5G: Where are we (going) in EU-China relations?

Liesbet van der Perre, KU Leuven
Tim Rühlig, DGAP

Reindeer-project.eu

Digital Power China

A European research consortium

Outline

- **Introduction of project**
- **5G: what's new?**
- **5G rollout: an update on progress and challenges**
- **The political relevance of 5G – Huawei and beyond**
- **Open RAN – a non-Chinese alternative?**
- **What's ahead? 6G**

DPC – just the beginning?!
Interdisciplinary, policy-oriented research pairing technical and China expertise

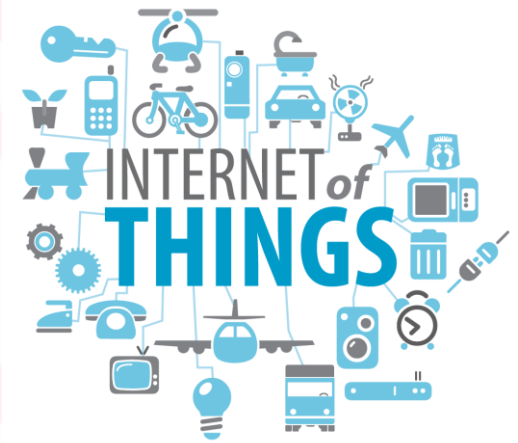
- Questioning **conventional wisdom**
- Information is available, **interpretation is rare**
- Disciplinary perspectives prevent grasping the full picture
- Authoritarianism is an important factor among several

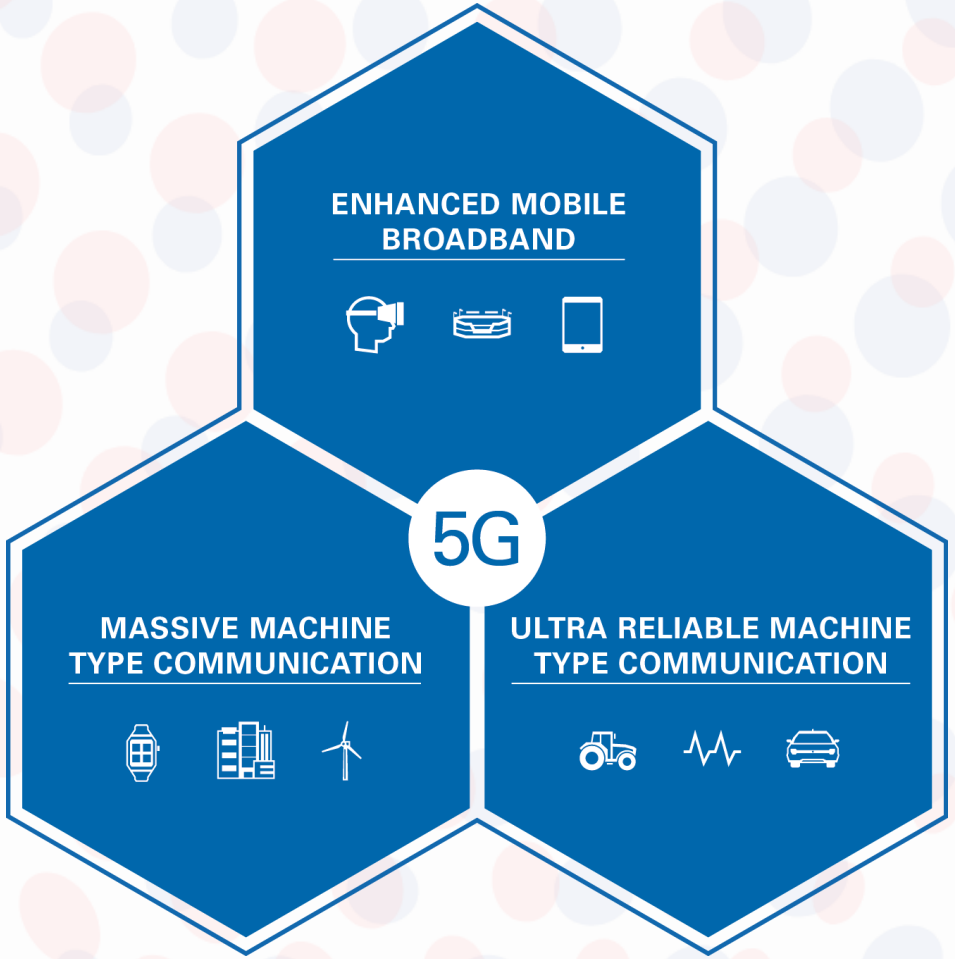
- "China cannot innovate", "The internet cannot be controlled"
- CCP focus on **"rule by documents"** – in Chinese language, comparative technological advance in question
- Does ambition meet feasibility? What is the political context of tech advance?
- **Diverse set of tech and political actors** of China's political economy

International Telecommunication Union (ITU): Vision for 5G

10 Gbps Peak rates

10 Mbps/m^2



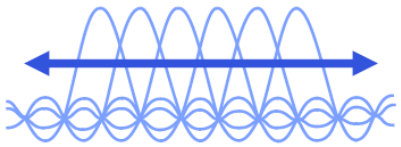
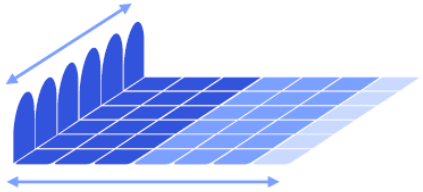
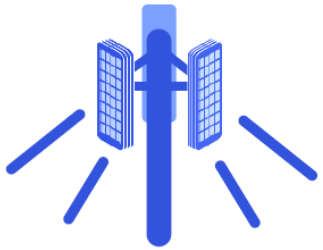
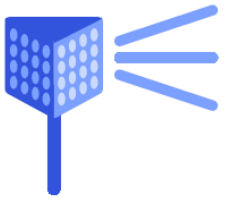


> 1Million / km^2
Connections

< 1 ms Latency

New technologies in ‘New Radio’ (5G): a summary

© Qualcomm ‘Making 5G NR a commercial reality’

Scalable OFDM-based air interface	Flexible slot-based framework	Advanced channel coding	Massive MIMO	Mobile mmWave
				
Scalable OFDM numerology	Self-contained slot structure	Multi-Edge LDPC and CRC-Aided Polar	Reciprocity-based MU-MIMO	Beamforming and beam-tracking
Address diverse services, spectrum, deployments	Low latency, URLLC, forward compatibility	Support large data blocks, reliable control channel	Large # of antennas to increase coverage/capacity	For extreme capacity and throughput

Flexible resource allocation to support **diverse services**

Reliability

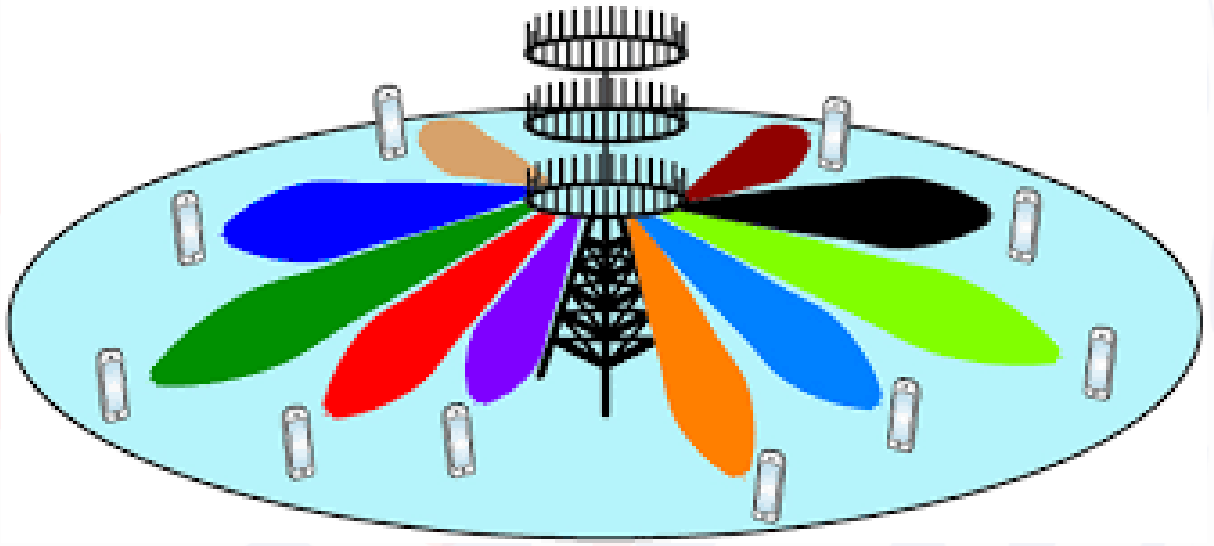
PHY-layer innovation
Unprecedented capacity

High-level interpretation by L. Van der Perre

Exploiting available spectrum better: spatial reuse

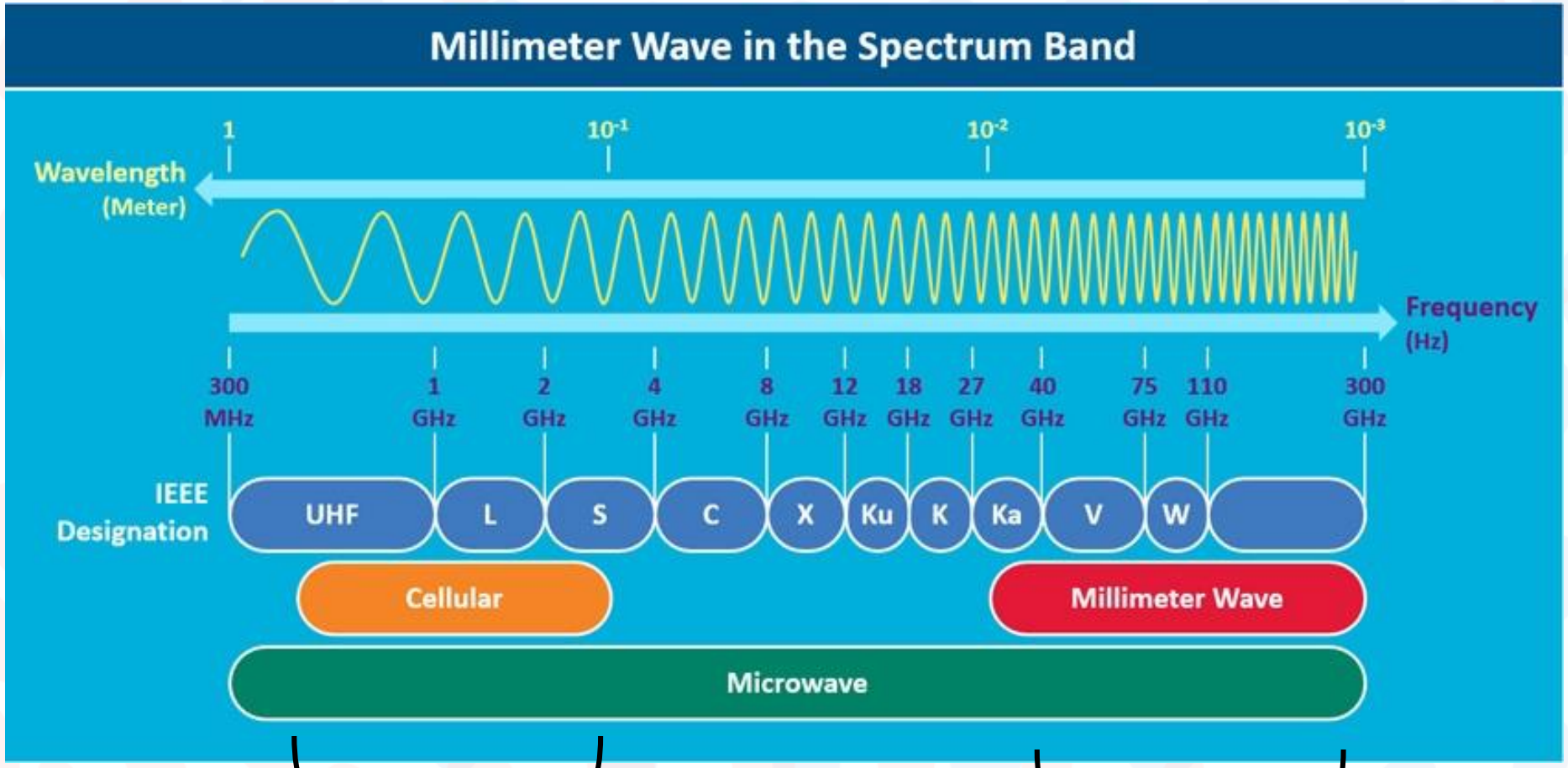
‘Messy patchwork’
(conventional densification)

Massive MIMO
(large array-based processing)



Massive MIMO = more antennas, locate them centrally
Energy/power gets focused to you
Spatial multiplexing allows to serve multiple users in the same cell at the same time

Exploiting higher frequencies



2/3/4/5G

New for 5G

Global roll-out of 5G is on-going

- First national-wide roll-out of 5G network: South-Korea (Apr. ‘19)

- Large volume deployment in progress: China
  - 80% of all 5G connections in mid-2021
  - Ambition: full coverage by 2025 (instead of 2030)
  - 35% of all major industrial companies by 2023
  - Fast adoption of 5G packages (low cost) and novel handsets
  - Status ‘wide’ deployment unclear
  - Operators logically focus on large cities first

Digital Single Market

POLICY

Towards 5G

⇒ European commission has started R&D initiatives many years ago with the ambition to lead

The "fifth generation" of telecommunication systems, or 5G, will be one of the most critical building blocks of our digital economy and society in the next decade. Europe has taken significant steps to lead global developments towards this strategic technology..

About 5G

Policies +

Blog posts

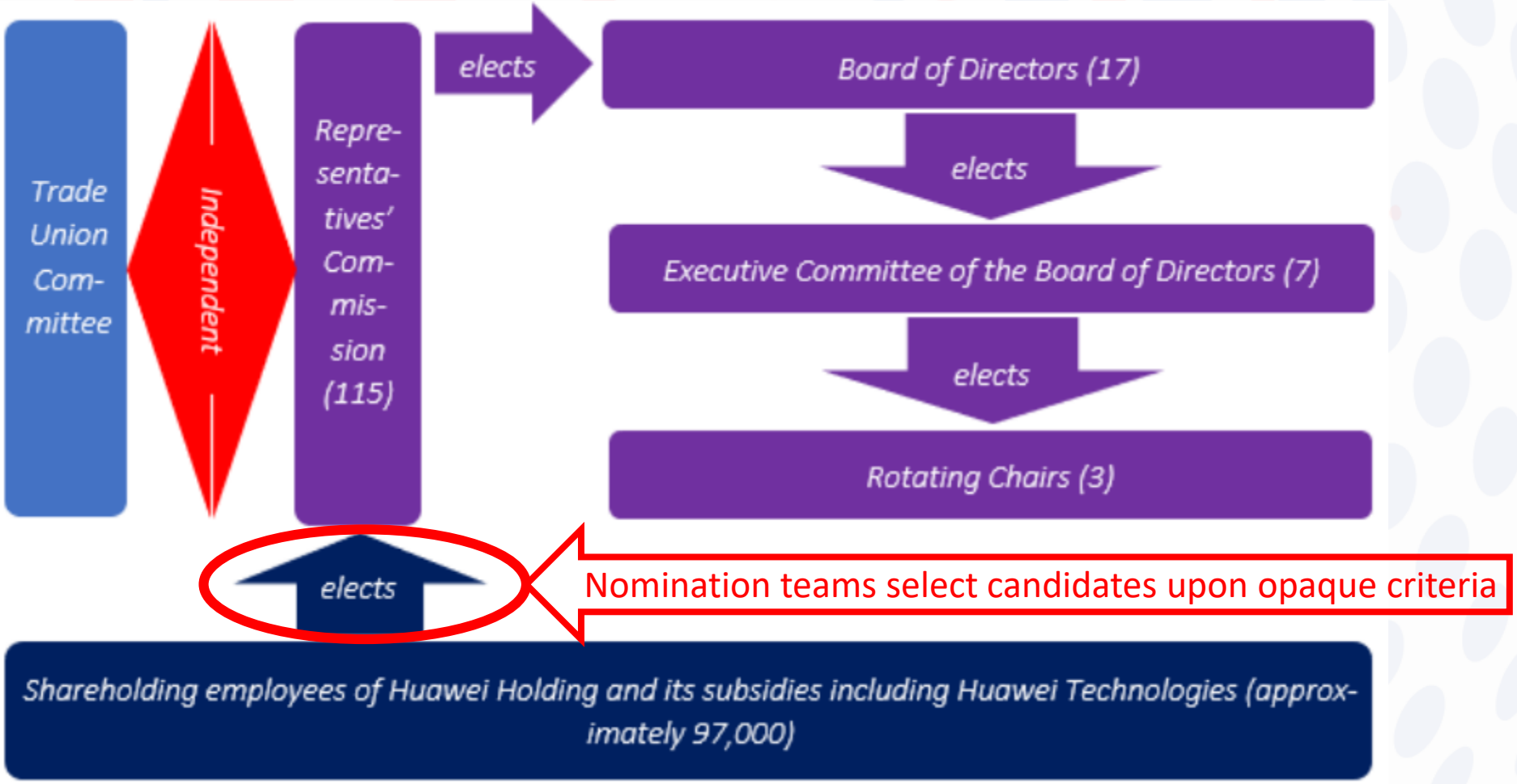
5G in Europe: Daily news!

- Strong European expertise in innovative companies and R&D
- Trials and deployment: Reported on a regularly base since end 2018/Q12019 - Most numerous in Spain, France, Germany and Italy.
- Private and/or local networks in many countries (City-wide, port-area, science park-wide, …)
- Reasons for slower rollout in Europe:
    - Regulatory diversity
    - Cost for spectrum and deployment
    - Shortage of hardware components
    - Lack of human resources

Why 5G is of strategic political importance?

- Risks/threats are strategically crucial
  - Espionage 
  - ’Kill switch’ 
- No such thing as ’perfect’ security – nor desired: cryptography = friend and/or foe
- Increase costs for malign actors – diversification & redundancies
- China’s role: Huawei and beyond

Huawei and alternatives?



Open RAN – an alternative to Huawei?

- Open RAN: disaggregating the components of RAN by means of virtualization
  - Open RAN ≠ open source
  - Open RAN ≠ trustworthy
  - Open = open interfaces + open to combine different suppliers
- Open RAN requires a degree of interoperability beyond international technical standards

Open RAN – an alternative to Huawei?

Most prominent industry consortium: O-RAN Alliance

Merging xRAN Foundation (US) and C-RAN (CN)

- a German entity since 2018
- founded by AT&T, China Mobile, Deutsche Telekom, NTT Docomo, Orange
- NOT compliant with WTO criteria for international standards
- Close collaboration with Telecom Infra Project (TIP) incl. China Unicom leading the 5G NR Small Cell Subgroup
- Three work streams: specification effort, software community, testing and integration effort

Joint development of software code for virtualization and automation specifications
Chinese actors are not excluded
Close collaboration with the Linux foundation

Linux foundation board of directors includes Huawei and Tencent

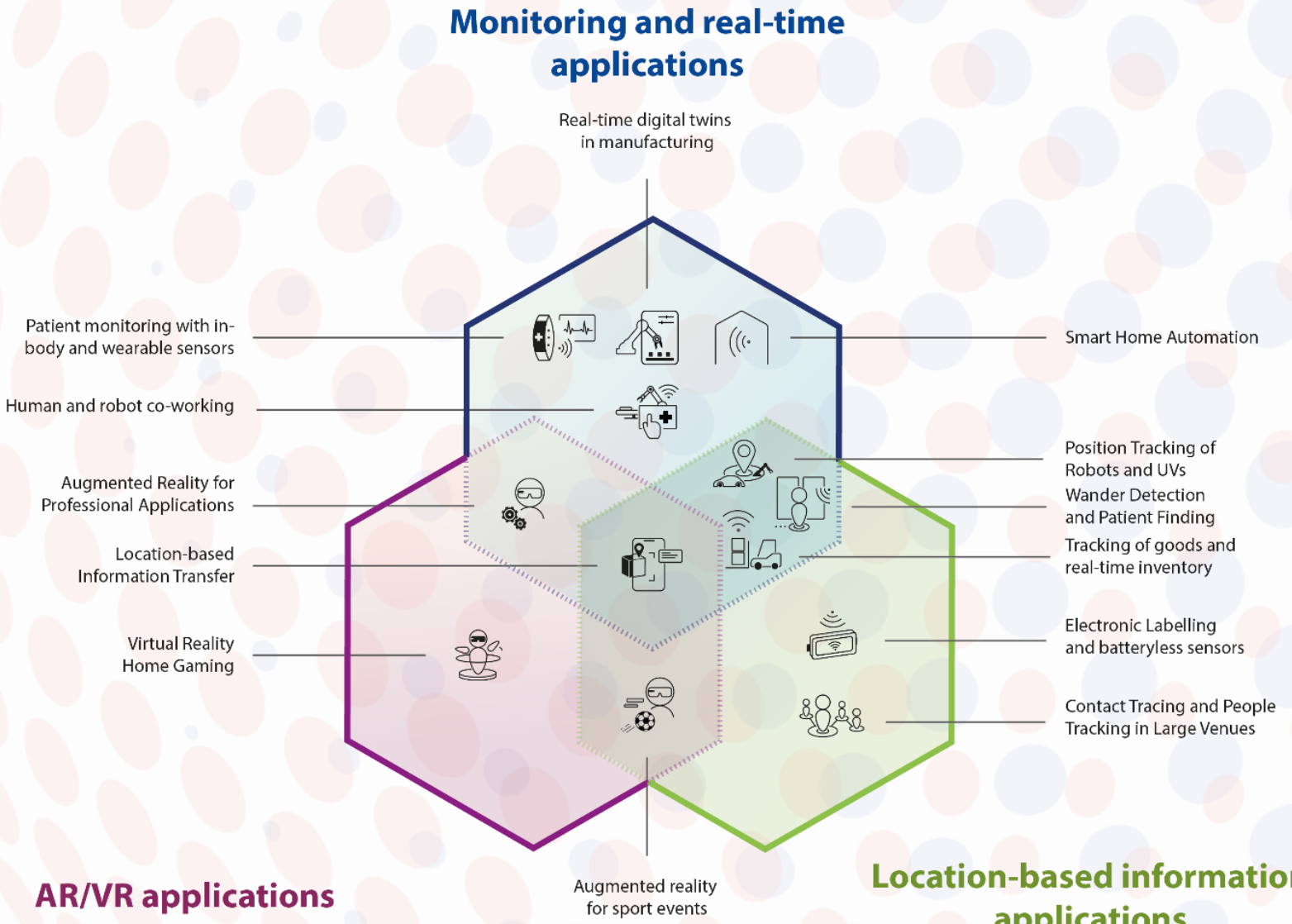
Open RAN – an alternative to Huawei-reduction of tech dependency?

- Market entry remains high: expertise and capital intensive
- Uneven playing field: tax breaks, soft loans, cheap loans for customers incl. export, shielded domestic market…
- O-RAN Alliance: 36 members headquartered in China – 2/3 have state ownership (6 are public institutions)
- US BIS Entity List: Inspur, Kindroid, Phytium, H3C
- US Treasury OFAC sanctions: China Mobile, China Telecom, China Unicom
- 16 O-RAN Alliance members have publicized links to the Chinese security apparatus (ZTE, Sichuan Huihou, Grentech, HGTech, Nanjing Haojun, SageRAN, Spider Radio, Sunwave, Tsinghua University and H3C)
- China Mobile: veto power, supervised by MIIT, involvement in PLA activities in the SCS, 2016 MoU with PLA

Open RAN – an alternative to Huawei?

- Open RAN – increasing network security?
  - Access to information in the Open RAN community: O-RAN software community is problematic – code review is undoable, requires trustworthiness
  - Vulnerabilities resulting from deployment: high degree of virtualization increases complexity and potential attack surface
- Open RAN and vRAN are promising technological developments, but:
  - Not solving the geopolitical challenge
  - No alternative to Huawei
  - Europe has good single vendor alternatives: Ericsson, Nokia

6G: new drivers need better networks still



EU R&D programs in progress