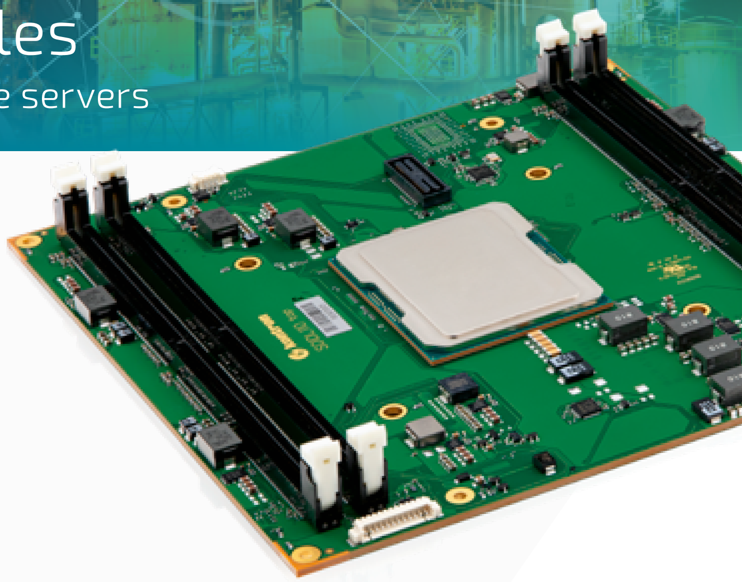
COM-HPC® Server Modules

High-performance basis for compact edge servers



The new module standard offers high computing power and extensive I/O options

For particularly compact edge server designs in harsh environments, there are no standard layouts commonly found on rackmount systems. Box PC-like systems often require highly customized I/O layouts, which can be elegantly implemented with Server-on-Modules. Modules designed according to the COM-HPC® server specification open up new performance horizons here.

The edge server market is currently growing rapidly compared to the demand for classic servers. Global demand was estimated at around USD 3.8 billion in 2022 and is expected to grow at a remarkable CAGR of 31.76% during the forecast period, with sales projected to reach USD 19.7 billion by 2028.[1] In contrast, the overall market for classic servers is growing at a modest CAGR of 5.81% with sales expected to reach around 119.9 billion in 2028.[2] By then, around 16.43% of all servers installed worldwide will then be edge servers and this shift in market share is expected to continue.

JUMPtec®

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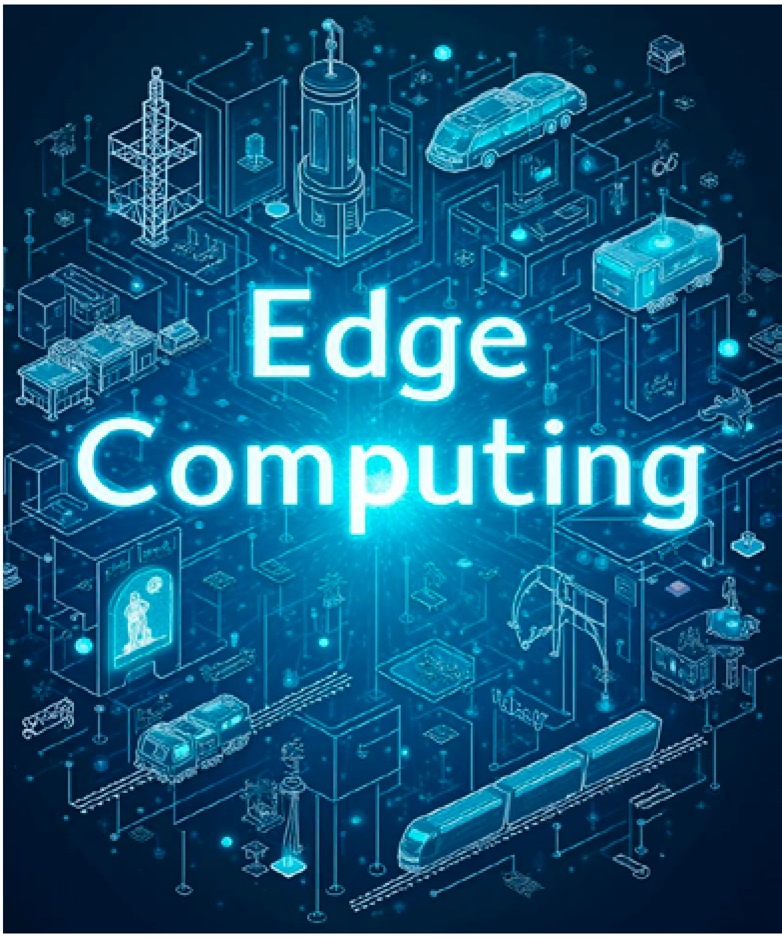
Why are edge servers becoming increasingly important?

The dynamic increase in demand for edge servers is primarily driven by the need for the lowest possible latency and increasing real-time capability. After all, nobody wants to wait for high-resolution video from a streaming service provider - to name just one large commercial application area. Another advantage is that processing data on edge devices requires less bandwidth, which saves costs and reduces the load on the network. As sensitive data can only be processed locally, data protection and cyber security are also improved. Edge computing also improves the scalability of IoT systems, as the load can be distributed across multiple devices. Even in the event of network failures, edge devices can operate autonomously, which increases their robustness. These are all advantages that are also of great interest for industrial applications. This is why there is also high demand in this market segment.

What industrial edge server applications are there?

- In industrial production, edge servers are collecting and analyzing real-time data from machines. This allows the optimization of production processes and the minimization of downtimes through predictive maintenance
- In medical technology, edge servers are used to process real-time data from medical devices to react quickly to changes in the health of their patients - sometimes via telemedicine
- In the automotive industry, edge servers are collecting and analyzing real-time data from vehicles for ADAS in order to improve the performance of their vehicles or develop new functions such as autonomous driving
- In rail technology, edge servers are processing real-time data from trains and rail infrastructure to control train traffic more efficiently and increase rail safety
- In the energy industry, edge servers are analyzing real-time data from power grids and renewable energies to ensure the stability of the power grid and optimize the use of renewable energies
- In video surveillance, edge servers are used to analyze live video data in order to detect and respond to security risks on public transport or at airports at an early stage.



High robustness for 24/7 operation in harsh environments

Compared to commercial edge servers for the IT segment, all of these applications are subject to significantly higher requirements in terms of long-term availability and fail-safe 24/7 operation. This requires all components to be highly robust in terms of EMC/EMI, shock and vibration as well as extended operating temperatures, which can be between -40 °C and +85 °C in outdoor and in-vehicle applications. This also applies to generic infrastructure components such as small cells and micro data centers for 5G/6G telecom infrastructures. Coating (conformal coating) of the electrical assemblies is also required for application areas with extreme humidity, rapid temperature fluctuations, harmful gasses and/or aggressive dust.

Low latencies, for example, require streaming and Voice-over-IP (VoIP) services as well as cloud-based Next Generation Central Office (NG CO) architectures. Edge servers in this segment are often installed on the network side and are therefore part of the telecoms infrastructure. Response times required in these areas are around 10-40 milliseconds.[3] Even lower latencies are required for all applications that are assigned to the Internet of Things and on-premises edge. Response times of less than 1-5 milliseconds are often required here. Such short cycle times are also often required in deterministic real time.

Rack servers take up too much space

A certain proportion of these applications can be addressed very well with standard industrial servers which, apart from the robustness requirements, are designed in much the same way as those used in commercial data centers: As standard 19-inch rack servers. The only major difference is that the motherboards used have more long-term availability and are designed for industrial temperature ranges.

Why should you do it any other way? After all, the ATX-based ecosystem is largely standardized and many components from the commercial sector can also be used in the industrial server variants.

It's always recommended for rack servers to have numerous dedicated I/O layouts. They also generally fit into 19-inch control cabinets. So as long as there is sufficient space, there is no reason to do anything differently.

The JUMPtec high-performance edge server ME1310 is designed to solve challenges such as limited space and energy requirements

Compact designs require fitting I/Os

However, the requirements of the IIoT are currently giving rise to many new applications in the entry server class. These can no longer be implemented in this standard rackmount design, as the space is simply not available and/or because significantly higher IP protection is required than rack systems can offer. Specific I/O designs and housing dimensions are typical here, as we know it from Box PCs:

- Edge servers integrated into medical devices with DSP/FPGA/ASIC-based signal data processing for imaging
- Small cells mounted on lampposts with integrated micro-servers for 5G/6G connected stationary and mobile equipment in manufacturing and logistics
- Automotive edge servers for the driver's cab or trunk with a mix of up to 100 GbE, two-wire Ethernet and automotive connectors for test & measurement and production vehicles
- Box-type railway edge servers for wagons or track bed systems with robust M12 sockets
- Compact edge servers for charging station infrastructures in outdoor control cabinets
- Compact video analysis platforms for multicam applications in traffic light and airport control cabinets

One problem for manufacturers of such compact solutions is the fact that server processors at board level are generally only manufactured in ATX-compatible form factors or for modular backplane systems. Smaller board dimensions for integration in control cabinets or compact Box PC housings are not available. However, integrating a processor completely from scratch at board level is far too complex for almost all OEMs.

Modular designs offer the necessary flexibility

Fortunately, there is a design principle that has been tried and tested for many years, which can also be applied to solve this challenge in compact industrial servers - Computer-on-Modules. At around 30%, they have the largest market share in terms of unit numbers among the industrial computer boards worldwide. Nearly one in three industrial computer designs is based on such modules and for a good reason: they are specifically designed for developing of dedicated system designs and come with an application-ready computing core, complete with ready-made BSPs for all common operating systems and standard interfaces. Users only have to develop the individual carrier board, saving a significant amount of integration work for the processor by purchasing a computer-on-module. The investment in an individual carrier board is also secured in the long term over the lifetime of the application, as the modules are standardized regardless of the manufacturer. Scaling across processor generations and manufacturers is easily achieved by exchanging modules. In many cases, the PCB of the carrier board can also be manufactured with fewer layers, reducing costs in series production.
JUMPtec also offers a design review or the development of the development of the carrier board.

The COM-HPC® server specification opens up new performance horizons

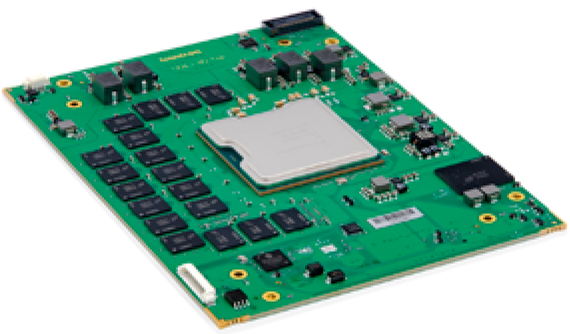
This design principle of Computer-on-Modules is also available for server processors qualified for embedded and edge computing applications, which are now increasingly being used in harsh environments due to the IoT trend. Originally offered on the basis of the PICMG COM Express® Type 7 specification, these modules are now also available with the PICMG COM-HPC Server specification, developed for particularly high-performance modular system designs.

COM-HPC Server modules support an immensely high number of interfaces via their total of 800 pins, including up to 64 +1 PCIe lanes, up to PCIe Gen5/6 and up to 8x 25 GbE. Depending on the module size used (Size D with 160 x 160 mm or Size E with 200 x 160 mm), there is space for 4 or up to 8 memory banks of RAM on the modules, allowing suitable memory layouts to be selected based on the server load. OEMs can therefore develop dedicated edge and fog servers very efficiently, even in box PC sizes.

Modules with Intel® Xeon® D processors

The latest COM-HPC® server modules, such as the JUMPtec COMh-sdID based on the Intel Xeon D-2700 / D-2800 server processors (codenamed Ice Lake-D HCC), offer at least 10 years of long-term availability and scalability from 4 to 22 cores, including SKUs designed for 24/7 operations in extended temperature ranges. This enables highly robust implementations in harsh environments and extreme conditions, all within a particularly compact mechanical footprint of 160 mm wide and 160 mm deep (plus metal housing). These modules can boot the operating system within 5 seconds if slim bootloader support has been activated.

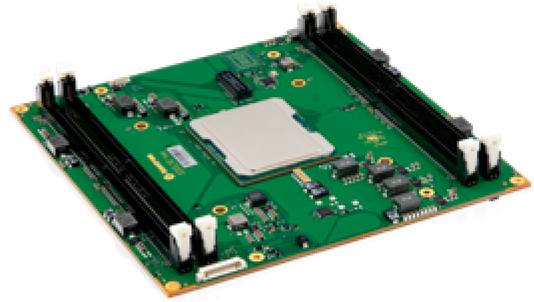
The COMh-sdID module offers 4x DIMM sockets, supporting up to 512GB DDR4 memory at 3200 MT/s. An optional soldered NVMe SSD with up to 1 TByte storage capacity is available as a storage medium. With 48x PCIe lanes (32x PCIe Gen4 plus 16x PCIe Gen3 lanes) and 2x Quad LAN interfaces supporting up to 100Gb Ethernet, the COMh-sdID is an ideal platform for meeting particularly high data throughput requirements in demanding I/O and network structures.



The COMh-sdIL with Intel® Xeon® D-1700 / D-1800 server processors with soldered memory is particularly robust for harsh environmental conditions

Extremely robust with soldered RAM

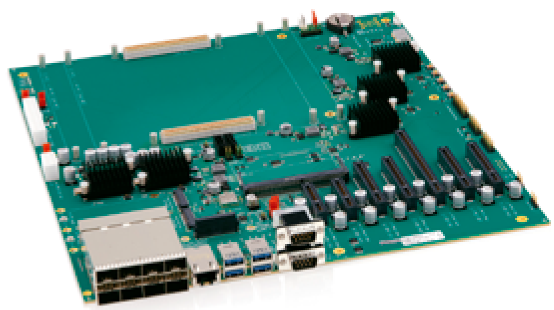
For an even more robust design, we recommend the JUMPtec COMh-sdIL COM-HPC server module, based on the Intel Xeon D-1700 / D-1800 server processors (Ice Lake-D LCC), which are scalable from 4 to 10 cores. The COMh-sdIL covers the lower performance level. Unlike the COMh-sdID, these modules feature 64GB DDR4 memory with ECC in soldered directly onto the board,enabling particularly flat and robust designs for the extended temperature range, as the memory can make direct contact with the heatspreader. As with the COMh-sdID module, an optional soldered NVMe SSD can be added.



The COMh-sdID based on Intel® Xeon® D-2700/ D-2800 Serverprocessors offers highest performance for a COM-HPC® module

The smallest server footprints become possible

But how do you find the right application-specific I/O layout for such Server-on-Modules? For pure evaluation purposes, manufacturers such as JUMPtec naturally provide suitable evaluation carrier boards that support the entire range of functions of COM-HPC Server-on-Modules. However, these boards are only partially suitable for evaluating designs in a certain compact form factor and harsh environment.



The JUMPtec Eval-Carrier for COM-HPC® has a E-ATX size

In addition to this evaluation carrier, another so-called reference carrier is offered, designed to closely mimic a real application environment thanks to its compact design. It is also equipped with components specified for series use in harsh environments. At 182 mm x 215 mm, the particularly compact JUMPtec COM-HPC/Server Reference Carrier primarily provides design inspiration for box PC-like system layouts. It resembles the board of a powerful router or a system known in the IT environment as Universal Customer Premises Equipment (u-CPE). The only difference is that when equipped with server-on-modules, it offers significantly more computing power and connectivity.

The high number of cores enables even more efficient consolidation using virtual (real-time) machines.

On the front, the reference carrier offers 25 SFP28 cages, 1 or 2.5 GbE BASE-T and 4x USB 3.2 ports. Additional front panel interfaces l - 1x GBASE-T, USB 3.1, UART and DisplayPort - are provided via the associated RunBMC module. Internal slots for 2x M.2 2280, 1x M.2 2240 and PCIe Gen 4 with dual x4 lane support for riser cards also open up numerous expansion options within a flat design.

With off-the-shelf components for individual system design

Many edge server tasks can already be implemented off-the-shelf with such a compact server reference carrier, and customization options are also available at board and system levels. Circuit boards with round cutouts for mounting on radio masts are conceivable, as are industrial housings designed to fit specific mounting situations and equipped with particularly robust M12 connectors. These are just some of the options JUMPtec offers as part of its customer-specific Design & Manufacturing Services.

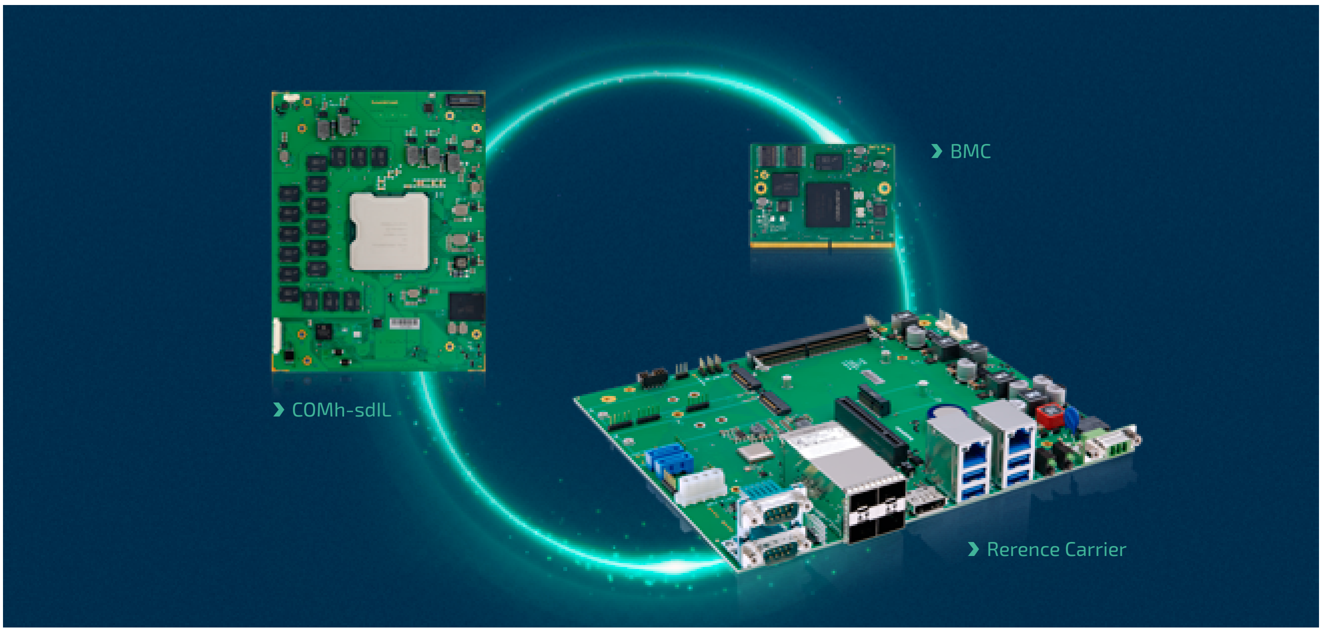
Only one question remains: How do such compact servers based on COM-HPC modules achieve a server class management concept to meet the highest requirements for reliability, availability, maintainability and manageability (= RASM / Reliability, Availability, Serviceability, Manageability)

Modules for server administration

JUMPtec also offers a modular approach based on its ASPEED AST2600-based RunBMC module. The RunBMC module supports interfaces such as Ethernet, USB, PCI Express and DisplayPort and the connected COM-HPC module can be operated via KVM-over-IP using the integrated OpenBMC web interface. In addition, the IPMI command sets required in the COM-HPC IPMI specification are integrated in order to communicate with the carrier board via the IPMB. This enables:

- **Monitoring:** monitoring of hardware parameters, such as voltage, temperature, fans, malfunctions, etc.) including alarms
- **Recovery control:** Switching the server on and off, shutting it down and restarting it and restoring the server (BIOS configuration, reinstalling the operating system, etc.)
- **Logging:** Recording Hardware events and error messages

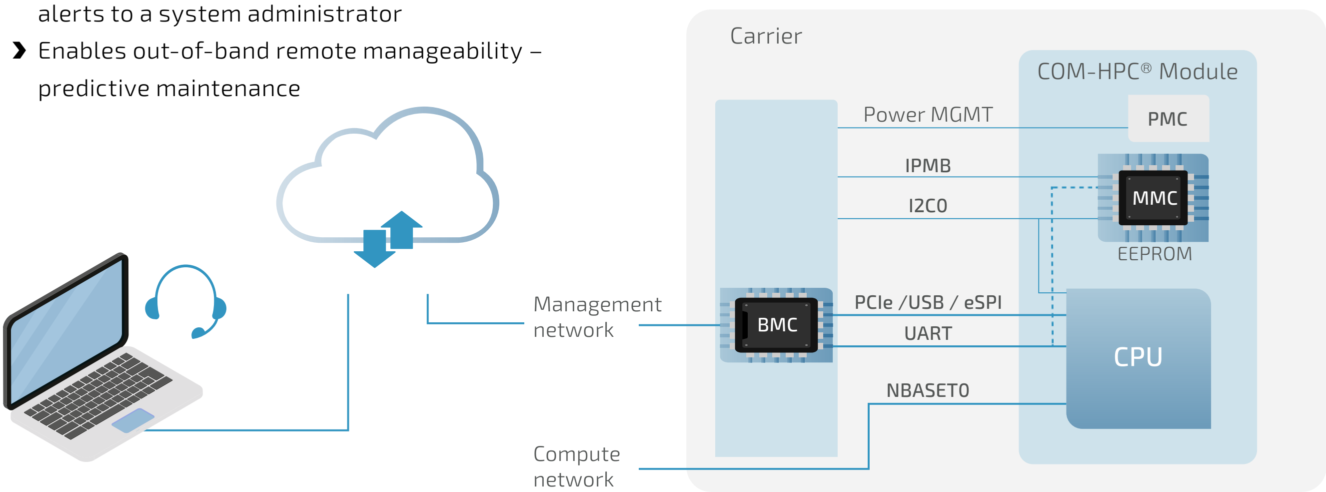
More Information:
JUMPtec COM-HPC®



The ASPEED AST2600-based RunBMC module offers a full range of functions for best possible RASM (Reliability, Availability, Serviceability, Manageability)

The COM-HPC®/Server Reference Carrier has a particularly compact footprint of 182 mm x 215 mm

- Interface to connect a MMC to a BMC
- Monitors the sensors and can send alerts to a system administrator
- Enables out-of-band remote manageability – predictive maintenance

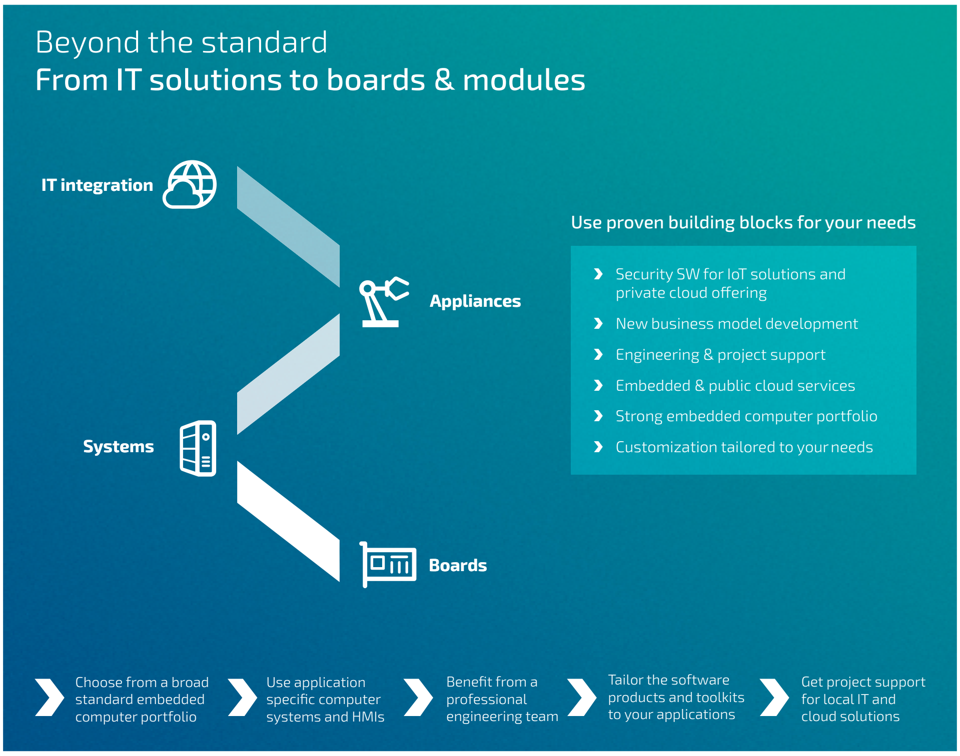


Block diagram of the communication between the Server-on-Module and RunBMC module

Complete ecosystem for the „Rugged-Edge-in-a-Box"

COM-HPC® modules and application carriers, together with RunBMC modules for server management, provide a complete ecosystem for developing particularly compact and robust edge servers that can be used in harsh environments and extended temperature ranges. Combined with the ability to develop customer-specific carrier boards and integrate them into industrial housings that fit seamlessly into the installation situation, OEMs have the perfect foundation for the rapid field deployment of their specific edge server design. Third-party hardware can also be integrated, such as low-power GPU cards to relieve the CPU, thereby accelerating complex cryptographic algorithms, intrusion detection and threat analysis. All resulting in a significant improvement in response to cyber attacks.

What should your „Rugged-Edge-in-a-Box" look like?
Tell us your requirements for your edge server configuration. Our experts will support you in selecting and integrating the perfect server-on-module for the entire life cycle of your products!



[1] www.marketgrowthreports.com/global-edge-server-industry-research-report-2023-competitive-landscape-market-22382642
[2] www.statista.com/outlook/tmo/data-center/servers/worldwide
[3] itnext.io/4-types-of-edge-computing-broadly-categorized-be557f3556ea

Kontron SystemController

One4All - Precise monitoring in one system

Enhanced embedded board monitoring and
remote system control

3 Stage Watchdog
Multi-stage interrupts, based on the watchdog, temperature and voltage monitoring

Temperature and voltage monitoring
Independently monitor and supervise critical conditions during the bring-up or operating phase

Customer specific data
Store interface-specific data, like manufacturer identifiers, delivery data or operating data

Fully programmable fan control
Control of connected fans depending on operating status

GPIOs
Free programming of digital inputs and outputs

Software API
Software library for Windows and Linux allows the use of all features

Use for all Kontron motherboards, modules and single board computers (SBC) as well as for complete Kontron systems.

Kontron ToolSuite

One4All - Seamless Maintenance on one platform

Suite of powerful board configuration tools -
BIOS configuration

Up- and downgrade BIOS

Recover corrupted BIOS

Transfer BIOS settings

Exchange BIOS Boot Logo

System Management

Software API

Be prepared for NIS-2 and CRA
Kontron's innovative and user-friendly API enables uniform use for all Kontron motherboards, modules and single board computers (SBC) as well as for complete Kontron systems. It is available for both Linux® and Windows and offers simple, efficient integration into a wide range of applications.

About JUMPtec®

JUMPtec specializes its technical expertise in designing both - standard and highly customized compute products. Our newly optimized structure enables us to take customers from prototyping and design through to mass production faster than ever before.

We are uniquely positioned to leverage our global design and manufacturing expertise alongside Kontron's extensive worldwide network. While JUMPtec remains a fully owned subsidiary of Kontron, we benefit from their global distribution capabilities and work closely with Kontron's other solution businesses. With more OEMs seeking to mitigate risk and outsource complex manufacturing, the shift to modular solutions is becoming more prevalent. JUMPtec, backed by Kontron, is well-positioned to support customers in implementing this modular approach, offering high-quality, scalable solutions without compromising on size or capability.

JUMPtec serves a diverse range of markets, providing innovative solutions tailored to the unique needs of each industry. Find out more about our offering!

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

Your Contact

JUMPtec GmbH

Brunwiesenstrasse 16
94469 Deggendorf
Tel.: +49 991 37024-0
info@jumptec.com

www.jumptec.com