Internet of Things and the road to 5G

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I. Introduction

The aim of this presentation is to give an overview of two closely related emerging technologies: 'Internet of Things' and the next generation of mobile telecommunications standards (5G).

II. Overview of the legacy mobile standards (2-3-4G)

To be able to differentiate 5G from the other generations of mobile telecommunications standards, it is important to outline the evolution from 2G to 4G. In a first part, we will give an overview of this evolution.

III. What is Internet of Things? Motivation and Applications

The **Internet of Things** (**IoT**) extends internet connectivity beyond traditional devices like desktop and laptop computers, smartphones and tablets. Examples are connected security systems, thermostats, coffee machine, cars, drones, lights in household and commercial environments, alarm clocks, speaker systems, vending machines and more. The current revolution in Internet, mobile, and machine-to-machine (M2M) technologies can be seen as the first phase of the IoT. In the coming years, the IoT is expected to bridge diverse technologies to enable new applications. During the presentation we will give an overview of the enabling technologies, protocols, and applications of IoT.

IV. The road to 5G

A. What is 5G

5G denotes the next generation of mobile telecommunications standards beyond the current 3G/4G. The major difference with the 4G will be the requirements in terms of data rates, number of users, coverage, latency energy consumption etc

B. Requirements

Where 4G is focused on high data rates between mobile users and an infrastructure network, 5G will need to cover also requirements for IoT connectivity, M2M communication, smart sensor networks etc. This means that the 5G standard will need to cope with new types of traffic (peer-to-peer, multicast, broadcast), will need communication modes with a very low latency and multi-hop capacity, will need to be able to serve a massive number of devices, etc. The enabling technologies to meet these requirements are focusing on network densification, spectrum extension to the millimeter band, advanced antenna systems like massive MIMO, interference management techniques; offload techniques to devices and device-to-device (including car-to-car) communications. During the presentation some of these enabling technologies will be addressed.

C. Way ahead

For the moment a lot of research and standardisation work on new waveforms, access techniques and protocols is going on, but it is not clear yet what the outcome will be. Most probably, the 5G standard will be a mix of different waveforms as it will be very difficult for one waveform or technology to meet all requirements. The 5G deployment and commercialisation is not to be expected before the early 2020s.

V. CONCLUSION

The progress in telecommunication technologies and the constantly growing amount of wireless application is impressive on one hand, but difficult to catch up with on the other hand. However, it is important for us, military CIS community, to closely follow these modern evolutions as most probably there will be opportunities for dual use.