Preface

IoT is an emerging concept that involves a larger and larger number of heterogeneous smart everyday-life objects. They enable a large scope of new applications that require all these objects to communicate, to interact, and to share data and processes. All these objects have popped up from there to there, using their own communication means, OS or language, resulting in a jeopardized ecosystem in which different solutions are often isolated and non-interoperable. A key open issue to realize the full capacity of the IoT is thus interoperability.

After some market consolidation happening mostly between 2011 and 2013, IoT products are now hitting the market across all segments: consumer (wearables, home automation), commercial (HVAC, parking), and industrial (industrial process control, supervision).

Often driven by the fear to "fall behind," small and large companies push their engineering teams to productize solutions quickly. If those companies choose to implement standards-based products, the compliance testing, interoperation testing, and labeling of their product may take over a year, which is often unacceptable giving today's rush-to-market. Companies therefore often go for in-house proprietary solutions, which can be developed and tested much faster. The result is that the market is highly fragmented: a large number of non-interoperable solutions are being installed, eventually leading to increased cost, inefficiencies, customer frustration, and a rate of adoption of the IoT much slower than the numbers touted by analysts.

The market is now at a state where we need to think about integration, interconnection, and interoperability. What does it take to make different IoT solutions seamlessly integrate with one another? Are there architectures and tools one could develop to speed up interoperability testing? If interoperability is not feasible or desired, can we at least build in mechanisms for a different product to coexist?

The main objective of this edited book is, hence, to try answering such questions by investigating the lack of interoperability in the IoT realm, including innovative research as well as technical solutions to interoperability, integration, and interconnection of heterogeneous IoT systems, at any level. The book also explores issues caused by lack of interoperability such as impossibility to plug non-interoperable IoT devices into heterogeneous IoT platforms, impossibility to develop IoT applications exploiting multiple platforms in homogeneous and/or cross domains, slowness of IoT technology introduction at large scale: discouragement in adopting IoT technology, increase of costs, scarce reusability of technical solutions, and difficulty in meeting user satisfaction.

The book is structured into 10 chapters focused on the above mentioned topics and providing novel and cutting-edge contributions for the next-generation IoT systems. A short introduction to the chapters is provided below.

Chapter "3GPP Evolution on LTE Connectivity for IoT", by Almudena Díaz Zayas and Cesar A. García Pérez and Álvaro M. Recio Pérez and Pedro Merino focuses on the provision of wide area and efficient connectivity to the Internet of Things (IoT), a key factor in such an explosion, through the usage of LTE. LTE MTC (machine type communication), LTE M2M, or just LTE-M are the coined terms that refer to this issue. The chapter also provides a detailed analysis of the standardization efforts carried out by the 3GPP to convert LTE into an IoT capable technology.

Chapter "Towards Efficient Deployment in Internet of Robotic Things" by Cristanel Razamandimby, Valeria Loscri, and Anna Maria Vegni proposes IoT-based, and a neural network control scheme to efficiently maintain the global connectivity among multiple mobile robots to a desired quality-of-service (QoS) level.

Chapter "Transmission Power Control in WSNs: From Deterministic to Cognitive Methods" by Michele Chincoli and Antonio provides an overview of the Transmission Power Control (TPC) protocols present in literature, categorized as deterministic (proactive and reactive) and cognitive (Swarm Intelligence, Fuzzy Logic, and Reinforcement Learning). The review identifies key shortcomings in deterministic TPC, pinpointing the benefit of the emerging methods based on computational intelligence.

Chapter "Devices Can Be Secure and Easy to Install on the Internet of Things" by Roger D. Chamberlain, Mike Chambers, Darren Greenwalt, Brett Steinbrueck, and Todd Steinbrueck describes the industrial deployment experience of the EZConnect™ IoT security infrastructure implemented by BECS Technology, Inc., a firm that provides water chemistry monitoring and control equipment to the aquatics market.

Chapter "A Service-Based Approach for the Uniform Access of Wireless Sensor Networks and Custom Application Tasks Running on Sensor Nodes" by Theodoros Fronimos, Manos Koutsoubelias, Spyros Lalis, and Thomas Bartzanas proposes an approach for supporting both application-specific sensing and processing tasks information flows simultaneously and in a uniform way, via an open Web-based service interface that can be flexibly extended through appropriate XML descriptions.

Chapter "Towards Semantic Interoperability Between Internet of Things Platforms" by Maria Ganzha, Marcin Paprzycki, Wiesław Pawłowski, Paweł Szmeja, and Katarzyna Wasielewska is focused on semantic interoperability, which can be seen as the meta-level for all interoperability considerations. The aim of this chapter is to consider how multiple IoT platforms can "understand" each other and have meaningful "conversation."

Chapter "Linked Data for Internet of Everything" by Danh Le-Phuoc and Manfred Hauswirth proposes the idea of "Linking Everything" by extending Linked Data Principles to interlink "everything" into a hypergraph to tackle the problem of interoperability in the next generation of Internet, namely "Internet of Everything."

Chapter "Sensing Enabled Capabilities for Access Control Management" by Mikel Uriarte, Oscar López, Jordi Blasi, Oscar Lázaro, Alicia González, Iván Prada, Eneko Olivares, Carlos E. Palau, Miguel A. Portugués, and Alejandro García presents a new framework approach that provides flexible, open, fluid, and collaborative middleware for building access control management systems, based on the sensing enriched access control (SEAC) concept. The chapter also provides a description of a real use case raised to validate the framework, as well as the laboratory results supporting its scalability.

Chapter "The Application of Telematics and Smart Devices in Emergencies" by Marco Manso, Barbara Guerra, Cosmin Carjan, Evangelos Sdongos, Anastasia Bolovinou, Angelos Amditis, and David Donaldson shares two interesting use cases depicting emergencies where the use of telematics and smart devices enable improved emergency situational awareness for citizens and emergency services.

Chapter "Towards Multi-layer Interoperability of Heterogeneous IoT Platforms: The INTER-IoT Approach" by Giancarlo Fortino, Claudio Savaglio, Carlos E. Palau, Jara Suarez de Puga, Maria Ganzha, Marcin Paprzycki, Miguel Montesinos, Antonio Liotta, and Miguel Llop discusses how IoT interoperability is addressed within the INTER-IoT Project. The INTER-IoT voluntary approach supports the creation of new IoT interoperable ecosystems with hardware/software tools, frameworks for open IoT application and system programming and deployment, and engineering methodology for IoT systems integration.

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