Hochschule Offenburg
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ivESK Institut für verlässliche Embedded Systems und Kommunikationselektronik

***Offenburg University of Applied Sciences***
***Institute of reliable Embedded Systems and Communication Electronics (ivESK)***

# *Master Thesis*

## Resource Scheduling in Narrowband 5G Cellular Networks for Industry Automation

In the context of Industry 4.0, Cellular Internet of Things (CIoT) has gained much importance as a low cost and low energy consuming communication technologies for 5G wireless networks. As standardized in Release 13 by 3rd Generation Partnership project (3GPP), Narrowband-IoT (NB-IoT) and Cat-M1 can work along with other wideband technologies within the same network. Therefore, it is important to investigate and improve the possibility of coexistence of CIoT with other technologies. In context of industry automation, the resource scheduling is one of the most important factors when it comes to reducing latency and ensuring reliability.

Network Simulator - 3 (NS3) offers the full stack implementation for wideband technologies for 4G-LTE networks including the access and core network. The resource schedulers already implemented in NS3 are all based on Dynamic Scheduling, whereas, industry automation requires the other type of scheduling i.e. Semi-Persistent Scheduling (SPS) to be available for some of the devices in the network. We at ivESK have already developed SPS for CIoT, however, use of both scheduling types simultaneously is yet to be done. The proposed work in this thesis will focus on integrating of both scheduling types within one network. More specifically, the tasks will include:

- Study and understand the resource scheduling in cellular networks (4G and 5G)
- Understanding the schedulers (Dynamic and SPS) already implemented in NS3
- Integration of both types of scheduling in the NS3 module

What you can expect:

- Interesting research questions with practical relevance
- A good balance between theoretical and implementation work
- You will learn in detail how modern wireless cellular networks work

What you should bring:

- Experience in programming, preferably using C/C++
- Basic knowledge of 4G-LTE/5G cellular networks
- Basic knowledge of Linux-based software development

**For questions please contact:**
M. Eng. Zubair Amjad
zubair.amjad@hs-offenburg.de
Phone: 0781-205-4646
Room: STB 1.02

**For application please contact:**
Prof. Dr.-Ing. Axel Sikora
axel.sikora@hs-offenburg.de
Phone: 0781-205-416
Room: B130