Wireless for Verticals WIVE

- Mikko.Uusitalo@nokia-bell-labs.com
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WIVE use cases

Extreme Mobile Broadband (eMBB) "Next"

High data rates
VR/AR
Public authorities

Predictive maintenance
metering
Wearable activity meters
Low power consumption
High device density
Low cost
Tracking
Roaming

5G

High data rates
High reliability
High availability
Ultra-low latency

Massive machine type communication (mMTC) "Now"

Ultra Reliable Low Latency Communication (URLLC) "Soon"

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WIVE increases competitiveness of automated transport, smart grids, massive machine connectivity and media delivery via 5G

YLE Digita Teleste ABB Cargotec Kalmar Nordic Semiconductor Telia Digita

Use cases and scenarios, business models, regulation, (ÅA, VTT, Telia, FICORA, all others as well)

Media & Entertainment (Turku AMK, Nokia, Digita, YLE, UTU, ÅA)

URLLC (Nokia, Nordic, Aalto, TUT, VTT)

mMTC (Digita, Nokia, Nordic, TUT, UTU)

Technology validation; Service and application testing (VTT, all others as well)

5thGear technology and test platforms (5GTNF)

5G radio technologies (Nokia, Nordic Semiconductor, TUT, Magister)

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WIVE: 5G enablers for URLLC

- URLLC is one promising technical enabler for emerging applications like fully automated harbor, smart grid protection, future factory etc.

- **Objective**

  – Understanding of WIVE URLLC use cases, requirements and KPIs

  – Investigating the impact on overall system design e.g. reliability and requirements on both data and control channels

  – Developing 5G URLLC technical enablers and concept, bringing developed contribution to 3GPP.

  – Building a one-way latency measurement environment on top of the TAKE-5 testbed for measuring time-critical connections in different radio conditions.

- **Related trials**

  – **New solutions for smart grid protection**

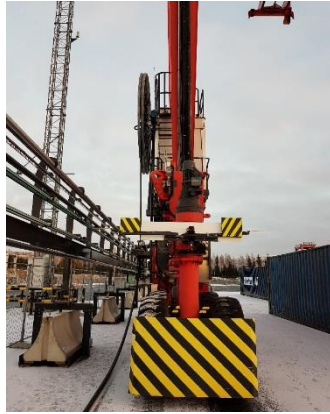 – **5G URLLC automation in a harbour environment**

URLLC Achievements

- 5G URLLC concept development, performance evaluation and contributing to 3GPP
- Filtered OFDM allows flexible frequency multiplexing of URLLC and eMBB (enhance mobile broadband)
- Measurements
  - Extensive latency/QoS measurements with Nokia Digital Automation Cloud (NDAC) and 5G URLLC prototype;
  - Mathematical analysis of URLLC measurement data.

Publications, Standard contributions, Patent applications
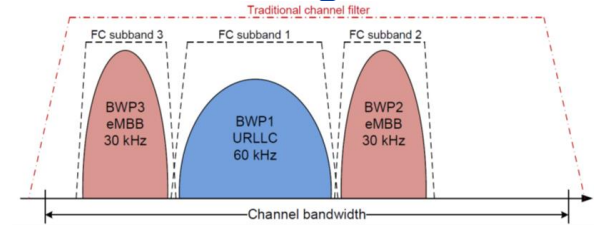
URLLC for port automation, case rubber-tyred gantry crane

5G link to replace optical communication link to achieve cost savings and improved mobility

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Press release Nov 13th, 2018

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Nokia, ABB and Kalmar conduct industry's first trial with ultra-reliable, low-latency 5G technology for electricity grid and harbor automation

- LTE can add significant value in digitalization of ports

- 5G and especially URLLC provide the highest reliability, leading to very predictable and efficient operation

ABB **VTT** **A!** Aalto University

CARGOTEC **Telia**

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WIVE: New Communications Solutions for Smart Grid Protection

5G replacing optical communication links to achieve improved flexibility, reliability and cost savings
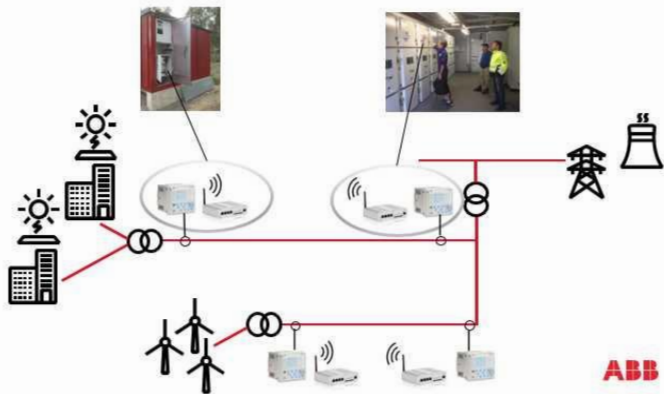
5G paves the way for wider integration of renewable energy sources to electric power network, as it enables new protection solutions required by intermittent generation like solar and wind

WIVE: TV & Radio broadcasting

- 5G and eMBMS is another distribution platform for TV broadcasting
- Transmission of YLE1 and YLE2 streams using eMBMS was trialed in Otaniemi with stream originating from 5GTN in Oulu
- eMBMS capable cell phones from two manufacturers were trialed
- Channel change delay and video quality were found suitable for broadcasting (with carefully configured DASH stream)
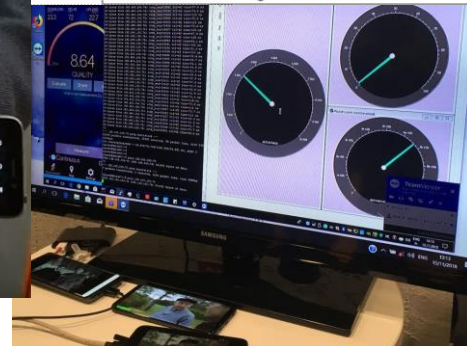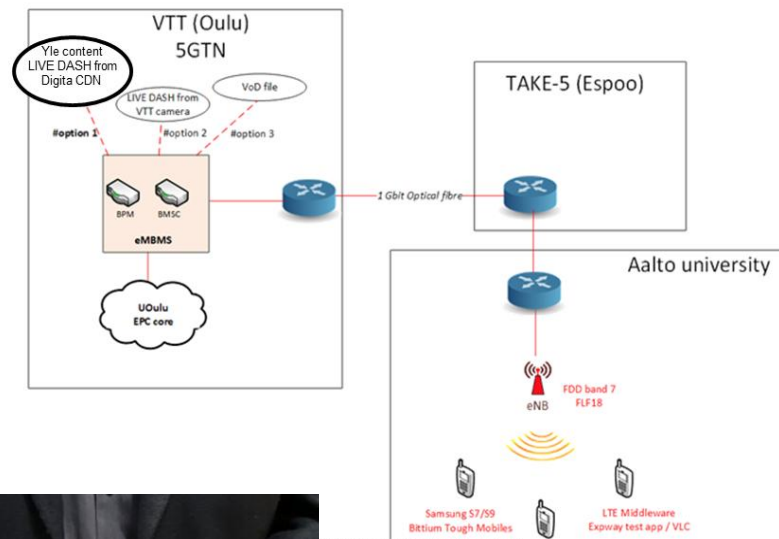
WIVE: High capacity link for railway applications

- The mmWave bands provide multi-gigabit capacities allowing its use for limited distance railway applications such as CCTV & media offload and intercarriage connection

- Robustness and performance of the 60 GHz link was successfully trialed in both indoor and outdoor conditions

WIVE: Multisite mMTC system for IoT remote monitoring

- Monitoring of both sensors data and communication quality is needed to distinguish communication link failures from SW and HW failures.
- Pilot connects mMTC networks in Espoo, Tampere, and Turku
- Pilot supports both public and private mMTC networks
- mMTC performance and security aspects of both mobile and stationary sensors were studied.
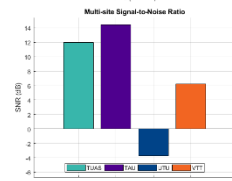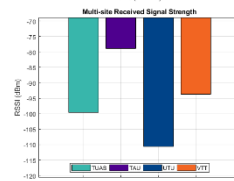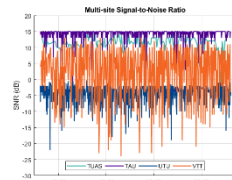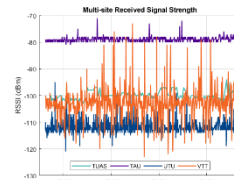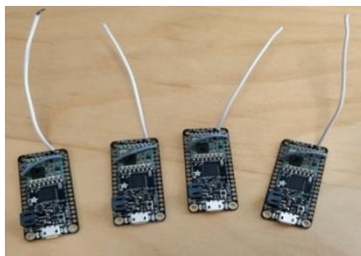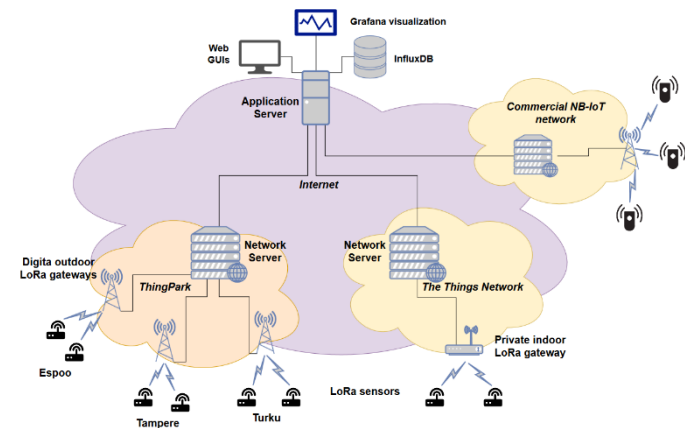
WIVE results in numbers so far

- Publications listed: >50
- Standardization in 3GPP: more than 400 contributions
- Eight quarterly media reports
- Six use case pilots
- Several other deliverables under finalization
- https://wive.turkuamk.fi/
- Contacts:
    mikko.uusitalo@nokia-bell-labs.com and jarkko.paavola@turkuamk.fi

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