

## **Project objectives**

The project on *Cognitive Engine for Radio environment Awareness In Networks of the future (CERTAIN)* aims at scientific breakthroughs by introducing novel design and analysis methods for the future radio communication networks characterized by radio environment awareness. It is anticipated that the traffic in these networks, constituting the Internet of Things (IoT), will be dominated by massive machine-to-machine type of communication with diverse Quality-of-Service (QoS) requirements. The context information on the spectral occupation, communication activity in various frequency bands and specific signaling features recognition will play a key role in the efficient operation, co-existence and interoperability of future networks, addressing the spectrum-scarcity challenge. The main goal of this project is to investigate methods and propose solutions for intelligent learning and detection of spectral-activity and its nature in a radio network to satisfy application, capacity and systems coexistence requirements of the future heterogeneous radio communication networks. The project will also create an architectural framework for acquisition, learning and updates of this information within the created knowledge-base. Finally, the goal is to advance artificial intelligence, machine-learning, optimization-, and information- theory for context-based communication.

## **Research to be carried out**

Within the CERTAIN project the following research are planned. First, we will investigate methods for cooperative detection of spectral-activity and its nature in radio network. We will focus on addressing the following questions: what types of information should be gathered, and what are the most efficient solution for detection spectral-activity in the network? We will also elaborate novel machine learning algorithms based on deep artificial neural networks, capable of identifying the signalling features (e.g. modulation type) at the acceptable accuracy. Moreover, reliability of spectrum-detection mechanisms in the presence of detection-information correlation will be evaluated. Finally, we will synthesize key intelligent technologies for mentioned radio-environment awareness, analyze and validate the research results. The project also plans to disseminate results in the international journals and conferences.

## **Motivation**

Communication of multitude of devices constituting the Internet of Things (IoT), connected humans and machines, increased data rates, spectral efficiency and radio-environment awareness are key paradigms stated for 5G communication. The motivation behind the *CERTAIN* project is to address spectrum-scarcity challenge, which is the following. On one hand, most of the prominent UHF bands are already licensed, on the other, the already lincensed frequency bands are underutilized by the contemporary radio systems. Cognitive and opportunistic access to the temporarily unused frequencies and sharing of the available spectrum require sensing and intelligent learning of this availability, spectral activity and signaling features in the environment. The framework for radio environmental awareness that will be proposed has the potential to be used as reference for future built spectrally-efficient network architectures with embedded intelligence.

The motivation behind the *CERTAIN* project, most of all, is to allow for further deployment of high-data rate wireless communications thus, impacting connectivity within the information society.