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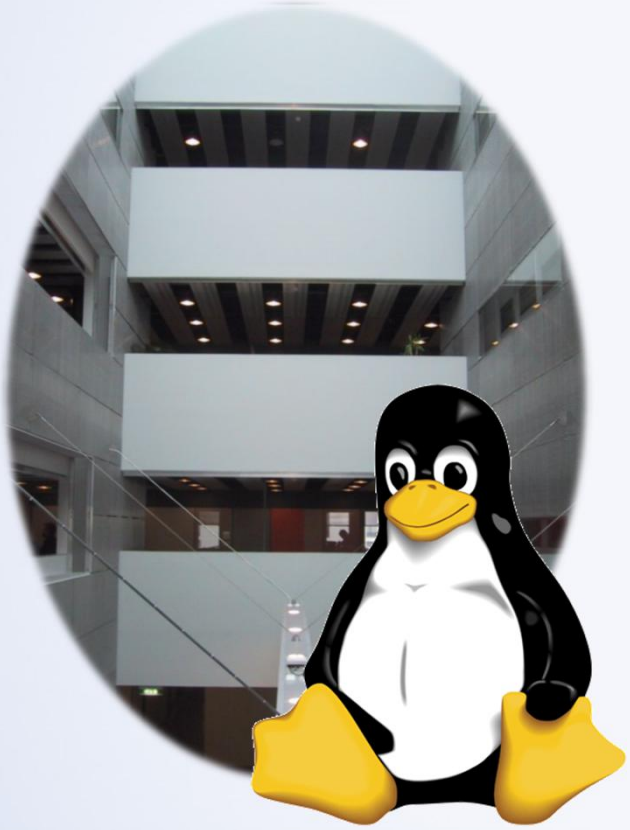
UNIVERSITY OF HELSINKI

52 Years of Excellence



- 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)

HIGHLIGHTS

- Ø THREE VIEWS ON AI:
- Ø AI FOR NETWORK AND SLICE GENERATION
- Ø AI FOR NETWORK SECURITY
- Ø AI AND NETWORK SLICE FOR SENSING

NOKIA CENTER FOR ADVANCED RESEARCH NCAR

HiDATA
HELSINKI CENTRE FOR DATA SCIENCE

FCAI Finnish Center for Artificial Intelligence

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.

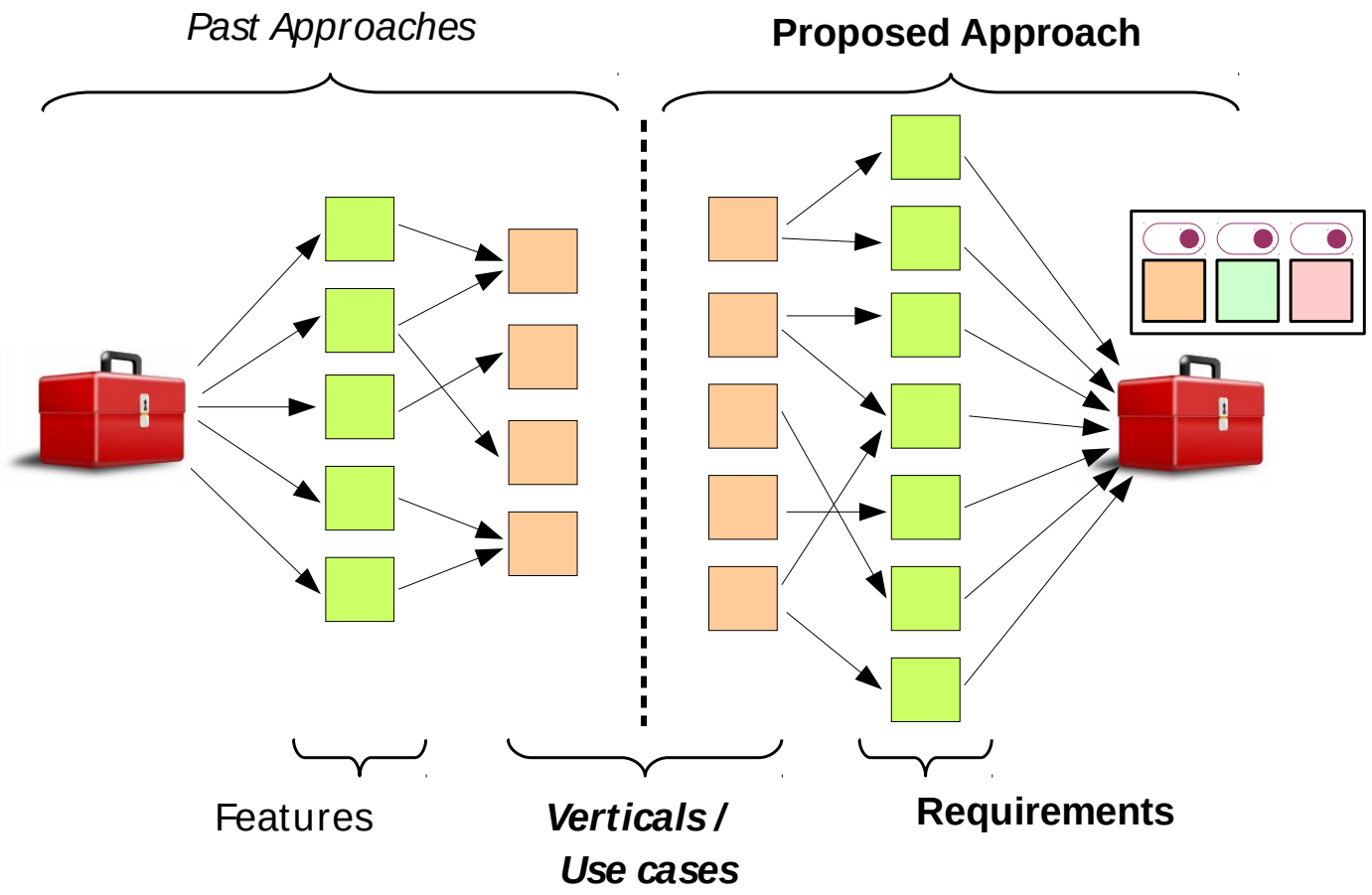
LTE control plane example:

- Modularize architecture
- Identify state variables
- Study signals between functions
- Combine modules

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*

	Total number of signals per event				
Implementation	*Initial Attach*	*Active to Idle*	*Idle to Active (UE)*	*Idle to Active (Net)*	*Handover (S1H)*
LTE (Baseline)	35	6	13	17	22
Thin Edge	**24**	**6**	**13**	**16**	**16**
Intelligent Edge	**17**	**3**	**10**	**12**	**12**

Network Generation: Create, scale, upgrade networks



AI for slice and network generation and revision

Matteo Pozza, Ashwin Rao, Hannu Flinck, Sasu Tarkoma: Network-In-a-Box: A Survey About On-Demand Flexible Networks. IEEE Communications Surveys and Tutorials 20(3): 2407-2428 (2018)

NETWORK SECURITY AI

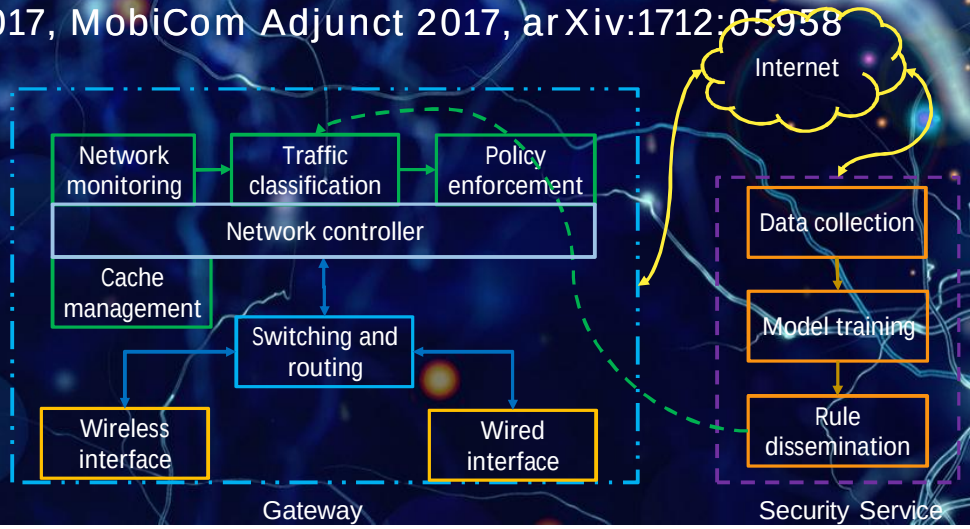
Many IoT devices have security vulnerabilities

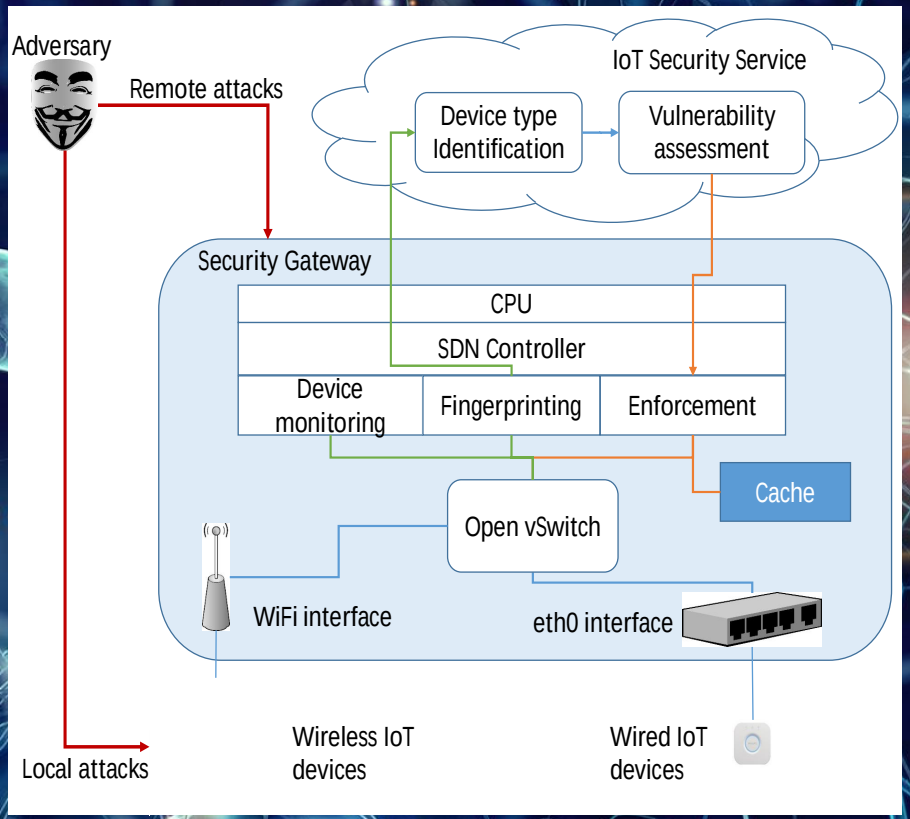
Securing devices by analyzing network traffic

Fingerprint devices based on their network traffic patterns and use these fingerprints for identification

Fingerprint devices activity in different states, any deviations are detected as anomalies. Anomalies are then identified using fingerprints.

ICDCS 2017, Best Demo at ICDCS 2017, NSS 2018, MobiCom 2017, MobiCom Adjunct 2017, arXiv:1712.05958





M. Miettinen, S. Marchal, I. Hafeez, N. Asokan, A-R Sadeghi and S. Tarkoma. IoT SENTINEL: Automated Device-Type Identification for Security Enforcement in IoT. Article in IEEE ICDCS 2017.

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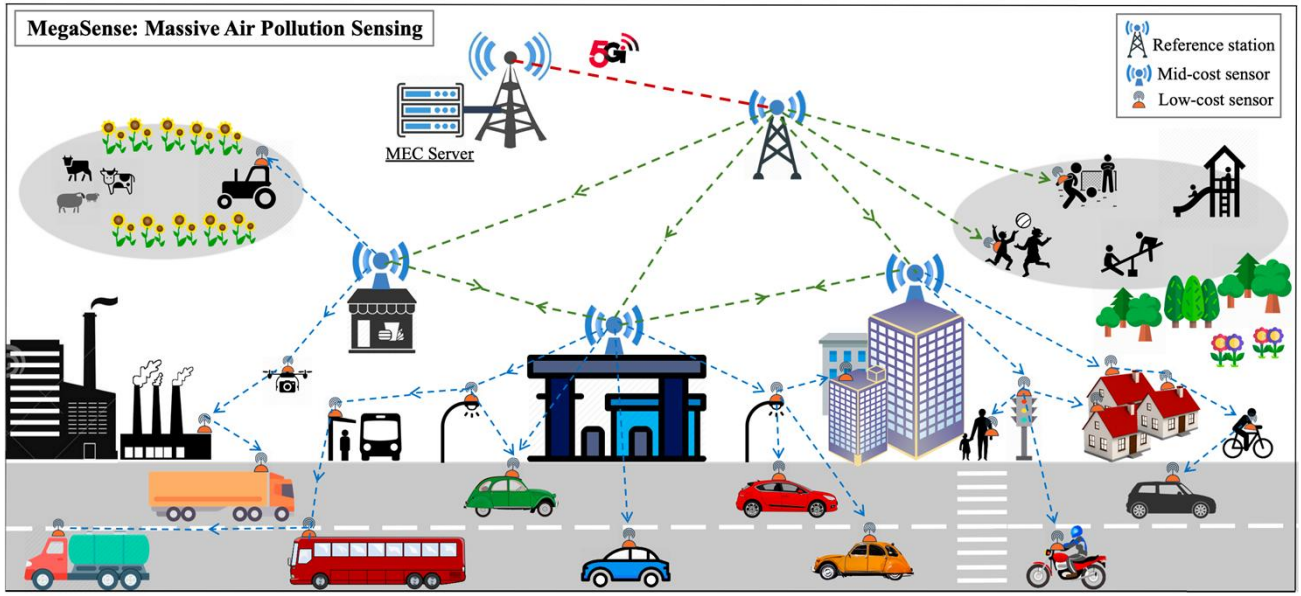
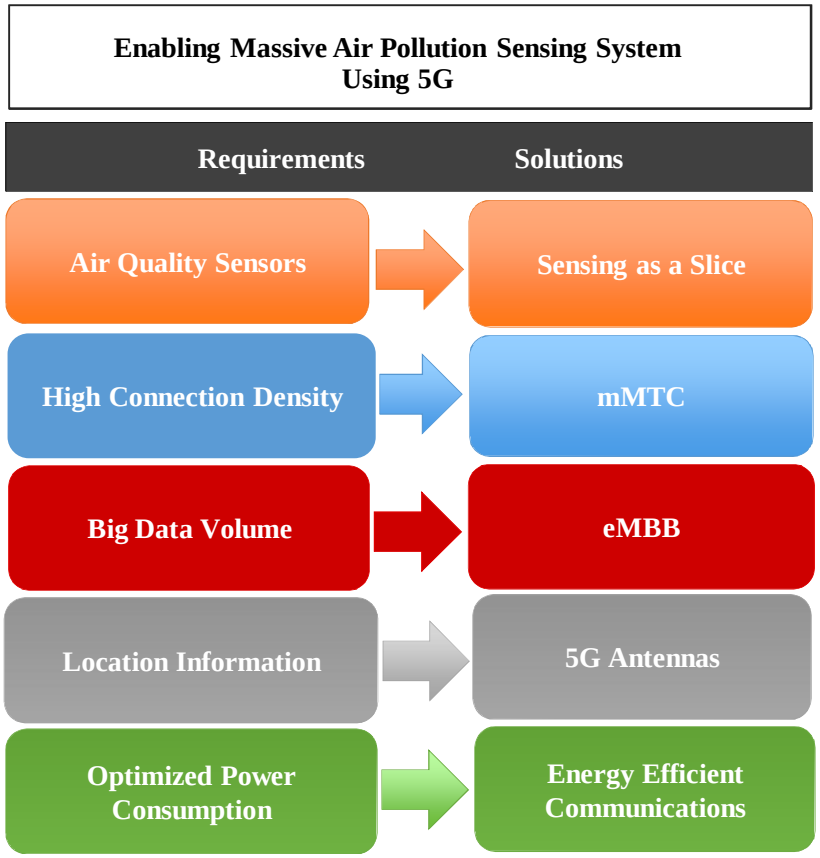
MegaSense as a 5G Vertical Application

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



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

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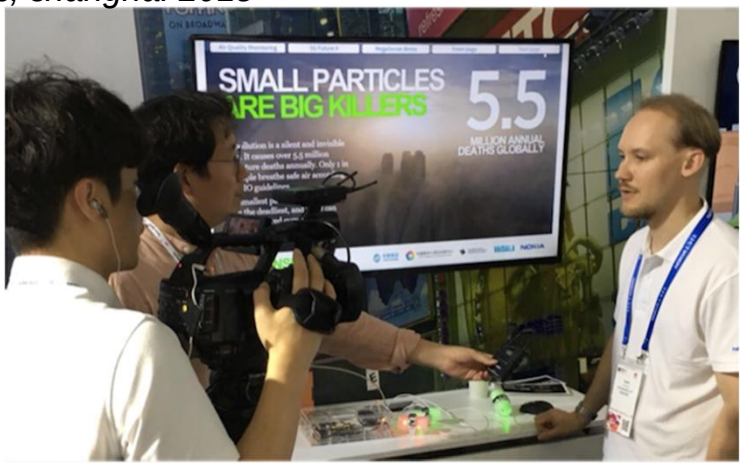
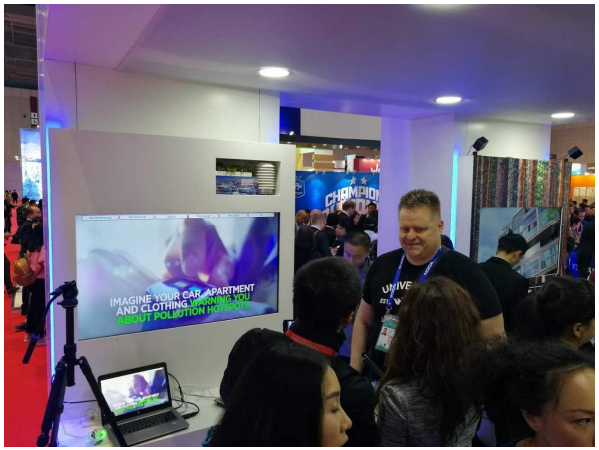
Promoting MegaSense

Mobile World Congress, Shanghai 2018



Drones in Urban Environment (Helsinki)

China International Import Expo 2018



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www.cs.helsinki.fi
www.fcai.fi
www.helsinki.fi/megasense
ncar.cs.helsinki.fi

THANK YOU