5G IoT Research infrastructure

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EXPERTISE AND INNOVATION

MORE THAN 15 YEARS OF COOPERATION WITH INDUSTRY

MEVICO.org

METRICS-itn.eu

SIGMONA.org

TAKE-5G.org

SSICLOPS.eu

SDN backhaul for mobility management
(WO 2015150638 A1)

EU Innovation award

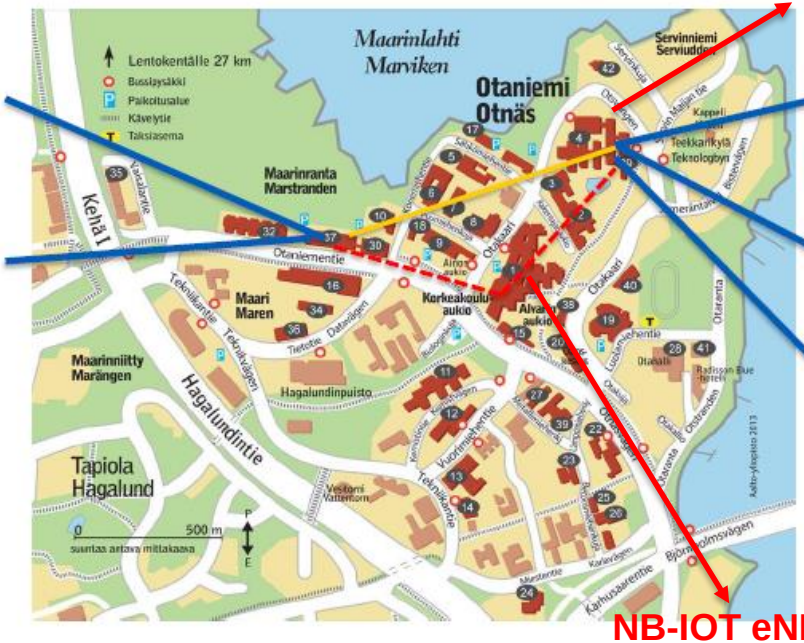
SDN Mobile Backhaul part of MEC and network slicing

- **5G compliant slice management (NRF, NSSF)**
- **SDN backhaul: European Innovation Award**

Aalto IoT and 5G research infrastructure

5G research infrastructure refers to the technical platform built incrementally throughout several research projects with academic and industry partners

Action Area



Current running setup with SDR and remote control via fiber

Current location lab antennas and core network(fiber, synchronization)

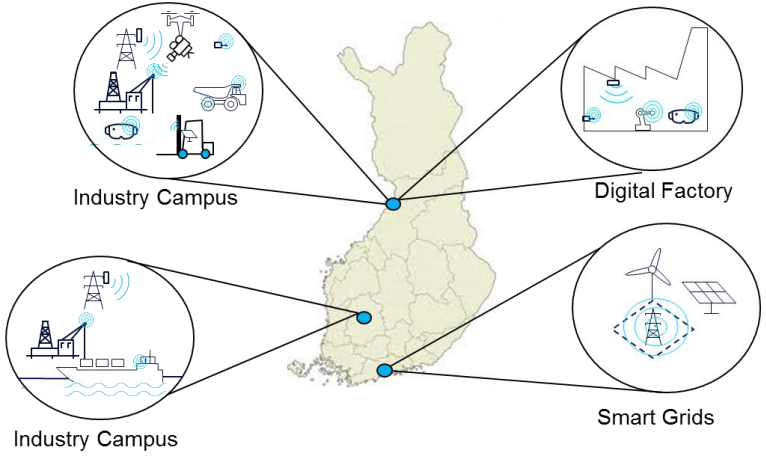
Current core network(fiber)

Plan core network(fiber)

5G infrastructure

- Aalto 5G infrastructure fills the gap between laboratory-based 5G testing environments and commercial network deployments in real deployment across the campus.

- 5G platform built together with industry vendors offer trials tailored infrastructure configurations for telecom and vertical industries and scientific community



- Facilitate the deployment of new use cases for verticals to support industry players to monetize investment in 5G mobile networks

- Engage SME, start-ups and industry players to test the benefits of 5G features with open platform for experimentation (e.g. hackathons)

AALTO 5G research platform

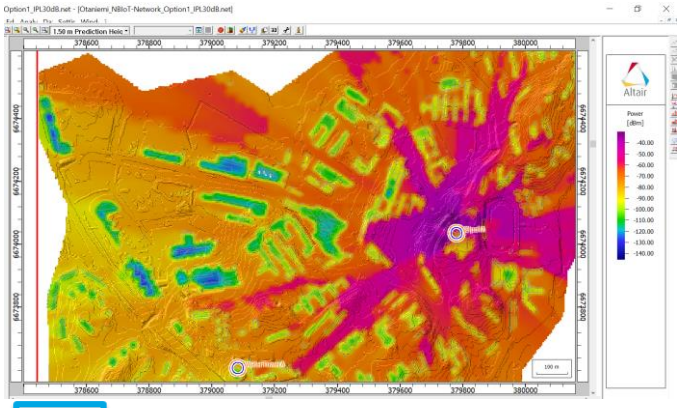
- Massive Distributed Multiantenna System (M-MIMO)
- Currently 4 macro base stations and 10 indoors pico base stations (2.6GHz)
- 700 MHz for NB-IOT (Ericsson Donation under installation in the Campus)
- Cloud servers (2-3 Dell PowerEdge 715):
- Multi-Access Edge Computing-MEC (Nokia donation)
- Several LTE Mobile Cores (Nokia EPC, Aalto own SW, Cumucore , OAI)

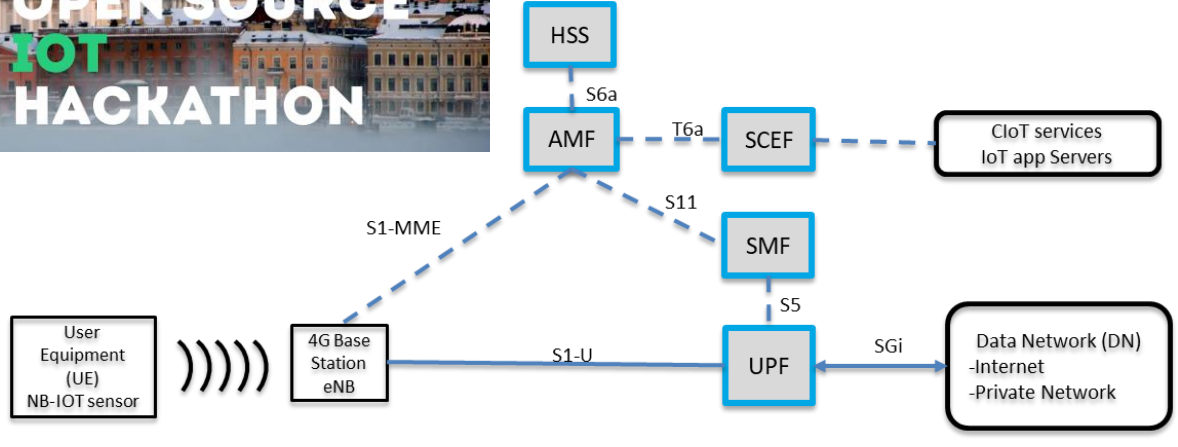
The platform serves research in the areas of

- Communications engineering
- Networking technology
- Mobile and edge computing
  - *VR/AR*
  - *Gaming*
- IOT hackathon
- Industrial Internet i.e. URLLC and IoT (AALTO Industrial Internet Campus)

NB-IOT infrastructure

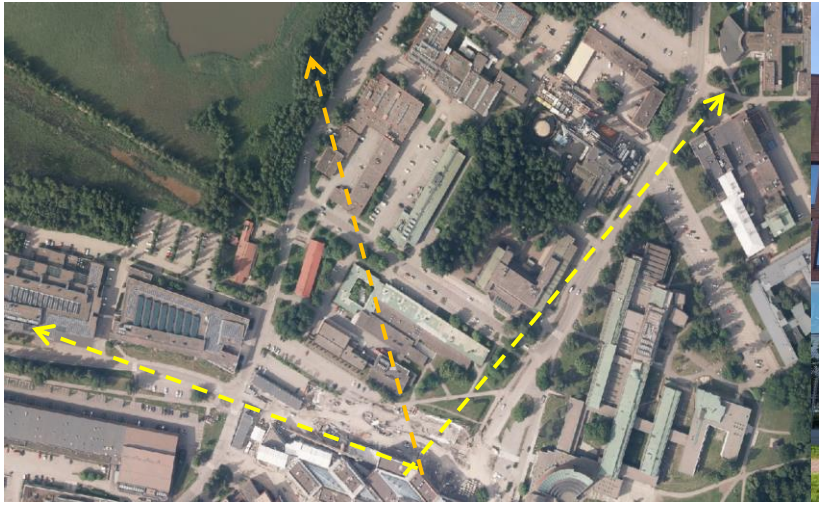
- 700MHz NB-IOT eNB installed in Dipoli roof and operational (donated Ericsson)
- NB-IOT infra used for IOTHON

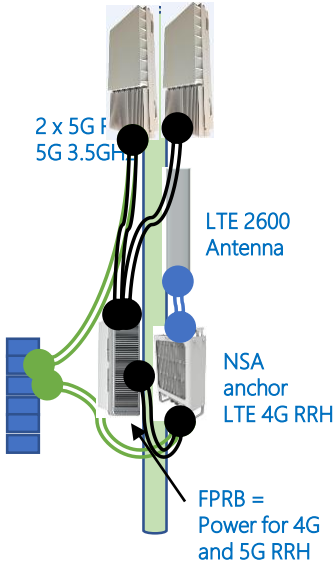




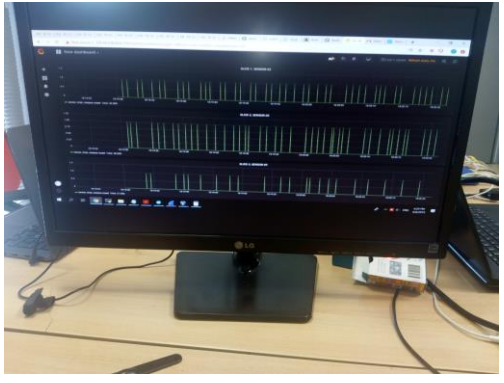
5G infrastructure

- 2x NR Radio heads to cover main road in the campus for several research projects (e.g. PriMO-5G: Drones, 5G-MOBIX: autonomous cars)
- Own license 3.5GHz (3640-3700 MHz with 60Mhz bandwidth
- Several 5Gs core both NSA and SA, own SIM with PLMN 50-59





IoT experiments: Network slicing

IoT experiments: Network slicing

- Objectives

- Demonstrate the on-demand setup of a network slice for NB-IOT devices following Ultra Reliable Low Latency (URLLC) requirements.
- Deployment of Network Slice Manager (NSM) system to dynamically deploy network slices for NB-IOT devices.
- Proof the usage of Software Defined Networks (SDN) to manage mobile backhaul resources for network slicing ensures URLLC requirements

- …

IoT experiments: Network slicing

- SETUP

- The setup consists of multiple NB-IOT devices (Arduino with u-blox NB-IOT chipset) connected to Nokia FZM commercial eNB running on 1.8GHz at the minimum transmission power 24dB and with 30dB attenuator to avoid interferences with commercial mobile operators.
- The eNB was connected to Cumucore mobile core that includes basic 4G and 5G core functions extended with NB-IOT support.
- Cumucore mobile core includes the SCEF which receives the data from the sensors and encapsulates it over UDP to be sent to external servers for data processing. The SCEF is connected to SDN mobile network that is managed from Cumucore Network Slice Manager.

- …

IoT experiments: Network slicing

- Meassurements

- Network Slice Manager receives information from the mobile core about the devices that should be allocated to different slice.
- The NSM receives the IMSI number from each device and will assign the device to different slice based on the requirements in terms of bandwidth and latency.
- We defined three network slices with different bandwidth to visualize that devices assigned to slice with low bandwidth requirements will not have a reliable data communication.
- Those devices allocated to a low preference network slice will have packet lost and longer delays.

- …

IoT experiments: Network slicing

VIDEO REMOVED DUE LARGE SIZE

Open for future IoT Experiments

The Aalto research infrastructure is available for all type of research and experiments.

The 5G and IoT infrastructure is open for both Aalto researchers but also for external companies, SMEs or startups that wisth to experience first hand IoT and 5G.

THANK YOU

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