

Intel® Media Server Studio 2018 R1 – Flexible Encode Infrastructure Release Notes

[Overview](#)

[What's New](#)

[What's New in FEI Encoding Sample](#)

[System Requirements](#)

[Installation](#)

[Known limitations](#)

[Legal Information](#)

[Attributions](#)

Overview

The **Flexible Encode Infrastructure** (hereinafter referred to as "FEI") is an extension of Intel® Media Server Studio - SDK (hereinafter referred to as "SDK") that gives more control over encoding process compared to the standard Media SDK API with the following caveats:

- Only AVC encode supported
- Intel does not provide technical support for the FEI through forum or Intel Premier Support
- Building an application with FEI may take significantly more effort compared to the standard Media SDK API
- FEI validation is limited. Some combinations of encoding parameters may lead to unstable application behavior, crashes and hangs.
- FEI API is not backward compatible
- FEI is subject to the same EULA terms as Intel® Media Server Studio. Some FEI components are distributed as "pre-release materials" which restricts their usage according to EULA.

FEI ENC interface is a **PRE-RELEASE** material.

FEI PREENC, FEI ENCODE, FEI PAK interfaces are in PV/production quality.

This extension is part of SDK API and you can find more information on how to use this extension in the following documentation:

- `<sdk-install-folder>/doc/mediasdkfei-man.pdf`

"SDK Developer Reference for Flexible Encode Infrastructure" describes Intel Media Server Studio - FEI API and use cases.

FEI Encoding Sample demonstrates the usage of SDK FEI API for creation of a simple console application that performs encoding and transcoding to H.264 format. You can find more information about the sample in the following documentation:

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 1 of 9

Copyright © 2018, Intel Corporation

- <samples-install-folder>/samples/sample_fei/readme-sample_fei.pdf
- <samples-install-folder>/samples/sample_fei/sample-fei-design-notes.pdf

In this document we will refer to processor families by their codenames for the sake of readability:

- Intel® Xeon® Processor E3-1200 v4 and 5th Generation Intel Core™ Processors will be referred to as “Broadwell”
- Intel® Xeon® Processor E3-1200/1500 v5 and 6th Generation Intel Core™ Processors will be referred to as “Skylake”

What’s New

Version 7.0.16083982

New features:

- FEI API had some changes for FEI ENCODE interfaces compared to previous release. Please pay attention to the list of API changes below to update your application accordingly.
- Support of explicit weighted B-prediction in FEI ENCODE with `mfxExtPredWeightTable` extension buffer.
- Support of reporting the number of repack passes in FEI ENCODE with `mfxExtFeiRepackStat` extension buffer. It can be used together with `mfxExtFeiRepackCtrl` extension buffer, to know exactly the number of repack attempts during the encoding.
- Support of P/I field encoding (first field encoded as P field, second as I field) in FEI ENCODE, to achieve better quality improvement for scenarios when there is scene change in-between the two fields in same frame.
- Support of GPU hang reporting (`MFX_ERR_GPU_HANG`) in FEI PreENC and PAK.

API changes:

- Introduced new extension buffer for repacking status report: `mfxExtFeiRepackStat`.

Full list of fixed bugs/no longer relevant known limitations:

- [33327]Input parameters checks significantly improved for FEI PreENC in SDK library.
- No longer relevant limitation: [30886] FEI PREENC doesn’t support GPU hang reporting (`MFX_ERR_GPU_HANG`). In most of cases `MFX_ERR_DEVICE_FAILED` will be returned from `SyncOperation()` after GPU hang. FEI ENCODE supports this functionality.
- No longer relevant limitation: [31417] PAK does not support GPU hang reporting (`MFX_ERR_GPU_HANG`). In most of cases `MFX_ERR_DEVICE_FAILED` will be returned from `SyncOperation()` after GPU hang.
- No longer relevant limitation: [35152] FEI ENCODE does not support negative weights in explicit P frame weighted prediction. If negative weight is provided then encoder behavior is undefined.

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 2 of 9

Copyright © 2018, Intel Corporation

- [36109] For FEI PAK, fields `TimeStamp`, `DecodeTimeStamp`, `PicStruct`, and `FrameType` in output `mfxBitstream` are correctly set in the library.

What's New in FEI Encoding Sample

Version 7.0.16083982

New Features:

- Support exposing number of repacking in FEI ENCODE.

Overview of source code changes:

- In FEI ENCODE, `mfxExtFeiRepackStat` extension buffer can be attached to `mfxBitstream` to expose the number of repacking.

System Requirements

Hardware

Intel® Media Server Studio – FEI supports the following platforms with the integrated graphics:

- Intel® Xeon® E3-1200 v4 Family with C226 chipset
- Intel® Xeon® E3-1200 and E3-1500 v5 Family with C236 chipset
- 5th Generation Intel® Core™
- 6th Generation Intel® Core™
- Note: chipset must have processor graphics enabled; make sure to check the datasheet.
 - Having a C226/C236 chipset is necessary but not sufficient. Make sure to consult with specific platform or board vendor regarding processor graphics being supported. Check Media Server Studio website for the list of “Known OEM/ODM Functional Platforms”:
<https://software.intel.com/en-us/intel-media-server-studio/details>

Installation

Intel® Media Server Studio 2018 R1 – Flexible Encode Infrastructure will be installed together with Intel® Media Server Studio 2018 R1 – Driver & SDK.

FEI Encoding Sample will be installed as part of Intel® Media Server Studio 2018 R1 – Samples.

Intel® Media Server Studio 2018 R1 – Flexible Encode Infrastructure includes the following components:

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Copyright © 2018, Intel Corporation

Page 3 of 9

Component	Description
doc/mediasdkfei-man.pdf	Reference Manual for Flexible Encode Infrastructure (FEI)
include/mfxfei.h	Extension to SDK API with definition of FEI interfaces
samples/_bin samples/sample_fei	FEI Encoding Sample documentation, source and binary files

Known Limitations

General limitations:

- ENC is not target use case for this release, provided for prototyping purposes. This component received less validation.
- PREENC, ENC, PAK support only video memory
- FEI components do not have any type of built-in bitrate control
- FEI components do not have Target Usage settings (mfxInfoMFX::TargetUsage is ignored)
- FEI components support only synchronous calling sequences: application need to do SyncOperation after each call of MFXVideoENC_ProcessFrameAsync, MFXVideoPAK_ProcessFrameAsync and MFXVideoENCODE_EncodeFrameAsync
- FEI ENC have the following limitations on number of references
 - Max 3 L0 references for P pictures, progressive and interlaced
 - Max 2 L0 references for B pictures, progressive and interlaced
 - Max 1 L1 reference for progressive B pictures
 - Max 2 L1 references for interlaced B pictures
- FEI PAK have the following limitations on number of references
 - Max 16 L0 and L1 references for progressive and interlaced
- FEI ENCODE has the following limitations on number of references:
 - Max 4 L0 references for P and B pictures, progressive and interlaced
 - Max 1 L1 reference for progressive B pictures
 - Max 2 L1 references for interlaced B pictures
- FEI ENCODE, ENC: for B pictures only L0[0] and L1[0] are searched w/o external motion vector predictors (MVP), external MVP enables specific ref picture search.
- Due different internal implementation it is impossible to align legacy ENCODE and FEI ENCODE performance.

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 4 of 9

Copyright © 2018, Intel Corporation

- FEI ENCODE, ENC, PAK: for progressive case each I frame is an access point to stream and references to previous GOP is forbidden. That is untrue for interlaced case, where such references present.
- FEI ENC and PAK don't support Long Term references.
- PAK only use case (without ENC or ENCODE in pipeline) is functionally available but limited by non-exposed/reserved fields in `mfxExtFeiPakMBCtrl` as well as non-documented limitations on the exposed fields in `mfxExtFeiPakMBCtrl`. You may refer to `mfxExtFeiPakMBCtrl` as output of ENC and ENCODE and to "Intel® Open Source HD Graphics and Intel Iris™ Graphics Programmer's Reference Manual Volume 8: Media VDBOX" (is available at <https://01.org/linuxgraphics/documentation/hardware-specification-prms>)
- PREENC, ENCODE, ENC and PAK have very limited coverage with regards to input parameters validation (partly due to gaps in implementation, partly intentional to not affect hardware performance) and may return non-expected statuses, cause crashes/HW hangs and expose other types of "undefined behavior" in case of invalid parameters. Functions affected by gaps in implementation: PREENC Init, ENCODE Init, Query.
- [28407] ENCODE and ENC do not use bidirectional search for external motion vector predictors. So bidirectional prediction mode can be a winner and appears in the bitstream only if one of the default MVPs wins. It can be fixed (not for 8x8 MBs [28542]), if repartition check is enabled.
- [29079] ENCODE and ENC work with one reference list (L0/L1) for external motion vector predictors. It means that MBs can be predicted only from L0 or L1. MBs predicted from both lists (w/o bi-prediction) can be a winner and appear in the bitstream only if one of the default MVPs wins. It can be fixed (not for 8x8 MBs), if repartition check is enabled.

Known issues:

DECODE

Note: in this section, limitations for H.264 Decode Stream Out functionality are listed. For the full list of limitations, refer to SDK Release Notes

- Decode Stream Out functionality supports Video memory only.
- [28879] Decoder provides only one motion vector for the entire 8x8 block, even if there are two of four sub-partitions.
- [28457] Decode stream out data does not contain field parity information for RefIdx field which makes it impossible to identify reference fields for interlaced streams.
- RefIdx for non-active references are not valid.
- [17696] RefIdx if points to frames which are missing from the stream is replaced as closest/maximum existing reference index.
- `mfxFeiDecStreamOutMBCtrl::IsLastMB` is always zero.
- `mfxFeiDecStreamOutMBCtrl::Direct8x8Pattern` is always zero.
- [29085] Invalid RefIdx reported for streams with SPS: :
`gaps_in_frame_num_value_allowed_flag` as 1.

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 5 of 9

Copyright © 2018, Intel Corporation

ENCODE, PREENC

- FEI Encode has limited support for coding options of Legacy Encode (for current state of test coverage please refer to test gaps below). The following coding options are not supported by FEI Encode but supported by Legacy Encode (please also pay attention on general limitations above):
 - `mfExtCodingOption2::SkipFrame`
 - `mfExtCodingOption3:: DirectBiasAdjustment, GlobalMotionBiasAdjustment, MVCostScalingFactor, MBDisableSkipMap`
- FEI ENCODE does not support temporal scalability functionality.
- [30888] On some workloads multiprocess transcoding based on FEI PREENC (on 4x downscaled surfaces) + FEI ENCODE pipeline may ensure a bit less density than transcoding based on Legacy ENCODE with TU4.
- [25073] On interlaced content, FEI PREENC+ENCODE usage model may ensure less objective quality than Legacy TU4. Average quality difference on big stream set is about 1% PSNR BDRATE.
- [29108] SKL gives bigger performance advantage to Legacy (7% of fps) than to FEI (2% of fps) on average, comparing to BDW.
- [28542] Result of bidirectional prediction by FEI ENCODE may be different to the expected: based on neighbor subblocks, bidirectional prediction may be not used for a particular 8x8 subblock even if such prediction gives the best distortion.
- [28398] FEI ENCODE may code 16x16, 16x8 and 8x16 MB partitions as 8x8 if repartition check or quarter pixel estimation are enabled.
- FEI ENCODE: on some cases Trellis=ON may give no objective quality improvement or even small degradation compared to Trellis=OFF.
- [1173] PREENC doesn't support `Query` function. `QueryIOSurf` function is not required for PREENC, as PREENC is a stateless interface, and it operates only on surfaces that are managed by application and doesn't leave locked surfaces after processing.
- [29112] Encoder finds good matches on all reference frames but then during mode decision one of the best found partitions is lost. It happens when we mix 8x8 partitions with minor subblocks, like 8x4.

ENC, PAK

- FEI ENC and PAK expect correct Frame Orders to be set for input surfaces (i.e. different for different frames and unique)
- ENC and PAK do not support reconstructed surface pools bigger than 127 surfaces.
- Incompatible combinations (per AVC standard) of DPB size, progressive/interlaced encoding, profile and level settings would not be adjusted by Media SDK and may lead to unpredictable errors, including corrupted bitstream and GPU hangs for FEI ENC and PAK.
- FEI ENC doesn't have proper `QueryIOSurf` implementation. It is suggested to use FEI PAK's one instead.
- [1173] FEI ENC and PAK don't support `Query` functions.

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 6 of 9

Copyright © 2018, Intel Corporation

- [35095] FEI PAK may insert wrong MMCO for LT references and for some transformations in mixed picstructs streams, which doesn't invoke sliding window algorithm.
- FEI PAK doesn't insert ALL_TO_UNUSED (MMCO_5), but uses multiple ST_TO_UNUSED / LT_TO_UNUSED (MMCO_1, MMCO_2).
- FEI PAK doesn't insert VUI to output bitstream.
- FEI ENC requires both `mfxExtFeiEncMV` and `mfxExtFeiPakMBCtrl` extension buffers to be in same state: attached/not attached.
- FEI ENC and PAK do not support RawRef feature.
- [31455] PAK does not support PAK objects with weighted predictions.
- [31623] FEI ENC and PAK don't support slices which are not aligned to rows of MBs.
- [31920] Usage of ENC + PAK in double field mode should be restricted to cases without references of second field to first field, otherwise output stream may contain artifacts. To avoid artifacts, use single-field mode.

FEI Encoding Sample

- `sample_fei` does not work correctly in case of PREENC-only pipeline and long miniGOPs (more than 7 B frames).
- [32280] Sample does not reorder B frames for the last miniGOP if B-pyramid and Strict GOP is used (and miniGOP is terminated on B frame).

Major testing gaps:

- [31382] PREENC on sequences with long miniGOPs and LTRs
- [29382] `mfxExtCodingOption`, `mfxExtCodingOption2`, `mfxExtCodingOption3`, `mfxPayload`, `mfxExtAVCRefListCtrl` were not tested (except of `mfxExtCodingOption2::Trellis`).
- MB and frame level QP test for PREENC has not been implemented due to complexity of the validation algorithm. These parameters are used only in cost calculation and don't directly influence component output.
- Major testing gaps for H.264 Decode Stream Out feature (referring to `mfxExtFeiDecStreamOut`):
 - ConcealMB
 - NzCoeffCount
 - CbpY/CbpCb/CbpCr
 - IntraPredAvailFlags
 - ChromaIntraPredMode
- Transform size test has not been implemented.
- Multiple slice encoding.
- [29374] RawRef feature.

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 7 of 9

Copyright © 2018, Intel Corporation

Legal Information

THIS DOCUMENT CONTAINS INFORMATION ON PRODUCTS IN THE DESIGN PHASE OF DEVELOPMENT.

No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document.

Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

This document contains information on products, services and/or processes in development. All information provided here is subject to change without notice. Contact your Intel representative to obtain the latest forecast, schedule, specifications and roadmaps.

The products and services described may contain defects or errors known as errata which may cause deviations from published specifications. Current characterized errata are available on request.

Copies of documents which have an order number and are referenced in this document may

be obtained by calling 1-800-548-4725 or by visiting www.intel.com/design/literature.htm.

MPEG is an international standard for video compression/decompression promoted by ISO. Implementations of MPEG CODECs, or MPEG enabled platforms may require licenses from various entities, including Intel Corporation.

VP8 video codec is a high quality royalty free, open source codec deployed on millions of computers and devices worldwide. Implementations of VP8 CODECs, or VP8 enabled platforms may require licenses from various entities, including Intel Corporation.

Intel, the Intel logo, Intel Core, Iris, Intel HD Graphics, Intel Xeon are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others

© Intel Corporation.

Optimization Notice

Intel's compilers may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel.

Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved

*Other names and brands may be claimed as the property of others.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Page 8 of 9

Copyright © 2018, Intel Corporation

for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice.

Notice revision #20110804

Attributions

Safe C Library

Copyright (C) 2012, 2013 Cisco Systems

All rights reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

*Other names and brands may be claimed as the property of others.