TOWARDS AI SUPPORTED NETWORKS AND SERVICES

PROFESSOR SASU TARKOMA
Department of Computer Science
Among top CS Departments in the Nordics
The number of professors has grown from 16 in 2017 to 29 in 2019.
Approx. 200 staff members in 2018

Architects of the Digital World
Core CS and Data Science
Algorithms, AI, Networking, Software

Helsinki Institute for Information Technology HIIT
Finnish Center for AI (FCAI)
Helsinki Center for Data Science (HiDATA)
Nokia Center for Advanced Research (NCAR)
THREE VIEWS ON AI:

1. AI FOR NETWORK AND SLICE GENERATION
2. AI FOR NETWORK SECURITY
3. AI AND NETWORK SLICE FOR SENSING
Network Refactoring: towards slice and network generation

1. Identifying the **roles** of the network functions
2. Splitting each network function into **modules**, creating one module for each role of the network function. For each module, we identify the requirements of a physical device instantiating that module.
3. Changing the **mapping** between physical devices and modules depending on the requirements (cost, latency, security, ...) from the network.

LTE control plane example:
- **Modularize** architecture
- Identify **state variables**
- Study **signals** between functions
- **Combine** modules

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<th>Implementation</th>
<th>Initial Attach</th>
<th>Active to Idle</th>
<th>Idle to Active (UE)</th>
<th>Idle to Active (Net)</th>
<th>Handover (S1H)</th>
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<tr>
<td>Thin Edge</td>
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**A Refactoring Approach for Optimizing Mobile Networks.** Matteo Pozza, Ashwin Rao, Armir Bujari, Claudio Palazzi, Hannu Flinck, and Sasu Tarkoma. *In the Proceedings of IEEE ICC 2017*
Network Generation: Create, scale, upgrade networks

Many IoT devices have security vulnerabilities. Securing devices by analyzing network traffic, fingerprinting devices based on their network traffic patterns, and using these fingerprints for identification. Fingerprinting devices activity in different states, any deviations are detected as anomalies. Anomalies are then identified using fingerprints.


Megasense is scalable and intelligent real-time air quality monitoring system that utilizes 5G network, AI and IoT. Megasense combines world-class science in three areas with high business potential within a unique application.
MegaSense as a 5G Vertical Application

A 5G network slice for air pollution sensing platforms

- Sensing campaign configuration over slice and in-field calibration AI
- Connection density of more than 400 sensors per $km^2$
- Large volume of data generated by Hyperspectral and LIDAR camera
- Accurate 3D location
- Energy efficient communication to optimize power consumption of sensors

Enabling Massive Air Pollution Sensing System Using 5G

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<th>Solutions</th>
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<td>Sensing as a Slice</td>
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<td>Optimized Power Consumption</td>
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Builds on: Station for Measuring Earth Surface-Atmosphere Relations (SMEAR)
https://www.atm.helsinki.fi/SMEAR/

Near real-time high-res air quality map
Green path navigation
A MESH OF SENSORS
MEASUREMENT CAMPAIGNS AT HELSINKI AND BEIJING
Promoting MegaSense

Mobile World Congress, Shanghai 2018

Drones in Urban Environment (Helsinki)

China International Import Expo 2018
THANK YOU