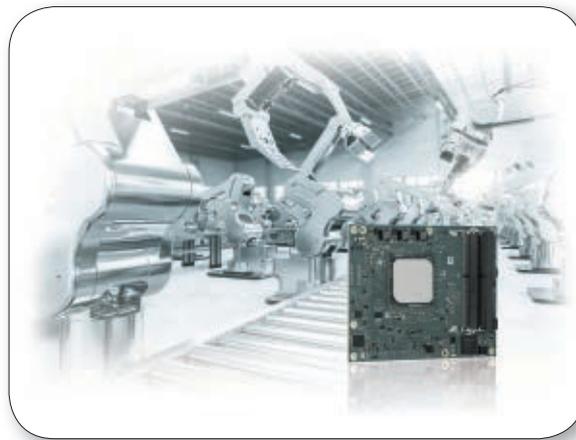


COM modules designed for industrial applications from edge to cloud

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This article explains the requirements digitalization will bring to the manufacturing industry, and how powerful COM Express modules can help to meet the demands for the embedded high-performance computing (eHPC) that is needed.



■ Manufacturing companies around the globe are faced with digital transformation of their production lines. Automation and smart manufacturing concepts erase the barrier between enterprise systems such as ERP, CRM, and order processing and process control. To benefit from the added efficiency, reduced cost and new business models inherent in the digital transformation of manufacturing, enterprises have to adapt their systems to serve in production environments. Edge, fog and cloud applications demand enhanced computing power. Traditional server approaches cannot provide the required robustness for operation in harsh industrial environments. Modular systems based on the well-established and tested COM Express modules provide an efficient solution. Type 7 is a new variant which for the first time ever meets the demands for embedded high-performance computing (eHPC).

In contrast to most business and IT applications, many production tasks cannot be easily outsourced to a cloud, although it would be useful in terms of simplification, cost saving, and maintenance. In spite of modern infrastructures such as TSN-based networks, the physical length of the lines with the associated latencies means real-time control out of the cloud is out of the question. Also, many companies do not want to see their entire pro-

duction data and know-how to be stored and processed off-premise. Edge and fog computing can provide a solution to this conundrum. This means moving the cloud physically closer to production or consolidating data by on-site pre-processing. Of course, there are robust, industry-grade edge gateways available. Their performance, however, is limited. In many scenarios, it is more cost-efficient and service-friendly to maintain ample computing power directly on site. A key enabler for cost-efficiency can be wide scalability, highest availability, and reliability – three qualities which are generally required in industrial applications. These features have also been long associated with standardized computer modules (COMs). So, what could be better than to base an on-premise, scalable computing infrastructure on proven module systems? This design would be scaled for today's demands, with the option of easy upgrading later.

One of the main advantages of the use of COMs is the largely pre-integrated platform. Customers can fully concentrate on the development of their own applications. This is where the know-how for the respective solution and also the actual core competency and the added value of their companies are based. Ideally, the module supplier offers a carrier board containing all required interfaces. If, however, special functionality (in the indus-

trial field, this usually means special fieldbus interfaces) is missing, using the module supplier know-how of existing solutions (IP) and resources will save time, resources, and trouble. This applies in particular to elements which require specific knowledge and experience, most importantly safety and security. Proven, standardized, cross-platform concepts that reduce time-to-market costs through synergy effects are ideal. A perfect manufacturer should have extensive experience in the production of standardized modules and a broad portfolio of customer references based on the specific application. Under current embedded module standards, the highest scalability with regard to maximum power dissipation (and thus indirectly also maximum computing power) is offered by the PICMG COM Express standard. For instance, its Basic form factor, measuring just 95 x 125mm, can easily use processors with a TDP (thermal design power) of 50 watts and more. The rapidly growing demand for high computing and network performance in the modular and embedded market has also led to the PICMG redefining the COM Express standard, based on the COM Express Standard Type 6, which dominates the current embedded market. Partially reorganizing the connector signals, it has dropped graphic signals altogether and replaced them by four 10 GBit interfaces to support faster external Ethernet connections. In addition, eight

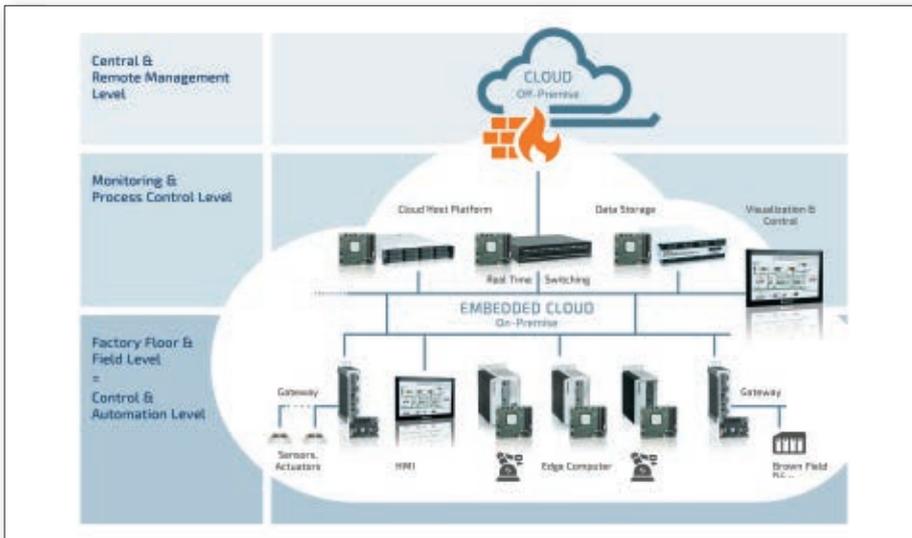


Figure 1. Embedded cloud computing

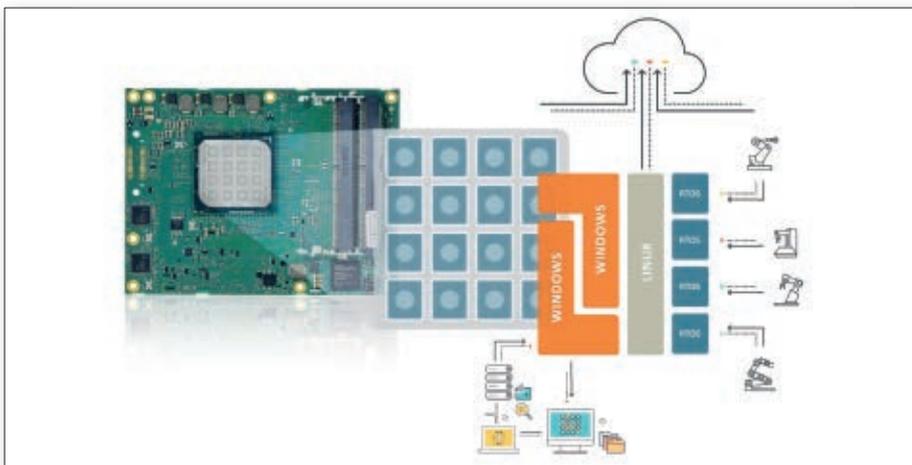


Figure 2. Consolidated real-time system with eHPC

additional PCI Express lanes have been added to achieve higher throughput. A further advantage of the design concept of COM Express is that the modules can be used not only as mezzanine (plug-in) boards for a carrier board, but also as a complete single-board computer (SBC). This makes building multi-module systems particularly easy. Depending on the thermal design, up to nine Type 7 modules in the Basic size and thus up to 144 CPU cores can be accommodated in a single 19" plug-in unit.

To protect against attacks, a comprehensive, cross-platform security concept comprising both hardware and software components is indispensable. State-of-the-art solutions contain modules for copy protection, IP protection (licensing), protection against reverse engineering and tampering. This allows comprehensive license management and completely new licensing and business models, such as billing according to usage time and test periods for certain features. Big Data is the trend of the future and more and more data must be reliably recorded and processed physically close to

machines and the cloud. Interfaces to sensors and actuators are largely established technologies, but the requirements for computing power grow disproportionately. Embedded solutions with interchangeable computer-on-modules (COMs) offer a singular price/performance ratio and future-proof investments. The robust design allows safe use in the vicinity of production environments.

The option of outsourcing control functionality to real-time embedded high-performance computers (eHPC) and their physical proximity to the production equipment lead to further cost savings through consolidation without sacrificing safety or functionality. Automation concepts offer increased productivity, more flexible production and allow for better efficiency. But these benefits are dependent on an IT architecture that is both scalable and powerful. Edge, fog and cloud applications based on embedded high-performance computing using COM Express Type 7 modules offer a cost-efficient way of reaping the benefits of digitalization in manufacturing. ■