AIOTI
ALLIANCE FOR INTERNET OF THINGS INNOVATION

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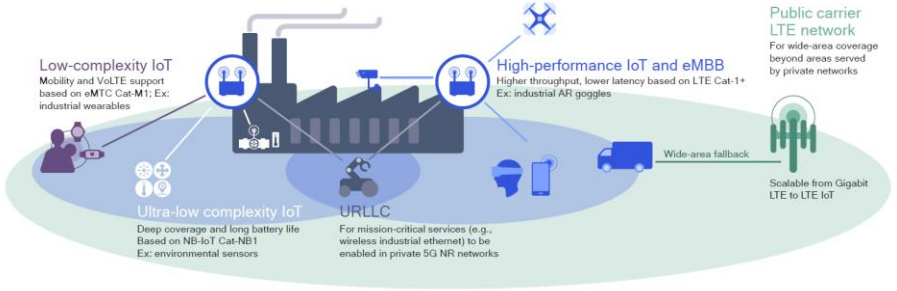
IoT International Symposium 2018

Smart IoT Acceleration Forum, Tokyo
9th March 2018

Session2: Discussion about the needs for IoT and wireless technologies in the production site and the direction of international collaboration



***"Impulse:** On the Importance of Industrial Wireless Communications"*

The Impact of Industrial Wireless Communications

Motivation: Wireless Needs and Issues – Risks and Opportunities

IoT and Wireless Technologies in the Production

Images: BOSCH

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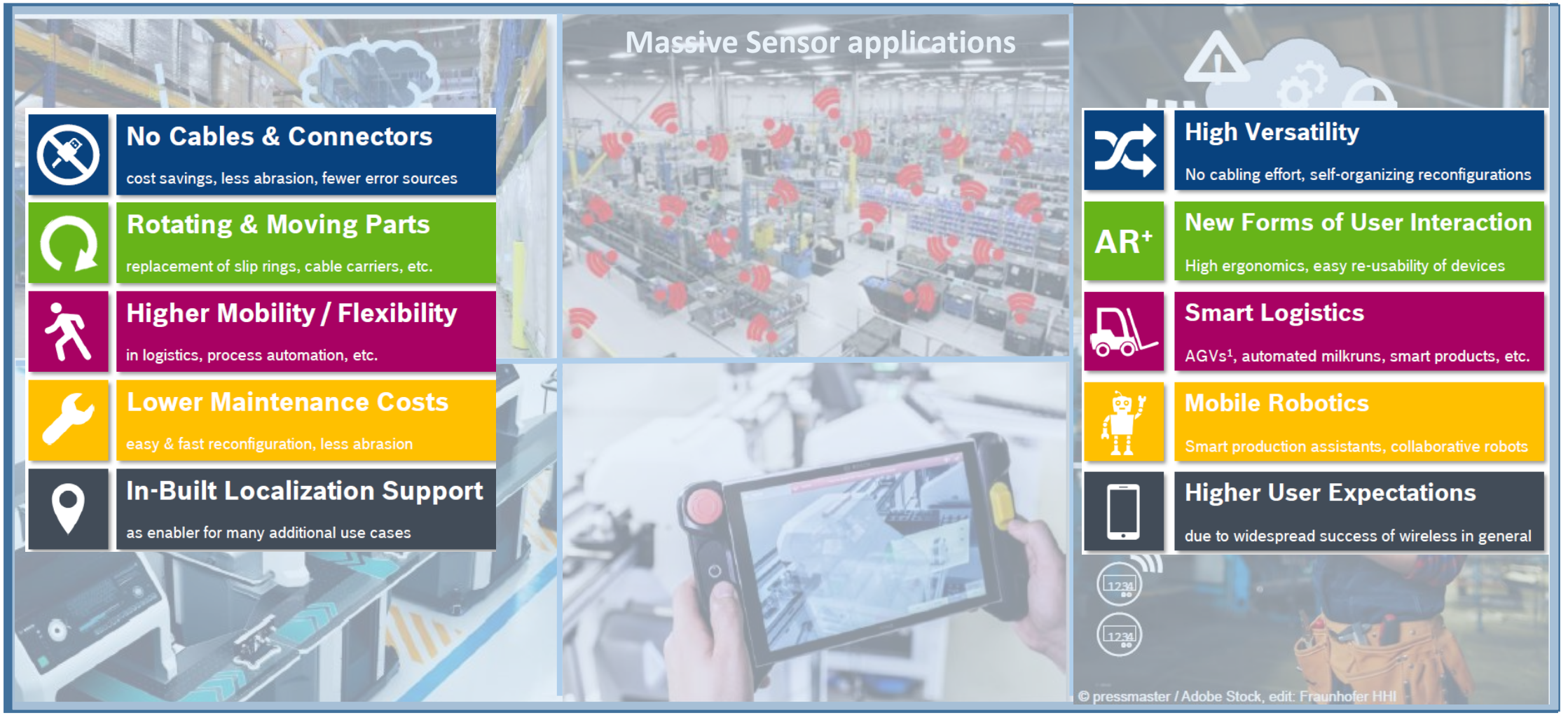
IoT and Wireless Technologies in the Production



Images: BOSCH

Motivation: Wireless Needs and Issues – Risks and Opportunities

IoT and Wireless Technologies in the Production

IIoT and wireless technologies promote new conceptual thinking including secure cross-domain, cross-manufacturer, cross-country and cross-continental communication

Digitisation encourages a massive change in production facilities and processes over the next five years.

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Comparison of Industrial Wireless Communication Technologies

Comparision of Techologies (1)

Industrial Wireless Communications

Wireless LAN

- WLAN as the dominant wireless technology today
  → widely used in factories, but mainly for non-critical communication (e.g. laptops)
- Next WLAN generations are on the doorstep:
  - **IEEE 802.11ax (2.4 / 5 GHz)**
    → OFDMA, MU-MIMO, 1024-QAM as main innovations, expected in 2019
  - **IEEE 802.11ay (60 GHz)**
    → channel bonding & MU-MIMO, peak data rate ~176 Gbps, expected in 2017
- Major challenge of WLAN: Shared spectrum
  → hard real-time & low latency hard to achieve

DECT-2020

- DECT has been popular in the past for:
  - Cordless telephony
  - IoT / Smart Home Connectivity (DECT ULE)
- **Special property: Own spectrum**
  → 1880 – 1900 MHz in Europe
- DECT-2020 as the next major DECT version, targeting at IMT-2020 / URLLC[1]
- Selected target KPIs[2] (cf. IMT-2020):
  - 1 ms latency
  - 99.999% link reliability
  - up to 100 Mbps
  - Seamless mobility
  - up to 1 Mio. devices / km²

Ref: BOSCH

Comparision of Techologies (2)

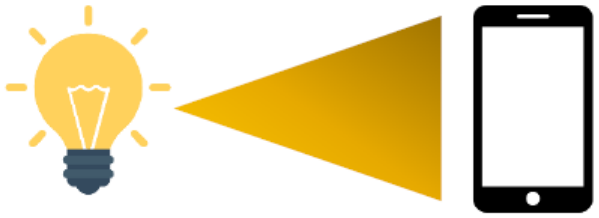
Industrial Wireless Communications

5G

- 5G is coming quickly & massively and promises to be the Holy Grail of (wireless) connectivity
- Strong focus on machine-type communication with three main flavors:
  - Enhanced mobile broadband
  - Ultra-reliable low-latency communication
  - Massive machine-type communication
- 5G is more than wireless: Multi-access edge computing, network slicing, localization, etc.
- Open issue: Who may operate 5G networks in a factory? → **"Private" 5G networks**

Visible Light Communication (VLC)

- Communication using visible light, mainly using LEDs at the TX and photo diodes at the RX side
- Signal blockage by walls and other objects is good and bad at the same time:
  - Intrinsic security enhancement ☺
  - Coverage & reliability is challenging ☹
- Data rates up to several Gbps / wavelength, a lot of bandwidth available – globally
- Outdoor coverage + realization of uplink as major challenges



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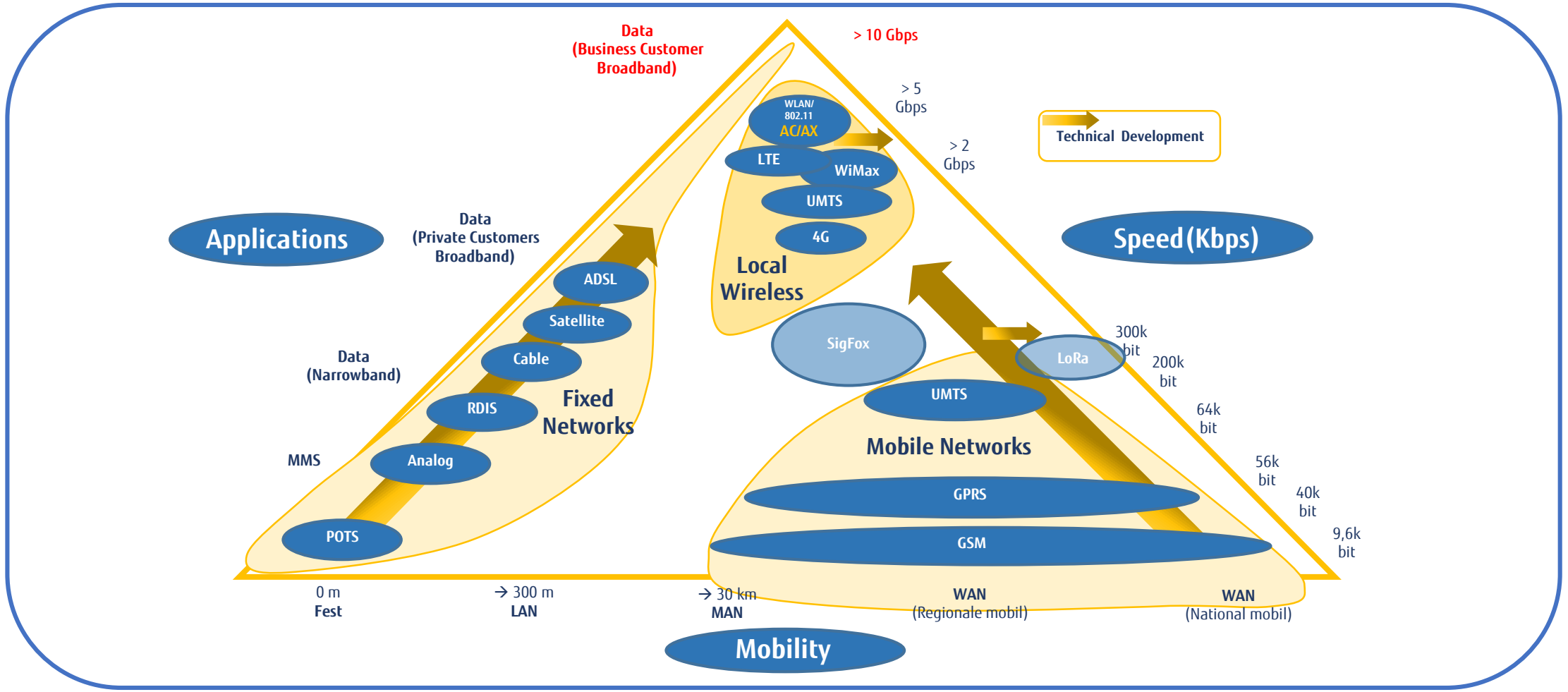
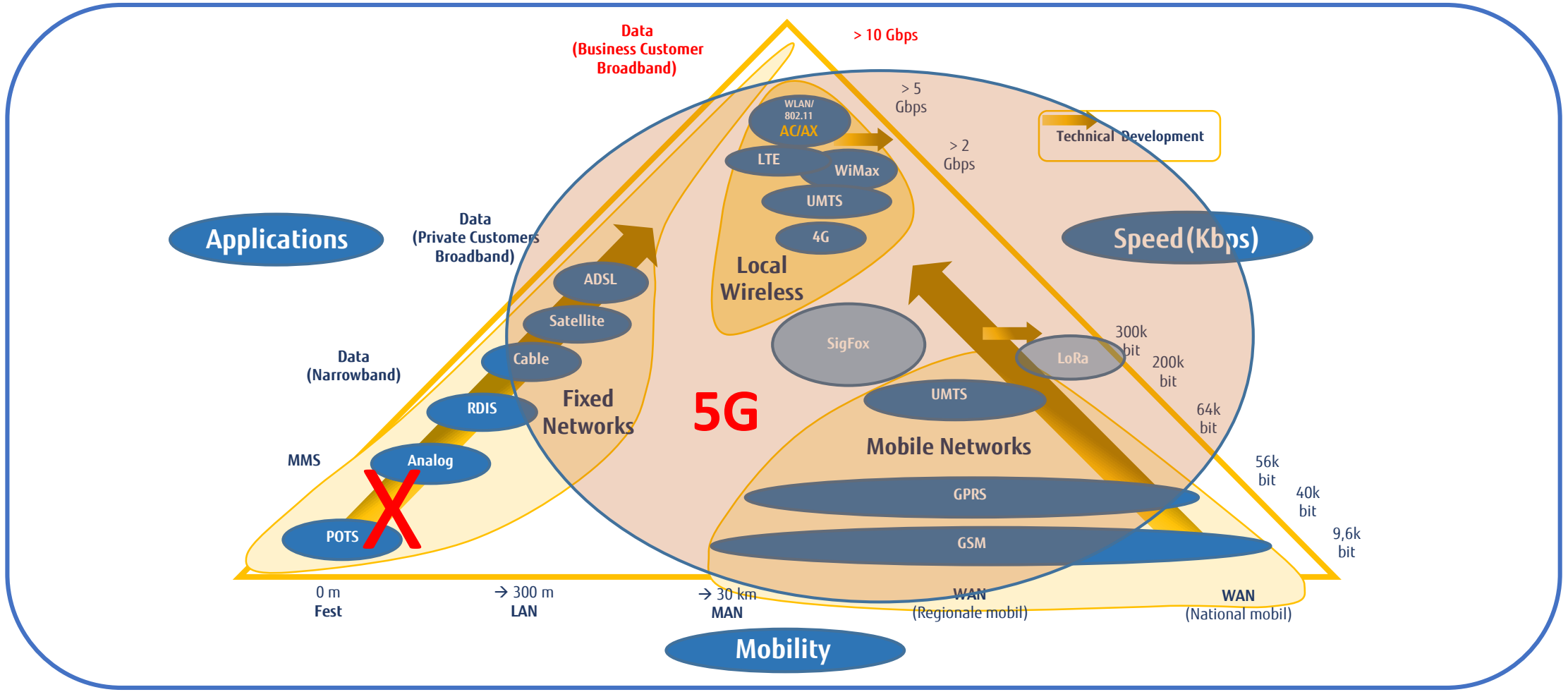
Network Technologies

Today's Network Technologies



Source: HARTING Stiftung & Co KG

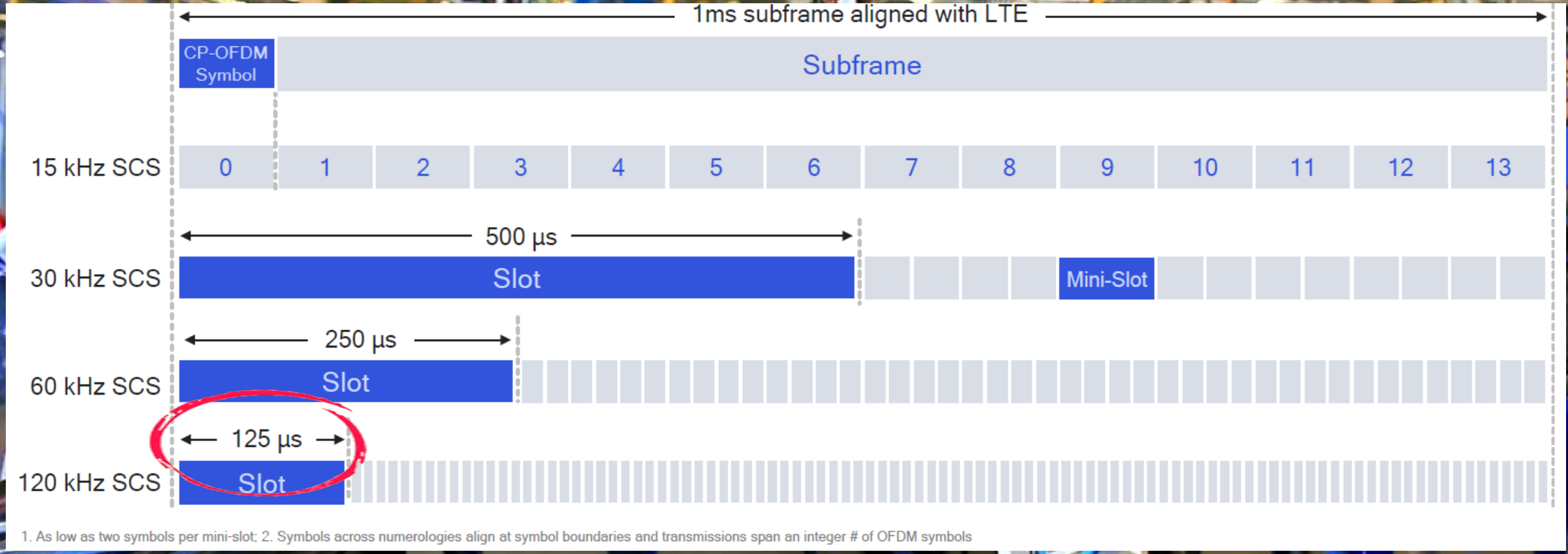
5G – Joining The Network Technologies



Source: HARTING Stiftung & Co KG

The Magic of 5G in Industrial Wireless Communication

Next Steps in Production



1. As low as two symbols per mini-slot; 2. Symbols across numerologies align at symbol boundaries and transmissions span an integer # of OFDM symbols

Security camera

Edge computing and analytics

5G based Production

Takeaways

- Private 5G networks encourage next Industrial Revolution
- Cutting the cord:
  Wireless Industrial Ethernet enables Reconfigurable Factories
- Enabling new use cases:
  Such as operators using Augmented Reality (AR)
- Leveraging big data analytics:
  Edge analytics of massive real-time data collection increases productivity

Many thanks for your patience
Q & A to follow

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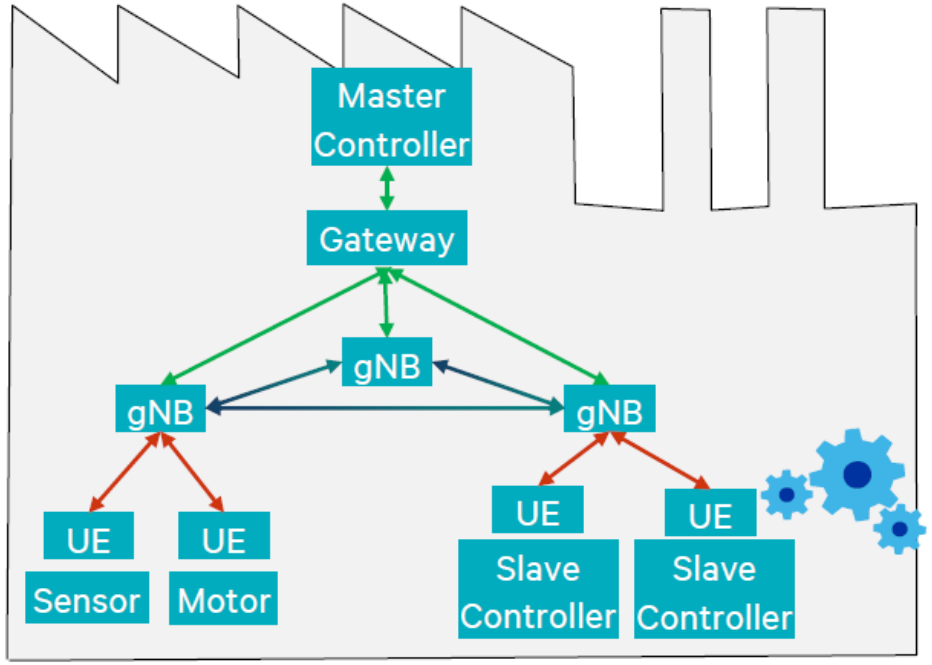
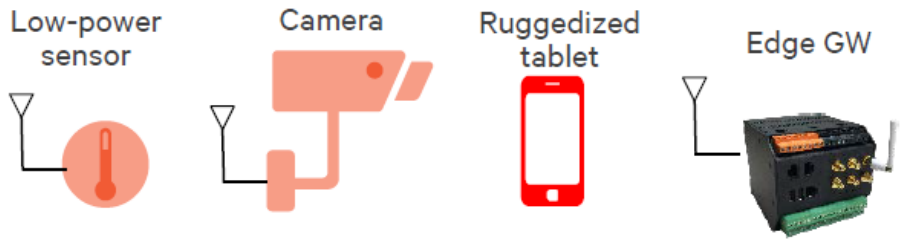
BACKUP

Factory Scenarios for Connectivity and Requirements



Key Requirements for factory automation

- Small application payload
- Deterministic, synchronous traffic pattern
- Stringent latency, jitter and error bounds
- Large number of devices per controller and many controllers in a facility
- Fast shadowing and high intercell interference



Other than real-time factory automation, various factory applications will also be served by 5G NR system

Industrial Wireless Communications

Comparison of Major Candidate Technologies

	Wireless LAN	DECT-2020	5G	VLC
Ultra-Low Latency	Hardly Possible (LBT[1], shared spectrum)	Yes	Yes	Yes
Ultra-High Reliability	Hardly Possible (shared spectrum)	Not clear yet	Yes	In controlled environments possible
High Data Rates	Yes	No	Yes	Yes
Seamless Mobility Support	No	Yes	Yes	No
Private Networks (w/o Operator)	Yes	Yes	Not clear yet	Yes
Worldwide Availability	Yes (esp. 2.4 GHz)	Important regions are missing (e.g. China)	Yes	Yes
Price Tag	Reasonable	Reasonable	High	Probably High

Ref: BOSCH