

Solution Brief

Media Transcoding
Intel® Xeon® 6 SoC with P-cores

intel

Revolutionizing Live Streaming: Built-in Media Transcode Accelerator Delivers 14x Performance per Watt Gains and Ultra Low-Latency

The Intel® Xeon® 6 system-on-chip (SoC) with Performance-cores (P-cores) and Intel® Media Transcode Accelerator¹ enables flexible usage models for efficient, low-latency encoding of high-quality video. It helps providers reduce costs with high stream density per server and low watts per channel compared to encoding on only the CPU cores. Video encoding can be distributed across CPU cores and the SoC's media accelerator to optimize the combination of performance and energy efficiency.



The popularity and consumption of IP-delivered video continues to grow without apparent limit, driven largely by over-the-top distribution models and consumer-generated content on social media. More than 80% of all data traveling across the internet is now video traffic, with the average user globally watching nearly an hour and a half of online video every day.² As 5G networks are built out, subscribers have access to dramatic increases in bandwidth, and their expectations continue to grow for higher resolutions and broadcast-quality content, on every device.

Intensified demands on video processing and distribution infrastructure drive the need for efficiency, flexibility and the ability to tune the balance between quality and cost. Competitiveness requires the reduction of capital expense (CapEx) with higher system density based on performance and latency improvements, handling escalating demand with fewer servers. At the same time, they must reduce operating expense (OpEx), including by means of lower energy consumption. The Intel® Xeon® 6 SoC is a compelling foundation for video transcoding infrastructure, with dramatic performance and energy-efficiency improvements compared to its predecessors.



82.5%
of global internet
traffic is video²

84 MINUTES
average daily online
video consumption²

Advanced, highly integrated SoC platform for video

The Intel Xeon 6 SoC increases video performance and efficiency over the previous generation. The redesigned microarchitecture's native performance and performance-per-watt advantages are complemented by a built-in media accelerator (Intel® Media Transcode Accelerator) based on a dedicated ASIC module. The Intel Media Transcode Accelerator can run software-based video encoders alongside the CPU cores, increasing throughput dramatically while consuming less power. More broadly, the SoC provides advances across the balanced platform, including the following:

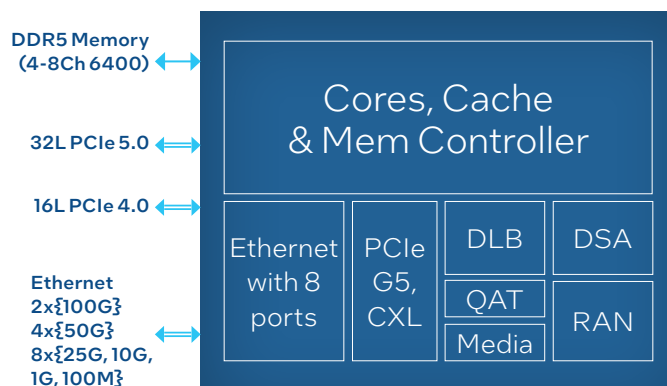
- **Enhanced compute resources**, including high per-core performance and up to 72 processor cores, assisted by the new built-in media accelerator and improvements to other accelerators and instruction sets.¹
- **Memory subsystem innovations**, including up to eight channels of DDR5 memory at up to 6400 MT/s, shared between the media accelerator and the CPU cores.
- **Increased I/O throughput with lower latency**, including up to 200 Gbps integrated Intel® Ethernet, as well as up to 32 lanes PCIe 5.0 and up to 16 lanes PCIe 4.0, for 48 lanes total.

The system-on-chip SoC form factor helps drive down solution TCO by means of extensive component integration that lowers server cost with a reduced bill of materials (BOM). In addition to the media accelerator, integrations also include built-in Intel Ethernet for low-latency network connectivity and integrated Intel® QuickAssist Technology (Intel® QAT) for hardware-accelerated crypto and compression. Building these components into the SoC package helps reduce system latency as well as energy use by avoiding accesses across the PCIe bridge. Low latency is increasingly important as consumer content and usage models become more immersive, such as for real-time gaming, interactive chat and virtual reality.

In addition to the integrated connectivity, discrete Intel Ethernet adapters are available for easy expansion. Intel® Ethernet E830 Network Adapters increase bandwidth capacity and port count with up to 200Gb bandwidth and a wide range of port configurations, enabling faster data transfer and increased network connectivity. This accelerated data flow streamlines the transcoding process, allowing for quicker processing of large media files.

Doubling the PCIe speed to PCIe 5.0 provides greater flexibility for connecting various devices and networks, facilitating remote access, collaboration and efficient distribution of transcoded content.

Intel Ethernet E830 Network Adapters are capable of Precise Time Measurement (PTM), which benefits large bursty data patterns typical of video encoding and streaming. In addition, standards such as those from SMPTE can use precise time to reduce in-cast and cost of equipment. Intel Ethernet E830 Network Adapters empower media transcoding systems to handle demanding workloads, deliver high-quality results and meet the evolving needs of modern media production and distribution workflows.



Video encoding can be performed in parallel on the Intel Media Transcode Accelerator and the CPU cores, with each operating independently, with its own output streams. Shared system memory between the media accelerator and the CPU cores helps encoding on the SoC realize significant advantages in lower latency and higher memory bandwidth. Because the media accelerator uses the same DDR memory as the CPU cores, no memory copies to discrete hardware are needed over PCIe, and processing bottlenecks created by contention for PCIe bandwidth are avoided.

Tight integration between the two sets of encoding hardware also allows for hybrid software solutions to be created that run individual workloads across both, combining the benefits of each. That creates the potential for co-processing, with selected portions of individual video workloads running on the execution resources that are best suited to them. Solutions can therefore provide the quality advantages of a software encoder with the performance and energy efficiency benefits of ASIC-class processing.

Intel® Xeon® 6 SoC with P-cores: Advances Across the Platform



COMPUTE

- Up to 72 P-cores
- Energy-Efficient High Performance
- Enhanced Instructions & Accelerators

MEMORY

- Up to 8 Channels of DDR5
- Transfer Speeds up to 6400 MT/s
- Increased L2 Cache

I/O

- Up to 200 Gbps integrated Ethernet
- Expandability with discrete Intel® Ethernet E830 Network Adapters
- Up to 48 lanes total PCIe

Media Transcode Performance on Intel® Xeon® 6 SoC with P-cores



UP TO
4.03x performance gain (FPS)³
UP TO
14.25x performance per watt gain³

Intel® Xeon® 6 SoC 36C versus Intel Xeon Gold 6538N 32C

Accelerated video transcoding for common use cases

The Intel Xeon 6 SoC with built-in Intel Media Transcode Accelerator provides the features and capabilities to support use cases that include low-latency live streaming, high-quality broadcast, video-on-demand encoding, high-density Virtual Desktop Infrastructure (VDI), responsive cloud gaming and other media-intensive services. It provides high-quality, low-latency transcoding of AVC, HEVC and AV1 video content. Configurable encoder controls enable workload optimization to reach targets for latency, quality and performance metrics, in addition to the use of quality and performance presets:

- Lookahead depth.
- Group of picture (GOP) configuration.
- Ability to disable B frames and picture reordering to meet ultra-low latency requirements.
- VBR, CBR and CRF rate control.

The platform supports encoding of up to 16x 1080p30 streams or 4x 4K50 streams per SoC. At the highest video quality setting, the HEVC encoder achieves quality comparable to that of x265 using the “slow” preset. The Intel Xeon 6 SoC media accelerator delivers significant efficiency and watts-per-channel improvements compared with either encoding on the CPU cores or using discrete accelerators.

Intel continues to make full-stack software investments to enable next-generation solutions for the media and entertainment industry.

- **Intel® Video Processing Library (Intel® VPL)** provides access to more controls and parameters. Codecs can be accessed using standard frameworks such as FFmpeg and GStreamer or with Intel VPL. Red Hat Enterprise Linux and Ubuntu are supported.
- **Intel® Tiber™ Broadcast Suite** accelerates the journey to software-defined broadcast. The modular video production pipeline is designed for creation of high-performance and high-quality solutions used in live video production. The video pipelines are built using Intel-optimized version of FFmpeg.
- **Intel® Tiber™ Media & Entertainment AI Suite** helps streamline the infusion of AI technology to transform media and entertainment workflows.



Codec Features

- **AVC encode/decode:** Hi10P @ L6.0 4:2:0 (8b/10b)
- **HEVC encode/decode:** Main10 @ L6.0 High Tier 4:2:0 (8b/10b)
- **AV1 encode high profile:** 4:2:0 (8b/10b)
- **JPEG encode/decode:** 4:2:0 (8b)

Media Accelerator Block Features/Performance

- **Max resolution:** 8Kx8K (AVC/HEVC/AV1), 16Kx16K (JPEG)
- **AVC/HEVC decode/encode:** Up to 40x 1080p30
- **AVC/HEVC/AV1 encode:** Up to 4x 4K50

Maximizing performance, quality and cost efficiency with hybrid hardware/software encoding

The combination of media IP built into the Intel Xeon 6 SoC with high-performance, low-latency cores enables greater density than predecessor hardware platforms while minimizing TCO and watts consumed per stream. To help assess the benefit, Intel performance engineers plotted the number of streams supported per server (as a proxy for performance) against quality, with different encoding options.

View the latest performance data at www.intel.com/PerformanceIndex

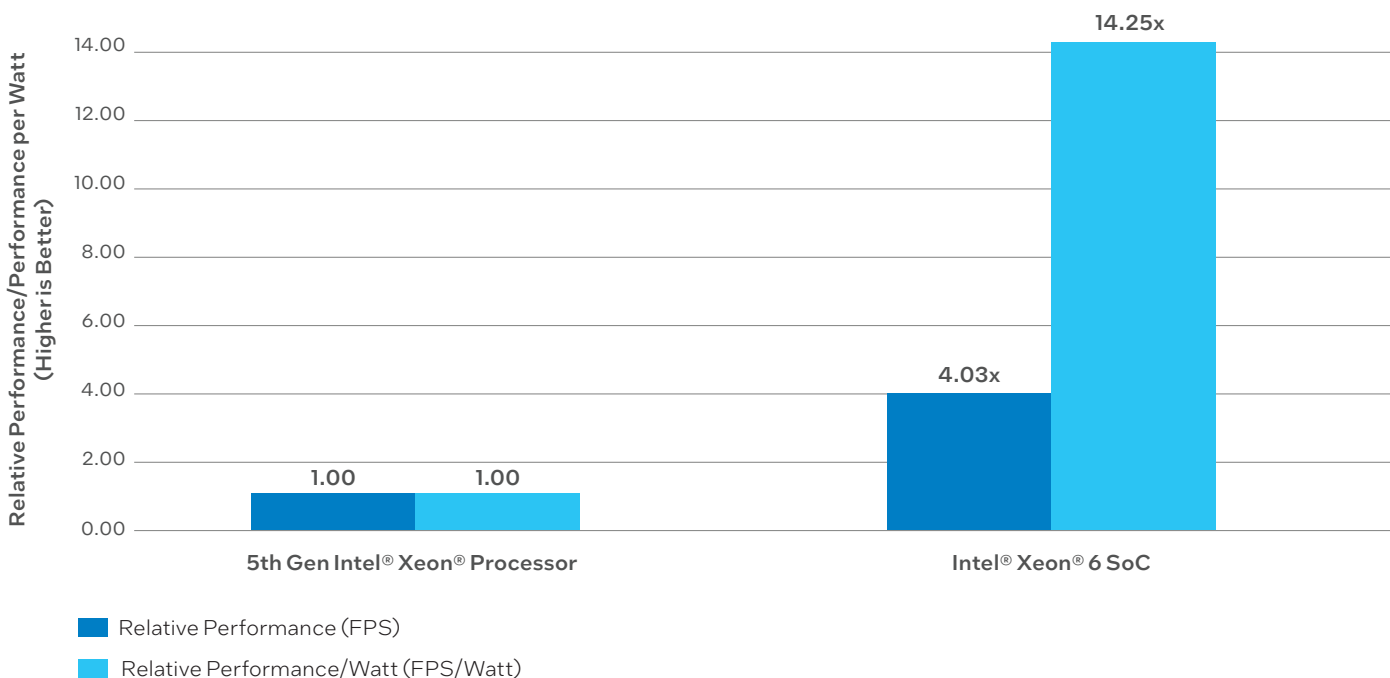
Testing used the average of two common quality measures — peak signal-to-noise ratio (PSNR) and structural similarity index measure (SSIM) with various presets. They found that a combined approach using both CPU cores and the media accelerator provided superior results.

Intel Xeon 6 SoC cores combined with media IP deliver up to a 4.03x increase in encoding performance (FPS) and up to 14.25x higher performance per watt, compared to 5th Gen Intel Xeon processors.³

Ecosystem Support Through Intel® Industry Solution Builders

The [Intel Industry Solution Builders](#) program helps partners innovate and adapt to evolving business, technology and end-user needs, effectively and cost-efficiently. The program provides members with a variety of technical enablement options such as hands-on support from subject matter experts, access to virtual testing and optimization labs, training, tools and other resources.

Intel® Xeon® 6 SoC One-Socket System HEVC -> HEVC 1080p Transcode³ Comparable Quality



Conclusion

The Intel Xeon 6 SoC with built-in Intel Media Transcode Accelerator provides a compelling deployment-hardware solution for video processing workloads. Using the media accelerator in conjunction with the CPU cores increases encoding performance (FPS) by up to 4x at the same video quality and performance per watt by up to 14.25x, compared to 5th Gen Intel Xeon processors.³ Extensive component integration in the SoC, including Intel Ethernet and Intel QAT in addition to the media accelerator and additional connectivity capacity from dedicated Intel Ethernet E830 Network Adapters, simplify server designs and reduce watts per channel, for improved TCO while meeting intensifying consumer demand.

Learn More

www.intel.com/xeon

networkbuilders.intel.com



¹ Availability of accelerators varies depending on SKU. Visit the Intel® Product Specifications page for additional product details.

² Demandsage, September 25, 2024. "Latest Video Marketing Statistics Of 2024." <https://www.demandsage.com/video-marketing-statistics/>.

³ See [7ND32] at [intel.com/processorclaims](https://www.intel.com/processorclaims): Intel® Xeon® 6. Results may vary.

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