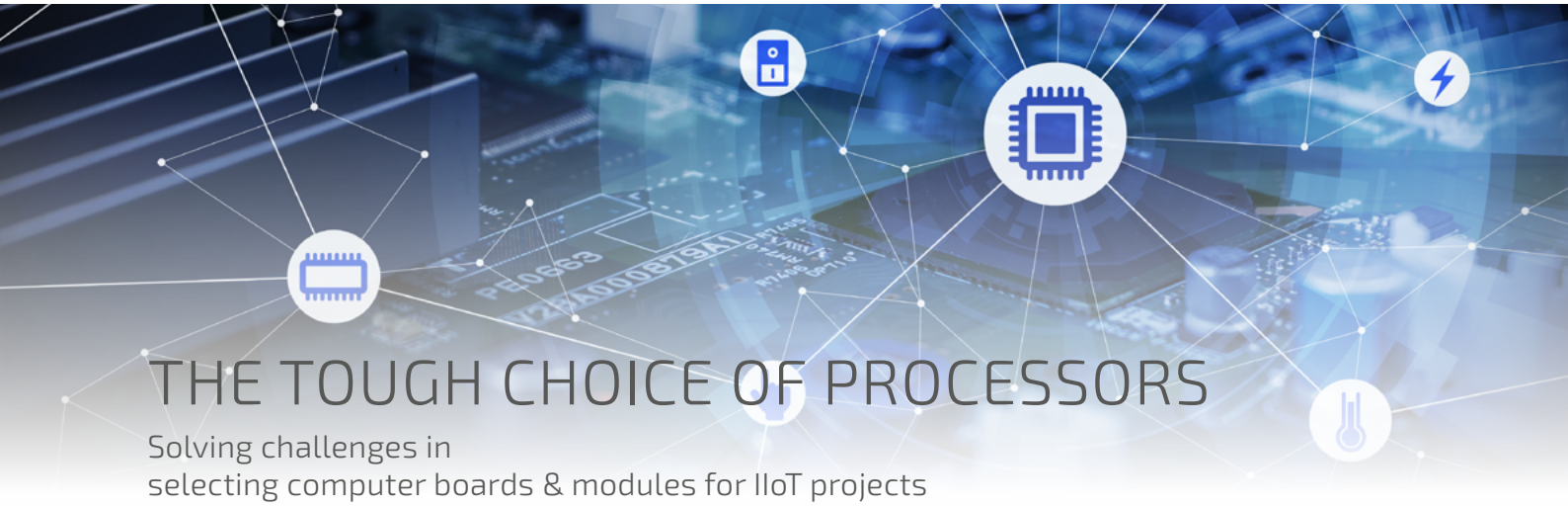
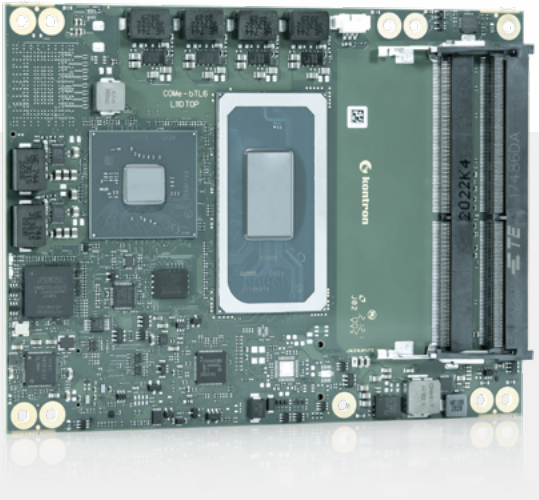


THE TOUGH CHOICE OF PROCESSORS

Solving challenges in selecting computer boards & modules for IIoT projects

By: Peter Müller, Vice President Product Center Modules, Kontron



Digitalization and Industry 4.0 require a system change away from centralized structures in favour of decentralized data processing. In the Internet of Things, embedded boards acting as processing units at all levels of complex systems communicate with each others well as with distributed edge servers in the cloud. They come in a tremendous variety, making it difficult to make the right choice for the application at hand. This choice is somewhat eased by standardized form factors and interfaces. On the other hand, design engineers gain decision certainty through the timely integration of leading-edge processor technologies. This way, Kontron can ensure the long-term availability of functionally equivalent products with a performance level matching the requirements of the time, while also enabling customers to achieve a minimum time-to-market.

Embedded Computing and IoT have long since ceased to be niche topics. On the contrary, they have become common practice. In the past, many device and machine manufacturers used to design the hardware from scratch themselves. Meanwhile, they predominantly integrate ready-made board products or standards-based modules together with individual carrier boards. The small size and low cost of many single-board computers facilitate solving individual control or data processing tasks locally, carrier boards make it easy to adapt modules to various dimensions and interfaces. Rugged variants with an extended temperature range allow their use within parts of increasingly modular-designed machines.

PRODUCT DIVERSITY REQUIRES SELECTION

There is an enormous variety of products, ranging from single-board microcontrollers and computers the size of a credit card such as Raspberry Pi through embedded motherboards and processor modules featuring Intel® and AMD x86 architectures all the way to computer-on-modules for high performance computing (COM-HPC®). This often makes selecting the right processor board or module difficult. Even if only the products of the market-leading German manufacturer Kontron are taken into consideration, the product variety is tremendous.

The main difference is in the application to realize. In addition, though, users need to find the best balance of processing power, graphics capabilities and connectivity on the one hand and size, power consumption, and cost on the other.

VISION SYSTEMS AND AI ON THE RISE

Especially since the train towards the Industrial Internet of Things (IIoT) and Industry 4.0 has picked up speed, processor boards and modules are required to handle and process exponentially growing amounts of data. The need for processing power as well as communication and memory bandwidth is increasing rapidly.

This is further boosted by the growing importance of sophisticated image processing tasks. They are to be found across all industries, from security to medical diagnostics to machine and robot vision in mechanical and plant engineering. More and more frequently, these tasks are outsourced to and performed by dedicated graphic processors (GPUs) to relieve the CPU. This similarly applies to applications involving Artificial Intelligence (AI) that are rapidly spreading not least to tackle image analysis. Meanwhile, there is specialised silicon to accelerate AI tasks such as for example the Google Coral Edge TPU.or the world-leading Hailo-8™ AI-accelerator.

EXTRA PERFORMANCE FOR CLOUD AND EDGE

The recent mind shift with regard to service-oriented data processing in the cloud is also consequential for the requirements imposed on computer hardware. In order to gain independence of transmission bandwidths, particularly time-critical data processing is performed at the device level, at the so-called edge.

Analogous to earlier developments in office computing, there is a shift away from strictly centralized data processing in the cloud as well. Edge devices now often communicate with decentralized edge servers dedicated to performing specific tasks rather than a central intelligence. Although cloud and edge share the processing workload, the power and performance demands imposed on edge servers are also rising continuously.

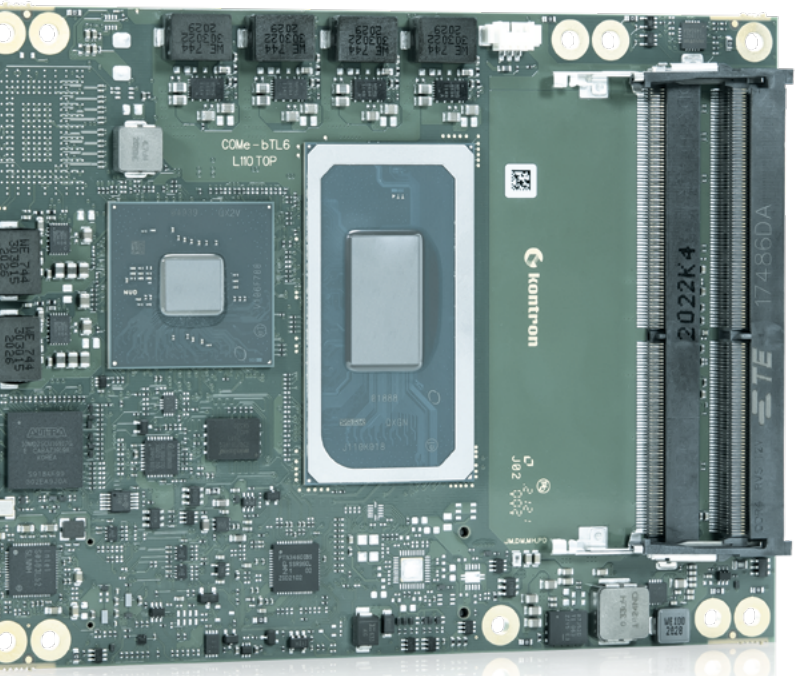
CONNECTIVITY FOR REAL-TIME APPLICATIONS

Similarly, demands on the connectivity of processor boards and modules are increasing. The upcoming 5G mobile communication standard enables unprecedented data throughputs. Adding real-time capabilities to Ethernet through Intel® Time Coordinated Computing (Intel® TCC) and Time Sensitive Networking (TSN), respectively, facilitates merging the formerly separate information technology (IT) and operational technology (OT) networks. x86 processors more and more frequently offer this real-time capability as they often feature integrated Arm® coprocessors.

The good news is that it is generally not necessary to specify the exact performance data required - even in the future. Using IO-Link or Industrial Ethernet for data transport, sensors can provide increasingly rich data packets.

WIDE SCALABILITY WITH COM Express®

The Intel Atom® x6000 (formerly known as Elkhard Lake) processor series, which was specifically designed for IIoT applications as well as the Intel® Pentium® and Celeron® N and J series with 10 nm structures provide a broad scalability. Kontron makes this available in the COM Express® Compact Type 6 and COM Express® Mini Type 10. With up to four CPU and 32 GPU cores, these boards provide unrivaled system performance per watt. This makes them extremely cost effective and energy efficient platforms with TSN and TCC functionality for IIoT applications in industrial real-time environments.



// 11th generation Intel® Core™ and Celeron® processors (previously known as Tiger Lake H) with up to eight cores provide COM Express® modules of the Basic form factor with the ability to perform high-end applications requiring a high bandwidth. They are supported by Intel® Iris® Xe Graphics and Intel® Deep Learning Boost for enhanced AI performance as well as integrated TSN and TCC functionality.

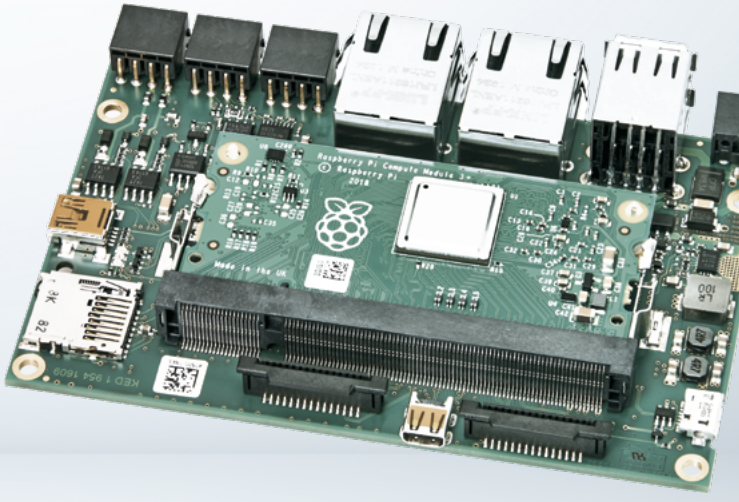
Equipped with 11th generation Intel® Core™ processors with 10 nm structures, PCIe 3.0 and an Ethernet controller capable of TSN, the COM Express® module in the Compact form factor ascends to a new performance class without unduly increasing power consumption. These CPUs feature an instruction set for the vectorised neuronal networks used in AI. Also regarding the Basic form factor, 11th generation Intel® Core™ and Celeron® processors (previously known as Tiger Lake H) with up to eight cores provide Kontron's modules with the ability to perform high-end applications requiring a high bandwidth. They are supported by Intel® Iris® Xᵉ Graphics and Intel® Deep Learning Boost for enhanced AI performance as well as integrated TSN and TCC functionality.

In the same processor performance class, the COM Express® Compact Type 6 module equipped with an AMD Ryzen™ V/R1000 processor combines superior graphics capabilities with a relatively low power consumption. It offers support for up to 16 threads on up to eight processor cores if fitted with an COM Express® Basic AMD Ryzen™ V2000.
This makes this module predestined not only for higher-level industrial control applications, but also for imaging procedures in medical diagnostics thanks to superior graphics and image processing capabilities.

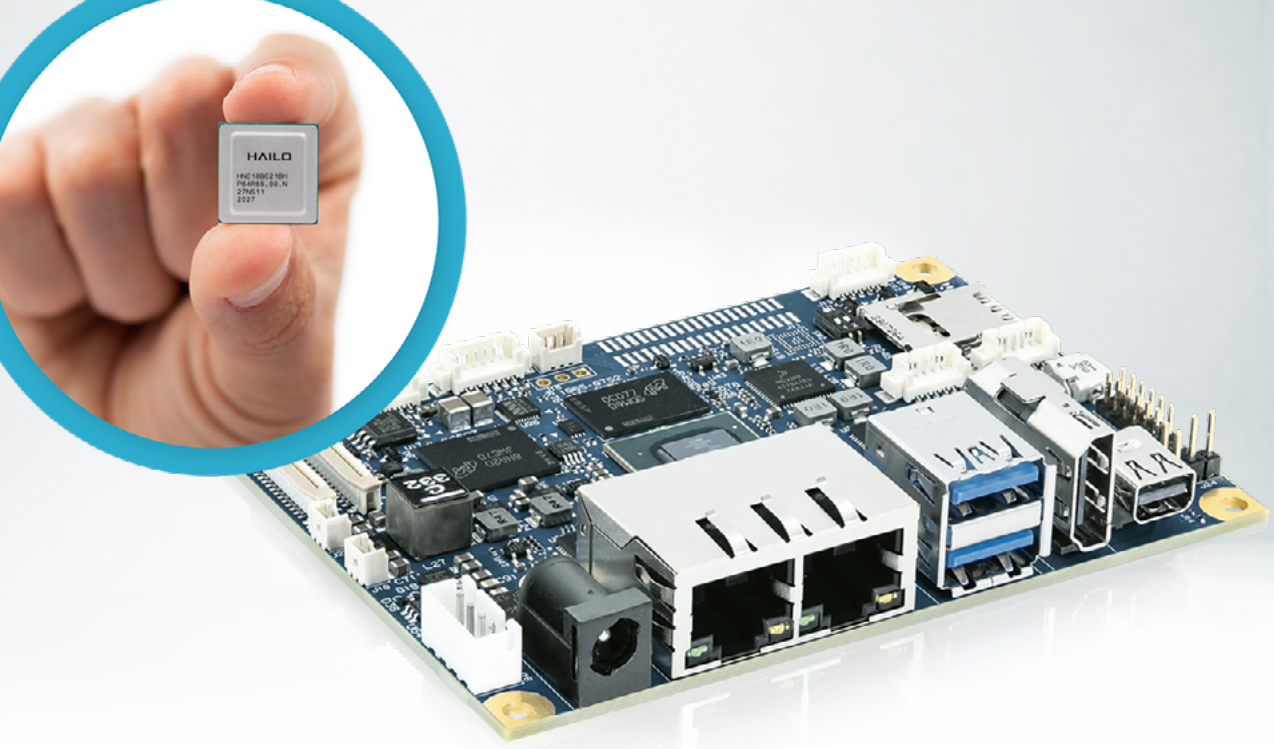
> Scalable, predefined computer-on-modules combined with the latest edge technologies are essential building blocks for the next steps in the IIoT. We provide engineers with a wide variety of suitable boards fulfilling a tremendous range of requirements in terms of performance, power consumption and connectivity and ensuring long-term compatibility with demands the future might have in store.
>
> Peter Müller, Vice President Product Center Modules, Kontron

A BROAD RANGE OF Arm®-BASED SOLUTIONS

The Pi-Tron CM3+ single-board computer is an industrial-grade variant of the popular Raspberry Pi it is based upon. Its Broadcom BCM283780 CPU comes with four Arm® Cortex®-A53 with 1.2 GHz and a separate video engine. Its CANbus interface makes it a prime choice as a compact control platform for home automation applications and HMI or portable devices. To better support industrial application developments according to IEC 61131-3, it has been extended to include CODESYS, the leading integrated development environment for programmable logic controllers (PLC).



// An industry-grade variant of Raspberry Pi, Pi-Tron CM3+ features a CANbus interface and was extended by the CODESYS environment for application software development according to IEC 61131-3. This makes the compact board a prime choice for industrial control equipment.



// The Hailo-8™ AI accelerator capable of 26 TOPS at under 2.5 watts turns the pITX-iMX8M-AI-H8 SBC into an high-end AI inference platform for advanced, "best-in-class" edge AI solutions. The intelligent and compact platform provides an unprecedented performance level in combination with versatile interfaces for demanding IoT gateway applications.

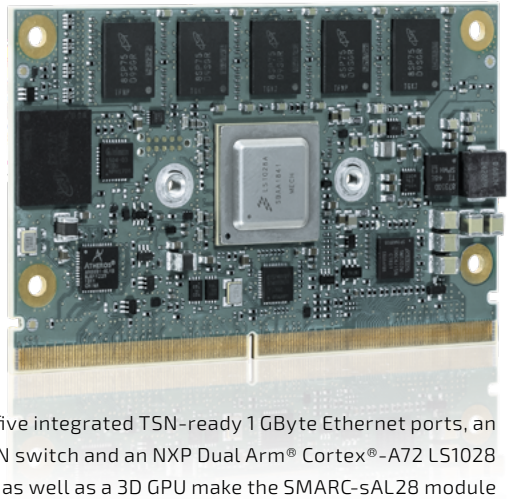
The pITX-iMX8M motherboard comes in the compact 2.5" Pico-ITX format. It can be used in extremely demanding environments, allowing for configurations with an extended temperature range (-40 °C to +85 °C). This makes it excellently suited for embedded applications in medical technology as well as industrial automation and building automation.

While featuring dual- or quad-core NXP CPUs based on the Arm® Cortex®-A53 architecture and Full 4K UltraHD graphics resolution as well as two Gigabit Ethernet interfaces, the pITX-iMX8M scores with very low power consumption. Kontron optionally supplies it with an integrated Google Coral M.2 module, which makes it an entry-level platform for demanding AI applications such as object recognition or visual quality inspection. It performess up to 4 TOPS (trillion operations per second) and 30 frames per second.

For high-end, "best-in-class" AI applications, the board is available with the integrated, world-leading Hailo-8™ AI-accelerator with 26 TOPS. At 3 TOPS/watt, this chip is singularly energy efficient. Its integrated memory makes it extremely fast.

ENERGY EFFICIENCY IS KEY

The SMARC™ (Smart Mobility ARChitecture) computer-on-modules are also designed for extremely compact low power systems. The SMARC-fA3399 module is equipped with the Arm® Rockchip processor. Thanks to its six processor cores (2x Arm® Cortex®-A72 and 4x Arm® Cortex®-A53) in two separate chips, it is well suited to perform simple AI applications and high-performance graphics. There also is an industrial-grade version with a -25 °C to +75 °C temperature range. As Rockchip is part of the Linux open source community, open source drivers are available for this platform. In relation to its performance level, this module's power consumption is remarkably low, and so is its price.



// Up to five integrated TSN-ready 1 GByte Ethernet ports, an integrated TSN switch and an NXP Dual Arm® Cortex®-A72 LS1028 processor as well as a 3D GPU make the SMARC-sAL28 module the perfect choice for use in IIoT or Industry 4.0 systems. It comes in the SMARC™ short-size form factor and is certified for the -40 °C to +85 °C industrial temperature range.

The SMARC-sAMX8X module features an iMX8X processor and up to 3 GByte RAM. Its low power consumption renders it exceptionally well-suited for use in battery-operated systems.

Up to five integrated TSN-ready 1 GByte Ethernet ports, an integrated TSN switch and an NXP Dual Arm® Cortex®-A72 LS1028 processor as well as a 3D GPU make the SMARC-sAL28 module the perfect choice for use in IIoT or Industry 4.0 systems. It comes in the SMARC™ short-size form factor and is certified for the -40 °C to +85 °C industrial temperature range.

These two modules were the first to adhere to the SMARC™ 2.1 standard featuring, among other things, extended Ethernet connectivity and additional I/O and camera interfaces. New SMARC™ modules at the upper end of the performance scale using the energy-efficient next-generation Intel Atom® processors also comply with this standard.

> We offer robust boards and modules in established, standardized formats in all performance classes. By working closely with all well-known semiconductor manufacturers, we can ensure the long-term availability of functionally equivalent products with performance data that grows with the times.
> In addition, thanks to our development experience in hardware and software and the extensive EMS / ODM services, we can offer solutions for a wide variety of vertical markets. In this way, we enable our customers to bring their solutions to the market at the right time.
>
> Werner Schmidt, Director Sales Central Europe

About Kontron

Kontron is a global leader in IoT/Embedded Computing Technology (ECT) and offers individual solutions in the areas of Internet of Things (IoT) and Industry 4.0 through a combined portfolio of hardware, software and services. With its standard and customized products based on highly reliable state-of-the-art technologies, Kontron provides secure and innovative applications for a wide variety of industries. As a result, customers benefit from accelerated time-to-market, lower total cost of ownership, extended product lifecycles and the best fully integrated applications.

For more information, please visit: **www.kontron.com**

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