



Industrial Perspective on 6G

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Our Requirement for 6G: 6G needs to be an evolution of 5G

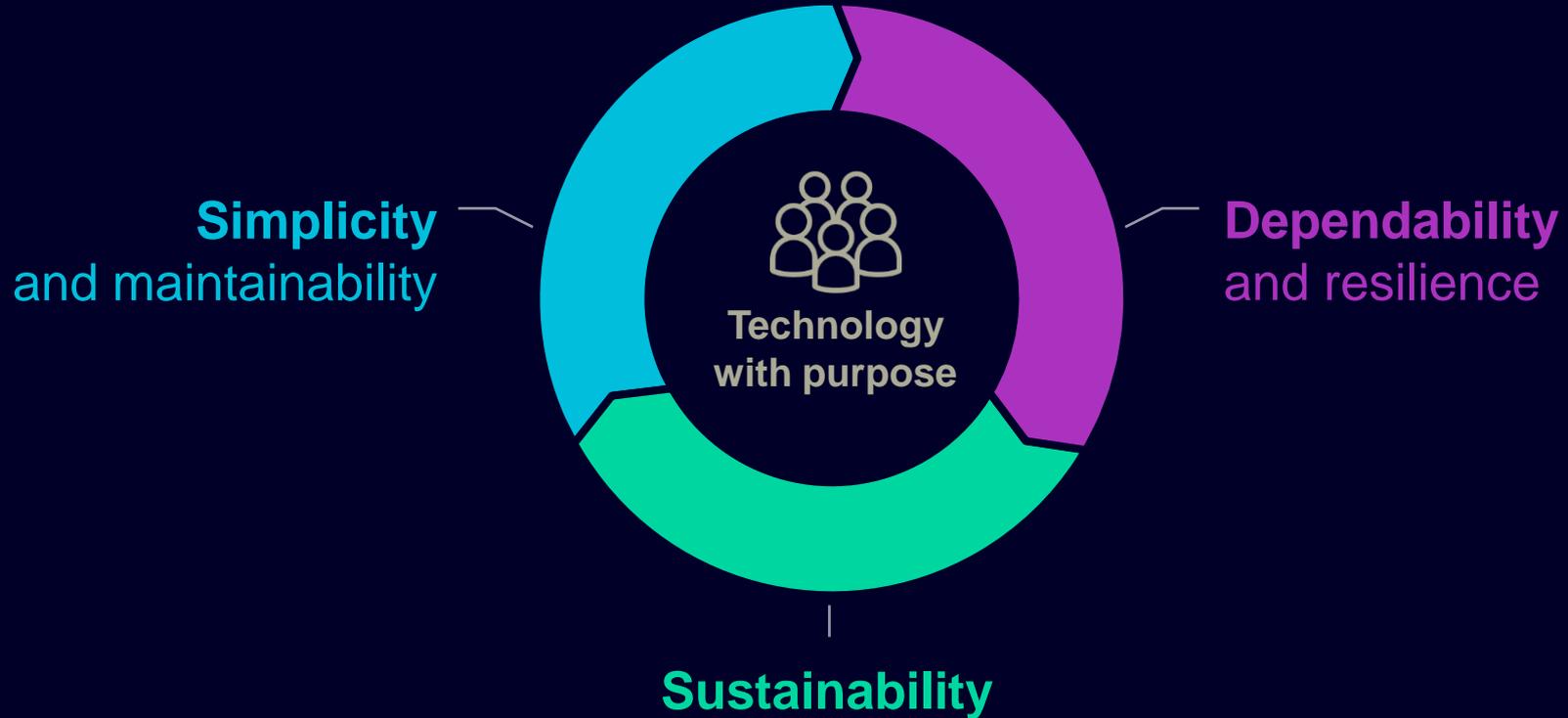
6G needs to be an evolution of 5G

- Protect investments and deployments in 5G of industrial users
- Much longer lifecycles in industrial manufacturing (15-20 years or more) than the usual 10 years for mobile network generations
- Backwards-compatible solutions
- Industrial 6G has to be considered from the very beginning



Our Focus for 6G:

Ensure applicability and integration in industrial contexts



Simplicity and maintainability

Focus on industrial campus networks



Reduced Complexity

AI-driven network management,
Tailor-made functionality

**Tailor-made
functionality**



Private Networks

Standalone Non-Public Networks / Campus Networks,
Privacy and URLLC performance, Integration into
existing industrial communication

**Private Networks
(NPN) important
also in 6G**



Modularity and Extensibility

Disaggregation, New operating models,
Virtualization and softwarization

**Well-defined
interfaces**

Dependability and Resilience

Industrial requirements and functionality



Use Cases and Requirements

Continuous support of 5G use cases and their requirements
Improved scalability and operational reliability expected for 6G networks,
Subnetworks, distributed mechanisms, network functionality at the device/UE

**Forward TS 22.104 into 6G
with improved scalability
and operational reliability**



Industrial 5G/6G/...

Integration into IT/OT landscape
Evaluation in industrial use cases
6G needs to be an evolution of 5G

**Integration in industrial
communication networks**

Sustainability

Sustainable 6G and 6G for Sustainability



Energy Efficiency

Energy-efficient network operation
Energy-efficient end devices

**Energy Efficient
Mechanisms**



Evolution from 5G to 6G

Protect investments and deployments of industrial users in 5G by new functionality via software updates, maintaining compatibility to 5G, no hardware exchange necessary.
New access technologies, e.g., NTN

**Evolution
from 5G to 6G**



„Enablement“-Effect

More efficient processes and utilization of resources in different industrial domains to support a circular economy

**Listen to
Vertical Users**

NTN: Non-terrestrial Network

Industrial 5G/6G Use Cases

Industrial 5G use cases are also applicable for 6G



Flexible Modular Assembly Area

Communication of mobile assets (AGVs, mobile robots, ...)

Private networks/SNPN/Campus Networks



Industrial Automation

Wireless communication between PLCs and devices

Private networks/SNPN/Campus Networks



Industry 4.0: Flexible Manufacturing

Dynamically configured production processes, in a distributed manner, mobility

Private networks/SNPN/Campus Networks



Smart Grid and Energy Automation

Distributed energy automation, control, and switching

Forward TS 22.104 into 6G – with improved scalability and operational reliability

Key 6G technology enablers

built on existing industrial 5G / IIoT functionality

**Subnetworks and support
for direct communication**



**Utilization of AI and
decentralized intelligence**



**Joint communication and
sensing and digital twins**



New 6G features built on existing industrial 5G/IIoT functionality may trigger new use cases for industrial verticals



Subnetworks and support for direct communication

Non-Public Networks (private, localized networks, campus networks)

Local direct connectivity (URLLC/industrial) for cooperative robots and subnetworks

Resiliency with infrastructure-less options, Non-Terrestrial Networks, ...



Utilization of AI and decentralized intelligence

AI in network management and operation of the network

Ensure efficient handling of AI workloads of external third-party AI applications (decentralized training, efficient local training, aggregation, privacy)

Distributed, decentralized mechanisms (e.g. for configuration of communication streams, end devices initiate communication)



Joint communication and sensing and digital twins

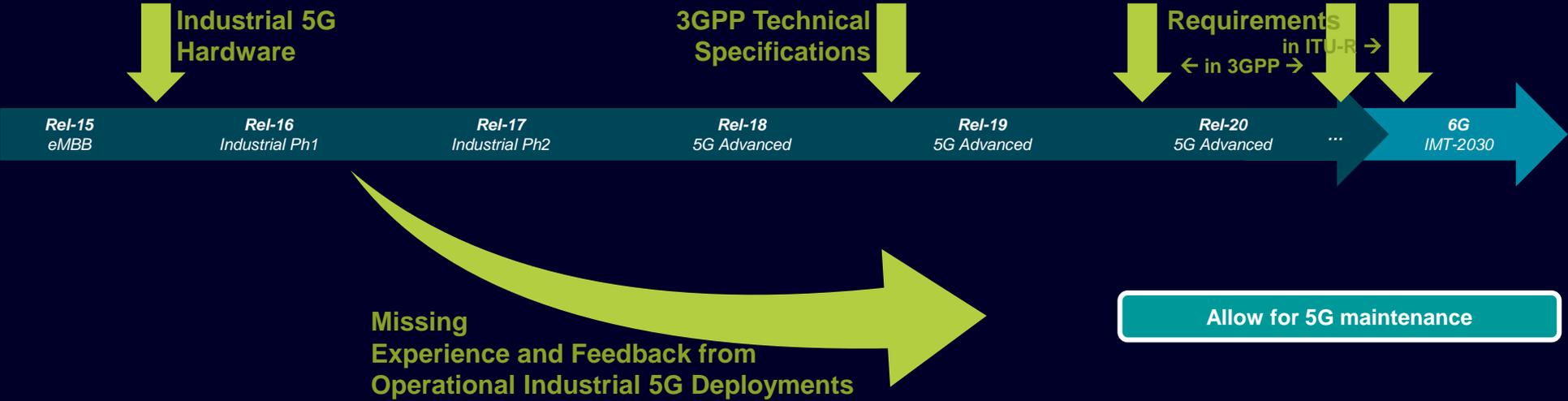
JCAS as sensor and input device

Support of transmission of Digital Twin data

Enable utilization of network digital twin for adaptive, forward-looking operation and network management

Industrial 5G | Where are we today?

Industrial 5G Reality – the Hardware-Specifications-Requirements Gap



Simplicity, Dependability, and Sustainability

Ensure smooth evolution from 5G to 6G for seamless and flexible applicability in OT environments

6G must be an evolution → 5G deployments need to be able to evolve into upcoming next generation technology

- ongoing and upcoming investments of industrial users in 5G applications, equipment, and infrastructure must be protected (lifetime 15-20 years or more)
- longer innovation cycles in several vertical domains

Industrial 5G requirements and use cases are carried forward into 6G – they are still applicable (improved scalability, operational reliability). New features may trigger new use cases for Industrial IoT.

6G needs to focus on adaptability and simplicity in industrial contexts. 6G must offer flexibility in spectrum use, network deployment, and operating models.

Industrial 6G / IIoT has to be considered from the very beginning.

... and do not forget to continue **progressing 5G further!**



Flexible Modular Assembly Area
Communication of mobile assets (AGVs, mobile robots, ...)



Industrial Automation
Wireless communication between PLCs and devices



Industry 4.0: Flexible Manufacturing
Dynamically configured production processes, in a distributed manner, mobility



6G in 3GPP



- 📶 6G needs to be an evolution of 5G
 - Ensure smooth evolution from 5G to 6G for seamless and flexible applicability in OT environments
 - Be considerate towards
 - current state of 5G/6G in vertical domains (hardware-specifications-requirements gap) and
 - their much longer lifecycles (15-20 years or more)
- 📶 3GPP has to develop an overall 6G vision
 - Covers all relevant use cases and domains over multiple releases
 - Pro-actively trigger contributions to achieve this 6G vision
- 📶 Industrial 6G / IIoT needs to be considered from the very beginning (first release)
- 📶 Forward TS 22.104 „Service requirements for cyber-physical control applications in vertical domains“ into 6G
 - Industrial 5G use cases are also applicable for 6G (improved scalability, operational reliability)
- 📶 Traceability of Requirements
- 📶 Allow for extensive 5G maintenance
 - Experience and feedback from operational Industrial 5G Deployments (Rel-16+) is still missing



Thank You!