

5G and Beyond Mobile Communications

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CHALMERS

ComSys at Chalmers

Sweden's largest group in its field

8 permanent faculty



Professor (full)
Erik Ström

Channel estimation, synchronization, positioning, vehicular communication



Professor (full)
Erik Agrell

Optical communications, modulation, coding, and information theory



Professor (full)
Thomas Eriksson

Modeling and compensation of amplifiers, oscillators, and other hardware components



Professor (full)
Tommy Svensson

Coded modulation, medium access, resource allocation, cooperative communications, mm-wave communications, moving networks, satellite networks



Professor
Henk Wymeersch

Optical communications, distributed inference, vehicular systems



Professor
Fredrik Brännström

Coding and modulation, distributed storage, uncoordinated multiple access, vehicular communications



Professor
Giuseppe Durisi

Finite blocklength and network information theory



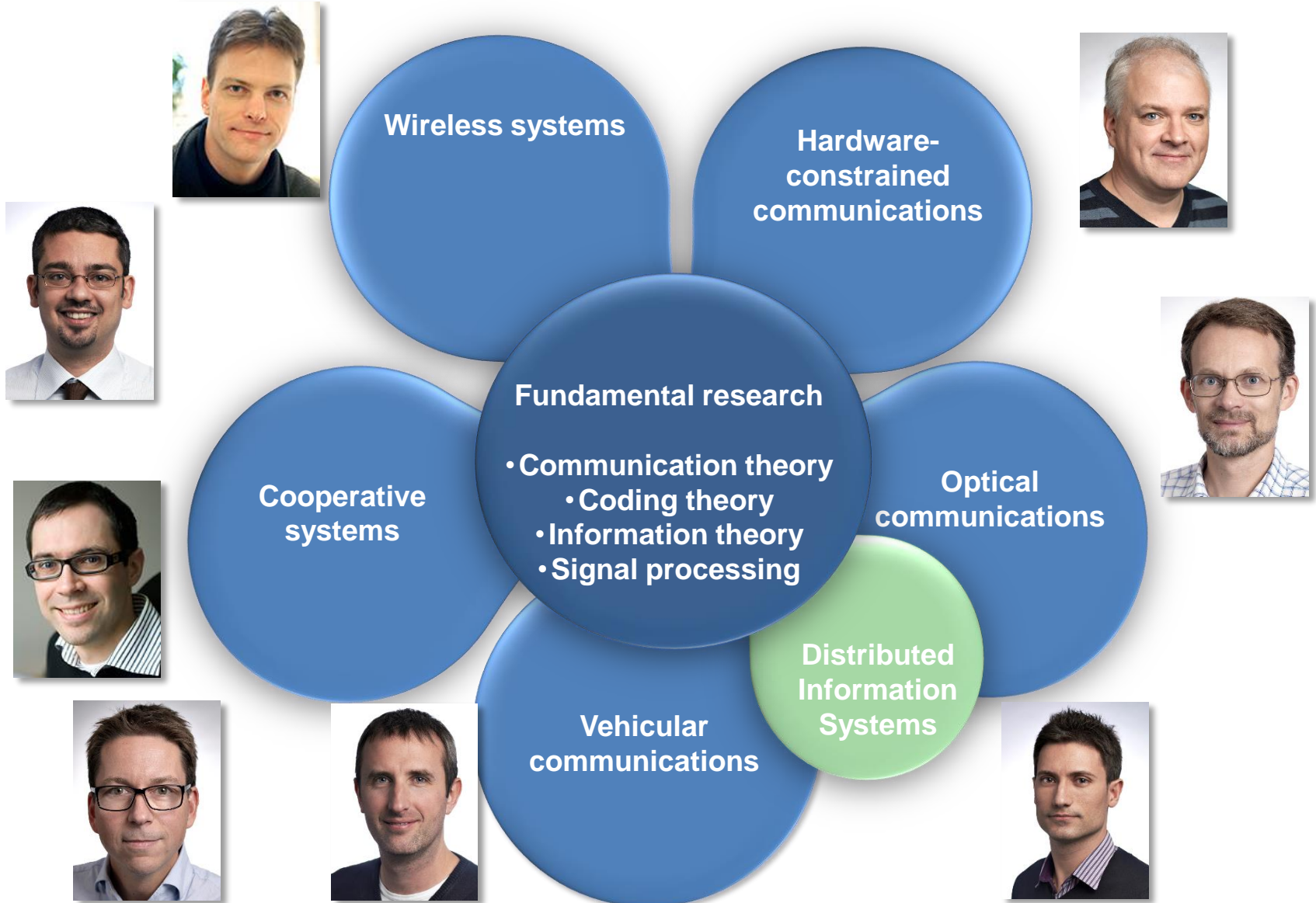
Professor
Alexandre Graell i Amat

Coding theory, distributed storage, optical communications

25+ postdoc and Ph.D. students

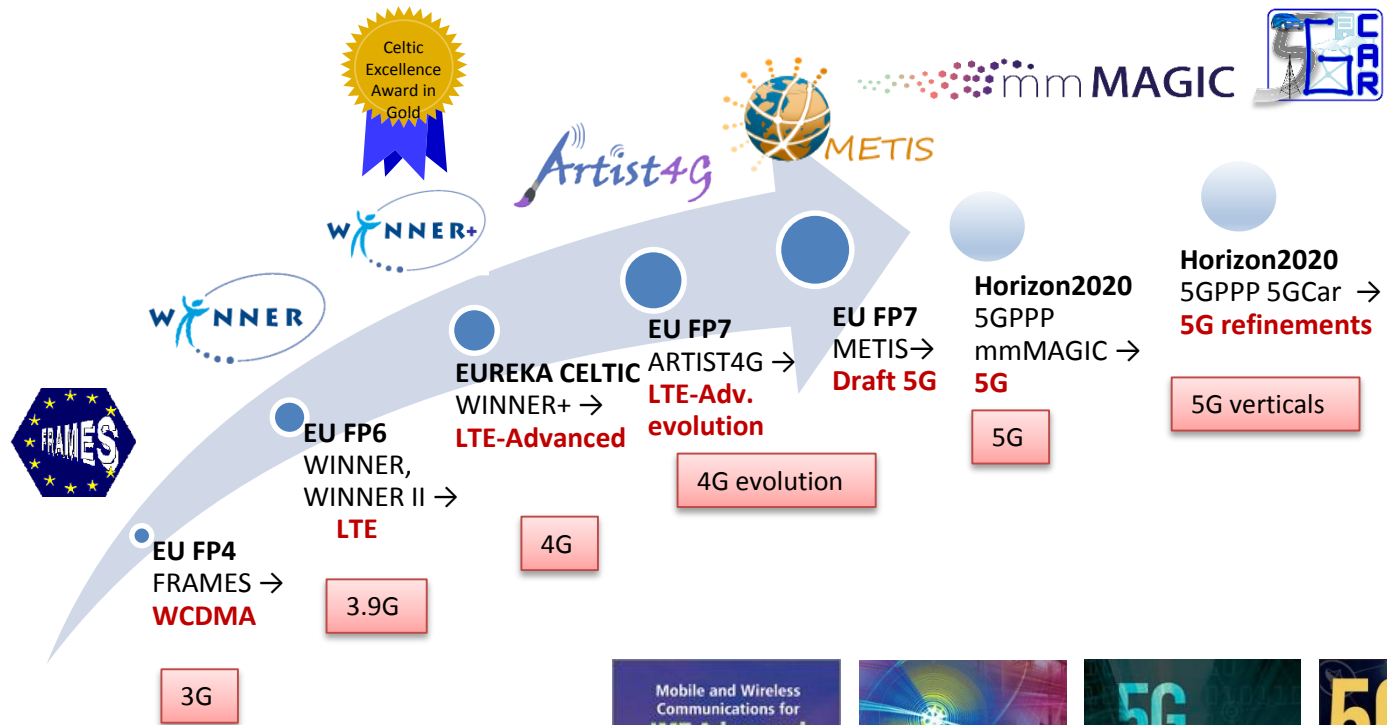


COMSYS Thematic Research Areas



Communications Systems group at Chalmers University of Technology

Impacts Wireless Standards: 3G, 4G, 5G, and counting...



<https://5g-ppp.eu/5gcar>

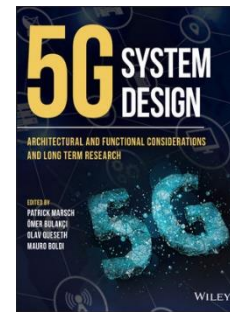
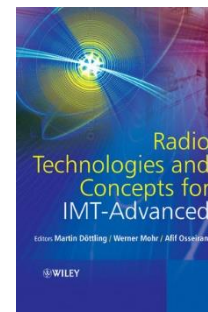
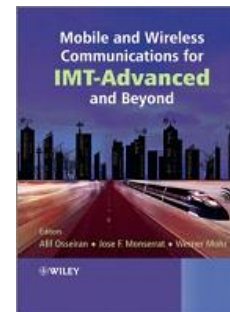
<https://5g-mmagic.eu>

<https://www.metis2020.eu>

<https://ict-artist4g.eu>

<http://projects.celtic-initiative.org/winner+>

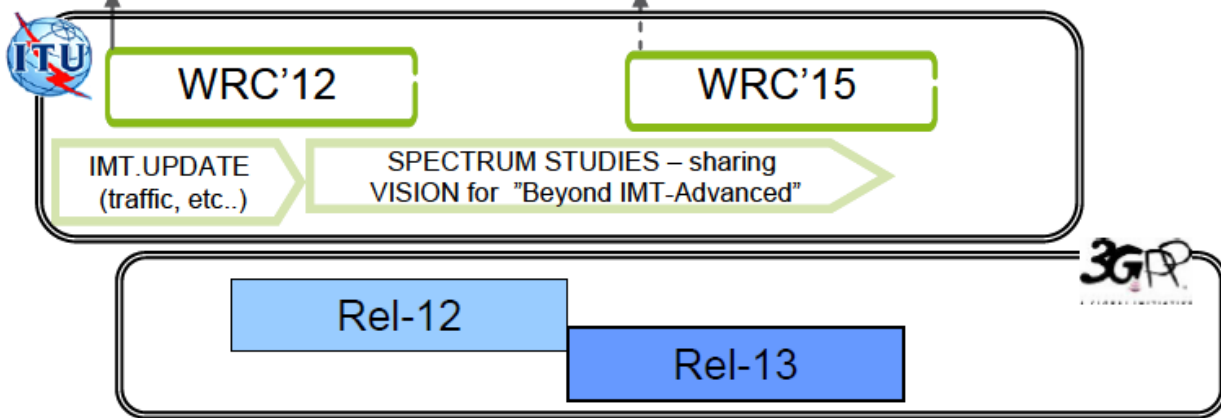
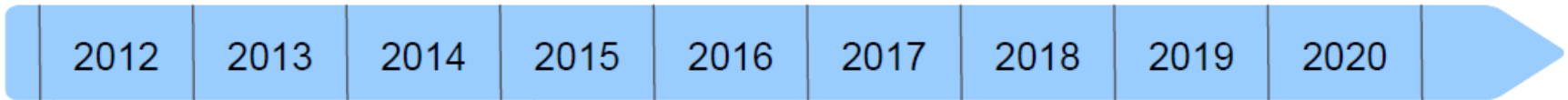
<http://cordis.europa.eu/infowin/acts/rus/projects/ac090.htm>



+51 EU project deliverables (sofar)

METIS Overall Objectives

Lay the foundation & **Ensure** a global forum & **Build** an early global consensus for beyond 2020 “5G” mobile & wireless communications



Avalanche of traffic



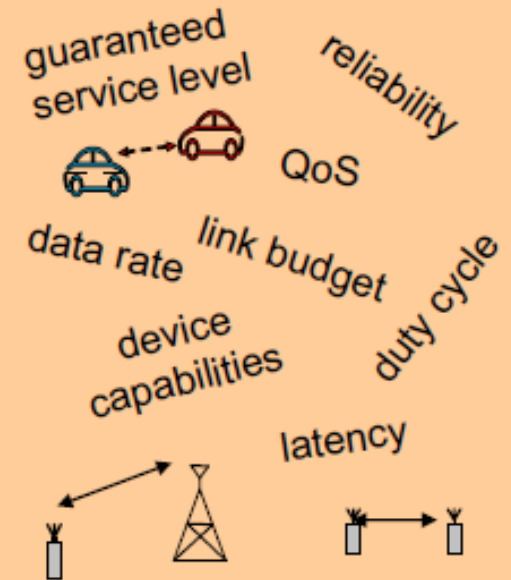
X 1000

Explosion of the number of connected devices



5 billion (2010) → 50 billion (2020)

Large diversity of use cases and requirements





METIS Overall Technical Goal

A system concept that, relative to today, supports:

- › 1000 times higher mobile data volume per area,
- › 10 times to 100 times higher number of connected devices,
- › 10 times to 100 times higher typical user data rate,
- › 10 times longer battery life for low power Massive Machine Communication (MMC) devices,
- › 5 times reduced End-to-End (E2E) latency.

METIS Scenarios and Test Cases

Amazingly fast

Great service in a crowd

Best experience follows you

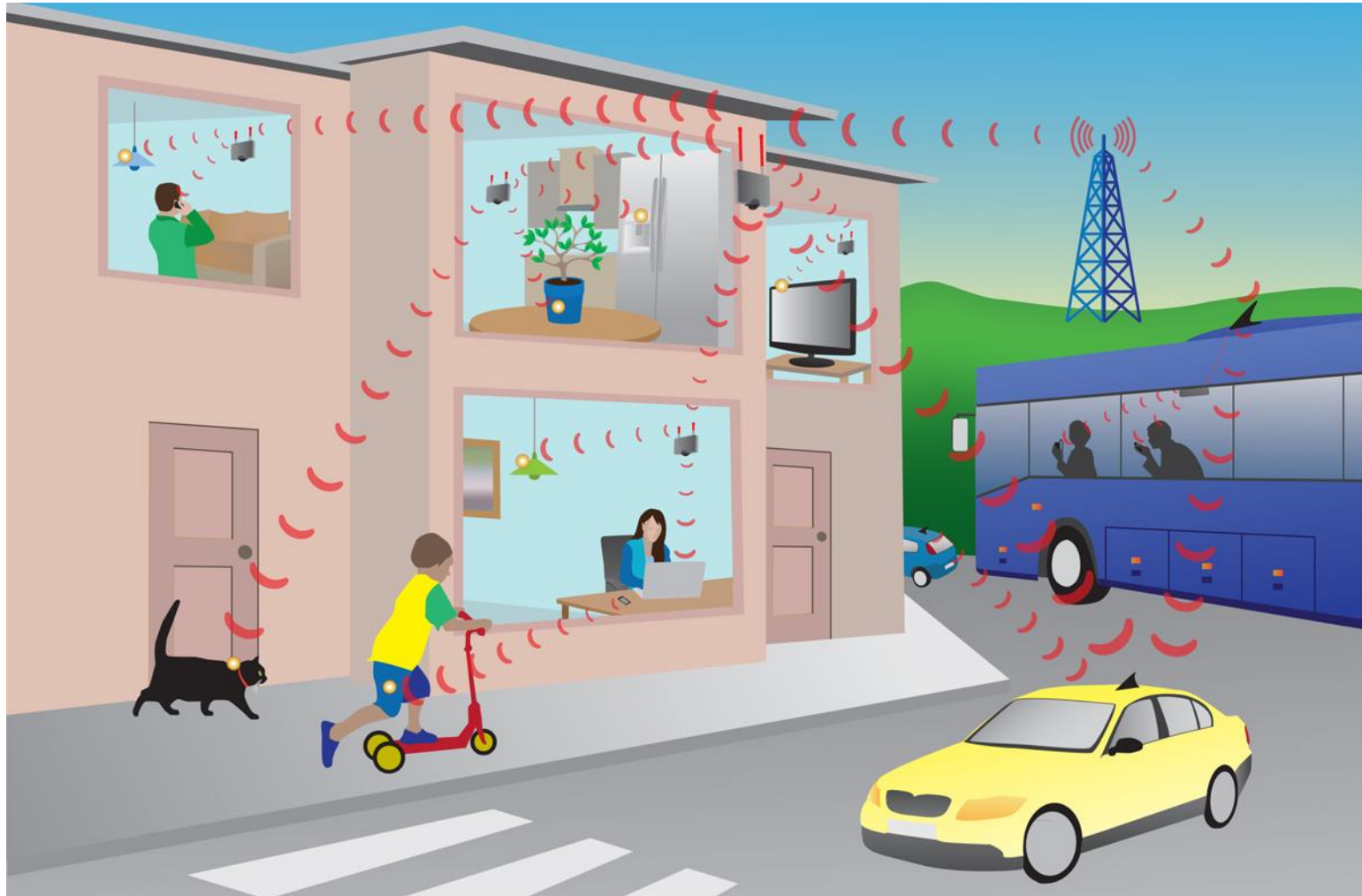
Super real-time and reliable connections

Ubiquitous things communicating



Source: METIS Deliverable D1.1 “Scenarios, requirements and KPIs for 5G mobile and wireless system”, <https://www.metis2020.com/>

Wireless Communications in Dense Heterogeneous Networks



5G Future

Integration
of access technologies
into one seamless experience

Respond to
traffic explosion

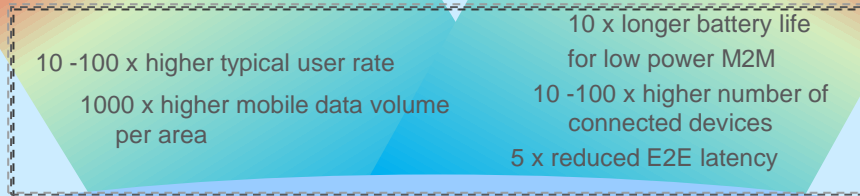
**Evolutionary
and/or
Revolutionary**

Extend to
novel applications

**Complementary
new technologies
and/or
Evolutionary**

- Massive MIMO
- Ultra-Dense Networks
- Moving Networks
- Higher Frequencies

- Mobile, Reliable D2D Communications
- Ultra-Reliable Communications
- Massive Machine Communications



Existing technologies in 2012

3G

4G

Wifi

A New Era Begins

Internet -> Mobile Internet -> ...

-> Wireless => Internet of Things



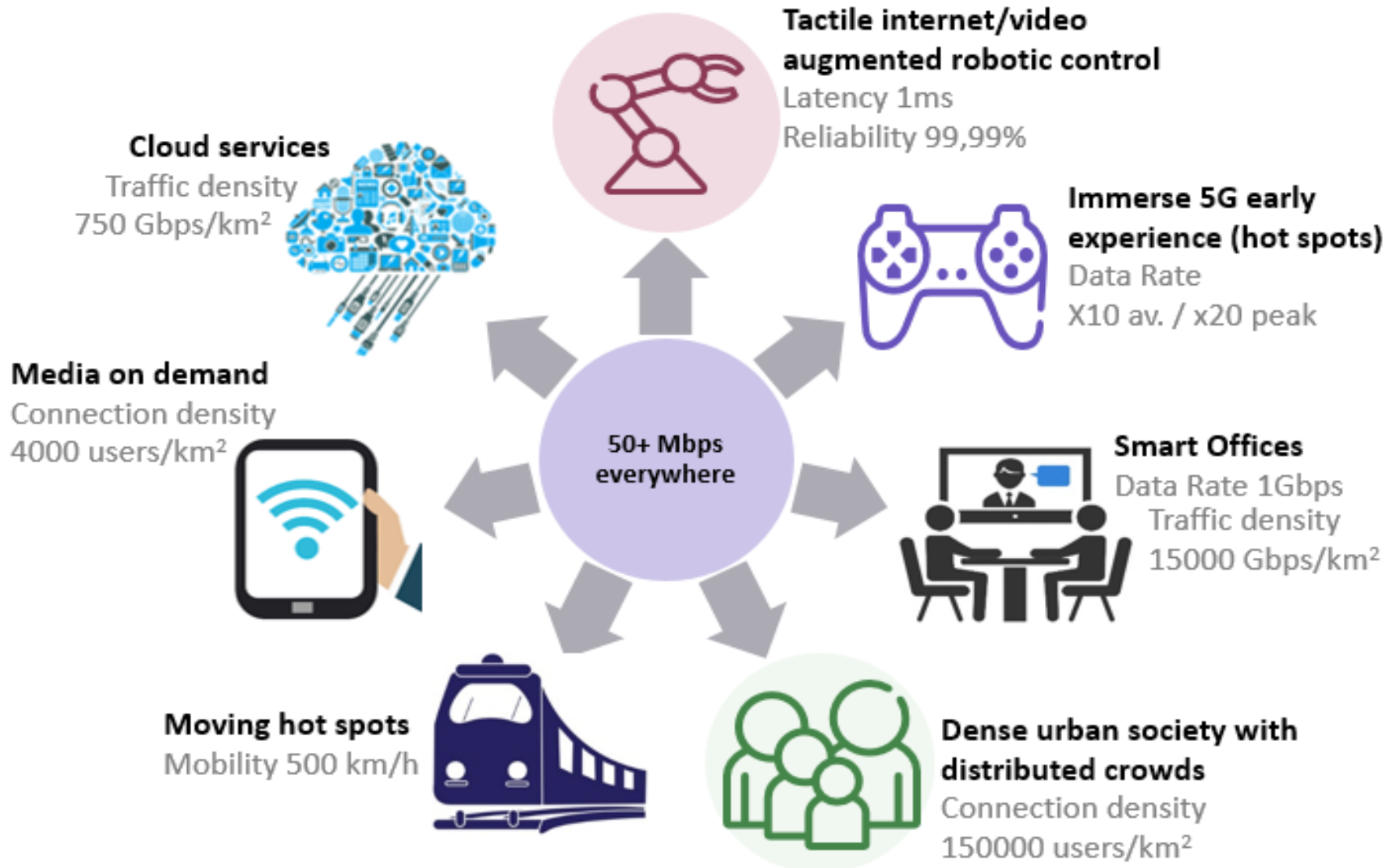
Source: <https://www.aeteurope.com/news/technologies-secure-internet-things/>

-> Robustness, Low latency => Internet of Skills!



Source: <https://www.ericsson.com/thinkingahead/the-networked-society-blog/2017/02/14/virtual-reality-comes-age-internet-skills/>

8 Use Cases in mmMAGIC

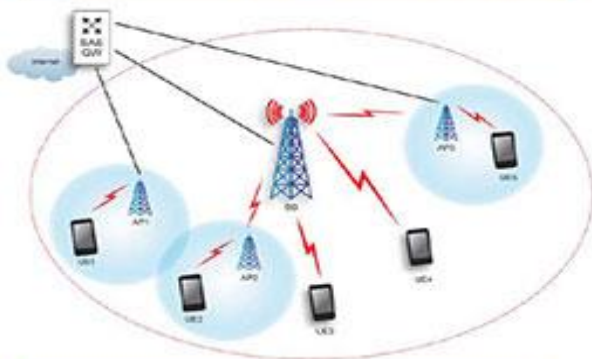


ChaseOn Antenna Systems Research Center at Chalmers

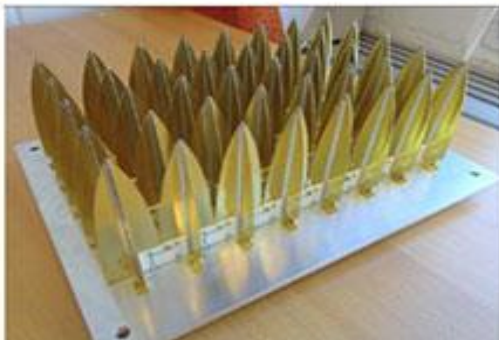
- Five interconnected projects in Communication, Sensing, and Medical treatment, 14 industrial partners.

Antenna Systems

Multiantenna Architectures



Integrated Array Antennas

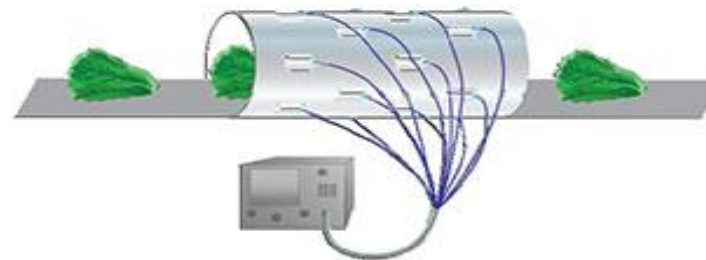


Communication

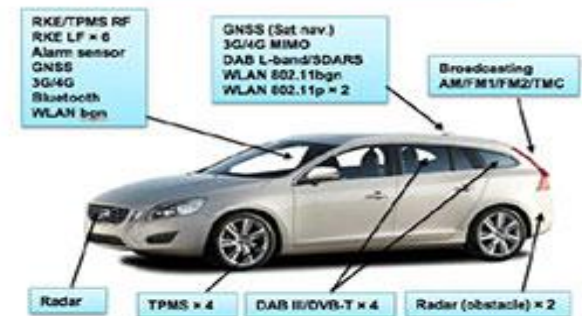
Sensing

Medical treatment

Sensor Systems



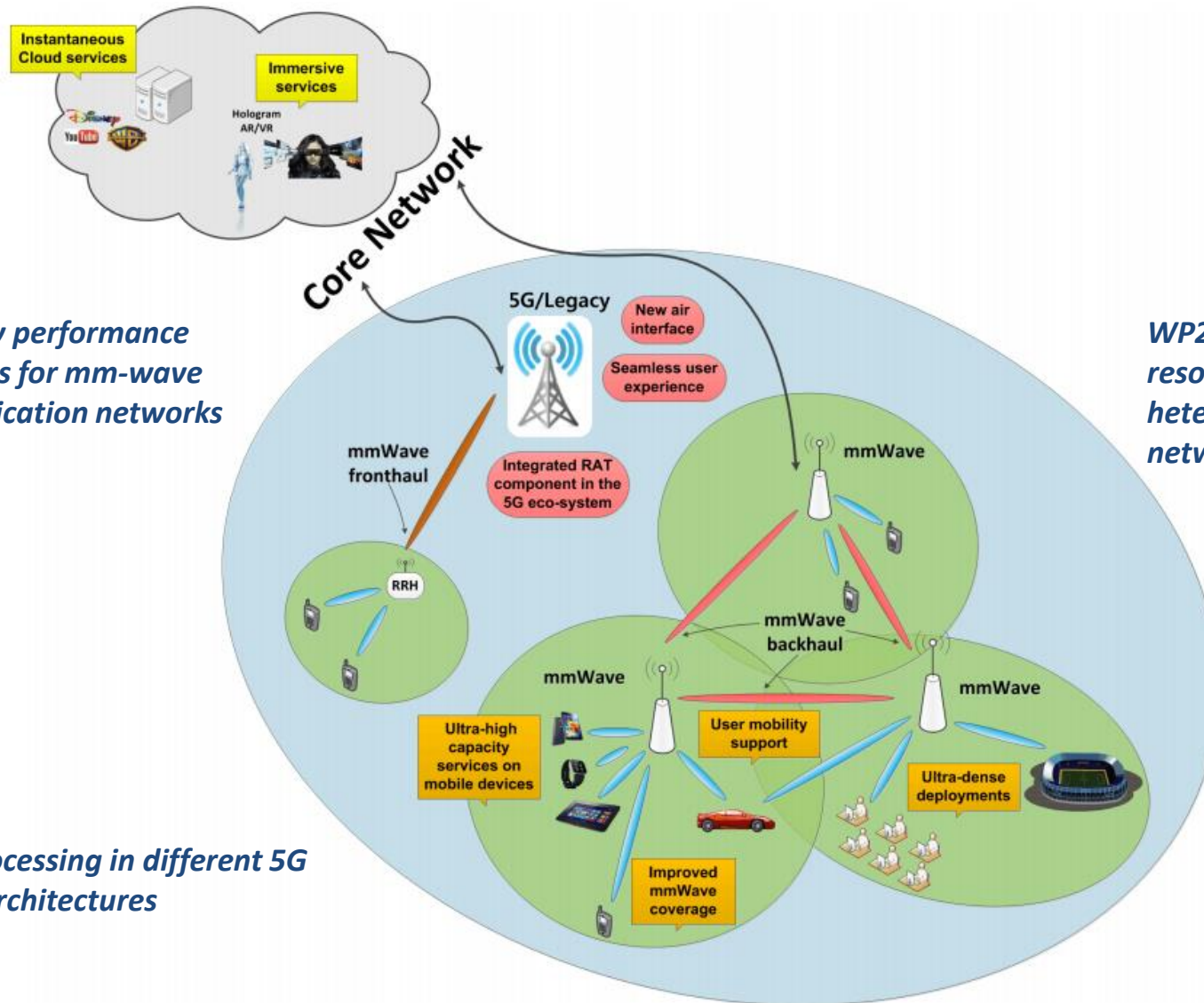
Next Generation V2X



Hyperthermia



MANTUA : Converged mmWave Access-Backhaul/Fronthaul Network



WP0: Key performance indicators for mm-wave communication networks

WP2: Cooperation and resource allocation in dense heterogeneous mm-wave networks

WP1: Processing in different 5G system architectures

WP3: Demonstration activities

Fifth Generation Communication Automotive Research and innovation

5G-PPP: Phase 2

5GCAR

Project Manager:
Dr. Mikael Fallgren, Ericsson

Facts

5G PPP Phase 2 Project
June 2017 – May 2019
30 Full time researchers
8 M€ budget

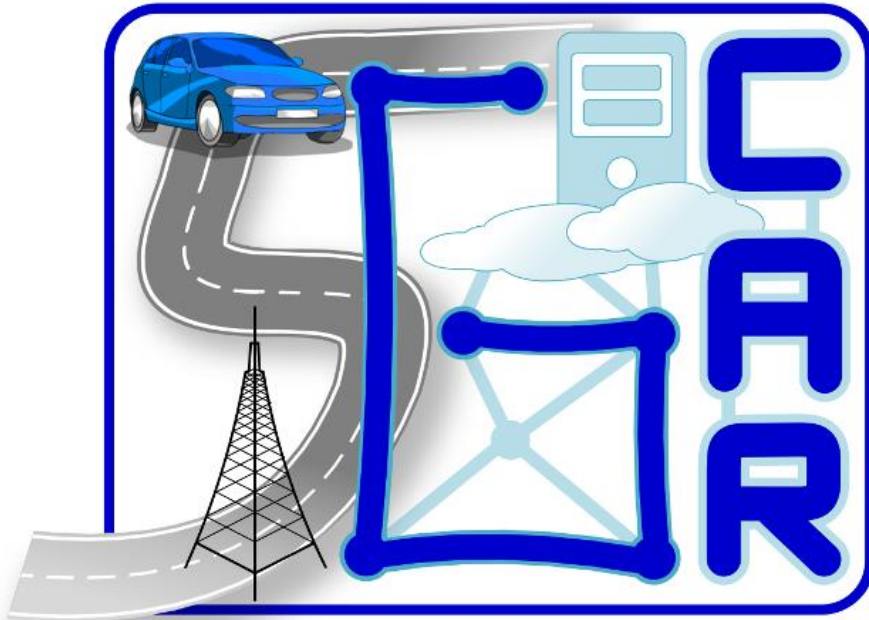
5GCAR contact

Webpage

<https://5g-ppp.eu/5gcar/>
<https://5gcar.eu/>

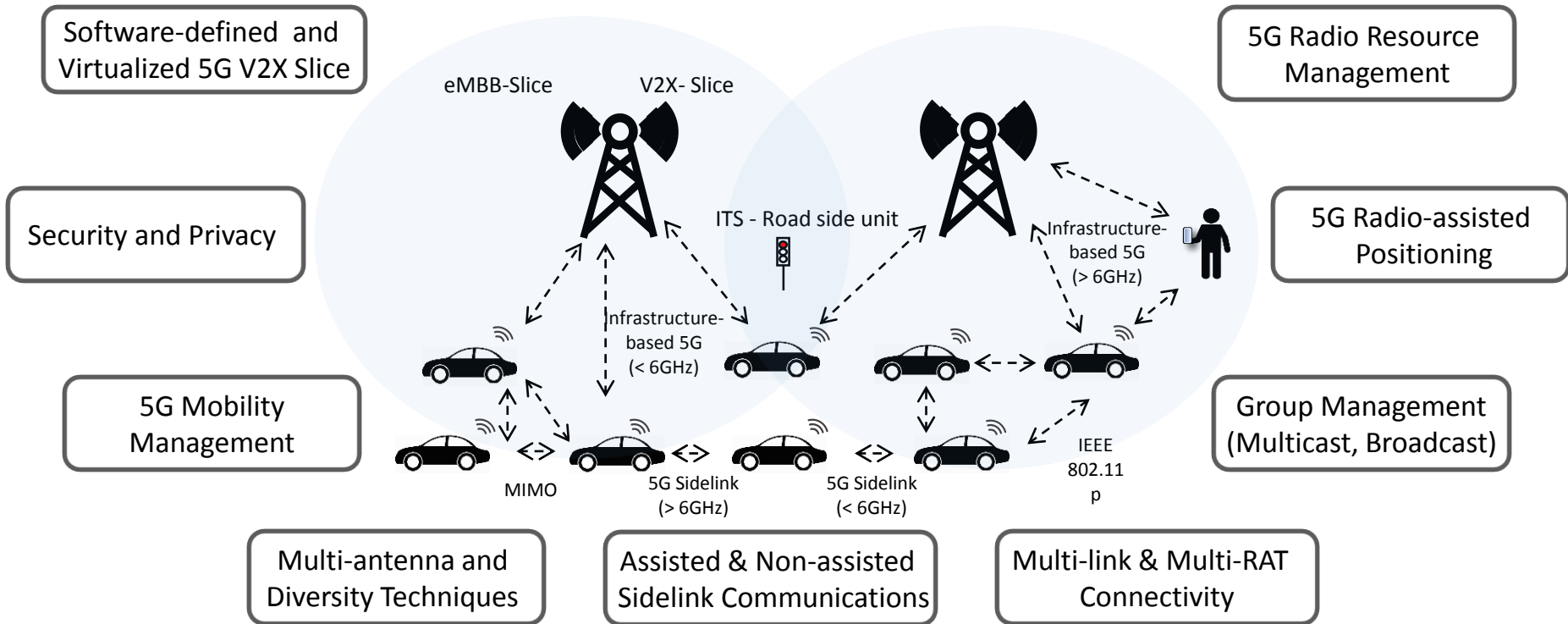
Email

5GCAR-Contact@5g-ppp.eu





Concept and Key Technical Components



Stay Tuned!

www.chalmers.se/e2