Intel® Quick Sync Video Technology and Intel® Xeon® Processor Based Servers—

Flexible Transcode Performance and Quality

Video transcoding involves converting one compressed video format to another. In the past this process has been a compute-intensive task which demanded a large amount of precious CPU resources. Intel® Quick Synch Video (QSV) can enable hardware-accelerated transcoding to deliver better performance than transcoding on the CPU without sacrificing quality.

First introduced in 2011, Intel Quick Sync technology is available in the Intel® Xeon® Processor E3-1200 v3 with Intel HD Graphics P4600/4700 and Iris™ Pro P5200. (From here on, we'll simply refer to Intel Quick Sync technology for Video as QSV.) This advanced graphics solution sets a milestone in performance by delivering a fast transcode experience and balances image quality with performance through a set of optimized user targets facilitating easy adoption.

The Intel® Media Server Studio provides software development tools and libraries needed to develop, debug, and deploy media solutions on Intel server processors. Four bundles of tools, libraries, and test content offer flexibility to software developers, datacenter solution providers, cloud solution providers, and OEMs. The Intel® Media Server Studio Professional Edition provides access to Intel hardware through a software development kit (SDK) and media and graphics drivers for Linux and Windows Server. Along with these components, it

provides enterprise-quality HEVC and audio codecs, Intel® VTune™ Amplifier XE performance analysis tools and Video Quality Caliper stream quality analyzer. Additionally, product family members, Intel® Video Pro Analyzer and Intel® Stress Bitstreams and Encoder bundles enable production–scale validation and debug of encode, transcode, and decode and playback applications.

Intel Media Server Studio SDK implements many codec and tools components initially in software, and later as hybrid (software and hardware) or entirely in hardware. The reason for this approach is a faster time to market for software solutions, followed by hybrid solutions that contain partial hardware acceleration, and then finally fast hardware solutions that scale. Intel Media Server Studio SDK 2015 is available for both Windows and Linux, and is an enabling software for Intel Quick Sync technology.
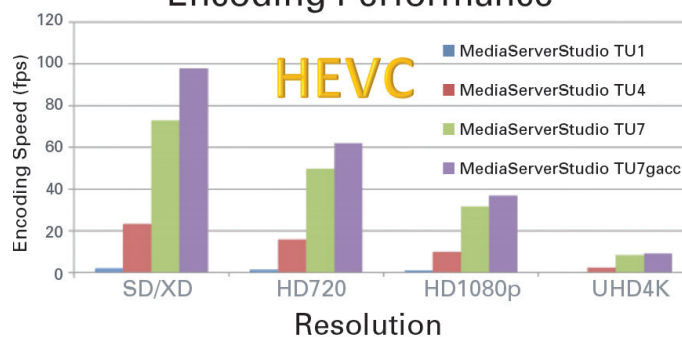
The new Intel Iris and Intel Iris Pro Graphics (5100+ Series) and Intel HD Graphics (4600+ Series) have seen a number of significant enhancements. Many new features and capabilities are included to improve performance, reduce power consumption,

and boost image quality. Some key improvements include the following:

- Additional JPEG/MJPEG decode in the multi-format codec engine. This support is on top of existing energy-efficient, high-performance AVC encode/decode that sustains multiple 4K and Ultra HD video streams.
- A dedicated new video quality engine to provide extensive video processing at low power consumption
- Programmable and media-optimized EU (execution units)/samplers for high quality
- A scalable architecture with the flexibility to enable acceleration based on application demand

There are different benefits to software and hardware approaches for encoding solutions. Typically software encoders have the luxury of performing extremely complicated motion estimation and

Encoding Performance

HEVC

- MediaServerStudio TU1
- MediaServerStudio TU4
- MediaServerStudio TU7
- MediaServerStudio TU7gacc

exhaustive rate-distortion optimization on the CPU in order to obtain the best possible quality. The tradeoff comes in a very high computational cost. Hardware encoders have commonly been regarded as less flexible and incapable of delivering the same quality. However, with Intel advances in hardware and software, developers should quickly learn to facilitate state-of-the-art algorithms that should improve the quality. Intel Quick Sync Video technology pre-defines various target usages (TU) ranging from TU1 to TU7. These are based on a range of different performance and quality tradeoffs. Note that at the Intel Media Server-API level there are additional options available for developers to further fine tune these targets.

Target Usage 7 (TU7) is the fastest encode mode provided on Intel Quick Sync Video. TU7 is meant to provide the fastest mode and quality improvements, but only when doing so does not hinder the targeted performance. The TU7 setting in the new Intel Quick Sync Video technology improve both energy efficiency and visual quality while still meeting a (12x) real-time speed target.

"The highlight of Intel's 14nm Broadwell processor is the Gen8 GPU, which offers 20% better compute and 50% more texturing performance than Haswell's … delivering 8x more performance per clock compared with Sandy Bridge's Gen6 GPU, eclipsing even the rapid growth rate that Moore's Law predicts." —Linley Group

The latest version of Intel Quick Sync Video is a significant improvement over previous generations in terms of performance and quality. The new high-performance hardware acceleration engine improves speed and quality targets for a full range of users. New target usage design optimizations provide significant performance headroom and enable a wider variety of applications. Developers can take advantage of greater flexibility in performance and quality to meet various application requirements. For example, hardware-specific features on Intel's on-die integrated Processor Graphics Architecture, such as shared physical memory and zero copy buffer transfers, are programmable through the buffer allocation mechanisms in APIs such as OpenCL 1.0+ and DirectX11.2+. The effect, as shown in the Encoding Performance diagram in purple, is an increase in performance with a GPU accelerated codec. in this case HEVC.

Intel's on-die integrated Processor Graphics Architecture (generically referred to as GEN) offers outstanding real-time 3D rendering and media performance. However, its underlying compute architecture also offers general-purpose compute capabilities that approach teraFLOPS performance. The architecture of Intel Processors Graphics delivers a full complement of high-throughput floating-point and integer compute capabilities, a layered high-bandwidth memory hierarchy, and deep integration with on-die CPUs. Additionally, this is accomplished in a modular design that provides scalability for a variety of uses.

The architecture begins with compute components called execution units (EUs). EUs are clustered into groups called sub-slices which are grouped into slices. Together, EU, subslices, and slices are the modular building blocks that are composed to create product variants based upon Intel Processor Graphics. Next in the architecture is sharing DRAM physical memory with the CPU. This unified memory architecture offers a number of system design, power efficiency, and programmability advantages over PCI Express hosted discrete memory systems. The obvious advantage is that shared, coherent physical memory enables zero copy buffer transfers between CPUs and GEN compute architecture. The net effect of these newest architectures is that they benefit performance, conserve memory footprint, and indirectly conserve system power not spent needlessly copying data.
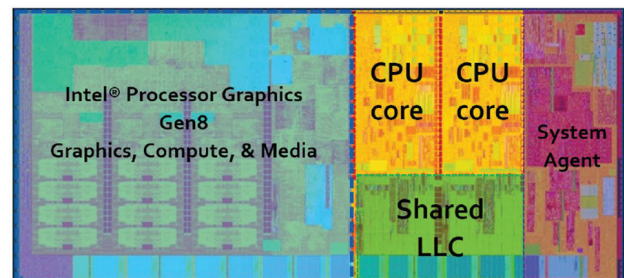
SUMMARY

Video delivery has become a critical service offering for cloud service providers, enterprises, and communications providers. With the proliferation of viewing devices—ranging from TVs to laptops to smart phones—efficiently transcoding video from one compressed video format to another is essential.

Developers of video delivery services should consider Intel® Quick Sync Video—available in Intel Xeon Processor E3-1200 v3—to enable hardware-accelerated transcoding to deliver better performance than transcoding on the CPU without sacrificing quality. To get enabled quickly, use the Intel® Media Server Studio, which provides development tools and libraries needed to develop, debug, and deploy media solutions on Intel server processors.

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