

Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering

169

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Internet of Things

IoT Infrastructures

Second International Summit, IoT 360° 2015
Rome, Italy, October 27–29, 2015
Revised Selected Papers, Part I

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ISSN 1867-8211 ISSN 1867-822X (electronic)
Lecture Notes of the Institute for Computer Sciences, Social Informatics
and Telecommunications Engineering
ISBN 978-3-319-47062-7 ISBN 978-3-319-47063-4 (eBook)
DOI 10.1007/978-3-319-47063-4

Library of Congress Control Number: 2016954126

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Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

SaSeIoT 2015

Preface

The Second EAI International Conference on Safety and Security in Internet of Things (SaSeIoT' 2015) was held in Rome, Italy, during October 26–27, 2015, as a collocated event of the IoT 360° Summit 2015.

This international conference attracted submissions from various countries. Each paper went through a rigorous peer-review process, with each submission receiving multiple reviews from the members of the Technical Program Committee. We could only select a few of the highest-quality papers for inclusion in the final program.

The accepted papers, which focus on security and privacy issues, provide great insight into the latest research findings in the area of the Internet of Things. In addition to the technical papers, the workshop program also included two keynote speeches. The first keynote entitled “Contract-Based Design Tailored to Safety Issues for Cyber-physical Systems” was delivered by Dr. Daniela Cancila. The second keynote entitled “Security and Privacy in IoT” was delivered by Dr. Hakima Chaouchi.

We would like to thank all the people who worked hard to make this conference a real success. First and foremost, we thank all authors who submitted their papers for consideration for this conference as well as all Technical Program Committee members for providing rigorous, timely reviews. We would also like to thank the European Alliance for Innovation (EAI) for its sponsorship. Finally, we express our gratitude to Kristina Lukáčová for her continuous administrative support throughout the preparation of this conference.

Hakima Chaouchi
Sherali Zeadally

CYCLONE 2015

Preface

The First EAI International Conference on Cyber Physical Systems, IoT and Sensors Networks (CYCLONE 2015) was held in Rome, Italy, on October 26, 2015, as a collocated event of the IoT 360° Summit 2015.

The conference was an incredible first step on the way to becoming a benchmark in the multidisciplinary fields of CPS, IoT, and sensor networks. The technologies originating from the areas of sensing, networking, control, and processing are enablers for exciting new opportunities for researchers, engineers, and business people to innovate in meaningful ways. And that is who CYCLONE 2015 was created for – the goal was to bring all of these different parties together to share ideas and visions.

It was our great pleasure to host prominent keynote speakers, and authors of all the excellent accepted papers, courtesy of the passionate and dedicated Program Committee members, to whom we would like to extend our warmest thanks. Lastly, this event could not happen without the support of EAI and Kristina Lukáčová, the event manager, who organized CYCLONE 2015 with great effort and expertise; and we wish to extend our sincere gratitude to both.

GOODTECHS 2015

Preface

The GOODTECHS 2015 Conference was the first edition of a conference that aims to become a point of attraction for researchers in the area and it was held in the beautiful city of Rome, a worldwide renowned historical, academic and cultural center. In GOODTECHS we were interested in experiences with the design, implementation, deployment, operation, and evaluation of smart objects and technologies for social good. Clearly, we were not considering only the so-called first world as the scenario for this evolution; we also referred to those areas where ICT is currently less widespread, hoping that it may represent a societal development opportunity rather than a source for further divide.

It was our honor to have prominent international scholars as speakers. The conference program included technical papers selected through peer reviews by the Technical Program Committee members and keynote speakers who provided even more insight into this area. We would like to thank the EAI for the support and all the members of the conference committees and the reviewers for their dedicated and passionate work. None of this would happen without the support and curiosity of the authors who sent their papers to this first event. Finally, we would like to encourage current and future authors to continue working in this direction and to participate in forums like this conference so as to exchange knowledge and experiences and to make ICT actually helpful to society.

Ombretta Gaggi
Pietro Manzoni
Claudio Palazzi

CN4IoT 2015

Preface

The First International Conference on Cloud, Networking for IoT systems (CN4IoT) was held in Rome, Italy, during October 26–27, 2015, as a collocated event of the IoT 360° Summit 2015.

CN4IoT 2015 was conceived to analyze limits and/or advantages in the exploitation of existing solutions developed for cloud, networking, and IoT, and to foster new, original, and innovative contributions. We strongly believe that it is time to link cloud, networking, and IoTs. Nowadays, ICT researchers are looking to improve networking, for example, to effectively improve the quality of life of citizens in smart city scenarios using IoT devices, and to put everything in place trying to improve the experience of common users. There are masses of users who like to use the cloud but it has to be easy to use and it must have a positive impact on their lives. Before, the cloud was an issue only ICT researchers were concerned with. Today, many people are trying to involve professionals in their activities, such as lawyers, doctors, engineers, and so on. They use services like cloud services, small things, and say, “It’s amazing, that we can interact with each other, write in the same document, we can make progress in our work and make the workflow better.” The workflow has changed. We realize this, and we try to move forward. It is a challenge but it is also time to change how we think, and we are first in the row.

It was our honor to have invited prominent and valuable ICT worldwide experts as keynote speakers. The conference program comprised technical papers selected through peer reviews by the Technical Program Committee members and invited talks. SDWN 2015 would not have been realized without the help and dedication of our conference manager, Kristina Lukáčová, from the European Alliance for Innovation (EAI). We would like to thank the conference committees and the reviewers for their dedicated and passionate work. None of this would have happened without the support and curiosity of the authors who sent their papers to this first edition of CN4IoT.

HealthyIoT 2015

Preface

The Second EAI International Conference on IoT Technologies for Health Care (HealthyIoT 2015) was held in Rome, Italy, during October 26–27, 2015, as a collocated event of the IoT 360° Summit 2015.

Internet of Things (IoT) devices are becoming more powerful every year, and there is an immense amount of information flowing between them in the cloud. By applying the concept of IoT to the health-care sector, it is possible to collect, store, and analyze physiological data and to provide new medical services for citizens based on a constant monitoring and early detection of dangerous situations. IoT offers greater opportunities in the field of health care, allowing for a wider access, a better quality, and a lower cost of health care.

When combining the power of IoT devices and physiological sensors, as well as cloud technology that enables us to work with data in new exciting ways, we can introduce the concept of pervasive health-care systems that provide new health services for chronically ill patients, for people with specific diseases or disorders, and for individuals switching to a healthier lifestyle. The HealthyIoT 2015 workshop produced valuable insights on how the IoT systems, together with new cloud computing and big data capabilities, can help patients, caregivers, and medical personnel to envisage new, value-added health-care solutions for the future.

We wish to extend our great thanks to all the members of the Program Committee for their rigorous effort, dedication, and critical eye. We would also like to thank all of the contributing authors, whose great passion and expertise have produced deep insight into the applications of IoT for health care. Finally, we would like to thank EAI for their support, and Kristina Lukáčová for managing HealthyIoT 2015 with great skill and enthusiasm.

IoTaaS 2015

Preface

It gives us a great pleasure to welcome you to the proceedings of the Second EAI International Conference on IoT as a Service (IoTaaS 2015) held in the beautiful city of Rome, as a part of IoT360, the international summit on Internet of Things. We plan this event as a melting point for researchers, engineers, and business people to meet and exchange ideas and information. IoTaaS is an international venue for publishing innovative and cutting-edge results on the convergence of next-generation technologies and methodologies reshaping our way of living. This conference focuses on the Internet of Things (IoT) in general and in particular on providing innovative and enabling capabilities “as a service.” The cloud serves as the central focal point for consumption and delivery of such technologies and applications.

As we are striding into the era of IoT, a key question is how we make the most of IoT for all stakeholders, including platform providers, IoT application developers, end-users, large and small organizations (such as city councils, enterprises) that wish to provide better service, and manufacturers of smart devices. The amount of smart devices immersed in everyday life, from manufacturing to clothing, is growing every day in terms of power, processing, and network connectivity. The sheer size and variety of contextual data that they produce, along with the actions they can take on their environment, is enormous. It remains to be answered how all this potential will come to bear; the Second International Conference on IoT as a Service (IoTaaS 2015) aimed to contribute to the discussion on the challenges posed by these trends.

The conference program comprised technical papers selected through peer reviews by the Technical Program Committee members, invited talks, industrial presentations, and a demo session. We received many good papers. These papers went through a rigorous review process for the selection of papers for the program. The selected papers cover a wide spectrum of topics related to IoTaaS. We had papers on architectures for the IoT, security and privacy, semantics, and testing. Additionally, we were honored to have two prominent keynote speakers: Gabi Zodik from IBM Research discussing “Future Directions in Mobile, IoT and Wearable Enterprise Computing”; and Alfeo Pareschi from Axiros, discussing “IoT Platforms: Security, Identity Management, Ontologies and Interoperability.” Finally we were honored to have an invited talk by Afonso Ferreira from the European Commission, who provided the commission’s point of view on IoT research and innovation in the European Commission. We believe that this strong program laid a concrete foundation for this conference for years to come.

We would like to thank the EAI for their initiative and support and all the members of the conference committees and the reviewers for their dedicated and passionate work. None of this could happen without the support and curiosity of the authors who sent their papers to this event.

Benny Mandler
Kostas Magoutis

MobilityIoT 2015

Preface

A wide selection of cutting-edge and insightful research papers were presented at the Second EAI International Conference on Mobility in IoT 2015.

The 2015 conference was an IoT co-located event that took place in Rome, Italy, during October 26–27 2015, forming one of the main conferences within the IoT 360 Summit organized by the European Alliance for Innovation, in Trento, Italy, and the European Alliance for Innovation in Slovakia.

The Mobility in IoT 2015 conference was organized by the Faculty of Materials Science and Technology (MTF STU) in Trnava, Institute of Industrial Engineering and Management, in collaboration with the European Alliance for Innovation in Slovakia, and its partner, the European Alliance for Innovation, in Trento, Italy.

It was a great satisfaction to have the opportunity to welcome and meet individuals from around the world, all of whom share a common interest in the area of mobility in IoT. In particular, the organizers would like to thank the presenters, who showcased their latest research, and the audience members, who added to active discussions and debate regarding the recent developments and the outlook for the future for the field.

The goal of the EAI International Conference on Mobility in IoT 2015 was to provide a platform for the cross-fertilization of ideas and to present cutting-edge innovation and technologies for sustainable solutions to the mobility agenda. The focus of the conference reflected the EU thematic priorities for research and innovation to improve the quality of life of citizens and make cities more sustainable with less impact on the environment. The conference presented participants with a unique opportunity to engage with different stakeholders from across Europe and around the world. In doing so, the conference offered an ideal platform to empower the triple helix of university research, industry, and government, while also providing innovative opportunities focusing on the growth and development of mobility in IoT.

A total of 13 research papers are featured in this publication, with contributions by researchers from across Europe and around the world. The publication includes articles that were written and presented by authors from nine countries, including Poland, the Czech Republic, Serbia, Italy, South Korea, Germany, Colombia, India, and Slovakia.

Among the papers presented at the conference were these presented by the conference keynote speakers, Prof. Milan Dado, the Dean of the Faculty of Electronics, TU Zilina, Slovakia, and a coordinator of the project ERA Chair H2020, who discussed the “Internet of Things as Advanced Technology to Support Mobility and Intelligent

Transport,” Jaroslav Holeček, vice-president of the Slovak Automotive Industry Association (ZAP), who discussed the topic of “Innovation as Basic Prerequisite of Competitiveness of Automotive Industry in Slovakia,” Prof. George Teodorescu, from the International Institute for Integral Innovation, Köln, Germany who presented the topic of “i-WALK, a Different Approach to Urban Mobility,” Prof. Dušan Petráš, of the Slovak University of Technology in Bratislava, Slovakia, former vice-rector of STU and former dean of the Faculty of Civil Engineering, who gave a talk on the topic “Smart Cities — Energy-Efficient and Environmentally Friendly Housing,” and Dr. Predrag K. Nikolic, Associate Professor at the Faculty of Digital Production, EDUCONS University, Serbia, and visiting professor at the Bergen Academy of Art and Design, Norway, as well as Shenzhen School of Industrial Design, China, who presented the topic of “Multimodal Interactions: Embedding New Meanings to Known Forms and Objects.”

The participants were particularly impressed by the wide range of innovative research solutions presented during the conference. As a result, the papers included here, in our opinion, accurately reflect the diversity of content and rapidly developing nature of the IoT agenda. The research not only illustrates the current state of the art in the field but it also helps to contribute to defining the future thematic areas of debate.

In conclusion, the Scientific Committee members and organizers would like to express their sincere thanks to all the authors and audience members who attended the conference in Rome, Italy, and also the authors, who contributed to the creation of this Mobility in IoT publication.

Dagmar Cagánová
Jana Šujanová

S-Cube 2015

Preface

This volume contains the proceedings of S-Cube 2015, the 6th International Conference on Sensor Systems and Software. The conference took place in Rome, Italy, during October 26–27, 2015. The aim of the conference was to provide a forum in which researchers and practitioners from academia and industry, as well as the “makers,” may work together in order to present and debate the different innovative solutions and applications in sensing systems and associated software.

This year the conference was organized in conjunction with the IoT360 Summit and was focused on the Internet of Things (IoT) paradigm. The reason for choosing this topic is that the IoT has slowly but steadily and increasingly permitted what researchers and engineers study and build. “Sensing systems” and “software” play a crucial role for the emerging world of the IoT.

S-Cube received a total of 28 paper submissions of which ten were selected for full publication and presentation. Apart from full papers, six short papers and four invited contributions are published and were presented during the conference. Paper submissions were received from 14 different countries from all over the world. The selection process involved over 90 reviews with all papers being evaluated by at least three independent reviewers. In addition, the reviews were discussed off-line by the chairs and the Technical Program Committee, prior to making final decisions. The final program covered a wide range of topics, which were grouped into six sessions: Sensors, Experimentation and Prototyping, IoT and Cyber Physical Systems, Software, Self-x and Smart Methods, and Evaluation and Analysis.

The conference program included other elements in addition to the presentation of research papers. Two keynotes were given by Andrew Markham, Lecturer in Software Engineering at the University of Oxford, UK, and Fahim Kawsar, Head of IoT Research at Alcatel Lucent Bell Laboratories, Belgium. Dr. Markham and Dr. Kawsar spoke about “Structural Monitoring” and “Innovative Human Centered IoT Systems,” respectively.

We would like to thank all authors for their contributions to this volume and in particular the reviewers for their hard work that significantly helped to improve the initial submissions and made our work easier when selecting the papers. We would like to also thank all the volunteers who shared their talent, dedication, and time for the workshop arrangements and for preparing these proceedings.

Andrey Somov
David Boyle

InterIoT 2015

Preface

It is our real pleasure to welcome you to the proceedings of the First EAI International Conference on Interoperability in IoT held in the amazing city of Rome, Italy. Colocated with the IoT360 summit and taking advantage of its attractiveness, InterIoT 2015 offered an exciting technical program consisting of a keynote speech, invited talks, and technical sessions that presented original and fundamental research advances in all aspects of interoperability of these heterogeneous IoT platforms. Indeed, IoT products are now hitting the market across a large variety of segments. Often driven by the fear of “falling behind”, small and large companies push their engineering teams to produce solutions quickly. The result is that the market is highly fragmented: A large number of non-interoperable solutions are being installed, eventually leading to increased costs, inefficiencies, customer frustration, and a rate of adoption of the IoT that is much slower than that touted by analysts. The market is now at a state where we ought to think about interoperability. Interoperability appears to a major and new challenge.

The goal of InterIoT is to bring together practicing engineers and advanced researchers to share information on the state of the art around interoperability in the IoT, analyze what is needed, and identify the work that lies ahead to increase the number of interoperable IoT products.

We received high-quality submissions from all parts of the world. After a rigorous review process, eight regular and invited papers were included in the technical program. The program also featured a keynote addressed by Prof. Carsten Bormann from Universität Bremen, Germany.

We would like to thank the Technical Program Committee chair Dr. Thomas Watteyne, who did a remarkable job in the establishment of the technical program. The conference would not have been possible without his help or that of all the TPC members, publicity chair, and external reviewers, who volunteered their time and professional expertise. We would like to take this opportunity to thank all of them for their help. We would also like to thank all the authors for contributing their quality work, and our sponsors and partners for their support, including CREATE-NET and EAI. We received excellent and support from our sponsors, especially from Kristina Lukáčová who managed the conference organization. Sincere and dedicated thanks to her.

Finally, we hope you enjoy the proceedings.

Nathalie Mitton
Thomas Noel

SDWNCT 2015

Preface

The Second EAI International Conference on Software Defined and Virtualized Future Wireless Networks and Cognitive Technologies (SDWNCT 2015) was held in Rome, Italy, on October 26, 2015, as a collocated event of the IoT 360° Summit 2015. SDWNCT aims to explore new design spaces, new challenges and solutions, as well as new applications and services of software-defined virtualized future mobile and wireless networks. At the same time, it targets enthusiastic researchers and practitioners from AI and IoT-related areas sharing the common goal of addressing the challenges posed by the Cognitive aspect of IoT by using new or leveraging existing Artificial Intelligence techniques. All this to bring to the community original and inspiring research contributions from technology experts, designers, researchers, and architects in academia and industry.

It was our honor to have invited prominent scholars as keynote speakers. The conference program comprised technical papers selected through peer reviews by the Technical Program Committee members, invited talks, special sessions, and a demo session. Putting together a workshop of the scope and caliber of SDWN was a challenging and exciting undertaking. We are very grateful for the contributions of each of the members of the Technical Program Committee in selecting the best out of all outstanding work submitted. SDWNCT 2015 would not have been a reality without the help and dedication of our conference manager, Kristina Lukáčová, from the European Alliance for Innovation (EAI), who worked with us and the Technical Program Committee chairs. As Organizing Committee, we hope you enjoy the proceedings of SDWNCT 2015 and the IoT 360° Summit 2015, which includes high-quality and exciting research work in SDN and Cognitive Technologies applied to future services in IoT.

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Contents – Part I

SaSeIoT

Innovative TLS/DTLS Security Modules for IoT Applications: Concepts and Experiments	3
<i>Pascal Urien</i>	
Controlled Android Application Execution for the IoT Infrastructure	16
<i>Michael N. Johnstone, Zubair Baig, Peter Hannay, Clinton Carpena, and Malik Feroze</i>	
Combined Danger Signal and Anomaly-Based Threat Detection in Cyber-Physical Systems	27
<i>Viktoriya Degeler, Richard French, and Kevin Jones</i>	
Performance Evaluation of Searchable Symmetric Encryption in Wireless Sensor Networks	40
<i>Cristina Muñoz, Lucas Rocci, Eduardo Solana, and Pierre Leone</i>	
Secure Data Exchange Based on Social Networks Public Key Distribution . . .	52
<i>Krzysztof Podlaski, Artur Hlobaž, and Piotr Milczarski</i>	

CYCLONE

An SDN and CPS Based Opportunistic Upload Splitting for Mobile Users . . .	67
<i>Maurizio Casoni, Carlo Augusto Grazia, and Martin Klapez</i>	
A Cloud-Based Platform of the Social Internet of Things	77
<i>Roberto Girau, Salvatore Martis, and Luigi Atzori</i>	
Stand-Alone Smart Wireless Sensor Nodes Providing Dynamic Routing by Means of Adaptive Beamforming	89
<i>Roberto Caso, Rosario Garroppo, Stefano Giordano, Giuliano Manara, Andrea Michel, Paolo Nepa, Luca Tavanti, Marco Magnaros, and Guido Nenna</i>	
A Centrality-Based ACK Forwarding Mechanism for Efficient Routing in Infrastructureless Opportunistic Networks	99
<i>Sanjay K. Dhurandher, Isaac Woungang, Anshu Rajendra, Piyush Ghai, and Periklis Chatzimisios</i>	
Zone-Based Living Activity Recognition Scheme Using Markov Logic Networks	109
<i>Asaad Ahmed, Hirohiko Suwa, and Keiichi Yasumoto</i>	

Acumen: An Open-Source Testbed for Cyber-Physical Systems Research . . .	118
<i>Walid Taha, Adam Duracz, Yingfu Zeng, Kevin Atkinson,</i> <i>Ferenc A. Bartha, Paul Brauner, Jan Duracz, Fei Xu,</i> <i>Robert Cartwright, Michal Konečný, Eugenio Moggi, Jawad Masood,</i> <i>Pererik Andreasson, Jun Inoue, Anita Sant’Anna, Roland Philippsen,</i> <i>Alexandre Chapoutot, Marcia O’Malley, Aaron Ames, Veronica Gaspes,</i> <i>Lise Hvatum, Shyam Mehta, Henrik Eriksson, and Christian Grante</i>	
Spatial Reuse Based Resource Allocation in Device-to-Device Communications	131
<i>Tiansheng Sun, Li Wang, Zilong Wu, and Tommy Svensson</i>	
Wireless M-BUS: An Attractive M2M Technology for 5G-Grade Home Automation.	144
<i>Pavel Masek, Krystof Zeman, Zenon Kuder, Jiri Hosek, Sergey Andreev,</i> <i>Radek Fujdiak, and Franz Kropfl</i>	
Carpooling in Urban Areas: A Real-Time Service Case-Study	157
<i>Matteo Mallus, Giuseppe Colistra, Luigi Atzori, and Maurizio Murrone</i>	
Spectrum Sharing Approaches for Machine-Type Communications over LTE Heterogeneous Networks	167
<i>Antonino Orsino, Massimo Condoluci, and Giuseppe Araniti</i>	
Softwarization and Virtualization in 5G Networks for Smart Cities	179
<i>Massimo Condoluci, Fragkiskos Sardis, and Toktam Mahmoodi</i>	
Feasibility of Signaling Storms in 3G/UMTS Operational Networks	187
<i>Frederic Francois, Omer H. Abdelrahman, and Erol Gelenbe</i>	
Countering Mobile Signaling Storms with Counters.	199
<i>Erol Gelenbe and Omer H. Abdelrahman</i>	
A Data Plane Approach for Detecting Control Plane Anomalies in Mobile Networks.	210
<i>Omer H. Abdelrahman and Erol Gelenbe</i>	
Demonstrating the Versatility of a Low Cost Measurement Testbed for Wireless Sensor Networks with a Case Study on Radio Duty Cycling Protocols	222
<i>Maite Bezunartea, Marie-Paule Uwase, Jacques Tiberghien,</i> <i>Jean-Michel Dricot, and Kris Steenhaut</i>	
GOODTECHS	
Technology, Citizens and Social Change in the Framework of European Research and Innovation Programmes: Towards a Paradigm Shift	233
<i>Marta Arniani</i>	

Understanding the City to Make It Smart	239
<i>Roberta De Michele and Marco Furini</i>	
MobilitApp: Analysing Mobility Data of Citizens in the Metropolitan Area of Barcelona	245
<i>Silvia Puglisi, Ángel Torres Moreira, Gerard Marrugat Torregrosa, Mónica Aguilar Igartua, and Jordi Forné</i>	
Calibrating Low-End Sensors for Ozone Monitoring	251
<i>Óscar Alvear, Carlos Tavares Calafate, Juan-Carlos Cano, and Pietro Manzoni</i>	
Evaluation of TSCH/IEEE 802.15.4e in a Domestic Network Environment . .	257
<i>Luis Pacheco, Tom Vermeulen, Sofie Pollin, and Priscila Solis</i>	
A Stochastic Optimization Model for the Placement of Road Site Units	263
<i>Luis Urquiza-Aguilar, Carolina Tripp-Barba, and Mónica Aguilar Igartua</i>	
Can a Game Improve People’s Lives? The Case of <i>Serious Games</i>	270
<i>Armır Bujari, Matteo Ciman, Ombretta Gaggi, and Claudio E. Palazzi</i>	
About Game Engines and Their Future	276
<i>Dario Maggiorini, Laura Anna Ripamonti, and Giacomo Cappellini</i>	
Smart Cart: When Food Enters the IoT Scenario	284
<i>Marco Furini and Claudia Pitzalis</i>	
Towards Autonomic Middleware-Level Management of QoS for IoT Applications	290
<i>Yassine Banouar, Saad Reddad, Codé Diop, and Christophe Chassot</i>	
Safe Bicycle Parking Platform Based on RFID Technology	297
<i>Víctor Juan Expósito Jiménez, Florian Salmhofer, Reinhold Frosch, Herwig Zeiner, and Werner Haas</i>	

CN4IoT

Opportunistic Collaborative Service Networks: The Facilitator for Efficient Data and Services Exchange	307
<i>Dimosthenis Kyriazis, George Kousiouris, Alexandros Psychas, Andreas Menychtas, and Theodora Varvarigou</i>	
A Case for Understanding End-to-End Performance of Topic Detection and Tracking Based Big Data Applications in the Cloud	315
<i>Meisong Wang, Rajiv Ranjan, Prem Prakash Jayaraman, Peter Strazdins, Pete Burnap, Omer Rana, and Dimitrios Georgakopoulos</i>	

On Security SLA-Based Monitoring as a Service	326
<i>Dana Petcu, Silviu Panica, Bogdan Irimie, and Georgiana Macariu</i>	
Security and IoT Cloud Federation: Design of Authentication Schemes	337
<i>Luciano Barreto, Antonio Celesti, Massimo Villari, Maria Fazio, and Antonio Puliafito</i>	
When the Cloud Goes Pervasive: Approaches for IoT PaaS on a Mobiquitous World	347
<i>Luiz Angelo Steffens and Manuele Kirsch Pinheiro</i>	
Coordinating Data Analysis and Management in Multi-layered Clouds.	357
<i>Ioan Petri, Javier Diaz-Montes, Omer Rana, Yacine Rezgui, Manish Parashar, and Luiz F. Bittencourt</i>	
Foundations for Simulating IoT Control Mechanisms with a Chemical Analogy.	367
<i>Gabor Kecskemeti and Zsolt Nemeth</i>	
Towards Urban Mobile Sensing as a Service: An Experience from Southern Italy	377
<i>Marco Zappatore, Antonella Longo, Mario A. Bochicchio, Daniele Zappatore, Alessandro A. Morrone, and Gianluca De Mitri</i>	
On the Minimization of the Energy Consumption in Federated Data Centers.	388
<i>Alexis I. Aravanis, Panagiotis Karkazis, Artemis Voulkidis, and Theodore Zahariadis</i>	
Towards Enabling Scientific Workflows for the Future Internet of Things . . .	399
<i>Attila Kertesz and Tamas Pflanzner</i>	
Cloud Computing-Based Marketplace for Collaborative Design and Manufacturing	409
<i>Ashis Gopal Banerjee, Benjamin Beckmann, John Carbone, Lynn DeRose, Annarita Giani, Peter Koudal, Patricia Mackenzie, Joseph Salvo, Dan Yang, and Walter Yund</i>	
Towards Defining Families of Systems in IoT: Logical Architectures with Variation Points.	419
<i>Simone Di Cola, Kung-Kiu Lau, Cuong Tran, and Chen Qian</i>	
HealthyIoT	
An Overview on the Internet of Things for Health Monitoring Systems	429
<i>Mobyen Uddin Ahmed, Mats Björkman, Aida Čaušević, Hossein Fotouhi, and Maria Lindén</i>	

An Adaptive QoE-Based Network Interface Selection for Multi-homed eHealth Devices	437
<i>Sami Souihi, Mohamed Souidi, and Abdelhamid Mellouk</i>	
An Internet-Based Tool for Pediatric Cardiac Disease Diagnosis Using Intelligent Phonocardiography	443
<i>Arash Gharehbaghi and Maria Lindén</i>	
Non-contact Physiological Parameters Extraction Using Camera	448
<i>Hamidur Rahman, Mobyen Uddin Ahmed, and Shahina Begum</i>	
Security Analysis of an IoT Architecture for Healthcare.	454
<i>M. Teresa Villalba, Manuel de Buenaga, Diego Gachet, and Fernando Aparicio</i>	
A Cooperative Decision Support System for Children's Neurodevelopment Monitoring	461
<i>María-Luisa Martín-Ruiz, Miguel-Angel Valero, Ana Gómez, and Carmen Torcal</i>	
Can the Regression Trees Be Used to Model Relation Between ECG Leads? . . .	467
<i>Ivan Tomasic, Roman Trobec, and Maria Lindén</i>	
Elderly Monitoring System with Sleep and Fall Detector	473
<i>Abdulakeem Odunmbaku, Amir-Mohammad Rahmani, Pasi Liljeberg, and Hannu Tenhunen</i>	
Health Sensors Information Processing and Analytics Using Big Data Approaches.	481
<i>D. Gachet Páez, M.L. Morales Botello, E. Puertas, and M. de Buenaga</i>	
Leveraging IoT Device Data for Emotional Health	487
<i>Hariprasad Anumala, Shiva Murthy Busetty, and Vishal Bharti</i>	
SMARTA: Smart Ambiente and Wearable Home Monitoring for Elderly. . . .	502
<i>Paolo Perego, Marco Tarabini, Marco Bocciolone, and Giuseppe Andreoni</i>	
A Labview Based Ubiquitous Telehealth System for the Elderly.	508
<i>M.W. Raad and Tarek Sheltami</i>	
Context-Aware Early Warning System for In-Home Healthcare Using Internet-of-Things	517
<i>Arman Anzanpour, Amir-Mohammad Rahmani, Pasi Liljeberg, and Hannu Tenhunen</i>	
On Evaluating Blood Pressure Through Photoplethysmography.	523
<i>Giovanna Sannino, Ivanoe De Falco, and Giuseppe De Pietro</i>	

An Inhaler Dose Recording Service Designed for Patients Who Need Chronic Respiratory Disease Control	530
<i>Shu-Hui Hung, Hsin-Hung Lin, Chin-Shian Wong, Ian Kuo, and James Pang</i>	
A Novel Approach to Unify Robotics, Sensors, and Cloud Computing Through IoT for a Smarter Healthcare Solution for Routine Checks and Fighting Epidemics	536
<i>Arijit Sinharay, Arpan Pal, Snehasis Banerjee, Rohan Banerjee, Soma Bandyopadhyay, Parijat Deshpande, and Ranjan Dasgupta</i>	
Author Index	543

Contents – Part II

IoTaaS

Managing Connected Smart Objects	3
<i>Alan McGibney, Alejandro Esquivia Rodriguez, Oliva Brickley, and Susan Rea</i>	
Configurable Role Based Concrete Architecture Layers: Constituting Business Process Aware Internet-of-Things Services' Reference Architecture	10
<i>Vikas S. Shah</i>	
Lightweight Device Task Actuation Framework as IoT Test Platform	20
<i>Dhiman Chattopadhyay, Abinash Samantaray, and Hari Raghav</i>	
Networked Smart Objects: Moving Data Processing Closer to the Source.	28
<i>Alessandra Rizzardi, Daniele Miorandi, Sabrina Sicari, Cinzia Cappiello, and Alberto Coen-Porisini</i>	
Automated Workflow Formation for IoT Analytics: A Case Study	36
<i>Tanushyam Chattopadhyay, Avik Ghose, Arijit Mukherjee, Santa Maiti, and Arpan Pal</i>	
On Integrating Heterogeneous Locating Services	44
<i>Hiroki Takatsuka, Sachio Saiki, Shinsuke Matsumoto, and Masahide Nakamura</i>	
A Semantic Algorithm Repository and Workflow Designer Tool: Signal Processing Use Case	53
<i>Sounak Dey, Dibyanshu Jaiswal, Himadri Sekhar Paul, and Arijit Mukherjee</i>	
Biotelemetry System for Remote Monitoring of Cardiac Signals and Temperature Using Social Networks	62
<i>Melissa Montalvo, Andrea García, Julio Montesdeoca, and René Ávila</i>	
IoT Testing - The Big Challenge Why, What and How	70
<i>Benny Sand</i>	
Data-Centric Security for the IoT	77
<i>Daniel Schreckling, Juan David Parra, Charalampos Doukas, and Joachim Posegga</i>	

Privacy Aware on-Demand Resource Provisioning for IoT Data Processing . . .	87
<i>Tom Kirkham, Arnab Sinha, Nikos Parlavantzas, Bartosz Kryza, Paul Fremantle, Kyriakos Kritikos, and Benjamin Aziz</i>	

Mobility IoT

Internet of Things as Advanced Technology to Support Mobility and Intelligent Transport	99
<i>Milan Dado, Aleš Janota, Juraj Spalek, Peter Holečko, Rastislav Pirmík, and Karl E. Ambrosch</i>	

Multimodal Interactions: Embedding New Meanings to Known Forms and Objects	107
<i>Predrag K. Nikolic</i>	

Mobility of 65 + Society – Needs and Expectations of Third Age University Students	122
<i>Janusz Grabara, Katarzyna Grondys, and Sebastian Kot</i>	

The Use of E-communication in Promoting Selected Religious, Cultural and Historical Monuments in Presov in the East of Slovakia	129
<i>Martina Ferencová, Beata Ślusarczyk, Sebastian Kot, and Veronika Mišenčíková</i>	

The International New Ventures: Applicability of the Theory on the Slovak Innovative Start-Ups	136
<i>Sonia Ferencikova Sr. and Sonia Ferencikova Jr.</i>	

Smart Infrastructure in Bratislava	142
<i>Julius Golej, Miroslav Panik, and Andrej Adamuscin</i>	

Economic Aspects of Land Grabbing in the Connection with Development Projects	150
<i>Daniela Spirkova, Dagmar Cagánová, and Manan Bawa</i>	

An IoT Approach for the Connected Vehicle	158
<i>Andrea Parodi, Massimo Maresca, Michele Provera, and Pierpaolo Baglietto</i>	

A Study on the Detection of Abnormal Behavior and Vulnerability Analysis in BYOD	162
<i>Taeun Kim</i>	

Mobile App for Public Transport: A Usability and User Experience Perspective	168
<i>Anaïs Luisa Habermann, Kai Kasugai, and Martina Ziegle</i>	

Open Platform Within the Smart Health Framework to Support the Development of Recreational Bike Path Applications: Smart Bike Path in the Context of the VAS Strategy in Colombia	175
<i>Mónica Trujillo and Dario Correal</i>	

Heterogeneous Travel Information Exchange	181
<i>Markus C. Beutel, Sevket Gökyay, Wolfgang Kluth, Karl-Heinz Krempels, Christian Samsel, Christoph Terwelp, and Maximilian Wiederhold</i>	

S-CUBE

Strain Calibration of Substrate-Free FBG Sensors at Cryogenic Temperature	191
<i>Venkataraman Narayanan Venkatesan, Klaus-Peter Weiss, Ram Prakash Bharti, Holger Neumann, and Rajinikumar Ramalingam</i>	

Fabrication and Application of Low Cost Flexible Film-Based Sensors to Environmental and Biomedical Monitoring Scenarios.	203
<i>Vladimir Laukhin, Victor Lebedev, Elena Laukhina, Andrey Somov, Alexander Baranov, Concepcio Rovira, and Jaume Veciana</i>	

Hazardous Gases Sensing: Influence of Ionizing Radiation on Hydrogen Sensors.	217
<i>Boris Podlepetsky and Nikolay Samotaev</i>	

Approach to Engineering the Temperature Sensing E-textile: A Lightweight Thermistor as an Active Sensing Element	223
<i>Victor Lebedev, Elena Laukhina, Vladimir Laukhin, Andrey Somov, Alexander Baranov, Concepcio Rovira, and Jaume Veciana</i>	

exIMUs: An Experimental Inertial Measurement Unit for Shock and Impact Detection in Sport Applications	235
<i>Ivan Minakov and Roberto Passerone</i>	

Towards Generic Intelligent WSN Platform for Hazardous Gases Detection . . .	250
<i>Nikolay Samotaev, Anastasia Ivanova, Konstantin Oblov, Pavel Laguzov, and Andrey Sokolov</i>	

Management of Ionization Source Based on a Pulsed Corona Discharge	260
<i>Vladimir Belyakov, Anatoliy Golovin, Viacheslav Pershenkov, Yulia Shaltaeva, Valeriy Vasilyev, Nikolay Samotaev, Evgeniy Malkin, Evgeniy Gromov, Vladimir Shurenkov, Igor Ivanov, Maxim Matusko, and Dmitry Yakovlev</i>	

Dynamic Reconfiguration of Network Protocols for Constrained Internet-of-Things Devices	269
<i>Peter Ruckebusch, Jo Van Damme, Eli De Poorter, and Ingrid Moerman</i>	

Surveying Indexing Methods for the Internet of Things	282
<i>Victor Kardeby, Ulf Jennehag, and Mikael Gidlund</i>	
Towards Precision Control in Constrained Wireless Cyber-Physical Systems	292
<i>David Boyle, Roman Kolcun, and Eric Yeatman</i>	
DESAL ^β : A Framework For Implementing Self-stabilizing Embedded Network Applications	307
<i>Yangyang He, Yuheng Du, Shiree Hughes, Jiannan Zhai, Jason O. Hallstrom, and Nigamanth Sridhar</i>	
Automatically Quantitative Analysis and Code Generator for Sensor Systems: The Example of Great Lakes Water Quality Monitoring	313
<i>Bojan Nokovic and Emil Sekerinski</i>	
Software Architecture for Remote Monitoring Systems of Surface Contamination by Alpha Radioactive Isotopes	320
<i>Boris Gurkovskiy, Evgeny Onishchenko, Vladimir Miroshnichenko, Andrey Simakov, and Nikolay Samotaev</i>	
DriverGen: Automating the Generation of Serial Device Drivers	325
<i>Jiannan Zhai, Yuheng Du, Shiree Hughes, and Jason O. Hallstrom</i>	
Ultra-Low Power Context Recognition Fusing Sensor Data from an Energy-Neutral Smart Watch	331
<i>Michele Magno, Lukas Cavigelli, Renzo Andri, and Luca Benini</i>	
Adaptive Methods for Managing Heterogeneity in Smart Spaces	344
<i>Mikko Asikainen, Lauri Väättäinen, Aleksu Suomalainen, Miika Toivanen, Keijo Haataja, and Pekka Toivanen</i>	
An Evaluation of Link Estimation Algorithms for RPL in Dynamic Wireless Sensor Networks	349
<i>Peter Ruckebusch, Jens Devloo, David Carels, Eli De Poorter, and Ingrid Moerman</i>	
A Mobile Camera-Based Evaluation Method of Inertial Measurement Units on Smartphones	362
<i>Lars Middendorf, Rainer Dorsch, Rudolf Bichler, Christina Strohrmann, and Christian Haubelt</i>	
Fast Phase Analysis of SAW Delay Lines	373
<i>Christian Gruber, Alfred Binder, and Martin Lenzhofer</i>	

InterIoT

Cross-Platform Scenario Module for Internet of Things Testing Architecture	385
<i>Osama Abu Oun, Christelle Bloch, and François Spies</i>	
Semantic Metastandards Will Unlock IoT Interoperability	396
<i>David P. Janes</i>	
Internet of Things and Crowdsourcing – Towards a Multiple Integrating Model Based on the IoT Lab European Research Project	403
<i>Sébastien Ziegler</i>	
Lessons Learned from the 6TiSCH Plugtests	415
<i>Maria Rita Palattella, Xavier Vilajosana, Tengfei Chang, Miguel Angel Reina Ortega, and Thomas Watteyne</i>	
BLE and IEEE 802.15.4 in the IoT: Evaluation and Interoperability Considerations	427
<i>PrithviRaj Narendra, Simon Duquennoy, and Thiemo Voigt</i>	
Visual Development Environment for Semantically Interoperable Smart Cities Applications	439
<i>Aikaterini Roukounaki, John Soldatos, Riccardo Petrolo, Valeria Loscri, Nathalie Mitton, and Martin Serrano</i>	
Remote Management of a Large Set of Heterogeneous Devices Using Existing IoT Interoperability Platforms	450
<i>Heleen Vandaele, Jelle Nelis, Tim Verbelen, and Chris Develder</i>	

SDWNCT

Dynamic Monitoring Dashboards Through Composition of Web and Visualization Services	465
<i>Sofie Van Hoecke, Cynric Huys, Olivier Janssens, Ruben Verborgh, and Rik Van de Walle</i>	
Real-Time Tracking Management System.	475
<i>Jose C. Almeida and Artur M. Arsenio</i>	
Distributed Neural Networks for Internet of Things: The Big-Little Approach	484
<i>Elias De Coninck, Tim Verbelen, Bert Vankeirsbilck, Steven Bohez, Pieter Simoens, Piet Demeester, and Bart Dhoedt</i>	
Learning About Animals and Their Social Behaviors for Smart Livestock Monitoring	493
<i>João Ambrosio, Artur M. Arsenio, and Orlando Remédios</i>	

Personal and Sensitive Data in the e-Health-IoT Universe	504
<i>Fiorella Guadagni, Noemi Scarpato, Ferroni Patrizia, Grazia D'Ottavi, Fernando Boavida, Mario Roselli, Graziano Garrisi, and Andrea Lisi</i>	
A Software Defined Network Solution for Spontaneous Wireless Access Extension	515
<i>Gianluca Aloï, Giancarlo Fortino, and Pasquale Pace</i>	
Towards Adoption of Software Defined Wireless Backhaul Networks	521
<i>Osianoh Glenn Aliu, Senka Hadzic, Christian Niephaus, and Mathias Kretschmer</i>	
USD: A User-Centric Software Defined Platform for 5G Mobile Devices. . . .	530
<i>Kien Nguyen, Kentaro Ishizu, and Fumihide Kojima</i>	
Extending SDN Framework for Communication Networks	539
<i>M. Saravanan, Arud Selvan Sundaramurthy, Divya Sundar, and K. Hiba Sadia</i>	
Author Index	551