Virtualizing Heterogeneous Wireless Networks with SDN for the 5G

Location	Network research group – ICube (UMR CNRS 7357), Strasbourg (France)
Supervision	Dr. Fabrice THÉOLEYRE (theoleyre@unistra.fr) and Prof. Kristof Van Laerhhoven

Principal Topics

— Internet of Things : protocols and algorithms ;
— Software Defined Networking ;
— Heterogeneous Networks ;
— Cooperation / Co-optimization ;

Context

The use of Information and Communication Technologies (ICT) is becoming increasingly important. The European Telecommunication Area has been reported to bypass the aerospace and pharmaceutical domains.Telcos offer a digital connection to an increasing number of diverse devices.

While the historical mobile networks were primarily designed for voice and later extended for data communication (smartphones), we now face the rise of intensive Machine-To-Machine communications. The LTE technology has recently provided a way to increase the throughput ($\approx$300Mbps), but it is mainly dedicated for smartphones applications. In particular, such technology has not been designed to support a very large density of devices transmitting only a few data packets per day / week. The 5G networks provide a cornerstone architecture for enabling the emerging smart cities and smart buildings applications that exhibit those characteristics.

Scientific Objectives

Currently, we face to concurrent technologies for IoT (LoRA, IEEE 802.11ah, IEEE 802.15.4g, IEEE 8021.5.4e-TSCH) which all exploit the same unlicensed band. Each of this technology has its own advantages and scenario of predilection : they will probably have to cohabit in the future. One of the major future challenge will consist in exploiting in symbiosis all of them.

The PhD student will explore how we may use all these technologies to provide a connectivity in the Internet of Everything. First of all, he will conduct experiments on our FIT IoT-Lab (http://iot-lab.info/) platform to more accurately model their interactions, and to extract pathological situations.

The second step will consist in proposing a new architecture, and new mechanisms to make them work together. We must be able to provide mechanisms to guarantee end-to-end performance : whatever the technology used for each hop, a minimum reliability or a maximum delay should be secured. Software Defined Networking (SDN) may provide interesting mechanisms to guarantee flow isolation.

Skills

The expected skills are :
— Excellent programming skills in C, knowledge of at least one scripting language
— Distributed algorithms ;

— Wireless networks (protocols and radio propagation), energy efficiency ;
— SDN would be a plus
— Applicants should possess good verbal and written English skills. French is not a requirement
— Holding an MSc in Computer Science or Electrical Engineering is mandatory

Supervision

The Ph.D. student will be jointly supervised by :
— Dr. Fabrice Théoleyre (CNRS / Univ. of Strasbourg, France)
— Prof. Kristof Van Laerhhoven (Univ. of Freiburg, Germany)
— Dr. Antoine Gallais (Univ. of Strasbourg, France)