

# **Advances in Intelligent Systems and Computing**

Volume 260

*Series editor*

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# Advances onto the Internet of Things

How Ontologies Make the Internet  
of Things Meaningful

 Springer

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# Preface

The title of this book is a pun on the use of the preposition “onto” with the aim of recalling “Ontology,” the term commonly adopted in the computer science community to indicate the study of the formal specification for organizing information about objects and entities.

The Ontology notion originates from philosophy, where it refers to the metaphysical study of the nature of being and existence. In computer science and more specifically in the field of knowledge engineering, ontologies are used for a quite different purpose, that is, for modeling concepts and relationships on some domain.

Year 2013 celebrates the twentieth anniversary of the World Wide Web. The simple network of hypermedia has transformed the world of communications with enormous implications on the social relationships; however, it soon showed its main drawback that, in the opinion of its creator—Tim Berners-Lee—is the lack of meaning in exchanged data when artificial agents are involved. Contents were designed to be read by humans and not to be meaningfully manipulated by computer programs.

With the introduction of the semantic web the meaningful contents are opportunely structured, in order to allow software agents roaming from page to page to readily carry out sophisticated tasks.

From an infrastructural perspective the traditional World Wide Web has experienced a further extension represented by the Internet of Things (IoT), today feasible thanks to the integration of the pervasive technology of sensor networks. Sensor networks are composed of several devices capable of sensing environmental phenomena, of performing small on-board computations, and of communicating with each other in order to cooperate.

Two different aspects, observable at two separate layers, characterize the Internet of Things. The physical devices connected to the *network* and the data they are able to collect and transmit constitute the raw infrastructure, deployed all over the globe.

The semantics of the collected data, the meaning of the actions they are able to trigger, their exploitation in ever-more challenging applications capable of dramatically changing everyday life, represent the real knowledge that human beings and even computers themselves may acquire.

The most important contribution of IoT regards the possibility of enabling more efficient machine-to-machine cooperation. To such aim, ontologies represent the

most suitable tool to enable transfer and comprehension of information among computer applications, even those designed and developed by unrelated people in different places.

It is thus possible to surf the sea of information available today in digital form without the intervention of a human being, thus accomplishing a real web of things.

This new paradigm uncovers new horizons for the development of visionary and challenging applications. Such new services, bridging the virtual and physical worlds, span various domains such as energy efficiency, health care, precision agriculture, and infrastructure monitoring.

This book proposes a collection of contributions illustrating different applications following these directions and that are the outcomes of real experiences developed in the context of research projects.

A relevant portion of the book contains papers illustrating the Internet of Things in the specific domain of Ambient Intelligence (AmI). AmI is a recent research field that considers the user as the focus of an environment equipped with pervasive devices, with the main goal of satisfying his requirements, and of assisting him in daily activities. The complexity of such a domain imposes the adoption of formal methods of knowledge representation; in such context, ontologies represent a useful instrument for overcoming the intrinsic difficulties arising from heterogeneity and dynamicity, thus effectively making the Internet of Things fully exploitable.

Papers presented in the first part of the book (1–15) fall within this group and have been discussed during a project workshop held in Palermo on October 29, 2013.

Furthermore, in order to reach a broader audience, we collected some other interesting contributions devoted to illustrate other compelling application fields, ranging from the tourism market to the public administration, from the thermo-solar plants to the multi-risk assessment.

We would like to thank all the authors for their contributions, which we believe represent interesting and stimulating advances in this cross-disciplinary field.

We also would like to thank all the colleagues for their invaluable support in reviewing the papers, and finally Dr. Alessandro Perricone for his help in the final editing.

November 2013

Salvatore Gaglio  
Giuseppe Lo Re

# Contents

<b>An Ontology-Based Autonomic System for Ambient Intelligence Scenarios</b> . . . . .	1
Alessandra De Paola	
<b>Detection of User Activities in Intelligent Environments</b> . . . . .	19
Agnese Augello and Salvatore Gaglio	
<b>An AMI System for User Daily Routine Recognition and Prediction</b> . . . . .	33
Salvatore Gaglio and Gloria Martorella	
<b>A Fuzzy Adaptive Controller for an Ambient Intelligence Scenario</b> . . . . .	47
Alessandra De Paola, Giuseppe Lo Re and Antonio Pellegrino	
<b>Design of an Adaptive Bayesian System for Sensor Data Fusion</b> . . . . .	61
Alessandra De Paola and Luca Gagliano	
<b>A Heterogeneous Sensor and Actuator Network Architecture for Ambient Intelligence</b> . . . . .	77
Enrico Daidone, Orazio Farruggia and Marco Morana	
<b>Short-Term Sensory Data Prediction in Ambient Intelligence Scenarios</b> . . . . .	89
Enrico Daidone and Fabrizio Milazzo	
<b>A Structural Approach to Infer Recurrent Relations in Data</b> . . . . .	105
Pietro Cottone, Salvatore Gaglio and Marco Ortolani	
<b>Hardware and Software Platforms for Distributed Computing on Resource Constrained Devices</b> . . . . .	121
Gloria Martorella, Daniele Peri and Elena Toscano	

<b>From IEEE 802.15.4 to IEEE 802.15.4e: A Step Towards the Internet of Things . . . . .</b>	135
Domenico De Guglielmo, Giuseppe Anastasi and Alessio Seghetti	
<b>Extracting Structured Knowledge From Sensor Data for Hybrid Simulation . . . . .</b>	153
Marco Ortolani	
<b>Gait Analysis Using Multiple Kinect Sensors . . . . .</b>	167
Gabriele Maida and Marco Morana	
<b>3D Scene Reconstruction Using Kinect . . . . .</b>	179
Marco Morana	
<b>Sensor Node Plug-in System: A Service-Oriented Middleware for Wireless Sensor Networks . . . . .</b>	191
Giuseppe Di Modica, Francesco Pantano and Orazio Tomarchio	
<b>Toward the Next Generation of Sensors as a Service . . . . .</b>	209
Dario Lombardo, Vito Morreale and Giuseppe Li Calsi	
<b>Advances in Internet of Things as Related to the e-government Domain for Citizens and Enterprises . . . . .</b>	217
Francesco Beltrame and Virginia Dagostino	
<b>Low-Effort Support to Efficient Urban Parking in a Smart City Perspective . . . . .</b>	233
Alessio Bechini, Francesco Marcelloni and Armando Segatori	
<b>An Integrated System for Advanced Multi-risk Management Based on Cloud for IoT . . . . .</b>	253
Maria Fazio, Antonio Celesti, Antonio Puliafito and Massimo Villari	
<b>Towards Internet Intelligent Services Based on Cloud Computing and Multi-Agents . . . . .</b>	271
Domenico Talia	
<b>Chatbots as Interface to Ontologies . . . . .</b>	285
Agnese Augello, Giovanni Pilato, Giorgio Vassallo and Salvatore Gaglio	
<b>Body Area Networks and Healthcare . . . . .</b>	301
Daniele Peri	



**Urban Air Quality Monitoring Using Vehicular Sensor Networks . . . .** 311  
Giuseppe Lo Re, Daniele Peri and Salvatore Davide Vassallo

**Concentrated Solar Power: Ontologies for Solar Radiation  
Modeling and Forecasting . . . . .** 325  
Antonino Piazza and Giuseppe Faso

**Designing Ontology-Driven Recommender Systems for Tourism . . . . .** 339  
Pierluca Ferraro and Giuseppe Lo Re