

# Research Topics in Semantic Sensor Networks

## Preface to the Proceedings of the 4th International Semantic Sensor Networks Workshop 2011

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Welcome to the fourth international workshop *Semantic Sensor Networks 2011*, held in conjunction with the 10th International Semantic Web Conference, Bonn, Germany, 23–27 October 2011.

Semantic technologies are often proposed as important components of complex, cross-jurisdictional, heterogeneous, dynamic information systems. The needs and opportunities arising from the rapidly growing capabilities of networked sensing devices are a challenging case.

It is estimated that today there are 4 billion mobile devices that can act as sensors, including active and passive RFID tags. This is complemented by an even larger number of fixed sensors recording observations of a wide variety of modalities. Geographically distributed sensor nodes are capable of forming ad hoc networking topologies, with nodes expected to be dynamically inserted and removed from a network. The sensors are increasingly being connected with Web infrastructure, and the Sensor Web Enablement (SWE) standard developed by the Open Geospatial Consortium is being widely adopted in industry, government and academia alike. While such frameworks provide some interoperability, semantics are increasingly seen as a key enabler for integration of sensor data and broader Web information systems. Analytical and reasoning capabilities afforded by Semantic Web standards and technologies are considered important for developing advanced applications that go from capturing observations to recognition of events and ultimately developing comprehensive situational awareness. Defence, transportation, global enterprise, and natural resource management industries are leading the rapid emergence of applications in commercial, civic, and scientific operations that involve sensors, web, services and semantics.

The goal of the Semantic Sensor Networks workshop is to develop an understanding of the ways semantic web technologies can contribute to the growth, application and deployment of large-scale sensor networks on the one hand, and the ways that sensor networks can contribute to the emerging semantic web, on the other. The workshop provides an inter-disciplinary forum to explore and promote these concepts.

The workshop sought paper submissions on topics including

- Semantic support for Sensor Web Enablement
- Spatio-temporal reasoning in sensor networks
- Semantic integration in heterogeneous sensor networks
- Sensors and observations for symbol grounding
- Reasoning with incomplete or uncertain information in sensor networks
- Semantic web services architectures for sensor networks
- Semantic middleware for active and passive sensor networks
- Semantic algorithms for data fusion and situation awareness
- Experience in sensor network applications of semantic technologies
- Rule-based sensor systems
- Ontologies for sensor and RFID networks
- Semantic policy management in shared networks
- Semantic feedback and control
- Semantic discovery of sensors, sensor data and services
- Emergent semantics and ambient intelligence in sensor systems
- Semantic approaches to status monitoring and configuration of sensor systems
- Scalability, security, trust and privacy in semantic sensor networks
- Semantic reasoning for network topology management
- Semantic web in sensor data mashups
- Semantic sensor context management and provenance
- Citizen sensors, participatory sensing and social sensing

The First International Semantic Sensor Network Workshop was held with ISWC in 2006, five years ago. Since that time there has been a considerable growth in interest in the use of modern semantic technologies to address long-standing issues that seem to inhibit the widespread deployment and application of sensor technologies. In particular, the Open Geospatial Consortium has begun to consider the contribution of semantic technologies to the SWE standards. In 2009, a new activity of the W3C, the Semantic Sensor Networks incubator group (SSN-XG) was established to address the development of both semantic annotation for SWE services and an ontology to describe sensor networks and to provide terms for the annotation. This activity published its final report in June this year [1] and a strong community of interest has been established. There are plans for a follow-on activity through a W3C Community Group.

The ontology developed by the Group is already being widely used and we are pleased to have the lead editor of the ontology as our keynote speaker at the workshop, Dr Michael Compton on *What now and where next for the W3C Semantic Sensor Networks Incubator Group sensor ontology*.

The best paper award is presented to Jean-Paul Calbimonte, Hoyoung Jeung, Oscar Corcho and Karl Aberer for the paper *Semantic Sensor Data Search in a Large-Scale Federated Sensor Network*. The paper describes an innovative end-to-end solution which demonstrates the flexibility and versatility of semantic solutions to sensor network challenges. The best paper was selected by an

independent sub-panel of our program committee, based on recommendations from the paper reviewers.

We received a record thirteen papers submitted to the workshop this year, including several short papers. These papers were each carefully reviewed by at least three members of our international program committee. Only five were accepted for presentation as full papers, indicating an increasing pressure for quality in the workshop. In response to the growing research community and developing maturity of the work, we also invited demonstration papers for the first time this year, and received five submissions which were reviewed by our program chairs. The demonstration session at the workshop seemed to be particularly well appreciated so we plan to continue this in future years.

The chairs would like to thank our advisors and program committee. We thank Kevin Page of University of Southampton for organising publicity.

We are very grateful to our sponsors. European project Spitfire (<http://spitfire-project.eu/>) funded by EU under contract 258885 supported our best paper prize for the workshop this year. CSIRO Australia (Commonwealth Scientific and Industrial Research Organisation) supported our keynote speaker.

We hope that you enjoy the workshop, and learn from the papers here. We appreciate your feedback on the workshop this year and hope that you can find a way to contribute in 2012.

1. Laurent Lefort, Cory Henson, Kerry Taylor, Payam Barnaghi, Michael Compton, Oscar Corcho, Ral Garca Castro, John Graybeal, Arthur Herzog, Krzysztof Janowicz, Holger Neuhaus, Andriy Nikolov, and Kevin Page. Semantic Sensor Network XG final report. W3C incubator group report, W3C, 28 June 2011. <http://www.w3.org/2005/Incubator/ssn/XGR-ssn-20110628/>.

## **Program Committee**

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## **Website**

<http://research.ict.csiro.au/conferences/ssn/ssn11>