process logic that when providing a design of a business process model, it may be used as a basis for execution. This approach aims to address problems, as mentioned above, arise from gaps between the design, implementation and maintenance phases of workflow system development. The logic-based description may also be verified statically as well as dynamically, this further helps maintain high quality of the produced workflow systems.

We present such an approach in an example to illustrate how this technology may be used in the context of a virtual organisation. Before we go into more detail, the relevant workflow technology is introduced.

2 A Semantic-based Business Process Modelling Language (FBPML)

FBPML adapts and merges two recognised process modelling standards: IDEF3 [7] and NIST PSL (the Process Specification Language) [8]. IDEF3 originated from concurrent engineering disciplines and is one of the richest methods available for process modelling. It provides relatively comprehensive visual notations, modelling method and model-building guidelines. These characteristics make IDEF3 a suitable candidate for capturing processes. Nevertheless, its semantics is informal and its models therefore are open to interpretation.
On the other hand, NIST PSL provides formal semantics for commonly shared process modelling concepts as well as theories that support temporal reasoning on activities. FBPML combines the two different methods by adapting IDEF3's rich visual and modelling methods and mapping those modelling concepts to the formal semantics and theories of PSL. FBPML has a formal representation that is based on First Order Predicate Logic and has a direct mapping to PSL. As a result, FBPML includes relatively standard visual notation and process modelling concepts and is applicable to theories that carries out formal analysis on its process models.

Precise process execution logic is also defined in FBPML virtual workflow machines are automatically generated and enacted at run-time based on FBPML descriptions through a workflow meta-interpreter - which is not possible for conventional IDEF3 or PSL models. This has several benefits. On one hand, requirement documents of a process model are always coherent with the actual implemented system. This closes the gap between the design and implementation phases of workflow system development, as stated previously. On the other hand, when environment changes that require modifications of workflow behaviours, the user only need to modify the process model without going through the coding phases, because the corresponding workflow system is automatically change. This closes the gap between the design and deployment phases, also as stated previously.

In addition, FBPML is within a set of languages that it includes a formal data language, FBPML-DL, that provides standard descriptions for data constructs and becomes an integral part of a FBPML process description. This explicit representation of data manipulated by a process is also not presented in IDEF3 or PSL. The design and use framework of FPBML is also coherent with current workflow standard [3]. For more information about FBPML, [1] provides a much-detailed account.

3 A Conceptual Overview of Workflow Framework

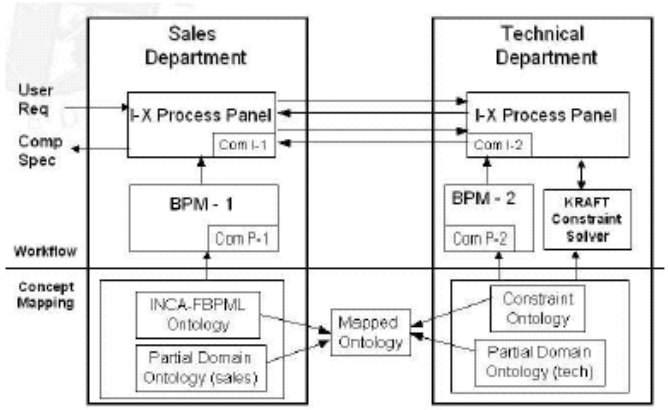

Fig. 1. *Conceptual architecture of collaboration between two (sub)organisations in the PC configuration domain*

Figure 1 gives a conceptual architecture for a virtual organisation where collaborative problem solving has been carried out in a semantic-based workflow framework. Two departments are involved, the Sales and Technical departments, together they provide on-demand customer-tailored computer configuration and building. The horizontal line that goes through the two departments divides the work: the upper part illustrates the individual process models within each department and the actual workflow execution based on the process models; the lower part depicts the underlying knowledge (grounded in ontologies) used by those processes and the mapping between the ontologies to enable smooth collaboration.

In this scenario, both departments have used I-X process panels as a front-end to host their individual process models. However, as indicated, the technical department deploys a specialised knowledge-intensive constraint solver agent, KRAFT, the mapping at a methodological level, i.e. between a workflow-oriented methodology and a very different constraint-solving paradigm has to be carried out. One also needs to consider the appropriate format that data needs to be presented so that it meaningfully supports both workflow executions as well as for carrying out constraint solving tasks.

We use this example to demonstrate how the different technologies involved may assist the cooperation between the two departments. Three technologies are used: FBPML [1] provides process modelling and workflow technologies, KRAFT system [6] enables specialised support for constraint problem solving and I-X system [9] facilities a user front-end to manage and monitor workflow execution.

I-X process panels are used to serve two functions: to provide a process-aware interface for user support and to provide a communication mechanism between two I-X agents and between an I-X agent and the KRAFT system. As I-X is based upon the conceptual framework of I-N-C-A that provides a human-machine interaction interface for FBPML, FBPML is firstly mapped to I-N-C-A, as indicated in *INCA-FBPML ontology* in Figure 1. This enables FBPML business process models *(BPM)* to be translated and managed through *I-X process panels*. This approach allows FBPML and its underlying workflow engine to work with other more sophisticated workflow front-end. On the other hand, the *constraint ontology* that underpins the KRAFT system is mapped with the INCA-FBPML ontology that allows communication between FBPML, I-X and KRAFT

constraint solver. The process of conceptual mapping also indicates patterns needed for correspondence that form the bodies of communication between systems. The communication processes in the FBPML, indicated by *(Com P-i)*, are a recognised type of process in FBPML and are clearly labelled in its models.

Two individual domain knowledge bases of different functions are stored in different departments. Each domain knowledge is ontologically constrained and is based upon individual specifications: the sales-and-costing and the technical ontologies. As the two departments overlap in their operations, their ontologies are partially shared. This shared knowledge assists the collaboration between departments of very different nature. This mimics real-life situations where specialised expertise centres are often geographically disperse yet collaboration is required between them. The mapping of the underlying ontologies provides a sound and robust foundation towards exchange of precise information as well as execution semantics thereby ensuring smoother cooperation.

4 An Agent-based Communication Architecture

Figure 1 illustrates a conceptual overview of the collaboration between two very different types of agent systems, i.e. workflow and constraint solving systems, based on loose-coupling techniques. An interaction model was built based upon a client-server architecture where an I-X agent sends an *issue* that contains a constraint-problem description to KRAFT in an attempt to get a solution; whereas KRAFT deploys its constraint solving mechanism and sends back an answer. This interaction model assumes that all required knowledge is provided and that the "*issue*" can be resolved within one interaction.

The same architecture, however, can support more sophisticated argumentative communication languages in which the two systems are free to exchange messages of constraint specifications, partially solved problems and solutions to achieve a more complex task. Under this arrangement, the two peer systems can be viewed as software agents that propose constraints, counter-propose constraints and partially solve a CSP, thus modifying the initial problem specification. This is especially useful if the two departments in a virtual organisation disagree and/or wish to negotiate new possibilities. This is an example that utilises the capabilities of Agent Mediated Knowledge Management [4].

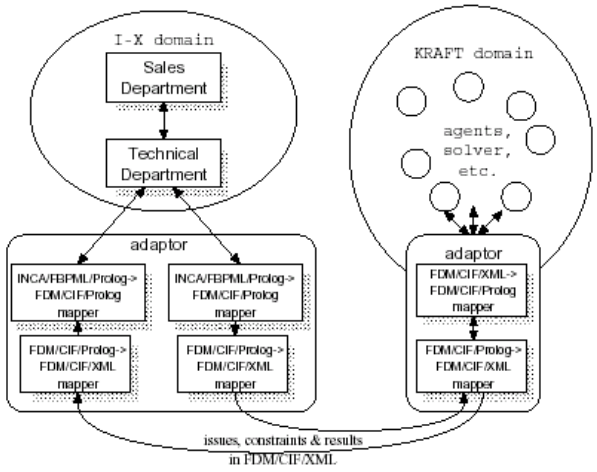

Fig. 2. *Knowledge transported between the two systems is translated as it goes through the adaptors.*

The inability to fully exchange knowledge in a virtual organization is a common phenomena. One possibility is that different departments do not share a common but only use a partially overlapping ontology. As a result, they can only exchange semantic knowledge that is commonly understood. For instance, the *Technical Department* may have the technical details of hardware components, but may not necessarily (nor care to) have knowledge of costing and sales. The *Sales Department*, on the contrary, may have some general knowledge about PC components, but is really only specialised in cost calculation and market prices. One common cause of only partially sharing information may be the unwillingness to disclose local knowledge. A department

may wish to keep its information private for commercial confidentiality reasons, e.g. calculation methods for product market price based on cost, or protection for advanced and competitive technologies. Our system copes with this by passing object IDs and constraints referring to (entity) types declared in the shared part of the ontology, but it encapsulates in different domains (see Figure 2) the processes that reason about them or access specific object properties. Thus, we only pass between domains information that the other end "needs to know". The automatic mapping of entity types and constraints between the different representational spaces (I-X/FBPML and KRAFT/CIF) takes place in the mappers shown in Figure 2. [5] stores a live recording of a sample system run based on the above scenario.

5 Conclusion

One vision of the Semantic Web is to enable arbitrary heterogeneous processing capabilities to be connected, thereby enables free sharing of knowledge and support automated execution of users' tasks from the web. Semantic-based workflow technologies make use of semantic-rich descriptions to support its execution tasks. It also provides a good foundation for inviting and incorporating other specialised knowledge-rich agents. We presented an interesting combined use of one typical business process modeling method (FBPML) and its workflow engines, a workflow management front (I-X) and a type of a knowledge agent, KRAFT, based on loose coupling approach. A similar approach to the one described here may be used to accommodate instantiations of different methodologies to achieve similar results.

This work has been successful in achieving its objectives, but mapping efforts was needed in the earlier stages of the project since various concepts could not be mapped easily. They are related to semantics that are deeply embedded in a system and its specific operation/reasoning mechanism that may not necessarily be fully understood or automatically translated by another system. How to enable arbitrary domain knowledge mapping without any prior knowledge and with minimum effort thereby allowing full integration between any arbitrary systems, especially in an automatic, on-demand and real-time fashion, is still an open-research question.

6 Acknowledgement

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RDF Technologies – Foundations, Applications and Developments

Columnist: Heiner Stuckenschmidt, Vrije Universiteit Amsterdam

There is a wide agreement that the Semantic Web will largely be built on top of RDF. Therefore, a flexible and scalable infrastructure for storing, managing and retrieving RDF-based information is essential. An increasing number of software tools is available supporting the complete life-cycle of RDF models. Editors and converters are available for the generation RDF schema representations from scratch or for extracting such descriptions from database schemas or software design documents. Storage and retrieval systems have been developed that can deal with RDF models containing millions of statements, and provide query engines for a number of RDF query languages. Annotation tools support the user in the task of attaching RDF descriptions to web pages and other information sources either manually or semi-automatically using techniques from natural language processing. Finally, special purpose tools support the maintenance of RDF models in terms of change detection and validation of models. Further, an increasing number of applications that use RDF for representing, integrating and reasoning about information are available. Example for such applications can be found at http://challenge.semanticweb.org. Most of the existing applications of RDF are in the area of information systems. In this area, the benefits of RDF in terms of conceptual representations, interoperability and reasoning support are directly visible.

This column will discuss RDF as a key technology for intelligent information systems on the web. The discussion be centered around there aspects of RDF technology:

Foundations

We will review the principles of RDF and relate them to other well established and emerging technologies such as graph theory, relational databases, topic maps and XML. The discussion will focus on identifying commonalities and differences and point to insights from other areas that can be used to improve RDF technologies.

Applications

We will review existing and potential applications of RDF technologies and discuss the benefits and problems of RDF in areas such as information integration and thesaurus-based information retrieval. Besides surveying existing approaches and their features, we will try to summarize lessons learned and open problems.

Developments

We will discuss recent research questions that have been raised in connection with RDF technologies. Examples are topics like query language standards for RDF, the notion of views or provenance in RDF representations. We will introduce the topic and its relevance, present the current status of the discussion and review existing proposals for a solution.

The column will be targeted at members of the semantic web as well as the information systems community. We aim to provide researchers and practitioners in information systems with a better understanding of the benefits and trade-offs of using RDF for building information systems. Further, we want to point semantic web researchers and practitioners engaged in the development of RDF technologies to the area of information systems as a fruitful application area and provide more insight in the special needs and problems of that area. In summary this column tries to strengthen the link between information systems and RDF technologies by discussing topics that are at the border of the two disciplines.

COLUMN 1:

RDF is not Re-inventing the Wheel

RDF often faces the critiques of being well-understood technology in a new dress. The cause for this critique can be seen in the fact that the widespread use of RDF as a format for storing and querying large datasets raises all the well known questions that the database community has addressed over the last decades. In this first edition of the column about RDF technologies I want to try to address this criticism by discussing the relation of RDF to existing Database technology. I do not aim to give a comprehensive overview of all the techniques that have been developed for different kinds of data models but rather compare RDF to a number of paradigms that have been developed by the database community. For this purpose I introduce RDF as a data model in the classical sense and compare it to other data models such as that have been proposed focussing on the basic principles of these paradigms rather than concrete techniques. Judging which of the technology developed in connection with one or the other paradigm is left to the reader.

A Data Model for Networked Data

A data model can be seen as "a collection of conceptual tools for describing real world objects to be modelled in a database and the relationships amongst these entities". In this sense RDF clearly is a data model as its basic building blocks are unique identifiers (URIs) for representing real world objects (called resources) as well as statements that describe binary relations between these objects. The limitation of statements to the use of binary relations provides us with two ways of talking about RDF models. In the so-called triple interpretation an RDF model can be seen as a set of logical axioms describing facts in the world. This view has some nice properties with respect to the definition of operators over RDF models. In particular, the union the intersection and even the difference of two RDF models can easily be defined and computed in terms of the set theoretic union, intersection or difference of the sets of statements that form the model. At the same time, an RDF model can be seen as a labelled graph. In this view resources are interpreted as nodes, statements involving two resources are edges connecting the nodes representing these resources. Using so-called blank nodes, nodes that do not correspond to a real world object represented by a unique ID, even more complex features like reification can be represented as a graph. The equivalence between RDF models and graphs allows the application of a number of graph theoretic techniques to RDF models. We can use efficient search algorithms to find resources and their descriptions, graph matching algorithms provide the basis for querying and comparing RDF models and graph layout algorithms help to visualize information stored in RDF.

Most classical data models distinguish between a schema language and a data language. While the data language is used to describe objects in the world, the schema language defines structures that are used to structure and access this information. In RDF the language for defining the schema is part of the data language. Schemas can be defined using a special vocabulary for defining the domains and ranges of relations as well as subclass and subproperty relations. Thus, a schema definition itself is an RDF model. What makes schema definition special is their semantics with respect to the interpretation of data. In particular, schema definitions can be used to derive implicit information from a given model. The semantics of schema definitions is given in terms of a model theoretic semantics and can be implemented using a fixed set of rules that define how to derive new statements the content of an RDF model and its schema. This is especially relevant upon exchange as within a closed system, the programmer also knows the semantics and can immediately reason about the data.

RDF and Databases

According to Jeffrey D. Ullmann, , the aim of database technologies is to deal with the largest amount of data possible. In order to reach this goal he names very high-level languages and query optimization as important subgoals. High level languages are necessary to be able to handle many different kinds of data in a uniform way. Query optimization is necessary to be able to process large amounts of data in reasonable time. In this context, we can see RDF as an answer to the first subgoal as it provides a high-level language for encoding and accessing distributed data in a uniform way. Viewing RDF as a high level-data model raises the question of

how current work on RDF relates to the database research. In particular, the question is whether existing methods from the database area can directly be used to process RDF. Answering this question is essential in order to identify open problems of processing RDF that have not yet been addressed in the database community and identify research challenges.

Of course we are not able to provide a detailed analysis of existing database methods and how they could be used for RDF. We will rather compare RDF with some major paradigms that have been investigated in the database community discussing commonalities and differences of RDF and the data model underlying the corresponding paradigm.

The most well known paradigm in the database area is the relational paradigm. Here data is stored in named relations. Manipulation and access of information stored in such relations can be formalized using relational algebra. Based on the relational algebra efficient methods for optimizing and answering queries have been developed that are ready to be used in existing products. If we compare this to the statement-based representation of RDF, we recognize some commonalities. In particular RDF stores data in binary relations where the property denotes the name of the relation and the subject and object of a statement correspond to the data stored in the relation.

On the other hand, RDF shows a number of characteristics that do not correspond to the relational model. In particular there are three points that distinguish RDF from the relational data model:

1. RDF restricts the storage of data to binary relations
2. RDF supports limited forms of reasoning about data
3. RDF supports and object-oriented way of modeling data

In the following, we will discuss these differences and relate it to the corresponding paradigms developed by the database community, i.e. graph databases, object-oriented databases and deductive databases.

RDF and Graph Databases

The restriction of the data model to binary relations makes RDF equivalent to a graph data model. Dealing with such data models has been investigated in connection with graph databases and more recently in connection with querying the web. In graph databases, labelled graphs are used as a higher level model to store and query data. In connection with the graph data model aspects like different storage models for graph data and query languages for graph shaped data have been investigated. There are many examples of techniques from graph databases that have been adopted in RDF technology. One example is the use of the vertical storage model in which the graph structure is stored using a link table. Each entry in this table corresponds to an edge in the graph and therefore to an RDF statement. Another example is the use of path expressions as the basic building block of query languages. Most RDF query languages use path expressions to define a graph structure that is further restricted by a number of constraints on labels of nodes and edges.

A significant difference of RDF compared to earlier work on graph databases is the fact that parts of the graph to be queried is only present virtually. As mentioned above, RDF schema can be used to define implicit knowledge about resources that imply additional statements not explicitly contained in the model. These additional statements have to be taken into account when an RDF model is queried. Therefore, what distinguishes RDF from a graph database is the need to integrate logical reasoning about the schema into the query process.

RDF and Deductive Databases

The integration of logical reasoning into database technologies has been studied in connection with deductive databases. For this purpose deductive databases distinguish between extensional and intentional relations. Extensional relations are database relations in the classical sense. Intentional relations are defined in terms of (a set of) logical rules over other relations (both extensional and intentional). Queries to a deductive database

can combine intentional and extensional relations. In order to answer such a query techniques from logic programming are used to find all implied answers. In principle, schema-based RDF models can be seen as a kind of a deductive database where the explicitly contained statements corresponds to the extensional part of the data and the deduction rules for the RDF schema semantics defines additional data similar to intentional relations in deductive databases. The advantages in terms of the need to only store a subset of the information are common to both approaches. In fact, techniques from deductive databases have been used in RDF repositories. Examples are the use of the RETE algorithm for computing derived facts from data and rules using a forward chaining strategy.

There are also a number of significant differences between RDF and deductive databases that make it impossible or unattractive to apply techniques that have been developed for deductive databases to RDF. One point is that RDF does not make a clear distinction between extensional and intentional relations as new facts can be derived with respect to any kind of relation. This is a consequence of the basic distinction between closed world assumption normally made in databases and the open world assumption that underlies the Web. Of course this can easily be modelled in a deductive database by introducing an intentional version of each extensional relation that is defined in terms of the extensional relation and the rules that can be used to compute additional facts, but it is a relevant conceptual difference. A more crucial difference lies in the specific trade-off of representation and reasoning made by RDF. One of the goals of RDF was to enable "anybody to say anything about everything". As a result, RDF allows arbitrary combinations of statements including statements about relations. On the other hand, reasoning about RDF models is limited to a fixed set of deduction rules specified in the RDF schema definition. This implies that many techniques developed for deductive databases do not directly apply to RDF because they are not able to deal with statements about relations or they deal with the processing of complex rule definitions that do not occur in RDF. In summary, we can say that techniques from deductive databases can only be applied to RDF in a very generic way by considering a single ´statement´ relation. More specific methods that take the schema of an RDF model into account need further investigations.

RDF and Object-Oriented Databases

Object-Oriented databases have been developed to better address the conceptual model that underlies a dataset into the functionality of a database. For this purpose, data is organized according to classes of objects. These classes are organized in an inheritance hierarchy that allows objects to inherit properties from their super classes. The data objects themselves are described by the values of properties and by links to other objects. In contrast to other database paradigms, data object have and identity that makes it possible to distinguish between two objects with identical values. All these properties are shared by RDF: Resources are organized in a class hierarchy, they are defined by values (literals) and relations to other resources and resources have an identity in terms of their URI. This correspondence between RDF and object oriented databases can be exploited in several ways. In particular, indexing techniques for object oriented data models can be adopted to improve the access to RDF data. On a more practical level, object oriented databases have been used to store and query RDF data. RDF also shares some of the problems of object oriented databases such as the problem of object identity and the need to decide whether two objects actually represent the same real world entity and thus need to be treated as one.

On the other hand, RDF shows a number of important differences with object oriented databases. These differences mostly aim at avoiding some of the problems that have prevented object-oriented databases from being widely used. In particular, RDF aims at providing a clear semantics and a simple and elegant way of defining object oriented features. One of the problems of object-oriented databases is that the notion of inheritance is often not well defined and adds significant complexity to the data model. Especially the treatment of methods for computing values of properties on the fly is not clear in the case of inheritance. RDF resolves this problem by using a very light weight notion of inheritance that only affects properties at the data level and by not allowing methods in the data. As a result inheritance can be computed using simple forward chaining rules. The other drawback of object oriented databases that is not shared by RDF is structural complexity. Merging to models for example is a very complex task in the context of an object oriented database. The restriction to a binary relations and the treatment of the schema as part of the data makes merging a trivial operation in RDF, because it is defined as the set-theoretic union of the statement sets. In

summary we can say that RDF takes a very light-weight approach to object orientation than typically assumed in object oriented databases.

Discussion
We introduced RDF as a data model for managing and exchanging networked data and compared its properties with different database paradigms. The observations so far can be summarized as follows: the RDF data model adopts and combines features from different paradigms in a novel way that is better suited to deal with information in an open and distributed environment such as the Web. In such environment the focus is more on exchange and interoperability than on indexing and query optimization. RDF combines the graph-based representation used in graph databases with limited inference capabilities similar to the ones used in deductive databases and a lightweight approach to object-orientation that shares basic principles with object-oriented databases. As a consequence, many techniques developed in the database area a relevant for RDF and their possible application should be investigated. This however does not mean that RDF is just old database technology with a new name. In the following I will give three arguments for this claim:

1) the combination of features from the different database paradigms in order to best fit the needs of Web-based data is already a scientific merit that has not been achieved before. Basic characteristics that influence the design choices made are openness (in contrasts to closeness of database systems), decentralization and scalability.

2) The second point is that the combination of different paradigms makes it impossible to directly apply existing technologies. In fact this is often done at the price of not conforming to the standard, but if we take RDF seriously, then there is a need to develop new methods to deal with well known problems. An example is the interpretation of domain and range restrictions. Interpreting these restrictions as integrity constraints like often done in the database World makes it possible to use them to guide query optimization and re-writing. This view of domain and range restriction, however, does not correspond with their official definition in which they are not interpreted as constraints but rather as production rules that can be used to derive new information about the type of statements. The problem reflected in this example is a result of fundamentally different semantic models underlying traditional database models and RDF. While the semantics used for databases is defined in an extensional way (two queries subsume each other if the result of one is a subset of the result of the other), the RDF semantics is an intentional one; in particular, we cannot derive a statement just because it holds for all objects.

3) Finally, the way RDF introduces the notion of a schema comes with new challenges that have not been addressed by previous work on databases. The big difference here is that RDF does not have a strict distinction between data and schema language. An RDF statement can contain information about the schema and can also cause other statements to become part of the schema definition, for example by declaring a certain resource to be of type class. As a consequence, it is not possible to tell whether a resource is part of the schema definition just by looking at it. In most cases we have to look at all statements to find out which resources describe schema elements. In many cases even this is not enough, because the fact that a resource is of type class might only be implicitly contained in the RDF model, for instance if a property is defined to be a subproperty of the subclass relation, all resources connected by this relation can be derived to be of type class. This means that we need a reasoning step just find out how our schema actually looks like. It also implies that whenever data is added to the model we first have to check whether the newly added statements cause the schema to change. This has serious consequences for the applicability of many data techniques such as indexing and query optimization, because these techniques often make use of information about the schema. This effect is even more difficult to deal with in a distributed setting where statements from one source can have an influence on the schema of the other sources and vice versa. To the best of my knowledge there is no work that explicitly takes this problem into account.

Conclusions
My conclusion is that RDF can be seen as a new paradigm for storing and accessing information that combines some well known features from other paradigms such as object oriented and deductive databases, but also introduces new aspects that directly result from the aim to represent information in an open and distributed

environment. The challenge from a research point of view is now two-fold. The first task is to identify relevant techniques that have been developed in the context of the previous paradigms RDF borrows from and to adapt them to fit the special requirements of RDF. The second point is to identify and address the unique aspects of RDF and develop methods that are able of dealing with the problems that arise from these aspects. In my opinion, the lack of a distinction between data and schema is one of these aspects that ask for the invention of new methods. In the case of databases, the algorithms are not adapted to the representation of the data, but vice versa. The goal is to efficiently and effectively query the (distributed) data. The representation should support that.
In RDF the focus is on the representation which needs to be flexible enough to accommodate many different ways of representing data, because it is meant as an exchange and communication format between different sources.

Both challenges as tightly connected with the interaction of the database and the semantic web community. Unfortunately, it seems that the mutual awareness of these communities is still quite limited. Semantic Web research on RDF is constantly in danger of ignoring relevant work from the database community. On the other hand, the database community is starting to pay attention to RDF as a promising model for data on the Web. Work in this direction rather focuses on XML as a new paradigm. I think that real progress can only be made if the two communities join forces to develop techniques for storing and querying RDF as a new paradigm for next generation databases on the web.

Semantic Web Research Community: A column dedicated to presentation of Research Groups Worldwide

By Gerd Wagner and Lina Zhou

(July additions)

1. Semantic Web Group at ILRT, UK, http://www.ilrt.bris.ac.uk/projects/semantic_web

The Semantic Web Group at ILRT is primarily interested in transforming mostly human-readable information on the web to there a critical mass of structured data via practical tools, applications and documentation for getting your data on to the Semantic Web. RSS and Calendaring are some of their key application interests, and they have produced tools for storage and query of RDF data.

2. **Semantic Computing Research Group** (SeCo) at University of Helsinki and HIIT, Finland, http://www.cs.helsinki.fi/group/seco/

The focus of SeCo is on machine-processable semantics. They investigate techniques for representing data and knowledge in such a way that machines can "understand" its meaning, and develop algorithmic methods for creating intelligent applications based on such representations.

3. Geospatial ontology research group (OntoGeo) at National Technical University of Athens, Greece, http://ontogeo.ntua.gr/

OntoGeo has focused on the application of ontology and semantics in geography, including spatio-temporal modeling, ontology engineering, semantic interoperability, geographic knowledge representation, and so on.

4. Knowledge-as-Media Research Group (KasM), National Institute of Informatics, Japan, http://www-kasm.nii.ac.jp

The aim of KasM group is to discuss and investigate knowledge sharing issues from various aspects that includes community engineering, ontology engineering, and metadata engineering. Knowledge is considered as a unique media that to interact other people and our environment. Their research investigates interaction among people and develops systems to support such activities.

5. Knowledge Representation Laboratory (KRLAB), Asian Institute of Technology, Thailand, http://kr.cs.ait.ac.th/

The current research in KRLAB focuses on information representation and modeling, the Semantic Web, and software engineering. One of their current researches is XML Semantic Query.

6. China Knowledge Grid (CKG) Research Group, Institute of Computing Technology, Chinese Academy of Sciences, http://kg.ict.ac.cn/

The aim of CKG is to establish a worldwide resources (including knowledge, information, and service) sharing and management model and to develop the corresponding software platform. Their final aim is to establish an intelligent and cooperative platform on the Internet for problem-solving, knowledge management, and decision support. They have proposed a Resources Space Model RSM and related theory and method for the first time.

7. DataBase Systems Lab, Information and Communication University, Korea, http://dblab.icu.ac.kr/
IUC DB Lab carries out a variety of research and development projects. They continue to explore advanced information/knowledge management techniques and apply them to a broad range of applications of the present and future. Some of the projects it has been involved includes: Development of Semantic-aware

Metadata Transformation Engine and Development of Semantic Web based Digital Library System.

8. Semantic Web Laboratory (SemWebLab) at the NRC Institute for Information Technology (NRC-IIT), Canada, http://iit-iti.nrc-cnrc.gc.ca/projects-projets/sem-web-lab-web-sem_e.html
SemWebLab aims to develop Semantic Web tools and applications and to coordinate with similar efforts in Canada and worldwide. At the basic layer, SemWebLab develops ontologies consisting of taxonomies that classify Web objects along with rules, typed by taxonomies, for integrity checking and knowledge inference. SemWebLab also studies agents that use ontologies to support, e.g., the similarity retrieval and composition of learning objects. SemWebLab has a focus on metadata extraction to cope with the vast number of Web objects that are natural language documents.

Key Research Centers (April List)

- The World Wide Web Consortium (W3C), http://www.w3.org/

  The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential as a forum for information, commerce, communication, and collective understanding.

- W3C SemanticWeb.org, http://www.w3.org/2001/sw/

  The ***Semantic Web*** provides a common framework that allows ***data*** to be shared and reused across application, enterprise, and community boundaries. It is a collaborative effort led by W3C with participation from a large number of researchers and industrial partners. It is based on the Resource Description Framework (*RDF*), which integrates a variety of applications using XML for syntax and URIs for naming.

- Web-Ontology (WebOnt) Working Group, http://www.w3.org/2001/sw/WebOnt/

  The OWL Web Ontology Language is designed for use by applications that need to process the content of information instead of just presenting information to humans. OWL facilitates greater machine interpretability of Web content than that supported by XML, RDF, and RDF Schema (RDF-S) by providing additional vocabulary along with a formal semantics. OWL has three increasingly-expressive sublanguages: OWL Lite, OWL DL, and OWL Full.

- Transatlantic Research Center for the Semantic Web and XML Technologies, http://www.semanticwebcenter.org.uk/

  The Centre provides leading European and American researchers and developers in the area of XML Technologies and the Semantic Web with unique opportunities for effective and flexible transatlantic collaboration aimed at achieving world-class results.

  The Center conducts research into a wide range of emerging leading-edge technologies. Specific research topics are defined in a particular Research Project. Each Project is being curried out by a Research Group, specially formed for this purpose. Every Research Project is aimed at publishing a world-class research monograph or research-based dictionary in order to make the major results of the project available to the world's scientific community.

- Competence Center Semantic Web (CCSW) at DFKI, http://ccsw.dfki.de/

  This site is part of the German research center for artificial intelligence. The focus of the center is on distributed information management with Web-based standardized object representations, ontologies, and rule systems.

- The Information Management Group at University of Manchester, UK, http://img.cs.man.ac.uk/cgi-bin/index.pl?groupsGo=groupsShow&group=semweb&groupsType=Project&strReturn

  The group concerns with Ontologies Knowledge Representation Hypermedia. It uses knowledge representation language to represent conceptual models in machine-amenable formats, while allowing

agents to reason and compute over those models. The group is linked to projects such as OilEd, OntoWeb, WonderWeb, and so on.

- The Knowledge Management Group at **University of Karlsruhe, Institute AIFB**, Karlsruhe, Germany, http://www.aifb.uni-karlsruhe.de/WBS/

  The group has a strong focus on Semantic Web and related areas. Core Semantic Web infrastructure technologies such as Ontobroker, OntoEdit and KAON are developed in collaboration with other groups in Karlsruhe. The group is involved into projects such as SEKT, Knowledge Web, AceMedia, OntoWeb, WonderWeb, SWAP and so on.

- The Knowledge Management Group (WIM) at the **Research Center for Information Technologies (FZI)**, Karlsruhe, Germany, http://www.fzi.de/wim/eng/

  The research group develops techniques and applications for the acquisition, representation & modeling, extraction, storage, access and application of knowledge. A wide range of knowledge intensive systems are based on different core techniques. The group is involved in projects such as DIP, SWWS, KAON, and so on.

- On-To-Knowledge, http://www.ontoknowledge.org/

  On-To-Knowledge-Project aims to develop tools and methods for supporting knowledge management relying on sharable and reusable knowledge ontologies. The technical backbone of On-To-Knowledge is the use of **ontologies** for the various tasks of information integration and mediation.

- **Knowledge Systems Laboratory** at Stanford University, http://www.ksl.stanford.edu/projects/DAML/

  They are developing semantic markup and agent-based technologies to help realize the vision of semantic web. DAML-Enabled Web Services Project had the goal of developing next generation semantic web tools and technology.

- The MINDSWAP Group at the University of Maryland, http://www.mindswap.org/

  It is Maryland Information and Network Dynamics Lab Semantic Web Agents Project. Simple HTML Ontology Extensions (SHOE) is one of its first research projects on Semantic Web. It is also involved with trust and security on the Semantic Web and automatic ontology mapping.

- **eBiquity Research Group at University of Maryland, Baltimore County, USA,** http://ebiquity.umbc.edu/v2.1/research/area/id/9/

  The group has been involved with a variety of projects related to the Semantic Web. Among others, Spire, a Personal application for the Semantic Web, explores the use of semantic web technologies in support science in general and the field of ecoinformatics in particular. Securing the Semantic Web investigates distributed trust management as an alternative to traditional authentication and access control schemes in dynamic and pen computing environments such as multiagent systems, web services and pervasive computing. Semantic Discovery focuses on the design, prototyping, and evaluation of a system, called SEMDIS that supports indexing and querying of complex semantic relationships and is driven by notions of information trust and provenance.

- **OntoWeb** , http://ontoweb.aifb.uni-karlsruhe.de/

  Ontoweb is a thematic network funded by the European commission. Its goal is to bring together activities in the area of ontology-based methods and tools for the Semantic Web, bypassing communication bottlenecks between the various and heterogeneous groups of interest.

- Large Scale Distributed Information Systems Lab (LSDIS) at the University of Georgia, http://lsdis.cs.uga.edu/

  The LSDIS lab has extensive research, training, and technology transfer program in the areas of Semantic (Web) technologies. The SemDis project focuses on knowledge discovery and semantic analytics, and have developed a very large populated ontology testbed SWETO for evaluating (million

object and relationship) that is being made available for all non-commercial usage. The METEOR-S project on Semantic Web Processes has researched and is developing tools/systems that utilize semantics in complete Web Service and Web Process lifecycle (annotation, discovery, composition, orchestration/execution). The Bioinformatics for Glycan Expression is applying semantic techniques for integration, analysis and discovery activities in the area of Glycomics, and has developed GLYCO, a comprehensive ontology covering some of the significant areas in the field. Example of commercialization of LSDIS lab's research is Semagix Freedom that has been used to develop semantic web applications for some of the world's biggest companies.

- Semantic Web enabled Web Services (SWWS) at HP, http://www.hpl.hp.com/semweb/swws.htm

  HP Labs Bristol has overall responsibility for two of case studies, which will concentrate on different aspects of procurement, to support developing SWWS platform. SWWS (Web Web Services) is a European 5th Framework project whose goal is to demonstrate how Semantic Web technology can be used to enable an open and flexible approach to web services. More specifically its goals are: 1) provide a comprehensive web services description framework; 2) define a web service discovery framework; and 3) provide a scalable web service mediation platform.

- Protégé Research Group at the Stanford University, http://protege.semanticweb.org/

Protégé-20000 is on ontology editor and a knowledge-based editor. It provides support for editing Semantic Web ontologies.

Projects Corner: A column dedicated to dissemination of project outcomes

PROJECT ONE: Description of the SEWASIE Project, provided by Sonia Bergamaschi, Christiph Quix, Matthias Jarke

SEWASIE

EU IST Project

http://www.SEWASIE.org/

SEWASIE (SEmantic Webs and AgentS in Integrated Economies) aims to design and implement an advanced search engine enabling intelligent access to heterogeneous data sources on the web via semantic enrichment to provide the basis of structured secure web-based communication.

Introduction

SEWASIE is implementing an advanced search engine that provides intelligent access to heterogeneous data sources on the web via semantic enrichment to provide the basis of structured secure web-based communication. SEWASIE provides users with a search client that has an easy-to-use query interface, and which can extract the required information from the Internet and can show it in a useful and user-friendly format. From an architectural point of view, the prototype will provide a search engine client and indexing servers and ontologies.

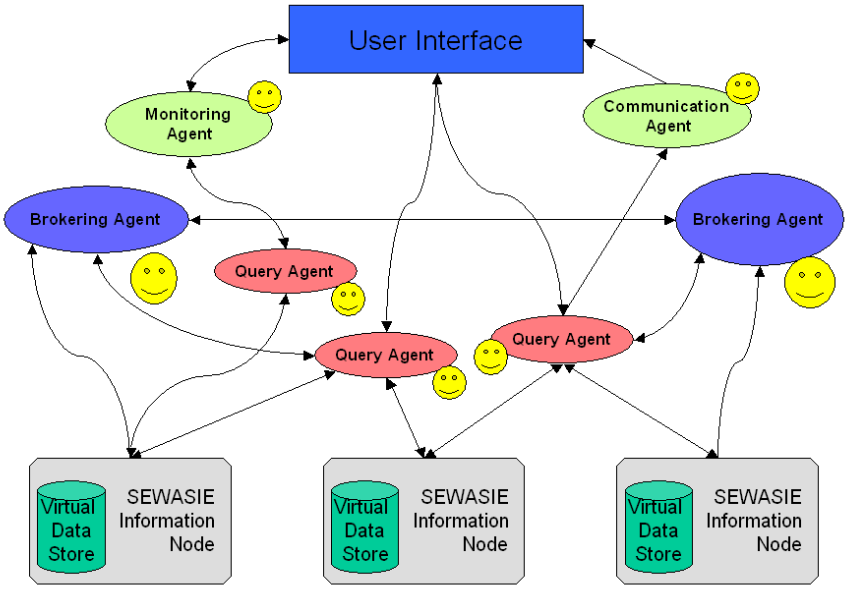
There are many benefits to be had from such a system. There will be a reduction of transaction costs by efficient search and communication facilities. Within the business context, the system will support integrated searching and negotiating, which will promote the take-up of key technologies for SMEs and give them a competitive edge.

The Business Scenario

Throughout Europe, much of the industrial fabric is made of small and medium-sized enterprises (SMEs) in fields such as agriculture, manufacturing, commerce and services. For social and historical reasons, these tend to aggregate into sectorial clusters in various parts of respective countries. Today, this kind of economic organization is threatened by globalisation.

One of the keys to sustainability and success is being able to access information. This could be a cheaper supplier, an innovative working method, a new market, potential clients, partners, sponsors, and so on. Current Internet search tools are inadequate because they not only are they difficult to use, the search results are often of little use with their pages and pages of hits.

Suppose an SME needs to find out about a topic - a product, a supplier, a fashion trend, a standard, etc. For example, a search is made for 'fabric dyeing processes' for the purpose of finding out about the disposal of the dyeing waste material. A query to www.google.com for 'fabric dyeing' listed 44.600 hits at the time of writing, which related not only manufacturers of fabric dyeing equipment, but also the history of dyeing, the dyeing technology, and so on. Eventually a useful contact may be found, and the search can continue for relevant laws and standards concerning waste disposal. But is it *law* or the



interpretation of the law? What if the laws are of a different country where the practices and terminologies are different?

SEWASIE Architecture

A user should be able to access the SEWASIE system through a central user interface where (s)he are provided with tools for query composition, for personalising search results and other web data, for visualising results, and for communicating with other business partners about search results, e.g. in electronic negotiations.

SEWASIE Information Nodes (SINodes) are mediator-based systems, providing a virtual view of the information sources managed within a SINode. Each SINode exports an ontology that represents the metadata of its virtual view. These ontologies are further integrated in Brokering Agents which build the bridge between the SINodes and the user interface. The user interface transfers queries to the Query Agents that are intelligent information agents with the specific task of solving a query. The query agents will use the Brokering Agents to get metadata about the SINodes, i.e. to identify the SINodes which have to queried to answer a specific query. Monitoring Agents filter and contextualise answers of the Query Agent, possibly linked to OLAP reports. They serve also as intelligent filters, which monitor Web sites of competitors or potential collaborators. Finally, the Communication Tool provides the means for structured web-based communication. It uses query results, contextualised information and ontologies from SINodes as the basis for the communicative content. The Communication Agent performs communication tasks in the early phase of electronic interactions.

Results

Following the design phase and the parallel development of the first core modules (query management, ontology design, user interface) the project achieved the first integration of the core and auxiliary modules into a first semantic search engine prototype. While several query types are already supported, more subtle and complex query formats are being explored to define common interpretations and query management policies. Techniques have been studied and tested to improve the workflow at the user end, at the intermediary level, and at the source end. This is particularly significant both from the design and development point of view, since it extends the general "ergonomics" of the system. It is also significant from a general economics point of view, since the deployment of the system in a real work environment will require an enterprise or even sector-level strategy to achieve an opportunity threshold whereby the users perceive the system as a useful tool to use due to available content and quality of results, with a favourable cost/benefits ratio.

The extended features of the system include negotiation systems, OLAP systems, monitoring and visualization components. All of these are being integrated with the basic search engine user interface to provide an integrated user environment where sophisticated analysis and processing may be performed. This may require substantial user interaction, like in a negotiation system where results from a query for suppliers of certain goods are injected to allow the establishment of (possibly several) contacts leading to competitive bids and a final contract. Alternatively, it may require no or minimal user participation while monitoring a certain information domain for specific events to occur, the events being defined as changes to the information content of some sources, content whose presence or absence may be decided with a query which is repeated periodically.

User testing is under way and more testing is currently being planned to validate the integrated system in more and more complex and demanding environments. The first test activities focused on the textile sector of a dynamic industrial district in the province of Modena (Italy), involving CNA and SMEs, and in collaboration with some medium-sized German firms (specifically for the OLAP, monitoring, and visualization modules). A second test plan is being finalised to focus on a mechanical high tech industry (moulding of plastic and metal).

More details on the results of the project have been published in several publications, see the project web site (http://www.sewasie.org) for a complete list.

Participants

Participant name	Contact Person
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Semantic Web Books Column

Feel free to send book copies for reviews at the EIC of AIS SIGSEMIS Bulletin and special presentations in this column.

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.

The book flyer is available at http://users.isoco.net/~ocorcho/documents/IOSPressFlyer.pdf

INTELLIGENT LEARNING INFRASTRUCTURES FOR KNOWLEDGE INTENSIVE ORGANIZATIONS: A SEMANTIC WEB PERSPECTIVE,
Miltiadis Lytras and Ambjorn Naeve (eds),
IDEA Group Publishing, Publication Date: May 2005
http://www.idea-group.com

SW Important Events: You must be there!!

Semantic Web Calendar Column

Conferences

European Semantic Web Conference ESWC 2005
Heraklion, Crete
May 29th - June 1st 2005

http://www.eswc2005.org

Call for Posters and Software Demos

The ESWC 2005 Program Committee invites proposals for the demonstrations and poster program. This program is intended to showcase innovative Semantic Web related implementations and technologies. Submissions will be evaluated on the basis of their innovation, relevance, scientific contribution, reusability, and presentation, by an international committee.

Areas of Interest

We would like to encourage the submission of proposals for demonstrations of software related to any areas of the Semantic Web. Areas of interest related to Semantic Web technology include, but are not limited to:

* Social Software and Portals
* Semantic Desktop Systems and Tools
* P2P systems
* Annotation tools
* Novel query and browsing interfaces
* Data visualization
* Ontology development environments
* Ontology libraries and management systems
* Tools for merging, integrating or articulating ontologies
* Tools for merging, integrating or articulating instance data
* Reusable components and APIs for RDF, DAML+OIL, OWL, etc.
* Repositories and inference systems
* Applications
* Agent systems embedded in the Semantic Web

* Systems that identify and compose web services

Requested Contributions We are looking for contributions whose nature make them less suited for submission to the official paper track. We would like to emphasize this point and make clear that the poster session is more than a second chance for a rejected paper.

In particular, we ask for contributions of the following kind:

* Late-breaking and Speculative Results:
Significant and original ideas and promising approaches to resolve open problems in semantic web research that are in an early stage and have not been verified and tested sufficiently to meet the requirements of a scientific publication. Submissions in this area will be evaluated like a scientific paper but limited to the aspects of originality, relevance and significance.

* Systems and Infrastructure:
Descriptions (preferably accompanied by demonstration) of new systems that use semantic web technology to solve important real world problems. We are also looking for software infrastructure supporting the development of systems that use semantic web technologies. Systems will be evaluated based on novelty and significance of the application as well as the use of semantic web technologies for solving the problem. Main criteria for contributions on infrastructure is successful use in existing applications as well as uniqueness of the provided services.

* Projects and Initiatives:
Descriptions of the objectives and results of ongoing projects and initiatives. The aim is to provide an overview of ongoing work in the area of the semantic web. Contributions in this area will be evaluated based on the importance and uniqueness of the objectives. Further criteria for project descriptions are the significance of results, descriptions of initiatives will also be evaluated with respect to the expected impact on the community .

S**ubmissions Format and Procedure**

Please submit papers by the deadline by email (pdf/zipped HTML) to:
eswc2005pd@semanticweb.org

The abstract should describe the content of the poster or demo to be demonstrated as well as the architecture and the availability of the software (if any) and should also include including title, authors, full contact information, and references (limited to a small number of closely related publications).

Important Dates

Abstract submission: March 1, 2005 (contact chairs for possible extension)
Acceptance notification: April 8, 2005
Camera ready Abstracts due: May 2, 2005

Contact Information:

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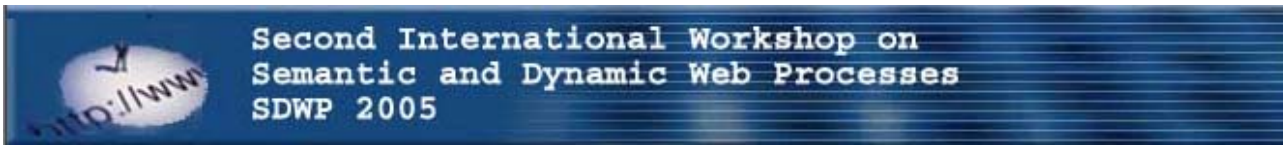

Second International Workshop on Semantic and Dynamic Web Process
http://dme.uma.pt/jcardoso/Research/Conferences/SDWP05/

In conjunction with the 2005 IEEE International Conference on Web Services (ICWS'2005), July 12-15, 2005, Orlando, Florida, USA

SDWP Workshop aims and Objectives

Organizations are increasingly faced with the challenge of managing e-business systems and e-commerce applications managing Web services and Web processes. Web services promise universal interoperability and integration.Several researchers agree that it is essential for Web services to be machine understandable in order to support all the phases of the lifecycle of Web processes. The intelligent combination of Web services and the Semantic Web can start off a technological revolution with the development of Semantic Web Processes. These processes can bring together autonomous and heterogeneous applications, data, services, and components residing in distributed environments. These technological advances can ultimately lead to a new breed of Web-based applications.The major goal of the workshop is to bring researchers, scientists from both industry and academics, and representatives from different communities together to study, understand, and explore the phases that compose the lifecycle of Semantic Web Processes.In particular, we wish to emphasize the research and technological issues related to supporting more flexible, dynamic and scalable Web processes to meet the advanced needs of the organizational processes in the networked global economy.

Last year workshop – SWSWPC 2004

Last year workshop (SWSWPC 2004) intended to bring researchers, scientists from both industry and academics, and representatives from different communities together to study, understand, and explore the phases that compose the lifecycle of Semantic Web Processes.The rich material discussed at the workshop, and the members of the Program Committee who have reviewed and assessed the scientific merit of each submitted paper, have ensured high quality standards. As a result, Springer-Verlag will publish the contributions in the Lecture Notes in Computer Science (LNCS) series (Volume 3387, lunch date Feb. 2005).

Topics of Interest

The theme of the workshop is: Semantic and Dynamic Web Processes. One of the main points of this workshop is to focus on one of the most promising solution to support all Web Process lifecycle phases, the use semantics. Semantics include rich descriptions of Web services and Web processes that can be used by computers for automatic processing in various applications. While enterprises have sought to apply semantics to manage and exploit data or content, for example to support data integration, Web Processes are the way to exploit their applications, increasingly made interoperable as Web Services.

Submissions are invited that focus specifically on the challenges in applying semantics to each of the steps in the Semantic Web Process lifecycle. In particular we present the role of semantics in:

- Annotation (Semantic Annotation of Web Services)
- Discovery (Semantic Web Service Discovery)
- Composition (Semantic Process Composition)

- Process Execution/Enactment (Semantic Web Process Orchestration), and Quality of Service of Semantic Web Processes

We invite researchers and experts of web service and semantics to submit original research papers as well as reports on work in progress related to Semantic Web Process lifecycle. Suggested topics include but are not restricted to:

- Semantic Web Processes
- Dynamic Web Processes
- Web Processes Lifecyle
- Use of Semantics in Annotation, Discovery, Composition, and Orchestration of Web Services and Processes
- Semantic Selection of Web Services
- Semantic Web Process Quality of Service
- Dynamic Changes and Composition of Semantic Web Processes
- Web Process Reasoning
- Web Processes Complexity
- Ontological representation of QoS and Execution Semantics
- Exploiting Domain Specific Semantics for Web Services (e.g. domains include, but not limited to, bioinformatics, telecommunication, travel, financial, and legal)
- SOA and Grid Computing with dynamic allocation and semantics
- Workflow Technologies and Semantics
- Standards extensions (incl. WSDL, UDDI, BPEL) to support dynamic evolution/changes, and semantics

Paper Submission and Review

Research papers should not exceed 5000 words (approximately 12 pages). Short papers (up to 6 pages) describing early research results are also welcome. Submitted papers must not overlap with papers that have been published or that are simultaneously submitted to a journal or a conference with proceedings.Papers submitted to the workshop will undergo a peer-review process. The workshop proceedings will be published electronically and made available from the Association for Information Systems, SIG on Semantic Web and Information Systems AIS SIGSEMIS, http://www.sigsemis.org.

Arrangements will be made with Kluwer Academic to possibly produce a book based on a selection of papers presented at the workshop. Therefore, papers should be prepared in Kluwer Academic's book chapter format. In particular, authors should check
http://dme.uma.pt/jcardoso/Research/Conferences/SDWP05/submission.html for further information.

On this year's edition, we have set up an online submission and reviewing system so that the whole track management process is simplified. Please go to
http://dme.uma.pt/jcardoso/Research/Conferences/sDWP05/OpenConf/ to submit your paper.

Important Dates

Papers submission deadline: April 22, 2005
Author notification: May 23, 2005
Camera ready: Jun 10, 2005
Workshop: Jul 11, 2005

Workshop Organization

Jorge Cardoso, University of Madeira, Portugal, jcardoso@uma,pt
Amit Sheth, University of Georgia, USA, amit@cs.uga.edu

4th International Semantic Web Conference (ISWC 2005)

6th - 10th November 2005
Galway, Ireland

Supported by the Semantic Web Science Association in cooperation with the Knowledge Web and DARPA.

ISWC is a major international forum where visionary and state-of-the-art research of all aspects of the Semantic Web are presented. ISWC2005 follows the 1st International Semantic Web Conference (ISWC2002 which was held in Sardinia, Italy, 9-12 June 2002), the 2nd International Semantic Web Conference (ISWC2003 which was held in Florida, USA, 20 - 23 October 2003) and 3rd International Semantic Web Conference (ISWC2004 which was held in Hiroshima, Japan, 7 - 11 November 2004).

ISWC2005 will be held in Galway, Ireland 6- 10 November 2005.

Call for Research Papers
Fourth International Semantic Web Conference (ISWC 2005)

November 6 –10, 2005
Radisson SAS Hotel
Galway, Ireland
http://iswc2005.semanticweb.org

Building on the current architecture for the World Wide Web, Semantic Web technologies provide a wide range of tools and techniques to support automated reasoning over distributed representations of Web content. The Semantic Web will enable a new generation of applications for education, business, science, and consumer services. It will inspire novel tools for general collaboration and research. The Semantic Web presents an unprecedented challenge of scale and heterogeneity to existing work in expressive representation and query languages, reasoning engines, data representation and integration, interoperability middleware, and distributed computing. To foster the exchange of ideas and collaboration, the International Semantic Web Conference brings together researchers in relevant disciplines such as artificial intelligence, databases, distributed computing, and information systems.
The Fourth International Semantic Web Conference (ISWC2005) follows on the success of previous conferences and workshops in Hiroshima, Japan (2004), Sanibel Island, USA (2003), Sardinia, Italy (2002), and Stanford, USA (2001).
In addition to this call for papers for the research track, ISWC 2005 will include an industrial track, a poster and demonstration track, and a special competition known as the Semantic Web Challenge. The calls for those tracks can be found on the ISWC 2005 Web site, http://iswc2005.semanticweb.org.
The research track of ISWC2005 solicits the submission of original, principled research papers dealing with both analytical and practical aspects of semantic Web research. Topics include, but are not limited to:

- Applications of Semantic Web technologies with clear lessons learned
- Semantic Web for e-business, e-science, e-government, and e-learning
- User-centered applications of the Semantic Web
- Languages, tools and methodologies for representing and managing Semantic Web data
- Robust and scalable knowledge management and reasoning on the Web
- Ontology creation, extraction, and evolution
- Ontology mapping, merging, and alignment
- Database technologies for the Semantic Web
- Semantic Web middleware
- Machine learning and human language technologies for the Semantic Web
- Semantic Web services
- Agents on the Web
- Representing and reasoning about trust, privacy, and security
- Semantic web technology for collaboration and cooperation

- Social software
- Semantic multimedia
- Semantics in peer-to-peer systems and grids
- Searching, querying, visualizing and interpreting the Semantic Web
- Evaluation of semantic Web techniques

Submission Details

Research papers must be submitted electronically via the ISWC2005 Web page at http://iswc2005.semanticweb.org. Papers must be submitted in PDF (Adobe's Portable Document Format) format. Papers will not be accepted in any other format.

Research track paper submissions must be formatted in the style of the Springer Publications format for Lecture Notes in Computer Science (LNCS). For complete details, see http://www.springeronline.com/sgw/cda/frontpage/0,11855,5-164-2-72376-0,00.html

Formatted papers must be no longer than 15 pages. Papers that exceed this limit will be rejected without review.

ISWC2005 will not accept research papers that, at the time of submission, are under review for or have already been published in or accepted for publication in a journal or another conference. Authors of accepted papers will be required to provide semantic annotations for the abstract of their submission for the Semantic Web (help will be provided for this task). Details will be provided on the conference Web page at the time of acceptance

Please monitor ISWC2005.semanticweb.org for any changes to these instructions.

Schedule

April 30, 2005	Research Track paper submissions due
July 8, 2005	Research Track paper acceptance notification
September 1, 2005	Research Track camera-ready papers due
November 6–10, 2005	ISWC 2005 Technical Program

The deadlines for submissions are strict. No extensions will be given.

[more info in the next Bulletin]

WORKSHOP ON **PRODUCT-RELATED DATA IN INFORMATION SYSTEMS**
IN CONJUNCTION WITH **INFORMATIK 2005**, SEPTEMBER 19-22, 2005, BONN, GERMANY

Call for Papers

http://www.deri.at/events/workshops/prodis2005/

Workshop Background and Objectives:

So far, e-business models and the deployment of respective e-business applications have not been as successful as widely expected, with e-marketplaces and e-procurement being prominent examples. It can be observed that one major obstacle is the insufficient degree of reliable mechanization in the exchange and integration of product-related content between business partners. For both suppliers and buyers, product-related data is the foundation for a multiplicity of processes along the life-cycle of a product, ranging from product design and construction to sales and procurement, and ending with the proper disposal.

Traditionally, product data mostly resides in intra-organizational systems, especially ERP, product data management (PDM), and, more recently, product life-cycle management (PLM) systems. The exchange of such data is widely organized in bulk data transfer cycles, often requiring manual tasks at both ends. This is costly, creates inconsistent data due to human error and delayed processing, limits the timely availability of current data for decision making, and in general hampers the success of inter-organizational business integration.

While there has been a lot of research on the ontological aspects of product data as well as on the importance of industry standards, a comprehensive and consensual understanding of the problem domain and its multiple facets is still lacking among information systems researchers, computer scientists, and domain experts. There are numerous important issues that have to be explored regarding the modeling, integration, harmonization and standardization of product-related data, both on an intra- and interorganiza-tional scale, as well as in terms of design, implementation, integration, deployment and assessment of respective information systems. Further progress in this field will be necessary to help manage the exchange, integration, and processing of such data in an automated manner between multiple different business entities and systems.

This workshop aims at providing a forum for researchers and practitioners in this field for both research in progress and final results with regard to innovative approaches, models, concepts, and solutions that address the key role of product-related data in information systems.

We especially invite contributions that help integrate the multiple research communities in information systems and knowledge representa-tion, and product domain experts. We also seek papers on the current state and possible further directions of product-related standards on all levels of standardization.

Possible topics include, but are not limited to:

- Product-related content integration in e-business
- Product data quality and interoperability
- Modeling, design, maintenance, and versioning of product-related data
- Product ontologies and ontological aspects of product-related data
- Standards for product classification and description
- Product data and product life-cycle management
- Product dictionaries and properties
- Cases and tools for managing product-related data

- Product data and related e-business standards
- Product data and ERP systems
- Dissemination and acceptance of product-related standards
- Product data in electronic catalogs
- Multilingual catalogs
- Concepts and mechanisms for distributed product catalogs
- Product models for configuration, pricing and services
- Usage of product data for spend analysis

Important Dates:

2005-04-29	Submission of papers
2005-05-27	Notification of acceptance
2005-06-24	Camera-ready versions due
2005-09-xx	Workshop

Submission:

Authors are invited to submit original research contributions in English, following the LNI format (www.gi-ev.de/LNI/autorenrichtlinien/guidelines.pdf).
Papers must not exceed 5 pages. Submitted papers will be reviewed by at least two members of the program committee. All accepted papers will be published in "Lecture Notes in Informatics" (LNI) by the German Informatics Society. LNI is indexed by DBLP and has a high visibility throughout Europe. Please send your submissions in PDF format to

martin.hepp@deri.org.

For accepted submissions, at least one author must register for the conference in order for the paper to appear in the proceedings and to be scheduled in the workshop program.

Workshop Co-chairs:

- Dieter Fensel (DERI, Austria)
- Martin Hepp (DERI, Austria)
- Joerg Leukel (University of Duisburg-Essen, Germany)
- Volker Schmitz (University of Duisburg-Essen, Germany)

Program Committee (tentative):

- Hans Akkermans (Vrije Universiteit Amsterdam, Netherlands)
- Martin Bichler (Technical University of Munich, Germany)
- Chris Bussler (DERI, Ireland)
- Oscar Corcho (ISOCO, Spain)
- Frank-Dieter Dorloff (University of Duisburg-Essen, Germany)
- Bruno de Vuyst (Vrije Universiteit Brussel, Belgium)
- Tommaso Di Noia (Politecnico di Bari, Italy)
- Ying Ding (DERI, Austria)
- Alea Fairchild (Universiteit van Tilburg, Netherlands)
- Doug Foxvog (DERI, Ireland)
- Jingzhi Guo (Griffith University, Australia)
- Juhnyoung Lee (IBM Research, USA)
- Sang-goo Lee (Seoul National University, Korea)
- Wee Keong Ng (Nanyang Technological University, Singapure)
- Axel Polleres (DERI, Austria)
- Yuxiao Zhao (Linköping University, Sweden)

Confirmation of additional PC members is pending. For an updated version of the PC, please check the workshop website.

Participating in the PRODIS 2005 workshop requires registration for the INFORMATIK 2005 conference. More information on the venue, registration, hotels, and related events will be available at www.informatik2005.de. In addition, we will provide detailed, all English information on the workshop website at

http://www.deri.at/events/workshops/prodis2005

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URL: http://sebis.deri.org

Workshop URL:
http://www.deri.at/events/workshops/prodis2005/

Pending PC members:

- Martin Dörr (ICS FORTH, Greece)
- Judith Gebauer (University of Illinois at Urbana-Champaign,USA)
- Ulrich Manz (University of Applied Sciences Darmstadt, Germany)
- Guy Pierra (ENSMA, France)
- Simon Shim (San José State University, USA)
- Chengzheng Sun (Griffith University, Australia)
- Wolfgang Willkes (University of Hagen, Germany)
- Johan Lövdahl (Linköping University, Sweden)

AIS SIG on Semantic Web and Information Systems, AIS SIG SEMIS Bulletin, 2(2) 2005

http://www.sigsemis.org

CALL FOR SHORT ARTICLES

Deadline for submission: May 20th, 2005.

AIS **SIGSEMIS** Bulletin invites short articles, case studies, and project reports for the April-June 2005 Issue (Volume 2, Issue 2, 2005). You can download the first Issues of AIS **SIGSEMIS** Bulletin at www.**sigsemis**.org

We invite submissions that are related (but not limited to) to the following topics:

Semantic Web Services
Intelligent Systems
Semantic E-Business
Semantic KM
Semantic E-learning
Semantic E-Government
Semantic Web & Business Intelligence
Semantic Web & Enterprise Application Integration
Semantic Web languages
Ontologies
Agents
Semantic Information Processing
Semantic Web & Multimedia
Semantic Web Standards
Open Source
Peer to Peer
Semantic Web and Mobile & wireless Technologies
Semantic Web and IS Research & Methodology
SW Curricula
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SW Industry
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Submission procedure:

1. The articles in the bulletin can be from 1000 to 3500 words.
2. The manuscripts should be either in Word or RTF format.
3. Please send the manuscripts by email as attachment to Dr. Miltiadis D. Lytras lytras@ceid.upatras.gr , copied to Dr. Miguel-Angel Sicilia, msicilia@uah.es (Subject: AIS **SIGSEMIS** Bulletin Issue 2(2) 2005.

- Discussion papers.

We invite submission of RIP papers that will be hosted also in **SIGSEMIS**.org and a discussion will be organized in order to strengthen the authors' approach. Only two papers max will be selected in each bulletin and must be from PhD students.

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A special issue that will be published in June

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