5G HEART

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ENHANCING ROAD TRAFFIC SAFETY WITH UBIQUITOUS DRIVER MONITORING AND CONNECTED VEHICLES: THE HUMAN TACHOGRAPH APPROACH

Jarno Pinola

VTT Technical Research Centre of Finland

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5G HEALTH AQUACULTURE AND TRANSPORT VALIDATION TRIALS

Outline

1. Description
2. Motivation
3. Proposed solution
4. Key take-aways
5. Future steps

1. Description

Background

- Occupational health of professional drivers
  - Direct effect to road traffic safety
- Life outside the vehicle (e.g. sleep, diet) also important for fatigue and fitness to drive
  - On-board systems can assess driver status only while driving
- Ubiquitous driver-centric approach is needed
  - Better accuracy and personalisation for real driver condition assessment

2. Motivation

Currently in use

- Digital tachographs (mandatory in commercial trucks and buses)
  - Focusing only on the driver's vehicle use
  - Do not take into consideration the real driver condition
- On-board systems
  - Isolated from the surrounding world
  - No knowledge of driver's activities outside the vehicle or interaction with other road users
- Wearables-based solutions
  - Rely heavily on user equipment and remote clouds
  - Not well suited for low latency interactions with other services

Human tachograph

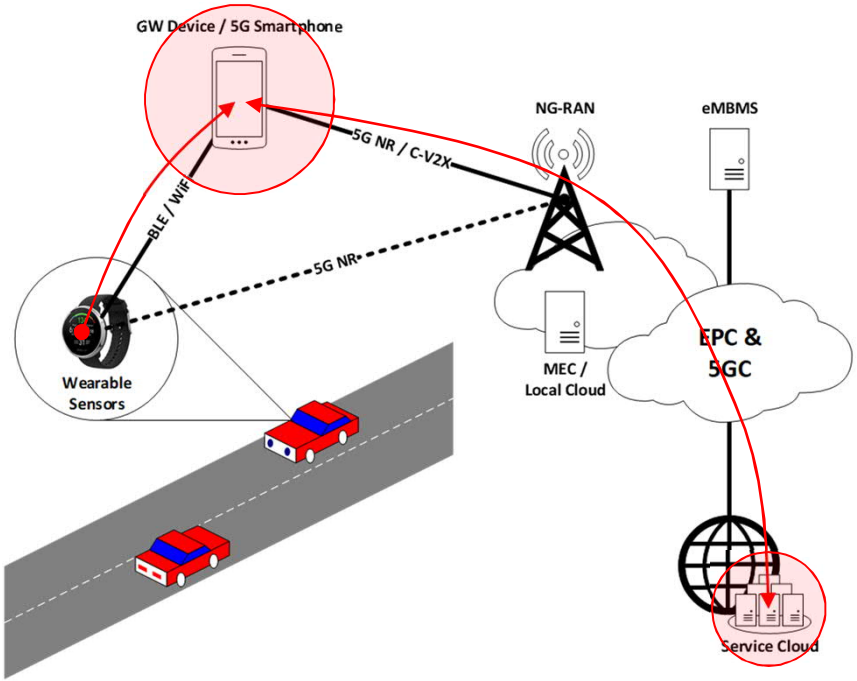
- Human tachograph provides wearables-based ubiquitous driver condition monitoring
  - Combines real-time and historical (e.g., recent and longer term sleep) data
  - Prevention and mitigation of driver fatigue and stress
- 5G enables fast interactions with other road users and road safety systems
  - Low link latency and edge computing
  - Warning messages to surrounding vehicles

3. Proposed solution

Overall approach

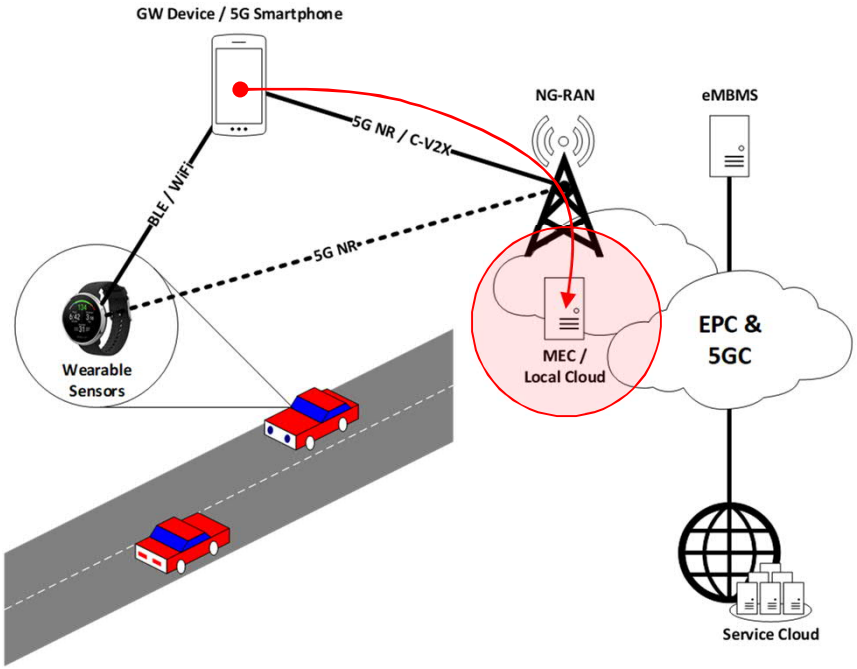
- Why 5G?
  - Architectural flexibility for tailored deployments
  - Future-proof technology platform providing economy of scale
  - Performance facilitating service implementation
- Deployment architectures
  - Device-centric architecture for near future
  - Network-centric architecture with 5G evolution
- Service models
  - Standalone service for wellbeing of professional drivers
  - Inter-connected service for collaborative road traffic safety

Conducted trials: Device-centric architecture



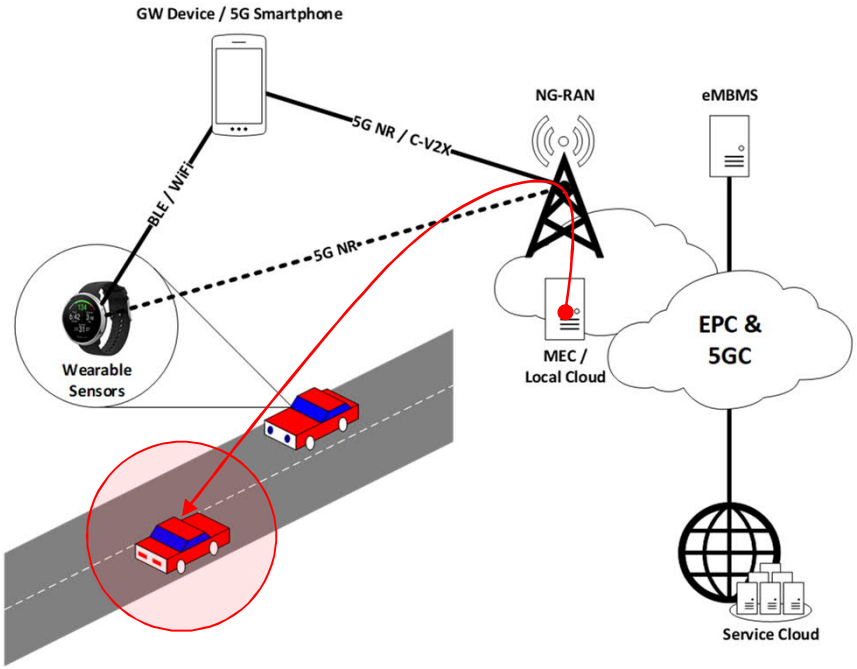
1. Sensor data collection, data analysis and warning message triggering

Conducted trials: Device-centric architecture



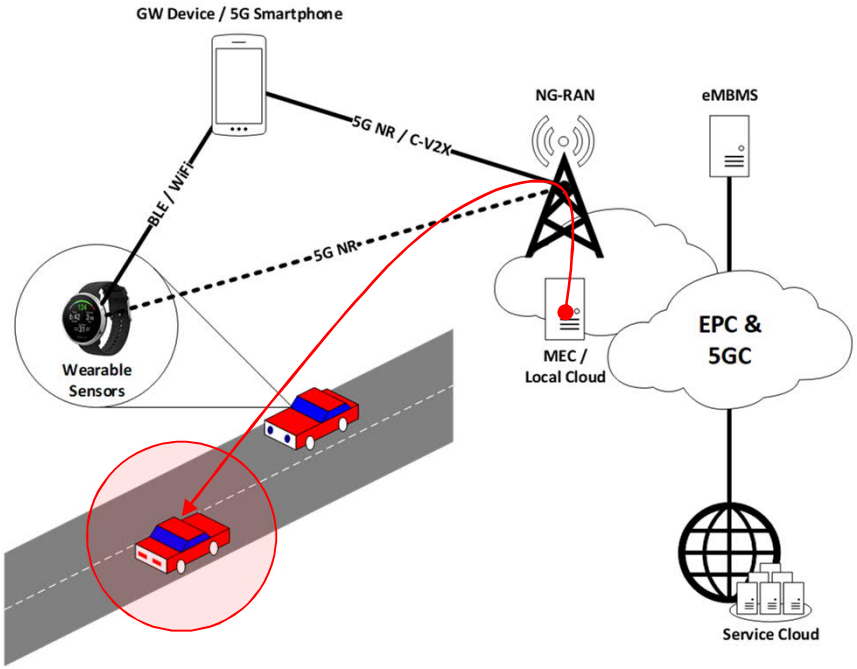
1. Sensor data collection, data analysis and warning message triggering
2. Warning message upload

Conducted trials: Device-centric architecture



1. Sensor data collection, data analysis and warning message triggering
2. Warning message upload
3. Warning message distribution

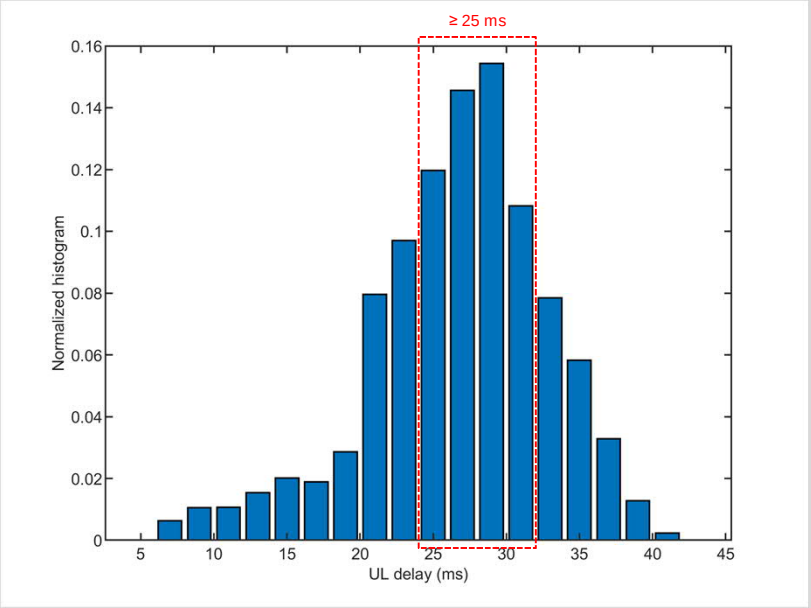
Conducted trials: Device-centric architecture



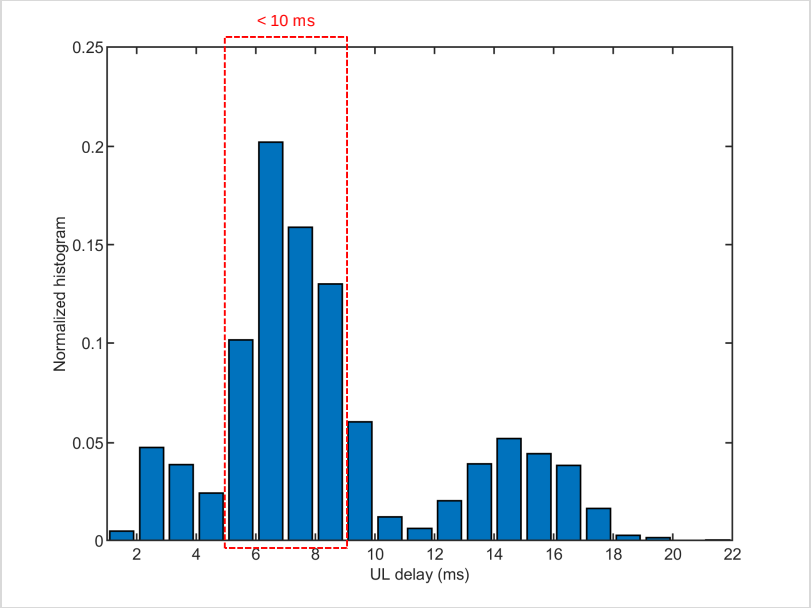
1. Sensor data collection, data analysis and warning message triggering
2. Warning message upload
3. Warning message distribution

➔ Processing dependent on the user device performance and multiple data transfers over 5G uplink and downlink

Focus on uplink latency as main KPI



a)



b)

Histograms of the measured a) 4G and b) 5G uplink delays from the conducted trials.

4. Key take-aways

What have we learned so far?

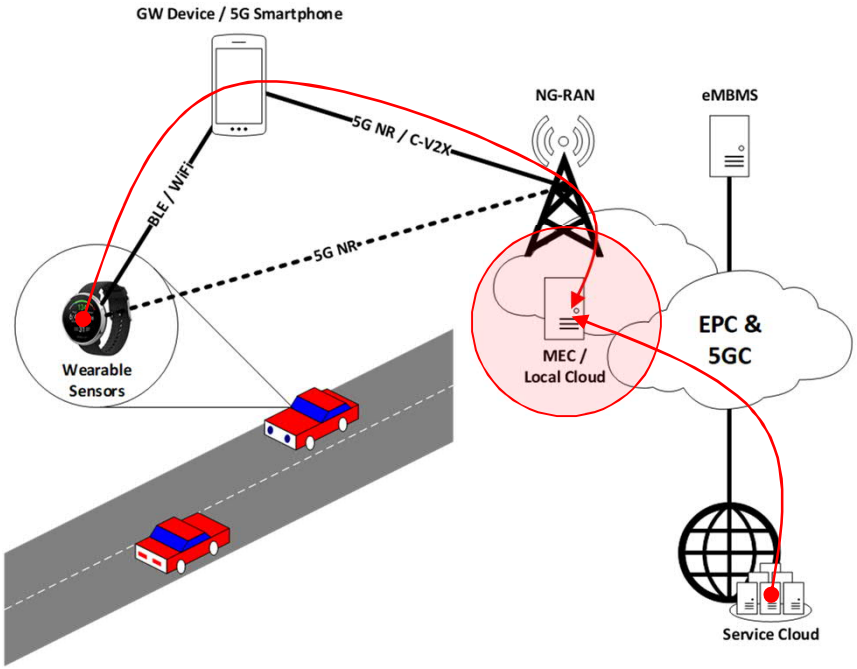
- Ubiquitous wearables-based driver condition monitoring coupled with 5G connectivity can solve many shortcomings of the current solutions
- With the “traditional” device-centric architecture, Rel-15 5G can already fulfil the latency requirements of many cooperative and remote driving scenarios
- More streamlined network-centric architecture (with edge computing capabilities) still needed to better support the inter-connected service model

5. Future steps

Ongoing trial development

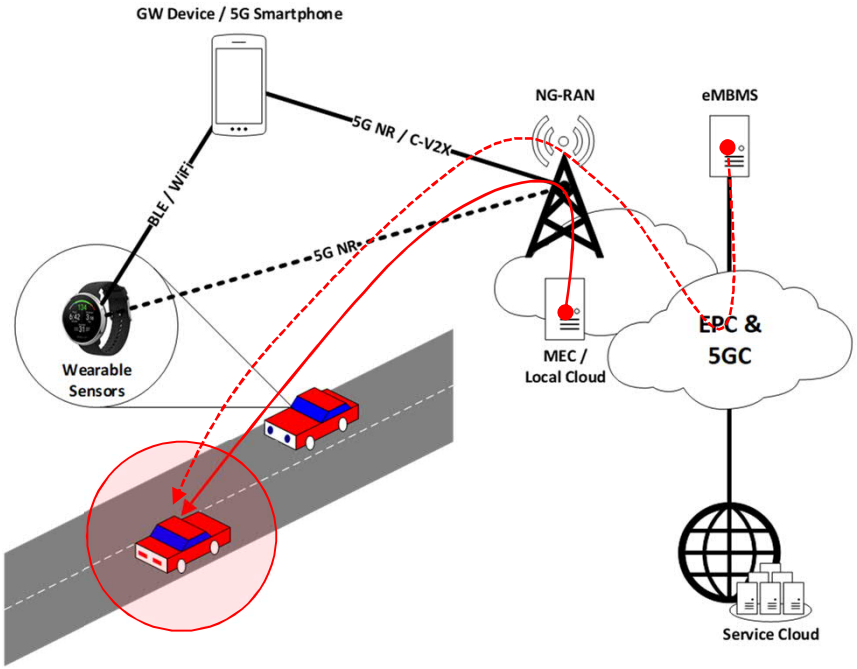
- Upgraded wearable sensor devices
  - Focusing on lightweight software and real-time streaming
- Updated API for historical data
  - Including new parameters relevant for the use case
- Introduction of data analysis and warning message triggering framework to the network edge
  - Enabling deployment of the network-centric architecture
  - Facilitating deployment of the inter-connected service

Future trials: Network-centric architecture



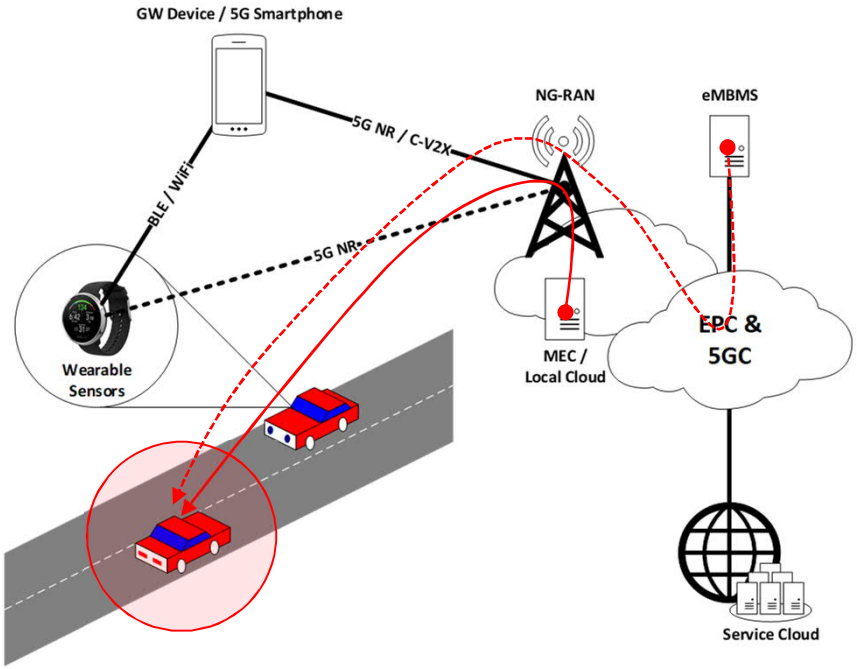
1. Sensor data collection, data analysis and warning message triggering

Future trials: Network-centric architecture



1. Sensor data collection, data analysis and warning message triggering
2. Warning message distribution

Future trials: Network-centric architecture



1. Sensor data collection, data analysis and warning message triggering
2. Warning message distribution

➔ Processing in the network and data transfer only in 5G uplink

Focus areas for future trials

- Communication latency and reliability
  - Uplink, downlink, end-to-end…
- Service latency
  - Data collection, data analysis, warning message processing…
- Warning message distribution
  - Unicast, multicast, broadcast…

THANK YOU
FOR YOUR ATTENTION

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