*Technical Article*
The Gap in Wireless Communications: Ultra-reliability and Low Latency

TEXAS INSTRUMENTS

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During the last few decades, wireless communications have evolved to enable more and more applications, including the Industrial Internet of Things (IIoT). This evolution has corresponded to the needs and interests of industrial players, who seek to modernize factories. For instance, low-power wide-area (LPWA) networks enable the gathering of tons of non-time-critical data coming from sensors all over the factory, while Wi-Fi® enables the remote management and monitoring of production facilities.

There is an area, however, in which wireless communications have made only modest progress. Available wireless technologies are not yet ready for machine-to-machine (M2M) communications where low latency and ultra-reliable communication patterns are required.
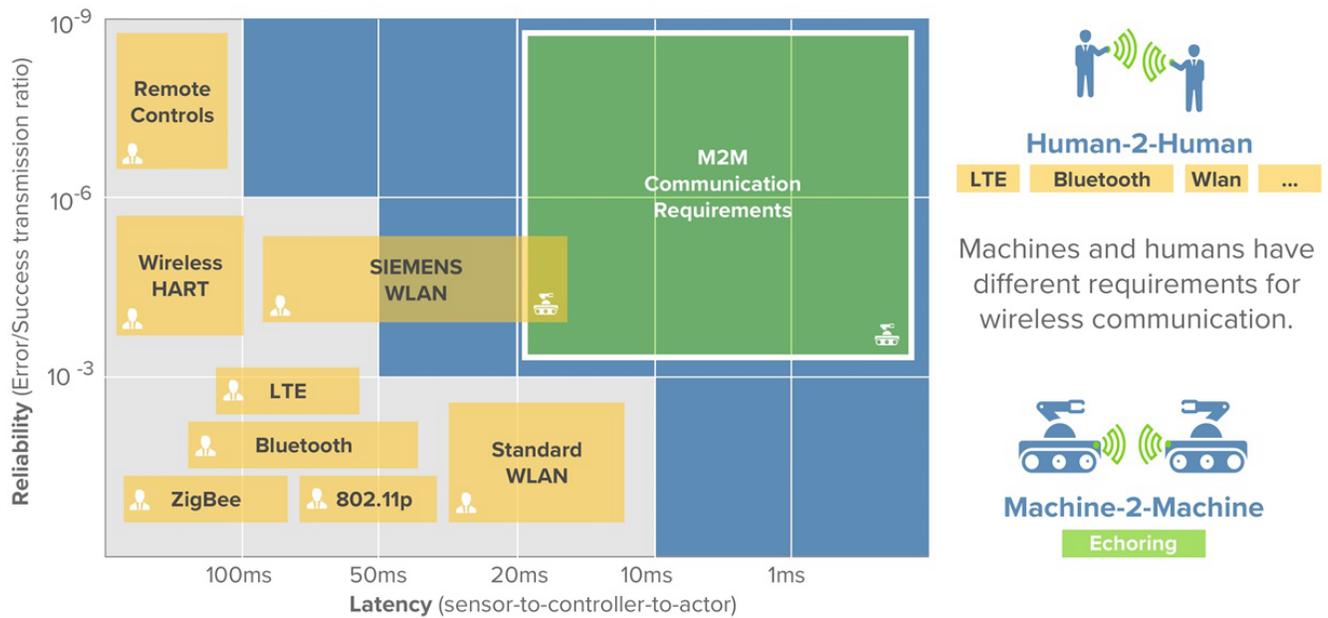
**Figure 1. Limitations of Available Wireless Technologies**

The applications that require such a communication behavior (ultra-reliable and low latency) include human-machine interfaces (HMI), robotics and intralogistics applications. Besides, applications typically need to fulfil functional safety requirements to protect human workers. To comply with these rules from a technical point of view, communication features such as ultra-reliability and low-latency are indispensable as well. In tomorrow's factories, all industrial assets interact with each other and need to coexist with human workers. For this to happen, wireless communications is required. However, the performance requirements of these described industrial applications with respect to reliability and latency are challenging to meet.

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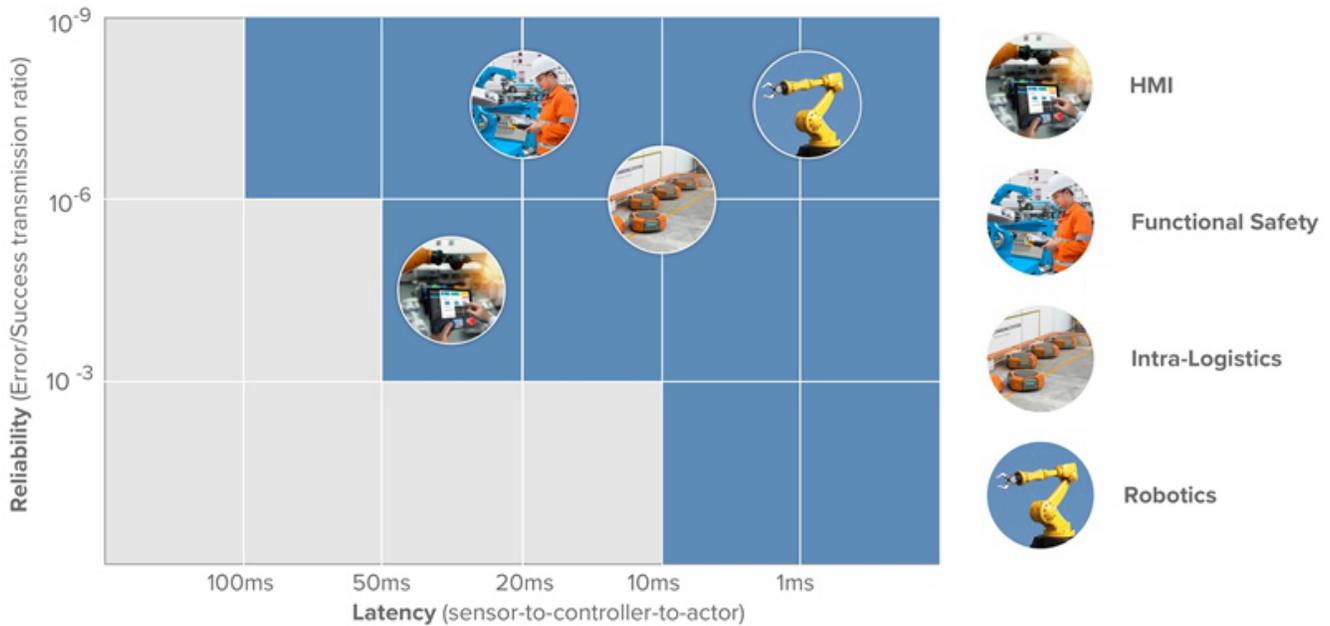
Figure 2. Performance Requirements of Selected Industrial Applications

With all of this in mind, R3 Communications has developed EchoRing, the first deterministic wireless communications technology that meets the demands of the highest requirements in M2M communications. EchoRing, for those familiar with the Open Systems Interconnection (OSI) model, is a media access control (MAC) technology that enables deterministic access to the wireless medium, avoiding packet collisions within the local network and minimizing interference effects. R3 Communications has built a product portfolio around EchoRing, offering different solutions depending on the required performance, ranging from basic to expert.

R3 Communications adapted the EchoRing technology to work as an updated firmware on the WiLink 8 device with a seamless driver integration to the operating host system. The WiLink 8 device works with high-performance processors as the host. However, TI offers a broader range of central processing units (CPUs) which can also easily connect to the TI WiLink 8 module. The following figure gives a simplified overview of the system architecture.
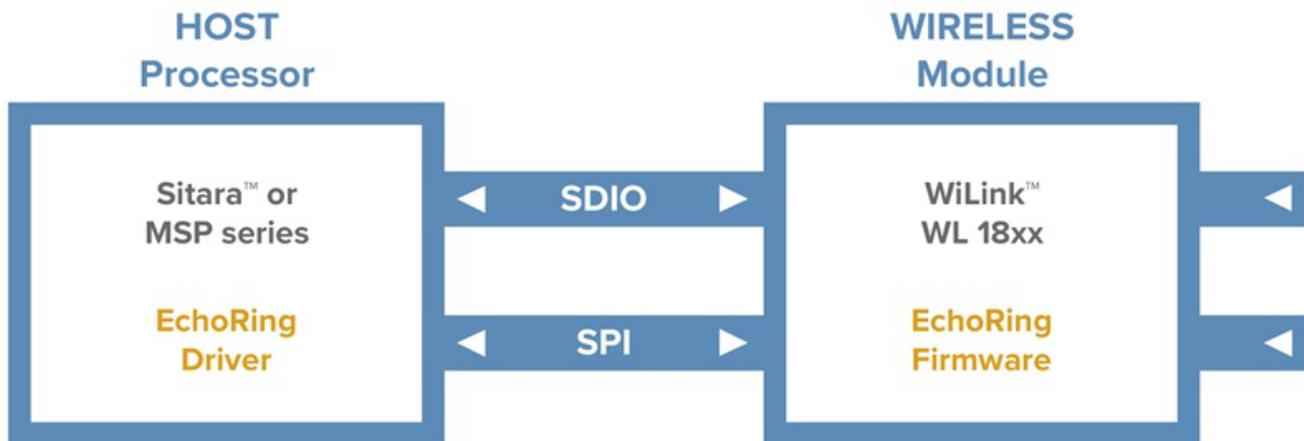
Figure 3. Simplified System Architecture

Flexibility plays the crucial role in the future of manufacturing and therefore requires high-performing wireless technologies. The availability of EchoRing technology enables the continuous transformation of industrial automation. Smart factories are arising and requiring the next generation of wireless connectivity. Smart manufacturing systems transform static production setups, where wireless communications is one primary enabling technology
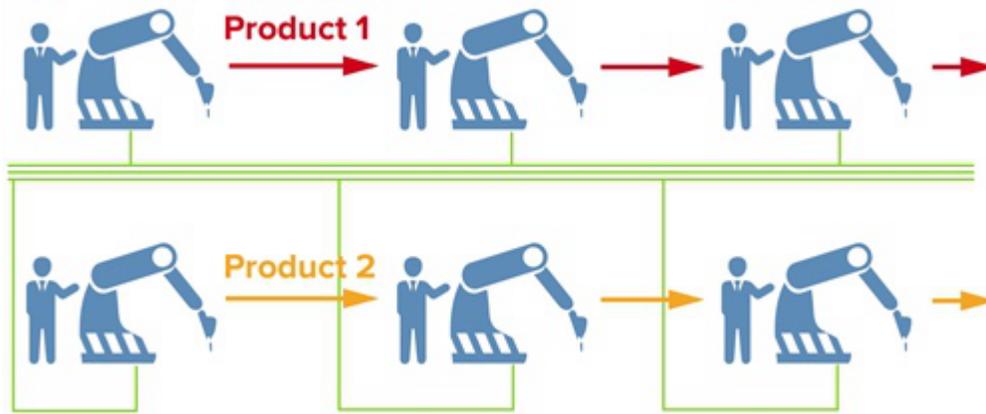
Figure 4. Manufacturing Today: Static Product Setup

Figure 5. Manufacturing Tomorrow: Smart Manufacturing Systems

The EchoRing evaluation kit is now available with the EchoRing software from R3 Communications. The primary purpose of the evaluation kit is to evaluate the performance of the EchoRing system in industrial environments based on a real-time evaluation software for measurement campaigns (e.g. Profinet over EchoRing).

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