Internet of Things – Which Connectivity Technology?

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The Internet of Things (IoT) is becoming more and more, an important part of the society life, in industry, smart cities, transportation, health, agriculture and environment and so on. The number of IoT connected devices is very high and will reach hundreds of billions in few years. Therefore, the connectivity technologies are essential for IoT system success. The wireless technologies are the main candidates to support the edge connectivity of things to the network.

An important and special factor in IoT is the large range of applications envisaged, for a lot of domains and having different sets of requirements, related to functional aspects, performance, security, trust, geographical ranges, real-time needs, quality of services, etc. Consequently, many variants of architectures, sets of protocols, implementation solutions, deployment and associated standards have been proposed, research performed on, and developed. In such conditions, selecting an appropriate technology and architecture for a given set of IoT applications is a major challenge.

This tutorial will provide a short overview of the existing wireless IoT connectivity technologies – including recent ones like 5G and beyond - and discuss several criteria of their selection for a given set of IoT applications. We categorize the existing wireless IoT connectivity technologies, based on criteria like coverage range, data rates, latency, scalability, security, backward compatibility, costs and other criteria. Popular short range (e.g., Bluetooth, Zigbee, WiFi, optical wireless communication (OWC), etc.) and long range (e.g., LoRa/LoRaWAN, other LPWANs, Sigfox, etc.) will be discussed. Special attention will be paid to cellular systems in 4G/5G context (long-term evolution (LTE) standards, e.g., narrowband IoT (NB-IoT) and LTE Machine Type Communications TC (LTE-M), within LTE systems. NB-IoT and LTE-M employ licensed bands and can support devices with the existing cellular infrastructure.

5G technologies are novel powerful candidates to serve IoT connectivity needs, applicable to any geographical area and offering high performance. The 5G technology can satisfy a large set of different requirements of various stakeholders, including those coming from IoT use cases. The 5G systems are highly flexible and programmable, providing end-to-end communication, networking, and computing infrastructures and offering increased performance (in terms of throughput, latency, reliability, capacity, mobility and also computation capabilities). The 5G network slicing concept defines several logical, dedicated and mutually isolated virtual networks, that can share the same physical infrastructure. Dedicated slices can be naturally constructed to serve IoT use cases. 5G enhances the traditional mobile broadband communications, but also promise to fulfil diverse connectivity requirements of new IoT applications, e.g., very low latency and ultra-high transmission reliability. This presentation will also cover the main aspects of cellular technology usage and especially 5G, as a support for IoT systems connectivity.