

# Cloudification of the internet of things

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The focus of this special issue is on the Internet of Things (IoT) with particular emphasis on the use of the Cloud as a central component of the IoT architecture and a key infrastructural support for IoT applications. With its virtualized infrastructure and software-defined networking substrate, the Cloud is in a good position to provide a flexible and scalable hosting environment for the plethora of emerging IoT applications in health, transportation, smart cities, and many other application areas. The shared infrastructure as service-oriented architecture of the Cloud can be indeed leveraged in support of IoT-generated data and control flows, Machine-to-Machine (M2M) communication, Big-data analytics, IoT management systems, security solutions, Network Function Virtualization (NFV), and SDN-based data forwarding to name a few.

This special issue addresses a wide spectrum of research issues pertaining to the use of Cloud infrastructures in support of IoT systems from the sensors and machines to the end users and applications hosted in the Cloud. It comprises selected papers that provide an overview of and in-depth research, development, and deployment efforts on the Cloudification of IoT, specifically IoT infrastructure, IoT gateways, and IoT cloud environments. Hereafter, a summary of each paper accepted in this special issue is described.

- Fadi et al. in their paper entitled “Cognition in Information-Centric Sensor Networks for IoT Applications: An

Overview” present state of the art of routing techniques in wireless sensor networks focusing on delivering information from user requirements rather than serving as a point-to-point data communication network.

- Perez et al. in their paper entitled “A Resilient Internet of Things Architecture for Smart Cities” propose an architecture that improves the resilience of the IoT infrastructure, along with the technologies to implement the components of the proposed architecture. This work, conducted in the scope of the European project SusCity, focuses on the key aspect of network and service recovery without human intervention in the event of faults.
- Petrolo et al. in their paper entitled “The design of the gateway for the Cloud of Things” propose a virtualized gateway capable to manage semantic-like things and act as an end point for the presentation of data to users. This is particularly useful since Cloud applications are typically based on different standards and protocols, making the IoT landscape widely fragmented. In this context, the development of the web semantic together with Cloud computing technologies can be leveraged to enable the horizontal integration of various IoT applications and platforms.
- Happ et al. in their paper entitled “Meeting IoT Platform Requirements with Open Pub/Sub Solutions” answer questions such as how a large number of connected devices that only sporadically send small sensor data messages affect the throughput and how much additional delay cloud-based pub/sub systems typically introduce. To do so, they analyze the main requirements of IoT platforms and evaluate which of those requirements are supported by prominent open pub/sub solutions.
- Longo et al. in their paper entitled “Stack4Things: a Sensing-and-Actuation-as-a-Service framework for IoT and Cloud integration” discuss widely used frameworks

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for Infrastructure-as-a-Service such as OpenStack. The authors describe approaches and architectures for IoT infrastructure management and for enabling Cloud-mediated interactions with sensor- and actuator-hosting nodes using the Stack4Things framework for Sensing-and-Actuation-as-a-Service.

- Dalčeković et al. in their paper entitled “Enabling the IoT paradigm through multi-tenancy supported by scalable data acquisition layer” build on the hypothesis that IoT is composed of a large number of end systems implying a large number of users who should have open access to specific subsets of data. They describe multi-tenant implementation approaches with an emphasis on security and data isolation. As multi-tenancy may involve sharing the same application instance, security is a key requirement that must be addressed when engineering SaaS applications.
- Narman et al. in their paper entitled “Scheduling Internet of Things Applications in Cloud Computing” argue that traditional cloud computing server scheduling is not ready to provide services to IoT because of the sheer number of heterogeneous devices and nonstandard applications. They propose a dynamic dedicated server scheduling scheme for heterogeneous and homogeneous systems that efficiently provide desired services while taking into account the priorities of service requests.
- Sangeetha et al. in their paper entitled “A Secure Cloud based Personal Health Record framework for a Multi Owner Environment” address the security problem of

IoT flows in a Cloud-based health application, namely Personal Health Record (PHR), an emerging online service model for health information exchange. The proposed framework provides the means for patients to securely create, manage, control, and share their health information with other users as well as healthcare providers.

- Velasquez et al. in their paper entitled “Service Placement for Latency Reduction in the Internet of Things” describe the architecture and implementation of a service orchestrator for handling IoT service placement with the objective to achieve low latency particularly important for time critical applications such as eHealth and public safety. This work has been conducted in the scope of the European SusCity project.

The papers included in this special issue illustrate some of the important research work in the IoT area covering the end-to-end IoT Cloudification continuum from the things to the Cloud infrastructure through IoT gateways. We believe this area will receive even more attention in the future and constitute a fertile ground for further research to realize the Cloudification of IoT vision.

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