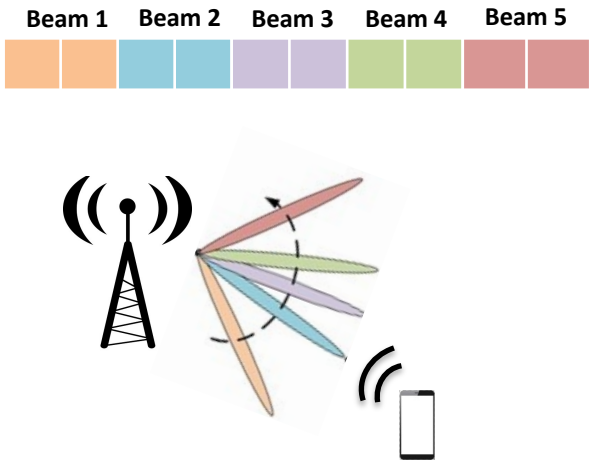
M.Sc thesis: Radio resource scheduling & beam management in 5G-NR (mm-wave) cellular networks

Background

Millimeter wave (mm-wave) is consider as a key enabler of 5G-and-beyond networks due to availability of huge bandwidth opportunities in the 6-100 GHz spectrum. However, mm-wave links are highly susceptible to channel variations, severe free-space pathloss and atmospheric absorption. To address these challenges, the base station (BS) and users (UE) will have to use highly directional, multi-antenna arrays to achieve sufficient link budget. The consequence is the need for precise beam alignment using beamsteering. However, this may increase the latency of establishing and maintaining the link, and will have important implications for management procedures such as initial access, handovers and radio resource scheduling. The directional transmissions also enable new ways of scheduling, i.e. the same time/frequency resources can be reused and scheduled in more than one beam simultaneously within the transmission time interval.



Tasks

In this thesis work, you will use an existing 5G-NR module for ns-3, a network simulator that has been widely used in academia. Your core task will be to implement a particular set of radio resource scheduling procedures for beam management, i.e. Synchronization Signal (SS) blocks, following the latest 5G-NR recommendations, and then conduct an extensive performance evaluation based on realistic mm-wave propagation data, which was acquired as part of our on-going mm-wave research work.

Other Information

This topic gives a student an excellent opportunity to learn more about mm-wave, an emerging technology for upcoming 5G-NR networks. Interested students should have basic knowledge in mobile radio networks, good C++/Python programming skills, and prior experience with (or willingness to learn) the ns-3 simulator.

Contact

Aleksandar Ichkov, M.Sc.
Institute for Networked Systems
0241 80-209 17
aic@inets.rwth-aachen.de

Dr Ljiljana Simić
Institute for Networked Systems
0241 80-209 25
lsi@inets.rwth-aachen.de