

Revolutionizing Industrial Connectivity: Cumucore Brings TSN to 5G

Cumucore is transforming industrial automation with Time-Sensitive Networking (TSN) over 5G, delivering wireless connectivity as reliable as wired networks.

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/EINPresswire.com/ -- Traditional Ethernet solutions ensure precise timing but limit mobility, while Wi-Fi lacks determinism. By integrating TSN capabilities into 5G private networks, bridges the gap—offering ultra-low latency, high reliability, and real-time synchronization essential for Industry 4.0.



The first deployment, developed in partnership with Intel and Kontron, has already demonstrated sub-50 microsecond time synchronization, paving the way for smart factories, autonomous guided vehicles (AGVs), process automation, and real-time AR applications. As industries demand flexibility, efficiency, and digitalization, TSN over 5G is set to redefine the future of industrial communication.

In Industry 4.0, people, machines, and devices have to communicate with each other in real time. This makes connectivity, or “industrial internet”, the very essence of Industry 4.0. The industrial environment sets very strict requirements for connectivity in terms of low latency, high throughput, maximum service availability, security, and reliability.

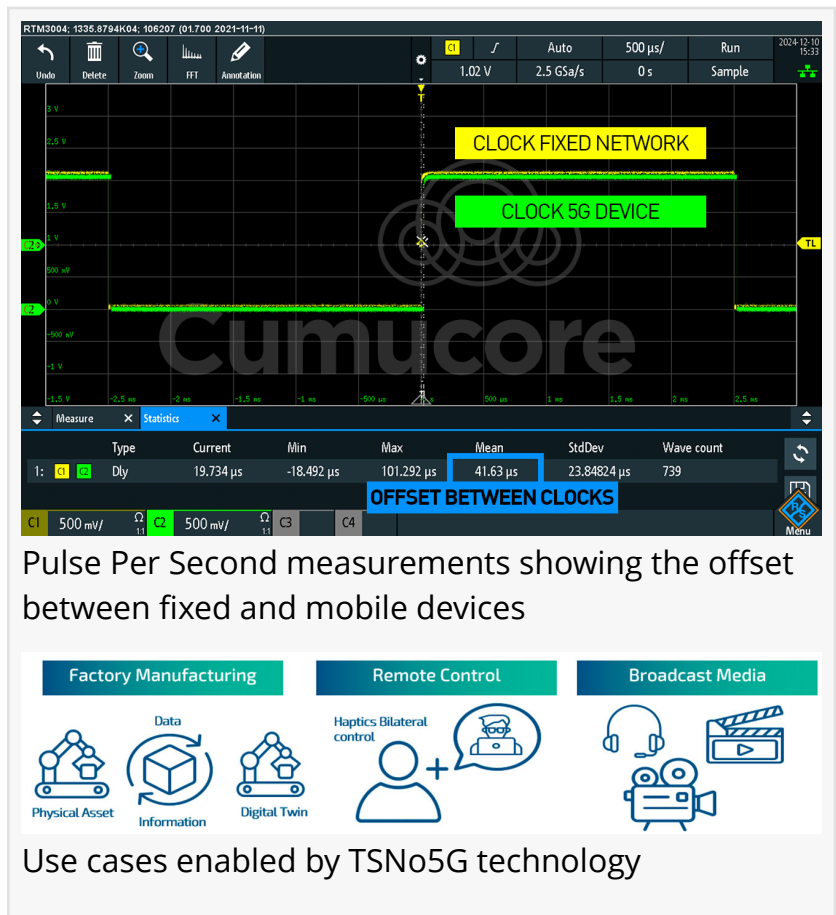
“ We have developed the worldwide first time sensitive connectivity solution. We utilize our 5G packet core software to deploy private industrial network with time sensitive requirements.”
Dr. José Costa-Requena. CEO at Cumucore.

GAME-CHANGING INNOVATION

Industry 4.0 requires increasing the level of automation to reduce labour intensive work. Automation is easier to do in manufacturing and transporting professions where environment is

closed and tasks repeatable. Good examples are mines, ports, warehouse and manufacturing factories. In automation network reliability is the most important.

In Industry 4.0 communication networks, a key requirement is data delivery with deterministic latency and high reliability, Time Sensitive Networking (TSN) is a set of tools/technologies based on IEEE 802.1 TSN standards that help networks provide such determinism. TSN guarantees that data reaches its destination fast (often in milliseconds) and at the right time synced across devices. Currently the TSN requirements can be met with wired connections.



1) A hardwired connection using Ethernet cables.

The major advantage of Ethernet-based networks is that they can meet the TSN requirements. The problem is that wired connections restrict mobility as there is always a “tail” behind the device that prevents free movement, making today’s devices like fixed phones at the end of the 1980s. Moreover, the wired connection construction period is long, and the cost is high. When cable breaks down, replacement takes time. So, the industry is looking for wireless alternatives.

2) Wi-Fi brings many benefits, such as flexibility, easy reconfigurability, mobility, and lower maintenance and life-cycle costs.

The Wi-Fi radios use a listen-before-talk procedure before every transmission so the transmission can be delayed for a random amount of time leading to additional latency. A large construction site may require up to 100 access points that can only reach a maximum of 50 meters.

3) 5G private networks provide a generational leap. An array of 100 spotty Wi-Fi access points, which are time- and labour-intensive to install, can be replaced by a single radio base station. 5G has a variation in packet delay due to attenuation in the air interface. TSN provides the tools for adding determinism to 5G networks. 3GPP Rel 16 has defined network functions Time Sensitive Network (NW-TT) and Device side (DS-TT) TSN translators as shown in Figure1.

Cumucore has developed the required TSN modules defined in the 5G standard specifications to deliver accurate time synchronization over 5G networks. In cooperation with Intel and Kontron,

Cumucore has deployed 5G core including the NW-TT integrated with the User Plane Function (UPF) and the DS-TT to deliver complete end to end system to deliver time synchronization. Figure 2 shows the first results of the offset between the Grand Master in the fixed network and the clock in the mobile device of 41us. This is first results, but Cumucore continues developing the 5G core modules to reach the 900ns required for reliable TSN connectivity-

KONTRON AND CUMUCORE PARTNERSHIP: REVOLUTIONIZING 5G SOLUTIONS FOR INDUSTRIAL AND MANUFACTURING SECTORS

Kontron and Cumucore have joined forces to usher in a new era of 5G connectivity for the industrial and manufacturing sectors. Together, they are delivering an innovative, end-to-end 5G solution tailored to meet the unique demands of these industries. By integrating Time-Sensitive Networking (TSN) capabilities into the 5G Core, this advanced system seamlessly bridges the gap between traditional fixed networks and wireless technologies. The result is a solution offering deterministic communication with unparalleled reliability, ultra-low latency, and guaranteed Quality of Service (QoS) — all critical for digitalized industrial operations.

TSNO5G IN ACTION: REAL-WORLD APPLICATIONS

The cutting-edge TSNo5G solution unlocks a wealth of possibilities across various industries, as illustrated in Figure 3. In smart factories, for instance, it enables synchronized communication between machines, robots, and sensors, driving more efficient automation processes.

Autonomous Guided Vehicles (AGVs) benefit from TSN over 5G by ensuring precise and safe navigation within manufacturing and warehouse environments.

In sectors like oil & gas, chemicals, and pharmaceuticals, the solution delivers the reliability and precision essential for mission-critical process automation. Additionally, augmented reality (AR) tools for maintenance leverage real-time, data-driven insights to enhance technician productivity. The broadcasting and media industries also stand to gain from TSN over 5G, achieving ultra-low latency and deterministic communication for seamless high-quality content delivery. This capability ensures reliable live streaming, real-time video production, and synchronized workflows across distributed teams and devices.

DRIVING THE DIGITAL TRANSFORMATION OF INDUSTRIES

Through their collaboration, Kontron and Cumucore are combining expertise in private 5G networks and industrial solutions to spearhead the digital transformation of enterprises worldwide. By enabling TSN over 5G and adopting mobile network-first principles, they empower industries to achieve greater efficiency, flexibility, and sustainability. This innovative solution positions organizations to thrive in an increasingly digital landscape, unlocking new opportunities for growth and innovation.

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