Transforming Patient Care with High Performance Computing at the Edge

Congatec’s COM-HPC module delivers the design flexibility and high performance needed to power AI, graphics, and other data-intensive applications driving modern healthcare systems.

Medical technologies are rapidly advancing, redefining many aspects of patient care. To remain at the forefront of innovation, OEMs and their customers serving this market must deliver high-performance edge computing solutions that can process near-real-time patient data wherever care is delivered. There is fierce competition across the industry as well, placing increasing pressure on OEMs and their customers to bring new products to market faster.

The new PICMG COM-HPC (high performance compute) standard for Computer-on-Modules (COMs) delivers the high performance and I/O bandwidth needed to meet the industry’s increasing workload requirements. The COM-HPC’s modular design enables the flexibility, scalability, and extensibility required to expedite product development and drive a growing array of new medical devices being deployed at the edge.

Challenge: Processing unprecedented volumes of healthcare data at the edge

Medical data is proliferating at the edge, with graphics, video, AI, and robotics increasingly driving applications. The ability to capture, store, transmit, and analyze near-real-time data is essential today in use cases ranging from medical imaging (e.g., MRI, CT, ultrasound, and X-ray systems) to robotic-assisted surgeries and telehealth platforms. These data-intensive applications must perform in ruggedized environments such as ambulances and mobile medical units, as well as in urban hospitals and clinics. To meet customer needs, OEMs must deliver near-real-time edge computing and the design flexibility required to address the complexities of modern healthcare applications.

Solution: COM-HPC, PICMG’s new, high-performance standard for COMs

COMs refer to a class of small- to medium-sized circuit boards containing both processors and memory. COMs are plugged directly into an application-specific carrier board via a standard connector, delivering the processing power and performance characteristics required to power the application in one standard, interchangeable module.

Using a COM in the design process allows OEMs and their customers to focus solely on the system features driving their application, as the chip-level design work has already been done for them. This flexibility dramatically increases design efficiency, enabling easier customization and faster time to market.

Since 2005, PICMG’s COM Express concept has been the industry standard for COMs. However, PICMG recently released the higher-performance COM-HPC specification,
featuring nearly double the pin count (800 pins vs. 440 for the COM Express) and significantly higher bandwidth for accelerated speed and throughput. For optimum flexibility, the COM-HPC’s modular design separates the standard PC core functionality from the customized extensions located on a carrier board. The COM-HPC’s 800-pin board-to-board connection design allows for easy system upgrades. In fact, upgrading an existing COM–HPC solution with a future generation of Intel® CPUs will require just a simple replacement of the module, along with a software stack upgrade.

With the COM–HPC, most interface circuitry is situated directly on the module, including PCI Express, Ethernet, SATA, display interfaces, general-purpose I/O, and similar interfaces. The interfaces are routed to the appropriate ports on the carrier board, which supports the application-specific circuit parts as well.

### Transitioning from COM Express to COM–HPC

When choosing between the COM Express and COM–HPC standards, there are many factors to consider. Overall, the COM Express standard is well suited for OEMs and their customers looking to upgrade easily from previous-generation COM Express modules. However, COM–HPC modules deliver new levels of performance and scale, with the higher I/O required to power future generations of Intel® technology. Both standards will be supported for many years to come.

While the 11th Gen Intel® Core™ processors fully optimize the computing performance of the COM Express standard, they represent just the first generation of Intel® processors to be supported by COM–HPC modules—with future generations promising even greater performance and scalability. The COM–HPC standard also supports Intel® Xeon® processors for server-class functionality.

The COM–HPC’s 800 pin count and support for PCIe Gen 5, USB4, and multiple lanes of high-speed Ethernet allow the COM–HPC to scale at a level not possible with the COM Express standard. Not every application requires the COM–HPC’s extensive scalability, though, and COM Express remains a viable standard for many healthcare applications.

As with any aspect of product development, cost is a consideration when upgrading to the new COM–HPC standard. The main price-defining parts of the high-performance COM–HPC are its CPU and memory. With nearly double the number of pins and four to eight times the data bandwidth of the COM Express, the COM–HPC delivers greater performance. Ultimately, the new connectors are included at a minimal additional cost to OEMs and their customers.

When designing with a COM–HPC, a high-quality PCB base material with low high-frequency damping may be required as well, depending on the distance between the high-speed device and the board-to-board connector. PICMG has published specifications on the COM–HPC’s PCB material requirements. In most cases, a low-cost PCB material can be used.

When upgrading to the COM–HPC standard, partnering with Congatec can help ease the transition. The company’s expert service and support teams are there to assist OEMs and their customers with evaluations and cost estimates for high-speed PCB designs.

### Introducing the COM–HPC standard:

**Congatec’s conga-HPC/CTLH COM–HPC Client Type Size B module**

To power today’s data-rich healthcare applications, Congatec offers its conga-HPC/CTLH COM–HPC Client Type Size B module. Featuring 11th Gen Intel Core processors, the Congatec module offers the high performance and expanded I/O capabilities required to process, store, and analyze volumes of medical data in near-real time.

The conga-HPC/CTLH is designed to enable high image resolutions, heavy workloads, and near-real-time data transmissions. The module also delivers the long-term availability (10 years+) required for lengthy industry qualification processes and to help ensure reliable performance throughout the system’s life cycle.

**Congatec conga-HPC/CTLH module features:**

- 800-pin board-to-board connection (PICMG standard) for fast processing, easy CPU upgrades, and scalability
- A rich I/O interface set for high performance computing, including 20x PCIe Gen 3 lanes, 16x (PEG support) Gen 4 lanes, and 4x PCIe Gen 4 lanes
- NVMe on PCIe Gen 4 for fast storage
- 2x USB4 with the highest data throughput
- Support for up to 128 GB DDR4 DRAM with 3200 MT/s memory
- Intel® Iris® Xe graphics to drive up to three DisplayPort (DP++) interfaces
- One extra eDP port for a system-integrated flat panel
- Integrated i225 Ethernet controller that supports 2x 2.5 Gb/s and is fully TSN capable
- Hypervisor for system consolidation and advanced data communication security
- Extended temperature ranges from -40°C to 85°C for mobile and outdoor deployments
Support for high-throughput applications, extreme temperatures

11th Gen Intel Core processors support up to 20 PCIe Gen 4 lanes, two USB 4 ports, and 2x 2.5GbE interfaces to ensure the connectivity required for the heavy workloads generated by medical devices. With 11th Gen Intel Core processors, OEMs and their customers can create solutions that facilitate, for example, the high-speed interfaces used to process near-real-time data in robotic surgeries. These processors perform reliably in the harshest of environments, as well as in extreme temperatures ranging from -40°C to 85°C. As a result, they meet the demands of healthcare applications deployed at the edge, whether indoors, outdoors, on mobile devices, or in rescue vehicles.

Intel® Time Coordinated Computing (Intel® TCC) for near-real-time data processing

11th Gen Intel Core CPUs also support Intel® TCC to expedite processing for near-real-time workloads and Time-Sensitive Networking (TSN). This powerful solution allows the conga-HPC/cTLH module to improve deterministic computing by synchronizing data and execution across the network. To simplify real-time tuning for proprietary and open source systems, Intel provides tools, libraries, and APIs. Supported real-time hypervisors and operating systems include Linux, Windows, ACRN, Wind River VxWorks, and Real Time Systems.

Expansive application support, near-real-time data transfers

The computing performance delivered by 11th Gen Intel Core processors powers a wide range of healthcare use cases that require near-real-time data transfers to the CPU. Key features include:

- New 10 nm++ process for improved power/performance
- Enhanced media (AV/12b)
- End-to-end support for one 8K display or up to three 4K displays
- Next-generation IPU6 SE imaging
- PCIe Gen 4 for premium storage and graphics
- Uncompromised performance with hardened security and remote manageability

Advanced features for fast AI workload processing

Exclusive to Intel processors, Intel® Advanced Vector Extensions 512 (Intel® AVX-512) accelerates AI workloads for rapid image analysis, audio/video processing, and cryptography. Intel® Deep Learning Boost (Intel® DL Boost) further extends Intel AVX-512 with a new instruction set that increases inference performance on lower-precision data types, such as those used in workloads for image classification, speech recognition, and object detection.

Layers of security protect sensitive medical data

To mitigate risk, healthcare providers must help secure patient data according to a range of industry security protocols and regulations. 11th Gen Intel Core processors help protect data with advanced hardware-enabled security:

- Intel® Total Memory Encryption (Intel® TME) enables full physical memory encryption. This helps defend against hardware-level attacks such as cold boot, freeze spray, and DIMM removal.
- Intel® Boot Guard and Intel® Trusted Execution Technology (Intel® TXT) help establish a secure boot and provide the foundation for safe computing.
- Intel® Key Locker helps protect encrypted keys and decrypt/encrypt operations.

For workloads and configurations, visit intel.com/PerformanceIndex. Results may vary.
Intel and Congatec: Powering the future of healthcare

With new AI, graphics, robotics, and other data-intensive applications revolutionizing healthcare, the demand has never been higher for reliable high performance computing at the edge. COM-HPC modules such as Congatec’s conga-HPC/cTLH deliver all the high-speed performance and design flexibility required to process heavy workloads in near-real time at the edge and quickly bring innovations to market. Together Congatec and Intel technologies are laying the foundation for the future of healthcare operations, one in which patient data generated at the edge can be accessed and leveraged faster, promoting more-responsive, data-driven treatments and supporting better outcomes.

Learn more

Explore the capabilities of Congatec modules at congatec.com/en/products/com-hpc.

Discover the value of 11th Gen Intel Core processors at intel.com/tigerlake-h.

Learn more about PICMG’s COM-HPC base specifications by visiting picmg.org/product/com-hpc-module-base-specification.

About Congatec

Congatec is a rapidly growing technology company focusing on embedded computing products. The company’s high-performance computer modules are used in a wide range of applications and devices in industrial automation, medical technology, transportation, telecommunications, and many other verticals.

congatec.com

Intel configurations

Performance results are based on Intel measurements as of May 25, 2021.

Processor: Intel® Core™ i7-11850HE (TGL-H) PL1=45W TDP, 8C16T turbo up to 4.7 GHz
Graphics: Intel® Graphics Gen 12 GFX
Memory: 32 GB DDR4-3200
Storage: Intel® SSD 545S (512 GB)
OS: Windows 10 Pro 20H2
Bios: TGLSFW1R.I00.0115.A01.2104060640 (Release date: 04/06/2021)
CPUz Microcode: 28h

Processor: Intel® Core™ i7-9850HE (CFL-H) PL1=45W TDP, 4C8T turbo up to 4.4 GHz
Graphics: Intel® Graphics Gen 9 GFX
Memory: 32 GB DDR4-2666
Storage: Intel® SSD 545S (512 GB)
OS: Windows 10 Pro 20H2
Bios: CNLSFR1R.I00.0168.B01.2006110406 (release date: 06/11/2020)
CPUz Microcode: D6h

For more complete information about performance and benchmark results, visit intel.com/benchmarks.

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