

Chapter 39

5G IoT Industry Verticals and Network Requirements

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ABSTRACT

The effective provisioning of industry verticals over the next-to-come 5G systems opens novel business opportunities for telco operators especially when considering the integration of Internet of Things (IoT) devices as enablers of business cases based on remote sensing and control. This chapter highlights the main features of IoT verticals with particular attention on healthcare, smart cities, industry automation and entertainment business cases. The aim of this Chapter is to derive the requirements such IoT verticals pose in terms of design features to be considered in the standardization of 5G systems. This chapter presents the state of the art on the contribution from the research community and standardization bodies to address the 5G design characteristics with particular attention to the features enabling a proper management of IoT-oriented business cases.

INTRODUCTION

Over the last decade, the Internet of Things (IoT) has gained an always growing importance in the mobile market scenario. Indeed, the availability of data collected from sensors as well as the possibility of extracting knowledge from such data opens new business opportunities and this can be applied to several environments of industry, home, office, city, etc. (Palattella et al, 2016). The IoT ecosystem,

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as analyzed for instance by Atzori et al. (2010), is based on providing connectivity to machines. This poses additional challenges to mobile networks which have been traditionally designed to provide high data rates for human-type communications (HTC). HTC traffic is usually characterized by the transmission of bursty-based traffic with large packets and non-strict constraints in terms of access delay (i.e., the time between the generation of a packet and its effective transmission) and energy consumption. IoT pushes unprecedented traffic features to be supported over mobile systems due to the set of unique characteristics of the so-called machine-type communications (MTC). MTC traffic is characterized by minimal human intervention, periodic or event-triggered small packets and strict connection time constraints (e.g., short access and data transmission delays) in order to keep low the energy consumption of battery-equipped devices. The main features of MTC traffic are analyzed by Laya et al. (2014), who also provides a comparison of MTC and HTC traffic types.

As briefly mentioned above, current mobile technologies such as Long Term Evolution (LTE) and LTE-Advanced (LTE-A), a.k.a. fourth generation (4G) systems, are designed to deal mainly with HTC traffic. As a consequence, when considering the next-to-come fifth generation (5G) networks, IoT dictates to re-design the transmission procedures to natively handle the simultaneous presence and interaction of HTC and MTC traffic while guaranteeing to meet the requirements of these two very heterogeneous traffic types. Furthermore, disruptive technologies considered to introduce flexibility, customization and re-configurability in 5G networks on both radio and core segments will enable the introduction of enhanced IoT-based services interconnecting people and everything. Indeed, a natural evolution of connecting devices to the Internet, is the remote control of these devices. Machines will be no longer able to only talk to each other. 5G will enable novel industry-related IoT applications in both consumer and business environments, for instance to increase industry automation, remote control and tactile Internet applications (Simsek et al., 2016).

This chapter covers the main trends in the industry to use the IoT to tackle several problems or to improve outcomes: business-to-business (B2B) market, increase in automation and remote control/operation, cost reduction, efficiency improvement. *This chapter also presents 5G use cases highlighting the novel business opportunities for IoT in the next-to-come mobile systems.* The aim of this analysis is to recognize the role of MTC in generating an added value to 5G business activity or consumer end. The main industry use cases we will discuss are healthcare, smart cities, industry automation and entertainment.

According to the features of the use cases listed above, in this chapter *we will derive and classify the requirements that above listed use cases push on 5G networks.* Discussed requirements range from QoS (e.g., data rates, latency, jitter, and energy consumption) to more generic constraints from a network point of view. Indeed, 5G networks need to exploit disruptive technologies that can simultaneously provide critical and non-critical MTC, and this dictates requirements in terms of network flexibility and customization.

In addition to the analysis of requirements of 5G use cases, *this chapter provides a survey of the contributions from the research community and standardization bodies to satisfy the requirements of 5G IoT use cases.* We will summarize the available literature by focusing on the recent advances in terms of network slicing, virtualization and softwarisation, solutions for supporting MTC traffic, device multi-connectivity and centralized/cloud radio access network (RAN).

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