ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TIK
Institut für Technische Informatik
und Kommunikationsnetze
Computer Engineering and
Networks Laboratory

Prof. L. Thiele

Semester Thesis:

Real-time Network Functions for the Internet of Things

Motivation Connected objects have become a part of our everyday life. Together, they form the so-called Internet of Things (IoT). Everything gets connected – not only your phone and your watch, but also your fridge, your clothes, even light bulbs!

Most of such objects have limited capabilities, in terms of computation power or memory storage. Therefore, IoT networks usually run very basic functionality, resulting in limited efficiency and high vulnerability to malicious attacks (see [1] for a recent example).

One solution to this problem is the *virtualization of services*, which basically consists in having complex network tasks (e.g. scheduling, intrusion prevention systems) running in the cloud, and using those services in local networks. The main limitation is that it is nowadays *impossible to run real-time applications in the cloud.* In other words, if you send a request, there is no guarantee on the delay until you get a response. This is a major limitation for many applications, especially in safety critical cases, e.g. with connected cars. As an alternative, we propose to connect a high capability device (e.g. your laptop) to an IoT network in order to provide such real-time services.

Task description In this project, the objective is to provide online computation of communication schedules for Wireless Sensor Networks (WSN), which is computationally complex. You will be given a hardware solution (Bolt, [2]) to interconnect in real-time your PC with one node in the network (called the host). Your tasks will consist in

- Managing the data exchange between the PC and the Host over Bolt,
- Adapting existing wireless communication protocols to use the schedules computed by the PC,
- Integrating this system into Flocklab [3], the WSN testbed running in our lab,
- Leveraging this setting to test and evaluate state-of-the-art wireless communication protocols (e.g. [4]).

From there, many further directions are possible, depending on your personal interest , motivation, and remaining time (e.g. formal analysis of the system performance, system enhancement, experimental comparison of various protocols ...).

Requirements: Familiarity with C programming, interest in real world implementation. Basic knowledge on wireless communication protocols is a plus.

Interested? Please have a look at `http://www.tec.ethz.ch/research.html` and contact us for more details!

References:

[1] IEEE Spectrum What Is a Distributed Denial-of-Service Attack and How Did It Break Twitter?, Oct. 2016
[2] Bolt: A Stateful Processor Interconnect, F. Sutton, et al., SenSys 2015.
[3] Flocklab: www.flocklab.ethz.ch/
[4] End-to-end Real-time Guarantees in Wireless Cyber-physical Systems, R. Jacob et al., RTSS 2016.

Contact:

Romain Jacob, ETZ G75
`romain.jacob@tik.ee.ethz.ch`