Sonic’s MainConcept* H.264/AVC Encoder for Quick Sync Video

Rapid Development of High-Performance Video Processing on 2nd Generation Intel® Core™ Processors

For companies that develop video-creation and playback applications, keeping pace with the evolutionary processor lifecycle is a daunting, yet critical task to maintaining market position and meeting customer demands for better/faster product capabilities. Maintaining the optimized code base to satisfy this expanding ecosystem of hardware platforms is not only expensive but time consuming and resource intensive. Known for solving this cost versus time-to-market dilemma for hundreds of companies in this space is MainConcept,* part of the Professional Technology Division at Sonic Solutions. Its recently released H.264/AVC Encoder for Intel® Quick Sync Video (QSV) is a key solution that gives developers a fast and convenient way to optimize video processing routines for delivering maximum performance on 2nd generation Intel® Core™ processors and a broad range of current and future Intel® client PC platforms including multi-core architectures.

Available in SDK and in application form as part of the MainConcept Codec SDK (software developers kit) and MC Reference* transcoding platform, the H.264/AVC Encoder for QSV acts as wrapper for the Intel Media SDK 2.0. The H.263/AVC Encoder for QSV streamlines application development with features such as video pre-processing (VPP) and encode/decode services. It also significantly streamlines access to the advanced Intel QSV hardware acceleration offered by 2nd Generation Intel Core family processor microarchitectures, which combine CPU and media processing functionality with deep parallelism and massively increased throughput in a single 32nm chip. For H.264/AVC encoding and decoding, these capabilities deliver faster than ever speeds at all profiles and levels supported by the popular standard. And further, the MainConcept H.264/AVC Encoder QSV builds on Intel Media SDK 2.0 with a number of high-end feature enhancement opportunities, providing a foundation for customization and product differentiation.
“Our customers are companies with world-recognized brands and products that rely on our ability to ease the development and implementation of strategic technologies that drive their business opportunities,” said Thorsten Schumann, chief technology officer for Sonic Solutions’ Professional Technology Division in Aachen, Germany. “Wrapping Intel’s Media SDK within the MainConcept SDK means that our customers can simply plug-in new capabilities, such as H.264 QSV, using their existing MainConcept implementation. So, the cost of deploying against new business initiatives such as hardware-accelerated encoding on Intel’s superb family of processors is super fast, super cheap, and highly profitable.”

A Next-Generation Encoder Optimized for Next-Generation Processors

Sonic’s Professional Technology Division provides high-end authoring and encoding applications under the Scenarist* and CineVision* brands used by Hollywood facilities to create the vast majority of DVD and Blu-ray titles for mass-market consumer release, as well as SDKs and APIs under the MainConcept brand including the world’s largest video codec library and engines for transcoding, authoring, muxing, burn, decode, streaming, and playback for a wide range of PC, CE, and device implementations.

The long-term, close collaboration between Sonic and Intel engineering teams is a major factor in ensuring the best possible performance expectation for MainConcept SDK implementations on 2nd generation Intel Core processor-based platforms and beyond. “The development partnership between Intel and Sonic has contributed to best practices innovations for both parties, yielding amazing results,” said Muzaffer Beygirci, general manager of Sonic’s Professional Technology Division. “For example, Intel’s Core processor expansion architecture combined with our comprehensive threading capabilities into the code engine fully optimized for Intel® Core™ 2 Duo and Intel® Core™ 2 Quad processors has positioned the MainConcept H.264 Encoder v2 as one of the most widely adopted implementations of the H.264/AVC codec in the industry.”

The engineering team collaboration also used Intel® Parallel Studio, Intel® Thread Checker, and Intel® C++ Compiler to build multi-core threading capability into the code and Intel® VTune™ Performance Analyzers to find and eliminate memory and threading bottlenecks.

MainConcept H.264/AVC Encoder QSV provides access to a high-performance software encoder specially optimized for Intel® processor microarchitectures. Through the MainConcept Low Level API and DirectShow filter set, developers can simply add Intel Quick Sync Video functionalities to their applications by upgrading to the latest version of the MainConcept Codec SDK. Even when run on platforms that lack dedicated graphics hardware-acceleration features, applications developed with the MainConcept H.264/AVC Encoder QSV SDK still gain the benefit of tuned, optimized, and threaded software-based video encoding and decoding, tailoring performance to the system’s capabilities.

H.264/AVC—A Codec with a Need for Speed

H.264/AVC—also known as MPEG-4 Part 10—is a major video standard that is supported by Adobe Flash,* Apple QuickTime,* and Microsoft Silverlight.* In addition, H.264/AVC is utilized in Blu-ray Disc, Sony PSP,* Apple iPod,* AVCHD, and other standards.

The MainConcept Codec SDK makes it easy to add support for H.264/AVC to existing professional and consumer video applications, and offers fast encoding and decoding speeds in all profiles and levels supported by the standard. (A Profile defines a subset of features needed to support a specific delivery platform. A Level specifies constraints within a Profile, such as maximum resolution or bitrate.)

The highly efficient codec earned its reputation by offering better quality at substantially lower bitrates than previous-generation codecs such as H.263 and MPEG-1. H.264/AVC achieves this efficiency through a variety of computationally intensive processes, such as motion estimation, the use of higher numbers of bi-directional reference frames, and—for main and higher profile encoding—context-adaptive binary arithmetic coding (CABAC).

The MainConcept H.264/AVC decoder offers configurable motion estimation (quality, search range and mode, full, half, and quarter pel), that is optimized for Intel processor microarchitectures. For example, Intel® Advanced Vector Extension instructions (AVX)—integral to 2nd generation Intel Core processor family architecture—provide built-in capabilities for processing motion-estimation tasks used by the H.264/AVC codec to identify regions in a video stream where compression can be tailored to the degree of rapid motion in the content.
To do large motion estimation, a video encoder must perform a massive number of sum of absolute difference (SAD) operations that include calculating absolute values, addition, and subtraction to find the best match in an area. AVX 256-bit-wide SSE SIMD instructions in 2nd generation Intel Core processors offer a significant performance improvement over previous-generation Intel Core processors, which featured 128-bit-wide SSE SIMD. Optimization for deep parallelism in the 2nd generation Intel Core processor family boosts encoding and decoding of bi-directional reference frames, CABAC entropy encoding, and other operations that have voracious appetites for processor cycles.

**An SDK within an SDK**

MainConcept H.264/AVC QSV Encoder SDK, like Intel Media SDK 2.0, gives developers a streamlined interface for handling otherwise complex coding tasks. And like Intel Media SDK 2.0, the MainConcept SDK uses a dispatcher layer within the API to insulate developers from the complexities of supporting Intel Quick Sync Video technology.

Intel Media SDK 2.0 outside the MainConcept SDK wrapper provides four building blocks for working with coded bit streams and raw video frames: decode (functions that convert compressed bit streams to raw, display-ready video frames); VPP (pre-processing such as scaling, color conversion, deinterlacing, cropping, procamp filters, and sharpening); encode (constant and variable bitrate encoding are supported); and user (supports creating custom video filters).

MainConcept’s SDK augments the feature set of Intel Media SDK 2.0 with MainConcept’s encoder, decoder, and transcoder, and by offering:

- Scalable profiles up to High Profile
- Selectable levels up to Level 5.1
- Configurable bitrate control (CBR, VBR, CQT)
- Configurable GOP structure (I-, P-, and B-frames in different combinations)
- Scene change and adaptive GOP structure
- Strict HDR restrictions compliance
- Configurable number of slices

In addition, H.264/AVC QSV supports NV12 and YV12 color spaces, as well as progressive and interlaced footage.

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**Figure 1.** A high-level view of the Intel® Media SDK 2.0 architecture within MainConcept® H.264/AVC QSV Encoder SDK.
Intel Media SDK within the MainConcept SDK provides developers with the means to handle Microsoft DirectX* Video Acceleration (DXVA) encoding, and complements MainConcept DirectShow filters for encoding and decoding. The decoder filters can be used by any DirectShow application (for example, Windows Media® Player).

**MainConcept DirectShow filters:**
- H.264/AVC Video Decoder filter
- SVC Video Decoder filter
- MPEG-2 Video Decoder filter
- MPEG-4 Part 2 Video Decoder filter
- VC-1 Video Decoder filter
- DV/DVCPRO 25/50/HD Video Decoder filter
- JPEG2000 Video Decoder filter
- Motion JPEG Video Decoder filter
- AAC Decoder filter
- MPEG Audio Decoder filter
- MP4 Demuxer filter
- MPEG Push Demultiplexer filter
- MPEG Pull Demultiplexer filter
- MXF Demultiplexer filter
- DV Splitter filter
- DV Dif Parser
- Network Source filter

**Meeting Customer Needs and Consumer Expectations**
Access to the latest codec standards and optimized implementation is obviously a key reason customers choose MainConcept. But developers and business professionals rely on the MainConcept SDK’s flexible architecture to develop customized solutions and gain deep access to parameters for higher-end codec functions to meet their business/product development objectives. MainConcept enables companies to visualize infinite possibilities thanks to the consulting, confidentiality, and especially the code indemnification not possible with Open Source implementations.

“The MainConcept SDK set a standard for business, not only for its technology, but also because of the expertise and commitment of its development team and mission-critical support organization.”
— Rolf Hartley, SVP and General Manager of Sonic Solutions’ Professional Technology Division

Obtain the latest product information and download details for the Intel Media SDK at www.intel.com/software/mediasdk
Request a copy of the MainConcept SDK at sales@mainconcept.com. Existing MainConcept customers can log-in and download the SDK through the MainConcept customer portal.