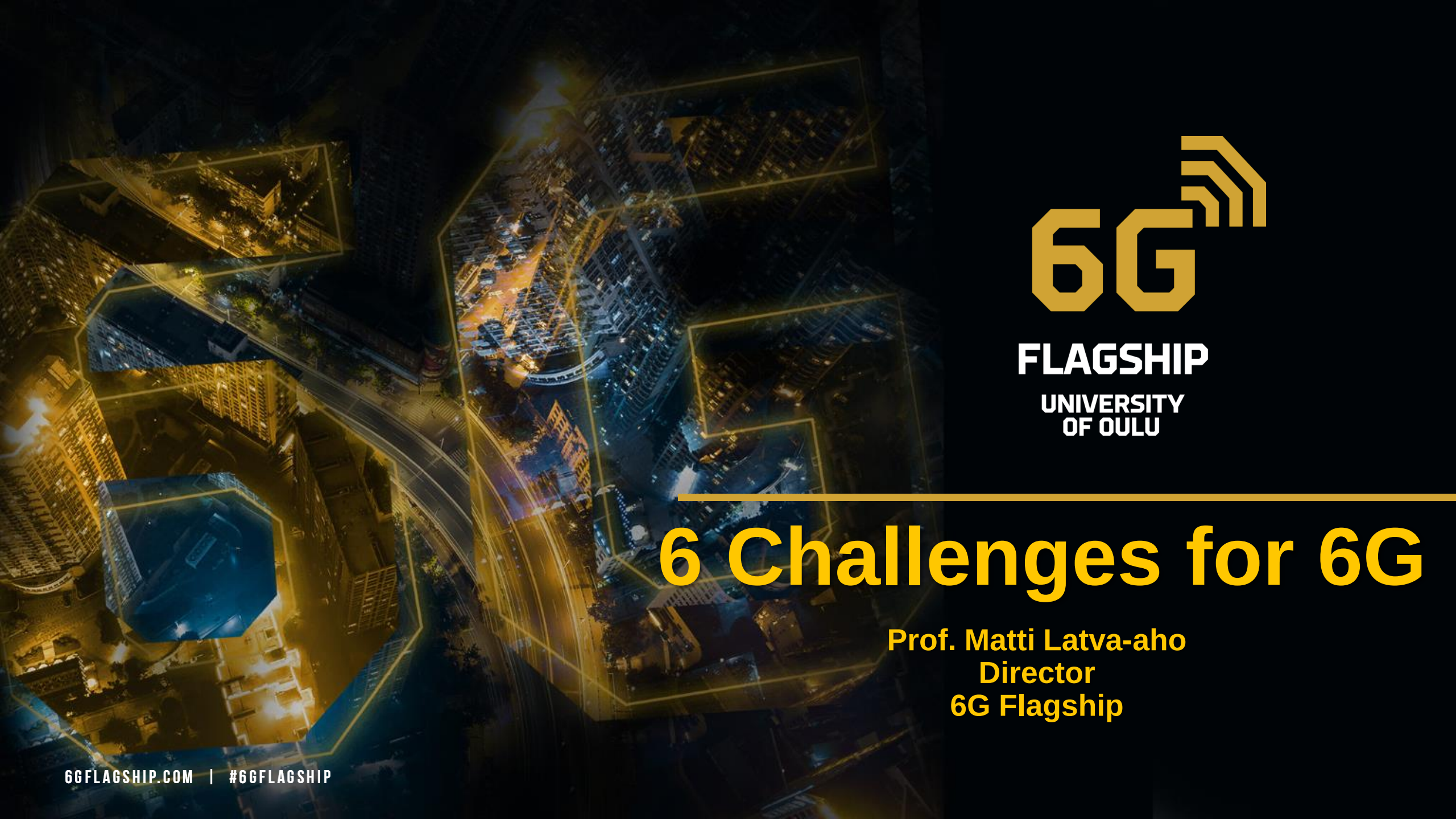
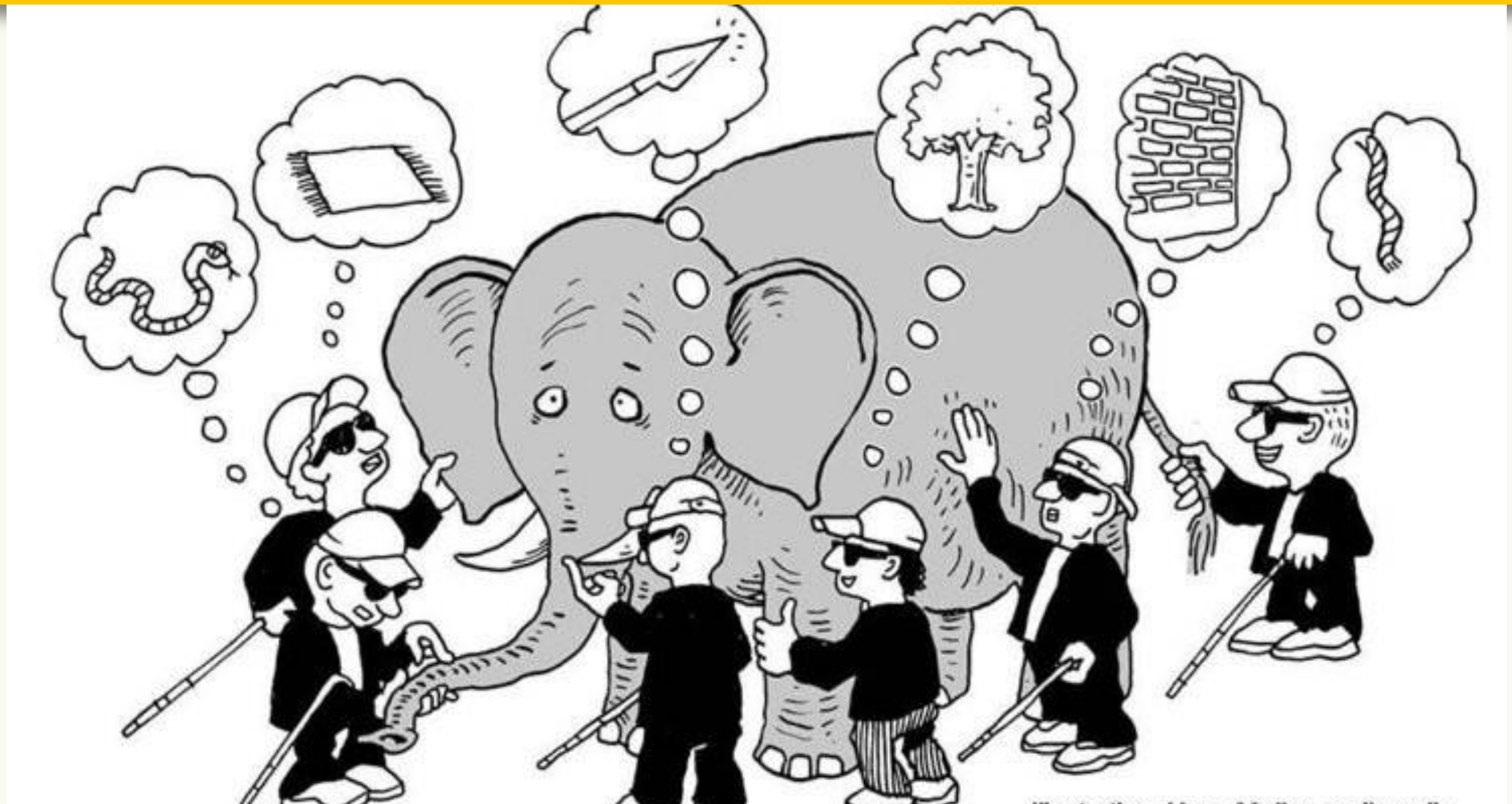


6G FLAGSHIP
UNIVERSITY OF OULU

6 Challenges for 6G

Prof. Matti Latva-aho
Director
6G Flagship

6G ???



#1 Verticals Driving Development

Wireless Connectivity Offers Unlimited Opportunities

Wireless connectivity is driving major societal changes:

1G - 2G

1980s – 2000s
Millions of voice users

3G - 4G

– 2020s Billions of Mobile Broadband users

5G and beyond

– 2040s Trillions of connected objects

Applications range explodes and new value chains emerge:

Logistics

Shopping

Agriculture

Industry 4.0

Health

Sustainable energy

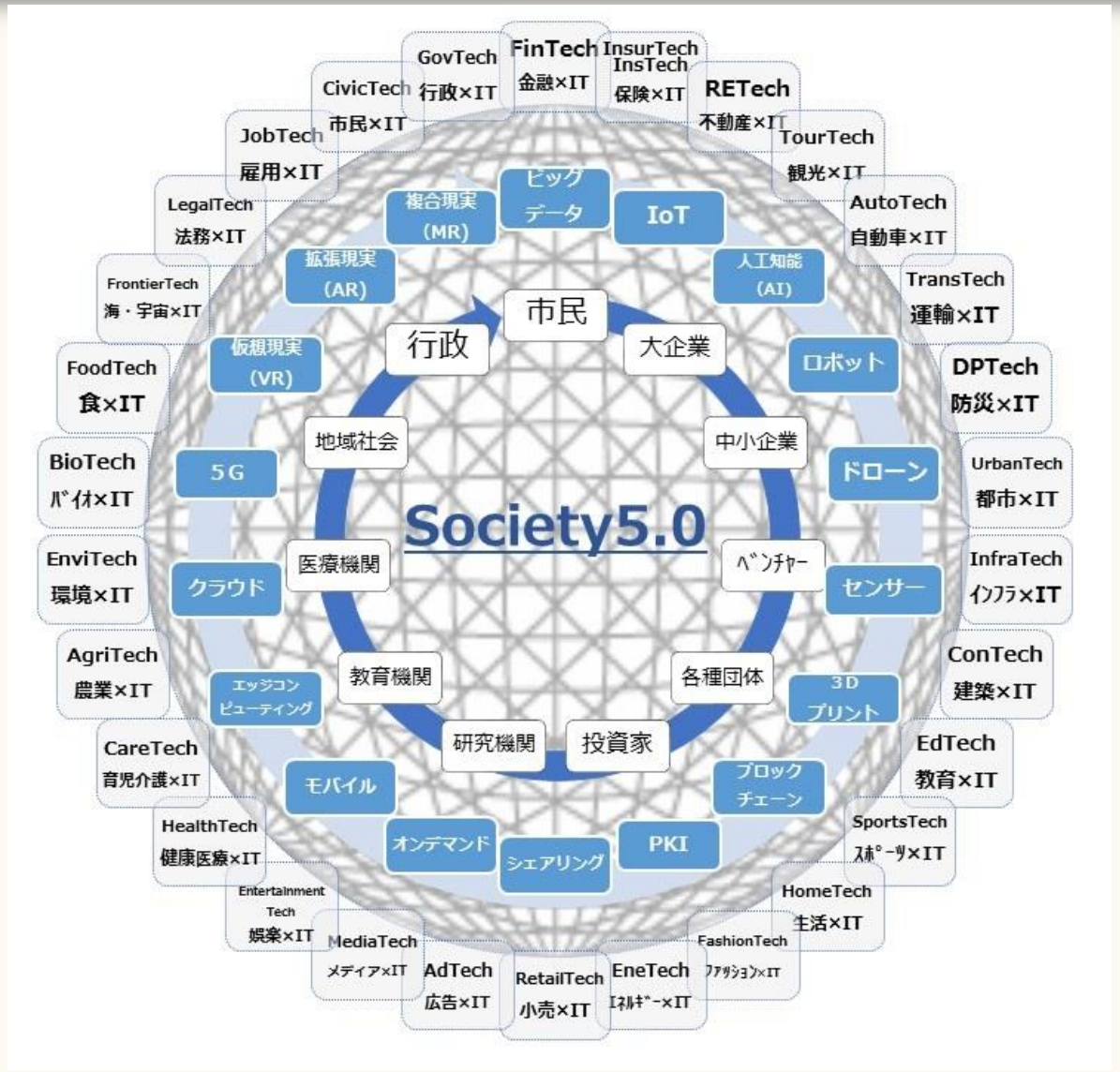
Automotive & transportation

EC estimates of 5G in Europe by 2025: **€113.1B revenue per year and 2.3M new jobs**.

Enourmous Societal Change Enabled by Wireless Connectivity

Example:
Japanese vision for Society 5.0:

- Savings in public expenditure
- Creation of new businesses
- Sustainable society



Disruptions needed for realisation:

- New wireless enabled **technologies**
- ICT **legistlation & regulation**
- **new value chains** serving different verticals

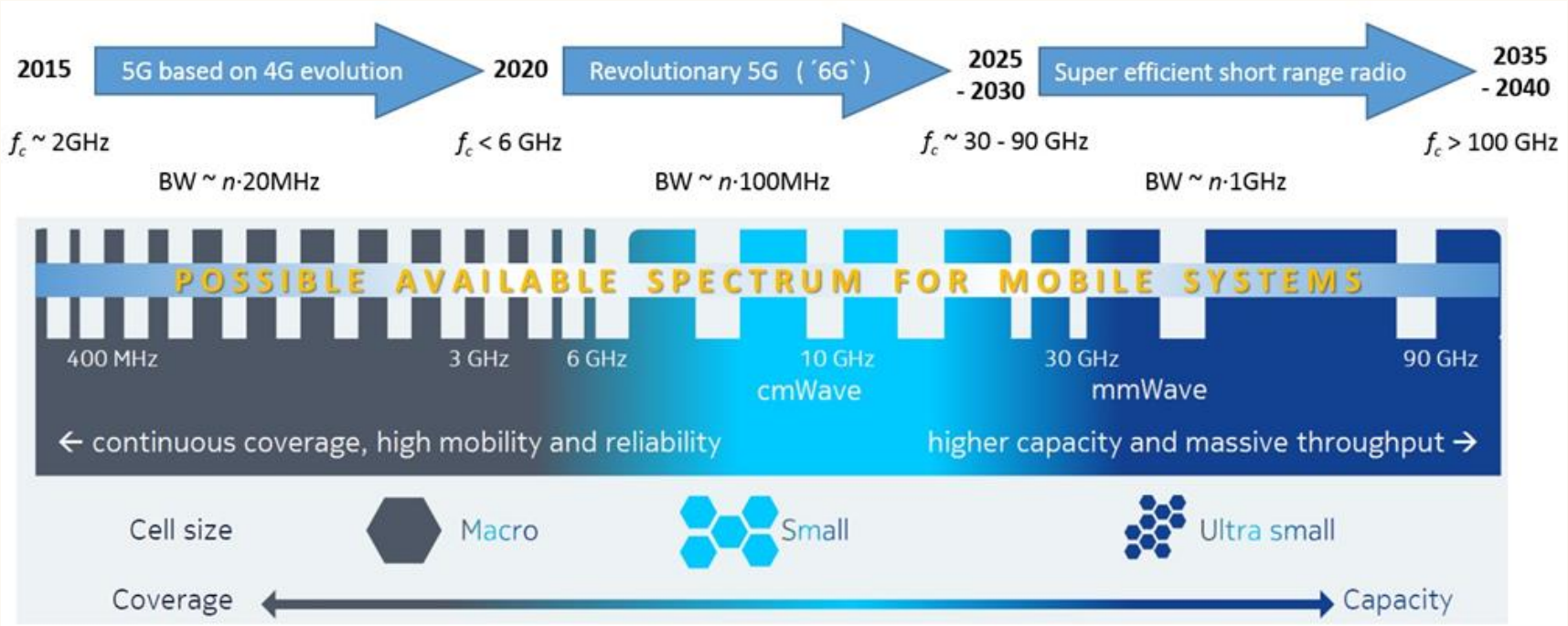
#2 Network Architectures Change

Short range connectivity starts to dominate

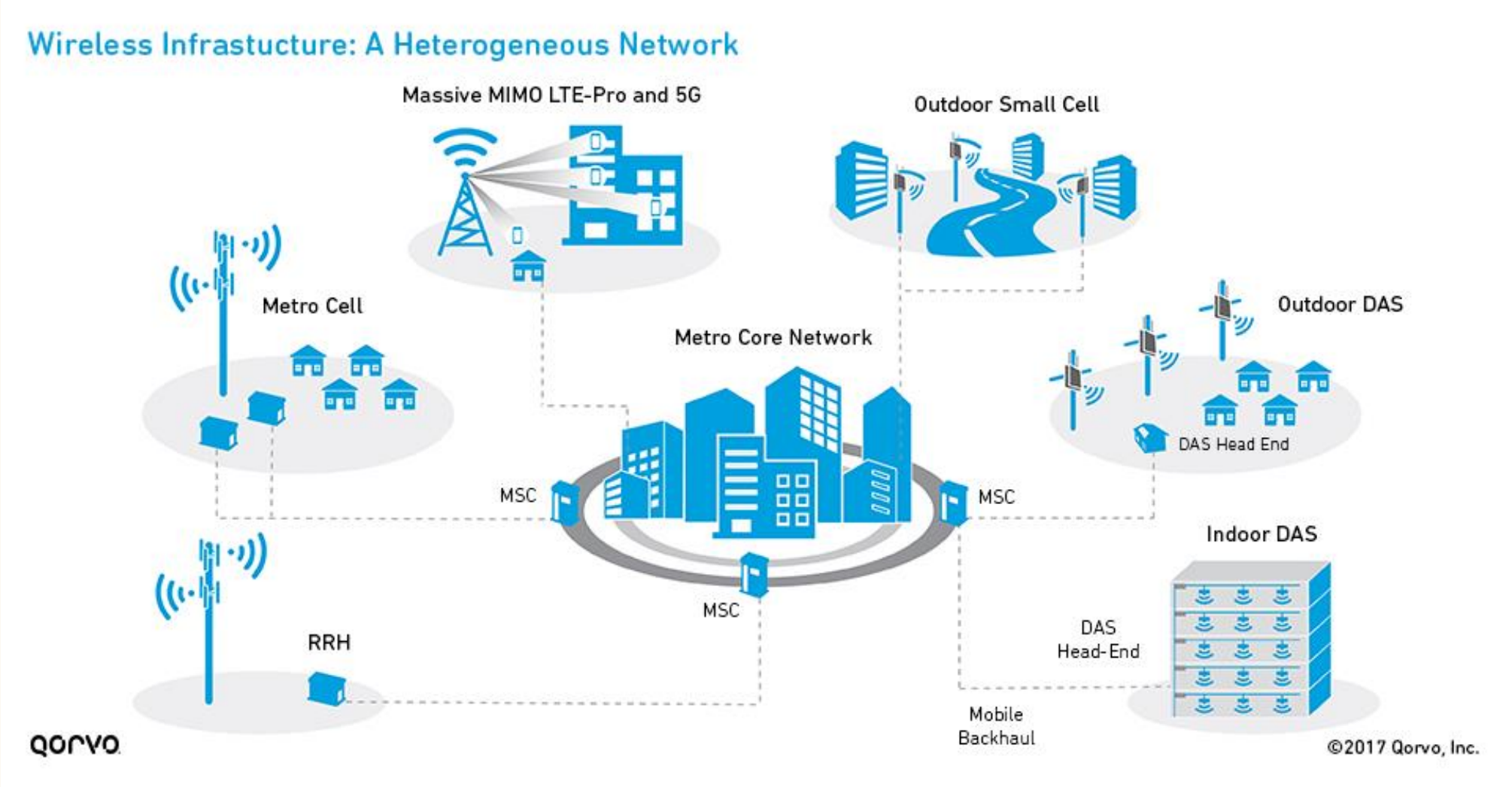
1) Higher frequencies needed => the physics of radio signals propagation mean shorter link ranges
⇒More basestations needed => **the role of short range connectivity** is drastically increasing.

2) Higher frequencies do not propagate through walls => **base stations must be installed indoors**
⇒who does that and pays the bill?? => new value chains / business models needed.

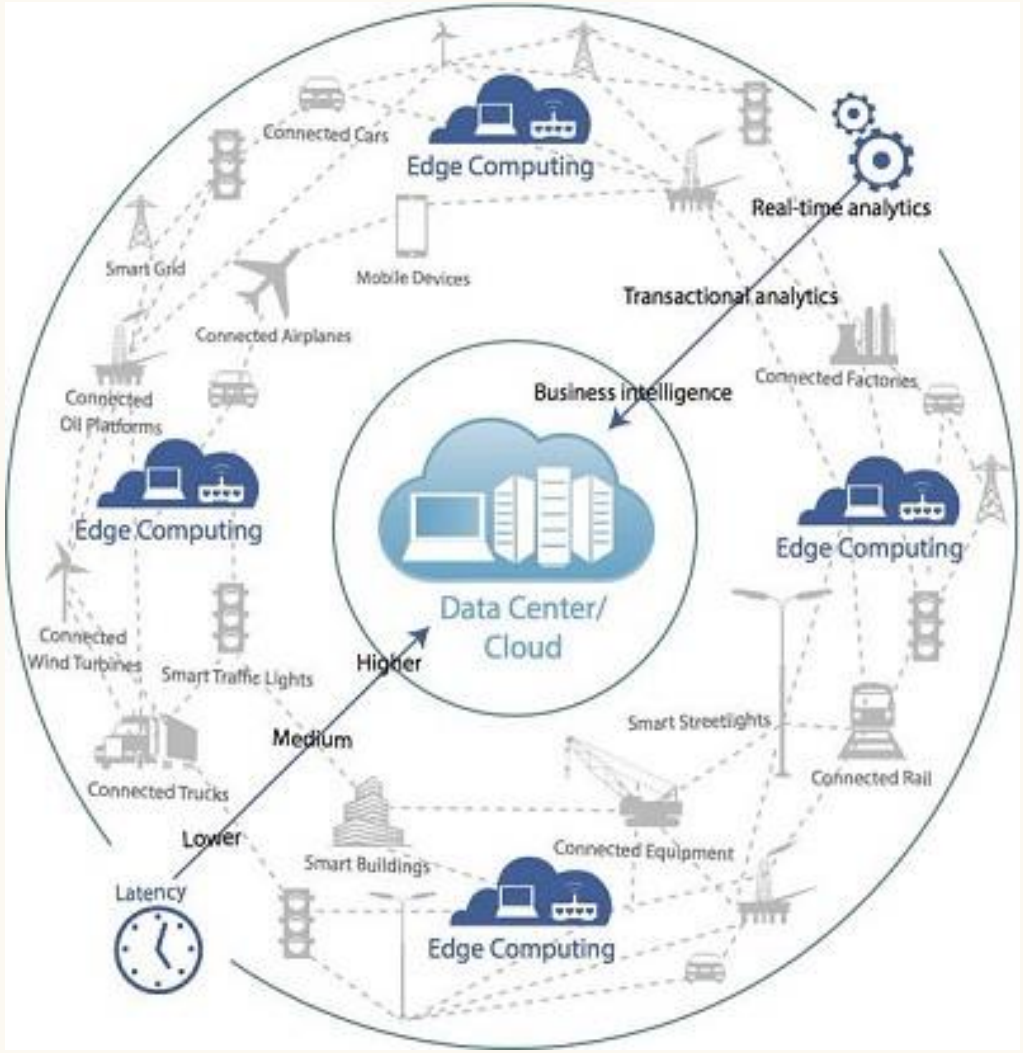
3) Spectrum regulation has to enable **local frequency licencing** for the benefit of different verticals
=> Radio Spectrum Policy Group (RSPG) in European Commission is pushing this.



More variety in Networks Deployment



Cloud Distribution Across Network



Smart society calls for distributed AI.

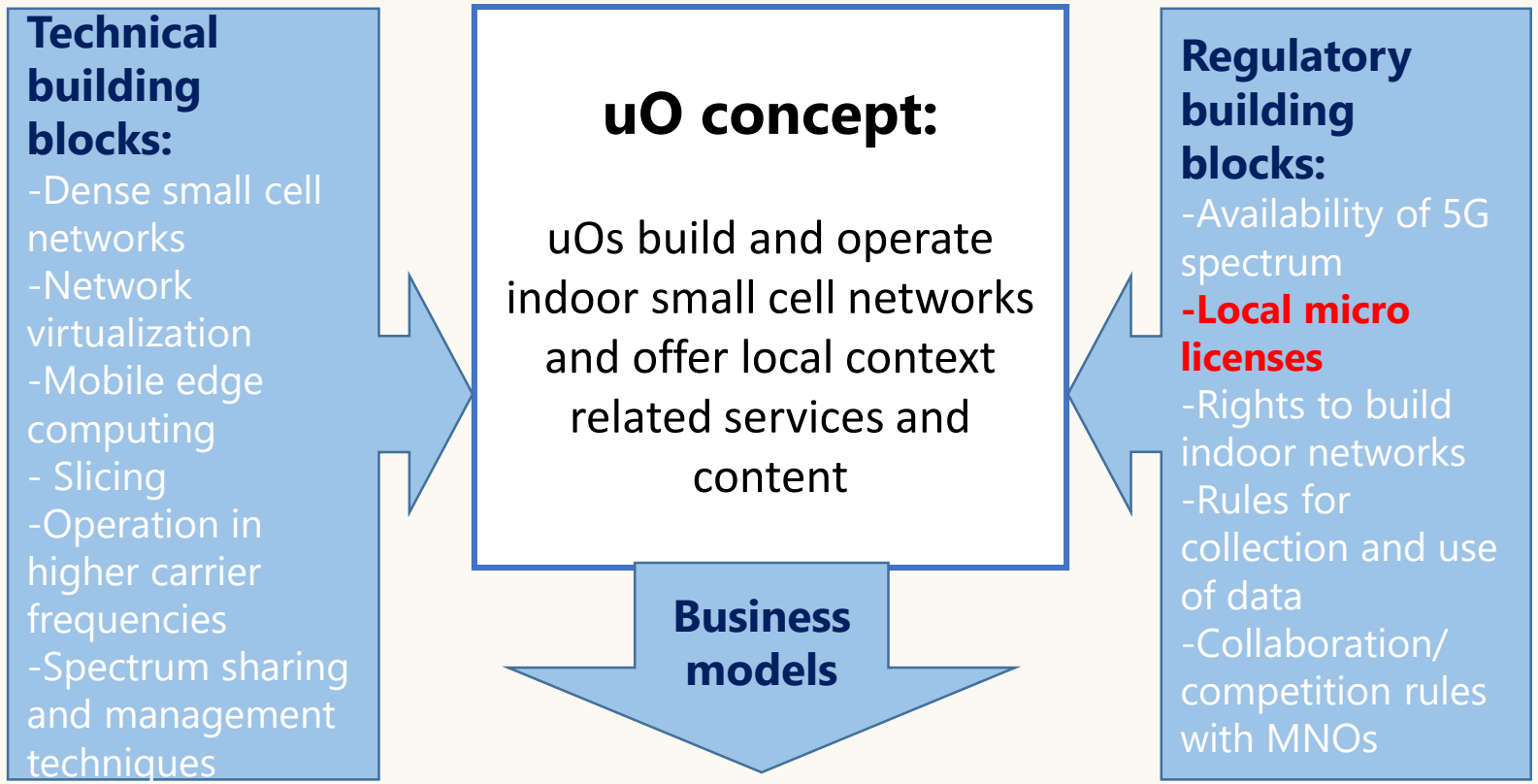
AI solutions are **driven by different verticals**.

Whole system architecture is changing: basestation densification, mobile edge computing, fog computing at devices…

What AI/ML brings to wireless systems and what wireless connectivity offers to AI/ML based apps.

#3 New Value Chains Appear

Vertical Specific Service Providers – Micro-Operators (uO)



HUGE ECONOMIC GROWTH VIA
FAST DIGITALIZATION OF SOCIETY ENABLED BY AGILE NEW PLAYERS IN THE ECOSYSTEM

1. It's about incentives investing locally in wireless connectivity and/or tailored local services.
2. It's can be a new player, but also existing MNO given incentives to invest are there.
3. It can be either open (requiring national roaming) or closed (private) network.

#4 Connecting the Last Billions

Wireless Solutions for Sustainability

Grand Challenges That Have Been Overlooked

How to solve **backhauling** in remote areas?

How remote area networks are **finaced**?

How about emerging economies and **developing countries**?

Spectrum regulation in remote areas should be handled differently.

Could **uO model** solve some of the problems?

ngmn
the engine of broadband wireless innovation

PRESS RELEASE

NGMN Alliance launches new projects to boost 5G success

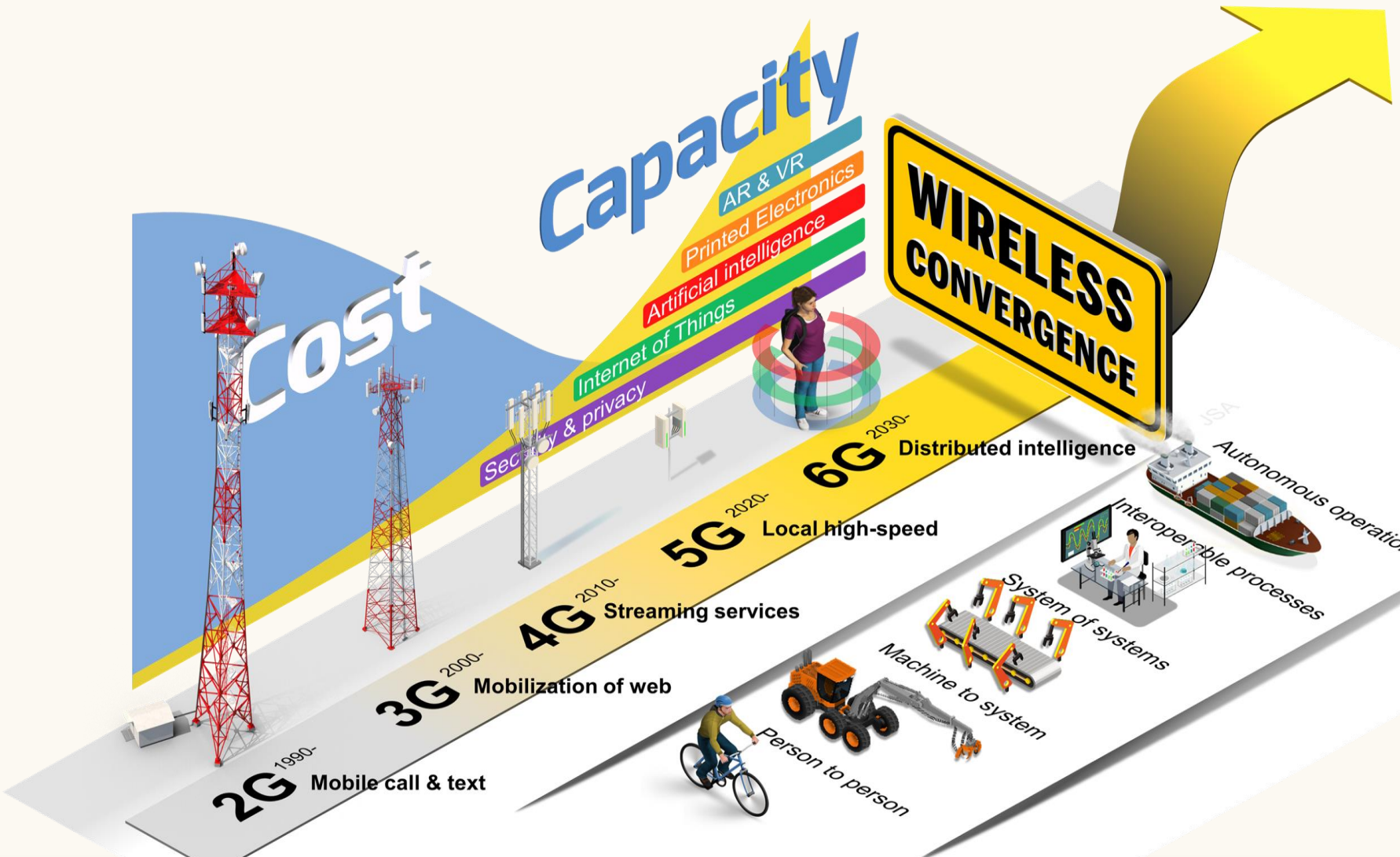
Updates on first 5G deployment experiences, further technology development and new business models to be shared at the NGMN Industry Conference in Vancouver, November 6-8, 2018

Frankfurt, GERMANY, June 18, 2018 – Next Generation Mobile Networks (NGMN) has confirmed the launch of four new key projects to support the development and deployment of 5G networks.

The projects – **"Spectrum and deployment efficiencies", "Ultra Reliable Low Latency Communication (URLLC) requirements for vertical industries", "RAN convergence"** and **"Extreme long-range communications for deep rural coverage"** – have been highlighted as crucial development areas to further optimise and guide the telecoms industry towards the successful deployment of 5G beyond 2018.

#5 Autonomous Wireless Systems

Towards Fully Automated Society



Example of automation

#6 Major Technology Leap Required

6G Enabled Wireless Smart Society & Ecosystem (6Genesis)

National Flagship for 2018-2026

Volume 251M€

Operated by University of Oulu, in collaboration with: Nokia, VTT, Aalto University, BusinessOulu, Oulu University of Applied Sciences

Strategic Research Areas at 6G Flagship Launch

Wireless Connectivity

Ultra-reliable low-latency communications

Unmanned processes

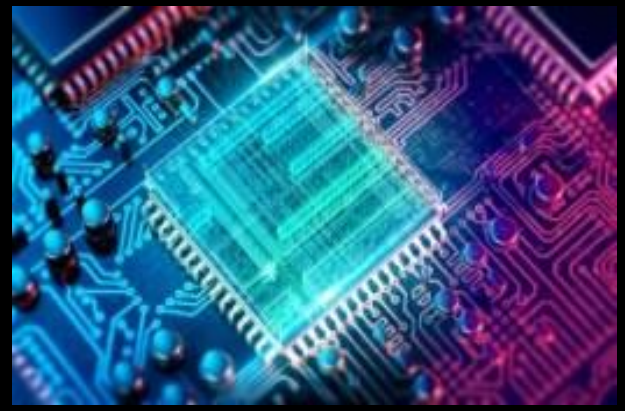
Distributed Computing

Mobile edge intelligence

Time critical & trusted applications

Devices & Circuit Technology

THz communications materials & circuits



Unlimited connectivity

Services and Applications

Multidisciplinary research accross verticals

Disruptive value networks

6G ecosystem benefits to partners

Benefits to Partners	Affiliate	Pioneer	Co-creator
Brand usage			
Company visibility in all 6G Flagship marketing, upon agreement	○	●	●
Web site visibility with category	○	●	●
6G Co-creator/Pioneer/Affiliate logo in company materials	●	●	●
Key note/co-creator in annual conference, company talk/pioneer in seminars/workshops	○	●	●
RDI agenda			
Steering 6G Flagship agenda (Research, Development, Test Network)	○	○	●
Defining research theme topics	○	○	●
Propose new topics and projects	○	●	●
Access to resources			
Nominated key account managers for strategic partners	○	○	●
Priority access to 6G Flagship premises and free access to VIP events	○	○	●
Pre-access to all published results	○	○	●
Assisted access to IPR	○	●	●
Assisted access to 5G/6G experts	○	●	●
Access to co-creation environments (5GTN etc.)	●	●	●
Finding partners			
Full access to profiled partner network	○	○	●
VIP access to digital partnering service Fenix	○	●	●
Company active part of partner service	●	●	●
Insight to future			
Company customised annual session	○	○	●
2 theme specific technology sessions for companies	○	●	●
Invitation to special events	○	●	●
Invitation and document delivery on public 6G events	●	●	●