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Modelling and Simulation of Opportunistic IoT Services with Aggregate Computing

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Abstract

The Internet of Things (IoT) is emerging as a ubiquitous and dense ecosystem in which novel devices and smart objects interoperate to establish smart cities, smart buildings, etc. In such application contexts, a plethora of innovative services are expected to stand out, deeply impacting our daily routine. In particular, real IoT drivers will be cyberphysical, collective, highly dynamic and contextualised services, called in the following Opportunistic IoT Services. This work proposes a full-fledged approach for their development, based on (i) a technology-agnostic yet detailed modelling phase, which allows opportunistic properties to emerge since the preliminary service analysis; and (ii) the implementation and further simulation of IoT services through Aggregate Computing, a distributed computing paradigm and engineering stack able to harness, in practice, the dynamic, collective and context-driven nature of Opportunistic IoT Services. A mass event case study, related to the real-world scenario of a large scale urban crowds detection and steering, provides evidence of the huge potential of the approach: indeed, simulation results highlight the effectiveness, flexibility, scalability and resilience of the Aggregate Computing-based approach to the design of Opportunistic IoT Services.

Keywords: Internet of Things, Opportunistic Services, Aggregate Computing.

1. Introduction

The Internet of Things (IoT) can be defined as an ensemble of different systems (e.g., Smart Roads, Smart Buildings, Smart Grids) composed of heterogeneous but interacting components (e.g., humans, cars, smartphones, gateways, smart meters) both individually and collectively providing innovative cyber-physical services. Namely, it can be described as a dense, large-scale, open and dynamic ecosystem of socio-technical entities and applications [1]. Despite a decade of research, however, the IoT is still into an emergent phase: indeed, it

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