# A new dawn in the factory:

OPC UA and TSN conquer the shop floor

By Norbert Hauser, Kontron

Fieldbuses will not vanish completely from industrial automation in the foreseeable future, yet the Ethernet standard for time sensitive networking (TSN), in conjuncture with the platform independent OPC UA (Open Platform Communications Unified Architecture) interoperability standard, already offers new ways forward.
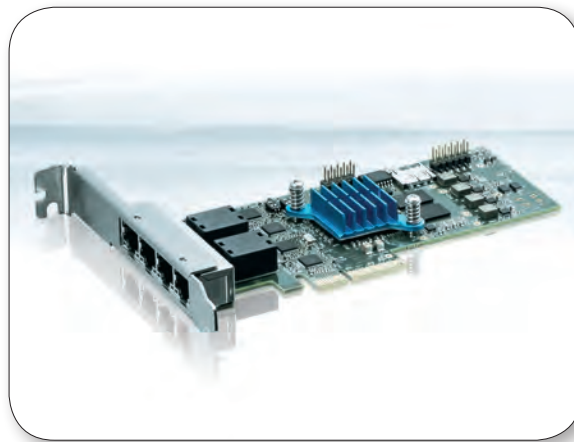
The standard Kontron network card includes an integrated switch for redundant networks with two or four gigabit Ethernet ports. It meets all specifications of IEEE 802.1 and is especially suited for rough industrial environments.

■ In evaluating manufacturing processes for digitization strategies (think industry 4.0 and industrial internet of things (IIoT)), it became apparent that the current distinction between IT (information technology) and OT (operational technology) would have to be gradually dismantled to warrant performance, cost and manageability of future infrastructure. TSN plays an important part in this, as it signifies the extension of the existing Ethernet standard towards deterministic data transfer (real-time capability), thus offering the main element for the convergence of IT and OT on the transport layer. The OPC UA interoperability standard allows the seamless, secure, and reliable flow of information between devices of different manufacturers and further drives the convergence of industrial infrastructures. With OPC UA, the new security, data modeling, scalability, and expandability requirements are optimally addressed.

Among the drivers of this inexorable trend are the rapid development of embedded hardware for IoT devices and technologies such as Cloud computing. But for establishing them in challenging industrial environments, appropriate standards are necessary. The two standards gaining traction rapidly are Open Platform Communications Unified Architecture (IEC62541 OPC UA) in conjecture with Time Sensitive Networking (IEEE 802.1

TSN). TSN is starting to supplant traditional fieldbus specifications and has the potential to replace them in the medium-term. Establishing a standard requires players on the manufacturer and user side working hard to prepare the market. The big IT players, Microsoft chief among them with its Azure IoT Edge Cloud offerings, are moving ever closer to the base of the automation pyramid. This is why Kontron has decided to have many of its embedded PCs and workstations - some of them as embedded servers, too - Microsoft Azure IoT Edge-certified for Fog and Edge computing. At this point, this includes more than 20 products, with their number growing continually. As for standards, Kontron fully supports OPC UA and TSN.

The OPC Foundation developing and defining the OPC UA standard counts more than 590 renowned companies and organizations among its members as of March 2018. These include manufacturing companies, suppliers, but also technology providers. The standard is important, because it enables the connection of the field level to the IT level device and operating-system independently. To ensure the standard success, Microsoft has published the corresponding specifications as open source software. Unlike the previous version, which ran on Windows exclusively, it now supports all common operating systems.

TSN makes convergent Ethernet-based networks running IT data transfers in parallel to time-synchronous, deterministic communication possible, which are indispensable for time-critical machine control and processes. The IEEE 802.1 TSN specifications - such as timing and synchronization, time-aware traffic scheduling, frame preemption, seamless redundancy, network configuration and others – guarantee data packets can be delivered in a timely manner and with high availability on a standard Ethernet network, if required. In industrial aplications, Ethernet TSN with guaranteed latency and quality of service (QoS) with time-sychnronization can supplement, or in the middle-term replace, proprietory fieldbusses in manufacturing machine control, while seamlessly communicating with the IT layer.

In late November 2017, Kontron introduced the first version of a network interface controller (NIC) enabling Time Sensitive Networking (TSN). The standard PCI Express network card and the associated network and switch drivers for Linux allow for industrial computers to be connected through a redundant ring-, line-, daisy-chain- or star-shaped TSN network. The Kontron TSN network card includes an integrated switch for redundant networks with two or four gigabit ethernet ports, and for connecting to the host

computer via PCI Express. Future extensions of the TSN specifications can be integrated through software updates in the FPGA. The TSN network card is especially suited for rough industrial environments and can be run in industrial temperature ranges from -40 to +85 degrees Celsius. It allows for the Kontron Box PCs, 19-inch servers, and workstations, namely its KBox C-series, ZINC19, and HPW product lines, to be extended for TSN. The TSN starter kit, available since the embedded world trade fair in March 2018, includes a KBox C-102 industrial computer for central control via the integrated TSN network card with the associated software included.

With the network card and Microsoft Azure Cloud support, Kontron is definitely doing its share in promoting the quick spread of TSN and the OPC UA standard. The TSN system starter kit is also offered as a private labelling version to enable machine manufacturers, automization specialists and systems integrators to expand their portfolio with TSN-connected products under their own brand, offering time-to-market-advantages to their customers for the integration of TSN networks. Today, the cumbersome interfaces between IT and OT are often an impediment to innovation. 59 percent of all SMBs name innovation cost as the obstacle for not using Industry 4.0 technology comprehensively. Companies appreciate the advantages: 72 percent hope for increases in production flexibility, 52 percent expect quicker reaction times, and 47 percent hope to raise their plants' efficiency. These are the results of an Ernest & Young survey published in November of 2017.

The rigid barrier between operational technology at the base and information technology at the top of the automatization pyramid is beginning to dissolve. Many areas of the field level, such as machine control, which seemed out of reach of internet-protocol-based technology, are nearing a turning point. Kontron in co-operation with S&T is not only well positioned to supply the appropriate hardware, but pre-integrated Cloud solutions such as Azure IoT Edge and other software, services and consulting also. ■