Chapter 12
M2M in 5G Communication Networks:
Characteristics, Applications, Taxonomy, Technologies, and Future Challenges

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ABSTRACT

Machine type communication (MTC), additionally called machine-to-machine (M2M) communications, broadly is referring to a number of cooperating machines exchange sensed data or information and make decisions with slight or zero human intervention. M2M technology will let a massive number of devices to be interconnected over the internet leading to a rapid development in recent time, which can be a promising enabling key for many areas, particularly for the internet of things (IoT) and 5th generation (5G) networks. This chapter presents a summary and state of art of M2M communications characteristics, taxonomy, applications, different technologies for deploying of M2M communications, and future challenges.

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INTRODUCTION

Machine Type Communication (MTC), additionally called Machine-to-Machine (M2M) communications, broadly is referring to a massive number of cooperating machines exchange sensed data or information and make decisions with slight or zero human intervention (Shariatmadari, 2015). M2M has been in demand; it is a newly improved communication technology with rapid development in recent time, which can be a promising enabling key for many areas, particularly for the Internet of Things (IoT) and 5G Networks (Condoluci, 2016). A serious challenge brought in by M2M communications is a way to connect a huge number of MTC devices (MTCDs) to the network. It's foreseen that in total regarding 11.6 billion devices ought to be connected by 2020 (Salem, 2019).

The term of IoT to begin with showed up within the late 1990s, and after that it was presented formally by International Telecommunication Union (ITU) in 2005. The aim of IoT is to make a network, where people and things can be associated anytime, wherever, with anything and anyone in a perfect world utilizing any path/network and any service. The IoT is a heterogeneous concept that combines many different technologies, application domains, equipment facilities, and different services, etc. In IoT, a huge number of sensors and devices will be connected through M2M communications which are anticipated to support many industries with deferent utilizations such as smart grids and cities, telemedicine applications, vehicular telematics, surveillance systems and manufacturing (Condoluci, 2016), (Al-fuqaha, 2015). According to Ericsson (Cerwall, 2015), the expected number of IoT Stations (STAs) is expected to be 23.3 billion worldwide in 2023. The digitalization of equipments, vehicles and different processes lead to an exponentially increasing in the number of connected STAs (Salem, 2019). The density of the network could be about 1~10 devices/m^2.

Both H2H and M2M communications need the support of mobile cellular systems that creates new issues within the design of the next generation cellular networks. Cellular communication networks are anticipated to act a great role in realizing of M2M/IoT, cellular networks provide many features especially a global infrastructure. Existing technologies are not able to offer efficient resources for massive M2M communications. Additionally, radio resource allocation is becoming challenging to support traditional mobile communications (Biral, 2015). The incoming of new wireless services makes the radio frequency spectrum overcrowded. 5G networks carry many utilizations and enabling techniques to solve these limitations such as traffic offload through Wi-Fi and small cells, millimeter wave (mmWave), massive multiple input multiple output (massive MIMO) and cognitive radios (Jaber, 2016), (Salem, 2015), and (Salem,2017).

The remainder of this chapter is structured as follows: Section 2 presents the characteristics of M2M communications such as (Bursty traffic, Low power …etc). M2M communications required that the network has different QoS support like high or low data rates, throughput and latency; therefore M2M communications are anticipated to support many industries with deferent utilizations, M2M applications are illustrated in section 3. Taxonomy of M2M architectures is described in section 4; in the same section, different technologies for deploying of M2M communications (Wi-Fi, LoRaWAN, LTE-M…etc) and comparison between them is illustrated. Section 5 describes the role of M2M in 5G communications. Most of the current M2M communications challenges require modifications in the current conventional networks or design of new network architecture. Cost, energy efficiency, reliability, heterogeneity and others are many research challenges in M2M communications, section 6 presents the future challenges of M2M communications.