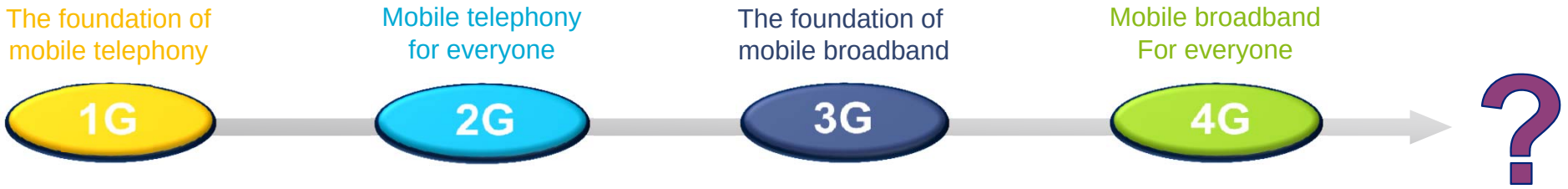
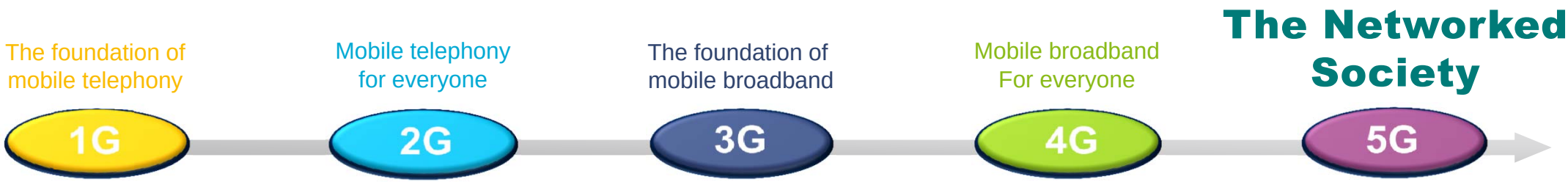
RESEARCH TRENDS AND IMT BEYOND 2020

Johan Skold
Ericsson Research

WIRELESS ACCESS GENERATIONS



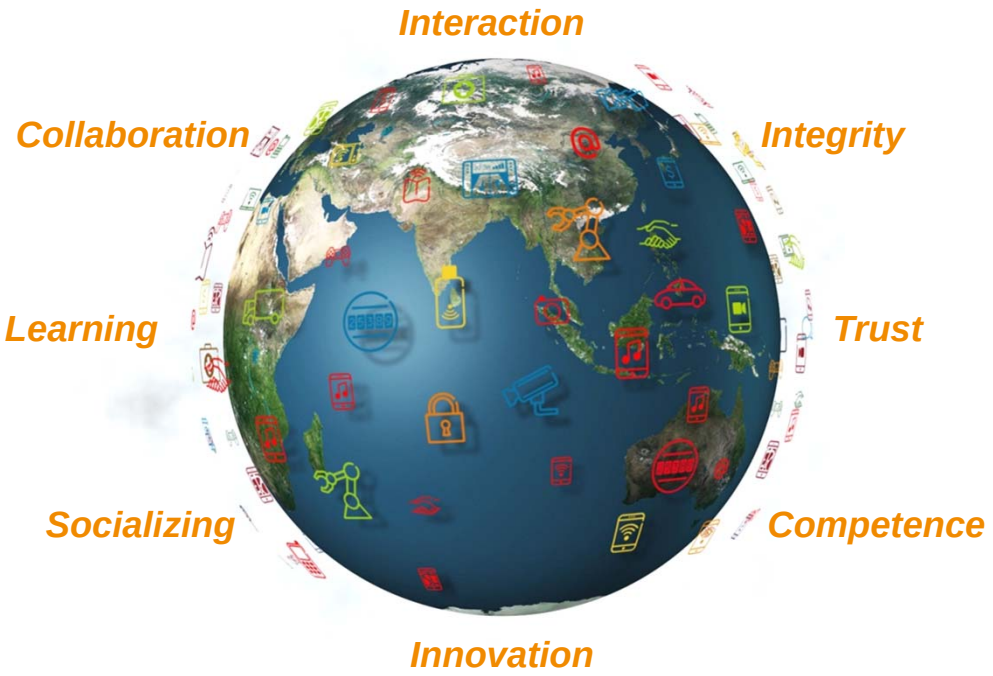
WIRELESS ACCESS GENERATIONS



UNLIMITED ACCESS TO INFORMATION AND SHARING OF DATA
AVAILABLE ANYWHERE AND ANYTIME TO ANYONE AND ANYTHING

THE NETWORKED SOCIETY

Unlimited *access to information* and *sharing of data*
anywhere and *anytime* for *anyone* and *anything*



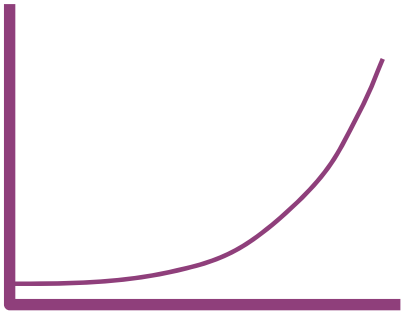
FUTURE WIRELESS ACCESS
KEY CHALLENGES

IT IS NOT ONLY ABOUT
BIGGER AND BETTER
MOBILE BROADBAND

KEY CHALLENGES

Massive growth in

Traffic Volume



Massive growth in

Connected Devices

Wide range of

Requirements & Characteristics

- **Data rates**
- **Latency**
- **Reliability/availability**
- **Device cost and energy consumption**
- **Security**
- **.....**

Affordable and sustainable

FUTURE WIRELESS ACCESS – "5G"

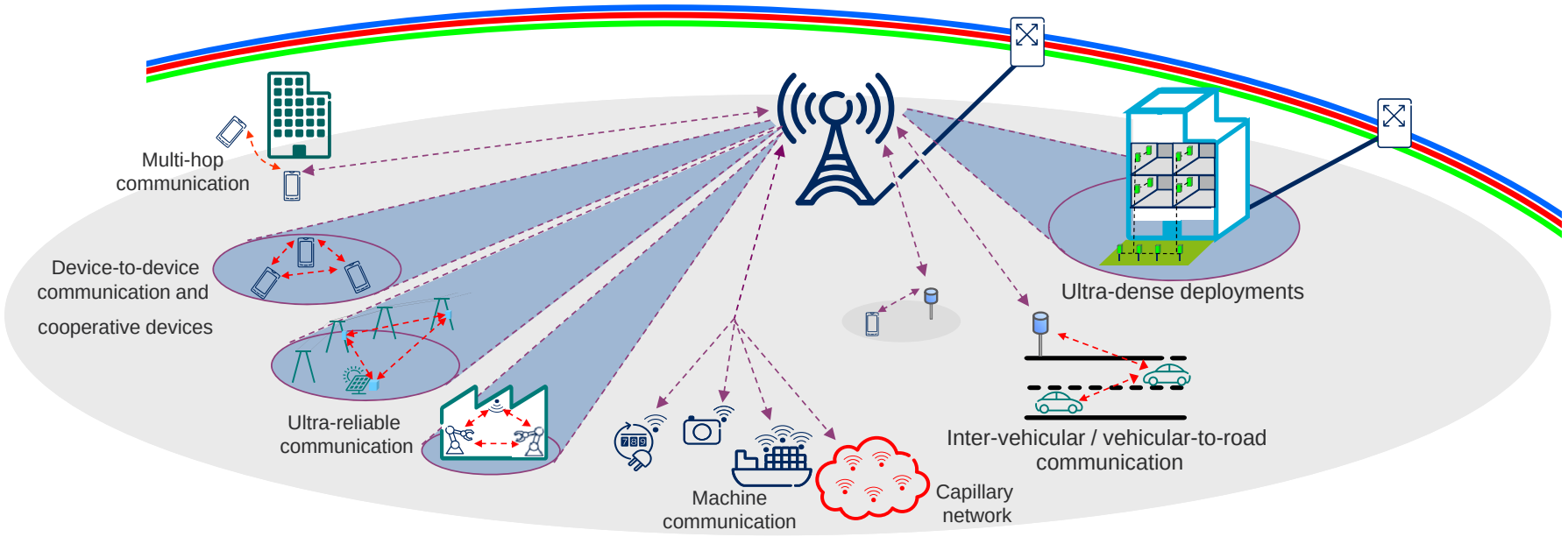
A set of well-integrated wireless-access technologies jointly enabling the long-term Networked Society

- Evolution of existing radio-access technologies
- New *complementary* radio-access technologies

New technology components needed in both cases

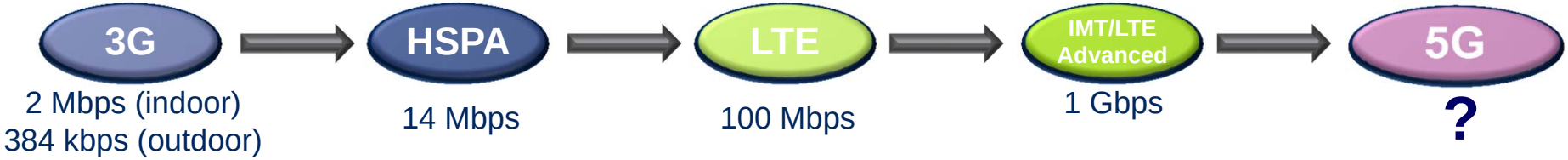
FUTURE WIRELESS ACCESS

A set of integrated radio-access technologies jointly enabling the long-term Networked Society



DATA RATES

Higher rata rates has been the “flying flag” for each technology step!



Future targets

› 10 Gbps in specific scenarios

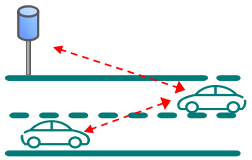
› 100 Mbps generally available in urban/suburban scenarios

› High-quality (Mbps) connectivity essentially everywhere

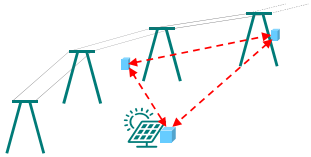
LATENCY / RELIABILITY0

LTE radio-interface latency sufficient in most cases

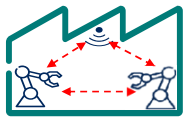
Very low latency may be required by some ”new applications”



Traffic safety/control



Smart grid



Industrial application

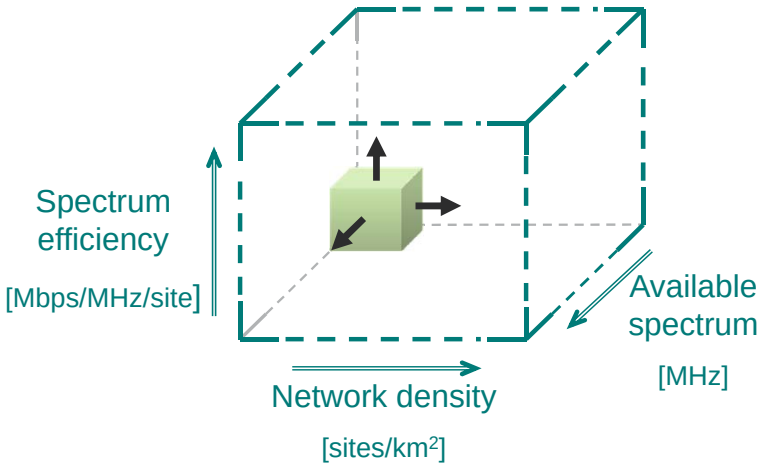
“Tactile Internet”

...

Target for the future

Possibility for sub-ms latency with very high reliability

TRAFFIC CAPACITY



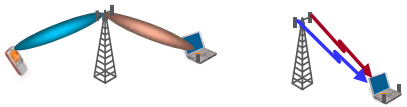
Traffic capacity [Mbps/km^2] = Available spectrum × (Network density × Spectrum efficiency)

Area spectrum efficiency

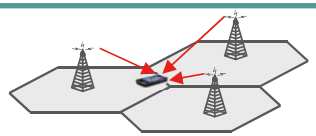
- More spectrum – extending into higher bands including mm-wave band
- More dense networks – including more extensive antenna configurations
- Smart cooperation between network nodes

AIR-INTERFACE EVOLUTION

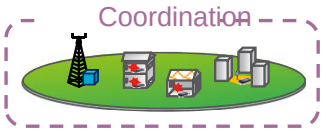
Multi-antenna transmission/reception



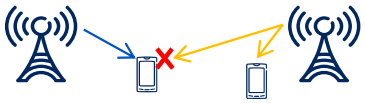
Multi-site transmission/reception



Multi-layer coordination

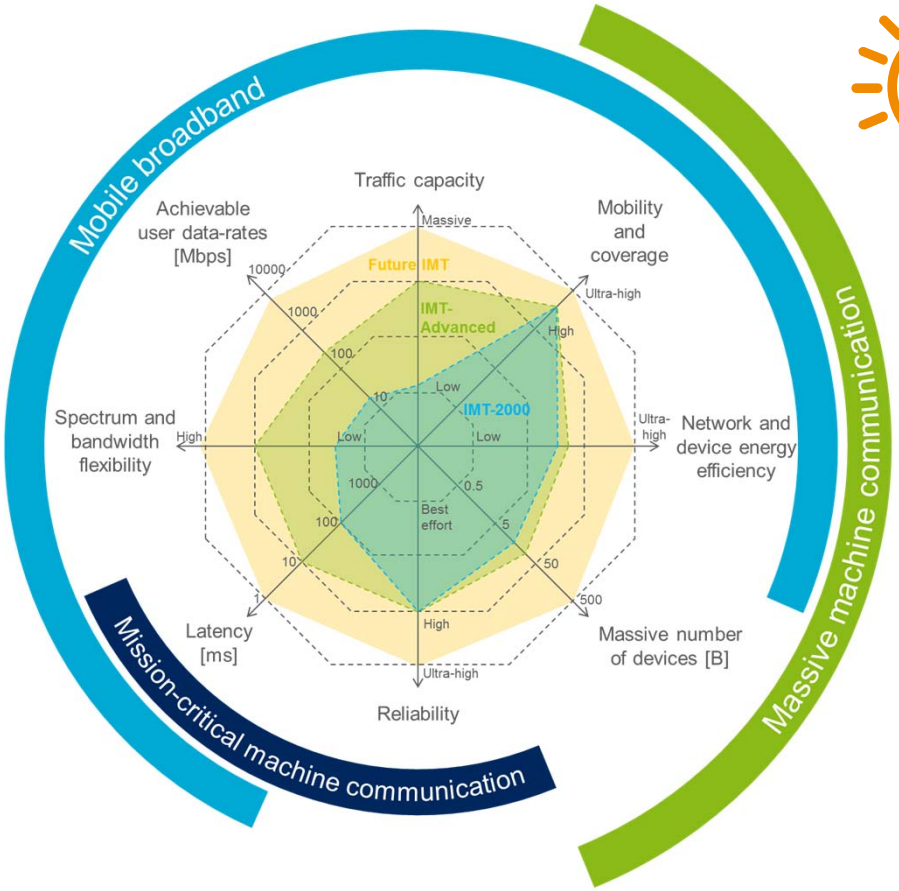


Interference suppression



Simultaneous transmission and reception, network coding, …

RESEARCH FOR 5G



Making the extremes possible:

- Extreme user data-rates
- Extreme capacity and density
- Extreme mobility
- Extreme energy efficiency
- Extreme number of devices
- Extreme reliability
- Extremely low latency
- Extreme bandwidth

TARGET AREAS FOR RESEARCH

Technologies for improved mobile broadband:

- General enhancements for “bigger and better” Mobile Broadband
- Higher bit rates, lower latency, more traffic, higher density

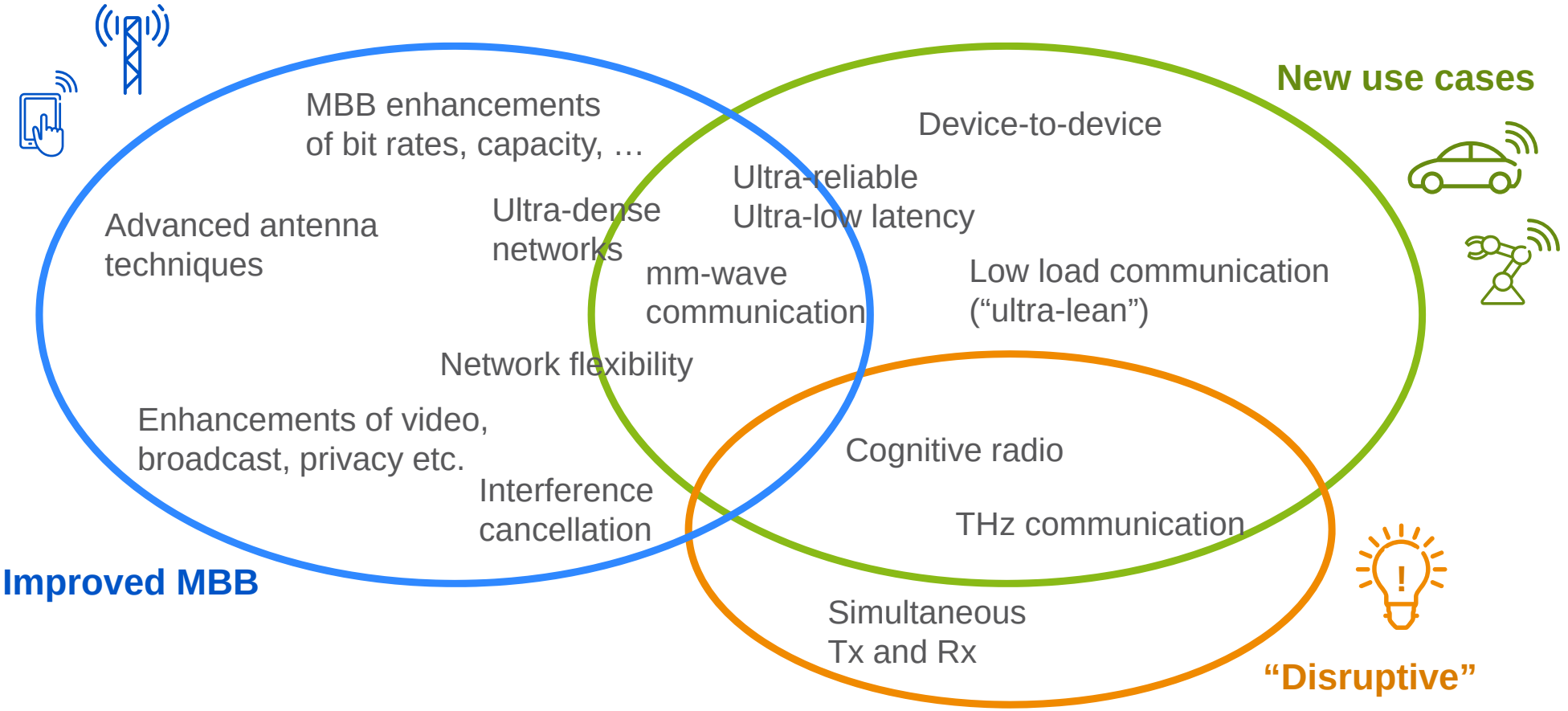
Technologies for new and specific use cases

- Machine-to-machine, proximity service
- Reaching the “extremes”: Ultra-low latency, high reliability applications, ultra-low power, etc.

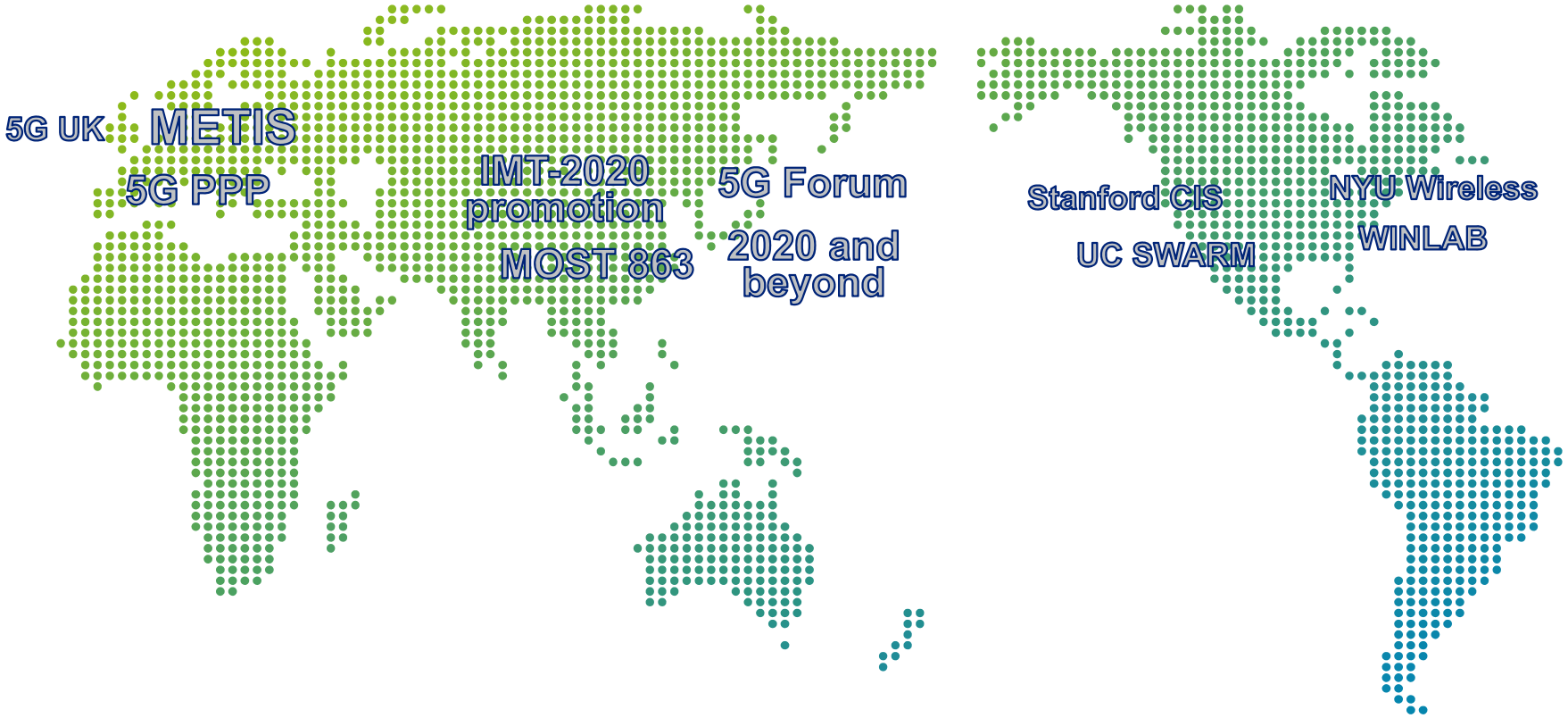
“Disruptive” technology components:

- Targets existing or new, possibly revolutionary use cases

EXAMPLES OF RESEARCH AREAS



RESEARCH INITIATIVES GLOBALLY
SOME EXAMPLES



SPECTRUM IMPLICATIONS

5G Capability evolution:

› Higher peak data rates

› More and denser traffic

› Ubiquitous and deeper coverage

New and evolved 5G use cases:

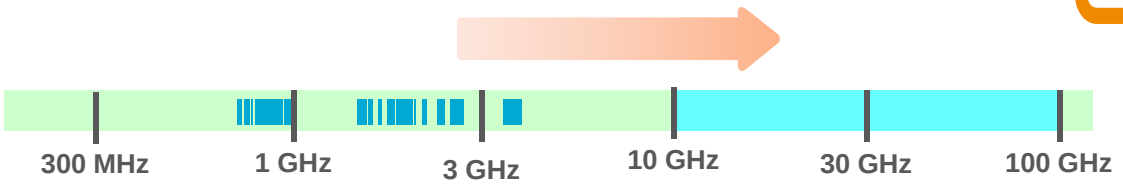
› Machine-type communications

› Ultra-reliable communications

› Etc. …

DRIVERS

- Larger carrier bandwidths
- More spectrum
- Spectrum at higher frequencies
- Need to be identified at WRC-18/19

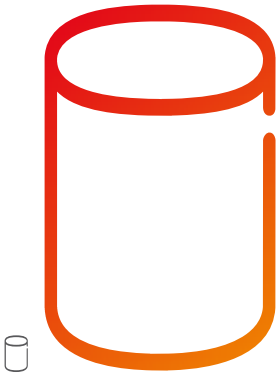


METIS PROJECT

EU-funded research project on future wireless communication

29 partners / ≈2500 man-month / 29 M€

METIS – OBJECTIVES

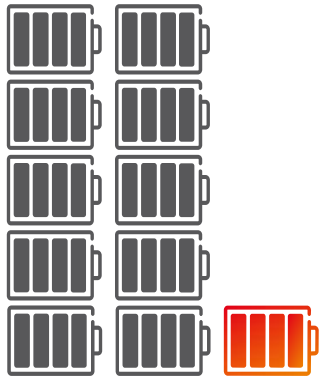


1000x
higher mobile data volumes

10x - 100x
higher number of connected devices

10x - 100x
typical end-user data rates

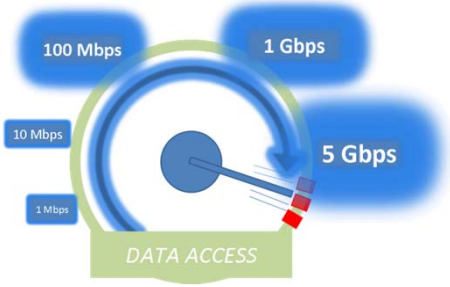
5x
lower latency



10x
longer battery life for low-power devices

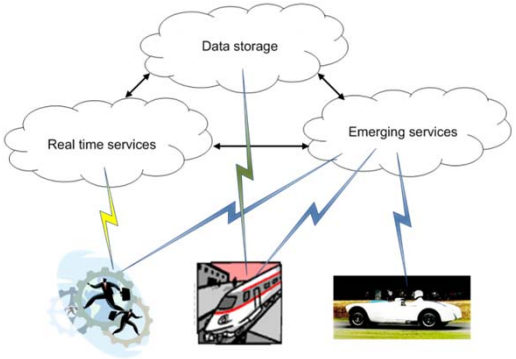
Develop a concept for future mobile and wireless communications system that supports the connected information society

METIS – DEFINED SCENARIOS



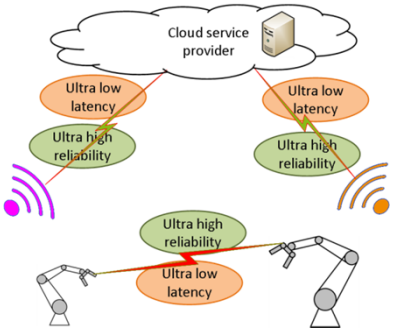
Amazingly fast

(Very high data rate)



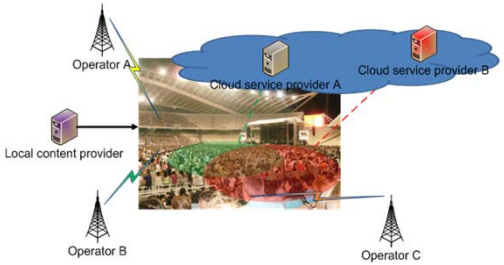
Best experience follows you

(Mobility)



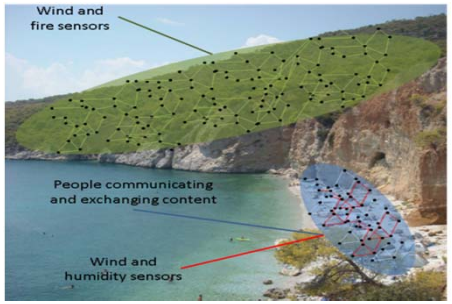
Super real-time and reliable connections

(Very low latency)



Great service in a crowd

(Very dense crowds of users)



Ubiquitous things communicating

(Very low energy and cost. Massive number of devices)

ERICSSON