The opportunities of dual-use technology in the Defense and Security sector

Morning coffee for companies by OIA
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Hannu Nikurautio
Research Director
Security & Defence vertical /
6G Technology Center
hannu.nikurautio@oulu.fi

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Facts sheet

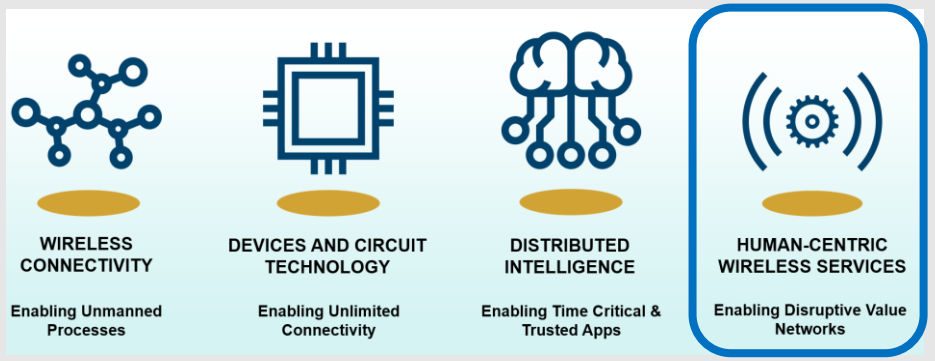
- National research flagship for 2018 – 2026 with a total volume of 250M€.
- 2nd phase started May 2022 – plan to continue until the end of 2028.
- Operated by University of Oulu.
- Currently involves 500 researchers from 50 nationalities.
- Steered the first 6G visions work via 13 6G White Papers (downloaded over 1M times).
- Published 2640 per-reviewed papers and 89 doctoral theses.
- Over 400 company collaborators and more than 400 research projects so far.

The Finnish 6G Flagship (2018-2026)

6G Flagship Vision for 2030

Data-driven sustainable future society enabled by near-instant, unlimited wireless connectivity

Strategic Research Areas (SRAs)



Flagship Goals

1. 6G technology enablers
2. 6GTN development
3. 6G vertical applications
4. 6G vision leadership

Impact Actions

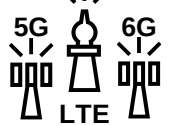
A 6G-enabled Sustainable Society

B Strategic Vertical Areas (SVAs)
- Health
- Industry
- Vehicular
- Energy
- Security & Defence

New Vertical
Hannu Nikurautio

C Global 6G Collaboration

D Research infra-structures – 6G Test Network (6GTN)



Security & Defence

Dual-usage, Radio- based positioning, AI/ML

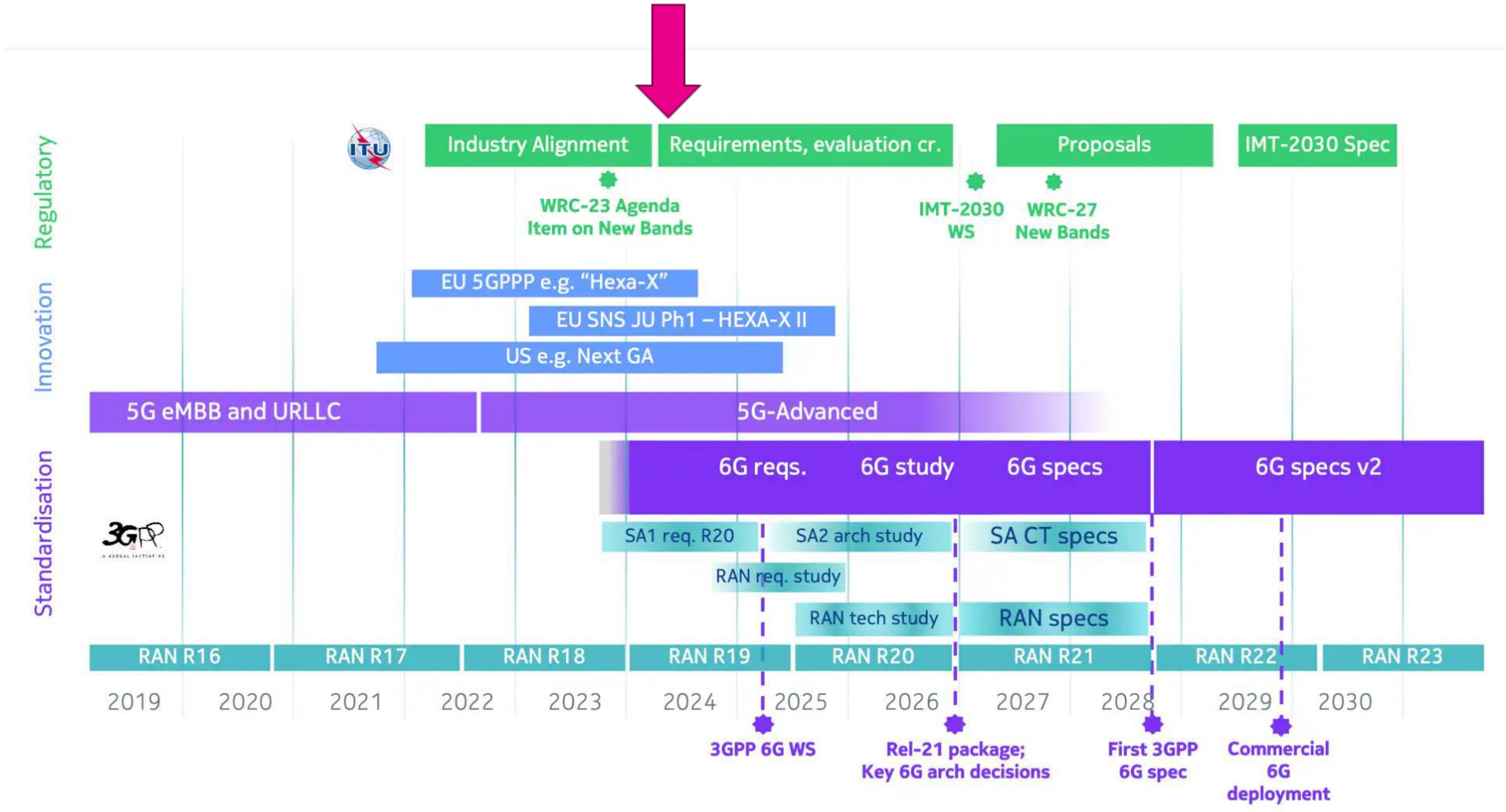
Resilient system and transceiver design

Enhanced S&D capabilities over 6G

Edge computing solutions

Distributed and secure data processing systems

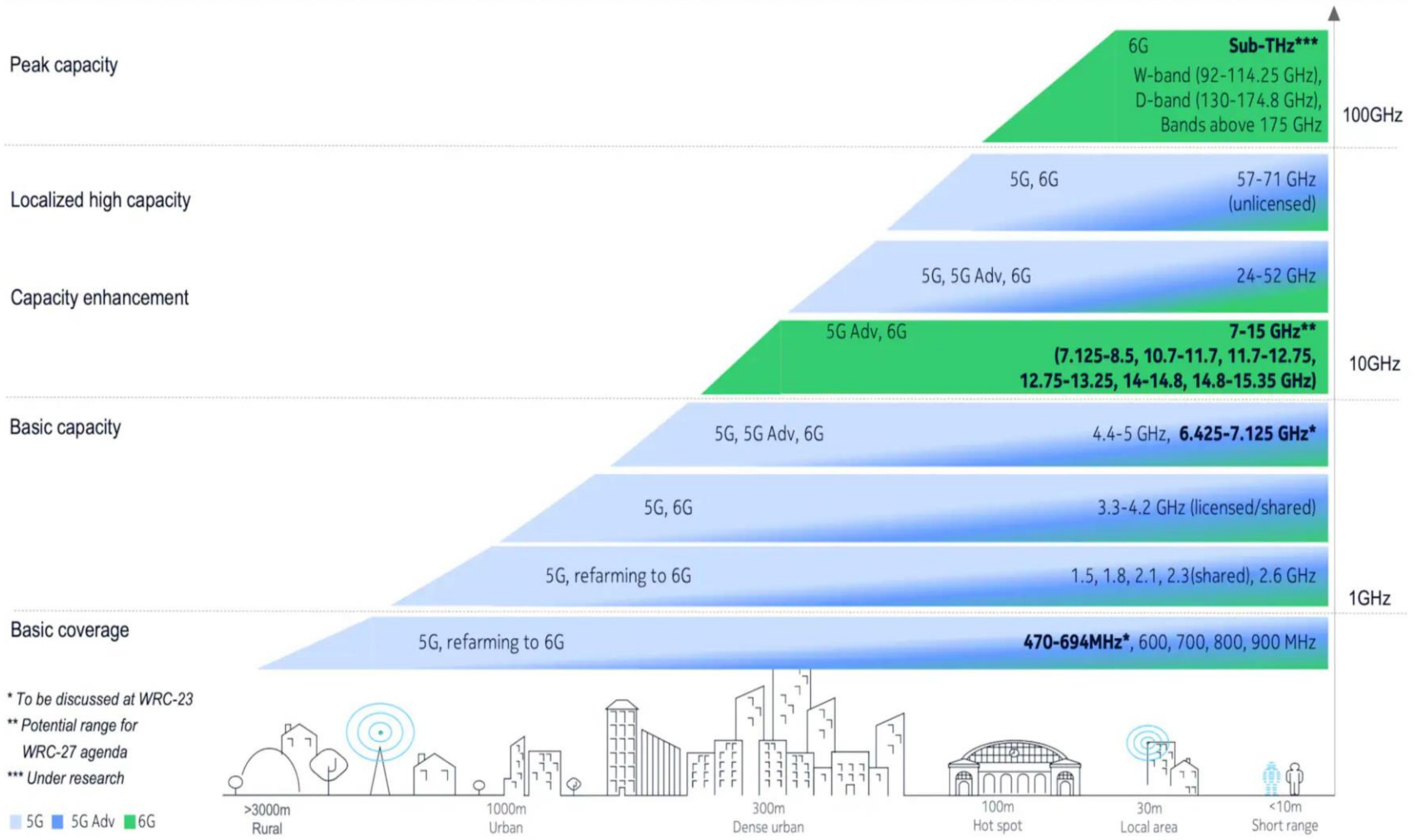
6G Schedule



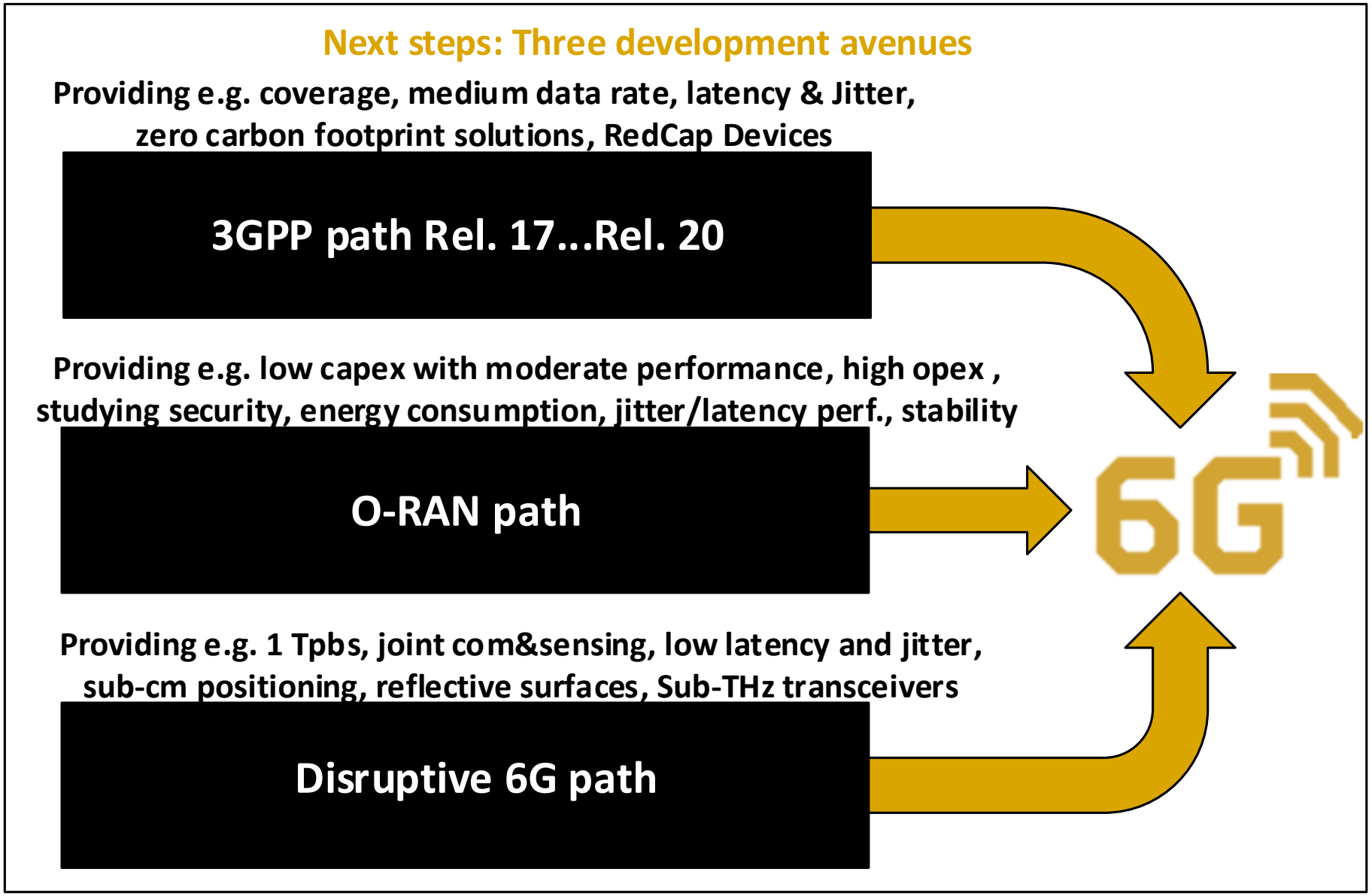
https://www.nokia.com/about-us/newsroom/articles/spectrum-for-6G-explained/

6G Spectrum – the real estate of mobile networks

- Inital new frequency for first installations (as 3.5 GHz was for 5G)
  - 7 – 15 GHz range seen potential, though it is rather contested
- Gradually 6G uses all (sensible) cellular frequencies



Going for 6G - Three Development Paths



Critical Communication sectors

Emergency Services

Healthcare

Public Safety and Government

Utilities and Infrastructure

Transportation

Corporate and Financial Services

Information Technology and Cybersecurity

Defense and Military:

Secure and timely communications are essential for national security, including operational command and control, intelligence sharing, and coordination of military operations.

Why
” The military and defense industry often seeks to utilize dual-use technologies and opportunities”


Cost Efficiency


Innovation and Technology Transfer


Market Expansion


Regulatory and Political Advantages


Enhanced Interoperability


Public Acceptance and Ethical Considerations


Strategic Autonomy and Security


Rapid Deployment and Scalability

Summary:

- to leverage technological innovation efficiently and effectively
- ensuring that advancements benefit both civilian and military domains while addressing economic, strategic, and societal goals

Why The 6G Flagship is involved in the defense sector

- it's important globally as well as for our armed forces and the Ministry of Defense.
- We with ecosystem provide dual-use disruptive innovation and solutions for defence and security needs.

Use case examples:
How 6G Technology Serves both Civil and Military Purposes in Defense Contexts

Enhanced Situational Awareness

Advanced Communication Systems

Autonomous Vehicles and Systems

Artificial Intelligence and Machine Learning

Cybersecurity Operations

Edge Computing

Remote Medical Services

Human-Machine Teaming

Energy and Communication Infrastructure

Quantum Communication and Sensing

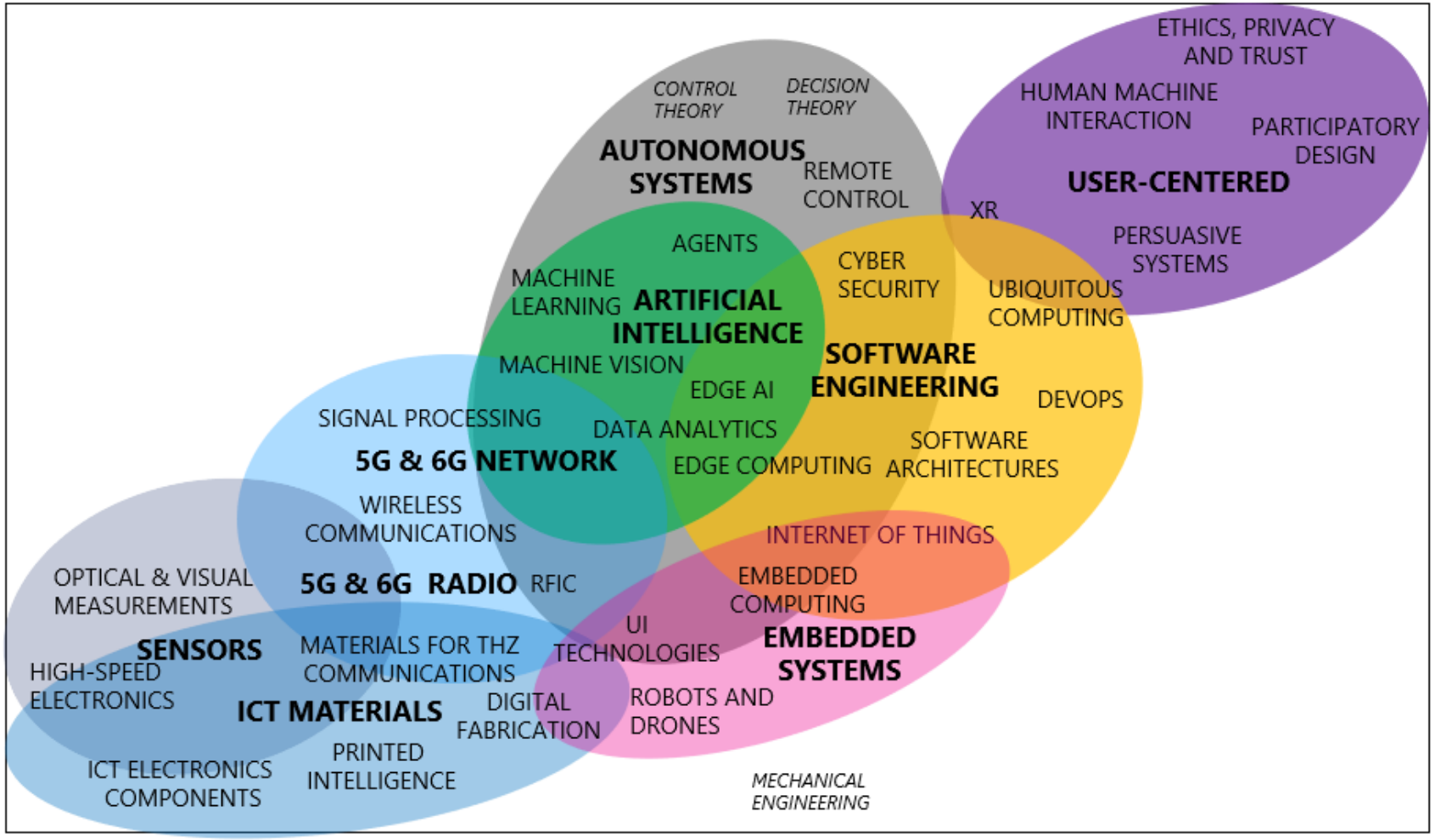
Integrated Air Defense Systems

Space Operations and Satellite Communications

Partnering via 6G research and Test Network from 5G to 6G

ITEE RESEARCH FORMS A SOLUTION CREATION VALUE CHAIN

BASIC RESEARCH COVERED BY 12 RESEARCH UNITS



Artificial Intelligence (AI) and Machine Learning (ML) play a central role in digitalization, but also

- **Sensors**
- **Printed electronics**
- **Embedded technology**
- **Drones & other robots**
- **Wireless communication**
- **Cyber security**
- **Software**
- **Edge computing**
- **Internet of Things (IoT)**
- **Novel user interfaces based on augmented reality (AR)**
- **And people!**

Partnering via research

Some of future research prospects in dual use of MIL area

- Resilient battlefield computing continuum
- Digital Twin of the Battlefield
- GenAI for CCCI (Command, Control, Communications and Intelligence)
- Integrated sensing and communication
- 5G/6G positioning services
- IoT, low-cost tracking and localization
- 5/6G connectivity-enhanced mil networks
- Critical communication (i.e. official use, they benefit same things)
- Integration on NTN and TN network, prioritization of communication
- Channel measurement and modelling
- Antenna design, MIMO beamforming algorithms
- Dynamic spectrum management
- Satellite access next phases

Partnering via Test Network from 5G to 6G

The test network has been used in many verticals

- Remote medicine/consultation/teaching
- Automotive/Remote excavator
- Multi-actor harbor campus (lidars, cameras, digital twins)
- Remote Controlled Harbor Cranes
- Demand Response in Smart Grids
- Production quality based on machine vision in Nokia Factory
- Drones
- Smart Campus (>2000 sensors)

And in near future

- Holographic communications
- Robotic control from 3D AR/VR digital twin
- View-to-communicate and communicate-to-view
- Quantum Communication and Sensing

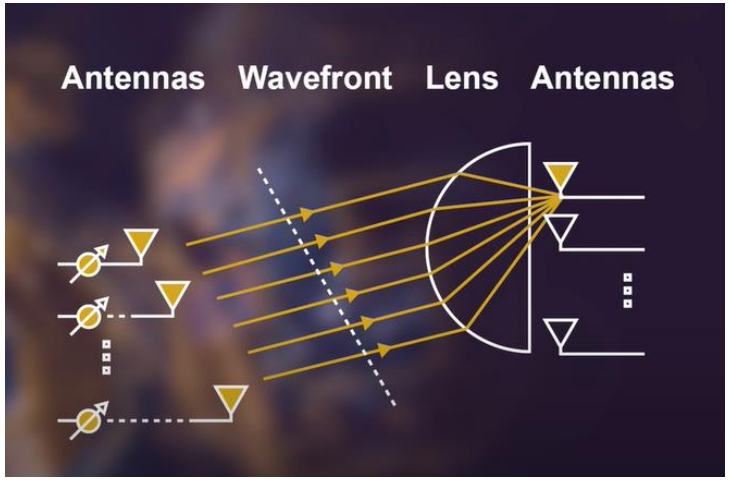
➔ **And many other use cases in each vertical as well in defence and security areas that was also mentioned in earlier slide**

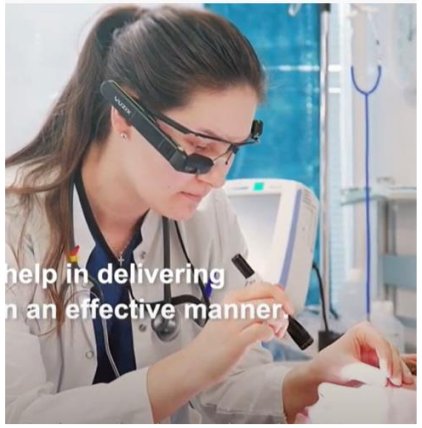
Ongoing co-operations
Security & Defence vertical

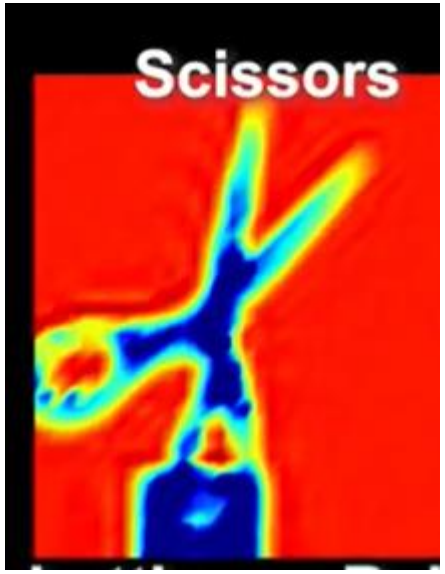
- Common research activities and projects
- Utilization of 5G/6G Test Network
- To be part of some “Veturi” programs or another funded projects
- NATO DIANA: 6G Technology Center
- Business Finland related projects
- Etc.

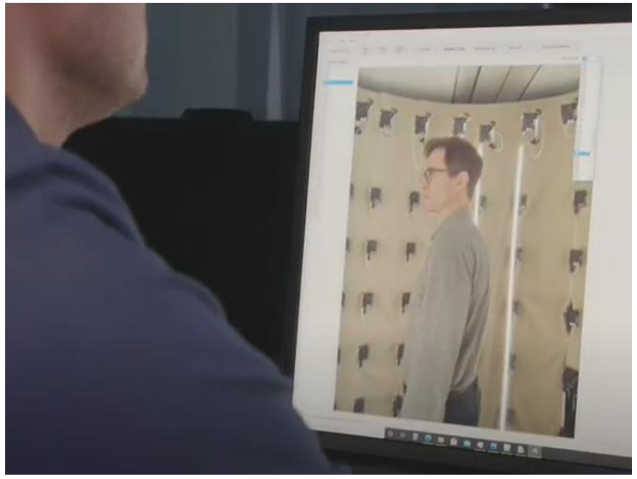
6GFlagship Result Examples

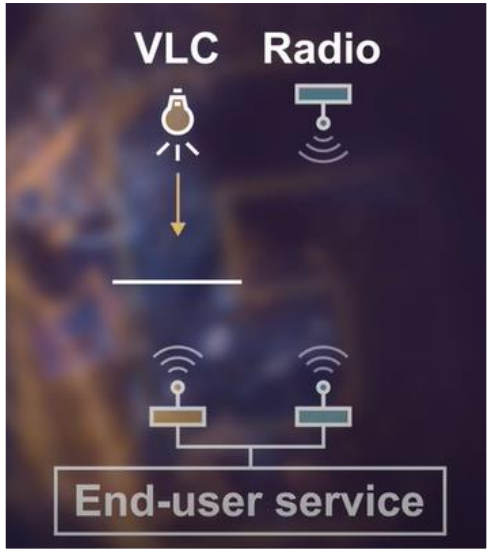
mmW Communications: https://youtu.be/ks39QkgrpM0
VLC BB: https://youtu.be/3ekNe5ooqbY
LTA Drone: https://youtu.be/3xKlj1vQPoU
3D Scanner: https://youtu.be/5WpTDv4r9Qg
THz Sensing: https://youtu.be/nbeGn3IPeLw
eHealth: https://youtu.be/aPedbk3xIO0
Location Awareness: https://youtu.be/GBf37Kps0dc











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Thank You!

Interested? Contact: hannu.nikurautio@oulu.fi

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