Chapter 4

IoT Platforms and Technologies Driving Spatial Planning and Analytics

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ABSTRACT

The continuous evolution of internet of things technologies is constantly evolving the concept of smart cities as well as the surrounding environments. From pervasive sensors through computational nodes at the edge of the network to the cloud and final user applications, the data flow chain makes available to the user a very large and heterogeneous amount of data. IoT platforms are at the core of this chain, providing seamless access to data independently from the hardware devices and making possible the interoperability with other data sources (e.g., GIS, SIM, etc.). Despite the availability of IoT platform solutions either commercial and open-source, research is still very active to design and implement flexible, easy-to-use, and efficient web-service-oriented software infrastructures. This chapter will review the current IoT platform infrastructures making also reference to state-of-the-art solutions in literature and proposed in recent research projects. The chapter will outline the main challenges and directions about future platforms, putting them in the context of realistic case studies.

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INTRODUCTION

In 2015 all 196 participant states of the international conference on climate changes (COP21) agreed in the urgency of reducing greenhouse gas emissions to avoid the rise of 2°C of the mean atmosphere temperature with respect to pre industrial era United Nations (2015). Recently, the Intergovernmental Panel on Climate Change (IPCC) have analysed the difference between an increase of 2° and an increase of 1.5° Masson-Delmotte et al. (2018). The report states that keeping the increase of temperature below 1.5° with respect to the pre-industrial era will mitigate the catastrophic impacts of climate change. To achieve this goal IPPC states that we must reduce the level of CO₂ emission by 2030 of at least of 45% with respect to the levels in 2010 and have net zero emissions for 2050. Furthermore, the report states that “pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems.” Urbanizations are largely energy-intensive as reported by the UN habitat division, cities consume about 75% of the global primary energy supply and are responsible for about 50-60% of the world’s total greenhouse gases United Nations (2017). Moreover, the majority of the consumed energy is still supplied by fossil fuels (coal, oil and gas). In 2016, more than half of the overall world’s population is living in urban areas. Projections states that by 2030, urban areas will host around 60% of people globally and one third of the population will live in cities with at least half a million inhabitants United Nations (2016). The International Energy Agency (IEA) states that buildings represent 40% of total final energy consumption in most countries. Heating and cooling systems in buildings consume the 60% of energy in the residential sector and 45% in the service sector IEA (2014). On this regard, in the last years, many countries are providing incentives to promote the deployment of low-carbon and sustainable energy production technologies (Dusonchet & Telaretti, 2010), generation such as Photovoltaic (PV) Systems. In order to achieve a reduction of greenhouse gas emission an increasing installation of Renewable Energy Sources (RES), Distributed Generation (DG) and an optimization of consumption with a smart use of energy in our cities are required

IEA (2016). ICT technologies, in particular Internet of Things (IoT), allows to control and optimize energy consumption Wigle (2014), hence increasing energy efficiency. In the last years, we have assisted to the spread deployment of IoT devices in our lives and cities. Such devices allow to monitor and interact with objects through the Internet. Furthermore, a massive deployment of IoT devices in our city is constantly increasing the amount of collected data that needs to be stored and analysed. Big data techniques can help in managing and such huge amount of
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