

Half Day Tutorial Proposal for ISWC 2006

“Tools and Technologies for Semantic Web Services: An OWL-S Perspective”

Katia Sycara and David Martin

Aims and Learning Objectives

To acquaint the participants with the current state of the art in Web services, contrast with traditional means of integration, and present tools and techniques for the development of Web services. To present advanced concepts for Web services, such as Web services enabled by the Semantic Web and Web services enabled by agent technology. To understand the technologies that are involved and/or must be developed to realize the advanced concepts.

Target Audience

Semantic Web and Web Service researchers; active practitioners; developers; graduate and senior undergraduate students; anyone interested in Web services, their value added and the technologies involved.

Prerequisite Knowledge of Audience

Some experience with Web programming; basic knowledge of agents, messaging and protocols, Web and Semantic Web.

Brief Description

Web services are being hailed as the Next Big Wave of innovation in e-commerce and B2B integration. Recent industrial interest in such services, and the availability of tools and standards to enable automated invocation of business functionality through message exchange (e.g. SOAP, UDDI, WSDL) holds the promise of fast progress in this area. The Web service initiatives in industry, government and research labs are many, diverse and for the most part uncoordinated.

As services proliferate, humans and agents need to be able to find, select, understand and invoke these services. Today, services (e.g. travel services, book selling services, stock reporting services etc) are discovered and invoked manually by human users. In the near future, such service discovery and use will be mediated by agents acting on behalf of their human users. Such use of agent technology will be the next Web revolution. Instead of being solely populated with human-readable documents, the Web will also be populated with agent-mediated services. For this to be accomplished, the Web must become agent-understandable, i.e. allow for *semantic annotation* of content.

Up to now, this vision has been conceived and pursued mainly in academia and research labs. However, recent industrial interest in such services, and the availability of tools to enable service automation (e.g. UDDI, WSDL, BPEL4WS, etc) holds the promise of fast progress in the automation in the Web Services area. OWL-based annotations of services (possibly using OWL-S,

the OWL ontology for services) will probably be the most visible application of OWL and other Semantic Web annotation languages.

This tutorial will take an in-depth look at the current state of the art in Web Services and sort through the increasing and confusing array of relevant tools, languages and theories both from academia and industry. The tutorial will also present and discuss business models for Web services and their potential for business value added. Many examples to illustrate the described concepts, techniques, tools and their use will be presented. The tutorial will also discuss limitations of current technologies and present value added advanced concepts, such as distributed service composition, Semantic Web enabled Web services, agent-mediated Web services, as well as open issues that must be addressed with emphasis on agent researcher contributions.

The tutorial will have six parts. Part I will present a general brief overview of the concept of Web Services. Part II will present a critical survey of the most promising current industry standards. Part III will present limitations of current state of the art industry standards and present needed semantic infrastructure for value added. Part IV will present schemas/languages and ontologies for semantic description of Web services and semantic annotation of content of services so they can be agent-discoverable, invocable and composable. In particular, this part will focus on OWL-S. Part V will present OWL-S tools and applications. Part VI will present conclusions, challenges and open problems.

Why the tutorial topic is of interest

This tutorial should be of interest both to researchers, government and industry. Semantically annotated Web Services may be the most important industrial application of Semantic Web technologies. The interest of computer companies, such as Microsoft, Sun, IBM, Intel, HP, in Web Services has produced competing infrastructure pieces from which convergent standards are being constructed. This tutorial will present a survey of these industrial, as well as academic research efforts. We believe that this knowledge will be beneficial both to academics and practitioners that may be interested in finding out the current state of practice and will possibly provide guidance in selecting the right tools for the job. Researchers will be informed about current limitations of tools proposed by industry, thus helping to identify research opportunities. In addition, the tutorial presentation of the needed infrastructure (e.g. for service discovery, service matching, service invocation, monitoring, composition) for Web services should be interesting to both researchers and practitioners.

Resume of Presenter(s)

Katia Sycara

- The Robotics Institute, Carnegie Mellon University. 5000 Forbes Avenue, Pittsburgh, PA 15213
- Phone: 412 268 8825
- Fax: 412 268 5569
- Email: katia@cs.cmu.edu

Katia Sycara is a Professor at the Robotics Institute, School of Computer Science, at Carnegie Mellon University, and holds (part time) the Sixth Century Chair in Computing Science at the University of Aberdeen. She is also the Director of the Advanced Agent Technology and Web Semantics Laboratory. She holds a B.S in Applied Mathematics from Brown University, an M.S. in Electrical Engineering from the University of Wisconsin and a PhD in Computer Science from the Georgia Institute of Technology. Sycara is a Fellow of the AAAI, Fellow of the IEEE and the

recipient of the ACM/SIGART Autonomous Agents Research Award (2002). She holds an Honorary Doctorate from the University of the Aegean (2004). She is a member of the Scientific Advisory Board of France Telecom, and a member of the Scientific Advisory Board of the Greek National Center of Scientific Research "Demokritos" Information Technology Division.

Prof. Sycara has served as the Program Chair of the Second International Semantic Web Conference (ISWC 2003), as General Chair of the Second International Conference on Autonomous Agents (Agents 98), as the Chair of the Steering Committee of the Agents Conference (1999-2001), as the Scholarship chair of AAAI (1993-1999) and as a member of the AAAI Executive Council (1996-99). From 2001-2003 she served as Invited Expert of the W3C (the World Wide Web Consortium) Working Group on Web Services Architecture and is currently a member of the OASIS Technical committee on the development of UDDI (Universal Description and Discovery for Interoperability).

Prof. Sycara is currently engaged in research in multi-agent systems, Web services, and Semantic Web including research in service discovery, invocation and composition, e-commerce, multi agent coordination and interoperation. She is a lead developer of the OWL-S Service Description Language, and the US co-chair of the *International Joint Semantic Web Services Initiative (SWSI)*. Sycara is also a founding member of the *Semantic Web Science Association*, the *International Foundation of Multi Agent Systems* and on the *Autonomous Agents steering committee*. Sycara has made many tutorial presentations and has taught a variety of courses at Carnegie Mellon on Artificial Intelligence, Case Based Reasoning and Intelligent Agents. Sycara is the founding Editor-in Chief of the Journal on "*Autonomous Agents and Multi-Agent Systems*", Area Editor for AI and Management Science for the journal "*Group Decision and Negotiation*" and on the editorial board of 5 additional journals dealing with Web Services and Agents technology.

Recent Tutorial Presentations by Katia Sycara

1. "*Agents in the Real World*", the Americas Multi Agents School, Pittsburgh, PA., July 7, 2005.
2. "*Tools and Technologies for Agent Mediated Semantic Web Services*", Fourth International Joint conference on Autonomous Agents and Multi Agent Systems, Utrecht, The Netherlands, July 25, 2005.
3. "*Semantic Web Services*", Second European Semantic Web Conference, Heraklion, Greece, May 29, 2005.
4. "*Tools and Technologies for Semantic Web Services*", Third International Conference on the Semantic Web, Hiroshima, Japan, November 7, 2004.
5. "*Software Architectures for Multi agent Systems*", India Multi-Agents School, Hyderabad, India, August 12-17, 2004.
6. "*Agent-Based Semantic Web Services*", Third International Joint Conference on Autonomous Agents and Multi-agent Systems, New York, NY, July 20, 2004
7. "*OWL-S and Semantic Web Services*", International Conference on Web Services, San Diego, California, July 6 2004
8. "*Agent-Mediated Semantic Web/Grid Services*", Whole Day Tutorial, Second International Semantic Web conference, Sanibel Island, Fla., October 20-23, 2003.
9. "*Agent-Mediated Semantic Web Services*", Whole Day Tutorial, Fifth International conference on Electronic Commerce, Pittsburgh, PA., September 30-October 3, 2003.
10. "*Semantic Web Services*", Whole Day Tutorial Presentation, International Semantic Web Conference, Chia, Sardinia, 2002.
11. "*In Depth Techniques, Technologies and Tools for Web Services*", Half Day Tutorial Presentation, AAMAS, Bologna, Italy, 2002.
12. "*Distributed Coordinating Intelligent Agents*". Whole day Tutorial Presentation, The First International Conference on Autonomous Agents, Marina del Ray, 1997.

13. "*Case-Based Reasoning: Theory and Practice*", Half-day Tutorial Presentation, IJCAI-93, Chambéry, France, August, 1993.
14. "*Distributed Artificial Intelligence Tools*", Half-day Tutorial Presentation, AAAI-93, Washington, DC, July 1993.
15. "*Case-Based Reasoning*", Half-day Tutorial Presentation, Tenth European Conference on Artificial Intelligence, Vienna, Austria, August, 1992.
16. "*Distributed Artificial Intelligence Tools*", Half-day Tutorial Presentation, AAAI-92, San Jose, CA., July 1992.

David Martin

- Artificial Intelligence Center; SRI International. 333 Ravenswood Av., EK282; Menlo Park, CA 94025.
- Phone: 650 859 4119
- Fax: 650 859 3735
- Email: martin@ai.sri.com

David Martin is a Senior Computer Scientist in the Artificial Intelligence Center at SRI International, where he has been on the research staff since 1994. He has worked extensively in the fields of Knowledge-Based Software Engineering and Agent-Based Systems, and was one of the principal designers of the Open Agent Architecture (OAA). He is currently engaged in research on topics in intelligent assistance, Semantic Web and Semantic Web Services. He was a Principal Investigator for SRI's DAML (DARPA Agent Markup Language) project, and serves as chair of the research coalition that developed OWL-S, a service description language for the Semantic Web. He is also co-chair of the language subcommittee of The Semantic Web Services Initiative (SWSI).

He has organized several Semantic Web Services workshops, served on numerous program committees related to Semantic Web and agent-based systems, and was a co-chair of the World Wide Web Consortium's 2005 Workshop on Frameworks for Semantics in Web Services. He is a co-editor of *Extending Web Services Technologies: The Use of Multi-Agent Approaches* (Springer, 2004).

Recent Tutorial Presentations by David Martin

1. "*Semantic Web Services: Where Are We Headed?*", Collaborative Technologies and Systems (CTS 2006), Las Vegas, Nevada, May 15, 2006.
2. "*Semantic Web Services: Tools and Applications*", Semantic Technology Conference (SemTech 2006), San Jose, CA, March 6, 2006.
3. "*Putting Semantic Web Services in Context*", International Workshop on Context for Web Services, Paris, July 5, 2005.
4. "*Semantic Web Services Overview*", Semantic Web Applications for National Security (SWANS), Arlington, VA, April 8, 2005.
5. "*Semantic Web Services: Promise, Progress, Challenges*", Semantic Technology Conference (SemTech 2005), San Francisco, March, 2005.
6. "*Tools and Technologies for Semantic Web Services*", Third International Conference on the Semantic Web (ISWC04), Hiroshima, Japan, November 7, 2004.
7. "*OWL-S: Bringing Services to the Semantic Web*", Semantic Web for the Military User, Alexandria, VA, May, 2003.