5G and e-health = true

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telenor group

Digital technologies such as 5G mobile communication, artificial intelligence and supercomputing offer new opportunities to transform the way we receive and provide health and care services.

– *European Commission – "Shaping Europe's Digital Future"*

https://digital-strategy.ec.europa.eu/en/policies/ehealth

Why are healthcare and 5G a good match?

- **e-health:**
- «… the use of information and communication technologies (ICT) for health» - WHO
- a priority in the European Digital Agenda
- puts strict requirements on ICT: Latency, reliability, bandwidth, security, mobility
- **5G can:**
- provide essential levels of connectivity
- transform and improve all critical components of healthcare
- transform from volume-based to value-based care
- build the digital base in healthcare
- provide network security and data privacy

European Commission Infographics on Digital health and care

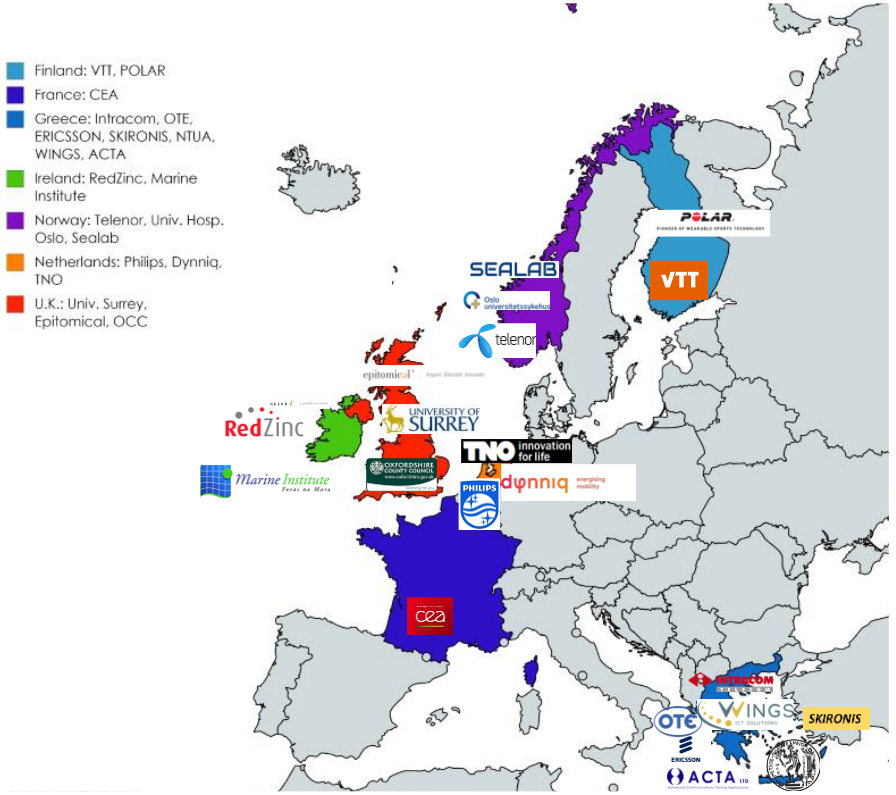
eHAction – Joint Action supporting the e-Health Network

Agenda

- The 5G-HEART project in a nutshell
- Which problem are we trying to solve – pain points of the health vertical
- E-health vision and use cases
- Requirements and essential 5G KPIs
- A 5G e-health ecosystem

5G-HEART in a nutshell

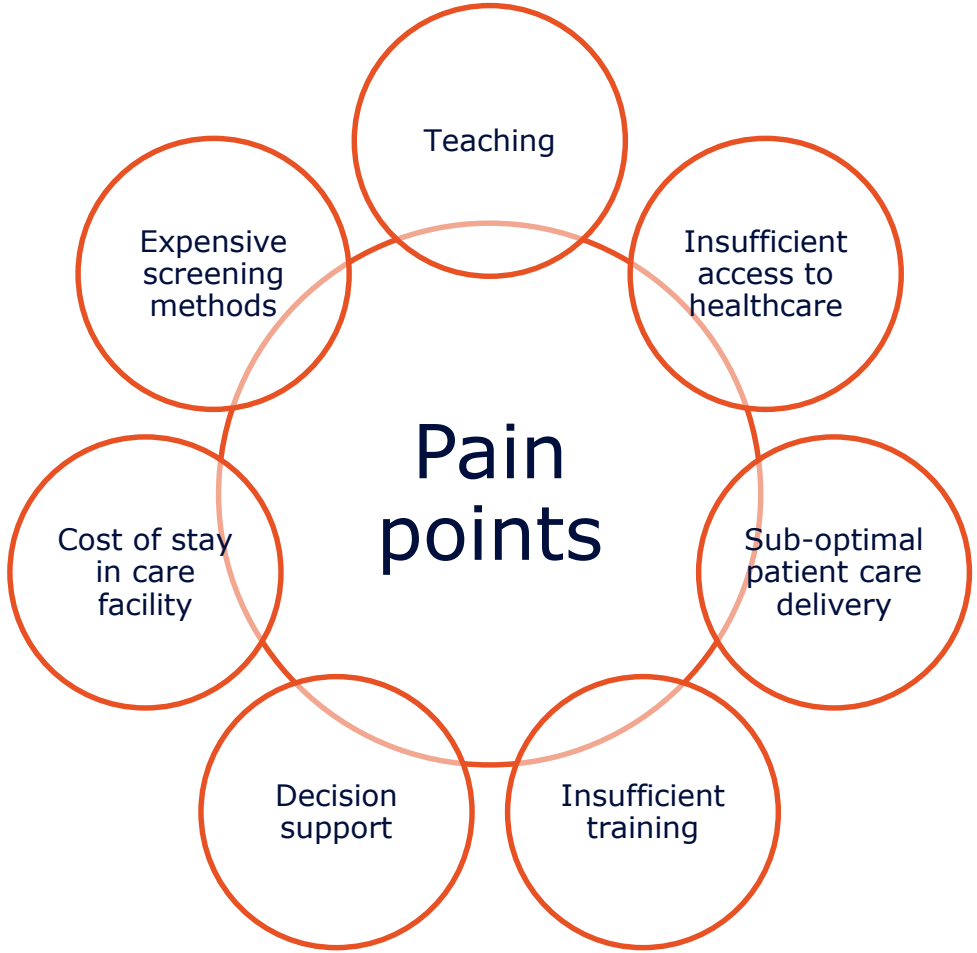
- **5G HEalth AquaculturE and Transport validation trials**
- 5G-HEART (validation trials) will focus on vital vertical use-cases of healthcare, transport and aquaculture
- Duration: June 2019 – November 2022
- Budget: 14 M€
- 22 partners



https://5gheart.org/

Understanding the healthcare vertical is essential

Which problems are we trying to solve?



E-health vision: A hospital without walls

Home and work

Educational

Emergency

Low cost and high volume screening

Central hospital

Paramedic support
Urban search and rescue

Remote monitoring of health conditions

Primary care

Remote assisted or robotic ultrasound

Local hospital

E-health can improve treatment both outside and inside hospitals

Image by user10320847 on Freepik
Doctor icons created by mavadee - Flaticon

Three major use cases for e-health which challenge the performance and availability of 5G services.

Use case H1: Remote interventional support

Using **remote assisted or controlled** ultrasound, advanced video and augmented reality in different clinical situations

- Educational surgery
- Remote ultrasound examination
- Paramedic support
- Critical health event

Use case H2: Automatic pill camera anomaly detection

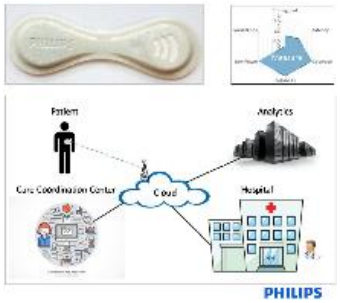
Colon wireless capsule endoscopy with automatic polyp detection for early detection of colon cancer with high mortality

- Pill based endoscopy for early anomaly detection
- Remote wireless capsule polyp detection

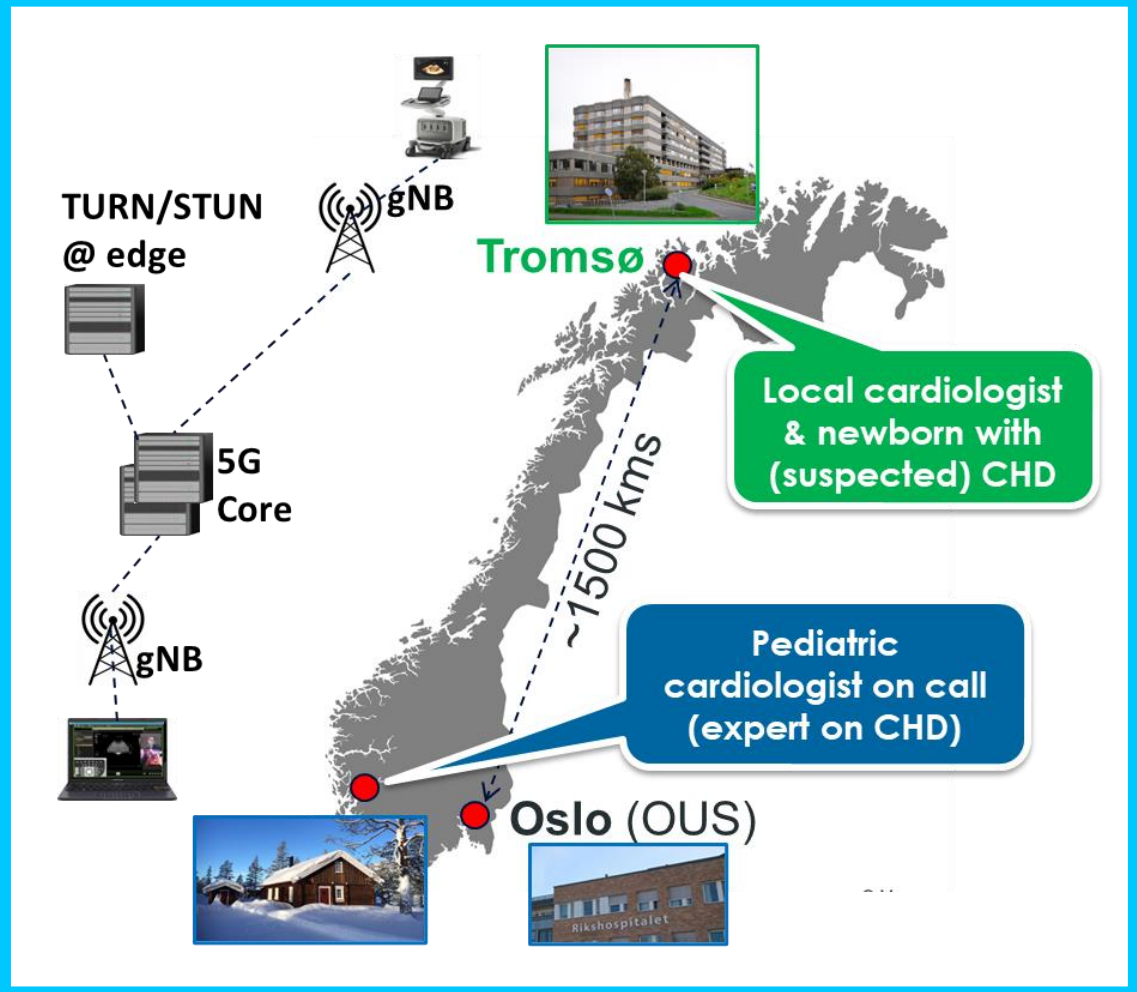
Use case H3: Vital-sign patches with advanced geo-location

Developing a prototype **single-use vital-sign patch** and **accurate geo-location** technology using current and future versions of NB-IoT and/or LTE-M. Trialling **monitoring of health** of workers in aquaculture environments

- Vital-sign patch prototype
- Localizable patch
- Aquaculture remote health monitoring



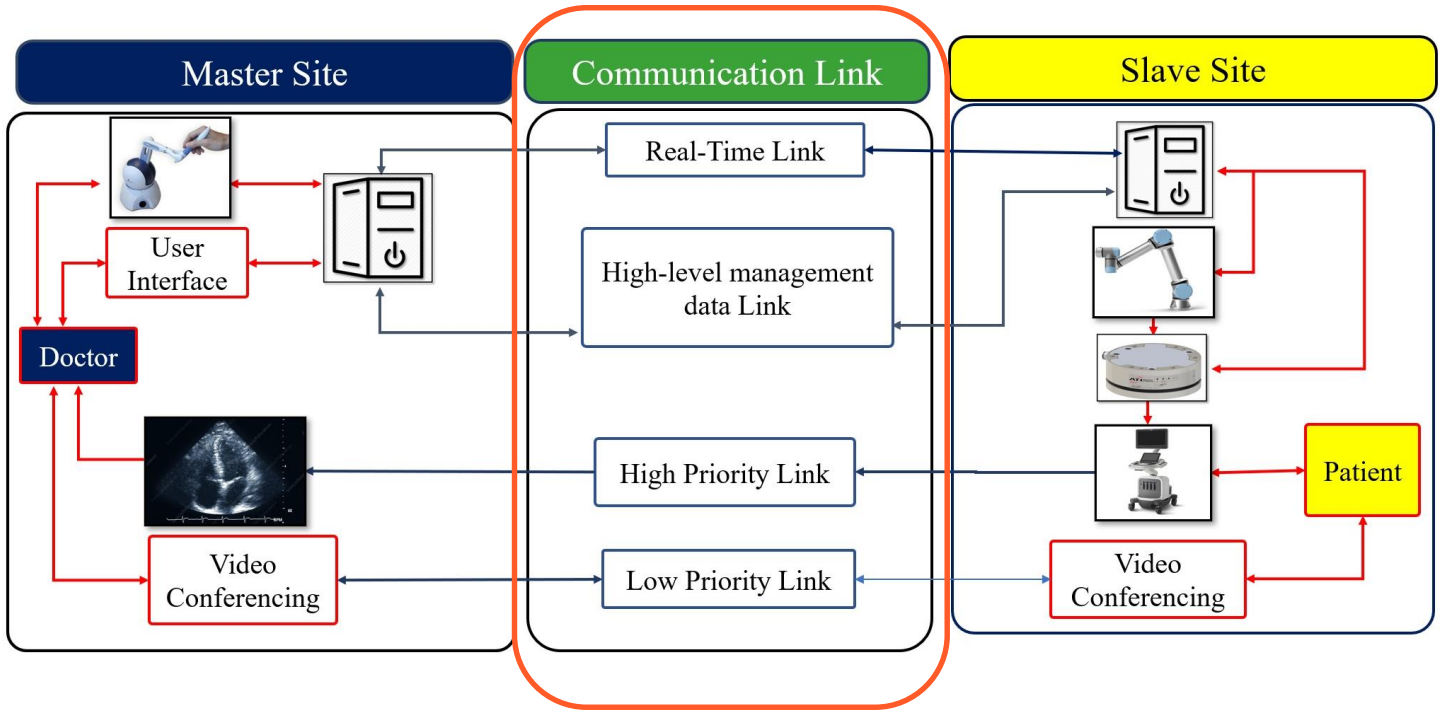
Use case: Remote Assisted Ultrasound for CHD

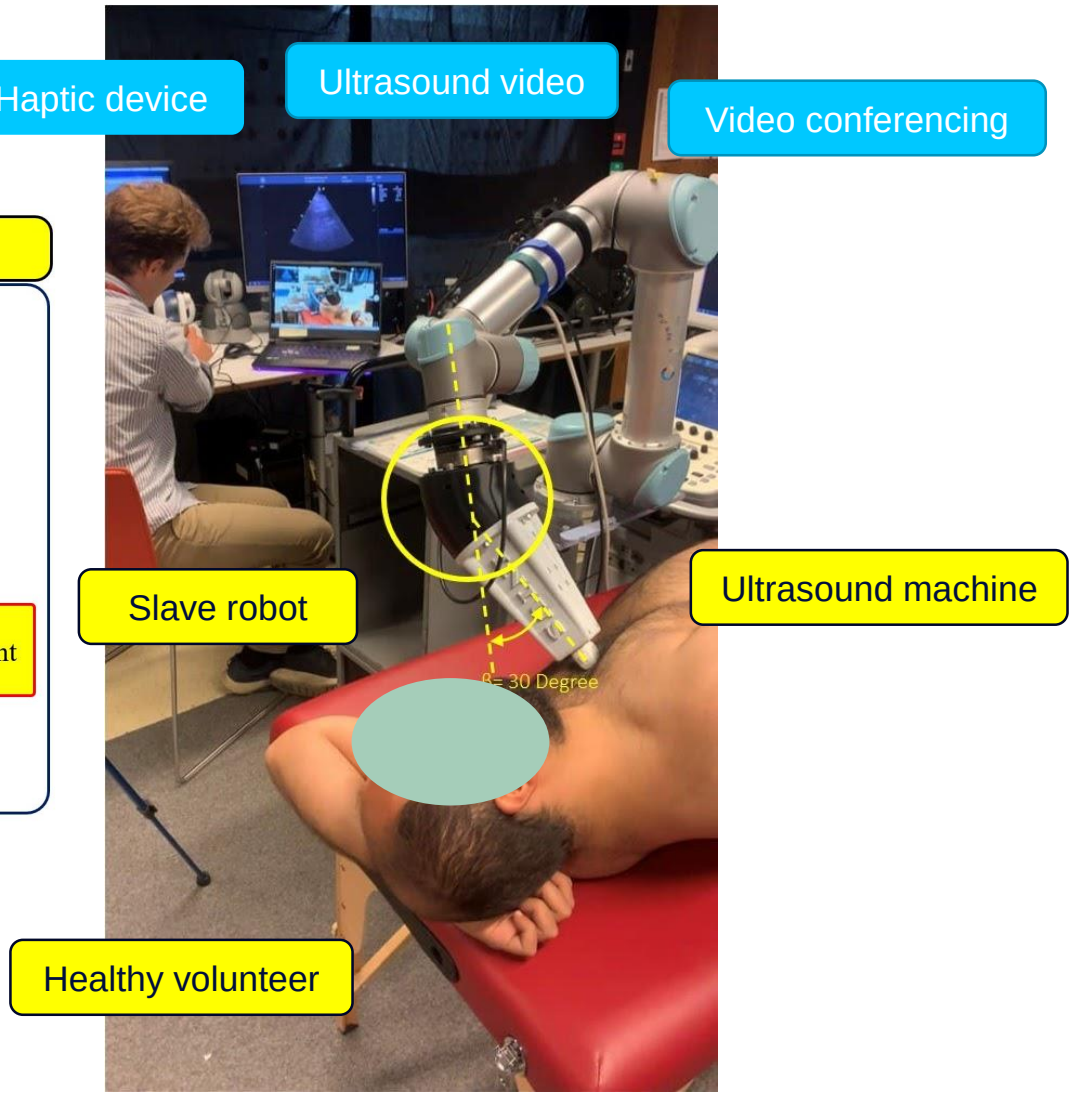


- **Case**
  - Only expert paediatric cardiologist can diagnose CHD.
  - 5G enables central experts to support local doctors in doing ultrasound-based diagnostics.
- **Test setup**
  - Telenor 5G-VINNI facility at OUS in Norway.
  - Philips EPIQ / Collaboration Live ultrasound platform.
- **Clinical study**
  - 15 neonates were examined using remote assisted cardiography, including six in need for transfer to a paediatric heart surgery centre.
  - All six were identified in the remote guided examinations.
- **Findings**
  - No critical CHD was overlooked.
  - Remote healthcare professional must have basic echo-cardiographic skills.
  - ***A guaranteed and stable network connection is a crucial enabler for remote clinical real-time collaboration.***

PHILIPS Oslo University Hospital

Robotic ultrasound: Concept and setup

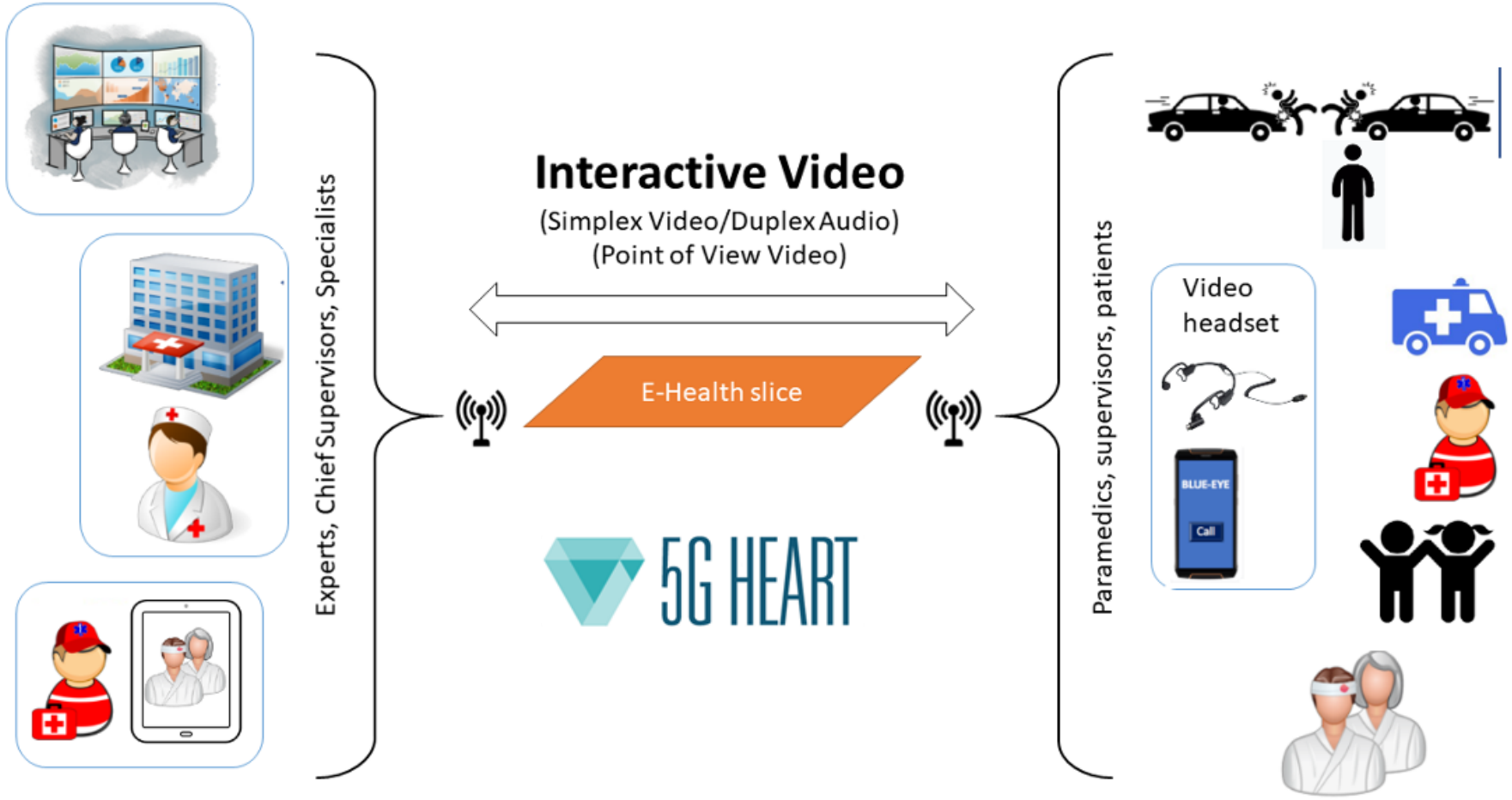




Oslo University Hospital

Paramedics and rescue workers with wearable video

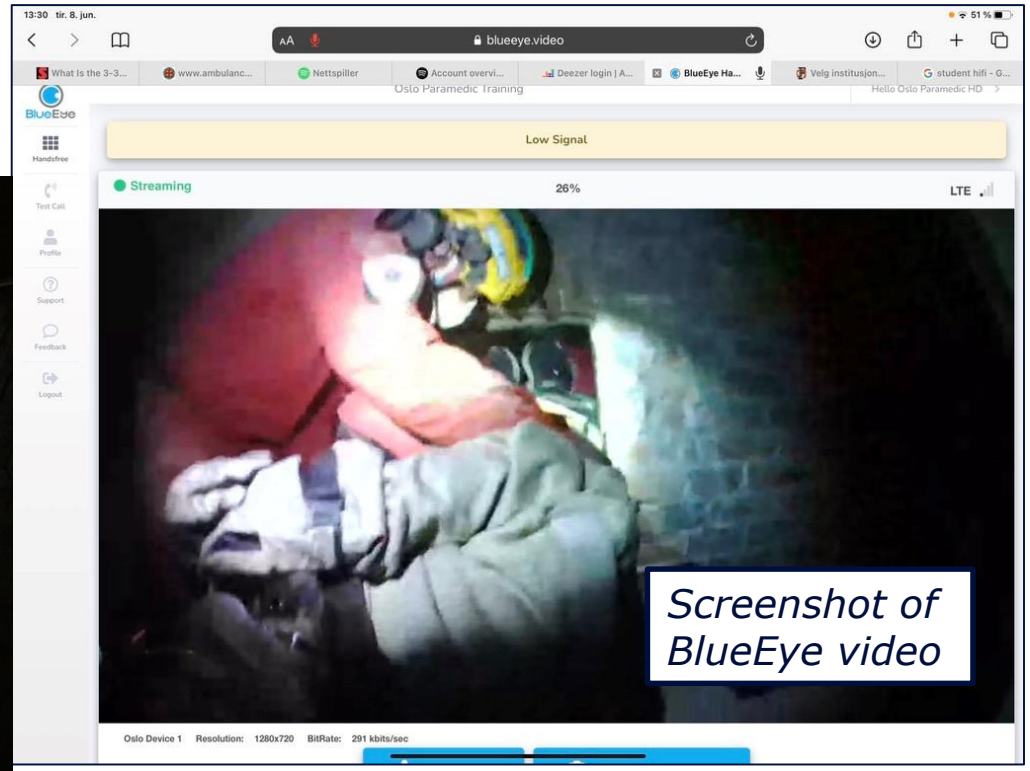
- The paramedic wears a **handsfree camera** on their head
- The patient diagnosis/treatment video is **shared remotely with other clinicians**
  - (doctors, consultants and student doctors).



Use case: Urban Search and Rescue (USAR)

USAR suit w/camera

USAR environment



Screenshot of BlueEye video

RedZinc

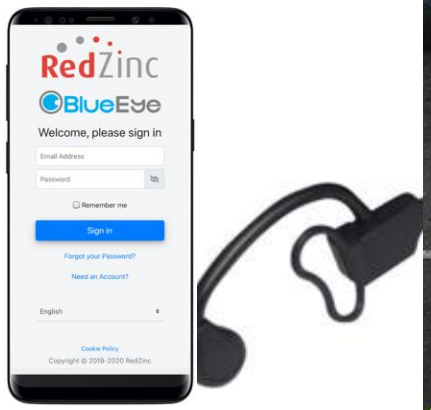
Oslo University Hospital

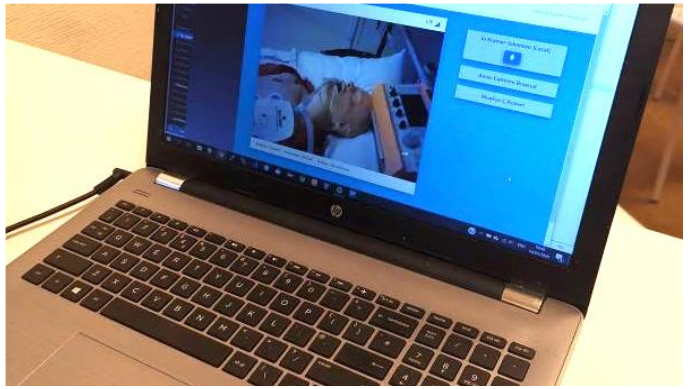
Oslo ambulance service case study

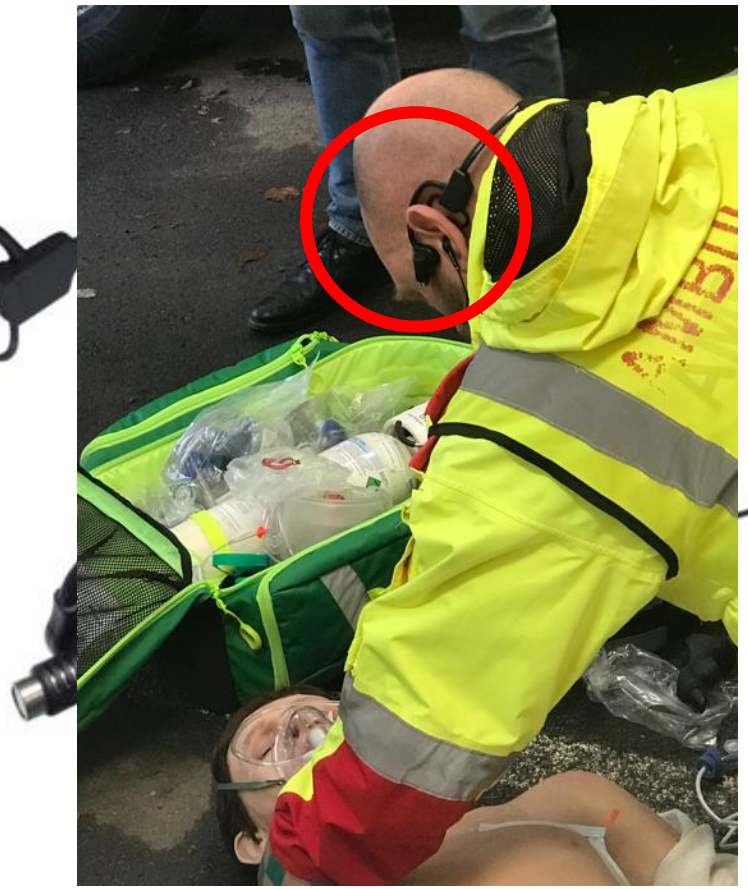
Scenario with pneumothorax in Oslo

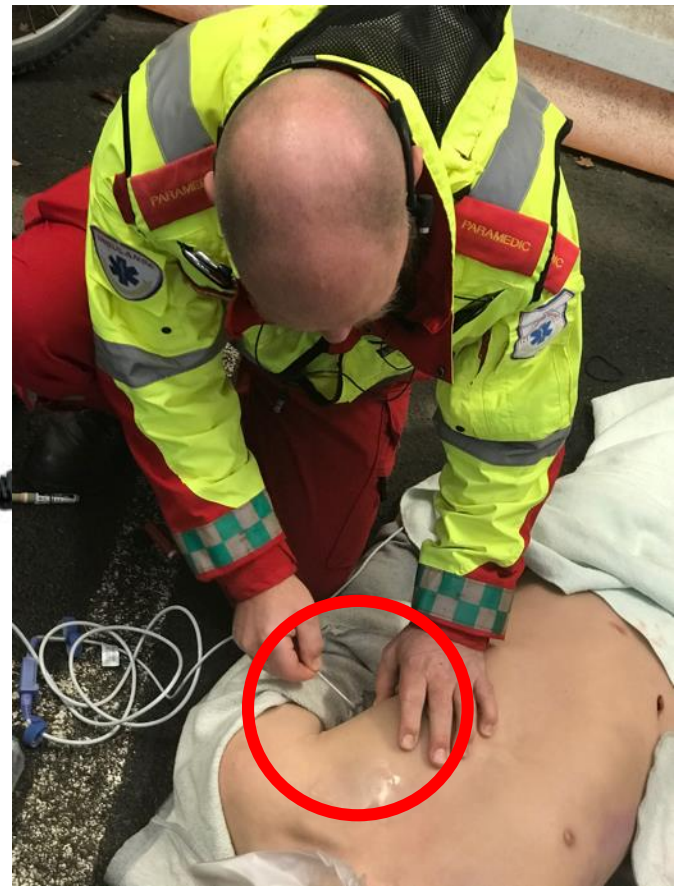
Learnings from early pilot in 2020:

- Camera performance out strips 4G capacity
- Constrained uplink bandwidth
- Users expect high quality images
- Priority is needed for emergency

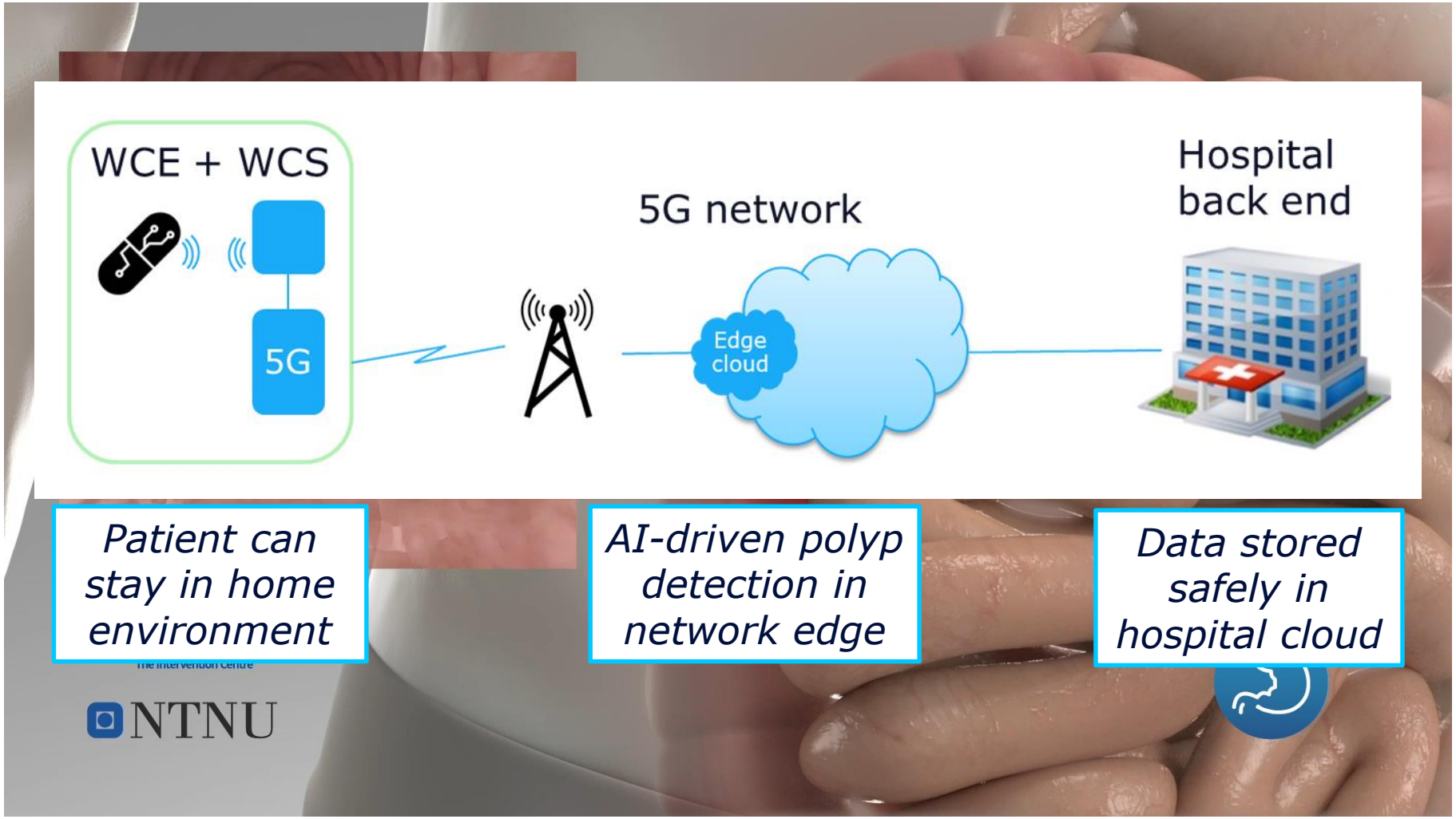








Wireless capsule endoscopy



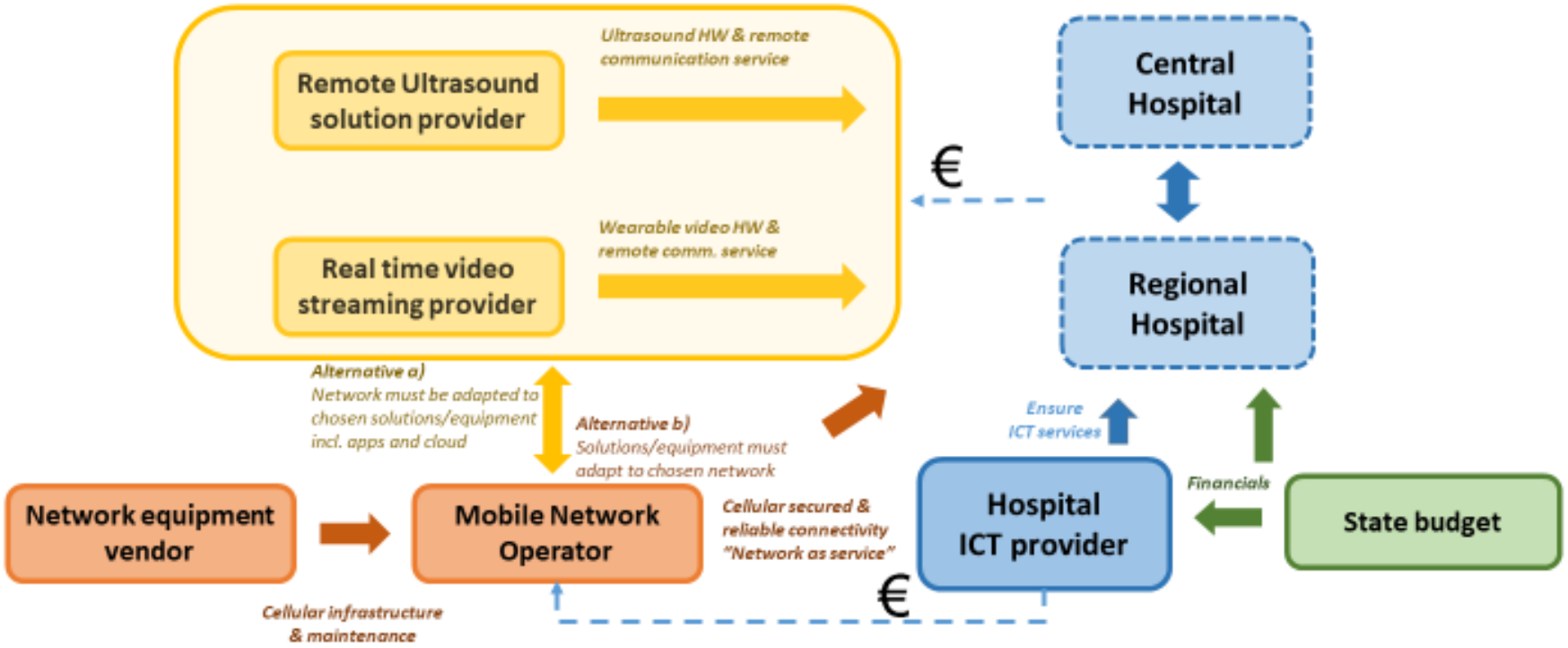
Most important 5G KPIs

		What is needed from 5G to solve the problems?
Throughput	*Large volumes of data and high definition video content generated from remote site*	Uplink and downlink ultrasound video and background video conferencing
Latency	*Real-time cloud processing of video and sensor data with feedback loops*	Pill camera videos to cloud for real-time AI-based polyp detection with feedback loop
Coverage	*To enable ubiquitous availability of services*	Bringing e-health to where people live and stay – especially in rural areas
Reliability	*Life-saving, critical communications*	Ensuring reliable connection for remote robotics
Security	*To ensure GDPR (or better) compliance and to secure business confidential data*	Patient security, GDPR
Location	*Native location service*	To locate e.g. remote monitored patients in critical situations
Energy efficiency/power consumption	*To enable sufficient life-span for battery powered sensors*	Sufficient life-span for vital-sign patches with limited battery power

Business cases and ecosystems

- ***Remote assisted ultrasound example***

Who are the stakeholders, which roles do they have and how can the money flow?



Sources and reading

- Web-page: https://5gheart.org/
- Deliverables: https://5gheart.org/dissemination/deliverables/
- Newsletters: https://5gheart.org/dissemination/newsletters/
- YouTube: https://www.youtube.com/channel/UCCMCgVJwrMmrfp3oQZzFDvw

Thank you