

# Encoding Sample

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## Overview

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**Encoding Sample** works with **Intel® Media Server Studio 2017 for Linux**.

It demonstrates how to use the **Intel® Media Server Studio – SDK** (hereinafter referred to as "**SDK**") API to create a simple console application that performs preprocessing and encoding of an uncompressed video stream according to a specific video compression standard. Also the sample shows how to integrate user-defined functions for video processing (on example of picture rotation plug-in) into **SDK** encoding pipeline.

The sample can work together with **Intel® Media Server Studio – HEVC Decoder & Encoder** (hereinafter referred to as "**HEVC**").

**Note:** To run HEVC, please read the instructions in the “HEVC Plugin” section carefully.

## Features

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**Encoding Sample** supports the following video formats:

Format type	
input (uncompressed)	YUV420, NV12
output (compressed)	H.264 (AVC, MVC – Multi-View Coding), H.265 (with <b>HEVC</b> ), MPEG-2 video, JPEG*/Motion JPEG, HEVC (High Efficiency Video Coding)

**Note:** For format YUV420, **Encoding Sample** assumes the order Y, U, V in the input file.

## Hardware Requirements

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See <install-folder>\Media Samples Guide.pdf.

## Software Requirements

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See <install-folder>\Media Samples Guide.pdf.

## How to Build the Application

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See <install-folder>\Media Samples Guide.pdf.

To enable V4L2 option during compilation, set --enable-v4l2=yes option while running build.pl

## Running the Software

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See <install-folder>\Media Samples Guide.pdf.

The executable file requires the following command-line switches to function properly:

h264 h265 mpeg2 mvc jpeg	Output video type. The use of option h265 is possible only if <b>HEVC</b> installed. The option <code>-q</code> is mandatory in case of JPEG encoding.
<code>-i &lt;InputFile&gt;</code>	Input (uncompressed) video file, name and path. In case of MVC <code>-i</code> option must be specified for each input YUV file. Only 2 views are supported
<code>-o &lt;Output&gt;</code>	Output (compressed) video file, name and path
<code>-w &lt;width&gt;</code>	Width of input video frame
<code>-h &lt;height&gt;</code>	Height of input video frame

The following command-line switches are optional:

<code>-p guid</code>	32-character hexadecimal guid string. Optional for in-box plugins, required for user-decoder ones (HEVC, f.e.).
<code>-path path_to_plugin</code>	Path to decoder plugin (works only in pair with ' <code>-p</code> ' option and requires guid to be specified).
<code>-vaapi</code>	Use VA-API surfaces
<code>-nv12</code>	Signals that the input stream is in NV12 color format
<code>-yuy2</code>	Signals that the input stream is in YUY2, works for JPEG encode only
<code>-tff bff</code>	Signals that the input stream is interlaced (top bottom field first). If this option is not specified, progressive stream is expected.
<code>-hw</code>	Use platform-specific implementation of <b>SDK</b> (default)
<code>-sw</code>	Use software implementation of <b>SDK</b> (platform-specific implementation is used by default)
<code>-b &lt;bitrate&gt;</code>	Bitrate of the encoded stream in Kbits/second, supported for all encoders except JPEG*/Motion JPEG
<code>-f &lt;framerate&gt;</code>	Frame rate of the encoded stream (30 by default)
<code>-g &lt;size&gt;</code>	GOP size (default 256)
<code>-idr_interval &lt;size&gt;</code>	IDR interval: default 0 means every I is an IDR, 1 means every other I frame is an IDR, etc...
<code>-u &lt;quality, speed, balanced&gt;</code>	Target usage (balanced by default). This parameter specifies a trade-off between quality and speed. Supported for all encoders except JPEG*/Motion JPEG
<code>-q</code>	The mandatory quality parameter for JPEG/Motion JPEG encoder (not valid for other encoders). In range [1,100], 100 is the best quality.

-la	Use the look ahead bitrate control algorithm (LA BRC) for H.264 encoder. Supported only with <code>-hw</code> library on processors with Intel® Iris™ Pro Graphics, Intel® Iris™ Graphics or Intel® HD Graphics 4200+ Series.
-lad	Depth parameter for the LA BRC, the number of frames to be analyzed before encoding. In range [10,100].
-cqp	Use constant quantization parameter (CQP BRC) bitrate control method (by default constant bitrate control method is used), should be used along with <code>-qpi</code> , <code>-qpp</code> , <code>-qpb</code> .
-qpi	Constant quantizer for I frames (if bitrate control method is CQP). In range [1,51]. 0 by default, i.e.no limitations on QP.
-qpp	Constant quantizer for P frames (if bitrate control method is CQP). In range [1,51]. 0 by default, i.e.no limitations on QP.
-qpb	Constant quantizer for B frames (if bitrate control method is CQP). In range [1,51]. 0 by default, i.e.no limitations on QP.
-qsv-ff	Enable QSV-FF mode
-num_slice	Number of slices in each video frame. 0 by default. If <code>num_slice</code> equals zero, the encoder may choose any slice partitioning allowed by the codec standard.
-mss	Maximum slice size in bytes. Supported only with hardware library ( <code>-hw</code> ) and H.264 encoder. This option is not compatible with <code>-num_slice</code> .
-dstw <width>	Width of encoded video frame. If specified and the value here is different from the value specified with <code>-w</code> , the encoder invokes video preprocessing (VPP) for scaling (resizing).
-dsth <height>	Height of encoded video frame. If specified and the value here is different from the value specified with <code>-h</code> , the encoder invokes video preprocessing (VPP) for scaling (resizing).
-angle 180	Invokes sample plug-in for 180 degrees picture rotation. CPU implementation is used by default. Rotate plugin module <code>sample_rotate_plugin.so</code> must be available when running the application with this option.
-opencl	Invokes Intel®OpenCL™ implementation of 180 degrees picture rotation. Rotate plugin module <code>libsampler_plugin_opencl.so</code> must be available. File <code>ocl_rotate.cl</code> must exist in the local folder when running the application with this option.
-async	Depth of asynchronous pipeline. default value is 4. must be between 1 and 20.
-bref	Arrange B frames in B pyramid reference structure
-nobref	Do not use B-pyramid (by default the decision is made by library)
-gpubcopy::<on,off>	Enable/disable GPU Copy functionality
-re	Enable region encode mode. Works only with HEVC encoder
-r <distance>	Distance between I- or P- key frames (1 means no B-frames)

-x <numRefs>	Number of reference frames. By default it is set to 1
-?	Print help

If V4L2 support is enabled during compilation, additional options are available:

-d	Device video node (eg: /dev/video0)
-p	Mipi Port number (eg: Port 0)
-m	Mipi Mode Configuration [PREVIEW/CONTINUOUS/STILL/VIDEO]
-uyvy	Input Raw format types V4L2 Encode
-YUY2	Input Raw format types V4L2 Encode
-i::v4l2	Enable v4l2 mode

Below are examples of a command-line to execute **Encoding Sample**:

```
$ sample_encode h264 -i input.yuv -o output.h264 -w 720 -h 480 -b 10000 -f
30 -u quality -d3d -hw
$ sample_encode mpeg2 -i input.yuv -o output.mpeg2 -w 1920 -h 1080 -b 15000
-u speed -nv12 -tff -hw
$ sample_encode h264 -i input.yuv -o output.h264 -w 1920 -h 1080 -dstw 360 -
dsth 240 -b 1000 -u balanced -hw
```

**Note 1:** You need to have **HEVC** installed to run with h265 codec. In case of HW library it will firstly try to load HW HEVC plugin in case of failure - it will try SW one if available.

**Tip:**

To achieve better performance, use input streams in NV12 color format. If the input stream is in YUV420 format, each frame is converted to NV12 which reduces overall performance.

## HEVC Plugin

HEVC codec is implemented as a plugin unlike codecs such as MPEG2 and AVC. After you install the HEVC package, you will see the following plugins installed – HEVC Decode SW, HEVC Encode SW and HEVC Encode GACC (GACC is Graphics ACCelerated plugin that uses both CPU and GPU for execution).

Our samples load the SW HEVC plugins, unless the GUI for the GACC counterparts are specified using “-p” parameter. For example, the following command-lines will use the SW HEVC Decode and Encode plugin respectively:

```
$ sample_decode h265 -i input.265 -o output.yuv
```

```
$ sample_encode h265 -i input.yuv -o output.h265 -w 720 -h 480 -b 10000 -f
30 -u quality
```

(Note: HEVC Decode GACC plugin is not available on Linux).

To run the HEVC GACC plugins, you have to specify the “-p” parameter to the GUID. For example, the following command-lines will use the HEVC GACC Decode and Encode plugin:

```
$ sample_decode h265 -i input.265 -o output.yuv -p
33a61cb4c27454ca8d85dde757c6f8e
```

```
$ sample_encode h265 -i input.yuv -o output.h265 -w 720 -h 480 -b 10000 -p
e5400a06c74d41f5b12d430bbaa23d0b
```

## Known Limitations

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- Not all combinations of optional switches are supported. If the option `-angle 180` or `-opencl` is specified, options `-tff|bfff`, `-dstw`, `-dsth`, `-d3d` and MVC output are not available.
- **Encoding Sample** if run with `-opencl` option requires input video frame width to be aligned by 4.
- In case of using HEVC plugin (h265 video type), plugin type (hardware or software) used by default is set depending on `-sw` or `-hw` sample options. However, hardware HEVC plugins work on specific platforms only. To force usage of specific HEVC plugin implementation, please use `-p` option with proper plugin GUID.

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