

PROVIDING 5G TECHNOLOGY SOLUTIONS

COLLABORATING IN 5G

Fraunhofer Institute for Integrated Circuits IIS targets the future of industrial communication in 5G networks with technologies for low-latency communication and high-precision positioning. Together with network operators, component vendors, and industry partners Fraunhofer IIS puts 5G technologies into application.

As an applied research organization Fraunhofer IIS provides 5G technology solutions by utilizing its research, development and engineering services across all phases of wireless technology development for industrial applications, including proof-of-concept demonstration and early adaptation.

In implementing upcoming 5G technologies our focus is on:

- Prototyping with software defined radio (SDR) platforms like OpenAirInterface
- Characterization and validation of components and systems, including over-the-air (OTA) testing facilities
- Simulation, evaluation, and validation techniques
- Collaboration in EU Horizon 2020 and other public programs

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5G – KEY ENABLER FOR INDUSTRIAL COMMUNICATION NETWORKS

5G AND INDUSTRIAL IOT



Manufacturing of complex and individualized products requires continuous operation of challenging automated factory workflows involving, e.g., decentralized production control. Important enablers for this kind of distributed systems are ubiquitous, seamless connectivity and real-time communication between machines in industrial environments. Establishing such systems increases flexibility and productivity because it allows for coordination and control of overall production processes. At the same time it creates a need for mobile machines which communicate and are positioned via wireless networks based on the instantaneous availability of data. Therefore, the reliability, latency, data rate and even positioning accuracy requirements on industrial communication systems are escalating continuously.

The upcoming 5G standard will be able to meet enhanced requirements as it targets latencies under one millisecond, data rates of up to ten gigabits per second, extremely high network reliability, and better accuracy in positioning. Thereby, 5G provides fast and reliable access to moving objects in order to achieve time-critical process control and optimization in industrial environments, which are not possible with today's cellular technology. As requirements vary according to the specific use cases, 5G New Radio (NR) will provide a flexible air interface allowing for scalable bandwidths, data rates, latencies, and positioning accuracy levels.

SEAMLESS INTERACTION BETWEEN MACHINES

LOW-LATENCY COMMUNICATION

Ultra-Reliable and Low-Latency Communication (URLLC) is a key enabler for seamless interaction between machines in time-critical applications.

Industrial applications require a reduction of communication latency while simultaneously guaranteeing an extremely high level of reliability. All layers of the communication system need to be optimized starting from physical layer by scaling down the transmission time and enhancing reliability through increased redundancies. Upcoming LTE releases use a shorter version of the transmission time interval (sTTI) and apply enhanced functionality for higher reliability (HRLLC). 5G NR will introduce increased subcarrier spacing resulting in shorter transmission slots and a shorter HARQ round-trip time enabling higher reliability. Complementarily, more effort in both LTE and NR is invested to further reduce the processing time required in the upper layers of the protocol stack.

Fraunhofer IIS is focusing on providing solutions for reducing the total latency and increasing the reliability of wireless communication systems to meet the stringent time requirements in industrial environments.



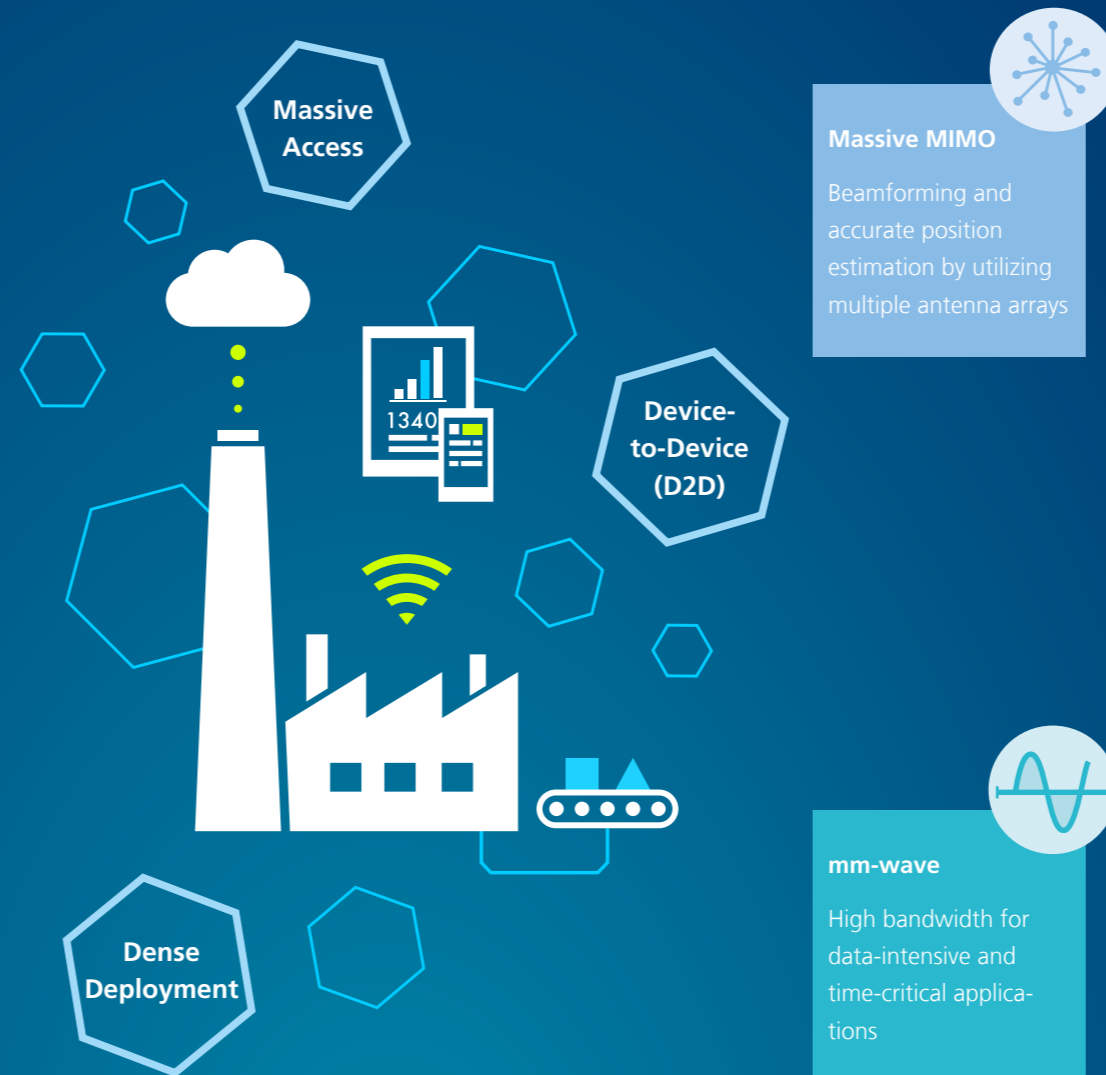
Mobile Edge Computing

Reducing system latency for real-time applications



URLLC

Ultra-reliable low-latency communication



Massive MIMO

Beamforming and accurate position estimation by utilizing multiple antenna arrays



mm-wave

High bandwidth for data-intensive and time-critical applications

PIONEERING POSITIONING PERFORMANCE

HIGH-PRECISION POSITIONING

With location awareness becoming an essential feature of many new markets, positioning is consequently considered as an integral part of the system design of 5G mobile networks. Increased contextual awareness of goods, parts, machines and workers enables an unprecedented degree of interaction and collaboration.

Therefore, Fraunhofer IIS is working on advanced accurate positioning technologies to provide flexible solutions for diverse positioning use cases with varying requirements. Novel approaches for sub-meter accuracy allow for tracking of mobile devices in indoor and urban areas when traditional approaches like GNSS are not accurate enough or not available.

The 5G positioning framework will integrate a multitude of sensors based on both, cellular signals and 3GPP independent techniques. 5G NR allows for a groundbreaking positioning performance by providing high bandwidths for precise timing, new frequency bands at mm-wave, massive MIMO for accurate angle of arrival estimation and new architectural options supporting especially positioning. Improved levels of accuracy, robustness and latency can be achieved to meet all the new application requirements that cannot be realized today.