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# The Semantic Web – ISWC 2014

13th International Semantic Web Conference  
Riva del Garda, Italy, October 19-23, 2014  
Proceedings, Part II

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# Preface

The Semantic Web is now a maturing field with a significant and growing adoption of semantic technologies in a variety of commercial, public sector, and scientific fields. Linked Data is pervasive: from enabling government transparency, to helping integrate data in life sciences and enterprises, to publishing data about museums, and integrating bibliographic data. Significantly, major companies, such as Google, Yahoo, Microsoft, and Facebook, have created their own “knowledge graphs” that power semantic searches and enable smarter processing and delivery of data: The use of these knowledge graphs is now the norm rather than the exception. The schema.org effort led by the major search companies illustrates the industry interest and support of the Semantic Web. Commercial players such as IBM, Siemens, BestBuy, and Walmart are seeing the value of semantic technologies and are regular presenters at Semantic Web conferences. The papers and the research topics covered in these proceedings follow directly from the requirements of this large adoption, and contribute greatly to the continuing success of the field.

The International Semantic Web Conference is the premier forum for Semantic Web research, where cutting-edge scientific results and technological innovations are presented, where problems and solutions are discussed, and where the future of this vision is being developed. It brings together specialists in fields such as artificial intelligence, databases, social networks, distributed computing, Web engineering, information systems, human–computer interaction, natural language processing, and the social sciences for tutorials, workshops, presentations, keynotes, and ample time for detailed discussions.

This volume contains the main proceedings of the 13th International Semantic Web Conference (ISWC 2014), which was held in Riva del Garda, Trentino, Italy, in October 2014. We received tremendous response to our calls for papers from a truly international community of researchers and practitioners. Indeed, several tracks of the conference received a record number of submissions this year. The careful nature of the review process, and the breadth and scope of the papers finally selected for inclusion in this volume, speak to the quality of the conference and to the contributions made by researchers whose work is presented in these proceedings. As such, we were all honored and proud that we were invited to serve the community in the stewardship of this edition of ISWC.

The proceedings include papers from four different tracks: the Research Track, the Semantic Web In-Use Track, the newly added Replication, Benchmark, Data and Software (RBDS) Track, and a selection of Doctoral Consortium papers. For the first time since we started publishing the LNCS proceedings, the papers are organized by their topic rather than by their track and correspond closely to the sessions in the conference schedule. The topics of the accepted papers reflect

the broad coverage of the Semantic Web research and application: Linked Data, its quality, link discovery, and application in the life sciences; data integration, search and query answering, SPARQL, ontology-based data access and query rewriting and reasoning; natural language processing and information extraction; user interaction and personalization, and social media; ontology alignment and modularization; and sensors and streams.

Creating the program for ISWC 2014 would not have been possible without the tireless and fantastic work of the Senior Program Committees (SPC), the Program Committees (PC), as well as of the many sub-reviewers in the different tracks, several of whom volunteered to provide high-quality emergency reviews. To acknowledge this work, the Research Track and the Semantic Web In-Use Track each offered a best reviewer award. The decision on the awards was taken with the input of the SPC members, of the fellow reviewers from the PC, of the authors, and also using objective measures about the reviews provided by EasyChair, the conference management system.

The Research Track of the conference attracted 180 submissions, 38 of which were accepted, resulting in a 21% acceptance rate. Each paper received at least three, and sometimes as many as five, reviews from members of the PC. After the first round of reviews, authors had the opportunity to submit a rebuttal, leading to further discussions among the reviewers, a metareview and a recommendation from a member of the SPC. The SPC held a 10-hour virtual meeting in order to select the final set of accepted papers, paying special attention to papers that were borderline or had at least one recommendation for acceptance. In many cases, additional last-minute reviews were sought out to better inform the SPC's decision.

The best paper nominations for the Research Track reflect the broad range of topics that were submitted to this track:

Best paper nominations:

- AGDISTIS - “Graph-Based Disambiguation of Named Entities Using Linked Data” by Ricardo Usbeck, Axel-Cyrille Ngonga Ngomo, Michael Röder, Daniel Gerber, Sandro Athaide Coelho, Sören Auer and Andreas Both
- “Expressive and Scalable Query-based Faceted Search over SPARQL Endpoints” by Sébastien Ferré
- “Explax: Exploring Associations Between Entities via Top-K Ontological Patterns and Facets” by Gong Cheng, Yanan Zhang and Yuzhong Qu
- “Querying Factorized Probabilistic Triple Databases” by Denis Krompaß, Maximilian Nickel and Volker Tresp

Best student paper nominations:

- “OBDA: Query Rewriting or Materialization? In Practice, Both!” by Juan F. Sequeda, Marcelo Arenas and Daniel P. Miranker
- “SYRql: A Dataflow Language for Large Scale Processing of RDF Data” by Fadi Maali, Padmashree Ravindra, Kemafor Anyanwu and Stefan Decker
- “Pushing the Boundaries of Tractable Ontology Reasoning” by David Carral, Cristina Feier, Bernardo Cuenca Grau, Pascal Hitzler and Ian Horrocks

The Semantic Web In-Use Track received 46 submissions. Fifteen papers were accepted – a 33% acceptance rate. The papers demonstrated how semantic technologies are applied in a variety of domains, including: biomedicine and drug discovery, smart cities, sensor streams, multimedia, visualization, link generation, and ontology development. The application papers demonstrated how semantic technologies are applied in diverse ways, starting from using linked data in mobile environments to employing fully fledged artificial intelligence methods in real-time use cases. At least three members of the In-Use PC provided reviews for each paper. After the first round of reviews, authors had the opportunity to submit a rebuttal, leading to further discussions among the reviewers, a metareview and a recommendation from a member of the SPC.

The best paper nominations for the Semantic Web In-Use Track are:

- “Web Browser Personalization with the Client Side Triplestore” by Hitoshi Uchida, Ralph Swick and Andrei Sambra
- “Semantic Traffic Diagnosis with STAR-CITY: Architecture and Lessons Learned from Deployment in Dublin, Bologna, Miami and Rio”, by Freddy Lecue, Robert Tucker, Simone Tallevi-Diotallevis, Rahul Nair, Yiannis Gkoulas, Giuseppe Liguori, Mauro Borioni, Alexandre Rademaker and Luciano Barbosa
- “Adapting Semantic Sensor Networks for Smart Building Analytics” by Joern Ploennigs, Anika Schumann and Freddy Lecue

This year we introduced the Replication, Benchmark, Data and Software (RBDS) track that provides an outlet for papers of these four categories. It extended and transformed last year’s evaluations and experiments track to incorporate new categories of contributions. The four types of papers had very clearly specified scope and reviewing criteria that were described in the Call for Papers: (1) Replication papers focus on replicating a previously published approach in order to shed light on some important, possibly overlooked aspect; (2) benchmark papers make available to the community a new class of resources, metrics or software that can be used to measure the performance of systems in some dimension; (3) data papers introduce an important data set to the community; and (4) software framework papers advance science by sharing with the community software that can easily be extended or adapted to support scientific study and experimentation. The RBDS track received 39 submissions (18 benchmark studies, eight data papers, eight software framework papers, and four replication studies), and accepted 16 papers (five benchmark studies, five data papers, four software framework papers, and two replication studies), corresponding to an acceptance rate of 41%. Each paper was reviewed by at least three members of the PC and discussed thoroughly. The papers address a range of areas, such as linked stream data, federated query processing, tag recommendation, entity summarization, and mobile semantic web.

The Doctoral Consortium is a key event at the ISWC conference. PhD students in the Semantic Web field get an opportunity to present their thesis proposals and to interact with leading academic and industrial scientists in the field, who act as their mentors. The Doctoral Consortium received 41 submissions, a record number compared to previous years. Each paper received two reviews, one from an SPC member, and one from a co-chair. Out of 41 submissions, six were selected to be both included in these proceedings and for presentation at the Doctoral Consortium, while an additional 11 were selected for presentation. The Doctoral Consortium day is organized as a highly interactive event, in which students present their proposals and receive extensive feedback and comments from mentors as well as from their peers.

A unique aspect of the ISWC conference is the Semantic Web Challenge, now in its 12th year, with the goal of demonstrating practical progress toward achieving the vision of the Semantic Web. The overall objective of the challenge is to apply Semantic Web techniques in building online end-user applications that integrate, combine, and deduce information needed to assist users in performing tasks. Organized this year by Andreas Harth and Sean Bechhofer, the competition enables practitioners and scientists to showcase leading-edge real-world applications of Semantic Web technology. The Semantic Web Challenge is advised by a board of experts working at universities and in industry. The advisory board also acts as a jury and awards the best applications at the conference.

The keynote talks given by leading scientists or practitioners in their field further enriched the ISWC program. Prabhakar Raghavan, Vice-President of Engineering at Google, discussed “Web Search – From the Noun to the Verb.” Paolo Traverso, Director of the Center for Information Technology at Fondazione Bruno Kessler, talked about “To Be or to Do?: The Semantics for Smart Cities and Communities.” Yolanda Gil, Associate Director of the Intelligent Systems Division at ISI University of South California, discussed the “Semantic Challenges in Getting Work Done” addressing the application of semantics to scientific tasks. The industry track featured a plenary keynote on “The Semantic Web in an Age of Open Data” by Sir Nigel Shadbolt, Chairman and Co-Founder of the UK’s Open Data Institute and Professor of Artificial Intelligence at the University of Southampton.

As in previous ISWC editions, the conference included an extensive tutorial and workshop program. Johanna Völker and Lora Aroyo, the chairs of this track, created a stellar and diverse collection of eight tutorials and 23 workshops, where the only problem that the participants faced was which of the many exciting workshops and tutorials to attend. This year, we hosted for the first time the Developers’ Workshop, a dedicated event for software developers discussing implementations, methods, techniques, and solutions to practical problems of Semantic Web and Linked Data. The main topic of the Developers’ Workshop was “Semantic Web in a Browser.”

We would like to thank Matthew Horridge, Marco Rospocher, and Jacco van Ossenbruggen for organizing a lively poster and demo session. This year, the track got a record 156 submissions, a 50% increase compared with previous years. Moreover, 71 posters and 50 demos were introduced in a “minute madness session,” where each presenter got 45 seconds to provide a teaser for their poster or demo. Axel Polleres, Alexander Castro, and Richard Benjamins coordinated an exciting Industry Track with presentations both from younger companies focusing on semantic technologies and from large enterprises, such as British Telecom, IBM, Oracle, and Siemens, just to name a few. With a record number of 39 submissions (seven of which were selected for full presentations and 23 for short lightning talks) in the industry track this year, the mix of presentations demonstrated the success and maturity of semantic technologies in a variety of industry- and business-relevant domains. The extended abstracts for posters, demos, and industry talks will be published in separate companion volumes in the CEUR workshop proceedings series.

We are indebted to Krzysztof Janowicz, our proceedings chair, who provided invaluable support in compiling the volume that you now hold in your hands (or see on your screen) and who put in many hours of additional work to create a completely new structure for these proceedings based on the topic rather than the tracks, as in previous years. Many thanks to Oscar Corcho and Miriam Fernandez, the student coordinators, for securing and managing the distribution of student travel grants and thus helping students who might not have otherwise attended the conference to come to Riva. Roberta Cuel, Jens Lehmann, and Vincenzo Maltese were tireless in their work as sponsorship chairs, knocking on every conceivable virtual “door” and ensuring an unprecedented level of sponsorship this year. We are especially grateful to all the sponsors for their generosity.

As has been the case in the past, ISWC 2014 also contributed to the Linked Data cloud by providing semantically annotated data about many aspects of the conference. This contribution would not have been possible without the efforts of Li Ding and Jie Bao, our metadata chairs.

Mauro Dragoni, our publicity chair, tirelessly tweeted, sent old-fashioned announcements on the mailing lists, and updated the website, creating more lively “buzz” than ISWC has had before.

Our very special thanks go to the local organization team, led by Luciano Serafini and Chiara Ghidini. They did a fantastic job of handling local arrangements, thinking of every potential complication way before it arose, often doing things when members of the Organizing Committee were only beginning to think about asking for them. Many thanks to the Rivotour Agency for providing great service for local arrangements.



Finally, we would like to thank all members of the ISWC Organizing Committee not only for handling their tracks superbly, but also for their wider contribution to the collaborative decision-making process in organizing the conference.

October 2014

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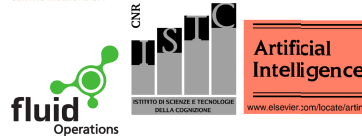
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## **Keynote Talk (Abstracts)**

# Web Search - From the Noun to the Verb (Keynote Talk)

Prabhakar Raghavan

Vice President Engineering  
Google, USA

**Abstract.** This talk examines the evolution of web search experiences over 20 years, and their impact on the underlying architecture. Early web search represented the adaptation of methods from classic Information Retrieval to the Web. Around the turn of this century, the focus shifted to triaging the need behind a query - whether it was Navigational, Informational or Transactional; engines began to customize their experiences depending on the need. The next change arose from the recognition that most queries embodied noun phrases, leading to the construction of knowledge representations from which queries could extract and deliver information regarding the noun in the query. Most recently, three trends represent the next step beyond these “noun engines”: (1) “Queryless engines” have begun surfacing information meeting a user’s need based on the user’s context, without explicit querying; (2) Search engines have actively begun assisting the user’s task at hand - the verb underlying the noun query; (3) increasing use of speech recognition is changing the distribution of queries.

# “To Be or to DO?": The Semantics for Smart Cities and Communities (Keynote Talk)

Paolo Traverso

Director

Center for Information Technology

Fondazione Bruno Kessler, Italy

**Abstract.** The major challenge for so-called smart cities and communities is to provide people with value added services that improve their quality of life. Massive individual and territorial data sets – (open) public and private data, as well as their semantics which allows us to transform data into knowledge about the city and the community, are key enablers to the development of such solutions. Something more however is needed. A “smart” community needs “to do things” in a city, and the people need to act within their own community. For instance, not only do we need to know where we can find a parking spot, which cultural event is happening tonight, or when the next bus will arrive, but we also need to actually pay for parking our car, buy a bus ticket, or reserve a seat in the theater. All these activities (paying, booking, buying, etc.) need semantics in the same way as data does, and such a semantics should describe all the steps needed to perform such activities. Moreover, such a semantics should allow us to define and deploy solutions that are general and abstract enough to be “portable” across the details of the different ways in which activities can be implemented, e.g., by different providers, or for different customers, or for different cities. At the same time, in order to actually “do things”, we need a semantics that links general and abstract activities to the possibly different and specific ICT systems that implement them. In my talk, I will present some of the main problems for realizing the concept of smart city and community, and the need for semantics for both understanding data and “doing things”. I will discuss some alternative approaches, some lessons learned from applications we have been working with in this field, and the still many related open research challenges.

# Semantic Challenges in Getting Work Done (Keynote Talk)

Yolanda Gil

Associate Director

Information Sciences Institute and Department of Computer Science  
University of Southern California, USA

**Abstract.** In the new millennium, work involves an increasing amount of tasks that are knowledge-rich and collaborative. We are investigating how semantics can help on both fronts. Our focus is scientific work, in particular data analysis, where tremendous potential resides in combining the knowledge and resources of a highly fragmented science community. We capture task knowledge in semantic workflows, and use skeletal plan refinement algorithms to assist users when they specify high-level tasks. But the formulation of workflows is in itself a collaborative activity, a kind of meta-workflow composed of tasks such as finding the data needed or designing a new algorithm to handle the data available. We are investigating "organic data science", a new approach to collaboration that allows scientists to formulate and resolve scientific tasks through an open framework that facilitates ad-hoc participation. With a design based on social computing principles, our approach makes scientific processes transparent and incorporates semantic representations of tasks and their properties. The semantic challenges involved in this work are numerous and have great potential to transform the Web to help us do work in more productive and unanticipated ways.

# The Semantic Web in an Age of Open Data (Keynote Talk)

Nigel Shadbolt

Professor of Artificial Intelligence  
The University of Southampton  
and  
Chairman of the Open Data Institute

**Abstract.** The last five years have seen increasing amounts of open data being published on the Web. In particular, governments have made data available across a wide range of sectors: spending, crime and justice, education, health, transport, geospatial, environmental and much more. The data has been published in a variety of formats and has been reused with varying degrees of success. Commercial organisations have begun to exploit this resource and in some cases elected to release their own open data. Only a relatively small amount of the data published has been linked data. However, the methods and techniques of the semantic web could significantly enhance the value and utility of open data. What are the obstacles and challenges that prevent the routine publication of these resources as semantically enriched open data? What can be done to improve the situation? Where are the examples of the successful publication and exploitation of semantically enriched content? What lessons should we draw for the future?



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