Chapter 4

IoT Architecture and Protocols in 5G Environment

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ABSTRACT

The Internet of Things (IoT) is defined by the International Telecommunication Union (ITU) and IoT European Research Cluster (IERC) as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual “things” have identities, physical attributes and virtual personalities, use intelligent interfaces and are seamlessly integrated into the information network. Many of the applications and use cases that drive the requirements and capabilities of 5G are about end-to-end communication between devices. This chapter describes the enabling technologies for the Internet of Things, the IoT architecture, the network and communication infrastructure for IoT, and the importance of scalability for 5G based IoT systems. Also, naming and addressing issues in IoT is presented along with an overview of the existing data exchange protocols that can be applied to IoT based systems.

INTRODUCTION

The Internet of Things (IoT) is a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. Many of the IoT-based applications are about end-to-end communication between devices. In order to distinguish them from the more human-centric applications such as mobile telephony and mobile broadband, these applications are often labeled
machine-type communication (MTC). Improved provisioning, device management, and service enablement will bring a wider range of potential IoT applications. Some predictions forecast that there will be 15 billion connected MTC devices by 2021, a nearly 40-fold increase over the number of currently deployed MTC devices. Although spanning a wide range of different applications, IoT can be divided into two main categories, massive MTC and critical MTC, depending on their characteristics and requirements. Each brings its own challenges and requirements for standardization.

Enabling technologies for the Internet of Things considered in can be grouped into three categories (Friess & Vermesan, 2013): i) technologies that enable “things” to acquire contextual information, ii) technologies that enable “things” to process contextual information, and iii) technologies to improve security and privacy. The first two categories can be jointly understood as functional building blocks required for building “intelligence” into “things”, which are indeed the features that differentiate the IoT from the usual Internet. The third category is not a functional but rather a de facto requirement, without which the security penetration of the IoT would be severely increased. Internet of Things developments implies that the environments, cities, buildings, vehicles, clothing, portable devices and other objects have more and more information associated with them and/or the ability to sense, communicate, network and produce new information. In addition, the network technologies have to cope with the new challenges such as very high data rates, dense crowds of users, low latency, low energy, low cost and a massive number of devices. The 5G scenarios that reflect the future challenges and will serve as guidance for further work are outlined by the EC funded METIS project.

The IoT should be capable of interconnecting billions or trillions of heterogeneous objects through the Internet, so there is a critical need for a flexible layered architecture. The ever increasing number of proposed architectures has not yet converged to a reference model. From the pool of proposed models, the basic model is a 3-layer architecture (R. Khan, S. U. Khan, Zaheer, & S. Khan, 2012; Yang et al., 2011; Wu, Lu, Ling, Sun, & Du, 2010) consisting of the Application, Network, and Perception Layers.

Mobile traffic today is driven by predictable activities such as making calls, receiving email, surfing the web, and watching videos (Friess & Vermesan, 2013). Over the next 5 to 10 years, billions of IoT devices with less predictable traffic patterns will join the network, including vehicles, machine-to-machine (M2M) modules, video surveillance that requires all the time bandwidth, or different types of sensors that send out tiny bits of data each day. The rise of cloud computing requires new network strategies for fifth evolution of mobile the 5G, which represents clearly a convergence of network access technologies. The architecture of such network has to integrate the needs for IoT applications and to offer seamless integration. To make the IoT and M2M communication possible there is a need for fast, high-capacity
Introduction to Quality of Service
Eva Ibarrola, Fidel Liberal and Armando Ferro (2010). *Intelligent Quality of Service Technologies and Network Management: Models for Enhancing Communication* (pp. 1-14).
[www.igi-global.com/chapter/introduction-quality-service/42469?camid=4v1a](www.igi-global.com/chapter/introduction-quality-service/42469?camid=4v1a)

The Blockchain Technology: Applications and Threats
[www.igi-global.com/article/the-blockchain-technology/201093?camid=4v1a](www.igi-global.com/article/the-blockchain-technology/201093?camid=4v1a)