Intel® Media Server Studio 2018 R1 - HEVC Decoder and Encoder Release Notes
(Version 1.0.10)

Overview

The **Intel® Media Server Studio 2018 R1 – HEVC Decoder and Encoder** is a set of software development libraries (plug-ins) and tools that that expose the HEVC (ISO*/IEC* 23008-2 MPEG-H Part 2 or ITU-T* H.265 standard) decode and encode acceleration capabilities of Intel® platforms.

Plug-ins are not standalone but additional libraries expanding the Intel® Media Server Studio 2018 R1 – SDK with HEVC decode and encode functionality.

The package includes the following components:

- *Intel® Media Server Studio 2018 R1 – HEVC Decode Plug-in version 1.25.3.1000*

- *Intel® Media Server Studio 2018 R1 – HEVC Encode plug-in version 1.25.3.1000*

- *Intel® Media Server Studio 2018 R1 – HEVC GPU Accelerated Encode plug-in version 1.25.3.1000*

This document covers components features, system requirements and known limitations.

New Features

Intel® Media Server Studio 2018 R1 – HEVC Decode Plug-in:

Version 1.8.1.22

- The very first version.

Version 1.10.3.45

- Support for MAIN 10 profile was added.
- Performance has improved on 15% in average, the best improvement reached on tiled content (up to 50%).
- Robustness of corrupted content decoding was improved.
- Decoder standard compliance for clips with width or height equal to 1 CU was fixed.

Version 1.11.2.29

- Decoded order output support was added.

Version 1.13.3.73

- Improved decoder conformance for MAIN10 profile bitstreams with variable Chroma bitdepth.
- Improved vps/sps sublayer profile info decoding.
- Aligned PCM macroblock decoding to conform to the latest standard.

Version 1.15.3.114

- For MAIN 10 profile output always will be P010, even in case real bit depth is 8 for both Chroma and Luma.
- Fixed cases when sequence of IDR was decoded as one frame

Version 1.16.3.176

- Improved performance.

Version 1.19.3.610:

- Improved decoder conformance for REXT profile bitstreams.

Intel® Media Server Studio 2018 R1 – HEVC Encode Plug-in:

Version 1.8.1.22

- The very first version.

Version 1.10.3.44

- Supported resolution was extended to 8K (8192x4096).

- For Target Usage 7, quality improved at 10% in average, performance improved at 15% in average.

Version 1.11.2.29

- MAIN 10 profile support was added for SW HEVC encoder.
- HEVC SW encoder average performance vs bitrate savings changed for different target usages(1080p content, Core i7 4770):
  - TU7: performance up 2.1x – reaching 30+ fps for QPs higher than 27, bitrate savings down 6% in common.
  - TU4: performance up 1.9x, bitrate savings up 3%.
  - TU1: performance up 2.5x, bitrate savings down 0.8%.

Version 1.13.3.73

- MAIN 422 and MAIN 422 10 range extensions profiles support added.
- Extended tiles support, added API options to control number of tiles.
- Improved multithreading performance on multi-socket headless systems.

- HEVC SW encoder average performance vs bitrate savings improved for different target usages comparing to previous version(1080p content, Core i7 4770K):
  - TU7: performance up 1.2x, bitrate savings up 10% in common.
  - TU4: performance up 1.3x, bitrate savings down 0.8%.
  - TU1: performance up 1.7x, bitrate savings up 0.1%.

Version 1.15.3.114

- CBR/AVBR Rate Control Methods improved for 10 bit encoding.
- Added Look Ahead feature.
- API extended buffer mfxExtHEVCRegion support added, featuring region based encoding for better scalability on multi-socket headless system. Currently supported only MFX_HEVC_REGION_SLICE region type.
- HEVC SW encoder average performance vs bitrate savings improved for different target usages, please check HEVC Whitepaper on Product web page.

Version 1.16.3.176

- Added chroma SAO improving quality up to 30%.
- CU 64x64 enabled for all target usages.
- Added Look Ahead by default, adding additional 12 frames buffering.
- Support for mfxEncodeStat structure added.
- Support for mfxExtCodingOptionSPSPPS export through GetVideoParam function added.
- Support for user-defined SEI messages implemented.
- Support for mfxExtHEVCParam added.
- Support for Range Extensions profile_idc added.

Version 1.17.3.387

- Added support for AUDelimiter.
- Added support for CTB-level delta QP (for now only for Const QP mode and High Quality presets: TU1 and TU2).
- Re-balanced low delay encoding setting for TU4-7:
  - TU7: performance up 1.4x, bitrate savings down 6%.
  - TU4: performance up 1.1x, bitrate savings not changed.
- Fixed exceeding of low target bitrate keeping in AVBR 10 bit 4:2:0/4:2:2 modes. How "low" depended on video content type.
- Improved bitrate keeping in VBR mode.
- Fixed crash when encoding out of 10 bit range samples.
- Fixed crash when encoding 10 bit at very high bitrates (>100Mbps)
- Fixed crash and hang when encoding very small resolutions (<128x128)
- Fixed crash and hang when transcoding with opaque memory.
- Improved profile and level compliance with other encoding parameters.
- Added support for CTB-level delta QP for all Quality presets (TU 1 thru 7), all BRC modes (CBR, VBR, AVBR, ConstQP) and all Profiles (MAIN, MAIN10, REXT).
- Added support for ROI priority map.
- Fixed build for non-SSE4 CPUs.
- Fixed value of syntax element general_profile_compatibility_flag.

Version 1.19.3.559

- Added support for per frame QP and FrameType controls.

- Added control for Generalized P/B picture (GPB).
- Improved scene-cut detection algorithm.
- Performance improvements:
  - TU7 – speedup 20%, same compression efficiency.
  - TU4 – speedup 10%, same compression efficiency.
  - TU1 – speedup 8%, same compression efficiency.

Version 1.23.3.735

- Added support for MaxFrameSize constrained VBR/AVBR encoding.
- Fixed compression efficiency issue with frequent Key Frames for TU1/2 encoding.
- Quality improvements for BRC modes.
- For speed vs compression ratio/quality improvement please see HEVC white paper at Media Server Studio web site (https://software.intel.com/en-us/intel-media-server-studio).

Intel® Media Server Studio 2018 R1 – HEVC GPU accelerated Encode Plug-in:

Version 1.11.1.108

- This is Pre-Release.
- Supports TU7 only.
- GPU accelerated encoder featuring GPU offloading for motion estimation provides performance/CPU utilization improvements compared to SW implementation (1080p content, Intel Core™ i7 4770):
  - Performance improvement is noticeable for QPs below 30, lesser QP - better performance. E.g. for QP 22 GPU accelerated encoder shows 30% average performance gain with 10% lesser CPU utilization.

Version 1.13.3.73

- This is Pre-Release.
- MAIN 422 range extension profile support added.
- This version provides the following improvements with regards to performance/bitrate (1080p content, Intel Core™ i7 4770):
  - Compared to SW encoder at TU7: 11% higher performance, CPU utilization 75% vs 100%, 1.3% lower bitrate savings.
  - Compared to previous version: 15% higher performance and 7.8% better bitrate savings

Version 1.15.3.114

- MAIN 10 and MAIN 10 422 range extension profile support added.
- Look Ahead feature implementation added.
- Added support for Extended Look Ahead plugin, featuring analyses for before encode or VPP session, and reuse analyses data for several encoding sessions in multi-session scenario, so significantly decreases memory utilization and improves performance.
- Extended look Ahead plugin added API support for B-pyramid analyses.
- TU4 support added featuring middle range encode quality/performance optimization.
- For general performance vs bitrates savings please check HEVC Whitepaper on Product web page.

Version 1.16.3.176

- Added chroma SAO improving quality up to 30%.
- CU 64x64 enabled for all target usages.
- Added Look Ahead by default, adding additional 12 frames buffering.
- Support for mfxEncodeStat structure added.
- Support for mfxExtCodingOptionSPSPPS export through GetVideoParam function added.
- Support for user-defined SEI messages implemented.
- Support for mfxExtHEVCParam added.
- Support for Range Extensions profile_idc added.
- Intel® Xeon® E3 128x v4 and 5th Generation Intel® Core™ support added.

Version 1.17.3.387

- Added support for AUDelimiter
- Enabled CU 64x64 for all target usages.
- Fixed exceeding of low target bitrate keeping in AVBR 10 bit 4:2:0/4:2:2 modes. How "low" depended on video content type.
- Improved bitrate keeping in VBR mode.
- Fixed crash when encoding out of 10 bit range samples.
- Fixed crash when encoding 10 bit at very high bitrates (>100Mbps)
- Fixed crash and hang when encoding very small resolutions (<128x128)
- Fixed crash and hang when transcoding with opaque memory.
- Improved profile and level compliance with other encoding parameters.
- Increased maximum supported resolution to 8192x4320.

Version 1.19.3.559

- Added support for field coding.
- Added support for per frame QP and FrameType controls.
- Added control for Generalized P/B picture (GPB).
- Improved scene-cut detection algorithm.
- Performance improvements:
  o TU7 – speedup 20%, same compression efficiency.
  o TU4 – speedup 10%, same compression efficiency.
  o TU1 – speedup 8%, same compression efficiency.
-

Version 1.23.3.735

- Added support for MaxFrameSize constrained VBR/AVBR encoding.
- Fixed compression efficiency issue with frequent Key Frames for TU1/2 encoding.
- Quality improvements for BRC modes.

Version 1.25.3.982

- Added compatibility with libva 2.0 and new mdf rt api.
- For speed vs compression ratio/quality improvement please see HEVC white paper at Media Server Studio web site (https://software.intel.com/en-us/intel-media-server-studio).

System Requirements

Hardware

- Please check Intel® Media Server Studio 2018 R1 – SDK for Linux* Release Notes document for HW requirements.

Software

- Please check Intel® Media Server Studio 2018 R1 – SDK for Linux* Release Notes document for SW requirements.

Installation

Linux*:

- Installation requires full administrative rights.

- Intel® Media Server Studio 2018 R1 – HEVC Decoder and Encoder requires Intel® Media Server Studio 2018 R1 – SDK for Linux to be already installed.

- Unpack `HEVC2018R1.tar.gz.`

- Enter to `HEVC2018R1` folder and run the install script

    `./install.sh`

    Installer will guide installation process, please follow it.

- The default top-level installation folder for Intel® Media Server Studio 2018 R1 – HEVC Decoder and Encoder is:

    `/opt/intel/mediasdk/plugins`

Installation Folders

Intel® Media Server Studio 2018 R1 – HEVC Decoder and Encoder installs under `/opt/intel/mediasdk/plugins` by default – this is referenced as <hevc-install-dir> in the remainder of this section.

`<hevc-install-folder>`	Intel® Media Server Studio 2018 R1 – HEVC Decoder and Encoder Release Notes (this file),
	Intel® Media Server Studio 2018 R1 – HEVC Decode Plug-in dynamic library:
	`libmfx_hevcd_sw64.so` for Intel® 64 architecture
	Intel® Media Server Studio 2018 R1 – HEVC Encode Plug-in dynamic library:
	`libmfx_hevce_sw64.so` for Intel® 64 architecture
	Intel® Media Server Studio 2018 R1 – HEVC GPU accelerated Encode Plug-in

	dynamic library:
	`libmfx_hevce_gacc64.so` for Intel® 64 architecture
	and configuration file `plugins.cfg`
	See SDK User Manual – `mediasdkusr-man.pdf` from Intel® Media Server Studio 2018 R1 – SDK, "Plug-in Distribution" chapter, for detailed description.

How To Use

You can find more information on how to use Intel® Media Server Studio 2018 R1 – HEVC Decode and Encode in the following documentation:

- `<SDK-install-folder>/doc/mediasdk-man.pdf`

  "Intel® Media Server Studio - SDK Reference Manual" describes the Intel SDK API, including HEVC codec related definitions.

- `<SDK-install-folder>/doc/mediasdkusr-man.pdf`

  "SDK Extensions for User-Defined Functions" describes an API extension (aka plug-ins API) that allows seamless integration of user-defined functions in SDK pipelines.

Note: `<SDK-install-folder>` - folder where Intel® Media Server Studio 2018 R1 – SDK for Linux is installed.

"SDK Developer's Guide" (`Intel_Media_Developers_Guide.pdf`) could be found on [Intel® Media Server Studio Support](#); the document provides development hints and tips to help developers create media applications using SDK. It also covers specifics of plug-ins API usage.

Supported Formats

	8 bit	10 bit	12 bit	14 bit
4:0:0	-	-	-	-
4:2:0	Y	Y	-	-
4:2:2	Y	Y	-	-
4:4:4	-	-	-	-

Known Limitations

The HEVC Decode Plug-in has the following known limitations:

- Decoding bitstreams not compliant with ITU-T H.265 standard or containing corruptions can lead to undefined behavior.

- MAIN10 profile decoding and range extensions profile decoding can be done only with system memory at input and output on linux (SDK/driver limitation for video memory frames allocation).

- Opaque memory is unsupported for usage with hardware library implementation.

- Transcoding from MAIN10 profile to any 8 bit profile using SW Decode plugin and HW library implementation of VPP is not supported due to limitations for data alignment in P010 surfaces.

- When transcoding HEVC decoder tasks should be synced before sending decoded frame to VPP or encoder (see Intel® Media Server Studio 2018 R1 – Samples, version 8.0.24.982).

- MAIN10 and range extensions profile decoding produces frames with Shift=0, Shift=1 is unsupported. See SDK User Manual for semantics of Shift.

The HEVC Encode Plug-in has the following known limitations:

- H.265 MAIN SP profile is not supported in current implementation.

- Produced bitstreams may be not HRD conformant.

- Real-time encoding not guaranteed.

- Application should zero data outside the cropping window on its own or use VPP cropping functionality; otherwise encoder can produce not bit exact results between runs.

- MAIN10 profile encoding/decoding and range extensions profile encoding can be done only with system memory at input and output on linux (SDK/driver limitation for video memory frames allocation).

- MAIN10 profile encoding and range extensions profile encoding can be done only with Shift=0, Shift=1 is unsupported. See SDK User Manual for semantics of Shift.

The HEVC GPU Accelerated Encode Plug-in has all the known limitations of the HEVC Encode Plug-in, plus additionally the following:

- Is supported only with the hardware implementation of SDK library.

- Memory utilization is significantly higher than for software encoder.

- Linux only: due to driver power mode configuration, simple encode and transcode workloads may have low performance as driver will keep low GPU frequency when the load is light. For predictable performance results you may want to fix frequency at certain level manually:

To set minimal frequency (as root):

```
$ sudo cat /sys/bus/pci/devices/0000\:00\:02.0/drm/card0/gt_max_freq_mhz >
/sys/bus/pci/devices/0000\:00\:02.0/drm/card0/gt_min_freq_mhz
```

To show minimal, maximal and current GPU frequency:

```
$ cat /sys/bus/pci/devices/0000\:00\:02.0/drm/card0/gt_min_freq_mhz
$ cat /sys/bus/pci/devices/0000\:00\:02.0/drm/card0/gt_max_freq_mhz
$ cat /sys/bus/pci/devices/0000\:00\:02.0/drm/card0/gt_cur_freq_mhz
```

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