

TAKE-5

**5th Evolution Take of Wireless
Communication Networks**

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Content

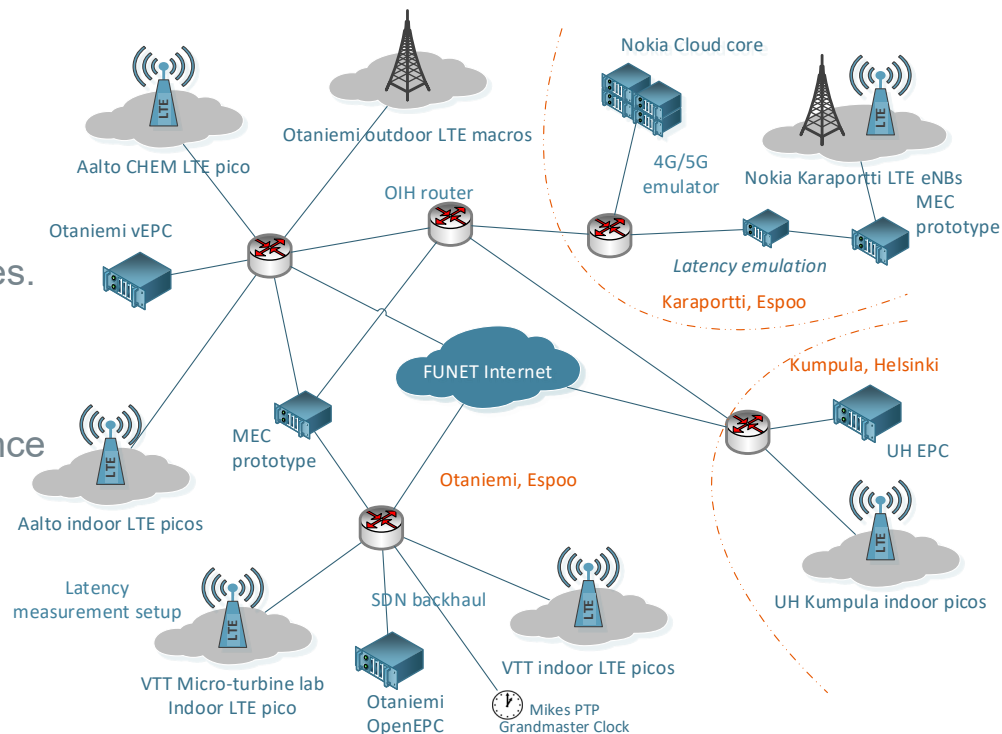
- Objective
- Overview of TAKE-5 project
- Key exploitable results
- Examples of collaborating projects
- Main lessons learned and barriers
- Needs for the future R&I

Objective

- Build a fair playground to facilitate end-to-end 5G research and experimentation and to boost the development of 5G mobile networks and respective competences.
- Main research topics are:
 - Architecture and validation
 - Network virtualization
 - Mobility and security
 - Edge computing and cloudification
 - Applications, services, and techno-economics
- The project is a part of 5G Test Network Finland (www.5gtnf.fi) framework, which promotes the multi-site 5G research and experimentation ecosystem.

TAKE-5 testbed

- Focus on 4G/5G testbed design and implementation.
- Edge computing used for supporting ultra-reliable low latency and positioning services.
- Network slicing to offer dedicated services e.g. for smart energy applications.
- Latency measurement setup for performance validation and testing.
- Localisation and IoT to offer information about operation conditions.



TAKE-5 test network infrastructure

TAKE-5 and pilot partners



5GTNF - 5G Test Network Finland



IoT



WiFi and IoT networks
integrated

5G Test Network

5GTNF coordinates the integration of the testbeds and facilitates the creation of an open innovation platform

Radio Access

From LTE evolution to 5G radio access (Cat-0, Cat-M1, Cat-NB1)

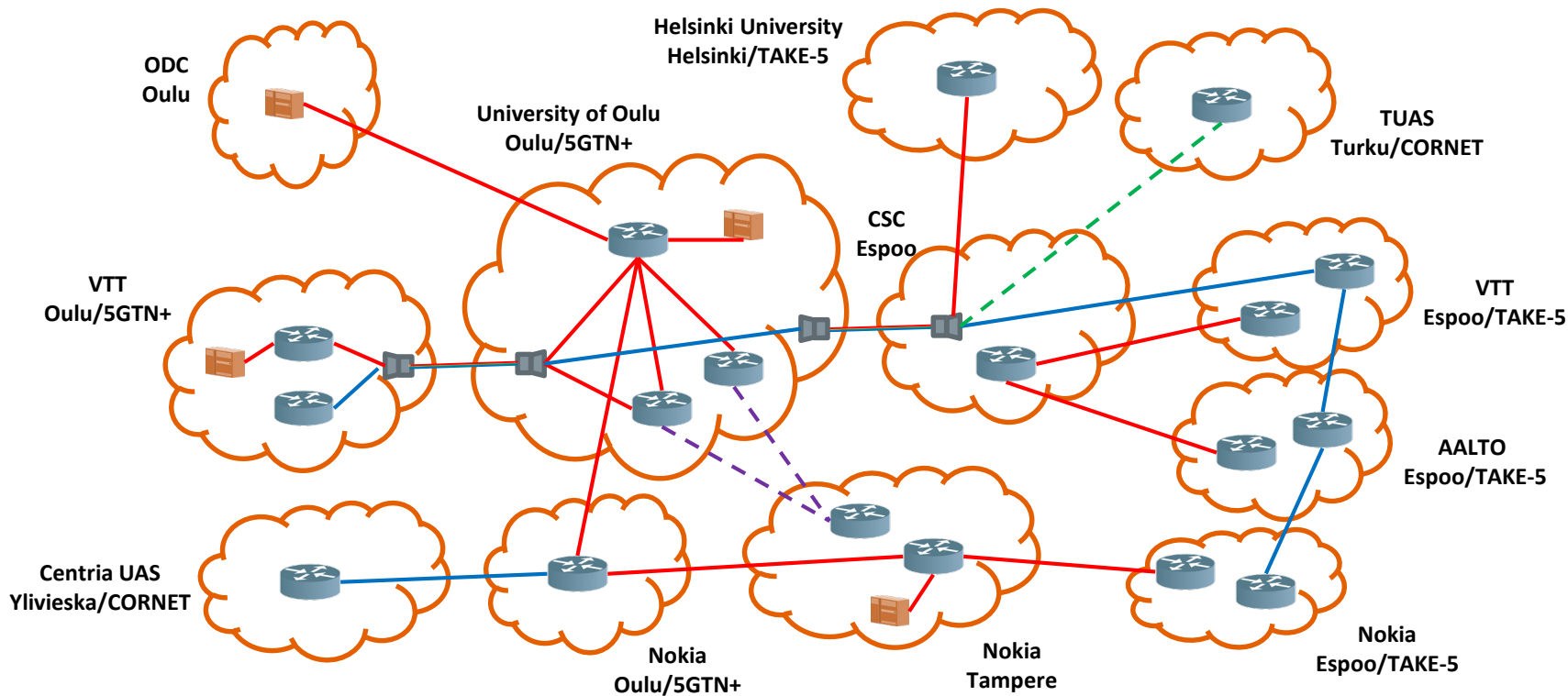
Mobile Edge Computing to bring services close to users access

Core network in a cloud environment

Cloud systems for applications available

Secure connections between 5G test sites in Finland and worldwide

5GTNF nationwide 5G testbed



Key exploitable results

- Tested for testing and developing key 5G technology

4G and earlier mobile technology generations are technology-driven focused on offering mobile services to consumers.

- Possibilities from component to service level tests and

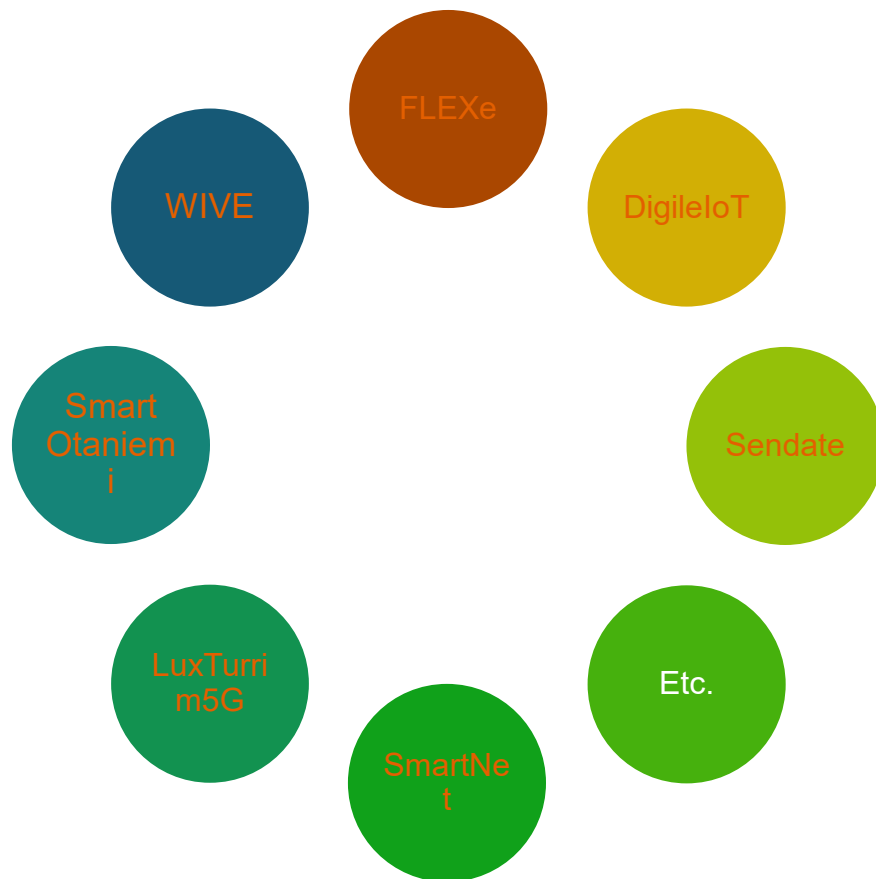
5G is more service oriented focusing on industrial customers and communications between machines.

- Enables more integrated development of new products and services in energy and communication domains

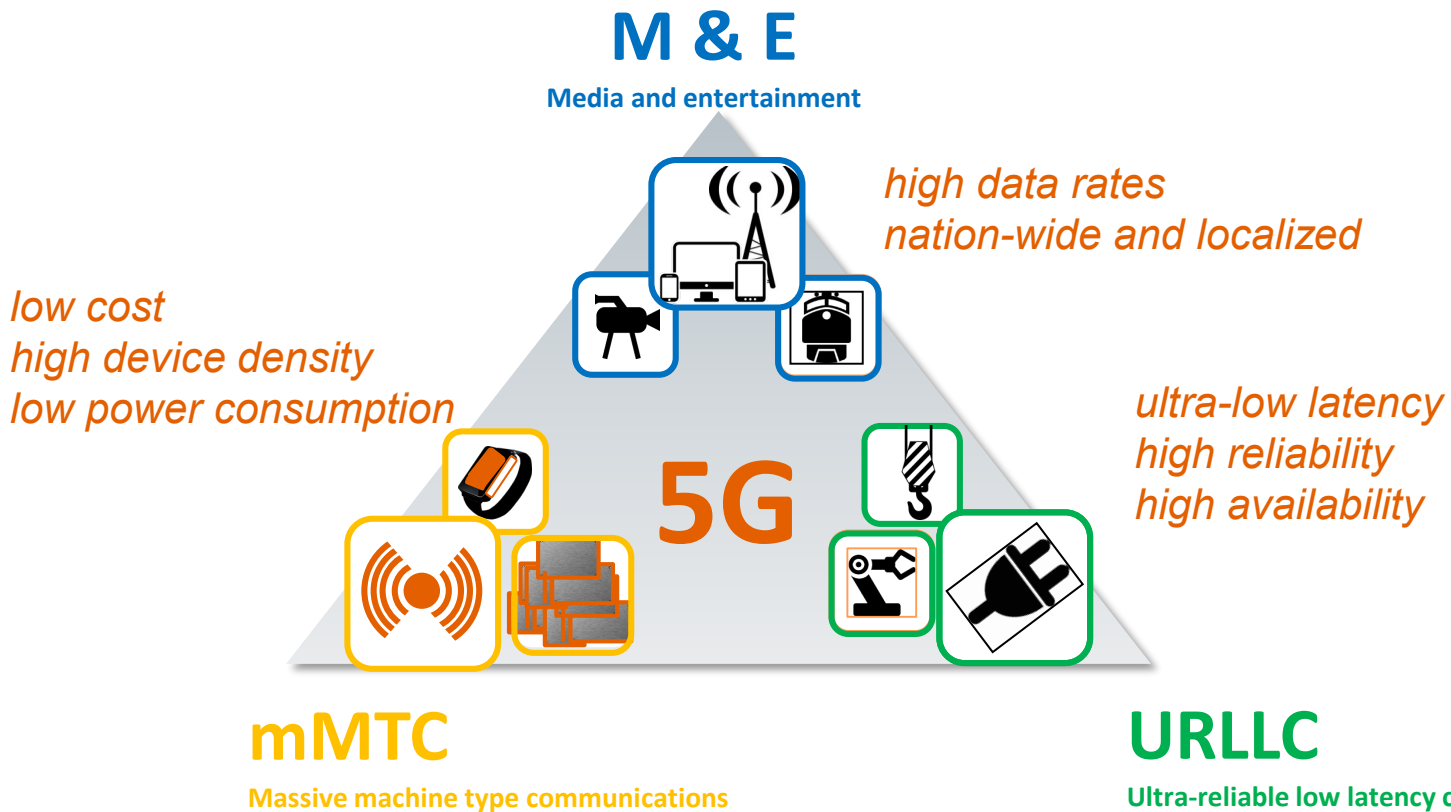
Exploiting projects

Other exploiting projects in the fields of:

- Smart city
- Security
- Situation awareness
- Critical communications
- Smart factory
- Smart transportation



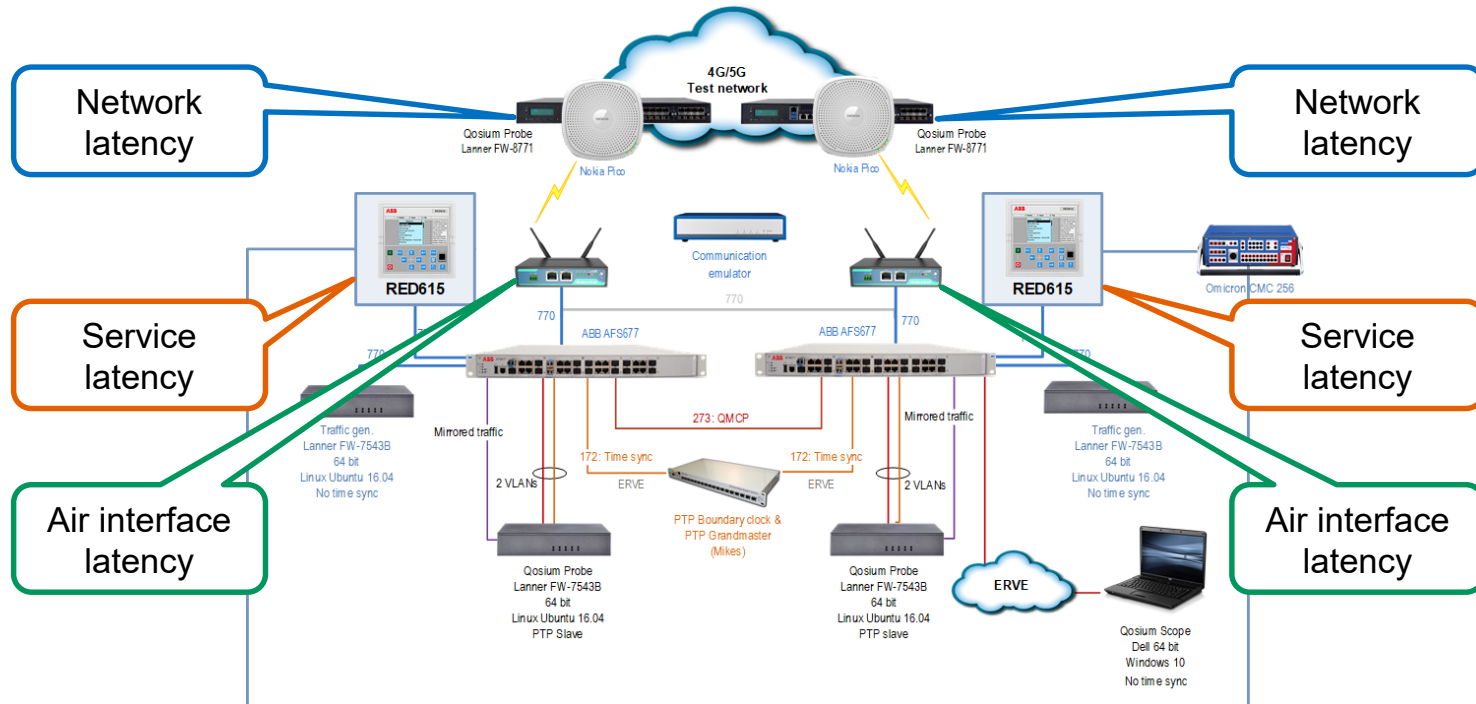
Case 1: WIVE



TAKE-5 in WIVE

- Enables testing and developing communication and grid protection components already in their prototyping stage:
 - Grid devices and application prototypes tested outside lab
 - Testbed infrastructure provides different communication technologies
 - Testbed offers different measurement setups and tools for testing and validation
- National Metrology Institute of Finland (MIKES) offers time services for ultra-accurate timing and synchronisation

WIVE: Ultra-reliable low latency communication for Smart Energy control and protection



Trial setup: URLLC use case – Line-differential protection

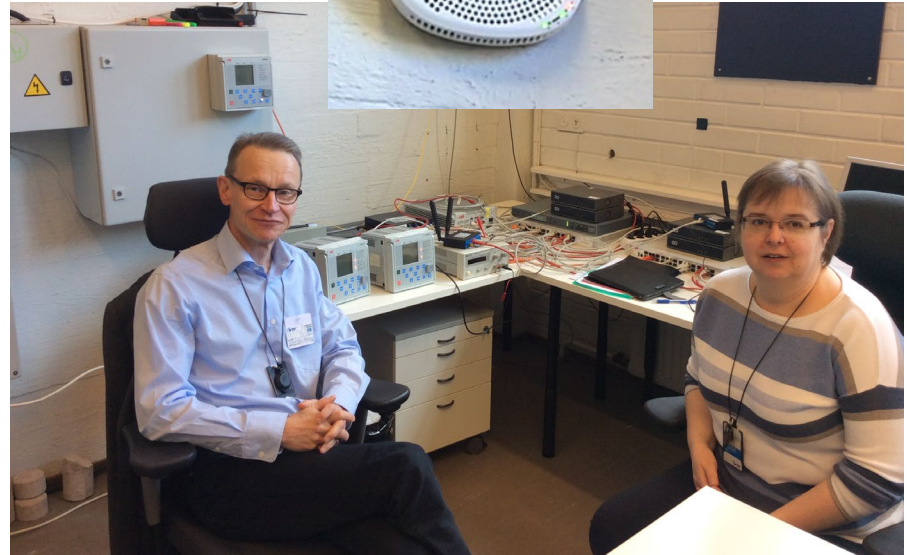
WIVE: Relay tests and QoS measurements



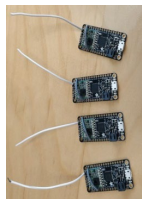
Relays connected to the test network



Indoor LTE/Wi-Fi picocell for wireless communication



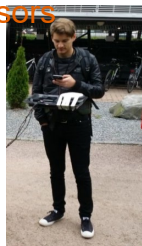
WIVE: Maintenance and asset tracking



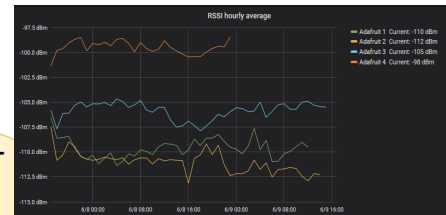
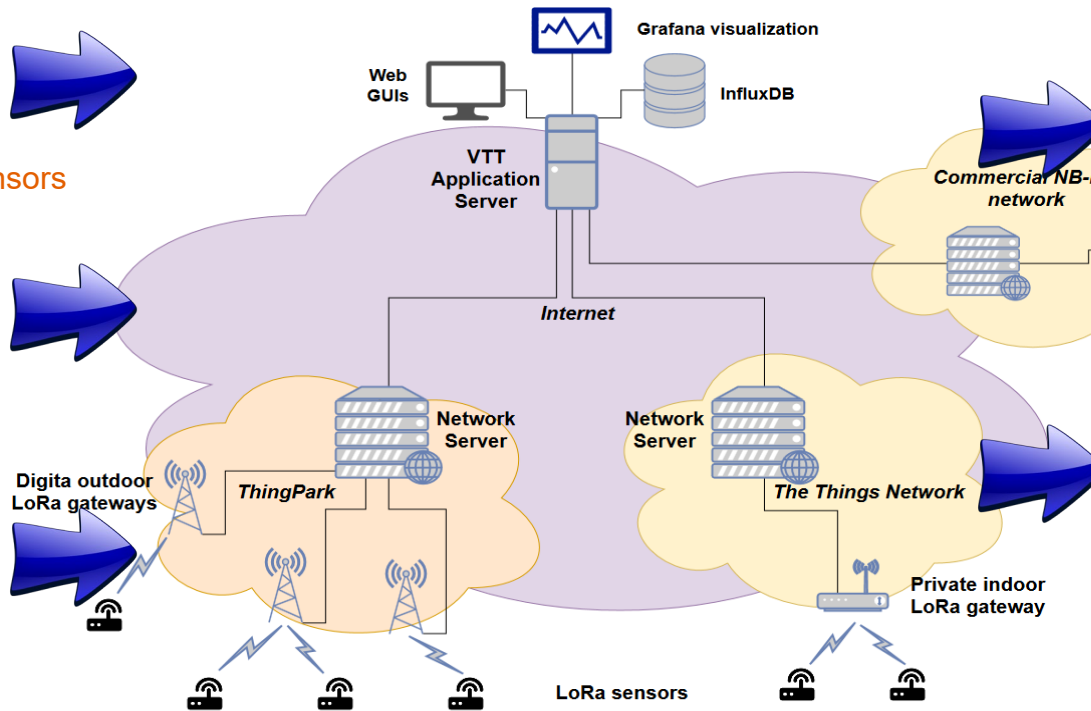
Stationary sensors



Mobile Indoor sensors



Mobile Outdoor sensors

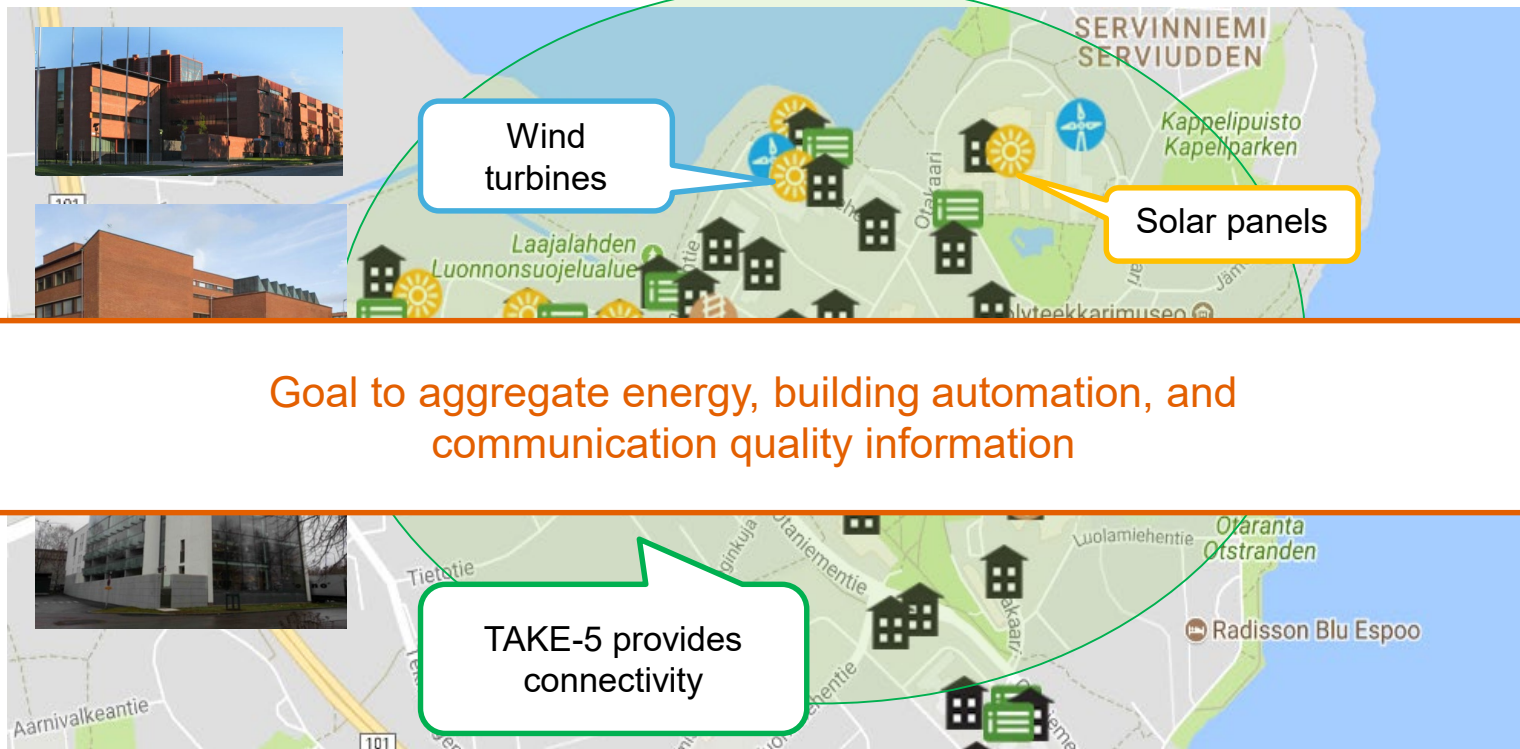


Real-time graphs



Visualisation with 3D model

Case 2: Smart Otaniemi pilot



Goal to aggregate energy, building automation, and communication quality information

The main lessons learned - barriers to innovation

- Building an integrated testbed requires a lot of co-operation, planning, and resources.
- Multi-site testbed adds a great deal of flexibility, but management becomes complex.
- Deployment time of new technologies is underestimated. Differences in the maturity level of network components affect the end-to-end service performance.
- Constant evolution, system updates, and configuration changes in the test network make it more challenging to conduct performance and validation tests.
- Lack of information sharing and tasks orchestration is still a barrier.
- Performance assessment against commercial and dedicated in-house networks is a must.

The future and needs for future R&I activities

- Network infrastructure stays operational after TAKE-5 project ends.
- Follow-up projects will continue the development and integration of 5GTNF test networks.
- New network and service capabilities will be developed further.
- Need to extend collaboration both nationally and internationally (more versatile use cases and devices) and to get SMEs better involved.
- Special need to collaborate with pilots that are not competing but complementing (operating at different domains).

Thank You

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