Fraunhofer UWIN - Wireless real-time connectivity on sensor/actuator and field level

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UWIN – Ultra Low Latency Wireless Industrial Network

Current challenges for industrial networks

Mobility

Control of sensors, actuators and other automation components located on movable subsystems

Reliability

Reliability of Ethernet bus systems as a benchmark

Interference-free coexistence with other radio technologies has to be ensured

Real-time wireless communication

Low-latency connection with cycle times of less than 1 millisecond between radio systems and superordinated control unit

(open-/closed-loop)

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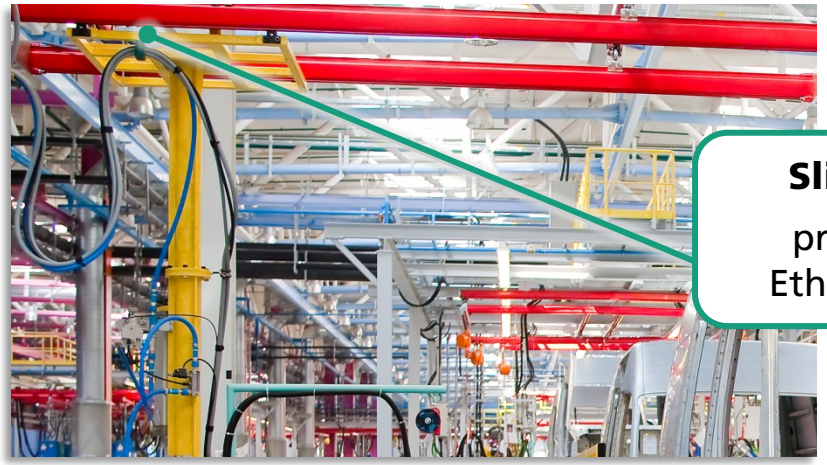
Drawbacks of wired communication systems



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Slide contacts:

problematic for Ethernet bus systems

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Cable drag and rotary feedthroughs:

risk of cable break and limited mobility

Consequences for conventional wired communication systems

- ➔ Unflexible, maintenance-intensive, space-wasting, difficult to retrofit
- ➔ Not suitable for flexible production concepts (e.g. distributed collaboration systems, smart factory)
- ➔ Many novel use cases are only realizable with wireless connections

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Benefits of wireless industrial communication

Higher flexibility	due to unrestricted motion trajectories
Improved process dynamics and accuracy	due to weight reduction
Higher process quality	due to additional sensors and actuators
Easy installation	due to reduced space requirements
Better investment protection	due to cost-efficient possibilities for retrofitting and expanding industrial facilities
Integration of customer-specific interfaces	due to simple adaptability to industrial environments

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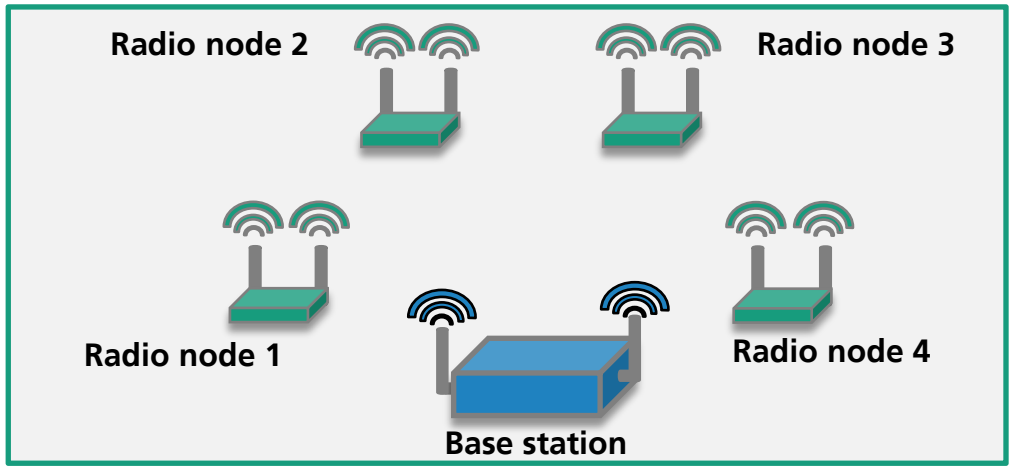
The reliable real-time radio system

UWIN – Ultra Low Latency Wireless Industrial Network =

Real-time radio system for connecting movable and remote machine components to time-critical control systems

- Radio system with Base Station and several Radio nodes
- Isochronous transmission with a minimum guaranteed cycle time of 125 µs
- Wireless extension or even substitute for wired fieldbuses



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Improved connectivity for the Industry

- Real-Time Data Transmission over the air is necesary for the Smart Factory

  → Communication for Device to Infrastructure and Device to Device

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Unique technical features

UWIN – Ultra Low Latency Wireless Industrial Network =

Number of radio nodes: **6 – 100 I/O devices**	Cycle time: **125 µs – 10 ms**	Synchronism: **< 1 µs**
Packet error rate: **10^{-6}**	Telegram size: **≤ 35 Byte**	Range: **20 m**
Latency: **< 100 µs**	Frequency bands: **Focused on license-free bands**	

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Ideal for wireless industrial communication

Mobility

Wireless radio connection

- Connecting movable and remote machine components
- Spatial coexistence of different cells

Reliability

Ultra-reliable wireless communication and coexistence management

- Robust modulation and coding
- Frequency, time and spatial diversity
- MIMO capable
- Monitoring of link quality and frequency band
- Optimum channel selection

Real-time wireless communication

Isochronous data transmission: low-latency and short cycle time

- Synchronized with fieldbus/control
- No listen-before-talk
- Guaranteed quality-of-service (QoS)

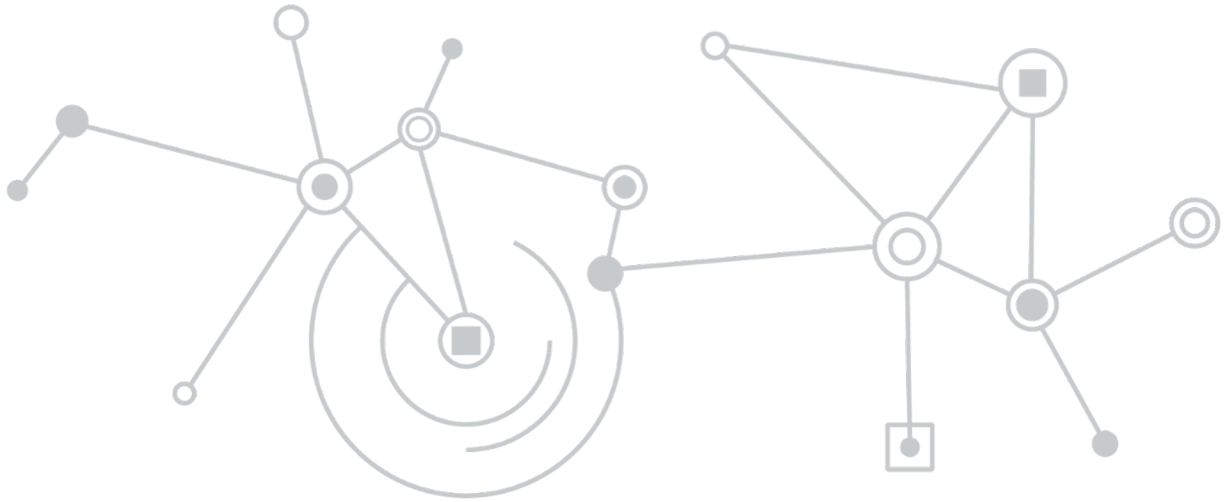
UWIN – Ultra Low Latency Wireless Industrial Network

Status quo and Way Forward

- Exibition at Hannover technology fair this year → Wireless connection between SPS Controller and motor for remote control applications in real-time
- First prototype installation in a drill in cooperation with industrial partners → Sensor conenection

Next Steps:

- Develop of a Evaluation Kit by end of 2020 and Standardization of UWIN
- Build of industrial and academical partnerships for further development of UWIN



Fraunhofer IIS Technologies for Chile

Activities in the field of 5G

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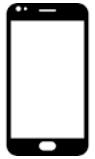
Summary of the Activities of Fraunhofer IIS in the field of Industrie 4.0

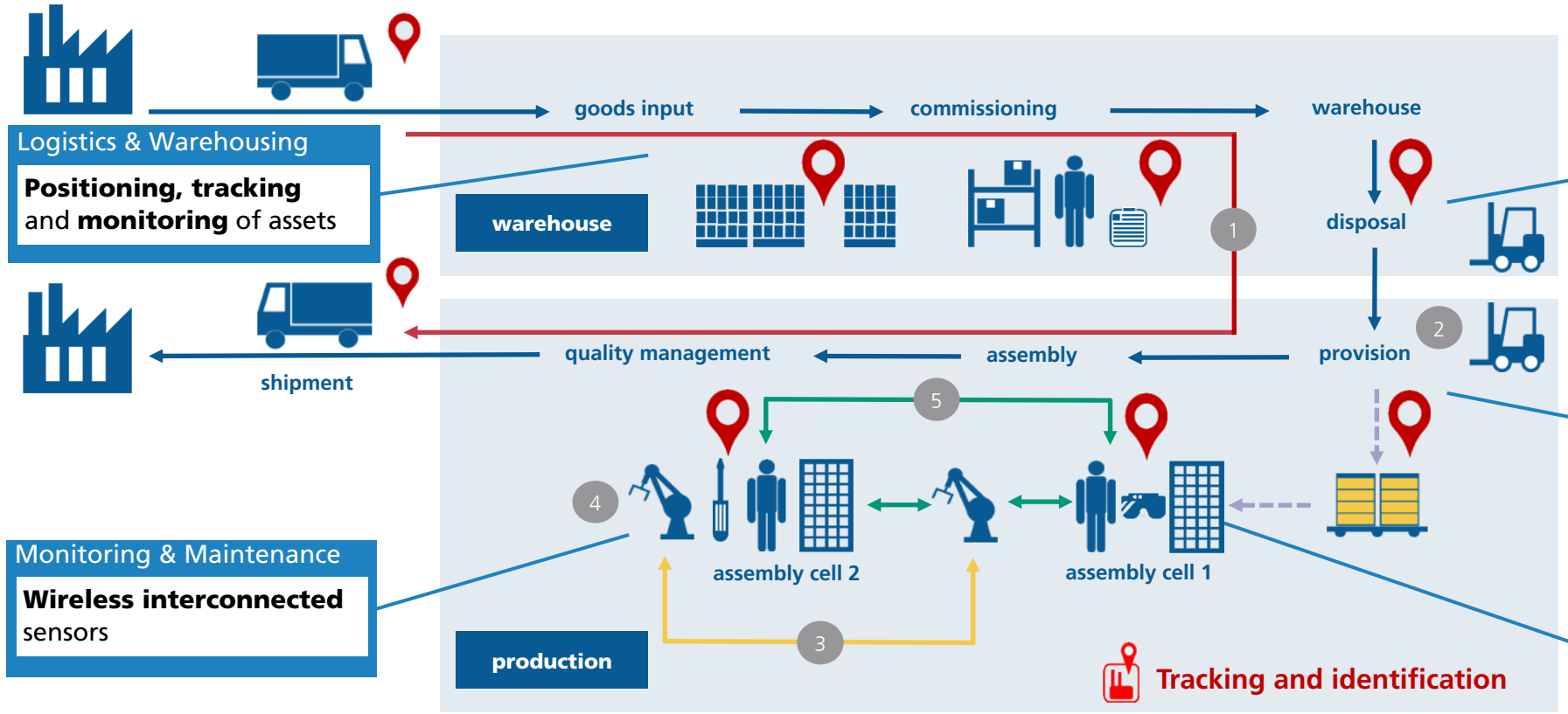
Development of wireless communication systems

Broadband IoT	Critical IoT	Massive IoT
 Drone/UAV	 Autonomous Driving	 Smart Metering
 VR/AR	 Robotics	 Predictive Maintenance
 Mobile Phones	 Smart Grid	 Facility Management
– High Throughput – Low Latency – Large Data Volume	– Ultra Reliability – Ultra-low latency – Very high availability	– Low Energy – Small Data Volumes – Massive numbers
LTE, 5G NR etc.	5G NR, UWIN (Fraunhofer) etc.	5G NR, MIOTY (Fraunhofer) etc.

Quelle: Fraunhofer IIS Research, Ericsson

Summary of the Activities of Fraunhofer IIS around Industrie 4.0

Technologies for 5G Applications - Testbeds



Logistics & Warehousing

Positioning, tracking and **monitoring** of assets

Monitoring & Maintenance

Wireless interconnected sensors

Process Automation

More than 100 000 measurement points within an area up to km² that need to be **wireless connected**

Factory Automation

Automated control, monitoring and optimization of processes and work-flows through wireless **communication** and **positioning**

Human-Machine Interfaces

Positioning and **communication** for HMIs like AR-applications

Massive IoT
1 Tracking and identification

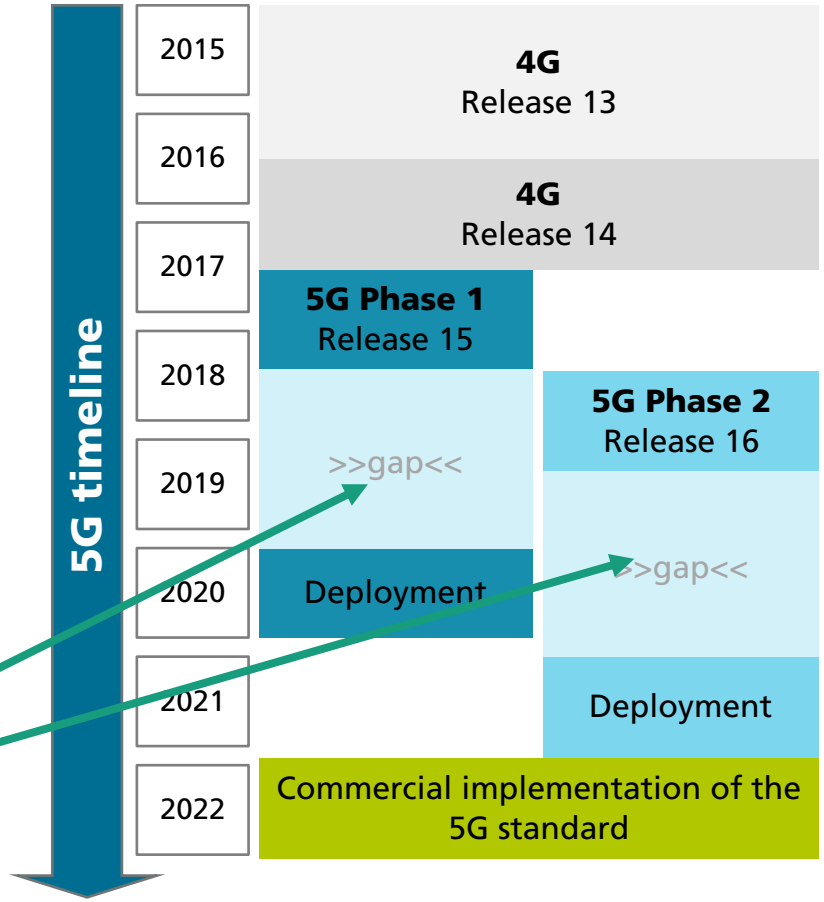
Critical IoT
2 Telecontrol of vehicles
3 Real time condition monitoring

Broadband IoT
4 Remote machine vision Remote operation & update
5 Human to human Machine to machine

Summary of the Activities of Fraunhofer IIS around Industrie 4.0
»From the virtual to the real world«

- Standardization of 5G is done by 3GPP
- Between the definition of new 5G-functionalities (»Release«) and their availability on the market (»Deployment«) is usually a gap in time
- Compared to large enterprises SMEs do not have the possibility to use this »gap« for systematic product development
- Foremost Release 16 consider Industry 4.0
- Test centers and test beds will cover this need

Solution: 5G Bavaria Initative



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5G Bavaria

Organizational Structure

5G test center

- The **simulation** and **emulation** of 5G technologies happens through virtual test environments at the 5G test center.
- Users get timely feedback on the **usability of their 5G application** and can therefore implement improvements earlier and develop prototypes.

5G test beds

- Development and operation **of 5G test beds** in different parts of **Bavaria**.
- The test beds purpose is to **test** a user's specific **use case** with actual 5G technology, allowing to **test the limits of 5G** – and all that before 5G is widely available.

5G cooperation projects

- R&D program „Informations- und Kommunikationstechnik Bayern"
- Funding for projects promising major innovation in the area of 5G
- Possible applications are e.g. Industry 4.0, Mobility, Energy, Smart City, …

5G Bavaria

Gefördert durch

Bayerisches Staatsministerium für Wirtschaft, Landesentwicklung und Energie

Summary of the Activities of Fraunhofer IIS in the field of Industrie 4.0
Standardization Efforts, Partnerships & Associations

- **IIS Participation in Standardization**
  - 3GPP 3rd Generation Partnership Project – Mobile Communications Standardization Body
  - ETSI European Telecommunications Standards Institute
  - IEEE Institute of Electrical and Electronics Engineers

- **IIS Memberships around 5G**
  - 5G ACIA 5G Alliance for Connected Industries and Automation
  - 5G AA 5G Automotive Association
  - 5G IA 5G Infrastructure Association
  - 5G Media Initiative
  - NGMN Next Generation Mobile Networks
  - Open Air Interface

Fraunhofer IIS – Communication Systems Division

Collaboration Opportunities

Contract Research for Clients from Industry

- Applied research
- Development services
- Test and validation

Collaborative Research with Partners

- Applied research and technology demonstrations
- e.g. funded by European Union and national funding bodies

Consulting Services

- Based on own research capabilities
- Support for decision makers

Patent / Technology / Product Licensing

- Flexible licensing options
- Worldwide

Contact Information

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