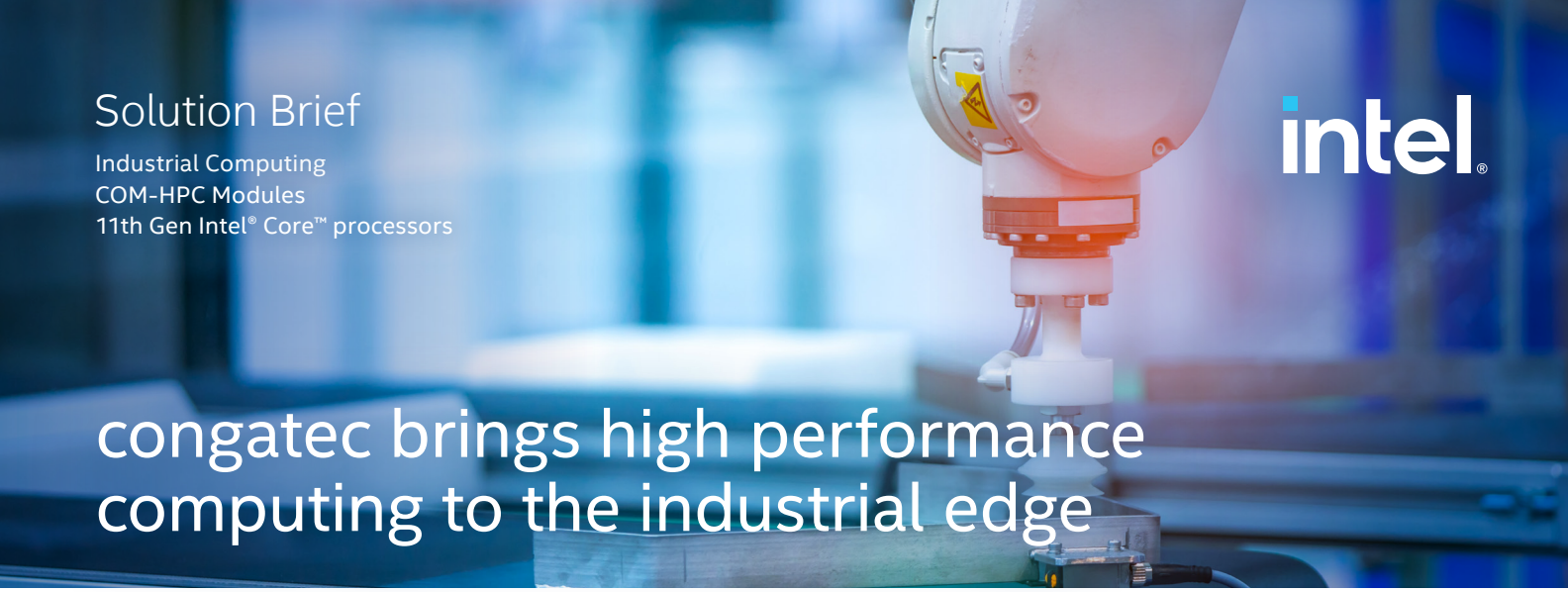


Solution Brief

Industrial Computing
COM-HPC Modules
11th Gen Intel® Core™ processors

congatec brings high performance computing to the industrial edge

congatec COM-HPC modules use “Enhanced for IoT” 11th Gen Intel® Core™ processors to meet demand for more lanes and more processing power that can scale

congatec

“Intel is clearly in this with us. They serve at our side on PICMG, devote engineering resources to open standards, and support us, and congatec customers, in the factory and in the field. On top of all that—they understand everything it takes—performance, reliability, and stable, long-term road maps—to manufacture CPUs for the industrial market.”

— Jason Carlson, CEO of congatec

A new ceiling for embedded computing

The demand for high performance computing and high-volume data at the edge is growing exponentially. These new demands have pushed the COM Express standard to its limit. That’s why more than 25 companies, including congatec and Intel, have been working together through the PCI Industrial Computer Manufacturers Group (PICMG) to create a new open standard for a higher-performance computer-on-module (COM). The result: COM-HPC.

The right engine for a high-performance standard

The new COM-HPC standard radically expands data volume and speed, I/Os, and memory capacity. For example: The COM-HPC client specification supports up to 49 PCIe lanes on modules as small as 95 x 120 mm. When the PICMG workgroup started in 2018, specs like those were for a future that technology couldn’t support at the time. But, with the arrival of 11th Gen Intel® Core™ processors, the COM-HPC spec now has a CPU that can bring it to market.

High-capacity, flexible lanes for data-intensive edge AI

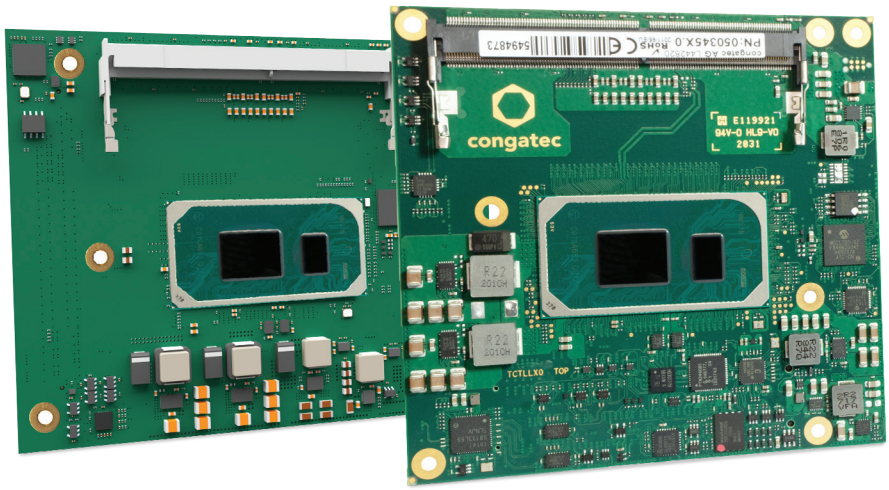
The amount of data coming to and from edge devices can be staggering. Computing systems for automated manufacturing produce and consume data horizontally as they communicate with other machines and material-handling and vision systems. Data travels vertically to and from gateways, edge servers, or, increasingly, real-time fog servers that seamlessly connect the real-time control infrastructure with cloud services.

On top of those core tasks, devices have to run big data analytics and predictive maintenance, serve up digital user guides, and support custom helpdesks—all with a single CPU on a single module.

That’s a lot of information to move. The congatec COM-HPC puts all of the 11th Gen Intel Core processor’s lanes and I/Os to work. Modules support data-intensive sensors, inputs, and workloads, plus multiple network paths to local systems and controllers, edge servers, and resources in the cloud.

Ready for demanding, industrial environments

Enhanced for IoT 11th Gen Intel Core CPUs are designed for embedded and industrial use cases. congatec modules build on this base reliability to create small form-factor computers that can withstand harsh environments.



High-speed, industrial-strength connectivity

COM-HPC supports multilane I/Os

- Four PCIe 4.0 lanes and eight PCIe 3.0 lanes
- Four Thunderbolt™ 4/USB 4.0 ports
- Two USB 3.2 Gen 2
- Eight USB 2.0

All heat-generating components are thermally connected to a heat spreader that interfaces with the system's cooling system. congatec's patented, high-efficiency flat heat pipes dissipate heat and create a high thermal reserve, which increases reliability even when CPUs run at higher performance levels. Innovative heat management, plus close attention to the details—like industrial-class components, long-life ceramic capacitors, and power-saving designs—make congatec COM Express and COM-HPC single-board computers a superior choice for extreme applications that require high reliability.

HEAT KILLS **5°K** **less heat** CAN RESULT IN UP TO **2x** **longer life**[1]

congatec's patented flat heat pipe dissipates heat more efficiently in space-constrained formats.

Dedicated board controllers

congatec uses an onboard microcontroller to fully isolate key embedded features from the x86 core architecture. System monitoring, multistage Watch Dog, and the I2C bus all run in insolation, resulting in higher embedded feature performance and higher overall system reliability.

Superior graphics and video performance

4K video and high frame rates may not sound like critical industrial computing needs, but in healthcare imaging, graphics performance can make a life-saving difference. Mobile medical imaging—digital X-rays and ultrasounds—depends on industrial-grade, 24/7 computing performance plus workstation-level graphics and AI-powered, computer vision diagnostics.

The Intel® Iris® Xᵉ Graphics engine features up to 96 execution units that can drive up to 4x4K60 HDR displays or 2x8K SDR displays for precision medical imaging or multiscreen digital signage. Dual video decode boxes, which can process up to 40 simultaneous streams of 1080p 30fps video, support applications like video management systems and network video recorders.

Accelerated AI inference without extra hardware

Intel Iris Xᵉ Graphics execution units excel as deep learning inference coprocessors. Intel also accelerates inference performance on the CPU with Intel® Deep Learning Boost and VNNI—an instruction set that condenses three Intel® Advanced Vector Extensions instructions into one. With up to four CPU cores and 96 graphics execution units, Enhanced for IoT 11th Gen Intel Core processors can support edge AI without additional accelerator cards.

Writing code that takes advantage of Intel® CPU and GPU architectures is relatively straightforward with the Intel® Distribution of OpenVINO™ toolkit. Developers can use the OpenVINO toolkit to optimize neural network models, build AI inference applications, and port them to any Intel® architecture. OpenVINO toolkit makes it easier to build applications that run on mixed architectures like a CPU/iGPU system with a VPU-powered accelerator card.

Processing inference workloads on the device—instead of shipping them to the cloud for processing—reduces latency drastically. Fast, local, edge AI is essential to autonomous systems like railway control systems, self-inspecting manufacturing lines, and smart industrial controls.

Ready for real-time computing

Robotic manufacturing, telecom, and smart power grids depend on precision timing and real-time computing. Traditional hardware designs use separate microcontrollers, even separate computing systems, for time synchronization.

congatec uses Intel® Time Coordinated Computing (Intel® TCC) and integrated Time-Sensitive Networking (TSN)[3]—available on select Enhanced for IoT 11th Gen Intel Core processors—and Real-Time Systems Hypervisor to support hard real-time computing alongside multiple operating systems and services.

Multiple cores, multiple, simultaneous workloads

congatec and their partner company Real-Time Systems are a pioneering force in workload virtualization and core splitting. Using Real-Time Systems Hypervisor, customers are able to run each CPU core as a separate virtual computing system.

Here's how splitting a quad-core CPU into virtual machines can improve performance and reduce computing hardware costs for a smart manufacturing robot:

- Core one runs a vision-based, AI application for situational awareness
- Core two runs a real-time operating system for deterministic (hard real-time) control software
- Core three runs Linux and a high-security firewall for an IoT gateway
- Core four runs a general-purpose operating system like Microsoft Windows or Android

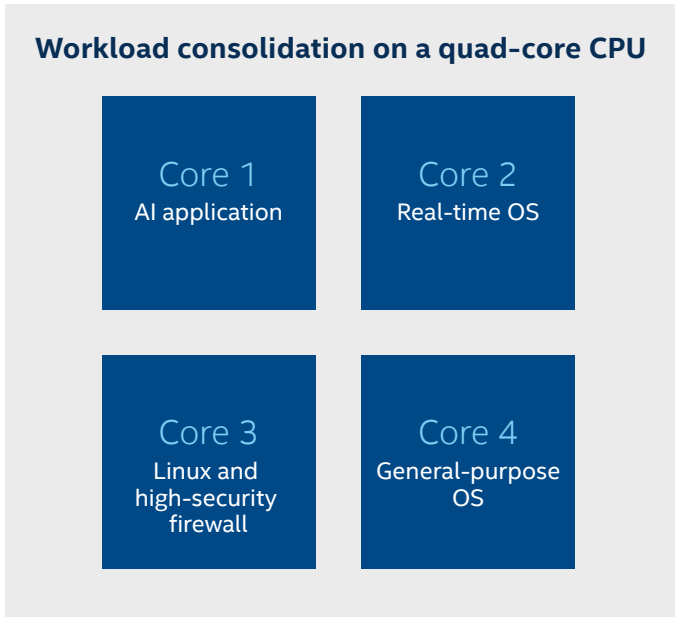
Using software to consolidate disparate workloads onto a single computing module makes systems far more flexible and enables new capabilities while reducing overall material and integration costs.

Stronger defenses for devices in the field

Embedded devices and industrial controls are vulnerable on multiple fronts. Hackers can exploit hardware and network weaknesses. Thieves can simply walk away with unguarded devices. Enhanced for IoT 11th Gen Intel Core processors feature hardware-based security technologies, including total memory encryption, ROP attack prevention, and advanced crypto-key protection to help thwart virtual and physical attacks.

COM-HPC: An evolution, not a replacement for the COM Express standard

COM-HPC will augment, rather than replace, the COM Express standard. congatec is using 11th Gen Intel Core hardware to develop the new COM-HPC standard and power the next generation of COM Express Type 6.



With Real-Time Systems Hypervisor, a single CPU can run as multiple, virtual machines for dedicated tasks.

congatec workload consolidation starter kit

Processor[3]	Cores/Threads	Frequency at 28/15/12W TDP (Max Turbo) GHz	Cache (MB)	Graphics Execution Units	Extended Temperature Range	COM-HPC	COM Express Type 6
Intel® Core™ i7-1185G7E	4/8	(Max Turbo) GHz	12	96	–	•	•
Intel® Core™ i5-1145G7E	4/8	2.6/1.5/1.1 (4.1)	8	80	–	•	•
Intel® Core™ i3-1115G4E	2/4	3.0/2.2/1.7 (3.9)	6	48	–	•	•
Intel® Core™ i7-1185GRE	4/8	2.8/1.8/1.2 (4.4)	12	96	•	•	•
Intel® Core™ i5-1145GRE	4/8	2.6/1.5/1.1 (4.1)	8	80	•	•	•
Intel® Core™ i3-1115GRE	2/4	3.0/2.2/1.7 (3.9)	6	48	•	•	•

Working together to advance industrial computing

Intel and congatec have worked together for over 15 years and delivered multiple generations of innovative, embedded, and industrial computers. But their partnership goes deeper than manufacturing. Intel and congatec work together to create new, open standards like COM-HPC; serve the industry through groups like PICMG; and support open-source software communities.

conga-HPC/cTLU and conga-TC570

Learn about congatec's first COM-HPC modules and new levels of industrial-grade performance for COM Express Type 6 modules powered by 11th Gen Intel Core processors.

Learn more ›

11th Gen Intel Core processors are enhanced for IoT

11th Gen Intel® Core™ processors feature high-performance CPU/GPU compute with integrated AI acceleration, plus real-time capabilities for critical applications that demand high-speed processing, computer vision, and low-latency deterministic computing.[3]

Learn more ›

Enhanced for IoT 11th Gen Intel® Core™ processors

KEY ADVANCES

Intel® 10 nm microarchitecture with up to four processing cores boosts performance up to 23 percent in single-thread applications and 19 percent in multi-thread applications vs. Intel® Core™ i7-8665UE.[2]

High-speed connectivity with four Thunderbolt™ 4/USB ports, four PCIe 4.0 lanes, and 12 PCIe 3.0 lanes.

Intel® Iris® Xᵉ Graphics with up to 96 execution units deliver up to a 2.95x performance increase vs. Intel® Core™ i7-8665UE.[2] Dual video decode boxes process up to 40 simultaneous streams of 1080p 30fps video and output four channels of 4K or two channels of 8K video.

Accelerated AI Inference on the CPU with Intel® Deep Learning Boost and VNNI, which condenses three Intel® AVX instructions into one, plus up to 96 Intel Iris Xᵉ Graphics execution cores for parallel processing.

Intel® Time Coordinated Computing and Time-Sensitive Networking support synchronous process control and real-time computing.

About congatec

congatec is a rapidly growing technology company focusing on embedded computing products. Their 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 is the global market leader in the computer-on-modules segment with an excellent customer base from start-ups to international, blue-chip companies. Founded in 2004 and headquartered in Deggendorf, Germany, the company reached sales of USD 126 million in 2019. More information is available on the congatec website at **congatec.com** or via **LinkedIn**, **Twitter**, and **YouTube**.

1. Source: Based on congatec mean time between failure (MTBF) calculations. See https://www.congatec.com/en/technologies/cooling-solutions/heat-pipe-cooling/ for more information. Intel does not control or audit third-party data. You should review this content, consult other sources, and confirm whether referenced data are accurate.
2. Source: Intel. Performance claim based on SPEC CPU 2017 metrics estimated by measurements on Intel internal reference platforms completed on August 27, 2020. Graphics claim based on 3DMark11_V1.0.4 Graphics Score estimated by measurements on Intel internal reference platforms on August 27, 2020.

   Testing configuration:

   Processor: Intel® Core™ i7 1185G7E PL1=15W TDP, 4C8T Turbo up to 4.4GHz
   Graphics: Intel Graphics Gen 12 gfx
   Memory: 16GB DDR4-3200
   Storage: Intel SSDPEKKW512GB (512 GB, PCI-E 3.0 x4)
   OS: Windows 10 Pro (x64) Build 19041.331 (2004/ May 2020 Update). Power policy set to AC/Balanced mode for all benchmarks. All benchmarks run in Admin mode & Tamper Protection Disabled / Defender Disabled.
   Bios: Intel Corporation TGLSFWI1.R00.3333.A00.2008122042
   OneBKC: tgl_b2b0_up3_pv_up4_qs_ifwi_2020_ww32_4_01

   Processor: Intel® Core™ i7 8665UE 15W PL1=15W TDP, 4C8T Turbo up to 4.4GHz
   Graphics: Intel Graphics Gen 9 gfx
   Memory: 16GB DDR4-2400
   Storage: Intel SSD 545S (512GB)
   OS: Windows 10 Enterprise (x64) Build 18362.175 (1903/ May 2019 Update). Power policy set to AC/Balanced mode for all benchmarks. All benchmarks run in Admin mode & Tamper Protection Disabled / Defender Disabled.
   Bios: CNLSFWR1.R00.X208.B00.1905301319
3. Not all features are available on all 11th Gen Intel® Core™ SKUs.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors.

Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information, visit www.intel.com/benchmarks.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

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Not all features are available on all SKUs.

Not all features are supported in every operating system.

Intel may change availability of products and support at any time without notice.

Your costs and results may vary.

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