intel.

Accelerated AI and Graphics on 15 Watts or Fewer

Low-power processors bring deep learning inference, graphics, and media processing to the edge.
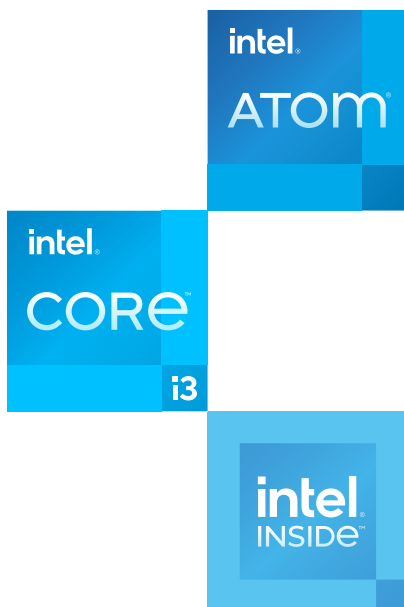
Expand capabilities at the edge without breaking your power budget

Intel Atom® processors x7000E Series and Intel® Core™ i3 processors break new ground for x86 processors in the 6W to 15W base processor power range. Built with the same Efficient-cores and Intel® UHD Graphics as 12th Gen Intel® Core™ processors, the series supports Intel® Advanced Vector Extensions 2 (Intel® AVX2) and Intel® Deep Learning Boost (Intel® DL Boost) for accelerated deep learning inference and media processing.

Accelerated deep learning AI

The series delivers new deep learning processing capabilities to the 6W to 15W power range: Intel® DL Boost and Intel UHD Graphics—which is built on Intel® X^e architecture. Intel DL Boost is an Intel AVX2 instruction set that accelerates inference processing on the CPU, while the Intel UHD Graphics execution units (EUs) and Intel GNA work as inferencing coprocessors.

The series is supported by the Intel® Distribution of OpenVINO™ toolkit, including many pretrained models in the Open Model Zoo and the Auto-Device (AUTO) plugin. The AUTO plugin automatically detects processing resources and balances deep learning workloads across any mix of CPUs, integrated GPUs, and other accelerators for maximum inference performance.

The ability to improve inferencing for deep learning AI models on a small power budget delivers new levels of object detection and image segmentation for network video recorders (NVRs), portable healthcare imaging, and smart point-of-sale (POS) systems plus natural language processing for speech recognition and automated attendants.

4K displays without a discrete graphics card

Intel Atom processors x7000E Series and Intel Core i3 processors feature Intel UHD Graphics with up to 32 EUs. The platform supports one 4K60 HDR display or up to three concurrent 4K60 SDR displays. Two outputs can be synced using Pipelock1 for multipanel displays.

Media processing and acceleration are fully programmable via API for precise control over image quality and encode/decode performance. Single-root I/O virtualization (SR-IOV) enables integrated GPU functionality for virtual machines, deep learning inference, multiple monitor outputs, and transcoding video streams.
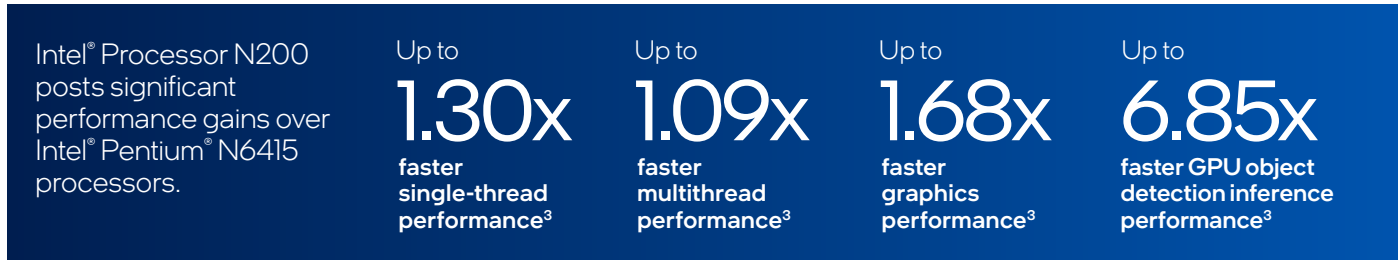
Real-time operating systems and hardware virtualization

Intel Atom x7000E Series SKUs include Intel® Time Coordinated Computing (Intel® TCC),[2] which can support hard real-time applications. These Intel Atom processors also include a 2.5GbE Time-Sensitive Networking (TSN)−capable integrated MAC so that devices can synchronize workloads across networks. Hard real-time support plus hardware virtualization and support for multiple operating systems and hypervisors create new possibilities for IoT.

What's new

- Up to eight Efficient-cores
- 6W to 15W TDP
- Two USB-C lanes on the CPU
- Intel® AVX2 instruction set
- Intel® Deep Learning Boost (Intel® DL Boost) with Vector Neural Network Instructions (VNNI)
- GPU and CPU support for FP32, FP16, and INT8 precision

Gen-over-gen performance gains

Intel® Processor N200 posts significant performance gains over Intel® Pentium® N6415 processors.

Up to	Up to	Up to	Up to
1.30x	**1.09x**	**1.68x**	**6.85x**
faster single-thread performance[3]	faster multithread performance[3]	faster graphics performance[3]	faster GPU object detection inference performance[3]

Intel® Processor N200 compared to Intel® Pentium® N6415 processors. See backup for workloads and configurations. Results may vary.

Long-term software support and long-life availability that IoT requires[4]

The Windows 10 IoT Enterprise 2021 Long-Term Servicing Channel (LTSC) and Linux Long-Term Support (LTS) kernel provide longer periods between updates for industries and applications that require maximum stability. Long processor production lifespans help manufacturers get more value out of platform validation and deliver solutions for long-term deployments.

Key features[5]

CPU Performance
- Up to eight Efficient-cores with Intel Core i3-N305 processors
- Up to four Efficient-cores with Intel Atom processors x7000E Series
- Full Intel AVX2 instruction set support, Intel DL Boost with VNNI

Graphics
- Intel UHD Graphics driven by Intel X^e architecture
- 32 execution units (EUs) with Intel Core i3-N305 processors
- Up to 24 execution units (EUs) with Intel Atom processors x7000E Series
- Run one 4K60 HDR display or up to three concurrent 4K60 SDR displays
- Pipelock for Windows synchronizes two outputs

Accelerated deep learning inference
- Intel DL Boost with VNNI accelerates deep learning inference on the CPU
- Up to 32 Intel UHD Graphics execution units (EUs) provide parallel processing for AI workloads
- Intel GNA increases throughput for deep learning audio and natural language processing
- GPU and CPU support for FP32, FP16, and INT8 precision
- Fully supported by the Intel Distribution of OpenVINO toolkit for optimized, cross-architecture deep learning inference
- Developers can access many pretrained models from the OpenVINO™ Open Model Zoo

Memory
- DDR4-3200, DDR5-4800, LPDDR5-4800
- 16 GB max memory capacity
- Supports in-band error correcting code (IBECC)

IoT enhancements
- Real-time computing with Intel TCC[2]
- TSN for real-time networking
- Rated for PC client and embedded use
- Long-life availability[7]

I/Os and connectivity
- Integrated platform controller hub (PCH)
- Two USB-C lanes on the CPU
- Nine PCIe 3.0 lanes on the PCH
- Four USB 3.2 or eight USB 2.0 lanes on the PCH
- 2.5GbE TSN-capable MAC on the PCH supports one TSN port
- Up to Wi-Fi 5/Bluetooth 5.2
- Image processing unit 6 EP (IPU6EP)

Management and security
- **Platform integrity** – Protected and verified boot process with hardware attestation (Intel® OS Guard, Intel® VT-d/x, Intel® Boot Guard, Secure Boot, Intel® PTT (TPM, measured boot, RSA/ECDSA key support)
- **Protected data, keys, and identity** – A protected repository for cryptography, storage for sensitive data, keys, and credentials at rest (Intel® PTT, discrete TPM)
- **Trusted execution** – Isolated enclaves to help protect sensitive data, processes, and keys at runtime and create a trusted application environment (Intel VT-d/x, Intel® DAL)
- **Crypto acceleration** – Hardware-assisted crypto acceleration and SecureKey generation (Intel® AES-NI, Intel® SHA-NI, Intel® SecureKey (DRNG)
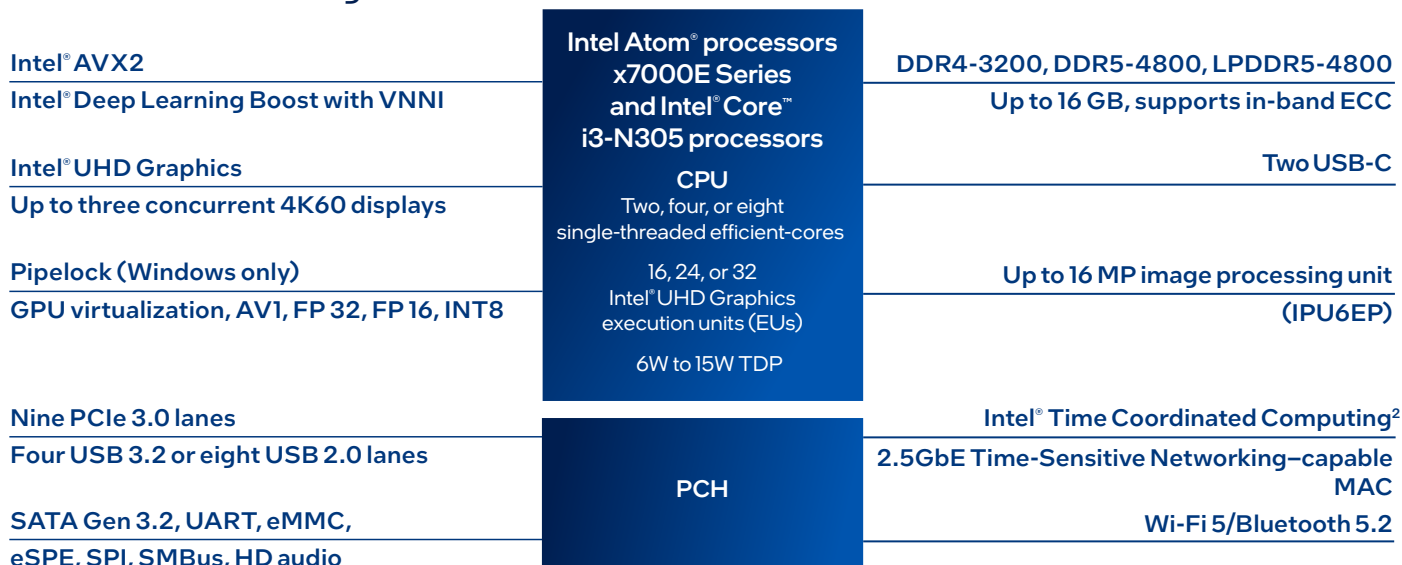
Software—operating systems
- Windows 10 IoT Enterprise LTSC 2021
- Ubuntu, RHEL, WR Linux
- Yocto Project (LTS kernel 2021)
- Celadon CiV (Android optimized for IA)
- Support for hypervisors and RTOS[6]

Software toolkits
- Intel® oneAPI Base Toolkit[7]
- Intel® oneAPI IoT Toolkit
- Intel Distribution of OpenVINO toolkit and OpenVINO Open Model Zoo

Processor block diagram*

	Intel Atom® processors x7000E Series and Intel® Core™ i3-N305 processors	
Intel® AVX2		DDR4-3200, DDR5-4800, LPDDR5-4800
Intel® Deep Learning Boost with VNNI		Up to 16 GB, supports in-band ECC
Intel® UHD Graphics	**CPU** Two, four, or eight single-threaded efficient-cores	Two USB-C
Up to three concurrent 4K60 displays		
Pipelock (Windows only)	16, 24, or 32 Intel® UHD Graphics execution units (EUs)	Up to 16 MP image processing unit
GPU virtualization, AV1, FP 32, FP 16, INT8		(IPU6EP)
	6W to 15W TDP	
Nine PCIe 3.0 lanes		Intel® Time Coordinated Computing[2]
Four USB 3.2 or eight USB 2.0 lanes	**PCH**	2.5GbE Time-Sensitive Networking–capable MAC
SATA Gen 3.2, UART, eMMC, eSPE, SPI, SMBus, HD audio		Wi-Fi 5/Bluetooth 5.2

Not all features are supported in every operating system. Not all features are available on all SKUs.

Use cases

Retail: Digital signage, kiosks, mobile point of sale with onboard AI[5]

Applications: Mobile order-taking and self-serve POS systems, interactive wayfinding, out-of-home digital advertising installations

- Up to eight CPU cores and Intel UHD Graphics with up to 32 execution units can run displays, process media, and perform deep learning inference simultaneously[5]

- Support one 4K60 HDR display or up to three concurrent 4K60 SDR displays with Pipelock synchronization on two displays (Windows only)[1]

- Intel AVX2 instruction set, including Intel DL Boost, accelerates AI workloads on the CPU, adding additional AI processing power for computer vision and natural language processing

- Programmable graphics, codecs, and media accelerators on the CPU and GPU are all controlled via the Intel® oneAPI Video Processing Library

- Image processing unit 6EP (IPU6E)

Office automation: UHD imaging and control panels with AI capabilities[5]

Applications: Copiers, printers, and scanners

- CPU with up to eight Efficient-cores and flexible, high-bandwidth I/Os supports next-generation applications and user interfaces plus high-volume data transfer

- Deep learning AI capabilities—Intel DL Boost on the CPU and Intel UHD Graphics with parallel processing on up to 32 execution units—support AI-powered image recognition, text recognition, and natural language processing

Healthcare: UHD graphics and deep learning AI[5]

Applications: Portable medical imaging machines, medical carts, and clinical devices with onboard AI

- Intel UHD Graphics driven by Intel X^e architecture supports one 4K60 HDR display or up to three concurrent 4K60 SDR displays and provides up to 32 execution units for deep learning inference processing for AI-assisted imaging

- The Intel AVX2 instruction set, including Intel DL Boost, accelerates AI workloads on the CPU for additional AI processing power

- Flexible, high-bandwidth I/Os deliver high-speed data transfer support for legacy interfaces

- Up to eight Efficient-cores and up to 16 GB DDR5 and LPDDR5 memory deliver energy-efficient performance

- 6W to 15W TDP with low-power standby mode is ideal for sealed, fanless, easy-to-disinfect designs

Vision, safety, and security: Entry-level network video recorders (NVRs) and AI appliances[5]

Applications: Smart cameras, NVRs for small security networks, and add-on AI appliances

- On-camera or NVR object detection and recognition, identify and follow, and other deep learning AI capabilities powered by Intel DL Boost on the CPU and Intel UHD Graphics with up to 32 execution units

- Programmable graphics, codecs, and media accelerators on the CPU and GPU controlled via the Intel oneAPI Video Processing Library

- Image processing unit 6EP (IPU6E)

- Support for up to three concurrent 4K60 SDR displays plus synchronize two displays with Pipelock[1]

Software overview

CATEGORY	OPERATING SYSTEMS/SDKS/ BOOTLOADERS/HYPERVISORS	IMPLEMENTATION	DISTRIBUTION AND SUPPORT
Operating systems[a]	Windows 10 IoT Enterprise 2021 LTSC	Intel	Intel, Microsoft
	Ubuntu, Red Hat Enterprise Linux (RHEL), WR Linux[b]	Canonical Ltd., Red Hat, and Wind River Systems	Canonical Ltd., Red Hat, and Wind River Systems
	Yocto Project (LTS Kernel 2021)	Intel	Intel, Yocto Project community
	Celadon CiV (Android optimized for Intel® architectures)	Intel	Intel, Celadon community
Real-time operating systems	Wind River VxWorks	Wind River Systems	Wind River Systems
	BlackBerry QNX	BlackBerry	BlackBerry
	Zephyr RTOS[c]	Intel	Zephyr open source community
Hypervisors	KVM	KVM	KVM open source community
	ACRN	ACRN	ACRN open source community
	Real-Time Hypervisor	Real-Time Systems GmbH	Real-Time Systems GmbH
Toolkits and SDKs	Intel® Distribution of OpenVINO™ toolkit and OpenVINO™ Open Model Zoo	Intel	Intel
	Intel® oneAPI Base Toolkit	Intel	Intel
	Intel® oneAPI IoT Toolkit	Intel	Intel

a. Not all features are supported in every operating system. Refer to the Intel® IoT Solutions Community for partner contact information.
b. Supported by Intel via upstreaming to open source community. Adoption into individual Linux distributions/hypervisors is dependent upon the OS/hardware vendors.
c. RTOS and Intel Time Coordinated Computing will not be available at launch. They are part of a planned update after launch.

Processor lineup

Processor		Intel® Processor N50	Intel® Processor N97	Intel® Processor N200	Intel® Core™ i3-N305		Intel Atom® x7211E	Intel Atom® x7425E	Intel Atom® x7213E
Use condition		PC client					Embedded		
TDP		6W	12W	6W	9W	15W	6W	12W	10W
CPU	Core count	2	4	4	8		2	4	2
	HFM	1.0 GHz	2.0 GHz	1.0 GHz	1.0 GHz	1.8 GHz	1.0 GHz	1.5 GHz	1.7 GHz
	1C turbo	3.4 GHz	3.6 GHz	3.7 GHz	3.8 GHz		3.2 GHz	3.4 GHz	3.2 GHz
	MC turbo	3.4 GHz	2.9 GHz	3.2 GHz	3.0 GHz		2.9 GHz	2.7 GHz	2.9 GHz
GPU	EU count	16	24	32	32		16	24	16
	HFM	600 MHz	850 MHz	450 MHz	1.0 GHz		600 MHz	800 MHz	800 MHz
	Turbo	750 MHz	1.2 GHz	750 MHz	1.25 GHz		1.0 GHz	1.0 GHz	1.0 GHz
Intel® Time Coordinated Computing[2]		No	No	No	No		Yes	Yes	Yes
Time-Sensitive Networking GbE		No	No	No	No		Yes	Yes	Yes

Learn more about Intel Atom® processors x7000E Series and
Intel® Core™ i3 processors at intel.com/atomx7000e-iot.

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