

Chapter 10

Interference Management Techniques for Device-to- Device Communications

Weston Mwashita

Vaal University of Technology, South Africa

Marcel Ohanga Odhiambo

Vaal University of Technology, South Africa

ABSTRACT

The snowballing of many different electronic gadgets connected to different networks and to the internet is a clear indication that the much-anticipated internet of things (IoT) is fast becoming a reality. It is generally agreed that the next generation mobile networks should offer wireless connection to anything and anyone with a proper enabling device at any time leading to the full realization of IoT. Device-to-device (D2D) communication is one technology that the research community believes will aid the implementation of the next generation of mobile networks, specifically 5G. Full roll out of D2D is however being impeded by the resulting interference. This chapter looks at the state-of-the-art research works on interference management technologies proposed for device-to-device communications. A comprehensive analysis of the proposed schemes is given and open challenges and issues that need to be considered by researchers in D2D communication for it to become a key enabler for 5G technology are highlighted and recommendations provided.

INTRODUCTION

When the fifth generation of mobile networks (5G) hits the market in 2020, it is generally agreed by academia and industry experts that by that time, there will be a 1000-fold increase in mobile traffic compared to what is being experienced today. This strategically positions 5G to become the backbone of the Internet of Things. What is currently hindering an expansive roll out of the Internet of Things are short range technologies such as Radio Frequency Identification (RFID), Bluetooth, etc which cannot be expected to offer seamless connection in large smart cities. This is where 5G comes in. 5G will be more

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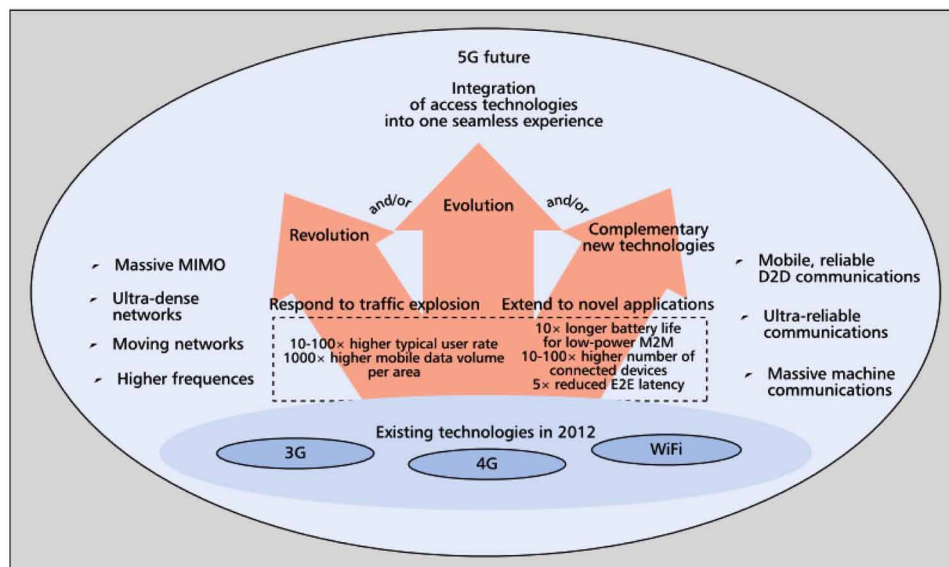
than a fast radio access technology. It will be a revolutionary change in the whole network architectures which will trigger highly innovative and revenue generating services. It is predicted that over 50 billion devices will be connected directly to cellular networks all over the world (Evans, 2011). A larger percentage of these devices will incorporate sensors for the measurement of temperature, pressure, speed or stress. 5G will allow for the remote monitoring of buildings, roads and bridges for structural changes. For the unlocking of IoT, 5G must address issues like latency, bandwidth and security. The revolutionary nature of 5G will usher in technologies like D2D. Figure 1 shows some of the technologies that will make 5G achieve most of users' expectations. D2D communications is when devices can directly communicate with each other without routing their communication via a base station. This is good for the Internet of Things. This allows sensors to directly send harvested information to processing equipment located at strategic points in smart cities and other environments. The integration of D2D communication into the legacy networks as well as in the next generation networks presents technical challenges and because of this, the implementation of D2D is still far. The biggest challenge is interference. There must be an effective interference management and mitigation of other challenges for the technology to achieve optimal system performance. Researchers have suggested several solutions but the fact that there hasn't been any meaningful D2D deployment speaks volumes of the ineffectiveness of these proposed schemes.

A qualitative comparison of the latest interference mitigation schemes is presented, and the technical challenges analysed. Open challenges and issues that need to be considered by researchers in D2D for it to become a key enabler for 5G technology are highlighted and recommendations provided in this chapter.

Various issues related to D2D are discussed and plans by researchers to integrate D2D into wireless sensor networking explored.

Figure 1. The 5G roadmap by METIS

Source: Osserain, Boccardi, Braun, Kusume, Marsch, Maternia,.... Fallgen (2014)



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