



SDK Developer Reference

API Version 1.23



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Overview

Intel® Media Server Studio – SDK, further referred to as the SDK, is a software development library that exposes the media acceleration capabilities of Intel platforms for decoding, encoding and video processing. The API library covers a wide range of Intel platforms.

This document describes the SDK API.

Document Conventions

The SDK API uses the Verdana typeface for normal prose. With the exception of section headings and the table of contents, all code-related items appear in the `Courier New` typeface (`mxStatus` and `MXInit`). All class-related items appear in all cap boldface, such as **DECODE** and **ENCODE**. Member functions appear in initial cap boldface, such as **Init** and **Reset**, and these refer to members of all three classes, **DECODE**, **ENCODE** and **VPP**. Hyperlinks appear in underlined boldface, such as **mxStatus**.

Acronyms and Abbreviations

API	Application Programming Interface
AVC	Advanced Video Codec (same as H.264 and MPEG-4, part 10)
Direct3D	Microsoft* Direct3D* version 9 or 11.1
Direct3D9	Microsoft* Direct3D* version 9
Direct3D11	Microsoft* Direct3D* version 11.1
DXVA2	Microsoft DirectX* Video Acceleration standard 2.0
H.264	ISO*/IEC* 14496-10 and ITU-T* H.264, MPEG-4 Part 10, Advanced Video Coding, May 2005
HRD	Hypothetical Reference Decoder
IDR	Instantaneous decoding fresh picture, a term used in the H.264 specification
LA	Look Ahead. Special encoding mode where encoder performs pre analysis of several frames before actual encoding starts.
MPEG	Motion Picture Expert Group
MPEG-2	ISO/IEC 13818-2 and ITU-T H.262, MPEG-2 Part 2, Information Technology- Generic Coding of Moving Pictures and Associate Audio Information: Video, 2000
NAL	Network Abstraction Layer
NV12	A color format for raw video frames
PPS	Picture Parameter Set
QP	Quantization Parameter



RGB3	Twenty-four-bit RGB color format. Also known as RGB24
RGB4	Thirty-two-bit RGB color format. Also known as RGB32
SDK	Intel® Media Server Studio – SDK
SEI	Supplemental Enhancement Information
SPS	Sequence Parameter Set
VA API	Video Acceleration API
VBR	Variable Bit Rate
VBV	Video Buffering Verifier
VC-1	SMPTE* 421M, SMPTE Standard for Television: VC-1 Compressed Video Bitstream Format and Decoding Process, August 2005
video memory	memory used by hardware acceleration device, also known as GPU, to hold frame and other types of video data
VPP	Video Processing
VUI	Video Usability Information
YUY2	A color format for raw video frames
YV12	A color format for raw video frames
GPB	Generalized P/B picture. B-picture, containing only forward references in both L0 and L1.

Architecture

SDK functions fall into the following categories:

DECODE	Decode compressed video streams into raw video frames
ENCODE	Encode raw video frames into compressed bitstreams
VPP	Perform video processing on raw video frames
CORE	Auxiliary functions for synchronization
Misc	Global auxiliary functions

With the exception of the global auxiliary functions, SDK functions are named after their functioning domain and category, as illustrated in Figure 1. Here, SDK only exposes video domain functions.

MFXVideoDECODE_DecodeFrameAsync			
Prefix	Domain	Class	Name

Figure 1: SDK Function Naming Convention

Applications use SDK functions by linking with the SDK dispatcher library, as illustrated in Figure 2. The dispatcher library identifies the hardware acceleration device on the running platform, determines the most suitable platform library, and then redirects function calls. If the dispatcher is unable to detect any suitable platform-specific hardware, the dispatcher redirects SDK function calls to the default software library.

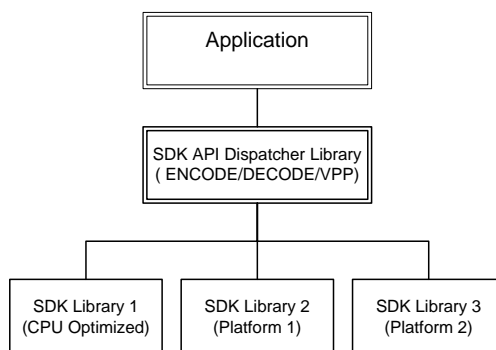


Figure 2: SDK Library Dispatching Mechanism

Video Decoding

The **DECODE** class of functions takes a compressed bitstream as input and converts it to raw frames as output.

DECODE processes only pure or elementary video streams. The library cannot process bitstreams that reside in a container format, such as MP4 or MPEG. The application must first de-multiplex the bitstreams. De-multiplexing extracts pure video streams out of the container format. The application can provide the input bitstream as one complete frame of data, less than one frame (a partial frame), or multiple frames. If only a partial frame is provided, **DECODE** internally constructs one frame of data before decoding it.

The time stamp of a bitstream buffer must be accurate to the first byte of the frame data. That is, the first byte of a video coding layer NAL unit for H.264, or picture header for MPEG-2 and VC-1. **DECODE** passes the time stamp to the output surface for audio and video multiplexing or synchronization.

Decoding the first frame is a special case, since **DECODE** does not provide enough configuration parameters to correctly process the bitstream. **DECODE** searches for the sequence header (a sequence parameter set in H.264, or a sequence header in MPEG-2 and VC-1) that contains the video configuration parameters used to encode subsequent video frames. The decoder skips any bitstream prior to that sequence header. In the case of multiple sequence headers in the bitstream, **DECODE** adopts the new configuration parameters, ensuring proper decoding of subsequent frames.

DECODE supports repositioning of the bitstream at any time during decoding. Because there is no way to obtain the correct sequence header associated with the specified bitstream position after a position change, the application must supply **DECODE** with a sequence header before the decoder can process the next frame at the new position. If the sequence header required to correctly decode the bitstream at the new position is not provided by the application, **DECODE** treats the new location as a new “first frame” and follows the procedure for decoding first frames.

Video Encoding

The **ENCODE** class of functions takes raw frames as input and compresses them into a bitstream.

Input frames usually come encoded in a repeated pattern called the Group of Picture (GOP) sequence. For example, a GOP sequence can start from an I-frame, followed by a few B-frames, a P-frame, and so on. **ENCODE** uses an MPEG-2 style GOP sequence structure that can specify the length of the sequence and the distance between two key frames: I- or P-frames. A GOP sequence ensures that the segments of a bitstream do not completely depend upon each other. It also enables decoding applications to reposition the bitstream.

ENCODE processes input frames in two ways:

Display order: **ENCODE** receives input frames in the display order. A few GOP structure parameters specify the GOP sequence during **ENCODE** initialization. Scene change results from the video processing stage of a pipeline can alter the GOP sequence.

Encoded order: **ENCODE** receives input frames in their encoding order. The application must specify the exact input frame type for encoding. **ENCODE** references GOP parameters to determine when to insert information such as an end-of-sequence into the bitstream.



An **ENCODE** output consists of one frame of a bitstream with the time stamp passed from the input frame. The time stamp is used for multiplexing subsequent video with other associated data such as audio. The SDK library provides only pure video stream encoding. The application must provide its own multiplexing.

ENCODE supports the following bitrate control algorithms: constant bitrate, variable bitrate (VBR), and constant Quantization Parameter (QP). In the constant bitrate mode, **ENCODE** performs stuffing when the size of the least-compressed frame is smaller than what is required to meet the Hypothetical Reference Decoder (HRD) buffer (or VBR) requirements. (Stuffing is a process that appends zeros to the end of encoded frames.)

Video Processing

Video processing (**VPP**) takes raw frames as input and provides raw frames as output.

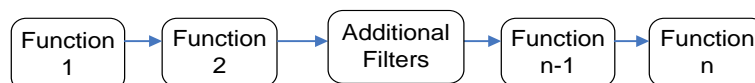


Figure 3: Video Processing Operation Pipeline

The actual conversion process is a chain operation with many single-function filters, as Figure 3 illustrates. The application specifies the input and output format, and the SDK configures the pipeline accordingly. The application can also attach one or more hint structures to configure individual filters or turn them on and off. Unless specifically instructed, the SDK builds the pipeline in a way that best utilizes hardware acceleration or generates the best video processing quality.

Table 1 shows the SDK video processing features. The application can configure supported video processing features through the video processing I/O parameters. The application can also configure optional features through hints. See ["Video Processing procedure / Configuration"](#) for more details on how to configure optional filters.

Table 1: Video Processing Features

Video Processing Features	Configuration
Convert color format from input to output (See Table 2 for supported conversions)	I/O parameters
De-interlace to produce progressive frames at the output (See Table 3 for supported conversions)	I/O parameters
Crop and resize the input frames to meet the output resolution and region of display	I/O parameters
Convert input frame rate to match the output	I/O parameters
Perform inverse telecine operations	I/O parameters
Fields weaving	I/O parameters
Fields splitting	I/O parameters
Remove noise	hint (optional feature)
Enhance picture details/edges	hint (optional feature)
Adjust the brightness, contrast, saturation, and hue settings	hint (optional feature)
Perform image stabilization	hint (optional feature)
Convert input frame rate to match the output, based on frame interpolation	hint (optional feature)
Perform detection of picture structure	hint (optional feature)

**Table 2: Color Conversion Support in VPP***

Output Color Input Color	NV12	RGB32	P010	P210	NV16	A2RGB10
RGB4 (RGB32)	X limited	X Limited				
NV12	X	X	X		X	
YV12	X	X				
UYVY	X					
YUY2	X	X				
P010	X		X	X		X
P210	X		X	X	X	X
NV16	X			X	X	

X indicates a supported function

*Conversions absent in this table are unsupported

The SDK video processing pipeline supports limited functionality for RGB4 input. Only filters that are required to convert input format to output one are included in pipeline. All optional filters are skipped. See description of [MFX_WRN_FILTER_SKIPPED](#) warning for more details on how to retrieve list of active filters.

Table 3: Deinterlacing/Inverse Telecine Support in VPP

Input Field Rate (fps) Interlaced	Output Frame Rate (fps) Progressive						
	23.976	25	29.97	30	50	59.94	60
29.97	Inverse Telecine		X				
50		X			X		
59.94			X			X	
60				X			X

X indicates a supported function.

This table describes pure deinterlacing algorithm. The application can combine it with frame rate conversion to achieve any desirable input/output frame rate ratio. Note, that in this table input rate is field rate, i.e. number of video fields in one second of video. The SDK uses frame rate in all configuration parameters, so this input field rate should be divided by two during the SDK configuration. For example, 60i to 60p conversion in this table is represented by right bottom cell. It should be described in mfxVideoParam as input frame rate equal to 30 and output 60.



SDK support two HW-accelerated deinterlacing algorithms: BOB DI (in Linux's libVA terms VAProcDeinterlacingBob) and Advanced DI (VAProcDeinterlacingMotionAdaptive). Default is ADI (Advanced DI) which uses reference frames and has better quality. BOB DI is faster than ADI mode. So user can select as usual between speed and quality.

User can exactly configure DI modes via [mfxExtVPPDeinterlacing](#).

There is one special mode of deinterlacing available in combination with frame rate conversion. If VPP input frame is interlaced (TFF or BFF) and output is progressive and ratio between source frame rate and destination frame rate is $\frac{1}{2}$ (for example 30 to 60, 29.97 to 59.94, 25 to 50), special mode of VPP turned on: for 30 interlaced input frames application will get 60 different progressive output frames.

Table 4: Color formats supported by VPP filters

Filter \ Color	RGB4 (RGB32)	NV12	YV12	YUY2	P010	P210	NV16
Denoise		X					
Deinterlace		X					
Image stabilization		X					
Frame rate conversion		X					
Resize		X			X	X	X
Detail		X					
Color conversion (see table 2 for details)	X	X	X	X	X	X	X
Composition	X	X					
Field copy		X					
Fields weaving		X					
Fields splitting		X					

X indicates a supported function

The SDK video processing pipeline supports limited HW acceleration for P010 format - zeroed [mfxFrameInfo::Shift](#) leads to partial acceleration.

The SDK video processing pipeline does not support HW acceleration for P210 format.

Programming Guide

This chapter describes the concepts used in programming the SDK.

The application must use the include file, `mfxvideo.h` (for C programming), or `mfxvideo++.h` (for C++ programming), and link the SDK static dispatcher library, `libmfx.lib` or `libmfx.a`. If the application is written in C then `libstdc++.a` library should also be linked.

Include these files:

```
#include "mfxvideo.h"      /* The SDK include file */
#include "mfxvideo++.h"    /* Optional for C++ development */
```

Link this library:

```
libmfx.lib                /* The SDK static dispatcher library */
or
libmfx.a                  /* The SDK static dispatcher library */
```

On Linux* there is slight difference between using dispatcher library from executable module or from shared object. To mitigate symbol conflict between itself and SDK shared object on Linux*, application should:

1. link against `dispatch_shared.a` instead of `libmfx.a`
2. define `MFX_DISPATCHER_EXPOSED_PREFIX` before any SDK includes

Status Codes

The SDK functions organize into classes for easy reference. The classes include **ENCODE** (encoding functions), **DECODE** (decoding functions), and **VPP** (video processing functions).

Init, **Reset** and **Close** are member functions within the **ENCODE**, **DECODE** and **VPP** classes that initialize, restart and de-initialize specific operations defined for the class. Call all other member functions within a given class (except **Query** and **QueryIOSurf**) within the **Init** ... **Reset** (optional) ... **Close** sequence.

The **Init** and **Reset** member functions both set up necessary internal structures for media processing. The difference between the two is that the **Init** functions allocate memory while the **Reset** functions only reuse allocated internal memory. Therefore, **Reset** can fail if the SDK needs to allocate additional memory. **Reset** functions can also fine-tune **ENCODE** and **VPP** parameters during those processes or reposition a bitstream during **DECODE**.

All SDK functions return status codes to indicate whether an operation succeeded or failed. See the [mfxStatus](#) enumerator for all defined status codes. The status code [MFX_ERR_NONE](#) indicates that the function successfully completed its operation. Status codes are less than [MFX_ERR_NONE](#) for all errors and greater than [MFX_ERR_NONE](#) for all warnings.



If an SDK function returns a warning, it has sufficiently completed its operation, although the output of the function might not be strictly reliable. The application must check the validity of the output generated by the function.

If an SDK function returns an error (except [MFX_ERR_MORE_DATA](#) or [MFX_ERR_MORE_SURFACE](#) or [MFX_ERR_MORE_BITSTREAM](#)), the function aborts the operation. The application must call either the **Reset** function to put the class back to a clean state, or the **Close** function to terminate the operation. The behavior is undefined if the application continues to call any class member functions without a **Reset** or **Close**. To avoid memory leaks, always call the **Close** function after **Init**.

SDK Session

Before calling any SDK functions, the application must initialize the SDK library and create an SDK session. An SDK session maintains context for the use of any of **DECODE**, **ENCODE**, or **VPP** functions.

The function [MFXInit](#) starts (initializes) an SDK session. [MFXClose](#) closes (de-initializes) the SDK session. To avoid memory leaks, always call [MFXClose](#) after [MFXInit](#).

The application can initialize a session as a software-based session ([MFX_IMPL_SOFTWARE](#)) or a hardware-based session ([MFX_IMPL_HARDWARE](#)). In the former case, the SDK functions execute on a CPU, and in the latter case, the SDK functions use platform acceleration capabilities. For platforms that expose multiple graphic devices, the application can initialize the SDK session on any alternative graphic device ([MFX_IMPL_HARDWARE1](#)...[MFX_IMPL_HARDWARE4](#)).

The application can also initialize a session to be automatic ([MFX_IMPL_AUTO](#) or [MFX_IMPL_AUTO_ANY](#)), instructing the dispatcher library to detect the platform capabilities and choose the best SDK library available. After initialization, the SDK returns the actual implementation through the [MFXQueryIMPL](#) function.

Multiple Sessions

Each SDK session can run exactly one instance of **DECODE**, **ENCODE** and **VPP** functions. This is good for a simple transcoding operation. If the application needs more than one instance of **DECODE**, **ENCODE** and **VPP** in a complex transcoding setting, or needs more simultaneous transcoding operations to balance CPU/GPU workloads, the application can initialize multiple SDK sessions. Each SDK session can independently be a software-based session or hardware-based session.

The application can use multiple SDK sessions independently or run a “joined” session. Independently operated SDK sessions cannot share data unless the application explicitly synchronizes session operations (to ensure that data is valid and complete before passing from the source to the destination session.)

To join two sessions together, the application can use the function [MFXJoinSession](#). Alternatively, the application can use the function [MFXCloneSession](#) to duplicate an existing session. Joined SDK sessions work together as a single session, sharing all session resources, threading control and prioritization operations (except hardware acceleration devices and external allocators). When joined, one of the sessions (the first join) serves as a parent session, scheduling execution resources, with all others child sessions relying on the parent session for resource management.



With joined sessions, the application can set the priority of session operations through the [MFXSetPriority](#) function. A lower priority session receives less CPU cycles. Session priority does not affect hardware accelerated processing.

After the completion of all session operations, the application can use the function [MFXDisjoinSession](#) to remove the joined state of a session. Do not close the parent session until all child sessions are disjoined or closed.

Frame and Fields

In SDK terminology, a frame (or frame surface, interchangeably) contains either a progressive frame or a complementary field pair. If the frame is a complementary field pair, the odd lines of the surface buffer store the top fields and the even lines of the surface buffer store the bottom fields.

Frame Surface Locking

During encoding, decoding or video processing, cases arise that require reserving input or output frames for future use. In the case of decoding, for example, a frame that is ready for output must remain as a reference frame until the current sequence pattern ends. The usual approach is to cache the frames internally. This method requires a copy operation, which can significantly reduce performance.

SDK functions define a frame-locking mechanism to avoid the need for copy operations. This mechanism is as follows:

1. The application allocates a pool of frame surfaces large enough to include SDK function I/O frame surfaces and internal cache needs. Each frame surface maintains a `Locked` counter, part of the [mfxFrameData](#) structure. Initially, the `Locked` counter is set to zero.
2. The application calls an SDK function with frame surfaces from the pool, whose `Locked` counter is zero. If the SDK function needs to reserve any frame surface, the SDK function increases the `Locked` counter of the frame surface. A non-zero `Locked` counter indicates that the calling application must treat the frame surface as "in use." That is, the application can read, but cannot alter, move, delete or free the frame surface.
3. In subsequent SDK executions, if the frame surface is no longer in use, the SDK decreases the `Locked` counter. When the `Locked` counter reaches zero, the application is free to do as it wishes with the frame surface.

In general, the application must not increase or decrease the `Locked` counter, since the SDK manages this field. If, for some reason, the application needs to modify the `Locked` counter, the operation must be atomic to avoid race condition. **Modifying the `Locked` counter is not recommended.**

Decoding Procedures

Example 1 shows the pseudo code of the decoding procedure. The following describes a few key points:

- The application can use the [MFXVideoDECODE DecodeHeader](#) function to retrieve decoding initialization parameters from the bitstream. This step is optional if such parameters are retrievable from other sources such as an audio/video splitter.
- The application uses the [MFXVideoDECODE QueryIOSurf](#) function to obtain the number of working frame surfaces required to reorder output frames.
- The application calls the [MFXVideoDECODE DecodeFrameAsync](#) function for a decoding operation, with the bitstream buffer (`bits`), and an unlocked working frame surface (`work`) as input parameters. If decoding output is not available, the function returns a status code requesting additional bitstream input or working frame surfaces as follows:

[MFX_ERR_MORE_DATA](#): The function needs additional bitstream input. The existing buffer contains less than a frame worth of bitstream data.

[MFX_ERR_MORE_SURFACE](#): The function needs one more frame surface to produce any output.

[MFX_ERR_REALLOC_SURFACE](#): Dynamic resolution change case - the function needs bigger working frame surface (`work`).

- Upon successful decoding, the [MFXVideoDECODE DecodeFrameAsync](#) function returns [MFX_ERR_NONE](#). However, the decoded frame data (identified by the `disp` pointer) is not yet available because the [MFXVideoDECODE DecodeFrameAsync](#) function is asynchronous. The application must use the [MFXVideoCORE SyncOperation](#) function to synchronize the decoding operation before retrieving the decoded frame data.
- At the end of the bitstream, the application continuously calls the [MFXVideoDECODE DecodeFrameAsync](#) function with a NULL bitstream pointer to drain any remaining frames cached within the SDK decoder, until the function returns [MFX_ERR_MORE_DATA](#).

Bitstream Repositioning

The application can use the following procedure for bitstream reposition during decoding:

1. Use the [MFXVideoDECODE Reset](#) function to reset the SDK decoder.
2. Optionally, if the application maintains a sequence header that decodes correctly the bitstream at the new position, the application may insert the sequence header to the bitstream buffer.
3. Append the bitstream from the new location to the bitstream buffer.

4. Resume the decoding procedure. If the sequence header is not inserted in the above steps, the SDK decoder searches for a new sequence header before starting decoding.

```

MFXVideoDECODE_DecodeHeader(session, bitstream, &init_param);
MFXVideoDECODE_QueryIOSurf(session, &init_param, &request);
allocate_pool_of_frame_surfaces(request.NumFrameSuggested);
MFXVideoDECODE_Init(session, &init_param);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    if (sts==MFX_ERR_MORE_DATA && !end_of_stream())
        append_more_bitstream(bitstream);
    find_unlocked_surface_from_the_pool(&work);
    bits=(end_of_stream())?NULL:bitstream;
    sts=MFXVideoDECODE_DecodeFrameAsync(session, bits, work, &disp, &syncp);
    if (sts==MFX_ERR_MORE_SURFACE) continue;
    if (end_of_bitstream() && sts==MFX_ERR_MORE_DATA) break;
    if (sts==MFX_ERR_REALLOC_SURFACE) {
        MFXVideoDECODE_GetVideoParam(session, &param);
        realloc_surface(work, param.mfx.FrameInfo);
        continue;
    }
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_decoded_frame(disp);
    }
}
MFXVideoDECODE_Close();
free_pool_of_frame_surfaces();

```

Example 1: Decoding Pseudo Code

Multiple Sequence Headers

The bitstream can contain multiple sequence headers. The SDK function returns a status code to indicate when a new sequence header is parsed.

The [MFXVideoDECODE_DecodeFrameAsync](#) function returns [MFX_WRN_VIDEO_PARAM_CHANGED](#) if the SDK decoder parsed a new sequence header in the bitstream and decoding can continue



with existing frame buffers. The application can optionally retrieve new video parameters by calling [MFXVideoDECODE_GetVideoParam](#).

The [MFXVideoDECODE_DecodeFrameAsync](#) function returns [MFX_ERR_INCOMPATIBLE_VIDEO_PARAM](#) if the decoder parsed a new sequence header in the bitstream and decoding cannot continue without reallocating frame buffers. The bitstream pointer moves to the first bit of the new sequence header. The application must do the following:

1. Retrieve any remaining frames by calling [MFXVideoDECODE_DecodeFrameAsync](#) with a NULL input bitstream pointer until the function returns [MFX_ERR_MORE_DATA](#). This step is not necessary if the application plans to discard any remaining frames.
2. De-initialize the decoder by calling the [MFXVideoDECODE_Close](#) function, and restart the decoding procedure from the new bitstream position.

Encoding Procedures

Example 2 shows the pseudo code of the encoding procedure. The following describes a few key points:

- The application uses the [MFXVideoENCODE_QueryIOSurf](#) function to obtain the number of working frame surfaces required for reordering input frames.
- The application calls the [MFXVideoENCODE_EncodedFrameAsync](#) function for the encoding operation. The input frame must be in an unlocked frame surface from the frame surface pool. If the encoding output is not available, the function returns the status code [MFX_ERR_MORE_DATA](#) to request additional input frames.
- Upon successful encoding, the [MFXVideoENCODE_EncodeFrameAsync](#) function returns [MFX_ERR_NONE](#). However, the encoded bitstream is not yet available because the [MFXVideoENCODE_EncodeFrameAsync](#) function is asynchronous. The application must use the [MFXVideoCORE_SyncOperation](#) function to synchronize the encoding operation before retrieving the encoded bitstream.
- At the end of the stream, the application continuously calls the [MFXVideoENCODE_EncodeFrameAsync](#) function with NULL surface pointer to drain any remaining bitstreams cached within the SDK encoder, until the function returns [MFX_ERR_MORE_DATA](#).

Configuration Change

The application changes configuration during encoding by calling [MFXVideoENCODE_Reset](#) function. Depending on difference in configuration parameters before and after change, the SDK encoder either continues current sequence or starts a new one. If the SDK encoder starts a new sequence it completely resets internal state and begins a new sequence with IDR frame.



The application controls encoder behavior during parameter change by attaching [mfxExtEncoderResetOption](#) to [mfxVideoParam](#) structure during reset. By using this structure, the application instructs encoder to start or not to start a new sequence after reset. In some cases request to continue current sequence cannot be satisfied and encoder fails during reset. To avoid such cases the application may query reset outcome before actual reset by calling [MFXVideoENCODE_Query](#) function with [mfxExtEncoderResetOption](#) attached to [mfxVideoParam](#) structure.

The application uses the following procedure to change encoding configurations:

1. The application retrieves any cached frames in the SDK encoder by calling the [MFXVideoENCODE_EncodeFrameAsync](#) function with a `NULL` input frame pointer until the function returns [MFX_ERR_MORE_DATA](#).

Note: The application must set the initial encoding configuration flag `EndOfStream` of the [mfxExtCodingOption](#) structure to `OFF` to avoid inserting an End of Stream (EOS) marker into the bitstream. An EOS marker causes the bitstream to terminate before encoding is complete.

2. The application calls the [MFXVideoENCODE_Reset](#) function with the new configuration:
 - If the function successfully set the configuration, the application can continue encoding as usual.
 - If the new configuration requires a new memory allocation, the function returns [MFX_ERR_INCOMPATIBLE_VIDEO_PARAM](#). The application must close the SDK encoder and reinitialize the encoding procedure with the new configuration.

```

MFXVideoENCODE_QueryIOSurf(session, &init_param, &request);
allocate_pool_of_frame_surfaces(request.NumFrameSuggested);
MFXVideoENCODE_Init(session, &init_param);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    if (sts==MFX_ERR_MORE_DATA && !end_of_stream()) {
        find_unlocked_surface_from_the_pool(&surface);
        fill_content_for_encoding(surface);
    }
    surface2=end_of_stream()?NULL:surface;
    sts=MFXVideoENCODE_EncodeFrameAsync(session,NULL,surface2,bits,&syncp);
    if (end_of_stream() && sts==MFX_ERR_MORE_DATA) break;
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_encoded_bits(bits);
    }
}
MFXVideoENCODE_Close();
free_pool_of_frame_surfaces();

```

Example 2: Encoding Pseudo Code

Video Processing Procedures

Example 3 shows the pseudo code of the video processing procedure. The following describes a few key points:

- The application uses the [MFXVideoVPP_QueryIOSurf](#) function to obtain the number of frame surfaces needed for input and output. The application must allocate two frame surface pools, one for the input and the other for the output.
- The video processing function [MFXVideoVPP_RunFrameVPPAsync](#) is asynchronous. The application must synchronize to make the output result ready, through the [MFXVideoCORE_SyncOperation](#) function.
- The body of the video processing procedures covers three scenarios as follows:
 - If the number of frames consumed at input is equal to the number of frames generated at output, **VPP** returns [MFX_ERR_NONE](#) when an output is ready. The application must process the output frame after synchronization, as the [MFXVideoVPP_RunFrameVPPAsync](#) function is asynchronous. At the end of a

sequence, the application must provide a `NULL` input to drain any remaining frames.

- If the number of frames consumed at input is more than the number of frames generated at output, **VPP** returns [MFX_ERR_MORE_DATA](#) for additional input until an output is ready. When the output is ready, **VPP** returns [MFX_ERR_NONE](#). The application must process the output frame after synchronization and provide a `NULL` input at the end of sequence to drain any remaining frames.
- If the number of frames consumed at input is less than the number of frames generated at output, **VPP** returns either [MFX_ERR_MORE_SURFACE](#) (when more than one output is ready), or [MFX_ERR_NONE](#) (when one output is ready and **VPP** expects new input). In both cases, the application must process the output frame after synchronization and provide a `NULL` input at the end of sequence to drain any remaining frames.

```
MFXVideoVPP_QueryIOSurf(session, &init_param, response);
allocate_pool_of_surfaces(in_pool, response[0].NumFrameSuggested);
allocate_pool_of_surfaces(out_pool, response[1].NumFrameSuggested);
MFXVideoVPP_Init(session, &init_param);
in=find_unlocked_surface_and_fill_content(in_pool);
out=find_unlocked_surface_from_the_pool(out_pool);
for (;;) {
    sts=MFXVideoVPP_RunFrameVPPAsync(session,in,out,aux,&syncp);
    if (sts==MFX_ERR_MORE_SURFACE || sts==MFX_ERR_NONE) {
        MFXVideoCore_SyncOperation(session,syncp,INFINITE);
        process_output_frame(out);
        out=find_unlocked_surface_from_the_pool(out_pool);
    }
    if (sts==MFX_ERR_MORE_DATA && in==NULL) break;
    if (sts==MFX_ERR_NONE || sts==MFX_ERR_MORE_DATA) {
        in=find_unlocked_surface(in_pool);
        fill_content_for_video_processing(in);
        if (end_of_input_sequence()) in=NULL;
    }
}
MFXVideoVPP_Close(session);
free_pool_of_surfaces(in_pool);
free_pool_of_surfaces(out_pool);
```

Example 3: Video Processing Pseudo Code

Configuration

The SDK configures the video processing pipeline operation based on the difference between the input and output formats, specified in the [mfxVideoParam](#) structure. A few examples follow:

- When the input color format is YUY2 and the output color format is NV12, the SDK enables color conversion from YUY2 to NV12.



- When the input is interleaved and the output is progressive, the SDK enables de-interlacing.
- When the input is a single field and the output is interlaced or progressive, the SDK enable field weaving, optionally with deinterlacing.

In addition to specifying the input and output formats, the application can provide hints to fine-tune the video processing pipeline operation. The application can disable filters in pipeline by using [mfxExtVPPDoNotUse](#) structure; enable them by using [mfxExtVPPDoUse](#) structure and configure them by using dedicated configuration structures. See Table 4 for complete list of configurable video processing filters, their IDs and configuration structures. See the [ExtendedBufferID](#) enumerator for more details.

The SDK ensures that all filters necessary to convert input format to output one are included in pipeline. However, the SDK can skip some optional filters even if they are explicitly requested by the application, for example, due to limitation of underlying hardware. To notify application about this skip, the SDK returns warning `MFX_WRN_FILTER_SKIPPED`. The application can retrieve list of active filters by attaching [mfxExtVPPDoUse](#) structure to [mfxVideoParam](#) structure and calling [MFXVideoVPP_GetVideoParam](#) function. The application must allocate enough memory for filter list.

Table 4 Configurable VPP filters

Filter ID	Configuration structure
MFX_EXTBUFF_VPP_DENOISE	mfxExtVPPDenoise
MFX_EXTBUFF_VPP_DETAIL	mfxExtVPPDetail
MFX_EXTBUFF_VPP_FRAME_RATE_CONVERSION	mfxExtVPPFrameRateConversion
MFX_EXTBUFF_VPP_IMAGE_STABILIZATION	mfxExtVPPImageStab
MFX_EXTBUFF_VPP_PICSTRUCT_DETECTION	none
MFX_EXTBUFF_VPP_PROCAMP	mfxExtVPPProcAmp
MFX_EXTBUFF_VPP_FIELD_PROCESSING	mfxExtVPPFieldProcessing

Example 4 shows how to configure the SDK video processing.

```

/* enable image stabilization filter with default settings */
mfxExtVPPDoUse du;
mfxU32 al=MFX_EXTBUFF_VPP_IMAGE_STABILIZATION;

du.Header.BufferId=MFX_EXTBUFF_VPP_DOUSE;
du.Header.BufferSz=sizeof(mfxExtVPPDoUse);
du.NumAlg=1;
du.AlgList=&al;

/* configure the mfxVideoParam structure */
mfxVideoParam conf;
mfxExtBuffer *eb=&du;

memset(&conf,0,sizeof(conf));
conf.IOPattern=MFX_IOPATTERN_IN_SYSTEM_MEMORY|
               MFX_IOPATTERN_OUT_SYSTEM_MEMORY;
conf.NumExtParam=1;
conf.ExtParam=&eb;

conf.vpp.In.FourCC=MFX_FOURCC_YV12;
conf.vpp.Out.FourCC=MFX_FOURCC_NV12;
conf.vpp.In.Width=conf.vpp.Out.Width=1920;
conf.vpp.In.Height=conf.vpp.Out.Height=1088;

/* video processing initialization */
MFXVideoVPP_Init(session, &conf);

```

Example 4: Configure Video Processing

Region of Interest

During video processing operations, the application can specify a region of interest for each frame, as illustrated in Figure 4.

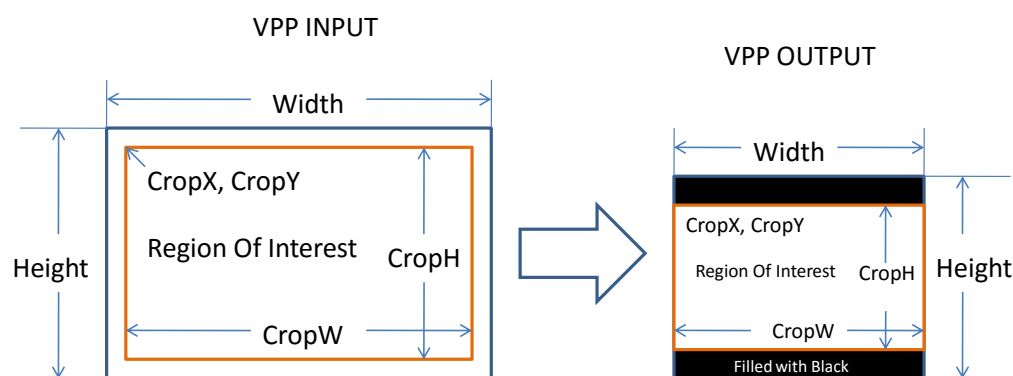


Figure 4: VPP Region of Interest Operation

Specifying a region of interest guides the resizing function to achieve special effects such as resizing from 16:9 to 4:3 while keeping the aspect ratio intact. Use the `CropX`, `CropY`, `CropW` and `CropH` parameters in the [mfxVideoParam](#) structure to specify a region of interest. Table 5 shows some examples.

Table 5: Examples of VPP Operations on Region of Interest

Operation	VPP Input		VPP Output	
	Width/Height	CropX, CropY, CropW, CropH	Width/Height	CropX, CropY, CropW, CropH
Cropping	720x480	16,16,688,448	720x480	16,16,688,448
Resizing	720x480	0,0,720,480	1440x960	0,0,1440,960
Horizontal stretching	720x480	0,0,720,480	640x480	0,0,640,480
16:9 → 4:3 with letter boxing at the top and bottom	1920x1088	0,0,1920,1088	720x480	0,36,720,408
4:3 → 16:9 with pillar boxing at the left and right	720x480	0,0,720,480	1920x1088	144,0,1632,1088

Transcoding Procedures

The application can use the SDK encoding, decoding and video processing functions together for transcoding operations. This section describes the key aspects of connecting two or more SDK functions together.

Asynchronous Pipeline

The application passes the output of an upstream SDK function to the input of the downstream SDK function to construct an asynchronous pipeline. Such pipeline construction is done at runtime and can be dynamically changed, as illustrated in Example 5.

```
mfxSyncPoint sp;
MFXVideoDECODE_DecodeFrameAsync(session, bs, work, vin, &sp_d);
if (going_through_vpp) {
    MFXVideoVPP_RunFrameVPPAsync(session, vin, vout, &sp_d);
    MFXVideoENCODE_EncodeFrameAsync(session, NULL, vout, bits2, &sp_e);
} else {
    MFXVideoENCODE_EncodeFrameAsync(session, NULL, vin, bits2, &sp_e);
}
MFXVideoCORE_SyncOperation(session, sp_e, INFINITE);
```

Example 5: Pseudo Code of Asynchronous Pipeline Construction

The SDK simplifies the requirement for asynchronous pipeline synchronization. The application only needs to synchronize after the last SDK function. Explicit synchronization of intermediate results is not required and in fact can slow performance.

The SDK tracks the dynamic pipeline construction and verifies dependency on input and output parameters to ensure the execution order of the pipeline function. In Example 5, the SDK will ensure [MFXVideoENCODE_EncodeFrameAsync](#) does not begin its operation until [MFXVideoDECODE_DecodeFrameAsync](#) or [MFXVideoVPP_RunFrameVPPAsync](#) has finished.

During the execution of an asynchronous pipeline, the application must consider the input data in use and must not change it until the execution has completed. The application must also consider output data unavailable until the execution has finished. In addition, for encoders, the application must consider extended and payload buffers in use while the input surface is locked.

The SDK checks dependencies by comparing the input and output parameters of each SDK function in the pipeline. Do not modify the contents of input and output parameters before the previous asynchronous operation finishes. Doing so will break the dependency check and can result in undefined behavior. An exception occurs when the input and output parameters are structures, in which case overwriting fields in the structures is allowed. (Note that the dependency check works on the pointers to the structures only.)

There are two exceptions with respect to intermediate synchronization:

1. The application must synchronize any input before calling the SDK function [MFXVideoDecode_DecodeFrameAsync](#), if the input is from any asynchronous operation.
2. When the application calls an asynchronous function to generate an output surface in video memory and passes that surface to a non-SDK component, it must explicitly synchronize the operation before passing the surface to the non-SDK component.

Surface Pool Allocation

When connecting SDK function **A** to SDK function **B**, the application must take into account the needs of both functions to calculate the number of frame surfaces in the surface pool. Typically,



the application can use the formula $N_a + N_b$, where N_a is the frame surface needs from SDK function **A** output, and N_b is the frame surface needs from SDK function **B** input.

For performance considerations, the application must submit multiple operations and delays synchronization as much as possible, which gives the SDK flexibility to organize internal pipelining. For example, the operation sequence, `ENCODE(f1) → ENCODE(f2) → SYNC(f1) → SYNC(f2)` is recommended, compared with `ENCODE(f1) → SYNC(f1) → ENCODE(f2) → SYNC(f2)`.

In this case, the surface pool needs additional surfaces to take into account multiple asynchronous operations before synchronization. The application can use the `AsyncDepth` parameter of the [mfxVideoParam](#) structure to inform an SDK function that how many asynchronous operations the application plans to perform before synchronization. The corresponding SDK `QueryIOSurf` function will reflect such consideration in the `NumFrameSuggested` value. Example 6 shows a way of calculating the surface needs based on `NumFrameSuggested` values.

```
async_depth=4;
init_param_v.AsyncDepth=async_depth;
MFXVideoVPP_QueryIOSurf(session, &init_param_v, response_v);
init_param_e.AsyncDepth=async_depth;
MFXVideoENCODE_QueryIOSurf(session, &init_param_e, &response_e);
num_surfaces=      response_v[1].NumFrameSuggested
                  +response_e.NumFrameSuggested
                  -async_depth; /* double counted in ENCODE & VPP */
```

Example 6: Calculate Surface Pool Size

Pipeline Error Reporting

During asynchronous pipeline construction, each stage SDK function will return a synchronization point (sync point). These synchronization points are useful in tracking errors during the asynchronous pipeline operation.

Assume the pipeline is **A**→**B**→**C**. The application synchronizes on sync point **C**. If the error occurs in SDK function **C**, then the synchronization returns the exact error code. If the error occurs before SDK function **C**, then the synchronization returns [MFX_ERR_ABORTED](#). The application can then try to synchronize on sync point **B**. Similarly, if the error occurs in SDK function **B**, the synchronization returns the exact error code, or else [MFX_ERR_ABORTED](#). Same logic applies if the error occurs in SDK function **A**.

Working with hardware acceleration

To fully utilize the SDK acceleration capability, the application should support OS specific infrastructures, Microsoft* DirectX* for Micorosoft* Windows* and VA API for Linux*. The exception is transcoding scenario where opaque memory type may be used. See [Surface Type Neutral Transcoding](#) for more details.

The hardware acceleration support in application consists of video memory support and acceleration device support.

Depending on usage model, the application can use video memory on different stages of pipeline. Three major scenarios are illustrated on Figure 5.

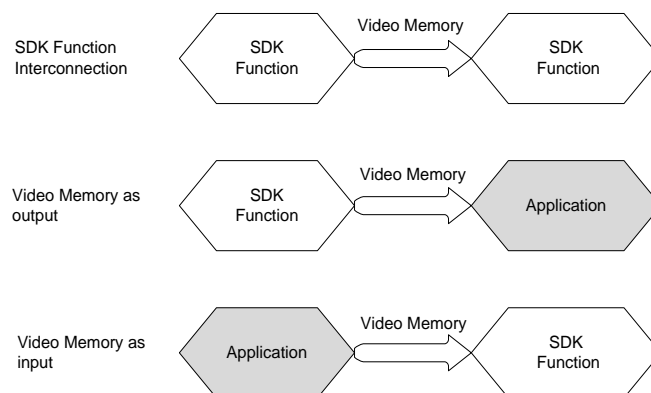


Figure 5 Usage of video memory for hardware acceleration

The application must use the `IOPattern` field of the `mfxVideoParam` structure to indicate the I/O access pattern during initialization. Subsequent SDK function calls must follow this access pattern. For example, if an SDK function operates on video memory surfaces at both input and output, the application must specify the access pattern `IOPattern` at initialization in `MFX_IOPATTERN_IN_VIDEO_MEMORY` for input and `MFX_IOPATTERN_OUT_VIDEO_MEMORY` for output. This particular I/O access pattern must not change inside the `Init ... Close` sequence.

Initialization of any hardware accelerated SDK component requires the acceleration device handle. This handle is also used by SDK component to query HW capabilities. The application can share its device with the SDK by passing device handle through the `MFXVideoCORE_SetHandle` function. It is recommended to share the handle before any actual usage of the SDK.



Working with Microsoft* DirectX* Applications

The SDK supports two different infrastructures for hardware acceleration on Microsoft* Windows* OS, "Direct3D 9 DXVA2" and "Direct3D 11 Video API". In the first one the application should use the **IDirect3DDeviceManager9** interface as the acceleration device handle, in the second one - **ID3D11Device** interface. The application should share one of these interfaces with the SDK through the **MFVideoCORE_SetHandle** function. If the application does not provide it, then the SDK creates its own internal acceleration device. This internal device could not be accessed by the application and as a result, the SDK input and output will be limited to system memory only. That in turn will reduce SDK performance. If the SDK fails to create a valid acceleration device, then SDK cannot proceed with hardware acceleration and returns an error status to the application.

The application must create the Direct3D9* device with the flag **D3DCREATE_MULTITHREADED**. Additionally the flag **D3DCREATE_FPU_PRESERVE** is recommended. This influences floating-point calculations, including PTS values.

The application must also set multithreading mode for Direct3D11* device. Example 7 Setting multithreading mode illustrates how to do it.

```
ID3D11Device          *pD11Device;
ID3D11DeviceContext   *pD11Context;
ID3D10Multithread     *pD10Multithread;

pD11Device->GetImmediateContext(&pD11Context);
pD11Context->QueryInterface(IID_ID3D10Multithread, &pD10Multithread);
pD10Multithread->SetMultithreadProtected(true);
```

Example 7 Setting multithreading mode

During hardware acceleration, if a Direct3D* "device lost" event occurs, the SDK operation terminates with the return status **MF_ERR_DEVICE_LOST**. If the application provided the Direct3D* device handle, the application must reset the Direct3D* device.

When the SDK decoder creates auxiliary devices for hardware acceleration, it must allocate the list of Direct3D* surfaces for I/O access, also known as the surface chain, and pass the surface chain as part of the device creation command. In most cases, the surface chain is the frame surface pool mentioned in the Frame Surface Locking section.

The application passes the surface chain to the SDK component **Init** function through an SDK external allocator callback. See the [Memory Allocation and External Allocators](#) section for details.

Only decoder **Init** function requests external surface chain from the application and uses it for auxiliary device creation. Encoder and VPP **Init** functions may only request internal surfaces. See the **ExtMemFrameType** enumerator for more details about different memory types.

Depending on configuration parameters, SDK requires different surface types. It is strongly recommended to call one of the **MFVideoENCODE_QueryIOSurf**, **MFVideoDECODE_QueryIOSurf** or **MFVideoVPP_QueryIOSurf** functions to determine the appropriate type.

Table 6: Supported SDK Surface Types and Color Formats for Direct3D9 shows supported Direct3D9 surface types and color formats. Table 7: Supported SDK Surface Types and Color Formats for Direct3D11 shows Direct3D11 types and formats. Note, that NV12 is the major



encoding and decoding color format. Additionally, JPEG/MJPEG decoder supports RGB32 and YUY2 output, JPEG/MJPEG encoder supports RGB32 and YUY2 input for Direct3D9/Direct3D11 and YV12 input for Direct3D9 only, and VPP supports RGB32 output.

Table 6: Supported SDK Surface Types and Color Formats for Direct3D9

SDK Class	SDK Function Input		SDK Function Output	
	Surface Type	Color Format	Surface Type	Color Format
DECODE	Not Applicable		Decoder Render Target	NV12
			Decoder Render Target	RGB32, YUY2 JPEG only
VPP	Decoder/Processor Render Target	Listed in ColorFourCC	Decoder Render Target	NV12
			Processor Render Target	RGB32
ENCODE	Decoder Render Target	NV12	Not Applicable	
	Decoder Render Target	RGB32, YUY2, YV12 JPEG only		

Note: "Decoder Render Target" corresponds to DXVA2_VideoDecoderRenderTarget type, "Processor Render Target" to DXVA2_VideoProcessorRenderTarget.

Table 7: Supported SDK Surface Types and Color Formats for Direct3D11

SDK Class	SDK Function Input		SDK Function Output	
	Surface Type	Color Format	Surface Type	Color Format
DECODE	Not Applicable		Decoder Render Target	NV12
			Decoder /Processor Render Target	RGB32, YUY2 JPEG only
VPP	Decoder/Processor Render Target	Listed in ColorFourCC	Processor Render Target	NV12
			Processor Render Target	RGB32

ENCODE	Decoder/Processor Render Target	NV12	Not Applicable
	Decoder /Processor Render Target	RGB32, YUY2 JPEG only	

Note: "Decoder Render Target" corresponds to D3D11_BIND_DECODER flag, "Processor Render Target" to D3D11_BIND_RENDER_TARGET.

Working with VA API Applications

The SDK supports single infrastructure for hardware acceleration on Linux* - "VA API". The application should use the **VADisplay** interface as the acceleration device handle for this infrastructure and share it with the SDK through the **MFVideoCORE_SetHandle** function. Because the SDK does not create internal acceleration device on Linux, the application must always share it with the SDK. This sharing should be done before any actual usage of the SDK, including capability query and component initialization. If the application fails to share the device, the SDK operation will fail.

Example 8 Obtaining VA display from X Window System and Example 9 Obtaining VA display from Direct Rendering Manager show how to obtain and share VA display with the SDK.

```
Display *x11_display;
VADisplay va_display;

x11_display = XOpenDisplay(current_display);
va_display = vaGetDisplay(x11_display);

MFVideoCORE_SetHandle(session, MF_HANDLE_VA_DISPLAY,
                        (mfxHDL) va_display);
```

Example 8 Obtaining VA display from X Window System

```
int card;
VADisplay va_display;

card = open("/dev/dri/card0", O_RDWR); /* primary card */
va_display = vaGetDisplayDRM(card);
vaInitialize(va_display, &major_version, &minor_version);

MFVideoCORE_SetHandle(session, MF_HANDLE_VA_DISPLAY,
                        (mfxHDL) va_display);
```

Example 9 Obtaining VA display from Direct Rendering Manager

When the SDK decoder creates hardware acceleration device, it must allocate the list of video memory surfaces for I/O access, also known as the surface chain, and pass the surface chain as



part of the device creation command. The application passes the surface chain to the SDK component Init function through an SDK external allocator callback. See the [Memory Allocation and External Allocators](#) section for details.

Only decoder Init function requests external surface chain from the application and uses it for device creation. Encoder and VPP Init functions may only request internal surfaces. See the [ExtMemFrameType](#) enumerator for more details about different memory types.

The VA API does not define any surface types and the application can use either `MFx_MEMTYPE_VIDEO_MEMORY_DECODER_TARGET` or `MFx_MEMTYPE_VIDEO_MEMORY_PROCESSOR_TARGET` to indicate data in video memory.

Table 8: Supported SDK Surface Types and Color Formats for VA API shows supported by VA API color formats.

Table 8: Supported SDK Surface Types and Color Formats for VA API

SDK Class	SDK Function Input	SDK Function Output
	Color Format	Color Format
DECODE	Not Applicable	NV12
		RGB32, YUY2 JPEG only
VPP	Listed in _ColorFourCC	NV12, RGB32
ENCODE	NV12	Not Applicable
	RGB32, YUY2, YV12 JPEG only	

Memory Allocation and External Allocators

All SDK implementations delegate memory management to the application. The application must allocate sufficient memory for input and output parameters and buffers, and de-allocate it when SDK functions complete their operations. During execution, the SDK functions use callback functions to the application to manage memory for video frames through external allocator interface [mfxFrameAllocator](#).

[mfxBufferAllocator](#) interface is deprecated.



If an application needs to control the allocation of video frames, it can use callback functions through the [mfxFrameAllocator](#) interface. If an application does not specify an allocator, an internal allocator is used. However, if an application uses video memory surfaces for input and output, it must specify the hardware acceleration device and an external frame allocator using [mfxFrameAllocator](#).

The external frame allocator can allocate different frame types:

- in system memory and
- in video memory, as “decoder render targets” or “processor render targets.” See the section Working with hardware acceleration for additional details.

The external frame allocator responds only to frame allocation requests for the requested memory type and returns [MFX_ERR_UNSUPPORTED](#) for all others. The allocation request uses flags, part of memory type field, to indicate which SDK class initiates the request, so the external frame allocator can respond accordingly. Example 10 illustrates a simple external frame allocator.

```
typedef struct {
    mfxU16 width, height;
    mfxU8 *base;
} mid_struct;

mfxStatus fa_alloc(mfxHDL pthis, mfxFrameAllocRequest *request,
mfxFrameAllocResponse *response) {
    if (!(request->type&MFX_MEMTYPE_SYSTEM_MEMORY))
        return MFX_ERR_UNSUPPORTED;
    if (request->Info->FourCC!=MFX_FOURCC_NV12)
        return MFX_ERR_UNSUPPORTED;
    response->NumFrameActual=request->NumFrameMin;
    for (int i=0;i<request->NumFrameMin;i++) {
        mid_struct *mmid=(mid_struct *)malloc(sizeof(mid_struct));
        mmid->width=ALIGN32(request->Info->Width);
        mmid->height=ALIGN32(request->Info->Height);
        mmid->base=(mfxU8*)malloc(mmid->width*mmid->height*3/2);
        response->mids[i]=mmid;
    }
    return MFX_ERR_NONE;
}

mfxStatus fa_lock(mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr) {
    mid_struct *mmid=(mid_struct *)mid;
    ptr->pitch=mmid->width;
    ptr->Y=mmid->base;
    ptr->U=ptr->Y+mmid->width*mmid->height;
    ptr->V=ptr->U+1;
    return MFX_ERR_NONE;
}

mfxStatus fa_unlock(mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr) {
    if (ptr) ptr->Y=ptr->U=ptr->V=ptr->A=0;
    return MFX_ERR_NONE;
}

mfxStatus fa_gethdl(mfxHDL pthis, mfxMemId mid, mfxHDL *handle) {
    return MFX_ERR_UNSUPPORTED;
}

mfxStatus fa_free(mfxHDL pthis, mfxFrameAllocResponse *response) {
    for (int i=0;i<response->NumFrameActual;i++) {
        mid_struct *mmid=(mid_struct *)response->mids[i];
        free(mmid->base); free(mmid);
    }
    return MFX_ERR_NONE;
}
```

Example 10: Example Frame Allocator

For system memory, it is highly recommended to allocate memory for all planes of the same frame as a single buffer (using one single `malloc` call).

Surface Type Neutral Transcoding

Performance wise, software SDK library (running CPU instructions) prefers system memory I/O, and SDK platform implementation (accelerated by platform graphic devices) prefers video memory surface I/O. The application needs to manage both surface types (thus two data paths in a transcoding **A**→**B**) to achieve the best performance in both cases.

The SDK provides a third surface type: opaque surface. With opaque surface, the SDK will map the surface type to either system memory buffer or video memory surface at runtime. The application only needs to manage one surface type, or one transcoding data path.

It is recommended the application use opaque surfaces for any transcoding intermediate data. For example, the transcoding pipeline can be **DECODE** → Opaque Surfaces → **VPP** → Opaque Surfaces → **ENCODE**. It is possible to copy an opaque surface to a “real” surface through a **VPP** operation.

The application uses the following procedure to use opaque surface, assuming a transcoding pipeline SDK A → SDK B:

- As described in section *Surface Pool Allocation*, the application queries SDK component **A** and **B** and calculates the surface pool size. The application needs to use [MFX_IOPATTERN_IN_OPAQUE_MEMORY](#) and/or [MFX_IOPATTERN_OUT_OPAQUE_MEMORY](#) while specifying the I/O pattern. It is possible that SDK component A returns a different memory type than SDK component B, as the `QueryIOSurf` function returns the native allocation type and size. In this case, the surface pool type and size should follow only one SDK component: either A or B.
- The application allocates the surface pool, which is an array of the [mfxFrameSurface1](#) structures. Within the structure, specify `Data.Y= Data.U= Data.V= Data.A= Data.MemId=0` for all array members.
- During initialization, the application communicates the allocated surface pool to both SDK components by attaching the [mfxExtOpaqueSurfaceAlloc](#) structure as part of the initialization parameters. The application needs to use [MFX_IOPATTERN_IN_OPAQUE_MEMORY](#) and/or [MFX_IOPATTERN_OUT_OPAQUE_MEMORY](#) while specifying the I/O pattern.
- During decoding, encoding, and video processing, the application manages the surface pool and passes individual frame surface to SDK component **A** and **B** as described in section *Decoding Procedures*, section *Encoding Procedures*, and section *Video Processing Procedures*, respectively.

Example 11 shows the opaque procedure sample code.

Since the SDK manages the association of opaque surface to “real” surface types internally, the application cannot read the content of opaque surfaces. Also the application does not get any opaque-type surface allocation requests if the application specifies an external frame allocator.



If the application shares opaque surfaces among different SDK sessions, the application must join the sessions before SDK component initialization and ensure that all joined sessions have the same hardware acceleration device handle. Setting device handle is optional only if all components in pipeline belong to the same session. The application should not disjoin the session which share opaque memory until the SDK components are not closed.

```

mfxExtOpqueSurfaceAlloc osa, *posa=&osa;
memset(&osa,0,sizeof(osa));

// query frame surface allocation needs
MFXVideoDECODE_QueryIOSurf(session, &decode_param, &request_decode);
MFXVideoENCODE_QueryIOSurf(session, &encode_param, &request_encode);

// calculate the surface pool surface type and numbers
if (MFX_MEMTYPE_BASE(request_decode.Type) ==
    MFX_MEMTYPE_BASE(request_encode.Type)) {
    osa.Out.NumSurface = request_decode.NumFrameSuggested +
        request_encode.NumFrameSuggested - decode_param.AsyncDepth;
    osa.Out.Type=request_decode.Type;
} else {
    // it is also ok to use decode's NumFrameSuggested and Type.
    osa.Out.NumSurface=request_encode.NumFrameSuggested;
    osa.Out.Type=request_encode.Type;
}

// allocate surface pool and zero MemId/Y/U/V/A pointers
osa.Out.Surfaces=alloc_mfxFrameSurface1(osa.Out.NumSurface);

// attach the surface pool during decode & encode initialization
osa.Header.BufferId=MFX_EXTBUFF_OPAQUE_SURFACE_ALLOCATION;
osa.Header.BufferSz=sizeof(osa);
decode_param.NumExtParam=1;
decode_param.ExtParam=&posa;
MFXVideoDECODE_Init(session, &decode_param);

memcpy(&osa.In, &osa.Out, sizeof(osa.Out));
encode_param.NumExtParam=1;
encode_param.ExtParam=&posa;
MFXVideoENCODE_Init(session, &encode_param);

```

Example 11: Pseudo-Code of Opaque Surface Procedure



Hardware Device Error Handling

The SDK accelerates decoding, encoding and video processing through a hardware device. The SDK functions may return the following errors or warnings if the hardware device encounters errors:

<code>MFx_ERR_DEVICE_FAILED</code>	Hardware device returned unexpected errors. SDK was unable to restore operation.
<code>MFx_ERR_DEVICE_LOST</code>	Hardware device was lost due to system lock or shutdown.
<code>MFx_WRN_PARTIAL_ACCELERATION</code>	The hardware does not fully support the specified configuration. The encoding, decoding, or video processing operation may be partially accelerated.
<code>MFx_WRN_DEVICE_BUSY</code>	Hardware device is currently busy.

SDK functions `Query`, `QueryIOSurf`, and `Init` return [`MFx_WRN_PARTIAL_ACCELERATION`](#) to indicate that the encoding, decoding or video processing operation can be partially hardware accelerated or not hardware accelerated at all. The application can ignore this warning and proceed with the operation. (Note that SDK functions may return errors or other warnings overwriting [`MFx_WRN_PARTIAL_ACCELERATION`](#), as it is a lower priority warning.)

SDK functions return [`MFx_WRN_DEVICE_BUSY`](#) to indicate that the hardware device is busy and unable to take commands at this time. Resume the operation by waiting for a few milliseconds and resubmitting the request. Example 12 shows the decoding pseudo-code. The same procedure applies to encoding and video processing.

SDK functions return [`MFx_ERR_DEVICE_LOST`](#) or [`MFx_ERR_DEVICE_FAILED`](#) to indicate that there is a complete failure in hardware acceleration. The application must close and reinitialize the SDK function class. If the application has provided a hardware acceleration device handle to the SDK, the application must reset the device.

```
mfxStatus sts=MFx_ERR_NONE;
for (;;) {
    ...
    sts=MFxVideoDECODE_DecodeFrameAsync(session, bitstream,
    surface_work, &surface_disp, &syncp);
    if (sts == MFx_WRN_DEVICE_BUSY) Sleep(5);
}
```

Example 12: Pseudo-Code to Handle `MFx_ERR_DEVICE_BUSY`



Function Reference

This section describes SDK functions and their operations.

In each function description, only commonly used status codes are documented. The function may return additional status codes, such as [MFX_ERR_INVALID_HANDLE](#) or [MFX_ERR_NULL_PTR](#), in certain case. See the [mfxStatus](#) enumerator for a list of all status codes.

Global Functions

Global functions initialize and de-initialize the SDK library and perform query functions on a global scale within an application.

Member Functions	Description
MFXInit	Initializes an SDK session
MFXQueryIMPL	Queries the implementation type
MFXQueryVersion	Queries the implementation version
MFXJoinSession	Join two sessions together
MFXCloneSession	Clone the current session
MFXSetPriority	Set session priority
MFXGetPriority	Obtain session priority
MFXDisjoinSession	Remove the join state of the current session
MFXClose	De-initializes an SDK session

MFXCloneSession

Syntax

```
mfxStatus MFXCloneSession(mfxSession session, mfxSession *clone);
```

Parameters

<code>session</code>	SDK session handle
----------------------	--------------------



`clone` Pointer to the cloned session handle

Description

This function creates a clean copy of the current session. The cloned session is an independent session. It does not inherit any user-defined buffer, frame allocator, or device manager handles from the current session. This function is a light-weight equivalent of [MFXJoinSession](#) after [MFXInit](#).

Return Status

`MFX_ERR_NONE` The function completed successfully.

Change History

This function is available since SDK API 1.1.

MFXClose

Syntax

```
mfxStatus MFXClose(mfxSession session);
```

Parameters

`session` SDK session handle

Description

This function completes and de-initializes an SDK session. Any active tasks in execution or in queue are aborted. The application cannot call any SDK function after this function.

All child sessions must be disjoined before closing a parent session.

Return Status

`MFX_ERR_NONE` The function completed successfully.

Change History

This function is available since SDK API 1.0.

MFXDoWork

Syntax



[mfxStatus](#) MFXDoWork(mfxSession session);

Parameters

session	SDK session handle
---------	--------------------

Description

This function complements `MFXInitEx` with external threading mode on. Application expected to create no less than two work threads per session and pass them to SDK via this function. This function won't return control to application unless session is closed.

In case of joined sessions, application should call `MFXDoWork` only for parent session.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.14.

MFXDisjoinSession

Syntax

[mfxStatus](#) MFXDisjoinSession(mfxSession session);

Parameters

session	SDK session handle
---------	--------------------

Description

This function removes the joined state of the current session. After disjoining, the current session becomes independent. The application must ensure there is no active task running in the session before calling this function.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_IN_EXECUTION</code>	Active tasks are in execution or in queue. Wait for the completion of the tasks and then call this function again.
<code>MFX_ERR_UNDEFINED_BEHAVIOR</code>	The session is independent, or this session is the parent of all joined sessions.



Change History

This function is available since SDK API 1.1.

MFXGetPriority

Syntax

```
mfxStatus MFXGetPriority(mfxSession session, mfxPriority *priority);
```

Parameters

session	SDK session handle
priority	Pointer to the priority value

Description

This function returns the current session priority.

Return Status

MFX_ERR_NONE	The function completed successfully.
--------------	--------------------------------------

Change History

This function is available since SDK API 1.1.

MFXInit

Syntax

```
mfxStatus MFXInit(mfxIMPL impl, mfxVersion *ver, mfxSession *session);
```

Parameters

impl	mfxIMPL enumerator that indicates the desired SDK implementation
ver	Pointer to the minimum library version or zero, if not specified
session	Pointer to the SDK session handle

Description



This function creates and initializes an SDK session. Call this function before calling any other SDK functions. If the desired implementation specified by `impl` is [MFX_IMPL_AUTO](#), the function will search for the platform-specific SDK implementation. If the function cannot find it, it will use the software implementation.

The argument `ver` indicates the desired version of the library implementation. The loaded SDK will have an API version compatible to the specified version (equal in the major version number, and no less in the minor version number.) If the desired version is not specified, the default is to use the API version from the SDK release, with which an application is built.

We recommend that production applications always specify the minimum API version that meets their functional requirements. For example, if an application uses only H.264 decoding as described in API v1.0, have the application initialize the library with API v1.0. This ensures backward compatibility.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully. The output parameter contains the handle of the session.
<code>MFX_ERR_UNSUPPORTED</code>	The function cannot find the desired SDK implementation or version.

Change History

This function is available since SDK API 1.0.

MFXInitEx

Syntax

```
mfxStatus MFXInitEx(mfxInitParam par, mfxSession *session);
```

Parameters

<code>par</code>	mfxInitParam structure that indicates the desired SDK implementation, minimum library version and desired threading mode
<code>session</code>	Pointer to the SDK session handle

Description

This function creates and initializes an SDK session. Call this function before calling any other SDK functions. If the desired implementation specified by `par`. Implementation is [MFX_IMPL_AUTO](#), the function will search for the platform-specific SDK implementation. If the function cannot find it, it will use the software



implementation.

The argument `par.Version` indicates the desired version of the library implementation. The loaded SDK will have an API version compatible to the specified version (equal in the major version number, and no less in the minor version number.) If the desired version is not specified, the default is to use the API version from the SDK release, with which an application is built.

We recommend that production applications always specify the minimum API version that meets their functional requirements. For example, if an application uses only H.264 decoding as described in API v1.0, have the application initialize the library with API v1.0. This ensures backward compatibility.

The argument `par.ExternalThreads` specifies threading mode. Value 0 means that SDK should internally create and handle work threads (this essentially equivalent of regular `MFxInit`). If this parameter set to 1 then SDK will expect that application should create work threads and pass them to SDK via single-entry function `MFxDoWork`. Setting `par.ExternalThreads` to 1 requires setting minimum API version to 1.14, as previous versions of SDK didn't have such functionality.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully. The output parameter contains the handle of the session.
<code>MFx_ERR_UNSUPPORTED</code>	The function cannot find the desired SDK implementation or version.

Change History

This function is available since SDK API 1.14.

MFxJoinSession

Syntax

```
mfxStatus MFxJoinSession(mfxSession session, mfxSession child);
```

Parameters

<code>session</code>	The current session handle
<code>child</code>	The child session handle to be joined

Description

This function joins the child session to the current session.

After joining, the two sessions share thread and resource scheduling for asynchronous operations. However, each session still maintains its own device manager and buffer/frame allocator. Therefore, the application must use a compatible device manager and buffer/frame allocator to share data between two joined sessions.



The application can join multiple sessions by calling this function multiple times. When joining the first two sessions, the current session becomes the parent responsible for thread and resource scheduling of any later joined sessions.

Joining of two parent sessions is not supported.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
<code>MFx_WRN_IN_EXECUTION</code>	Active tasks are executing or in queue in one of the sessions. Call this function again after all tasks are completed.
<code>MFx_ERR_UNSUPPORTED</code>	The child session cannot be joined with the current session.

Change History

This function is available since SDK API 1.1.

MFxQueryIMPL

Syntax

```
mfxStatus MFxQueryIMPL(mfxSession session, mfxIMPL *impl);
```

Parameters

<code>session</code>	SDK session handle
<code>impl</code>	Pointer to the implementation type

Description

This function returns the implementation type of a given session.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.0.



MFxQueryVersion

Syntax

```
mfxStatus MFxQueryVersion(mfxSession session, mfxVersion *version);
```

Parameters

<code>session</code>	SDK session handle
<code>version</code>	Pointer to the returned implementation version

Description

This function returns the SDK implementation version.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.0.

MFxSetPriority

Syntax

```
mfxStatus MFxSetPriority(mfxSession session, mfxPriority priority);
```

Parameters

<code>session</code>	SDK session handle
<code>priority</code>	Priority value

Description

This function sets the current session priority.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.1.

MFXVideoCORE

This class of functions consists of auxiliary functions that all functions of the SDK implementation can call.

Member Functions

<u>MFXVideoCORE SetHandle</u>	Sets system handles that the SDK implementation might need
<u>MFXVideoCORE GetHandle</u>	Obtains system handles previously set
<u>MFXVideoCORE SetBufferAllocator</u>	Sets the external system buffer allocator
<u>MFXVideoCORE SetFrameAllocator</u>	Sets the external frame allocator
<u>MFXVideoCORE SyncOperation</u>	Initializes execution of the specified sync point and returns a status code

MFXVideoCORE_SetHandle

Syntax

```
mfxStatus MFXVideoCORE_SetHandle(mfxSession session, mfxHandleType type, mfxHDL hdl);
```

Parameters

session	SDK session handle
type	Handle type
hdl	Handle to be set

Description

This function sets any essential system handle that SDK might use.

If the specified system handle is a COM interface, the reference counter of the COM interface will increase. The counter will decrease when the SDK session closes.

Return Status



MFx_ERR_NONE

The function completed successfully.

MFx_ERR_UNDEFINED_BEHAVIOR

The same handle is redefined. For example, the function has been called twice with the same handle type or internal handle has been created by the SDK before this function call.

Change History

This function is available since SDK API 1.0.

MFxVideoCORE_GetHandle

Syntax

```
mfxStatus MFxVideoCORE_GetHandle(mfxSession session, mfxHandleType type,  
mfxHDL *hdl);
```

Parameters

session	SDK session handle
type	Handle type
hdl	Pointer to the handle to be set

Description

This function obtains system handles previously set by the [MFxVideoCORE_SetHandle](#) function. If the handler is a COM interface, the reference counter of the interface increases. The calling application must release the COM interface.

Return Status

MFx_ERR_NONE

The function completed successfully.

MFx_ERR_NOT_FOUND

Specified handle type not found.

Change History

This function is available since SDK API 1.0.

MFxVideoCORE_SetBufferAllocator

Syntax



```
mfxStatus MFXVideoCORE_SetBufferAllocator(mfxSession session,  
mfxBufferAllocator *allocator);
```

Parameters

<code>session</code>	SDK session handle
<code>allocator</code>	Pointer to the mfxBufferAllocator structure

Description

This function is deprecated.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.0.
Deprecated since SDK API 1.17.

MFXVideoCORE_SetFrameAllocator

Syntax

```
mfxStatus MFXVideoCORE_SetFrameAllocator(mfxSession session,  
mfxFrameAllocator *allocator);
```

Parameters

<code>session</code>	SDK session handle
<code>allocator</code>	Pointer to the mfxFrameAllocator structure

Description

This function sets the external allocator callback structure for frame allocation. If the `allocator` argument is `NULL`, the SDK uses the default allocator, which allocates frames from system memory or hardware devices.

The behavior of the SDK is undefined if it uses this function while the previous allocator is in use. A general guideline is to set the allocator immediately after initializing the session.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------



Change History

This function is available since SDK API 1.0.

MFXVideoCORE_QueryPlatform

Syntax

```
mfxStatus MFXVideoCORE_QueryPlatform(mfxSession session, mfxPlatform *platform);
```

Parameters

session	SDK session handle
platform	Pointer to the mfxPlatform structure

Description

This function returns information about current hardware platform.

Return Status

MFX_ERR_NONE	The function completed successfully.
--------------	--------------------------------------

Change History

This function is available since SDK API 1.19.

MFXVideoCORE_SyncOperation

Syntax

```
mfxStatus MFXVideoCORE_SyncOperation(mfxSession session, mfxSyncPoint syncp, mfxU32 wait);
```

Parameters

session	SDK session handle
syncp	Sync point
wait	Wait time in milliseconds

Description

This function initiates execution of an asynchronous function not already started and returns the status code after the specified asynchronous operation completes. If `wait`



is zero, the function returns immediately.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_IN_EXECUTION</code>	The specified asynchronous function is in execution.
<code>MFX_ERR_ABORTED</code>	The specified asynchronous function aborted due to data dependency on a previous asynchronous function that did not complete.

Change History

This function is available since SDK API 1.0.

Remarks

See status codes for specific asynchronous functions.

MFXVideoENCODE

This class of functions performs the entire encoding pipeline from the input video frames to the output bitstream.

Member Functions

<u>MFXVideoENCODE_Query</u>	Queries the feature capability
<u>MFXVideoENCODE_QueryIOSurf</u>	Queries the number of input surface frames required for encoding
<u>MFXVideoENCODE_Init</u>	Initializes the encoding operation
<u>MFXVideoENCODE_Reset</u>	Resets the current encoding operation and prepares for the next encoding operation
<u>MFXVideoENCODE_Close</u>	Terminates the encoding operation and de-allocates any internal memory
<u>MFXVideoENCODE_GetVideoParam</u>	Obtains the current working parameter set
<u>MFXVideoENCODE_GetEncodeStat</u>	Obtains the statistics collected during encoding
<u>MFXVideoENCODE_EncodeFrameAsync</u>	Performs the encoding and returns the compressed bitstream

MFxVideoENCODE_Query

Syntax

```
mfxStatus MFxVideoENCODE_Query(mfxSession session, mfxVideoParam *in,
mfxVideoParam *out);
```

Parameters

session	SDK session handle
in	Pointer to the mfxVideoParam structure as input
out	Pointer to the mfxVideoParam structure as output

Description

This function works in either of four modes:

1. If the `in` pointer is zero, the function returns the class configurability in the output [mfxVideoParam](#) structure. A non-zero value in each field of the output structure indicates that the SDK implementation can configure the field with **Init**.
2. If the `in` parameter is non-zero, the function checks the validity of the fields in the input [mfxVideoParam](#) structure. Then the function returns the corrected values in the output [mfxVideoParam](#) structure. If there is insufficient information to determine the validity or correction is impossible, the function zeroes the fields. This feature can verify whether the SDK implementation supports certain profiles, levels or bitrates.
3. If the `in` parameter is non-zero and [mfxExtEncoderResetOption](#) structure is attached to it, then the function queries for the outcome of the [MFxVideoENCODE_Reset](#) function and returns it in the [mfxExtEncoderResetOption](#) structure attached to `out`. The query function succeeds if such reset is possible and returns error otherwise. Unlike other modes that are independent of the SDK encoder state, this one checks if reset is possible in the present SDK encoder state. This mode also requires completely defined [mfxVideoParam](#) structure, unlike other modes that support partially defined configurations. See [mfxExtEncoderResetOption](#) description for more details.
4. If the `in` parameter is non-zero and [mfxExtEncoderCapability](#) structure is attached to it, then the function returns encoder capability in [mfxExtEncoderCapability](#) structure attached to `out`. It is recommended to fill in [mfxVideoParam](#) structure and set hardware acceleration device handle before calling the function in this mode.

The application can call this function before or after it initializes the encoder. The `CodecId` field of the output [mfxVideoParam](#) structure is a mandated field (to be filled



by the application) to identify the coding standard.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_ERR_UNSUPPORTED</code>	The function failed to identify a specific implementation for the required features.
<code>MFX_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters; The encoding may be partially accelerated. Only SDK HW implementations may return this status code.
<code>MFX_WRN_INCOMPATIBLE_VIDEO_PARAMETERS</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFXVideoENCODE_QueryIOSurf

Syntax

```
mfxStatus MFXVideoENCODE_QueryIOSurf(mfxSession session, mfxVideoParam *par, mfxFrameAllocRequest *request);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure as input
<code>request</code>	Pointer to the mfxFrameAllocRequest structure as output

Description

This function returns minimum and suggested numbers of the input frame surfaces required for encoding initialization and their type. **Init** will call the external allocator for the required frames with the same set of numbers.

The use of this function is recommended. For more information, see the section Working with hardware acceleration.

This function does not validate I/O parameters except those used in calculating the number of input surfaces.



Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters. The encoding may be partially accelerated. Only SDK HW implementations may return this status code.
<code>MFX_ERR_INVALID_VIDEO_PARAM</code>	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.
<code>MFX_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFxVideoENCODE_Init

Syntax

```
mfxStatus MFxVideoENCODE_Init(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function allocates memory and prepares tables and necessary structures for encoding. This function also does extensive validation to ensure if the configuration, as specified in the input parameters, is supported.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters. The encoding may be partially accelerated. Only SDK HW implementations may return this status code.



<code>MXF_ERR_INVALID_VIDEO_PARAM</code>	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.
<code>MXF_ERR_UNDEFINED_BEHAVIOR</code>	The function is called twice without a close;

Change History

This function is available since SDK API 1.0.

MXFVideoENCODE_Reset

Syntax

```
mfxStatus MXFVideoENCODE_Reset(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function stops the current encoding operation and restores internal structures or parameters for a new encoding operation, possibly with new parameters.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
<code>MXF_ERR_INVALID_VIDEO_PARAM</code>	The function detected that video parameters are wrong or they conflict with initialization parameters. Reset is impossible.
<code>MXF_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected that provided by the application video parameters are incompatible with initialization parameters. Reset requires additional memory allocation and cannot be executed. The application should close the SDK component and then reinitialize it.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters



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were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFXVideoENCODE_Close

Syntax

```
mfxStatus MFXVideoENCODE_Close(mfxSession session);
```

Parameters

<code>session</code>	SDK session handle
----------------------	--------------------

Description

This function terminates the current encoding operation and de-allocates any internal tables or structures.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.0.

MFXVideoENCODE_GetVideoParam

Syntax

```
mfxStatus MFXVideoENCODE_GetVideoParam(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the corresponding parameter structure

Description

This function retrieves current working parameters to the specified output structure. If extended buffers are to be returned, the application must allocate those extended



buffers and attach them as part of the output structure.

The application can retrieve a copy of the bitstream header, by attaching the [mfxExtCodingOptionSPSPPS](#) structure to the [mfxVideoParam](#) structure.

Returned information

`MXF_ERR_NONE`

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MXFVideoENCODE_GetEncodeStat

Syntax

```
mfxStatus MXFVideoENCODE_GetEncodeStat(mfxSession session, mfxEncodeStat *stat);
```

Parameters

session

SDK session handle

stat

Pointer to the [mfxEncodeStat](#) structure

Description

This function obtains statistics collected during encoding.

Return Status

`MXF_ERR_NONE`

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MXFVideoENCODE_EncodeFrameAsync

Syntax

```
mfxStatus MXFVideoENCODE_EncodeFrameAsync(mfxSession session, mfxEncodeCtrl *ctrl, mfxFrameSurface1 *surface, mfxBitstream *bs, mfxSyncPoint *syncp);
```

Parameters



<code>Session</code>	SDK session handle
<code>ctrl</code>	Pointer to the mfxEncodeCtrl structure for per-frame encoding control; this parameter is optional—it can be <code>NULL</code> —if the encoder works in the display order mode.
<code>surface</code>	Pointer to the frame surface structure
<code>bs</code>	Pointer to the output bitstream
<code>syncp</code>	Pointer to the returned sync point associated with this operation

Description

This function takes a single input frame in either encoded or display order and generates its output bitstream. In the case of encoded ordering the [mfxEncodeCtrl](#) structure must specify the explicit frame type. In the case of display ordering, this function handles frame order shuffling according to the GOP structure parameters specified during initialization.

Since encoding may process frames differently from the input order, not every call of the function generates output and the function returns [MFX_ERR_MORE_DATA](#). If the encoder needs to cache the frame, the function locks the frame. The application should not alter the frame until the encoder unlocks the frame. If there is output (with return status [MFX_ERR_NONE](#)), the return is a frame worth of bitstream.

It is the calling application's responsibility to ensure that there is sufficient space in the output buffer. The value `BufferSizeInKB` in the [mfxVideoParam](#) structure at encoding initialization specifies the maximum possible size for any compressed frames. This value can also be obtained from [MFXVideoENCODE GetVideoParam](#) after encoding initialization.

To mark the end of the encoding sequence, call this function with a `NULL` surface pointer. Repeat the call to drain any remaining internally cached bitstreams—one frame at a time—until [MFX_ERR_MORE_DATA](#) is returned.

This function is asynchronous.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_ERR_NOT_ENOUGH_BUFFER</code>	The bitstream buffer size is insufficient.
<code>MFX_ERR_MORE_DATA</code>	The function requires more data to generate any output.
<code>MFX_ERR_DEVICE_LOST</code>	Hardware device was lost; See Working with Microsoft* DirectX* Applications section for



further information.

`MFX_WRN_DEVICE_BUSY`

Hardware device is currently busy. Call this function again in a few milliseconds.

`MFX_ERR_INCOMPATIBLE_VIDEO_PARAM`

Inconsistent parameters detected not conforming to Appendix A.

Change History

This function is available since SDK API 1.0.

Remarks

If the [EncodedOrder](#) field in the [mfxInfoMFX](#) structure is true, input frames enter the encoder in the order of their encoding. However, the [FrameOrder](#) field in the [mfxFrameData](#) structure of each frame must be set to the display order. If [EncodedOrder](#) is false, the function ignores the [FrameOrder](#) field.

MFVideoENC

This class of functions performs the first step of encoding process – motion estimation, intra prediction and mode decision. These functions are declared in `mfxenc.h` file.

Member Functions

<code>MFVideoENC_Query</code>	Queries the feature capability
<code>MFVideoENC_QueryIOSurf</code>	Queries the number of input surface frames required for encoding
<code>MFVideoENC_Init</code>	Initializes the encoding operation
<code>MFVideoENC_Reset</code>	Resets the current encoding operation and prepares for the next encoding operation
<code>MFVideoENC_Close</code>	Terminates the encoding operation and de-allocates any internal memory
<code>MFVideoENC_ProcessFrameAsync</code>	Performs the first step of encoding process and returns intermediate data.

MFXVideoENC_Query

Syntax

```
mfxStatus MFXVideoENC_Query(mfxSession session, mfxVideoParam *in,
mfxVideoParam *out);
```

Parameters

session	SDK session handle
in	Pointer to the mfxVideoParam structure as input
out	Pointer to the mfxVideoParam structure as output

Description

This function works in either of two modes:

1. If the `in` pointer is zero, the function returns the class configurability in the output [mfxVideoParam](#) structure. A non-zero value in each field of the output structure indicates that the SDK implementation can configure the field with **Init**.
2. If the `in` parameter is non-zero, the function checks the validity of the fields in the input [mfxVideoParam](#) structure. Then the function returns the corrected values in the output [mfxVideoParam](#) structure. If there is insufficient information to determine the validity or correction is impossible, the function zeroes the fields. This feature can verify whether the SDK implementation supports certain profiles, levels or bitrates.

The application can call this function before or after it initializes the ENC.

Return Status

MFX_ERR_NONE	The function completed successfully.
MFX_ERR_UNSUPPORTED	The function failed to identify a specific implementation for the required features.
MFX_WRN_INCOMPATIBLE_VIDEO_PARAM	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.10.



MFXVideoENC_QueryIOSurf

Syntax

```
mfxStatus MFXVideoENC_QueryIOSurf(mfxSession session, mfxVideoParam *par, mfxFrameAllocRequest *request);
```

Parameters

session	SDK session handle
par	Pointer to the mfxVideoParam structure as input
request	Pointer to the mfxFrameAllocRequest structure as output

Description

This function returns minimum and suggested numbers of the input frame surfaces required for ENC initialization and their type.

This function does not validate I/O parameters except those used in calculating the number of input surfaces.

Return Status

MFX_ERR_NONE	The function completed successfully.
MFX_ERR_INVALID_VIDEO_PARAM	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.
MFX_WRN_INCOMPATIBLE_VIDEO_PARAM	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.10.

MFXVideoENC_Init

Syntax

```
mfxStatus MFXVideoENC_Init(mfxSession session, mfxVideoParam *par);
```

Parameters



<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function performs ENC initialization.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
<code>MXF_ERR_INVALID_VIDEO_PARAM</code>	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.
<code>MXF_ERR_UNDEFINED_BEHAVIOR</code>	The function is called twice without a close;

Change History

This function is available since SDK API 1.10.

MFXVideoENC_Reset

Syntax

```
mfxStatus MFXVideoENC_Reset(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function stops the current encoding operation and restores internal structures or parameters for a new encoding operation, possibly with new parameters.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------



<code>MFx_ERR_INVALID_VIDEO_PARAM</code>	The function detected that video parameters are wrong or they conflict with initialization parameters. Reset is impossible.
<code>MFx_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected that provided by the application video parameters are incompatible with initialization parameters. Reset requires additional memory allocation and cannot be executed. The application should close the SDK component and then reinitialize it.
<code>MFx_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.10.

MFxVideoENC_Close

Syntax

```
mfxStatus MFxVideoENC_Close(mfxSession session);
```

Parameters

<code>session</code>	SDK session handle
----------------------	--------------------

Description

This function terminates the current encoding operation and de-allocates any internal tables or structures.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.10.

MFxVideoENC_GetVideoParam

Syntax



```
mfxStatus MFXVideoENC_GetVideoParam(mfxSession session, mfxVideoParam *par);
```

Parameters

session	SDK session handle
par	Pointer to the corresponding parameter structure

Description

This function retrieves current working parameters to the specified output structure. If extended buffers are to be returned, the application must allocate those extended buffers and attach them as part of the output structure.

Returned information

MFX_ERR_NONE	The function completed successfully.
--------------	--------------------------------------

Change History

This function is available since SDK API 1.19.

MFXVideoENC_ProcessFrameAsync

Syntax

```
mfxStatus MFXVideoENC_ProcessFrameAsync(mfxSession session, mfxENCInput *in, mfxENCOutput *out, mfxSyncPoint *syncp);
```

Parameters

Session	SDK session handle
in	Input parameters for ENC operation.
out	Output parameters of encoding operation.
syncp	Pointer to the returned sync point associated with this operation

Description

This function performs the first step of encoding process – motion estimation, intra prediction and mode decision. Its exact operation, input and output parameters depend on usage model.

This function is stateless, i.e. each function call is independent from other calls.

This function is asynchronous.



Return Status

`MXF_ERR_NONE`

The function completed successfully.

Change History

This function is available since SDK API 1.10.

MXFVideoDECODE

This class of functions implements a complete decoder that decompresses input bitstreams directly to output frame surfaces.

Member Functions

<u>MXFVideoDECODE Query</u>	Queries the feature capability
<u>MXFVideoDECODE QueryIOSurf</u>	Queries the number of frames required for decoding
<u>MXFVideoDECODE DecodeHeader</u>	Parses the bitstream to obtain the video parameters for initialization
<u>MXFVideoDECODE Init</u>	Initializes the decoding operation
<u>MXFVideoDECODE Reset</u>	Resets the current decoding operation and prepares for the next decoding operation
<u>MXFVideoDECODE Close</u>	Terminates the decoding operation and de-allocates any internal memory
<u>MXFVideoDECODE GetVideoParam</u>	Obtains the current working parameter set
<u>MXFVideoDECODE GetDecodeStat</u>	Obtains statistics during decoding
<u>MXFVideoDECODE GetPayload</u>	Obtains user data or SEI messages embedded in the bitstream
<u>MXFVideoDECODE SetSkipMode</u>	Set decoder skip mode
<u>MXFVideoDECODE DecodeFrameAsync</u>	Performs decoding from the input bitstream to the output frame surface

MFXVideoDECODE_DecodeHeader

Syntax

```
mfxStatus MFXVideoDECODE_DecodeHeader(mfxSession session, mfxBitstream *bs, mfxVideoParam *par);
```

Parameters

session	SDK session handle
bs	Pointer to the bitstream
par	Pointer to the mfxVideoParam structure

Description

This function parses the input bitstream and fills the [mfxVideoParam](#) structure with appropriate values, such as resolution and frame rate, for the **Init** function. The application can then pass the resulting [mfxVideoParam](#) structure to the [MFXVideoDECODE_Init](#) function for decoder initialization.

An application can call this function at any time before or after decoder initialization. If the SDK finds a sequence header in the bitstream, the function moves the bitstream pointer to the first bit of the sequence header. Otherwise, the function moves the bitstream pointer close to the end of the bitstream buffer but leaves enough data in the buffer to avoid possible loss of start code.

The `CodecId` field of the [mfxVideoParam](#) structure is a mandated field (to be filled by the application) to identify the coding standard.

The application can retrieve a copy of the bitstream header, by attaching the [mfxExtCodingOptionSPSPPS](#) structure to the [mfxVideoParam](#) structure.

Return Status

MFX_ERR_NONE	The function successfully filled mfxVideoParam structure. It does not mean that the stream can be decoded by SDK. The application should call MFXVideoDECODE_Query function to check if decoding of the stream is supported.
MFX_ERR_MORE_DATA	The function requires more bitstream data.

Change History

This function is available since SDK API 1.0.

MFxVideoDECODE_Query

Syntax

```
mfxStatus MFxVideoDECODE_Query(mfxSession session, mfxVideoParam *in,
mfxVideoParam *out);
```

Parameters

session	SDK session handle
in	Pointer to the mfxVideoParam structure as input
out	Pointer to the mfxVideoParam structure as output

Description

This function works in one of two modes:

1. If the `in` pointer is zero, the function returns the class configurability in the output [mfxVideoParam](#) structure. A non-zero value in each field of the output structure indicates that the field is configurable by the SDK implementation with the [MFxVideoDECODE_Init](#) function).
2. If the `in` parameter is non-zero, the function checks the validity of the fields in the input [mfxVideoParam](#) structure. Then the function returns the corrected values to the output [mfxVideoParam](#) structure. If there is insufficient information to determine the validity or correction is impossible, the function zeros the fields. This feature can verify whether the SDK implementation supports certain profiles, levels or bitrates.

The application can call this function before or after it initializes the decoder. The `CodecId` field of the output [mfxVideoParam](#) structure is a mandated field (to be filled by the application) to identify the coding standard.

Return Status

<code>MFx_ERR_NONE</code>	The function completed successfully.
<code>MFx_ERR_UNSUPPORTED</code>	The function failed to identify a specific implementation.
<code>MFx_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters; The decoding may be partially accelerated. Only SDK HW implementations may return this status code.
<code>MFx_WRN_INCOMPATIBLE_VIDEO_PARAMS</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.



Change History

This function is available since SDK API 1.0.

MFXVideoDECODE_QueryIOSurf

Syntax

```
mfxStatus MFXVideoDECODE_QueryIOSurf(mfxSession session, mfxVideoParam *par, mfxFrameAllocRequest *request);
```

Parameters

session	SDK session handle
par	Pointer to the mfxVideoParam structure as input
request	Pointer to the mfxFrameAllocRequest structure as output

Description

The function returns minimum and suggested numbers of the output frame surfaces required for decoding initialization and their type. **Init** will call the external allocator for the required frames with the same set of numbers.

The use of this function is recommended. For more information, see the section Working with hardware acceleration.

The `CodecId` field of the [mfxVideoParam](#) structure is a mandated field (to be filled by the application) to identify the coding standard.

This function does not validate I/O parameters except those used in calculating the number of output surfaces.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters; The decoding may be partially accelerated. Only SDK HW implementations may return this status code.
<code>MFX_ERR_INVALID_VIDEO_PARAM</code>	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.



<code>MFX_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.
---	--

Change History

This function is available since SDK API 1.0.

MFxVideoDECODE_Init

Syntax

```
mfxStatus MFxVideoDECODE_Init(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function allocates memory and prepares tables and necessary structures for decoding. This function also does extensive validation to determine whether the configuration is supported as specified in the input parameters.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully.
<code>MFX_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters; The decoding may be partially accelerated. Only SDK hardware implementations return this status code.
<code>MFX_ERR_INVALID_VIDEO_PARAM</code>	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of parameters resulted in an incompatibility error. Incompatibility was not resolved.
<code>MFX_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible; Incompatibility resolved.
<code>MFX_ERR_UNDEFINED_BEHAVIOR</code>	The function is called twice without a close.

Change History



This function is available since SDK API 1.0.

MFxVideoDECODE_Reset

Syntax

```
mfxStatus MFxVideoDECODE_Reset(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function stops the current decoding operation and restores internal structures or parameters for a new decoding operation.

Reset serves two purposes:

- It recovers the decoder from errors.
- It restarts decoding from a new position.

The function resets the old sequence header (sequence parameter set in H.264, or sequence header in MPEG-2 and VC-1). The decoder will expect a new sequence header before it decodes the next frame and will skip any bitstream before encountering the new sequence header.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
<code>MXF_ERR_INVALID_VIDEO_PARAM</code>	The function detected that video parameters are wrong or they conflict with initialization parameters. Reset is impossible.
<code>MXF_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected that provided by the application video parameters are incompatible with initialization parameters. Reset requires additional memory allocation and cannot be executed. The application should close the SDK component and then reinitialize it.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible; Incompatibility resolved.

Change History



This function is available since SDK API 1.0.

MFVideoDECODE_Close

Syntax

```
mfxStatus MFVideoDECODE_Close(mfxSession session);
```

Parameters

<code>session</code>	SDK session handle
----------------------	--------------------

Description

This function terminates the current decoding operation and de-allocates any internal tables or structures.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
---------------------------	--------------------------------------

Change History

This function is available since SDK API 1.0.

MFVideoDECODE_GetVideoParam

Syntax

```
mfxStatus MFVideoDECODE_GetVideoParam(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the corresponding parameter structure

Description

This function retrieves current working parameters to the specified output structure. If extended buffers are to be returned, the application must allocate those extended buffers and attach them as part of the output structure.

The application can retrieve a copy of the bitstream header, by attaching the [mfxExtCodingOptionSPSPPS](#) structure to the [mfxVideoParam](#) structure.



Return Status

MFx_ERR_NONE

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MFxVideoDECODE_GetDecodeStat

Syntax

```
mfxStatus MFxVideoDECODE_GetDecodeStat(mfxSession session, mfxDecodeStat *stat);
```

Parameters

session	SDK session handle
stat	Pointer to the mfxDecodeStat structure

Description

This function obtains statistics collected during decoding.

Return Status

MFx_ERR_NONE

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MFxVideoDECODE_GetPayload

Syntax

```
mfxStatus MFxVideoDECODE_GetPayload(mfxSession session, mfxU64 *ts, mfxPayload *payload);
```

Parameters

session	SDK session handle
ts	Pointer to the user data time stamp in units of 90 KHz; divide <i>ts</i> by 90,000 (90 KHz) to obtain the time in seconds; the time stamp



matches the payload with a specific decoded frame.

`payload` Pointer to the [mfxPayload](#) structure; the payload contains user data in MPEG-2 or SEI messages in H.264.

Description

This function extracts user data (MPEG-2) or SEI (H.264) messages from the bitstream. Internally, the decoder implementation stores encountered user data or SEI messages. The application may call this function multiple times to retrieve the user data or SEI messages, one at a time.

If there is no payload available, the function returns with `payload→NumBit=0`.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully and the output buffer is ready for decoding.
<code>MXF_ERR_NOT_ENOUGH_BUFFER</code>	The payload buffer size is insufficient.

Change History

This function is available since SDK API 1.0.

MXFVideoDECODE_SetSkipMode

Syntax

```
mfxStatus MXFVideoDECODE_SetSkipMode(mfxSession session, mfxSkipMode mode);
```

Parameters

<code>session</code>	SDK session handle
<code>mode</code>	Decoder skip mode. See the mfxSkipMode enumerator for details.

Description

This function sets the decoder skip mode. The application may use it to increase decoding performance by sacrificing output quality. The rising of skip level firstly results in skipping of some decoding operations like deblocking and then leads to frame skipping; firstly, B then P. Particular details are platform dependent.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully and the
---------------------------	---



output surface is ready for decoding.

`MFX_WRN_VALUE_NOT_CHANGED`

The skip mode is not affected as the maximum or minimum skip range is reached.

Change History

This function is available since SDK API 1.0.

MFXVideoDECODE_DecodeFrameAsync

Syntax

```
mfxStatus MFXVideoDECODE_DecodeFrameAsync(mfxSession session,
mfxBitstream *bs, mfxFrameSurface1 *surface_work, mfxFrameSurface1
**surface_out, mfxSyncPoint *syncp);
```

Parameters

Session	SDK session handle
Bs	Pointer to the input bitstream
surface_work	Pointer to the working frame buffer for the decoder
surface_out	Pointer to the output frame in the display order
Syncp	Pointer to the sync point associated with this operation

Description

This function decodes the input bitstream to a single output frame.

The `surface_work` parameter provides a working frame buffer for the decoder. The application should allocate the working frame buffer, which stores decoded frames. If the function requires caching frames after decoding, the function locks the frames and the application must provide a new frame buffer in the next call.

If, and only if, the function returns `MFX_ERR_NONE`, the pointer `surface_out` points to the output frame in the display order. If there are no further frames, the function will reset the pointer to zero and return the appropriate status code.

Before decoding the first frame, a sequence header—sequence parameter set in H.264 or sequence header in MPEG-2 and VC-1—must be present. The function skips any bitstreams before it encounters the new sequence header.

The input bitstream `bs` can be of any size. If there are not enough bits to decode a frame, the function returns `MFX_ERR_MORE_DATA`, and consumes all input bits except if a partial start code or sequence header is at the end of the buffer. In this case, the



function leaves the last few bytes in the bitstream buffer. If there is more incoming bitstream, the application should append the incoming bitstream to the bitstream buffer. Otherwise, the application should ignore the remaining bytes in the bitstream buffer and apply the end of stream procedure described below.

The application must set `bs` to `NULL` to signal end of stream. The application may need to call this function several times to drain any internally cached frames until the function returns [MFX_ERR_MORE_DATA](#).

If more than one frame is in the bitstream buffer, the function decodes until the buffer is consumed. The decoding process can be interrupted for events such as if the decoder needs additional working buffers, is readying a frame for retrieval, or encountering a new header. In these cases, the function returns appropriate status code and moves the bitstream pointer to the remaining data.

The decoder may return [MFX_ERR_NONE](#) without taking any data from the input bitstream buffer. If the application appends additional data to the bitstream buffer, it is possible that the bitstream buffer may contain more than 1 frame. It is recommended that the application invoke the function repeatedly until the function returns [MFX_ERR_MORE_DATA](#), before appending any more data to the bitstream buffer.

This function is asynchronous.

Return Status

<code>MFX_ERR_NONE</code>	The function completed successfully and the output surface is ready for decoding.
<code>MFX_ERR_MORE_DATA</code>	The function requires more bitstream at input before decoding can proceed.
<code>MFX_ERR_MORE_SURFACE</code>	The function requires more frame surface at output before decoding can proceed.
<code>MFX_ERR_DEVICE_LOST</code>	Hardware device was lost; See the Working with Microsoft* DirectX* Applications section for further information.
<code>MFX_WRN_DEVICE_BUSY</code>	Hardware device is currently busy. Call this function again in a few milliseconds.
<code>MFX_WRN_VIDEO_PARAM_CHANGED</code>	The decoder detected a new sequence header in the bitstream. Video parameters may have changed.
<code>MFX_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	The decoder detected incompatible video parameters in the bitstream and failed to follow them.
<code>MFX_ERR_REALLOC_SURFACE</code>	Bigger <code>surface_work</code> required. May be returned only if <code>mfxInfoMFX::EnableReallocRequest</code> was



set to ON during initialization.

Change History

This function is available since SDK API 1.0.

MFXVideoVPP

This class of functions performs video processing before encoding.

Member Functions

<u>MFXVideoVPP_Query</u>	Queries the feature capability
<u>MFXVideoVPP_QueryIOSurf</u>	Queries the number of input and output surface frames required for video processing
<u>MFXVideoVPP_Init</u>	Initializes the VPP operation
<u>MFXVideoVPP_Reset</u>	Resets the current video processing operation and prepares for the next operation
<u>MFXVideoVPP_Close</u>	Terminates the video processing operation and de-allocates internal memory
<u>MFXVideoVPP_GetVideoParam</u>	Obtains the current working parameter set
<u>MFXVideoVPP_GetVPPStat</u>	Obtains statistics collected during video processing
<u>MFXVideoVPP_RunFrameVPPAsync</u>	Performs video processing on the frame level

MFXVideoVPP_Query

Syntax

```
mfxStatus MFXVideoVPP_Query(mfxSession session, mfxVideoParam *in,  
mfxVideoParam *out);
```

Parameters

session	SDK session handle
in	Pointer to the <u>mfxVideoParam</u> structure as input
out	Pointer to the <u>mfxVideoParam</u> structure as output



Description

This function works in either of two modes:

1. If `in` is zero, the function returns the class configurability in the output [mfxVideoParam](#) structure. A non-zero value in a field indicates that the SDK implementation can configure it with **Init**.
2. If `in` is non-zero, the function checks the validity of the fields in the input [mfxVideoParam](#) structure. Then the function returns the corrected values in the output [mfxVideoParam](#) structure. If there is insufficient information to determine the validity or correction is impossible, the function zeroes the fields.

The application can call this function before or after it initializes the preprocessor.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
<code>MXF_ERR_UNSUPPORTED</code>	The SDK implementation does not support the specified configuration.
<code>MXF_WRN_PARTIAL_ACCELERATION</code>	The underlying hardware does not fully support the specified video parameters; The video processing may be partially accelerated. Only SDK HW implementations may return this status code.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFXVideoVPP_QueryIOSurf

Syntax

```
mfxStatus MFXVideoVPP_QueryIOSurf(mfxSession session, mfxVideoParam *par, mfxFrameAllocRequest request[2]);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure as input



`request`

Pointer to the output [mfxFrameAllocRequest](#) structure; use `request[0]` for input requirements and `request[1]` for output requirements for video processing.

Description

This function returns minimum and suggested numbers of input and output frame surfaces required for video processing initialization and their type. The parameter `request[0]` refers to the input requirements; `request[1]` refers to output requirements. **Init** will call the external allocator for the required frames with the same set of numbers.

The function is recommended. For more information, see the Working with hardware acceleration.

This function does not validate I/O parameters except those used in calculating the number of input and output surfaces.

Return Status

`MFX_ERR_NONE`

The function completed successfully.

`MFX_WRN_PARTIAL_ACCELERATION`

The underlying hardware does not fully support the specified video parameters; The video processing may be partially accelerated. Only SDK HW implementation may return this status code.

`MFX_ERR_INVALID_VIDEO_PARAM`

The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.

`MFX_WRN_INCOMPATIBLE_VIDEO_PARAM`

The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFXVideoVPP_Init

Syntax

```
mfxStatus MFXVideoVPP_Init(mfxSession session, mfxVideoParam *par);
```



Parameters

Session	SDK session handle
Par	Pointer to the mfxVideoParam structure

Description

This function allocates memory and prepares tables and necessary structures for video processing. This function also does extensive validation to ensure the configuration, as specified in the input parameters, is supported.

Return Status

MF_X_ERR_NONE	The function completed successfully.
MF_X_WRN_PARTIAL_ACCELERATION	The underlying hardware does not fully support the specified video parameters; The video processing may be partially accelerated. Only SDK HW implementation may return this status code.
MF_X_ERR_INVALID_VIDEO_PARAM	The function detected invalid video parameters. These parameters may be out of the valid range, or the combination of them resulted in incompatibility. Incompatibility not resolved.
MF_X_WRN_INCOMPATIBLE_VIDEO_PARAM	The function detected some video parameters were incompatible with others; incompatibility resolved.
MF_X_ERR_UNDEFINED_BEHAVIOR	The function was called twice without a close.
MF_X_WRN_FILTER_SKIPPED	The VPP skipped one or more filters requested by the application.

Change History

This function is available since SDK API 1.0. SDK API 1.6 added new return status, MF_X_WRN_FILTER_SKIPPED.

MF_XVideoVPP_Reset

Syntax

```
mfxStatus MF_XVideoVPP_Reset(mfxSession session, mfxVideoParam *par);
```



Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the mfxVideoParam structure

Description

This function stops the current video processing operation and restores internal structures or parameters for a new operation.

Return Status

<code>MXF_ERR_NONE</code>	The function completed successfully.
<code>MXF_ERR_INVALID_VIDEO_PARAM</code>	The function detected that video parameters are wrong or they conflict with initialization parameters. Reset is impossible.
<code>MXF_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected that provided by the application video parameters are incompatible with initialization parameters. Reset requires additional memory allocation and cannot be executed. The application should close the SDK component and then reinitialize it.
<code>MXF_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	The function detected some video parameters were incompatible with others; incompatibility resolved.

Change History

This function is available since SDK API 1.0.

MFXVideoVPP_Close

Syntax

```
mfxStatus MFXVideoVPP_Close(mfxSession session);
```

Parameters

<code>session</code>	SDK session handle
----------------------	--------------------

Description

This function terminates the current video processing operation and de-allocates internal tables and structures.



Return Status

`MFx_ERR_NONE`

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MFxVideoVPP_GetVideoParam

Syntax

```
mfxStatus MFxVideoVPP_GetVideoParam(mfxSession session, mfxVideoParam *par);
```

Parameters

<code>session</code>	SDK session handle
<code>par</code>	Pointer to the corresponding parameter structure

Description

This function obtains current working parameters to the specified output structure. To return extended buffers, the application must allocate those extended buffers and attach them as part of the output structure.

Return Status

`MFx_ERR_NONE`

The function completed successfully.

Change History

This function is available since SDK API 1.0.

MFxVideoVPP_GetVPPStat

Syntax

```
mfxStatus MFxVideoVPP_GetVPPStat(mfxSession session, mfxVPPStat *stat);
```

Parameters

<code>session</code>	SDK session handle
<code>stat</code>	Pointer to the mfxVPPStat structure



Description

This function obtains statistics collected during video processing.

Return Status

`MXF_ERR_NONE` The function completed successfully.

Change History

This function is available since SDK API 1.0.

MXFVideoVPP_RunFrameVPPAsync

Syntax

```
mxStatus MXFVideoVPP_RunFrameVPPAsync (mxSession session,  
mxFrameSurface1 *in, mxFrameSurface1 *out, mxExtVppAuxData *aux,  
mxSyncPoint *syncp);
```

Parameters

<code>session</code>	SDK session handle
<code>in</code>	Pointer to the input video surface structure
<code>out</code>	Pointer to the output video surface structure
<code>aux</code>	Optional pointer to the auxiliary data structure
<code>syncp</code>	Pointer to the output sync point

Description

This function processes a single input frame to a single output frame. Retrieval of the auxiliary data is optional; the encoding process may use it.

The video processing process may not generate an instant output given an input. See section Video Processing Procedures for details on how to correctly send input and retrieve output.

At the end of the stream, call this function with the input argument `in=NULL` to retrieve any remaining frames, until the function returns [MXF_ERR_MORE_DATA](#).

This function is asynchronous.

Return Status

`MXF_ERR_NONE` The output frame is ready after synchronization.



`MFx_ERR_MORE_DATA`

Need more input frames before **VPP** can produce an output

`MFx_ERR_MORE_SURFACE`

The output frame is ready after synchronization. Need more surfaces at output for additional output frames available.

`MFx_ERR_DEVICE_LOST`

Hardware device was lost; See the [Working with Microsoft* DirectX* Applications](#) section for further information.

`MFx_WRN_DEVICE_BUSY`

Hardware device is currently busy. Call this function again in a few milliseconds.

Change History

This function is available since SDK API 1.0.

Structure Reference

In the following structure references, all reserved fields must be zero.

mfxBitstream

Definition

```
typedef struct mfxBitStream {
    union {
        struct {
            mfxEncryptedData* EncryptedData;
            mfxExtBuffer **ExtParam;
            mfxU16  NumExtParam;
        };
        mfxU32  reserved[6];
    };
    mfxI64  DecodeTimeStamp;
    mfxU64  TimeStamp;
    mfxU8*  Data;
    mfxU32  DataOffset;
    mfxU32  DataLength;
    mfxU32  MaxLength;

    mfxU16  PicStruct;
    mfxU16  FrameType;
    mfxU16  DataFlag;
    mfxU16  reserved2;
} mfxBitstream;
```

Description

The `mfxBitstream` structure defines the buffer that holds compressed video data.

Members

`EncryptedData` Reserved and must be zero.



ExtParam	Array of extended buffers for additional bitstream configuration. See the ExtendedBufferID enumerator for a complete list of extended buffers.
NumExtParam	The number of extended buffers attached to this structure.
DecodeTimeStamp	<p>Decode time stamp of the compressed bitstream in units of 90KHz. A value of MF_X_TIMESTAMP_UNKNOWN indicates that there is no time stamp.</p> <p>This value is calculated by the SDK encoder from presentation time stamp provided by the application in mfxFrameSurface1 structure and from frame rate provided by the application during the SDK encoder initialization.</p>
TimeStamp	Time stamp of the compressed bitstream in units of 90KHz. A value of MF_X_TIMESTAMP_UNKNOWN indicates that there is no time stamp.
Data	Bitstream buffer pointer—32-bytes aligned
DataOffset	Next reading or writing position in the bitstream buffer
DataLength	Size of the actual bitstream data in bytes
MaxLength	Allocated bitstream buffer size in bytes
PicStruct	Type of the picture in the bitstream; this is an output parameter.
FrameType	Frame type of the picture in the bitstream; this is an output parameter.
DataFlag	Indicates additional bitstream properties; see the BitstreamDataFlag enumerator for details.

Change History

This structure is available since SDK API 1.0.

SDK API 1.1 extended the `DataFlag` field definition.

SDK API 1.6 adds `DecodeTimeStamp` field.

SDK API 1.7 adds `ExtParam` and `NumExtParam` fields.

mfxBufferAllocator

Definition

```
typedef struct {
    mfxU32      reserved[4];
    mfxHDL      pthis;
    mfxStatus    (*Alloc) (mfxHDL pthis, mfxU32 nbytes,
                           mfxU16 type, mfxMemId *mid);
    mfxStatus    (*Lock) (mfxHDL pthis, mfxMemId mid, mfxU8 **ptr);
    mfxStatus    (*Unlock) (mfxHDL pthis, mfxMemId mid);
    mfxStatus    (*Free) (mfxHDL pthis, mfxMemId mid);
} mfxBufferAllocator;
```

Description

The `mfxBufferAllocator` structure is deprecated.

Members

<code>pthis</code>	Pointer to the allocator object
<u>Alloc</u>	Pointer to the function that allocates a linear buffer
<u>Lock</u>	Pointer to the function that locks a memory block and returns the pointer to the buffer
<u>Unlock</u>	Pointer to the function that unlocks a linear buffer; after unlocking, any pointer to the linear buffer is invalid.
<u>Free</u>	Pointer to the function that de-allocates memory

Change History

This structure is available since SDK API 1.0.

Deprecated since API 1.17

Alloc

Syntax

```
mfxStatus (*Alloc) (mfxHDL pthis, mfxU32 nbytes, mfxU16 type, mfxMemId
*mid);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
--------------------	---------------------------------



<code>nbytes</code>	Number of bytes in the linear buffer
<code>type</code>	Memory type; see the ExtMemBufferType enumerator for details.
<code>mid</code>	Pointer to the allocated memory ID

Description

This function allocates a linear buffer and returns its block ID. The allocated memory must be 32-byte aligned.

Return Status

<code>MFx_ERR_NONE</code>	The function successfully allocated the memory block.
<code>MFx_ERR_MEMORY_ALLOC</code>	The function ran out of the specified type of memory.

Change History

This function is available since SDK API 1.0.

Free

Syntax

```
mfxStatus (*Free)(mfxHDL pthis, mfxMemId mid);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID

Description

This function de-allocates memory specified by `mid`.

Return Status

<code>MFx_ERR_NONE</code>	The function successfully de-allocated the memory block.
<code>MFx_ERR_INVALID_HANDLE</code>	The memory block ID is invalid.

Change History

This function is available since SDK API 1.0.

Lock

Syntax

```
mfxStatus (*Lock)(mfxHDL pthis, mfxMemId mid, mfxU8 **ptr);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID
<code>ptr</code>	Pointer to the returned linear buffer pointer

Description

This function locks the linear buffer and returns its pointer. The returned buffer must be 32-byte aligned.

Return Status

<code>MFx_ERR_NONE</code>	The function successfully locked the memory block.
<code>MFx_ERR_INVALID_HANDLE</code>	The memory block ID is invalid.
<code>MFx_ERR_LOCK_MEMORY</code>	The function failed to lock the linear buffer.

Change History

This function is available since SDK API 1.0.

Unlock

Syntax

```
mfxStatus (*Unlock)(mfxHDL pthis, mfxMemId mid);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID

Description

This function unlocks the linear buffer and invalidates its pointer.



Return Status

<code>MXF_ERR_NONE</code>	The function successfully unlocked the memory block.
<code>MXF_ERR_INVALID_HANDLE</code>	The memory block ID is invalid.

Change History

This function is available since SDK API 1.0.

mfxDecodeStat

Definition

```
typedef struct _mfxDecodeStat {  
    mfxU32    reserved[16];  
    mfxU32    NumFrame;  
    mfxU32    NumSkippedFrame;  
    mfxU32    NumError;  
    mfxU32    NumCachedFrame;  
} mfxDecodeStat;
```

Description

The `mfxDecodeStat` structure returns statistics collected during decoding.

Members

<code>NumFrame</code>	Number of total decoded frames
<code>NumSkippedFrame</code>	Number of skipped frames
<code>NumError</code>	Number of errors recovered
<code>NumCachedFrame</code>	Number of internally cached frames

Change History

This structure is available since SDK API 1.0.

mfxEncodeCtrl

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    mfxU32    reserved[5];
    mfxU16    SkipFrame;

    mfxU16    QP;

    mfxU16    FrameType;
    mfxU16    NumExtParam;
    mfxU16    NumPayload;
    mfxU16    reserved2;

    mfxExtBuffer    **ExtParam;
    mfxPayload    **Payload;
} mfxEncodeCtrl;
```

Description

The **mfxEncodeCtrl** structure contains parameters for per-frame based encoding control.

Members

SkipFrame	Indicates that current frame should be skipped or number of missed frames before the current frame. See the mfxExtCodingOption2::SkipFrame for details.
QP	If nonzero, this value overwrites the global QP value for the current frame in the constant QP mode.
FrameType	Encoding frame type; see the FrameType enumerator for details. If the encoder works in the encoded order, the application must specify the frame type. If the encoder works in the display order, only key frames are enforceable.
NumExtParam	Number of extra control buffers.
NumPayload	Number of payload records to insert into the bitstream.
ExtParam	Pointer to an array of pointers to external buffers that provide additional information or control to the encoder for this frame or field pair; a typical usage is to pass the VPP auxiliary data generated by the video processing pipeline to the encoder. See the ExtendedBufferID for the list of extended buffers.
Payload	Pointer to an array of pointers to user data (MPEG-2) or SEI messages (H.264) for insertion into the bitstream; for field pictures, odd payloads are associated with the first field and even payloads are associated with the second field. See the mfxPayload structure



for payload definitions.

Change History

This structure is available since SDK API 1.0. SDK API 1.1 extended the `QP` field. Since SDK API 1.3 specification of `QP` in display order mode is allowed.

mfxEncodeStat

Definition

```
typedef struct _mfxEncodeStat {  
    mfxU32      reserved[16];  
    mfxU32      NumFrame;  
    mfxU64      NumBit;  
    mfxU32      NumCachedFrame;  
} mfxEncodeStat;
```

Description

The `mfxEncodeStat` structure returns statistics collected during encoding.

Members

<code>NumFrame</code>	Number of encoded frames
<code>NumCachedFrame</code>	Number of internally cached frames
<code>NumBit</code>	Number of bits for all encoded frames

Change History

This structure is available since SDK API 1.0.

mfxExtBuffer

Definition

```
typedef struct _mfxExtBuffer {  
    mfxU32      BufferId;
```

```

        mfxU32      BufferSz;
    } mfxExtBuffer;

```

Description

The `mfxExtBuffer` structure is the common header definition for external buffers and video processing hints.

Members

<code>BufferId</code>	Identifier of the buffer content. See the ExtendedBufferID enumerator for a complete list of extended buffers.
<code>BufferSz</code>	Size of the buffer

Change History

This structure is available since SDK API 1.0.

mfxExtAVCRefListCtrl

Definition

```

typedef struct {
    mfxExtBuffer    Header;
    mfxU16          NumRefIdxL0Active;
    mfxU16          NumRefIdxL1Active;

    struct {
        mfxU32      FrameOrder;
        mfxU16      PicStruct;
        mfxU16      ViewId;
        mfxU16      LongTermIdx;
        mfxU16      reserved[3];
    } PreferredRefList[32], RejectedRefList[16], LongTermRefList[16];

    mfxU16          ApplyLongTermIdx;
    mfxU16          reserved[15];
} mfxExtAVCRefListCtrl;

```

Description

The `mfxExtAVCRefListCtrl` structure configures reference frame options for the



H.264 encoder. See Reference List Selection and Long-term Reference frame chapters for more details.

Not all implementations of the SDK encoder support `LongTermIdx` and `ApplyLongTermIdx` fields in this structure. The application has to use query mode 1 to determine if such functionality is supported. To do so, the application has to attach this extended buffer to [mfxVideoParam](#) structure and call [MFXVideoENCODE_Query](#) function. If function returns `MFX_ERR_NONE` and these fields were set to one, then such functionality is supported. If function fails or sets fields to zero then this functionality is not supported.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_AVC_REFLIST_CTRL
<code>NumRefIdxL0Active</code>	Specify the number of reference frames in the active reference list L0. This number should be less or equal to the NumRefFrame parameter from encoding initialization.
<code>NumRefIdxL1Active</code>	Specify the number of reference frames in the active reference list L1. This number should be less or equal to the NumRefFrame parameter from encoding initialization.
<code>PreferredRefList</code>	Specify list of frames that should be used to predict the current frame.
<code>RejectedRefList</code>	Specify list of frames that should not be used for prediction.
<code>LongTermRefList</code>	Specify list of frames that should be marked as long-term reference frame.
<code>FrameOrder</code> <code>PicStruct</code>	Together these fields are used to identify reference picture. Use <code>FrameOrder = MFX_FRAMEORDER_UNKNOWN</code> to mark unused entry.
<code>ViewID</code>	Reserved and must be zero.
<code>LongTermIdx</code>	Index that should be used by the SDK encoder to mark long-term reference frame.
<code>ApplyLongTermIdx</code>	If it is equal to zero, the SDK encoder assigns long-term index according to internal algorithm. If it is equal to one, the SDK encoder uses <code>LongTermIdx</code> value as long-term index.

Change History

This structure is available since SDK API 1.3.

The SDK API 1.7 adds `LongTermIdx` and `ApplyLongTermIdx` fields.

mfxExtAVCRefLists

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    mfxU16          NumRefIdxL0Active;
    mfxU16          NumRefIdxL1Active;
    mfxU16          reserved[2];

    struct mfxRefPic{
        mfxU32      FrameOrder;
        mfxU16      PicStruct;
        mfxU16      reserved[5];
    } RefPicList0[32], RefPicList1[32];

}mfxExtAVCRefLists;
```

Description

The `mfxExtAVCRefLists` structure specifies reference lists for the SDK encoder. It may be used together with the `mfxExtAVCRefListCtrl` structure to create customized reference lists. If both structures are used together, then the SDK encoder takes reference lists from `mfxExtAVCRefLists` structure and modifies them according to the `mfxExtAVCRefListCtrl` instructions. In case of interlaced coding, the first `mfxExtAVCRefLists` structure affects TOP field and the second – BOTTOM field.

Not all implementations of the SDK encoder support this structure. The application has to use query function to determine if it is supported

Members

<code>Header.BufferId</code>	Must be <u>MF_EXTBUFF_AVC_REFLISTS</u>
<code>NumRefIdxL0Active</code>	Specify the number of reference frames in the active reference list L0. This number should be less or equal to the NumRefFrame parameter from encoding initialization.
<code>NumRefIdxL1Active</code>	Specify the number of reference frames in the active reference list L1. This number should be less or equal to the NumRefFrame parameter from encoding initialization.
<code>RefPicList0,</code> <code>RefPicList1</code>	Specify L0 and L1 reference lists.



FrameOrder	Together these fields are used to identify reference picture.
PicStruct	Use FrameOrder = MFX_FRAMEORDER_UNKNOWN to mark unused entry. Use PicStruct = MFX_PICSTRUCT_FIELD_TFF for TOP field, PicStruct = MFX_PICSTRUCT_FIELD_BFF for BOTTOM field.

Change History

This structure is available since SDK API 1.9.

mfxExtCodingOption

Definition

```
typedef struct {
    mfxExtBuffer      Header;

    mfxU16             reserved1;
    mfxU16             RateDistortionOpt;
    mfxU16             MECostType;
    mfxU16             MESearchType;
    mfxI16Pair         MVSearchWindow;
    mfxU16             EndOfSequence;
    mfxU16             FramePicture;

    union {
        struct { /* AVC */
            mfxU16 CAVLC;
            mfxU16 reserved2[2];
            mfxU16 RecoveryPointSEI;
            mfxU16 ViewOutput;
            mfxU16 NalHrdConformance;
            mfxU16 SingleSeiNalUnit;
            mfxU16 VuiVclHrdParameters;
            mfxU16 RefPicListReordering;
        };
    };
};
```

```

        mfxU16      ResetRefList;
        mfxU16      RefPicMarkRep;
        mfxU16      FieldOutput;
        mfxU16      IntraPredBlockSize;
        mfxU16      InterPredBlockSize;
        mfxU16      MDPrecision;
        mfxU16      MaxDecFrameBuffering;
        mfxU16      AUDelimiter;
        mfxU16      EndOfStream;
        mfxU16      PicTimingSEI;
        mfxU16      VuiNalHrdParameters;

    };

};

} mfxExtCodingOption;

```

Description

The `mfxExtCodingOption` structure specifies additional options for encoding.

The application can attach this extended buffer to the [mfxVideoParam](#) structure to configure initialization.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_CODING_OPTION
<code>RateDistortionOpt</code>	Set this flag if rate distortion optimization is needed. See the CodingOptionValue enumerator for values of this option.
<code>MECostType</code>	Motion estimation cost type; this value is reserved and must be zero.
<code>MESearchType</code>	Motion estimation search algorithm; this value is reserved and must be zero.
<code>MVSearchWindow</code>	Rectangular size of the search window for motion estimation; this parameter is reserved and must be (0, 0).
<code>EndOfSequence</code>	Deprecated.
<code>CAVLC</code>	If set, CAVLC is used; if unset, CABAC is used for encoding. See the CodingOptionValue enumerator for values of this option.
<code>NalHrdConformance</code>	If this option is turned ON, then AVC encoder produces HRD conformant bitstream. If it is turned OFF, then AVC encoder



may, but not necessary does, violate HRD conformance. I.e. this option can force encoder to produce HRD conformant stream, but cannot force it to produce unconformant stream.

See the [CodingOptionValue](#) enumerator for values of this option.

SingleSeiNalUnit	<p>If set, encoder puts all SEI messages in the single NAL unit. It includes both kinds of messages, provided by application and created by encoder. It is three states option, see CodingOptionValue enumerator for values of this option:</p> <p>UNKNOWN - put each SEI in its own NAL unit, ON - put all SEI messages in the same NAL unit, OFF - the same as unknown</p>
VuiVclHrdParameters	<p>If set and VBR rate control method is used then VCL HRD parameters are written in bitstream with identical to NAL HRD parameters content. See the CodingOptionValue enumerator for values of this option.</p>
RefPicListReordering	<p>Set this flag to activate reference picture list reordering; this value is reserved and must be zero.</p>
ResetRefList	<p>Set this flag to reset the reference list to non-IDR I-frames of a GOP sequence. See the CodingOptionValue enumerator for values of this option.</p>
RefPicMarkRep	<p>Set this flag to write the reference picture marking repetition SEI message into the output bitstream. See the CodingOptionValue enumerator for values of this option.</p>
FieldOutput	<p>Set this flag to instruct the AVC encoder to output bitstreams immediately after the encoder encodes a field, in the field-encoding mode. See the CodingOptionValue enumerator for values of this option.</p>
ViewOutput	<p>Set this flag to instruct the MVC encoder to output each view in separate bitstream buffer. See the CodingOptionValue enumerator for values of this option and <i>SDK Reference Manual for Multi-View Video Coding</i> for more details about usage of this flag.</p>
IntraPredBlockSize	<p>Minimum block size of intra-prediction; This value is reserved and must be zero.</p>
InterPredBlockSize	<p>Minimum block size of inter-prediction; This value is reserved and must be zero.</p>



MVPrecision	Specify the motion estimation precision; this parameter is reserved and must be zero.
MaxDecFrameBuffering	Specifies the maximum number of frames buffered in a DPB. A value of zero means "unspecified."
AUDelimiter	Set this flag to insert the Access Unit Delimiter NAL. See the CodingOptionValue enumerator for values of this option.
EndOfStream	Deprecated.
PicTimingSEI	Set this flag to insert the picture timing SEI with pic_struct syntax element. See sub-clauses D.1.2 and D.2.2 of the ISO*/IEC* 14496-10 specification for the definition of this syntax element. See the CodingOptionValue enumerator for values of this option. The default value is ON.
VuiNalHrdParameters	Set this flag to insert NAL HRD parameters in the VUI header. See the CodingOptionValue enumerator for values of this option.
FramePicture	Set this flag to encode interlaced fields as interlaced frames; this flag does not affect progressive input frames. See the CodingOptionValue enumerator for values of this option.
RecoveryPointSEI	<p>Set this flag to insert the recovery point SEI message at the beginning of every intra refresh cycle. See the description of IntRefType in mfxExtCodingOption2 structure for details on how to enable and configure intra refresh.</p> <p>If intra refresh is not enabled then this flag is ignored.</p> <p>See the CodingOptionValue enumerator for values of this option.</p>

Change History

This structure is available since SDK API 1.0.

SDK API 1.3 adds `RefPicMarkRep`, `FieldOutput`, `NalHrdConformance`, `SingleSeiNalUnit` and `VuiVclHrdParameters` fields.

SDK API 1.4 adds `ViewOutput` field.

SDK API 1.6 adds `RecoveryPointSEI` field.

SDK API 1.17 deprecates `EndOfSequence` and `EndOfStream` fields.

mfxExtCodingOption2

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      IntRefType;
    mfxU16      IntRefCycleSize;
    mfxI16      IntRefQPDelta;

    mfxU32      MaxFrameSize;
    mfxU32      MaxSliceSize;

    mfxU16      BitrateLimit;           /* tri-state option */
    mfxU16      MBBRC;                 /* tri-state option */
    mfxU16      ExtBRC;                 /* tri-state option */
    mfxU16      LookAheadDepth;
    mfxU16      Trellis;
    mfxU16      RepeatPPS;              /* tri-state option */
    mfxU16      BRefType;
    mfxU16      AdaptiveI;              /* tri-state option */
    mfxU16      AdaptiveB;              /* tri-state option */
    mfxU16      LookAheadDS;
    mfxU16      NumMbPerSlice;
    mfxU16      SkipFrame;
    mfxU8       MinQPI;                 /* 1..51, 0 = default */
    mfxU8       MaxQPI;                 /* 1..51, 0 = default */
    mfxU8       MinQPP;                 /* 1..51, 0 = default */
    mfxU8       MaxQPP;                 /* 1..51, 0 = default */
    mfxU8       MinQPB;                 /* 1..51, 0 = default */
    mfxU8       MaxQPB;                 /* 1..51, 0 = default */
    mfxU16      FixedFrameRate;         /* tri-state option */
    mfxU16      DisableDeblockingIdc;
    mfxU16      DisableVUI;
    mfxU16      BufferingPeriodSEI;
    mfxU16      EnableMAD;              /* tri-state option */
    mfxU16      UseRawRef;              /* tri-state option */
} mfxExtCodingOption2;
```

Description

The `mfxExtCodingOption2` structure together with [mfxExtCodingOption](#) structure specifies additional options for encoding.

The application can attach this extended buffer to the [mfxVideoParam](#) structure to configure initialization and to the [mfxEncodeCtrl](#) during runtime.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_CODING_OPTION2 .
<code>IntRefType</code>	Specifies intra refresh type. See the IntraRefreshTypes . The



major goal of intra refresh is improvement of error resilience without significant impact on encoded bitstream size caused by I frames. The SDK encoder achieves this by encoding part of each frame in refresh cycle using intra MBs.

`MFX_REFRESH_NO` means no refresh. `MFX_REFRESH_VERTICAL` means vertical refresh, by column of MBs.

`MFX_REFRESH_HORIZONTAL` means horizontal refresh, by rows of MBs. `MFX_REFRESH_SLICE` means horizontal refresh by slices without overlapping. In case of `MFX_REFRESH_SLICE` SDK ignores `IntRefCycleSize` (size of refresh cycle equals number slices). This parameter is valid during initialization and runtime. When used with [temporal scalability](#), intra refresh applied only to base layer.

<code>IntRefCycleSize</code>	Specifies number of pictures within refresh cycle starting from 2. 0 and 1 are invalid values. This parameter is valid during initialization and runtime
<code>IntRefQPDelta</code>	Specifies QP difference for inserted intra MBs. This is signed value in [-51, 51] range. This parameter is valid during initialization and runtime.
<code>MaxFrameSize</code>	Specify maximum encoded frame size in byte. This parameter is used in AVBR and VBR bitrate control modes and ignored in others. The SDK encoder tries to keep frame size below specified limit but minor overshoots are possible to preserve visual quality. This parameter is valid during initialization and runtime.
<code>MaxSliceSize</code>	<p>Specify maximum slice size in bytes. If this parameter is specified other controls over number of slices are ignored.</p> <p>Not all codecs and SDK implementations support this value. Use <code>Query</code> function to check if this feature is supported.</p>
<code>BitrateLimit</code>	Turn off this flag to remove bitrate limitations imposed by the SDK encoder. This flag is intended for special usage models and usually the application should not set it. Setting this flag may lead to violation of HRD conformance and severe visual artifacts. See the CodingOptionValue enumerator for values of this option. The default value is ON, i.e. bitrate is limited. This parameter is valid only during initialization.
<code>MBBRC</code>	Setting this flag enables macroblock level bitrate control that generally improves subjective visual quality. Enabling this flag may have negative impact on performance and objective visual quality metric. See the <code>CodingOptionValue</code> enumerator for values of this option. The default value depends on target usage settings.
<code>ExtBRC</code>	Deprecated.



LookAheadDepth	Specifies the depth of look ahead rate control algorithm. It is the number of frames that SDK encoder analyzes before encoding. Valid value range is from 10 to 100 inclusive. To instruct the SDK encoder to use the default value the application should zero this field.
Trellis	This option is used to control trellis quantization in AVC encoder. See TrellisControl enumerator for possible values of this option. This parameter is valid only during initialization.
RepeatPPS	This flag controls picture parameter set repetition in AVC encoder. Turn ON this flag to repeat PPS with each frame. See the CodingOptionValue enumerator for values of this option. The default value is ON. This parameter is valid only during initialization.
BRefType	This option controls usage of B frames as reference. See BRefControl enumerator for possible values of this option. This parameter is valid only during initialization.
AdaptiveI	This flag controls insertion of I frames by the SDK encoder. Turn ON this flag to allow changing of frame type from P and B to I. This option is ignored if <code>GopOptFlag</code> in mfxInfoMFX structure is equal to <code>MFX_GOP_STRICT</code> . See the CodingOptionValue enumerator for values of this option. This parameter is valid only during initialization.
AdaptiveB	This flag controls changing of frame type from B to P. Turn ON this flag to allow such changing. This option is ignored if <code>GopOptFlag</code> in mfxInfoMFX structure is equal to <code>MFX_GOP_STRICT</code> . See the CodingOptionValue enumerator for values of this option. This parameter is valid only during initialization.
LookAheadDS	This option controls down sampling in look ahead bitrate control mode. See LookAheadDownSampling enumerator for possible values of this option. This parameter is valid only during initialization.
NumMbPerSlice	This option specifies suggested slice size in number of macroblocks. The SDK can adjust this number based on platform capability. If this option is specified, i.e. if it is not equal to zero, the SDK ignores <code>mfxInfoMFX::NumSlice</code> parameter.
SkipFrame	<p>This option enables usage of mfxEncodeCtrl::SkipFrame parameter. See the SkipFrame enumerator for values of this option.</p> <p>Not all codecs and SDK implementations support this value.</p>



	Use Query function to check if this feature is supported.
MinQPI, MaxQPI MinQPP, MaxQPP MinQPB, MinQPB	Minimum and maximum allowed QP values for different frame types. Valid range is 1..51 inclusive. Zero means default value, i.e.no limitations on QP. Not all codecs and SDK implementations support this value. Use Query function to check if this feature is supported.
FixedFrameRate	This option sets <code>fixed_frame_rate_flag</code> in VUI. Not all codecs and SDK implementations support this value. Use Query function to check if this feature is supported.
DisableDeblockingIdc	This option disable deblocking. Not all codecs and SDK implementations support this value. Use Query function to check if this feature is supported.
DisableVUI	This option completely disables VUI in output bitstream. Not all codecs and SDK implementations support this value. Use Query function to check if this feature is supported.
BufferingPeriodSEI	This option controls insertion of buffering period SEI in the encoded bitstream. It should be one of the following values: MFx_BPSEI_DEFAULT – encoder decides when to insert BP SEI, MFx_BPSEI_IFRAME – BP SEI should be inserted with every I frame.
EnableMAD	Turn ON this flag to enable per-frame reporting of Mean Absolute Difference. This parameter is valid only during initialization.
UseRawRef	Turn ON this flag to use raw frames for reference instead of reconstructed frames. This parameter is valid during initialization and runtime (only if was turned ON during initialization). Not all codecs and SDK implementations support this value. Use Query function to check if this feature is supported.

Change History

This structure is available since SDK API 1.6.

The SDK API 1.7 added `LookAheadDepth` and `Trellis` fields.

The SDK API 1.8 adds `RepeatPPS`, `BRefType`, `AdaptiveI`, `AdaptiveB`, `LookAheadDS` and `NumMbPerSlice` fields.

The SDK API 1.9 adds `MaxSliceSize`, `SkipFrame`, `MinQPI`, `MaxQPI`, `MinQPP`, `MaxQPP`, `MinQPB`, `MinQPB`, `FixedFrameRate` and `DisableDeblockingIdc` fields.



The SDK API 1.10 adds `DisableVUIFields` and `BufferingPeriodSEI` fields.

The SDK API 1.11 adds `EnableMAD` field.

The SDK API 1.13 adds `UseRawRef` field.

The SDK API 1.17 deprecates `ExtBRC` field.

mfxExtCodingOption3

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16    NumSliceI;  
    mfxU16    NumSliceP;  
    mfxU16    NumSliceB;  
  
    mfxU16    WinBRCMaxAvgKbps;  
    mfxU16    WinBRCSIZE;  
  
    mfxU16    QVBRQuality;  
    mfxU16    EnableMBQP;  
    mfxU16    IntRefCycleDist;  
    mfxU16    DirectBiasAdjustment;        /* tri-state option */  
    mfxU16    GlobalMotionBiasAdjustment;  /* tri-state option */  
    mfxU16    MVCostScalingFactor;  
    mfxU16    MBDisableSkipMap;           /* tri-state option */  
  
    mfxU16    WeightedPred;  
    mfxU16    WeightedBiPred;  
  
    mfxU16    AspectRatioInfoPresent;      /* tri-state option */  
    mfxU16    OverscanInfoPresent;        /* tri-state option */  
    mfxU16    OverscanAppropriate;        /* tri-state option */  
    mfxU16    TimingInfoPresent;          /* tri-state option */  
    mfxU16    BitstreamRestriction;       /* tri-state option */  
}
```



```

mfxU16      LowDelayHrd;                      /* tri-state option */
mfxU16      MotionVectorsOverPicBoundaries; /* tri-state option */
mfxU16      reserved1[2];

mfxU16      ScenarioInfo;
mfxU16      ContentInfo;

mfxU16      PRefType;
mfxU16      FadeDetection;                    /* tri-state option */
mfxU16      reserved2[2];
mfxU16      GPB;                             /* tri-state option */

mfxU32      MaxFrameSizeI;
mfxU32      MaxFrameSizeP;
mfxU32      reserved3[3];

mfxU16      EnableQPOffset;                   /* tri-state option */
mfxI16      QPOffset[8];                     /* FrameQP = QPX +
QPOffset[pyramid_layer]; QPX = QPB for B-pyramid, QPP for P-pyramid */

mfxU16      NumRefActiveP[8];
mfxU16      NumRefActiveBL0[8];
mfxU16      NumRefActiveBL1[8];

mfxU16      reserved4[5];

mfxU16      BRCPanicMode;                     /* tri-state option */
mfxU16      LowDelayBRC;                      /* tri-state option */
mfxU16      EnableMBForceIntra;               /* tri-state option */
mfxU16      AdaptiveMaxFrameSize;             /* tri-state option */
mfxU16      RepartitionCheckEnable;           /* tri-state option */
mfxU16      reserved[169]; } mfxExtCodingOption3;

```

Description

The `mfxExtCodingOption3` structure together with [mfxExtCodingOption](#) and [mfxExtCodingOption2](#) structures specifies additional options for encoding.

The application can attach this extended buffer to the [mfxVideoParam](#) structure to configure



initialization and to the [mfxEncodeCtrl](#) during runtime.

Members

Header.BufferId	Must be MFX_EXTBUFF_CODING_OPTION3 .
NumSliceI	The number of slices for I, P and B frames separately.
NumSliceP	Not all codecs and SDK implementations support these values. Use Query function to check if this feature is supported
NumSliceB	
WinBRCTMaxAvgKbps	When rate control method is MFX_RATECONTROL_LA , MFX_RATECONTROL_LA_HRD , MFX_RATECONTROL_VBR or MFX_RATECONTROL_QVBR this parameter specifies the maximum bitrate averaged over a sliding window specified by WinBRCTSize.
WinBRCTSize	When rate control method is MFX_RATECONTROL_LA , MFX_RATECONTROL_LA_HRD , MFX_RATECONTROL_VBR or MFX_RATECONTROL_QVBR this parameter specifies sliding window size in frames. Set this parameter to zero to disable sliding window.
QVBRQuality	When rate control method is MFX_RATECONTROL_QVBR this parameter specifies quality factor. It is a value in the 1...51 range, where 1 corresponds to the best quality.
EnableMBQP	Turn ON this flag to enable per-macroblock QP control, rate control method must be MFX_RATECONTROL_CQP . See the CodingOptionValue enumerator for values of this option. This parameter is valid only during initialization.
IntRefCycleDist	Distance between the beginnings of the intra-refresh cycles in frames. Zero means no distance between cycles.
DirectBiasAdjustment	Turn ON this flag to enable the ENC mode decision algorithm to bias to fewer B Direct/Skip types. Applies only to B frames, all other frames will ignore this setting. See the CodingOptionValue enumerator for values of this option.
GlobalMotionBiasAdjustment	Enables global motion bias. See the CodingOptionValue enumerator for values of this option.



MVCostScalingFactor	<p>MV cost scaling ratio. It is used when <code>GlobalMotionBiasAdjustment</code> is ON.</p> <p>Values are:</p> <ul style="list-style-type: none">0: set MV cost to be 01: scale MV cost to be 1/2 of the default value2: scale MV cost to be 1/4 of the default value3: scale MV cost to be 1/8 of the default value
MBDisableSkipMap	<p>Turn ON this flag to enable usage of mfxExtMBDisableSkipMap. See the CodingOptionValue enumerator for values of this option. This parameter is valid only during initialization.</p>
WeightedPred	<p>Weighted prediction mode. See the WeightedPred enumerator for values of these options.</p>
WeightedBiPred	
AspectRatioInfoPresent	<p>Instructs encoder whether aspect ratio info should present in VUI parameters. See the CodingOptionValue enumerator for values of this option.</p>
OverscanInfoPresent	<p>Instructs encoder whether overscan info should present in VUI parameters. See the CodingOptionValue enumerator for values of this option.</p>
OverscanAppropriate	<p>ON indicates that the cropped decoded pictures output are suitable for display using overscan. OFF indicates that the cropped decoded pictures output contain visually important information in the entire region out to the edges of the cropping rectangle of the picture. See the CodingOptionValue enumerator for values of this option.</p>
TimingInfoPresent	<p>Instructs encoder whether frame rate info should present in VUI parameters. See the CodingOptionValue enumerator for values of this option.</p>
BitstreamRestriction	<p>Instructs encoder whether bitstream restriction info should present in VUI parameters. See the CodingOptionValue enumerator for values of this option.</p>
ScenarioInfo	<p>Provides a hint to encoder about the scenario for the encoding session. See the ScenarioInfo enumerator</p>



	for values of this option.
ContentInfo	Provides a hint to encoder about the content for the encoding session. See the ContentInfo enumerator for values of this option.
PRefType	When <code>GopRefDist=1</code> , specifies the model of reference list construction and DPB management. See the PRefType enumerator for values of this option.
FadeDetection	Instructs encoder whether internal fade detection algorithm should be used for calculation of <code>weigh/offset</code> values for <code>pred_weight_table</code> unless application provided mfxExtPredWeightTable for this frame. See the CodingOptionValue enumerator for values of this option.
GPB	Turn this option OFF to make HEVC encoder use regular P-frames instead of GPB. See the CodingOptionValue enumerator for values of this option
LowDelayHrd	Corresponds to AVC syntax element <code>low_delay_hrd_flag</code> (VUI). See the CodingOptionValue enumerator for values of this option.
MotionVectorsOverPicBoundaries	When set to OFF, no sample outside the picture boundaries and no sample at a fractional sample position for which the sample value is derived using one or more samples outside the picture boundaries is used for inter prediction of any sample. When set to ON, one or more samples outside picture boundaries may be used in inter prediction. See the CodingOptionValue enumerator for values of this option.
MaxFrameSizeI	Same as mfxExtCodingOption2::MaxFrameSize but affects only I-frames.
MaxFrameSizeP	Same as mfxExtCodingOption2::MaxFrameSize but affects only P-frames.
EnableQPOffset	Enables <code>QPOffset</code> control. See the CodingOptionValue enumerator for values of this option.



QPOffset	<p>When <code>EnableQPOffset</code> set to ON and <code>RateControlMethod</code> is CQP specifies QP offset per pyramid layer.</p> <p>For B-pyramid, B-frame $QP = QPB + QPOffset[layer]$.</p> <p>For P-pyramid, P-frame $QP = QPP + QPOffset[layer]$.</p>
NumRefActiveP	Max number of active references for P and B frames in reference picture lists 0 and 1 correspondingly. Array index is pyramid layer.
NumRefActiveBL0	
NumRefActiveBL1	
BRCPanicMode	Controls panic mode in AVC and MPEG2 encoders.
LowDelayBRC	<p>When rate control method is <code>MFx_RATECONTROL_VBR</code>, <code>MFx_RATECONTROL_QVBR</code> or <code>MFx_RATECONTROL_VCM</code> this parameter specifies frame size tolerance. Set this parameter to <code>MFx_CODINGOPTION_ON</code> to allow strictly obey average frame size set by <code>MaxKbps</code>, e.g. cases when $MaxFrameSize == (MaxKbps * 1000) / (8 * FrameRateExtN / FrameRateExtD)$.</p> <p>Also <code>MaxFrameSizeI</code> and <code>MaxFrameSizeP</code> can be set separately.</p>
EnableMBForceIntra	Turn ON this flag to enable usage of mfxExtMBForceIntra for AVC encoder. See the CodingOptionValue enumerator for values of this option. This parameter is valid only during initialization.
AdaptiveMaxFrameSize	When this option is ON, BRC may decide a larger P or B frame size than what <code>MaxFrameSizeP</code> dictates when the scene change is detected but still less than limited by <code>MaxFrameSizeI</code> . It may benefit the video quality.
RepartitionCheckEnable	Controls AVC encoder attempts to predict from small partitions. Default value allows encoder to choose preferred mode, <code>MFx_CODINGOPTION_ON</code> forces encoder to favor quality, <code>MFx_CODINGOPTION_OFF</code> forces encoder to favor performance.

Change History

This structure is available since SDK API 1.11.

The SDK API 1.13 adds `EnableMBQP`, `MbDisableSkipMap`, `DirectBiasAdjustment`, `GlobalMotionBiasAdjustment` and `MVCostScalingFactor` fields.

The SDK API 1.16 adds `IntRefCycleDist`, `WeightedPred`, `WeightedBiPred`,



AspectRatioInfoPresent, OverscanInfoPresent, OverscanAppropriate, TimingInfoPresent, BitstreamRestriction, ScenarioInfo, ContentInfo, PRefType fields.

The SDK API 1.17 adds `FadeDetection` field.

The SDK API 1.18 adds `GPB` field.

The SDK API 1.19 adds `LowDelayHrd`, `MotionVectorsOverPicBoundaries`, `MaxFrameSizeI`, `MaxFrameSizeP`, `EnableQPOffset`, `QPOffset`, `NumRefActiveP`, `NumRefActiveBL0`, `NumRefActiveBL1` fields.

The SDK API 1.21 adds `BRCPanicMode` field.

The SDK API 1.23 adds `LowDelayBRC`, `EnableMBForceIntra`, `AdaptiveMaxFrameSize`, `RepartitionCheckEnable` fields.

mfxExtCodingOptionSPSPPS

Definition

```
struct {  
    mfxExtBuffer      Header;  
    mfxU8              *SPSBuffer;  
    mfxU8              *PPSBuffer;  
    mfxU16             SPSBufSize;  
    mfxU16             PPSBufSize;  
    mfxU16             SPSId;  
    mfxU16             PPSId;  
} mfxExtCodingOptionSPSPPS;
```

Description

Attach this structure as part of the [mfxVideoParam](#) extended buffers to configure the SDK encoder during [MFXVideoENCODE Init](#). The sequence or picture parameters specified by this structure overwrite any such parameters specified by the [mfxVideoParam](#) structure or any other extended buffers attached therein.

For H.264, `SPSBuffer` and `PPSBuffer` must point to valid bitstreams that contain the sequence parameter set and picture parameter set, respectively. For MPEG-2, `SPSBuffer` must point to valid bitstreams that contain the sequence header followed by any sequence header extension. The `PPSBuffer` pointer is ignored. The SDK encoder imports parameters from these buffers. If the encoder does not support the specified parameters, the encoder does not initialize and returns the status code [MFX_ERR_INCOMPATIBLE_VIDEO_PARAM](#).

Check with the [MFXVideoENCODE Query](#) function for the support of this multiple



segemnt encoding feature. If this feature is not supported, the query returns [MFX_ERR_UNSUPPORTED](#).

Members

Header.BufferId	Must be <u>MFX_EXTBUFF_CODING_OPTION_SPSPPS</u> .
SPSBuffer	Pointer to a valid bitstream that contains the SPS (sequence parameter set for H.264 or sequence header followed by any sequence header extension for MPEG-2) buffer; can be <code>NULL</code> to skip specifying the SPS.
PPSBuffer	Pointer to a valid bitstream that contains the PPS (picture parameter set for H.264 or picture header followed by any picture header extension for MPEG-2) buffer; can be <code>NULL</code> to skip specifying the PPS.
SPSBufSize	Size of the SPS in bytes
PPSBufSize	Size of the PPS in bytes
SPSId	SPS identifier; the value is reserved and must be zero.
PPSId	PPS identifier; the value is reserved and must be zero.

Change History

This structure is available since SDK API 1.0.

mfxExtOpaqueSurfaceAlloc

Definition

```
typedef struct {
    mfxExtBuffer      Header;
    mfxU32             reserved1[2];
    struct {
        mfxFrameSurface1 **Surfaces;
        mfxU32             reserved2[4];
        mfxU16             Type;
        mfxU16             NumSurface;
    } In, Out;
} mfxExtOpaqueSurfaceAlloc;
```



Description

The `mfxExtOpaqueSurfaceAlloc` structure defines the opaque surface allocation information.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_OPAQUE_SURFACE_ALLOCATION
<code>Type</code>	<p>Surface type chosen by the application. Any valid combination of flags may be used, for example:</p> <pre>MFX_MEMTYPE_SYSTEM_MEMORY MFX_MEMTYPE_FROM_DECODE MFX_MEMTYPE_EXTERNAL_FRAME.</pre> <p>The SDK ignores any irrelevant flags. See the ExtMemFrameType enumerator for details.</p>
<code>NumSurface</code>	The number of allocated frame surfaces.
<code>Surfaces</code>	The array pointers of allocated frame surfaces.
<code>In, Out</code>	<code>In</code> refers to surface allocation for input and <code>out</code> refers to surface allocation for output. For decoding, <code>In</code> is ignored. For encoding, <code>out</code> is ignored.

Change History

This structure is available since SDK API 1.3.

mfxExtVideoSignalInfo

Definition

```
typedef struct {  
    mfxExtBuffer    Header;  
    mfxU16          VideoFormat;  
    mfxU16          VideoFullRange;  
    mfxU16          ColourDescriptionPresent;  
    mfxU16          ColourPrimaries;  
    mfxU16          TransferCharacteristics;  
    mfxU16          MatrixCoefficients;  
} mfxExtVideoSignalInfo;
```

Description

The `mfxExtVideoSignalInfo` structure defines the video signal information.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VIDEO_SIGNAL_INFO
<code>VideoFormat</code>	These parameters define the video signal information.
<code>VideoFullRange</code>	For H.264, see Annex E of the ISO*/IEC* 14496-10 specification for the definition of these parameters.
<code>ColourPrimaries</code>	
<code>TransferCharacteristics</code>	For MPEG-2, see section 6.3.6 of the ITU* H.262 specification for the definition of these parameters. The field VideoFullRange is ignored.
<code>MatrixCoefficients</code>	
<code>ColourDescriptionPresent</code>	For VC-1, see section 6.1.14.5 of the SMPTE* 421M specification. The fields VideoFormat and VideoFullRange are ignored. If ColourDescriptionPresent is zero, the color description information (including ColourPrimaries , TransferCharacteristics , and MatrixCoefficients) will/does not present in the bitstream.

Change History

This structure is available since SDK API 1.3.

mfxExtPictureTimingSEI

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    mfxU32          reserved[14];

    struct {
        mfxU16      ClockTimestampFlag;
        mfxU16      CtType;
        mfxU16      NaitFieldBasedFlag;
        mfxU16      CountingType;
        mfxU16      FullTimestampFlag;
    }
}
```



```

    mfxU16    DiscontinuityFlag;
    mfxU16    CntDroppedFlag;
    mfxU16    NFrames;
    mfxU16    SecondsFlag;
    mfxU16    MinutesFlag;
    mfxU16    HoursFlag;
    mfxU16    SecondsValue;
    mfxU16    MinutesValue;
    mfxU16    HoursValue;
    mfxU32    TimeOffset;
} TimeStamp[3];
} mfxExtPictureTimingSEI;

```

Description

The `mfxExtPictureTimingSEI` structure configures the H.264 picture timing SEI message. The encoder ignores it if HRD information in stream is absent and `PicTimingSEI` option in `mfxExtCodingOption` structure is turned off. See [mfxExtCodingOption](#) for details.

If the application attaches this structure to the [mfxVideoParam](#) structure during initialization, the encoder inserts the picture timing SEI message based on provided template in every access unit of coded bitstream.

If application attaches this structure to the [mfxEncodeCtrl](#) structure at runtime, the encoder inserts the picture timing SEI message based on provided template in access unit that represents current frame.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_PICTURE_TIMING_SEI
<code>ClockTimestampFlag</code>	These parameters define the picture timing information. An invalid value of 0xFFFF indicates that application does not set the value and encoder must calculate it.
<code>CtType</code>	
<code>NuitFieldBasedFlag</code>	See Annex D of the ISO*/IEC* 14496-10 specification for the definition of these parameters.
<code>CountingType</code>	
<code>FullTimestampFlag</code>	
<code>DiscontinuityFlag</code>	
<code>CntDroppedFlag</code>	
<code>NFrames</code>	
<code>SecondsFlag</code>	
<code>MinutesFlag</code>	
<code>HoursFlag</code>	

```
SecondsValue
MinutesValue
HoursValue
TimeOffset
```

Change History

This structure is available since SDK API 1.3.

mfxExtAvcTemporalLayers

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    mfxU32          reserved1[4];
    mfxU16          reserved2;
    mfxU16          BaseLayerPID;

    struct {
        mfxU16 Scale;
        mfxU16 reserved[3];
    } Layer[8];
} mfxExtAvcTemporalLayers;
```

Description

The `mfxExtAvcTemporalLayers` structure configures the H.264 temporal layers hierarchy. If application attaches it to the [mfxVideoParam](#) structure during initialization, the SDK encoder generates the temporal layers and inserts the prefix NAL unit before each slice to indicate the temporal and priority IDs of the layer.

This structure can be used with the display-order encoding mode only.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_AVC_TEMPORAL_LAYERS
<code>BaseLayerPID</code>	The priority ID of the base layer; the SDK encoder increases the ID for each temporal layer and writes to the prefix NAL unit.



Scale	The ratio between the frame rates of the current temporal layer and the base layer.
Layer	The array of temporal layers; Use Scale=0 to specify absent layers.

Change History

This structure is available since SDK API 1.3.

mfxExtVppAuxData

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    union{
        struct{
            mfxU32    SpatialComplexity;
            mfxU32    TemporalComplexity;
        };
        struct{
            mfxU16    PicStruct;
            mfxU16    reserved[3];
        };
    };
    mfxU16          SceneChangeRate;
    mfxU16          RepeatedFrame;
} mfxExtVppAuxData;
```

Description

The `mfxExtVppAuxData` structure returns auxiliary data generated by the video processing pipeline. The encoding process may use the auxiliary data by attaching this structure to the [mfxEncodeCtrl](#) structure.

Members

Header.BufferId Must be [MFX_EXTBUFF_VPP_AUXDATA](#)



PicStruct	Detected picture structure - top field first, bottom field first, progressive or unknown if video processor cannot detect picture structure. See the PicStruct enumerator for definition of these values. By default, detection is turned off and the application should explicitly enable it by using mfxExtVPPDoUse buffer and MFX_EXTBUFF_VPP_PICSTRUCT_DETECTION algorithm.
SpatialComplexity	Deprecated
TemporalComplexity	Deprecated
SceneChangeRate	Deprecated
RepeatedFrame	Deprecated

Change History

This structure is available since SDK API 1.0. SDK API 1.6 adds `PicStruct` field and deprecates `SpatialComplexity`, `TemporalComplexity`, `SceneChangeRate` and `RepeatedFrame` fields.

mfxExtVPPDenoise

Definition

```
typedef struct {  
    mfxExtBuffer      Header;  
    mfxU16             DenoiseFactor;  
} mfxExtVppDenoise;
```

Description

The `mfxExtVPPDenoise` structure is a hint structure that configures the **VPP** denoise filter algorithm.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_DENOISE
<code>DenoiseFactor</code>	Value of 0-100 (inclusive) indicates the level of noise to remove.

Change History



This structure is available since SDK API 1.1.

mfxExtVPPDetail

Definition

```
typedef struct {  
    mfxExtBuffer      Header;  
    mfxU16             DetailFactor;  
} mfxExtVppDetail;
```

Description

The `mfxExtVPPDetail` structure is a hint structure that configures the **VPP** detail/edge enhancement filter algorithm.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_DETAIL
<code>DetailFactor</code>	0-100 value (inclusive) to indicate the level of details to be enhanced.

Change History

This structure is available since SDK API 1.1.

mfxExtVPPDoNotUse

Definition

```
typedef struct {  
    mfxExtBuffer      Header;  
    mfxU32             NumAlg;  
    mfxU32             *AlgList;  
} mfxExtVPPDoNotUse;
```

Description

The `mfxExtVPPDoNotUse` structure tells the **VPP** not to use certain filters in pipeline. See



“Table 4 Configurable VPP filters” for complete list of configurable filters.

The user can attach this structure to the [mfxVideoParam](#) structure when initializing video processing.

Members

Header.BufferId	Must be MFX_EXTBUFF_VPP_DONOTUSE
NumAlg	Number of filters (algorithms) not to use
AlgList	Pointer to a list of filters (algorithms) not to use

Change History

This structure is available since SDK API 1.0.

mfxExtVPPDoUse

Definition

```
typedef struct {  
    mfxExtBuffer    Header;  
    mfxU32          NumAlg;  
    mfxU32          *AlgList;  
} mfxExtVPPDoUse;
```

Description

The `mfxExtVPPDoUse` structure tells the **VPP** to include certain filters in pipeline.

Each filter may be included in pipeline by two different ways. First one, by adding filter ID to this structure. In this case, default filter parameters are used. Second one, by attaching filter configuration structure directly to the [mfxVideoParam](#) structure. In this case, adding filter ID to `mfxExtVPPDoUse` structure is optional. See “Table 4 Configurable VPP filters” for complete list of configurable filters, their IDs and configuration structures.

The user can attach this structure to the [mfxVideoParam](#) structure when initializing video processing.

NOTE: [MFX_EXTBUFF_VPP_COMPOSITE](#) cannot be enabled using `mfxExtVPPDoUse` because default parameters are undefined for this filter. Application must attach appropriate filter configuration structure directly to the [mfxVideoParam](#) structure to enable it.

Members



Header.BufferId	Must be MFX_EXTBUFF_VPP_DOUSE
NumAlg	Number of filters (algorithms) to use
AlgList	Pointer to a list of filters (algorithms) to use

Change History

This structure is available since SDK API 1.3.

mfxExtVPPFrameRateConversion

Definition

```
typedef struct {  
    mfxExtBuffer      Header;  
    mfxU16             Algorithm;  
    mfxU16             reserved;  
    mfxU32             reserved2[15];  
} mfxExtVPPFrameRateConversion;
```

Description

The `mfxExtVPPFrameRateConversion` structure configures the **VPP** frame rate conversion filter. The user can attach this structure to the [mfxVideoParam](#) structure when initializing video processing, resetting it or query its capability.

On some platforms advanced frame rate conversion algorithm, algorithm based on frame interpolation, is not supported. To query its support the application should add `MFX_FRCALGM_FRAME_INTERPOLATION` flag to `Algorithm` value in `mfxExtVPPFrameRateConversion` structure, attach it to [mfxVideoParam](#) structure and call [MFXVideoVPP_Query](#) function. If filter is supported the function returns `MFX_ERR_NONE` status and copies content of input structure to output one. If advanced filter is not supported then simple filter will be used and function returns `MFX_WRN_INCOMPATIBLE_VIDEO_PARAM`, copies content of input structure to output one and corrects `Algorithm` value.

If advanced FRC algorithm is not supported both [MFXVideoVPP_Init](#) and [MFXVideoVPP_Reset](#) functions returns `MFX_WRN_INCOMPATIBLE_VIDEO_PARAM` status.

Members

Header.BufferId	Must be MFX_EXTBUFF_VPP_FRAME_RATE_CONVERSION .
Algorithm	See the FrcAlgm enumerator for a list of frame rate conversion

algorithms.

Change History

This structure is available since SDK API 1.3.

mfExtVPPProcAmp

Definition

```
typedef struct {
    mfExtBuffer      Header;

    mfxF64           Brightness;
    mfxF64           Contrast;
    mfxF64           Hue;
    mfxF64           Saturation;
} mfExtVPPProcAmp;
```

Description

The `mfExtVPPProcAmp` structure is a hint structure that configures the **VPP** ProcAmp filter algorithm. The structure parameters will be clipped to their corresponding range and rounded by their corresponding increment.

Members

<code>Header.BufferId</code>	Must be <u>MF_EXTBUFF_VPP_PROCA</u>
<code>Brightness</code>	The brightness parameter is in the range of -100.0F to 100.0F, in increments of 0.1F. The default brightness value is 0.0F.
<code>Contrast</code>	The contrast parameter is in the range of 0.0F to 10.0F, in increments of 0.01F. The default contrast value is 1.0F.
<code>Hue</code>	The hue parameter is in the range of -180F to 180F, in increments of 0.1F. The default hue value is 0.0F.
<code>Saturation</code>	The saturation parameter is in the range of 0.0F to 10.0F, in increments of 0.01F. The default saturation value is 1.0F.

Change History

This structure is available since SDK API 1.1.

mfxExtVPPImageStab

Definition

```
typedef struct {
    mfxExtBuffer    Header;
    mfxU16    Mode;
    mfxU16    reserved[11];
} mfxExtVPPImageStab;
```

Description

The `mfxExtVPPImageStab` structure is a hint structure that configures the **VPP** image stabilization filter.

On some platforms this filter is not supported. To query its support, the application should use the same approach that it uses to configure VPP filters - by adding filter ID to [mfxExtVPPDoUse](#) structure or by attaching `mfxExtVPPImageStab` structure directly to the [mfxVideoParam](#) structure and calling [MFXVideoVPP_Query](#) function. If this filter is supported function returns `MFX_ERR_NONE` status and copies content of input structure to output one. If filter is not supported function returns `MFX_WRN_FILTER_SKIPPED`, removes filter from [mfxExtVPPDoUse](#) structure and zeroes `mfxExtVPPImageStab` structure.

If image stabilization filter is not supported, both [MFXVideoVPP_Init](#) and [MFXVideoVPP_Reset](#) functions returns `MFX_WRN_FILTER_SKIPPED` status.

The application can retrieve list of active filters by attaching [mfxExtVPPDoUse](#) structure to [mfxVideoParam](#) structure and calling [MFXVideoVPP_GetVideoParam](#) function. The application must allocate enough memory for filter list.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_IMAGE_STABILIZATION
<code>Mode</code>	Specify the image stabilization mode. It should be one of the next values: <code>MFX_IMAGESTAB_MODE_UPSCALE</code> <code>MFX_IMAGESTAB_MODE_BOXING</code>

Change History

This structure is available since SDK API 1.6.

mfxExtVPPComposite

Definition

```
typedef struct mfxVPPCompInputStream {
    mfxU32    DstX;
```

```

        mfxU32   DstY;
        mfxU32   DstW;
        mfxU32   DstH;

        mfxU16   LumaKeyEnable;
        mfxU16   LumaKeyMin;
        mfxU16   LumaKeyMax;

        mfxU16   GlobalAlphaEnable;
        mfxU16   GlobalAlpha;

        mfxU16   PixelAlphaEnable;

        mfxU16   reserved2[18];
    } mfxVPPCompInputStream;

typedef struct {
    mfxExtBuffer    Header;

    /* background color*/
    union {
        mfxU16      Y;
        mfxU16      R;
    };
    union {
        mfxU16      U;
        mfxU16      G;
    };
    union {
        mfxU16      V;
        mfxU16      B;
    };

    mfxU16          reserved1[24];

    mfxU16          NumInputStream;
    mfxVPPCompInputStream *InputStream;
} mfxExtVPPComposite;

```

Description

The `mfxExtVPPComposite` structure is used to control composition of several input surfaces in the one output. In this mode, the VPP skips any other filters. The VPP returns error if any mandatory filter is specified and filter skipped warning for optional filter. The only supported filters are deinterlacing and interlaced scaling. The only supported combinations of input and output color formats are:

- RGB to RGB,
- NV12 to NV12,
- RGB and NV12 to NV12, for per pixel alpha blending use case.

The VPP returns `MFX_ERR_MORE_DATA` for additional input until an output is ready. When the output is ready, VPP returns `MFX_ERR_NONE`. The application must process the output frame after synchronization.



Composition process is controlled by:

- **mfxFrameInfo::CropXYWH** in input surface- defines location of picture in the input frame,
- **InputStream[i].DstXYWH** - defines location of the cropped input picture in the output frame,
- **mfxFrameInfo::CropXYWH** in output surface - defines actual part of output frame. All pixels in output frame outside this region will be filled by specified color.

If the application uses composition process on video streams with different frame sizes, the application should provide maximum frame size in **mfxVideoParam** during initialization, reset or query operations.

If the application uses composition process, **MFXVideoVPP_QueryIOSurf** function returns cumulative number of input surfaces, i.e. number required to process all input video streams. The function sets frame size in the **mfxFrameAllocRequest** equal to the size provided by application in the **mfxVideoParam**.

Composition process supports all types of surfaces, but opaque type has next limitations:

- all input surfaces should have the same size,
- all input surfaces should have the same color format,
- all input surfaces should be described in one **mfxExtOpaqueSurfaceAlloc** structure.

All input surfaces should have the same type and color format, except per pixel alpha blending case, where it is allowed to mix NV12 and RGB surfaces.

There are three different blending use cases:

1. Luma keying. In this case, all input surfaces should have NV12 color format specified during VPP initialization. Part of each surface, including first one, may be rendered transparent by using **LumaKeyEnable**, **LumaKeyMin** and **LumaKeyMax** values.
2. Global alpha blending. In this case, all input surfaces should have the same color format specified during VPP initialization. It should be either NV12 or RGB. Each input surface, including first one, can be blended with underling surfaces by using **GlobalAlphaEnable** and **GlobalAlpha** values.
3. Per pixel alpha blending. In this case, it is allowed to mix NV12 and RGB input surfaces. Each RGB input surface, including first one, can be blended with underling surfaces by using **PixelAlphaEnable** value.

It is not allowed to mix different blending use cases in the same function call.

Members

<code>Header.BufferId</code>	Must be <u>MFX_EXTBUFF_VPP_COMPOSITE</u>
<code>Y, U, V</code> <code>R, G, B</code>	background color, may be changed dynamically through Reset. No default value. YUV black is (0;128;128) or (16;128;128) depending on the sample range. The SDK uses YUV or RGB triple depending on output color format.
<code>NumInputStream</code>	Number of input surfaces to compose one output. May be changed dynamically at runtime through Reset. Number of surfaces can be decreased or increased, but should not exceed number specified during initialization. Query mode 2 should be used to find maximum supported number.



<code>InputStream</code>	This array of <code>mfxVPPCompInputStream</code> structures describes composition of input video streams. It should consist of exactly <code>NumInputStream</code> elements.
<code>DstX,</code> <code>DstY,</code> <code>DstW,</code> <code>DstH</code>	Location of input stream in output surface.
<code>LumaKeyEnable</code>	None zero value enables luma keying for the input stream. Luma keying is used to mark some of the areas of the frame with specified luma values as transparent. It may be used for closed captioning, for example.
<code>LumaKeyMin,</code> <code>LumaKeyMax</code>	Minimum and maximum values of luma key, inclusive. Pixels whose luma values fit in this range are rendered transparent.
<code>GlobalAlphaEnable</code>	None zero value enables global alpha blending for this input stream.
<code>GlobalAlpha</code>	Alpha value for this stream in [0..255] range. 0 – transparent, 255 – opaque.
<code>PixelAlphaEnable</code>	None zero value enables per pixel alpha blending for this input stream. The stream should have RGB color format.

Change History

This structure is available since SDK API 1.8.

The SDK API 1.9 adds `LumaKeyEnable`, `LumaKeyMin`, `LumaKeyMax`, `GlobalAlphaEnable`, `GlobalAlpha` and `PixelAlphaEnable` fields.

mfxExtVPPVideoSignalInfo

Definition

```
/* TransferMatrix */
enum {
    MFX_TRANSFERMATRIX_UNKNOWN = 0,
    MFX_TRANSFERMATRIX_BT709   = 1,
    MFX_TRANSFERMATRIX_BT601   = 2
};

/* NominalRange */
enum {
    MFX_NOMINALRANGE_UNKNOWN   = 0,
    MFX_NOMINALRANGE_0_255     = 1,
    MFX_NOMINALRANGE_16_235    = 2
}
```

```
};

typedef struct {
    mfxExtBuffer    Header;
    mfxU16          reserved1[4];

    union {
        struct { // Init
            struct {
                mfxU16  TransferMatrix;
                mfxU16  NominalRange;
                mfxU16  reserved2[6];
            } In, Out;
        };
        struct { // Runtime
            mfxU16  TransferMatrix;
            mfxU16  NominalRange;
            mfxU16  reserved3[14];
        };
    };
} mfxExtVPPVideoSignalInfo;
```

Description

The `mfxExtVPPVideoSignalInfo` structure is used to control transfer matrix and nominal range of YUV frames. The application should provide it during initialization. It is supported for all kinds of conversion YUV->YUV, YUV->RGB, RGB->YUV.

This structure is used by VPP only and is not compatible with `mfxExtVideoSignalInfo`.

Members

Header.BufferId	Must be MFX_EXTBUFF_VPP_VIDEO_SIGNAL_INFO
TransferMatrix	Transfer matrix
NominalRange	Nominal range

Change History

This structure is available since SDK API 1.8.

mfxExtEncoderCapability

Definition

```
typedef struct {
    mfxExtBuffer Header;
```



```
    mfxU32      MBPerSec;
    mfxU16      reserved[58];
} mfxExtEncoderCapability;
```

Description

The `mfxExtEncoderCapability` structure is used to retrieve SDK encoder capability. See description of mode 4 of the [MFXVideoENCODE_Query](#) function for details how to use this structure.

Not all implementations of the SDK encoder support this extended buffer. The application has to use query mode 1 to determine if such functionality is supported. To do so, the application has to attach this extended buffer to [mfxVideoParam](#) structure and call [MFXVideoENCODE_Query](#) function. If function returns `MFX_ERR_NONE` then such functionality is supported.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_ENCODER_CAPABILITY
<code>MBPerSec</code>	Specify the maximum processing rate in macro blocks per second.

Change History

This structure is available since SDK API 1.7.

mfxExtEncoderResetOption

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      StartNewSequence;
    mfxU16      reserved[11];
} mfxExtEncoderResetOption;
```

Description

The `mfxExtEncoderResetOption` structure is used to control the SDK encoder behavior during reset. By using this structure, the application instructs the SDK encoder to start new coded sequence after reset or continue encoding of current sequence.

This structure is also used in mode 3 of [MFXVideoENCODE_Query](#) function to check for reset outcome before actual reset. The application should set `StartNewSequence` to required behavior and call query function. If query fails, see status codes below, then such reset is not possible in current encoder state. If the application sets `StartNewSequence` to `MFX_CODINGOPTION_UNKNOWN` then query function replaces it by actual reset type: `MFX_CODINGOPTION_ON` if the SDK encoder will begin new sequence after reset or



`MFX_CODINGOPTION_OFF` if the SDK encoder will continue current sequence.

Using this structure may cause next status codes from [MFXVideoENCODE_Reset](#) and [MFXVideoENCODE_Query](#) functions:

- `MFX_ERR_INVALID_VIDEO_PARAM` - if such reset is not possible. For example, the application sets `StartNewSequence` to off and requests resolution change.
- `MFX_ERR_INCOMPATIBLE_VIDEO_PARAM` - if the application requests change that leads to memory allocation. For example, the application set `StartNewSequence` to on and requests resolution change to bigger than initialization value.
- `MFX_ERR_NONE` - if such reset is possible.

There is limited list of parameters that can be changed without starting a new coded sequence:

- bitrate parameters, `TargetKbps` and `MaxKbps` in the [mfxInfoMFX](#) structure.
- number of slices, `NumSlice` in the [mfxInfoMFX](#) structure. Number of slices should be equal or less than number of slices during initialization.
- number of temporal layers in [mfxExtAvcTemporalLayers](#) structure. Reset should be called immediately before encoding of frame from base layer and number of reference frames should be big enough for new temporal layers structure.
- Quantization parameters, `QPI`, `QPP` and `QPB` in the [mfxInfoMFX](#) structure.

As it is described in Configuration Change chapter, the application should retrieve all cached frames before calling reset. When query function checks for reset outcome, it expects that this requirement be satisfied. If it is not true and there are some cached frames inside the SDK encoder, then query result may differ from reset one, because the SDK encoder may insert IDR frame to produce valid coded sequence.

Not all implementations of the SDK encoder support this extended buffer. The application has to use query mode 1 to determine if such functionality is supported. To do so, the application has to attach this extended buffer to [mfxVideoParam](#) structure and call [MFXVideoENCODE_Query](#) function. If function returns `MFX_ERR_NONE` then such functionality is supported.

See also Appendix C: Streaming and Video Conferencing Features.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_ENCODER_RESET_OPTION
<code>StartNewSequence</code>	<p>Instructs encoder to start new sequence after reset. It is one of the CodingOptionValue options:</p> <p><code>MFX_CODINGOPTION_ON</code> – the SDK encoder completely reset internal state and begins new coded sequence after reset, including insertion of IDR frame, sequence and picture headers.</p> <p><code>MFX_CODINGOPTION_OFF</code> – the SDK encoder continues encoding of current coded sequence after reset, without insertion of IDR frame.</p> <p><code>MFX_CODINGOPTION_UNKNOWN</code> – depending on the current encoder state and changes in configuration parameters the SDK encoder may or may not start new coded sequence. This value is also used to</p>

query reset outcome.

Change History

This structure is available since SDK API 1.7.

mfxExtAVCEncodedFrameInfo

Definition

```
typedef struct {
    mfxExtBuffer    Header;

    mfxU32          FrameOrder;
    mfxU16          PicStruct;
    mfxU16          LongTermIdx;
    mfxU32          MAD;
    mfxU16          BRCPanicMode;
    mfxU16          QP;
    mfxU32          SecondFieldOffset;
    mfxU16          reserved[2];

    struct {
        mfxU32      FrameOrder;
        mfxU16      PicStruct;
        mfxU16      LongTermIdx;
        mfxU16      reserved[4];
    } UsedRefListL0[32], UsedRefListL1[32];
} mfxExtAVCEncodedFrameInfo;
```

Description

The `mfxExtAVCEncodedFrameInfo` is used by the SDK encoder to report additional information about encoded picture. The application can attach this buffer to the [mfxBitstream](#) structure before calling [MFXVideoENCODE EncodeFrameAsync](#) function. For interlaced content the SDK encoder requires two such structures. They correspond to fields in encoded order.

Not all implementations of the SDK encoder support this extended buffer. The application has to use query mode 1 to determine if such functionality is supported. To do so, the application has to attach this extended buffer to [mfxVideoParam](#) structure and call [MFXVideoENCODE Query](#) function. If function returns `MFX_ERR_NONE` then such functionality is supported.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_ENCODED_FRAME_INFO
<code>FrameOrder</code>	Frame order of encoded picture.



<code>PicStruct</code>	Picture structure of encoded picture.
<code>LongTermIdx</code>	Long term index of encoded picture if applicable.
<code>MAD</code>	Mean Absolute Difference between original pixels of the frame and motion compensated (for inter macroblocks) or spatially predicted (for intra macroblocks) pixels. Only luma component, Y plane, is used in calculation.
<code>BRCPanicMode</code>	Bitrate control was not able to allocate enough bits for this frame. Frame quality may be unacceptably low.
<code>QP</code>	Luma QP.
<code>SecondFieldOffset</code>	Offset to second field. Second field starts at <code>mfxBitstream::Data + mfxBitstream::DataOffset + mfxExtAVCEncodedFrameInfo::SecondFieldOffset</code>
<code>UsedRefListL0</code> <code>UsedRefListL1</code>	Reference lists that have been used to encode picture.
<code>FrameOrder</code>	Frame order of reference picture.
<code>PicStruct</code>	Picture structure of reference picture.
<code>LongTermIdx</code>	Long term index of reference picture if applicable.

Change History

This structure is available since SDK API 1.7.

The SDK API 1.8 adds `MAD` and `BRCPanicMode` fields.

The SDK API 1.9 adds `SecondFieldOffset` fields.

mfxExtEncoderROI

Definition

```
/* ROI QP adjustment mode */
enum {
    MFX_ROI_MODE_PRIORITY = 0,
    MFX_ROI_MODE_QP_DELTA = 1
};

typedef struct {
    mfxExtBuffer    Header;

    mfxU16    NumROI;
    mfxU16    ROIMode;
    mfxU16    reserved1[10];
}
```

```

struct {
    mfxU32 Left;
    mfxU32 Top;
    mfxU32 Right;
    mfxU32 Bottom;

    union {
        mfxI16 Priority;
        mfxI16 DeltaQP;
    };
    mfxU16 reserved2[7];
} ROI[256];
} mfxExtEncoderROI;

```

Description

The `mfxExtEncoderROI` structure is used by the application to specify different Region Of Interests during encoding. It may be used at initialization or at runtime.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_ENCODER_ROI
<code>NumROI</code>	Number of ROI descriptions in array. The Query function mode 2 returns maximum supported value (set it to 256 and Query will update it to maximum supported value).
<code>ROIMode</code>	QP adjustment mode for ROIs. Defines if Priority or DeltaQP is used during encoding in BRC mode (only CBR and VBR are affected). For CQP rate control mode DeltaQP is always used for ROI encoding.
<code>ROI</code>	Array of ROIs. Different ROI may overlap each other. If macroblock belongs to several ROI, Priority from ROI with lowest index is used.
<code>Left,</code> <code>Top,</code> <code>Right,</code> <code>Bottom</code>	ROI location. Should be aligned to MB boundaries (should be dividable by 16). If not, the SDK encoder truncates it to MB boundaries, for example, both 17 and 31 will be truncated to 16.
<code>DeltaQP</code>	Delta QP of ROI. Used if ROIMode = <code>MFX_ROI_MODE_QP_DELTA</code> . This is absolute value in the -51...51 range, which will be added to the MB QP. Lesser value produces better quality.
<code>Priority</code>	Priority of ROI. Used if ROIMode = <code>MFX_ROI_MODE_PRIORITY</code> . For VBR, CBR and AVBR modes, this is relative priority of the region in the -3...3 range. Bigger value produces better quality.

Change History



This structure is available since SDK API 1.8.

The SDK API 1.22 adds `ROI Mode` & `DeltaQP` fields.

mfxExtVPPDeinterlacing

Definition

```
typedef struct {  
    mfxExtBuffer    Header;  
    mfxU16    Mode;  
    mfxU16    TelecinePattern;  
    mfxU16    TelecineLocation;  
    mfxU16    reserved[9];  
} mfxExtVPPDeinterlacing;
```

Description

The `mfxExtVPPDeinterlacing` structure is used by the application to specify different deinterlacing algorithms.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_DEINTERLACING
<code>Mode</code>	Deinterlacing algorithm. See the DeinterlacingMode enumerator for details.
<code>TelecinePattern</code>	Specifies telecine pattern when <code>Mode = MFX_DEINTERLACING_FIXED_TELECINE_PATTERN</code> . See the TelecinePattern enumerator for details.
<code>TelecineLocation</code>	Specifies position inside a sequence of 5 frames where the artifacts start when <code>TelecinePattern = MFX_TELECINE_POSITION_PROVIDED</code> .

Change History

This structure is available since SDK API 1.8.

The SDK API 1.13 adds `TelecinePattern` and `TelecineLocation` fields.

mfxFrameAllocator

Definition

```
typedef struct {
```



```

mfxU32      reserved[4];
mfxHDL      pthis;
mfxStatus   (*Alloc)(mfxHDL pthis, mfxFrameAllocRequest *request,
mfxFrameAllocResponse *response);
mfxStatus   (*Lock)(mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr);
mfxStatus   (*Unlock)(mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr);
mfxStatus   (*GetHDL)(mfxHDL pthis, mfxMemId mid, mfxHDL *handle);
mfxStatus   (*Free)(mfxHDL pthis, mfxFrameAllocResponse *response);
} mfxFrameAllocator;

```

Description

The `mfxFrameAllocator` structure describes the callback functions `Alloc`, `Lock`, `Unlock`, `GetHDL` and `Free` that the SDK implementation might use for allocating internal frames. Applications that operate on OS-specific video surfaces must implement these callback functions.

Using the default allocator implies that frame data passes in or out of SDK functions through pointers, as opposed to using memory IDs.

The SDK behavior is undefined when using an incompletely defined external allocator. See the section [Memory Allocation and External Allocators](#) for additional information.

Members

<code>pthis</code>	Pointer to the allocator object
<u>Alloc</u>	Pointer to the function that allocates frames
<u>Lock</u>	Pointer to the function that locks a frame and obtain its pointers
<u>Unlock</u>	Pointer to the function that unlocks a frame; after unlocking, any pointers to the frame are invalid.
<u>GetHDL</u>	Pointer to the function that obtains the OS-specific handle
<u>Free</u>	Pointer to the function that de-allocates a frame

Change History

This structure is available since SDK API 1.0.

Alloc

Syntax



```
mfxStatus (*Alloc)(mfxHDL pthis, mfxFrameAllocRequest *request,  
mfxFrameAllocResponse *response);
```

Parameters

pthis	Pointer to the allocator object
request	Pointer to the mfxFrameAllocRequest structure that specifies the type and number of required frames
response	Pointer to the mfxFrameAllocResponse structure that retrieves frames actually allocated

Description

This function allocates surface frames. For decoders, [MFXVideoDECODE_Init](#) calls `Alloc` only once. That call includes all frame allocation requests. For encoders, [MFXVideoENCODE_Init](#) calls `Alloc` twice: once for the input surfaces and again for the internal reconstructed surfaces.

If two SDK components must share DirectX* surfaces, this function should pass the pre-allocated surface chain to SDK instead of allocating new DirectX surfaces. See the **Error! Reference source not found.** section for additional information.

Return Status

<code>MFX_ERR_NONE</code>	The function successfully allocated the memory block.
<code>MFX_ERR_MEMORY_ALLOC</code>	The function failed to allocate the video frames.
<code>MFX_ERR_UNSUPPORTED</code>	The function does not support allocating the specified type of memory.

Change History

This function is available since SDK API 1.0.

Free

Syntax

```
mfxStatus (*Free)(mfxHDL pthis, mfxFrameAllocResponse *response);
```

Parameters

pthis	Pointer to the allocator object
response	Pointer to the mfxFrameAllocResponse structure



returned by the [Alloc](#) function

Description

This function de-allocates all allocated frames.

Return Status

MFx_ERR_NONE

The function successfully de-allocated the memory block.

Change History

This function is available since SDK API 1.0.

Lock

Syntax

```
mfxStatus (*Lock)(mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID
<code>ptr</code>	Pointer to the returned frame structure

Description

This function locks a frame and returns its pointer.

Return Status

MFx_ERR_NONE

The function successfully locked the memory block.

MFx_ERR_LOCK_MEMORY

This function failed to lock the frame.

Change History

This function is available since SDK API 1.0.

Unlock

Syntax



```
mfxStatus (*Unlock) (mfxHDL pthis, mfxMemId mid, mfxFrameData *ptr);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID
<code>ptr</code>	Pointer to the frame structure; This pointer can be NULL.

Description

This function unlocks a frame and invalidates the specified frame structure.

Return Status

<code>MFX_ERR_NONE</code>	The function successfully unlocked the frame.
---------------------------	---

Change History

This function is available since SDK API 1.0.

GetHDL

Syntax

```
mfxStatus (*GetHDL) (mfxHDL pthis, mfxMemId mid, mfxHDL *hdl);
```

Parameters

<code>pthis</code>	Pointer to the allocator object
<code>mid</code>	Memory block ID
<code>hdl</code>	Pointer to the returned OS-specific handle

Description

This function returns the OS-specific handle associated with a video frame. If the handle is a COM interface, the reference counter must increase. The SDK will release the interface afterward.

Return Status

<code>MFX_ERR_NONE</code>	The function successfully returned the OS-specific handle.
---------------------------	--



MFx_ERR_UNSUPPORTED

The function does not support obtaining OS-specific handle.

Change History

This function is available since SDK API 1.0.

mfxFrameAllocRequest

Definition

```
typedef struct {
    union {
        mfxU32  AllocId;
        mfxU32  reserved[1];
    };
    mfxU32  reserved3[3];
    mfxFrameInfo    Info;
    mfxU16  Type;    /* decoder or processor render targets */
    mfxU16  NumFrameMin;
    mfxU16  NumFrameSuggested;
    mfxU16  reserved2;
} mfxFrameAllocRequest;
```

Description

The `mfxFrameAllocRequest` structure describes multiple frame allocations when initializing encoders, decoders and video preprocessors. A range specifies the number of video frames. Applications are free to allocate additional frames. In any case, the minimum number of frames must be at least `NumFrameMin` or the called function will return an error.

Members

<code>AllocId</code>	Unique (within the session) ID of component requested the allocation.
<code>Info</code>	Describes the properties of allocated frames
<code>Type</code>	Allocated memory type; see the ExtMemFrameType enumerator for details.

<code>NumFrameMin</code>	Minimum number of allocated frames
<code>NumFrameSuggested</code>	Suggested number of allocated frames

Change History

This structure is available since SDK API 1.0.

The SDK API 1.16 adds `AllocId` field.

mfxFrameAllocResponse

Definition

```
typedef struct {  
    mfxU32      AllocId;  
    mfxU32      reserved[3];  
    mfxMemId     *mids;      /* the array allocated by application */  
    mfxU16      NumFrameActual;  
    mfxU16      reserved2;  
} mfxFrameAllocResponse;
```

Description

The `mfxFrameAllocResponse` structure describes the response to multiple frame allocations. The calling function returns the number of video frames actually allocated and pointers to their memory IDs.

Members

<code>AllocId</code>	Unique (within the session) ID of component requested the allocation.
<code>mids</code>	Pointer to the array of the returned memory IDs; the application allocates or frees this array.
<code>NumFrameActual</code>	Number of frames actually allocated

Change History

This structure is available since SDK API 1.0.

The SDK API 1.16 adds `AllocId` field.

mfxFrameData

Definition

```
typedef struct {
    union {
        mfxExtBuffer **ExtParam;
        mfxU64         reserved2;
    };
    mfxU16  NumExtParam;

    mfxU16    reserved[9];
    mfxU16    MemType;
    mfxU16    PitchHigh;

    mfxU64    TimeStamp;
    mfxU32    FrameOrder;
    mfxU16    Locked;
    union{
        mfxU16  Pitch;
        mfxU16  PitchLow;
    };

    /* color planes */
    union {
        mfxU8    *Y;
        mfxU8    *R;
    };
    union {
        mfxU8    *UV;           /* for UV merged formats */
        mfxU8    *VU;           /* for VU merged formats */
        mfxU8    *CbCr;         /* for CbCr merged formats */
        mfxU8    *CrCb;         /* for CrCb merged formats */
        mfxU8    *Cb;
        mfxU8    *U;
        mfxU8    *G;
    };
};
```

```
};
union {
    mfxU8    *Cr;
    mfxU8    *V;
    mfxU8    *B;
};
mfxU8        *A;
mfxMemId     MemId;

/* Additional Flags */
mfxU16    Corrupted;
mfxU16    DataFlag;
} mfxFrameData;
```

Description

The `mfxFrameData` structure describes frame buffer pointers.

Members

TimeStamp	Time stamp of the video frame in units of 90KHz (divide <code>TimeStamp</code> by 90,000 (90 KHz) to obtain the time in seconds). A value of MF_X_TIMESTAMP_UNKNOWN indicates that there is no time stamp.
Pitch	Deprecated.
PitchHigh, PitchLow	Distance in bytes between the start of two consecutive rows in a frame.
FrameOrder	Current frame counter for the top field of the current frame; an invalid value of MF_X_FRAMEORDER_UNKNOWN indicates that SDK functions that generate the frame output do not use this frame.
Locked	Counter flag for the application; if <code>Locked</code> is greater than zero then the application locks the frame or field pair. Do not move, alter or delete the frame.
Y, U, V, A; R, G, B, A; Y, Cr, Cb, A; Y, CbCr; Y, CrCb; Y, UV;	Data pointers to corresponding color channels. The frame buffer pointers must be 16-byte aligned. The application has to specify pointers to all color channels even for packed formats. For example, for YUY2 format the application has to specify Y, U and V pointers. For RGB32 – R, G, B and A pointers.



Y, VU;

MemId Memory ID of the data buffers; if any of the preceding data pointers is non-zero then the SDK ignores `MemId`.

DataFlag Additional flags to indicate frame data properties. See the [FrameDataFlag](#) enumerator for details.

Corrupted Some part of the frame or field pair is corrupted. See the [Corruption](#) enumerator for details.

NumExtParam The number of extra configuration structures attached to this structure.

ExtParam Points to an array of pointers to the extra configuration structures; see the [ExtendedBufferID](#) enumerator for a list of extended configurations.

MemType Allocated memory type; see the [ExtMemFrameType](#) enumerator for details. Used for better integration of 3rd party plugins into SDK pipeline.

Change History

This structure is available since SDK API 1.0.

SDK API 1.3 extended the `Corrupted` and `DataFlag` fields.

SDK 1.8 replaced `Pitch` by `PitchHigh` and `PitchLow` fields.

SDK API 1.11 added `NumExtParam` and `ExtParam` fields.

SDK API 1.19 added `MemType` field.

mfxFrameInfo

Definition

```
typedef struct {
    mfxU32  reserved[4];
    mfxU16  reserved4;
    mfxU16  BitDepthLuma;
    mfxU16  BitDepthChroma;
    mfxU16  Shift;

    mfxFrameId FrameId;

    mfxU32  FourCC;
    union {
        struct { /* Frame parameters */
            mfxU16  Width;
```



```

        mfxU16  Height;

        mfxU16  CropX;
        mfxU16  CropY;
        mfxU16  CropW;
        mfxU16  CropH;
    };
    struct { /* Buffer parameters (for plain formats like P8) */
        mfxU64  BufferSize;
        mfxU32  reserved5;
    };
};

mfxU32  FrameRateExtN;
mfxU32  FrameRateExtD;
mfxU16  reserved3;

mfxU16  AspectRatioW;
mfxU16  AspectRatioH;

mfxU16  PicStruct;
mfxU16  ChromaFormat;
mfxU16  reserved2;
} mfxFrameInfo;

```

Description

The `mfxFrameInfo` structure specifies properties of video frames. See also Appendix A: Configuration Parameter Constraints.

Members

<code>BitDepthLuma</code>	<p>Number of bits used to represent luma samples.</p> <p>Not all codecs and SDK implementations support this value. Use <code>Query</code> function to check if this feature is supported.</p>
<code>BitDepthChroma</code>	<p>Number of bits used to represent chroma samples.</p> <p>Not all codecs and SDK implementations support this value. Use <code>Query</code> function to check if this feature is supported.</p>
<code>Shift</code>	<p>When not zero indicates that values of luma and chroma samples are shifted. Use <code>BitDepthLuma</code> and <code>BitDepthChroma</code> to calculate shift size. Use zero value to indicate absence of shift.</p>

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	Valid Data									

Data alignment for Shift = 0



Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Valid Data										0	0	0	0	0	0

Data alignment for Shift != 0

Not all codecs and SDK implementations support this value. Use `Query` function to check if this feature is supported.

FourCC	FourCC code of the color format; see the ColorFourCC enumerator for details.
Width	Width and height of the video frame in pixels; <code>Width</code> must be a multiple of 16. <code>Height</code> must be a multiple of 16 for progressive frame sequence and a multiple of 32 otherwise.
Height	
CropX, CropY, CropW, CropH	Display the region of interest of the frame; specify the display width and height in mfxVideoParam .
BufferSize	Size of frame buffer in bytes. Valid only for plain formats (when FourCC is P8); Width, Height and crops in this case are invalid.
AspectRatioW	These parameters specify the sample aspect ratio. If sample aspect ratio is explicitly defined by the standards (see Table 6-3 in the MPEG-2 specification or Table E-1 in the H.264 specification), <code>AspectRatioW</code> and <code>AspectRatioH</code> should be the defined values. Otherwise, the sample aspect ratio can be derived as follows: $\text{AspectRatioW} = \text{display_aspect_ratio_width} * \text{display_height};$ $\text{AspectRatioH} = \text{display_aspect_ratio_height} * \text{display_width};$ For MPEG-2, the above display aspect ratio must be one of the defined values in Table 6-3. For H.264, there is no restriction on display aspect ratio values. If both parameters are zero, the encoder uses default value of sample aspect ratio.
AspectRatioH	
FrameRateExtN	Specify the frame rate by the formula: $\text{FrameRateExtN} / \text{FrameRateExtD}.$ For encoding, frame rate must be specified. For decoding, frame rate may be unspecified (<code>FrameRateExtN</code> and <code>FrameRateExtD</code> are all zeros.) In this case, the frame rate is default to 30 frames per second.
FrameRateExtD	
PicStruct	Picture type as specified in the PicStruct enumerator



`ChromaFormat` Color sampling method; the value of `ChromaFormat` is the same as that of [ChromaFormatIdc](#). `ChromaFormat` is not defined if `FourCC` is zero.

Change History

This structure is available since SDK API 1.0.

SDK API 1.9 added `BitDepthLuma`, `BitDepthChroma` and `Shift` fields.

SDK API 1.15 adds `BufferSize` field.

Remarks

See Appendix A for constraints of specifying certain parameters during SDK class initialization and operation.

mfxFrameSurface1

Definition

```
typedef struct {  
    mfxU32          reserved[4];  
    mfxFrameInfo    Info;  
    mfxFrameData    Data;  
} mfxFrameSurface1;
```

Description

The `mfxFrameSurface1` structure defines the uncompressed frames surface information and data buffers. The frame surface is in the frame or complementary field pairs of pixels up to four color-channels, in two parts: [mfxFrameInfo](#) and [mfxFrameData](#).

Members

`Info` [mfxFrameInfo](#) structure specifies surface properties

`Data` [mfxFrameData](#) structure describes the actual frame buffer.

Change History

This structure is available since SDK API 1.0.

mfxInfoMFX

Definition

```
typedef struct {
    mfxU32  reserved[7];

    mfxU16  LowPower;
    mfxU16  BRCParamMultiplier;

    mfxFrameInfo  FrameInfo;
    mfxU32  CodecId;
    mfxU16  CodecProfile;
    mfxU16  CodecLevel;
    mfxU16  NumThread;

    union {
        struct { /* Encoding Options */
            mfxU16  TargetUsage;

            mfxU16  GopPicSize;
            mfxU16  GopRefDist;
            mfxU16  GopOptFlag;
            mfxU16  IdRInterval;

            mfxU16  RateControlMethod;
            union {
                mfxU16  InitialDelayInKB;
                mfxU16  QPI;
                mfxU16  Accuracy;
            };
            mfxU16  BufferSizeInKB;
            union {
                mfxU16  TargetKbps;
                mfxU16  QPP;
                mfxU16  ICQQuality;
            };
            union {
                mfxU16  MaxKbps;
                mfxU16  QPB;
                mfxU16  Convergence;
            };
        };
    };
};
```



```

    };

    mfxU16  NumSlice;
    mfxU16  NumRefFrame;
    mfxU16  EncodedOrder;
};

struct { /* Decoding Options */
    mfxU16  DecodedOrder;
    mfxU16  ExtendedPicStruct;
    mfxU16  TimeStampCalc;
    mfxU16  SliceGroupsPresent;
    mfxU16  MaxDecFrameBuffering;
    mfxU16  EnableReallocRequest;
    mfxU16  reserved2[7];
};

struct { /* JPEG Decoding Options */
    mfxU16  JPEGChromaFormat;
    mfxU16  Rotation;
    mfxU16  JPEGColorFormat;
    mfxU16  InterleavedDec;
    mfxU8   SamplingFactorH[4];
    mfxU8   SamplingFactorV[4];
    mfxU16  reserved3[5];
};

struct { /* JPEG Encoding Options */
    mfxU16  Interleaved;
    mfxU16  Quality;
    mfxU16  RestartInterval;
    mfxU16  reserved5[10];
};

};

} mfxInfoMFX;

```

Description

This structure specifies configurations for decoding, encoding and transcoding processes. A zero value in any of these fields indicates that the field is not explicitly specified.

Members

<p><code>LowPower</code></p>	<p>For encoders set this flag to ON to reduce power consumption and GPU usage. See the CodingOptionValue enumerator for values of this option. Use <code>Query</code> function to check if this feature is</p>
------------------------------	--



supported.

<code>BRCParamMultiplier</code>	Specifies a multiplier for bitrate control parameters. Affects next four variables <code>InitialDelayInKB</code> , <code>BufferSizeInKB</code> , <code>TargetKbps</code> , <code>MaxKbps</code> . If this value is not equal to zero encoder calculates BRC parameters as value * <code>BRCParamMultiplier</code> .
<code>FrameInfo</code>	<code>mfxFrameInfo</code> structure that specifies frame parameters
<code>CodecId</code>	Specifies the codec format identifier in the FOURCC code; see the <code>CodecFormatFourCC</code> enumerator for details. This is a mandated input parameter for QueryIOSurf and Init functions.
<code>CodecProfile</code>	Specifies the codec profile; see the <code>CodecProfile</code> enumerator for details. Specify the codec profile explicitly or the SDK functions will determine the correct profile from other sources, such as resolution and bitrate.
<code>CodecLevel</code>	Codec level; see the <code>CodecLevel</code> enumerator for details. Specify the codec level explicitly or the SDK functions will determine the correct level from other sources, such as resolution and bitrate.
<code>GopPicSize</code>	Number of pictures within the current GOP (Group of Pictures); if <code>GopPicSize=0</code> , then the GOP size is unspecified. If <code>GopPicSize=1</code> , only I-frames are used. See Example 13 for pseudo-code that demonstrates how SDK uses this parameter.
<code>GopRefDist</code>	Distance between I- or P (or GPB) - key frames; if it is zero, the GOP structure is unspecified. Note: If <code>GopRefDist = 1</code> , there are no regular B-frames used (only P or GPB); if <code>mfxExtCodingOption3::GPB</code> is ON, GPB frames (B without backward references) are used instead of P. See Example 13 for pseudo-code that demonstrates how SDK uses this parameter.
<code>GopOptFlag</code>	ORs of the <code>GopOptFlag</code> enumerator indicate the additional flags for the GOP specification; see Example 13 for an example of pseudo-code that demonstrates how to use this parameter.
<code>IdrInterval</code>	<p>For H.264, <code>IdrInterval</code> specifies IDR-frame interval in terms of I-frames; if <code>IdrInterval=0</code>, then every I-frame is an IDR-frame. If <code>IdrInterval=1</code>, then every other I-frame is an IDR-frame, etc.</p> <p>For HEVC, if <code>IdrInterval=0</code>, then only first I-frame is an IDR-frame. If <code>IdrInterval=1</code>, then every I-frame is an IDR-frame. If <code>IdrInterval=2</code>, then every other I-frame is an IDR-frame, etc.</p> <p>For MPEG2, <code>IdrInterval</code> defines sequence header interval in terms of I-frames. If <code>IdrInterval=N</code>, SDK inserts the sequence header before every Nth I-frame. If <code>IdrInterval=0</code> (default), SDK inserts the sequence header once at the beginning of the</p>



stream.

If `GopPicSize` or `GopRefDist` is zero, `IdrInterval` is undefined.

<code>TargetUsage</code>	Target usage model that guides the encoding process; see the TargetUsage enumerator for details.
<code>RateControlMethod</code>	Rate control method; see the RateControlMethod enumerator for details.
<code>InitialDelayInKB</code> <code>TargetKbps</code> <code>MaxKbps</code>	<p>These parameters are for the constant bitrate (CBR), variable bitrate control (VBR) and CQP HRD algorithms.</p> <p>The SDK encoders follow the Hypothetical Reference Decoding (HRD) model. The HRD model assumes that data flows into a buffer of the fixed size <code>BufferSizeInKB</code> with a constant bitrate <code>TargetKbps</code>. (Estimate the targeted frame size by dividing the framerate by the bitrate.)</p> <p>The decoder starts decoding after the buffer reaches the initial size <code>InitialDelayInKB</code>, which is equivalent to reaching an initial delay of $\text{InitialDelayInKB} * 8000 / \text{TargetKbps}$ ms. Note: In this context, KB is 1000 bytes and Kbps is 1000 bps.</p> <p>If <code>InitialDelayInKB</code> or <code>BufferSizeInKB</code> is equal to zero, the value is calculated using bitrate, frame rate, profile, level, and so on.</p> <p><code>TargetKbps</code> must be specified for encoding initialization.</p> <p>For variable bitrate control, the <code>MaxKbps</code> parameter specifies the maximum bitrate at which the encoded data enters the Video Buffering Verifier (VBV) buffer. If <code>MaxKbps</code> is equal to zero, the value is calculated from bitrate, frame rate, profile, level, and so on.</p>
<code>QPI</code> , <code>QPP</code> , <code>QPB</code>	Quantization Parameters (<code>QP</code>) for <code>I</code> , <code>P</code> and <code>B</code> frames, respectively, for the constant <code>QP</code> (CQP) mode.
<code>TargetKbps</code> <code>Accuracy</code> <code>Convergence</code>	<p>These parameters are for the average variable bitrate control (AVBR) algorithm. The algorithm focuses on overall encoding quality while meeting the specified bitrate, <code>TargetKbps</code>, within the accuracy range <code>Accuracy</code>, after a <code>Convergence</code> period. This method does not follow HRD and the instant bitrate is not capped or padded.</p> <p>The <code>Accuracy</code> value is specified in the unit of tenth of percent. The <code>Convergence</code> value is specified in the unit of 100 frames. The <code>TargetKbps</code> value is specified in the unit of 1000 bits per second.</p>



ICQQuality	This parameter is for Intelligent Constant Quality (ICQ) bitrate control algorithm. It is value in the 1...51 range, where 1 corresponds the best quality.
BufferSizeInKB	BufferSizeInKB represents the maximum possible size of any compressed frames.
NumSlice	Number of slices in each video frame; each slice contains one or more macro-block rows. If NumSlice equals zero, the encoder may choose any slice partitioning allowed by the codec standard. See also <code>mfxExtCodingOption2::NumMbPerSlice</code> .
NumRefFrame	Number of reference frames; if NumRefFrame = 0, this parameter is not specified.
EncodedOrder	If not zero, EncodedOrder specifies that ENCODE takes the input surfaces in the encoded order and uses explicit frame type control. Application still must provide <code>GopRefDist</code> and <code>mfxExtCodingOption2::BRefType</code> so SDK can pack headers and build reference lists correctly.
NumThread	Deprecated; Used to represent the number of threads the underlying implementation can use on the host processor. Always set this parameter to zero.
DecodedOrder	Deprecated; Used to instruct the decoder to decoded output in the decoded order. Always set this parameter to zero.
ExtendedPicStruct	Instructs DECODE to output extended picture structure values for additional display attributes. See the PicStruct description for details.
TimeStampCalc	Time stamp calculation method; see the TimeStampCalc description for details.
SliceGroupsPresent	Nonzero value indicates that slice groups are present in the bitstream. Only AVC decoder uses this field.
MaxDecFrameBuffering	Nonzero value specifies the maximum required size of the decoded picture buffer in frames for AVC and HEVC decoders.
EnableReallocRequest	For decoders supporting dynamic resolution change (VP9), set this option to ON to allow <code>MFVideoDECODE_DecodeFrameAsync</code> return MFX_ERR_REALLOC_SURFACE . See the CodingOptionValue enumerator for values of this option. Use <code>Query</code> function to check if this feature is supported.

Change History



This structure is available since SDK API 1.0.

SDK API 1.1 extended the QPI, QPP, QPB fields.

SDK API 1.3 extended the Accuracy, Convergence, TimeStampCalc, ExtendedPicStruct and BRCParamMultiplier fields.

SDK API 1.6 added SliceGroupsPresent field.

SDK API 1.8 added ICQQuality field.

SDK API 1.15 adds LowPower field.

SDK API 1.16 adds MaxDecFrameBuffering field.

SDK API 1.19 adds EnableReallocRequest field.

```
mfxU16 get_gop_sequence (...) {
    pos=display_frame_order;
    if (pos == 0)
        return MFX_FRAMETYPE_I | MFX_FRAMETYPE_IDR | MFX_FRAMETYPE_REF;

    /* Only I-frames */
    If (GopPicSize == 1)
        return MFX_FRAMETYPE_I | MFX_FRAMETYPE_REF;

    if (GopPicSize == 0)
        frameInGOP = pos; //Unlimited GOP
    else
        frameInGOP = pos%GopPicSize;

    if (frameInGOP == 0)
        return MFX_FRAMETYPE_I | MFX_FRAMETYPE_REF;

    if (GopRefDist == 1 || GopRefDist == 0)    // Only I,P frames
        return MFX_FRAMETYPE_P | MFX_FRAMETYPE_REF;

    frameInPattern = (frameInGOP-1)%GopRefDist;
    if (frameInPattern == GopRefDist - 1)
        return MFX_FRAMETYPE_P | MFX_FRAMETYPE_REF;

    return MFX_FRAMETYPE_B;
}
```

Example 13: Pseudo-Code for GOP Structure Parameters

mfxInfoVPP

Definition

```
typedef struct _mfxInfoVPP {  
    mfxU32          reserved[8];  
    mfxFrameInfo     In;  
    mfxFrameInfo     Out;  
} mfxInfoVPP;
```

Description

The `mfxInfoVPP` structure specifies configurations for video processing. A zero value in any of the fields indicates that the corresponding field is not explicitly specified.

Members

In	Input format for video processing
Out	Output format for video processing

Change History

This structure is available since SDK API 1.0.

mfxInitParam

Definition

```
typedef struct {  
    mfxIMPL          Implementation;  
    mfxVersion       Version;  
    mfxU16          ExternalThreads;  
    union {  
        struct {  
            mfxExtBuffer **ExtParam;  
            mfxU16  NumExtParam;  
        };  
        mfxU16  reserved2[5];  
    };  
};
```



```

        mfxU16      GPUCopy;
        mfxU16      reserved[21];
    } mfxInitParam;

```

Description

The `mfxInitParam` structure specifies advanced initialization parameters. A zero value in any of the fields indicates that the corresponding field is not explicitly specified.

Members

Implementation	mfxIMPL enumerator that indicates the desired SDK implementation
Version	Structure which specifies minimum library version or zero, if not specified
ExternalThreads	Desired threading mode. Value 0 means internal threading, 1 – external.
NumExtParam	The number of extra configuration structures attached to this structure.
ExtParam	Points to an array of pointers to the extra configuration structures; see the ExtendedBufferID enumerator for a list of extended configurations.
GPUCopy	Enables or disables GPU accelerated copying between video and system memory in the SDK components. See the GPUCopy enumerator for a list of valid values.

Change History

This structure is available since SDK API 1.14.

The SDK API 1.15 adds `NumExtParam` and `ExtParam` fields.

The SDK API 1.16 adds `GPUCopy` field.

mfxPlatform

Definition

```

typedef struct {
    mfxU16 CodeName;
    mfxU16 DeviceId;
    mfxU16 reserved[14];
}

```



```
} mfxPlatform;
```

Description

The `mfxPlatform` structure contains information about hardware platform.

Members

CodeName	Intel® processor microarchitecture codename. See the PlatformCodeName enumerator for a list of possible values.
DeviceId	Reserved.

Change History

This structure is available since SDK API 1.19.

mfxPayload

Definition

```
typedef struct {  
    mfxU32    CtrlFlags;  
    mfxU32    reserved[3];  
    mfxU8     *Data;        /* buffer pointer */  
    mfxU32    NumBit;       /* number of bits */  
    mfxU16    Type;         /* SEI message type in H.264 or user data  
start_code in MPEG-2 */  
    mfxU16    BufSize;     /* payload buffer size in bytes */  
} mfxPayload;
```

Description

The `mfxPayload` structure describes user data payload in MPEG-2 or SEI message payload in H.264. For encoding, these payloads can be inserted into the bitstream. The payload buffer must contain a valid formatted payload. For H.264, this is the `sei_message()` as specified in the section 7.3.2.3.1 "Supplemental enhancement information message syntax" of the ISO*/IEC* 14496-10 specification. For MPEG-2, this is the section 6.2.2.2.2 "User data" of the ISO*/IEC* 13818-2 specification, excluding the user data `start_code`. For decoding, these payloads can be retrieved as the decoder parses the bitstream and caches them in an internal buffer.

Payloads insertion support in encoders:

Codec	Supported Types
-------	-----------------

MPEG2	0x01B2 //User Data
AVC	02 //pan_scan_rect 03 //filler_payload 04 //user_data_registered_itu_t_t35 05 //user_data_unregistered 06 //recovery_point 09 //scene_info 13 //full_frame_freeze 14 //full_frame_freeze_release 15 //full_frame_snapshot 16 //progressive_refinement_segment_start 17 //progressive_refinement_segment_end 19 //film_grain_characteristics 20 //deblocking_filter_display_preference 21 //stereo_video_info 45 //frame_packing_arrangement
HEVC	All

Members

Type	MPEG-2 user data start code or H.264 SEI message type
NumBit	Number of bits in the payload data
Data	Pointer to the actual payload data buffer
BufSize	Payload buffer size in bytes
CtrlFlags	Additional payload properties. See the PayloadCtrlFlags enumerator for details.

Change History

This structure is available since SDK API 1.0.

The SDK API 1.19 adds `CtrlFlags` field.

mfxVersion

Definition

```
typedef union _mfxVersion {
    struct {
        mfxU16      Minor;
```



```

        mfxU16      Major;
    };
    mfxU32      Version;
} mfxVersion;

```

Description

The `mfxVersion` structure describes the version of the SDK implementation.

Members

Version	SDK implementation version number
Major	Major number of the SDK implementation
Minor	Minor number of the SDK implementation

Change History

This structure is available since SDK API 1.0.

mfxVideoParam

Definition

```

typedef struct _mfxVideoParam {
    mfxU32      AllocId;
    mfxU32      reserved[2];
    mfxU16      reserved3;
    mfxU16      AsyncDepth;
    union {
        mfxInfoMFX      mfx;
        mfxInfoVPP      vpp;
    }
    mfxU16      Protected;
    mfxU16      IOPattern;
    mfxExtBuffer      **ExtParam;
    mfxU16      NumExtParam;
    mfxU16      reserved2;
} mfxVideoParam;

```



Description

The `mfxVideoParam` structure contains configuration parameters for encoding, decoding, transcoding and video processing.

Members

<code>AllocId</code>	Unique component ID that will be passed by SDK to <code>mfxFrameAllocRequest</code> . Useful in pipelines where several components of the same type share the same allocator.
<code>AsyncDepth</code>	Specifies how many asynchronous operations an application performs before the application explicitly synchronizes the result. If zero, the value is not specified.
<code>mfx</code>	Configurations related to encoding, decoding and transcoding; see the definition of the mfxInfoMFX structure for details.
<code>vpp</code>	Configurations related to video processing; see the definition of the mfxInfoVPP structure for details.
<code>Protected</code>	Specifies the content protection mechanism; this is a reserved parameter. Its value must be zero.
<code>IOPattern</code>	Input and output memory access types for SDK functions; see the enumerator IOPattern for details. The Query functions return the natively supported IOPattern if the Query input argument is <code>NULL</code> . This parameter is a mandated input for QueryIOSurf and Init functions. For DECODE , the output pattern must be specified; for ENCODE , the input pattern must be specified; and for VPP , both input and output pattern must be specified.
<code>NumExtParam</code>	The number of extra configuration structures attached to this structure.
<code>ExtParam</code>	<p>Points to an array of pointers to the extra configuration structures; see the ExtendedBufferID enumerator for a list of extended configurations.</p> <p>The list of extended buffers should not contain duplicated entries, i.e. entries of the same type. If <code>mfxVideoParam</code> structure is used to query the SDK capability, then list of extended buffers attached to input and output <code>mfxVideoParam</code> structure should be equal, i.e. should contain the same number of extended buffers of the same type.</p>

Change History

This structure is available since SDK API 1.0. SDK API 1.1 extended the `AsyncDepth` field. SDK API 1.17 adds `AllocId` field.

mfxVPPStat

Definition

```
typedef struct _mfxVPPStat {  
    mfxU32      reserved[16];  
    mfxU32      NumFrame;  
    mfxU32      NumCachedFrame;  
} mfxVPPStat;
```

Description

The `mfxVPPStat` structure returns statistics collected during video processing.

Members

<code>NumFrame</code>	Total number of frames processed
<code>NumCachedFrame</code>	Number of internally cached frames

Change History

This structure is available since SDK API 1.0.

mfxENCInput

Definition

```
typedef struct _mfxENCInput mfxENCInput;  
  
struct _mfxENCInput{  
    mfxU32  reserved[32];  
  
    mfxFrameSurface1 *InSurface;  
  
    mfxU16  NumFrameL0;  
    mfxFrameSurface1 **L0Surface;  
    mfxU16  NumFrameL1;  
    mfxFrameSurface1 **L1Surface;  
  
    mfxU16  NumExtParam;  
    mfxExtBuffer **ExtParam;  
};
```

Description

The `mfxENCInput` structure specifies input for the **ENC** class of functions.



Members

InSurface	Input surface.
NumFrameL0, NumFrameL1	Number of surfaces in L0 and L1 reference lists.
L0Surface, L1Surface	L0 and L1 reference lists
NumExtParam	Number of extended buffers.
ExtParam	List of extended buffers.

Change History

This structure is available since SDK API 1.10.

mfxENCOutput

Definition

```
typedef struct _mfxENCOutput mfxENCOutput;  
  
struct _mfxENCOutput{  
    mfxU32 reserved[32];  
  
    mfxU16 NumExtParam;  
    mfxExtBuffer **ExtParam;  
};
```

Description

The `mfxENCOutput` structure specifies output of the **ENC** class of functions.

Members

NumExtParam	Number of extended buffers.
ExtParam	List of extended buffers.

Change History

This structure is available since SDK API 1.10.

mfxExtLAControl

Definition

```
typedef struct
{
    mfxExtBuffer    Header;
    mfxU16    LookAheadDepth;
    mfxU16    DependencyDepth;
    mfxU16    DownScaleFactor;
    mfxU16    BPyramid;

    mfxU16    reserved1[23];

    mfxU16    NumOutStream;
    struct mfxStream{
        mfxU16    Width;
        mfxU16    Height;
        mfxU16    reserved2[14];
    } OutStream[16];
}mfxExtLAControl;
```

Description

The `mfxExtLAControl` structure is used to control standalone look ahead behavior. This LA is performed by **ENC** class of functions and its results are used later by **ENCODE** class of functions to improve coding efficiency.

This LA is intended for one to N transcoding scenario, where one input bitstream is transcoded to several output ones with different bitrates and resolutions. Usage of integrated into the SDK encoder LA in this scenario is also possible but not efficient in term of performance and memory consumption. Standalone LA by **ENC** class of functions is executed only once for input bitstream in contrast to the integrated LA where LA is executed for each of output streams.

This structure is used at **ENC** initialization time and should be attached to the `mfxVideoParam` structure.

Members

<code>Header.BufferId</code>	Must be MF_EXTBUFF_LOOKAHEAD_CTRL .
<code>LookAheadDepth</code>	Look ahead depth. This parameter has exactly the same meaning as <code>LookAheadDepth</code> in the mfxExtCodingOption2 structure.
<code>DependencyDepth</code>	Dependency depth. This parameter specifies the number of frames that SDK analyzes to calculate inter-frame dependency. It should be less than <code>LookAheadDepth</code> filed.
<code>DownScaleFactor</code>	Down scale factor. This parameter has exactly the same meaning as <code>LookAheadDS</code> in the mfxExtCodingOption2 structure. It is recommended to execute LA on downscaled image to improve



	performance without significant quality degradation.
BPyramid	Turn ON this flag to enable BPyramid feature (this mode is not supported by h264 encoder). See the CodingOptionValue enumerator for values of this option.
NumOutStream	Number of output streams in one to N transcode scenario.
OutStream	Output stream parameters.
Width	Output stream width.
Height	Output stream height.

Change History

This structure is available since SDK API 1.10.

The SDK API 1.15 adds BPyramid field.

mfxExtLAFrameStatistics

Definition

```
typedef struct
{
    mfxU16  Width;
    mfxU16  Height;

    mfxU32  FrameType;
    mfxU32  FrameDisplayOrder;
    mfxU32  FrameEncodeOrder;

    mfxU32  IntraCost;
    mfxU32  InterCost;
    mfxU32  DependencyCost;
    mfxU16  Layer;
    mfxU16  reserved[23];

    mfxU64  EstimatedRate[52];
}mfxLAFrameInfo;

typedef struct {
    mfxExtBuffer  Header;

    mfxU16  reserved[20];

    mfxU16  NumAlloc;
    mfxU16  NumStream;
    mfxU16  NumFrame;
```



```

    mfxLAFRAMEINFO    *FrameStat;

    mfxFrameSurface1 *OutSurface;

} mfxExtLAFRAMESTATISTICS;

```

Description

The `mfxExtLAFRAMESTATISTICS` structure is used to pass standalone look ahead statistics to the SDK encoder in one to N transcode scenario. This structure is used at runtime and should be attached to the `mfxENCOUTPUT` structure and then passed, attached, to the `mfxEncodeCtrl` structure.

Members

<code>Header.BufferId</code>	Must be <code>MF_EXTBUFF_LOOKAHEAD_STAT</code> .
<code>NumAlloc</code>	Number of allocated elements in the <code>FrameStat</code> array.
<code>NumStream</code>	Number of streams in the <code>FrameStat</code> array.
<code>NumFrame</code>	Number of frames for each stream in the <code>FrameStat</code> array.
<code>FrameStat</code>	LA statistics for each frame in output stream.
<code>Width</code>	Output stream width.
<code>Height</code>	Output stream height.
<code>FrameType</code>	Output frame type.
<code>FrameDisplayOrder</code>	Output frame number in display order.
<code>FrameEncodeOrder</code>	Output frame number in encoding order.
<code>IntraCost</code>	Intra cost of output frame.
<code>InterCost</code>	Inter cost of output frame.
<code>DependencyCost</code>	Aggregated dependency cost. It shows how this frame influences subsequent frames.
<code>Layer</code>	BPyramid layer number. zero if BPyramid is not used.
<code>EstimatedRate</code>	Estimated rate for each QP.
<code>OutSurface</code>	Output surface.

Change History

This structure is available since SDK API 1.10.

The SDK API 1.15 adds `Layer` field.

mfxExtVPPFieldProcessing

Definition

```
typedef struct {
    mfxExtBuffer      Header;

    mfxU16            Mode;
    mfxU16            InField;
    mfxU16            OutField;
    mfxU16            reserved[25];
} mfxExtVPPFieldProcessing;
```

Description

The **mfxExtVPPFieldProcessing** structure configures the **VPP** field processing algorithm. The application can attach this extended buffer to the [mfxVideoParam](#) structure to configure initialization and/or to the [mfxFrameData](#) during runtime, runtime configuration has priority over initialization configuration. If field processing algorithm was activated via [mfxExtVPPDoUse](#) structure and **mfxExtVPPFieldProcessing** extended buffer was not provided during initialization, this buffer must be attached to [mfxFrameData](#) of each input surface.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_FIELD_PROCESSING .
<code>Mode</code>	Specifies the mode of field processing algorithm. See the VPPFieldProcessingMode enumerator for values of this option
<code>InField</code>	When <code>Mode</code> is <code>MFX_VPP_COPY_FIELD</code> specifies input field. See the PicType enumerator for values of this parameter.
<code>OutField</code>	When <code>Mode</code> is <code>MFX_VPP_COPY_FIELD</code> specifies output field. See the PicType enumerator for values of this parameter.

Change History

This structure is available since SDK API 1.11.

mfxExtMBQP

Definition

```
typedef struct {
    mfxExtBuffer    Header;

    mfxU32 reserved[11];
    mfxU32 NumQPAlloc;
    union {
        mfxU8    *QP;
        mfxU64 reserved2;
    };
} mfxExtMBQP;
```

Description

The **mfxExtMBQP** structure specifies per-macroblock QP for current frame if [mfxExtCodingOption3::EnableMBQP](#) was turned ON during encoder initialization. The application can attach this extended buffer to the [mfxEncodeCtrl](#) during runtime.

Members

Header.BufferId	Must be MFX_EXTBUFF_MBQP .
NumQPAlloc	The allocated QP array size.
QP	<p>Pointer to a list of per-macroblock QP in raster scan order. In case of interlaced encoding the first half of QP array affects top field and the second – bottom field.</p> <p>For AVC valid range is 1..51.</p> <p>For MPEG2 QP corresponds to quantizer_scale of the ISO*/IEC* 13818-2 specification and have valid range 1..112.</p>

Change History

This structure is available since SDK API 1.13.

mfxExtMBForceIntra

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU32 reserved[11];
    mfxU32 MapSize;
    union {
        mfxU8    *Map;
        mfxU64 reserved2;
    };
} mfxExtMBForceIntra;
```



Description

The `mfxExtMBForceIntra` structure specifies macroblock map for current frame which forces specified macroblocks to be encoded as Intra if `mfxExtCodingOption3::EnableMBForceIntra` was turned ON during encoder initialization. The application can attach this extended buffer to the [mfxEncodeCtrl](#) during runtime.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_MB_FORCE_INTRA .
<code>MapSize</code>	Macroblock map size.
<code>Map</code>	Pointer to a list of force intra macroblock flags in raster scan order. Each flag is one byte in map. Set flag to 1 to force corresponding macroblock to be encoded as intra. In case of interlaced encoding, the first half of map affects top field and the second – bottom field.

Change History

This structure is available since SDK API 1.23.

mfxExtChromaLocInfo

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      ChromaLocInfoPresentFlag;
    mfxU16      ChromaSampleLocTypeTopField;
    mfxU16      ChromaSampleLocTypeBottomField;
    mfxU16      reserved[9];
} mfxExtChromaLocInfo;
```

Description

The `mfxExtChromaLocInfo` structure defines the location of chroma samples information.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_CHROMA_LOC_INFO .
<code>ChromaLocInfoPresentFlag</code>	These parameters define the location of chroma samples information.
<code>ChromaSampleLocTypeTopField</code>	
<code>ChromaSampleLocTypeBottomField</code>	See Annex E of the ISO*/IEC* 14496-10 specification for the definition of these parameters.

Change History

This structure is available since SDK API 1.13.

mfxExtHEVCTiles

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16 NumTileRows;
    mfxU16 NumTileColumns;
    mfxU16 reserved[74];
} mfxExtHEVCTiles;
```

Description

The `mfxExtHEVCTiles` structure configures tiles options for the HEVC encoder. The application can attach this extended buffer to the [mfxVideoParam](#) structure to configure initialization.



Members

Header.BufferId	Must be MFX_EXTBUFF_HEVC_TILES .
NumTileRows	Number of tile rows.
NumTileColumns	Number of tile columns.

Change History

This structure is available since SDK API 1.13.

mfxExtMBDisableSkipMap

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU32 reserved[11];
    mfxU32 MapSize;
    union {
        mfxU8 *Map;
        mfxU64 reserved2;
    };
} mfxExtMBDisableSkipMap;
```

Description

The **mfxExtMBDisableSkipMap** structure specifies macroblock map for current frame which forces specified macroblocks to be non skip if [mfxExtCodingOption3::MBDisableSkipMap](#) was turned ON during encoder initialization. The application can attach this extended buffer to the [mfxEncodeCtrl](#) during runtime.

Members

Header.BufferId	Must be MFX_EXTBUFF_MB_DISABLE_SKIP_MAP .
MapSize	Macroblock map size.
Map	Pointer to a list of non-skip macroblock flags in raster scan order. Each flag is one byte in map. Set flag to 1 to force corresponding macroblock to be non-skip. In case of interlaced encoding the first half of map affects top field and the second – bottom field.

Change History

This structure is available since SDK API 1.13.

mfxExtDecodedFrameInfo

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16      FrameType;  
    mfxU16      reserved[59];  
} mfxExtDecodedFrameInfo;
```

Description

This structure is used by the SDK decoders to report additional information about decoded frame. The application can attach this extended buffer to the `mfxFrameSurface1::mfxFrameData` structure at runtime.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_DECODED_FRAME_INFO
<code>FrameType</code>	Frame type. See FrameType enumerator for the list of possible types.

Change History

This structure is available since SDK API 1.14.

mfxExtTimeCode

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16      DropFrameFlag;  
    mfxU16      TimeCodeHours;  
    mfxU16      TimeCodeMinutes;  
    mfxU16      TimeCodeSeconds;  
    mfxU16      TimeCodePictures;  
    mfxU16      reserved[7];  
} mfxExtTimeCode;
```

Description

This structure is used by the SDK to pass MPEG 2 specific timing information.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_TIME_CODE
------------------------------	---



DropFrameFlag
TimeCodeHours
TimeCodeMinutes
TimeCodeSeconds
TimeCodePictures

These parameters define timing information.

See ISO/IEC 13818-2 and ITU-T H.262, MPEG-2 Part 2 for the definition of these parameters.

Change History

This structure is available since SDK API 1.14.

mfxExtHEVCRegion

Definition

```
enum {  
    MFX_HEVC_REGION_ENCODING_ON = 0,  
    MFX_HEVC_REGION_ENCODING_OFF = 1  
};  
  
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU32      RegionId;  
    mfxU16      RegionType;  
    mfxU16      RegionEncoding;  
    mfxU16      reserved[24];  
} mfxExtHEVCRegion;
```

Description

Attached to the [mfxVideoParam](#) structure during HEVC encoder initialization, specifies the region to encode.

Members

Header.BufferId	Must be MFX_EXTBUFF_HEVC_REGION .
RegionId	Id of region.
RegionType	Type of region. See HEVCRegionType enumerator for the list of possible types.
RegionEncoding	Set to <code>MFX_HEVC_REGION_ENCODING_ON</code> to encode only specified region.

Change History

This structure is available since SDK API 1.15.

The SDK API 1.16 adds `RegionEncoding` field.

mfxExtThreadsParam

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      NumThread;
    mfxI32      SchedulingType;
    mfxI32      Priority;
    mfxU16      reserved[55];
} mfxExtThreadsParam;
```

Description

Attached to the [mfxInitParam](#) structure during the SDK session initialization, `mfxExtThreadsParam` structure specifies options for threads created by this session.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_THREADS_PARAM .
<code>NumThread</code>	The number of threads.
<code>SchedulingType</code>	Scheduling policy for all threads.
<code>Priority</code>	Priority for all threads.

Change History

This structure is available since SDK API 1.15.

mfxExtHEVCParam

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      PicWidthInLumaSamples;
    mfxU16      PicHeightInLumaSamples;
    mfxU64      GeneralConstraintFlags;
    mfxU16      reserved[118];
} mfxExtHEVCParam;
```

Description



Attached to the [mfxVideoParam](#) structure extends it with HEVC-specific parameters. Used by both decoder and encoder.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_HEVC_PARAM .
<code>PicWidthInLumaSamples</code>	Specifies the width of each coded picture in units of luma samples.
<code>PicHeightInLumaSamples</code>	Specifies the height of each coded picture in units of luma samples.
<code>GeneralConstraintFlags</code>	Additional flags to specify exact profile/constraints. See the GeneralConstraintFlags enumerator for values of this field.

Change History

This structure is available since SDK API 1.14.

The SDK API 1.16 adds `GeneralConstraintFlags` field.

mfxExtPredWeightTable

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16      LumaLog2WeightDenom;        // 0..7
    mfxU16      ChromaLog2WeightDenom;      // 0..7
    mfxU16      LumaWeightFlag[2][32];      // [list] 0,1
    mfxU16      ChromaWeightFlag[2][32];    // [list] 0,1
    mfxI16      Weights[2][32][3][2];       // [list][list entry][Y, Cb,
Cr][weight, offset]
    mfxU16      reserved[58];
} mfxExtPredWeightTable;
```

Description

When [mfxExtCodingOption3::WeightedPred](#) was set to [explicit](#) during encoder Init or Reset and the current frame is P-frame or [mfxExtCodingOption3::WeightedBiPred](#) was set to [explicit](#) during encoder Init or Reset and the current frame is B-frame, attached to [mfxEncodeCtrl](#), this structure specifies weighted prediction table for current frame.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_PRED_WEIGHT_TABLE .
------------------------------	---



LumaLog2WeightDenom	Base 2 logarithm of the denominator for all luma weighting factors. Value shall be in the range of 0 to 7, inclusive.
ChromaLog2WeightDenom	Base 2 logarithm of the denominator for all chroma weighting factors. Value shall be in the range of 0 to 7, inclusive.
LumaWeightFlag	LumaWeightFlag[L] [R] equal to 1 specifies that the weighting factors for the luma component are specified for R's entry of RefPicList L.
ChromaWeightFlag	LumaWeightFlag[L] [R] equal to 1 specifies that the weighting factors for the chroma component are specified for R's entry of RefPicList L.
Weights	The values of the weights and offsets used in the encoding processing. The value of Weights[i] [j] [k] [m] is interpreted as: i refers to reference picture list 0 or 1; j refers to reference list entry 0-31; k refers to data for the luma component when it is 0, the Cb chroma component when it is 1 and the Cr chroma component when it is 2; m refers to weight when it is 0 and offset when it is 1

Change History

This structure is available since SDK API 1.16.

mfxExtDirtyRect

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16  NumRect;
    mfxU16  reserved1[11];

    struct {
        mfxU32  Left;
        mfxU32  Top;
        mfxU32  Right;
        mfxU32  Bottom;

        mfxU16  reserved2[8];
    } Rect[256];
} mfxExtDirtyRect;
```



Description

Used by the application to specify dirty regions within a frame during encoding. It may be used at initialization or at runtime

Members

Header.BufferId	Must be MFX_EXTBUFF_DIRTY_RECTANGLES .
NumRect	Number of dirty rectangles.
Rect	Array of dirty rectangles.
Left	Dirty region location. Should be aligned to MB boundaries (should be dividable by 16). If not, the SDK encoder truncates it to MB boundaries, for example, both 17 and 31 will be truncated to 16.
Top	
Right	
Bottom	

Change History

This structure is available since SDK API 1.16.

mfxExtMoveRect

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16  NumRect;
    mfxU16  reserved1[11];

    struct {
        mfxU32  DestLeft;
        mfxU32  DestTop;
        mfxU32  DestRight;
        mfxU32  DestBottom;

        mfxU32  SourceLeft;
        mfxU32  SourceTop;
        mfxU16  reserved2[4];
    } Rect[256];
} mfxExtMoveRect;
```

Description

Used by the application to specify moving regions within a frame during encoding.

Members



Header.BufferId	Must be MFX_EXTBUFF_MOVING_RECTANGLES .
NumRect	Number of moving rectangles.
Rect	Array of moving rectangles.
DestLeft	Destination rectangle location. Should be aligned to MB boundaries (should be dividable by 16). If not, the SDK encoder truncates it to MB boundaries, for example, both 17 and 31 will be truncated to 16.
DestTop	
DestRight	
DestBottom	
SourceLeft	Source rectangle location.
SourceTop	

Change History

This structure is available since SDK API 1.16.

mfxExtCodingOptionVPS

Definition

```
typedef struct {
    mfxExtBuffer    Header;

    union {
        mfxU8        *VPSBuffer;
        mfxU64        reserved1;
    };

    mfxU16           VPSBufSize;
    mfxU16           VPSId;

    mfxU16           reserved[6];
} mfxExtCodingOptionVPS;
```

Description

Attach this structure as part of the [mfxVideoParam](#) extended buffers to configure the SDK encoder during [MFXVideoENCODE_Init](#). The sequence or picture parameters specified by this structure overwrite any such parameters specified by the [mfxVideoParam](#) structure or any other extended buffers attached therein.



If the encoder does not support the specified parameters, the encoder does not initialize and returns the status code [MFX_ERR_INCOMPATIBLE_VIDEO_PARAM](#).

Check with the [MFXVideoENCODE_Query](#) function for the support of this multiple segment encoding feature. If this feature is not supported, the query returns [MFX_ERR_UNSUPPORTED](#).

Members

Header.BufferId	Must be MFX_EXTBUFF_CODING_OPTION_VPS .
VPSBuffer	Pointer to a valid bitstream that contains the VPS (video parameter set for HEVC) buffer.
VPSBufSize	Size of the VPS in bytes
VPSId	VPS identifier; the value is reserved and must be zero.

Change History

This structure is available since SDK API 1.17.

mfxExtVPPRotation

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16 Angle;  
    mfxU16 reserved[11];  
} mfxExtVPPRotation;
```

Description

The `mfxExtVPPRotation` structure configures the **VPP** Rotation filter algorithm.

Members

Header.BufferId	Must be MFX_EXTBUFF_VPP_ROTATION
Angle	Rotation angle. See Angle enumerator for supported values.

Change History



This structure is available since SDK API 1.17.

mfxExtVPPScaling

Definition

```
/* ScalingMode */
enum {
    MFX_SCALING_MODE_DEFAULT    = 0,
    MFX_SCALING_MODE_LOWPOWER   = 1,
    MFX_SCALING_MODE_QUALITY    = 2
};

typedef struct {
    mfxExtBuffer Header;

    mfxU16 ScalingMode;
    mfxU16 reserved[11];
} mfxExtVPPScaling;
```

Description

The `mfxExtVPPScaling` structure configures the **VPP** Scaling filter algorithm.

Members

<code>Header.BufferId</code>	Must be MFX_EXTBUFF_VPP_SCALING
<code>ScalingMode</code>	Scaling mode

Change History

This structure is available since SDK API 1.19.

mfxExtVPPMirroring

Definition

```
/* MirroringType */
```



```
enum
{
    MFX_MIRRORING_DISABLED    = 0,
    MFX_MIRRORING_HORIZONTAL  = 1,
    MFX_MIRRORING_VERTICAL    = 2
};
```

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16 Type;
    mfxU16 reserved[11];
} mfxExtVPPMirroring;
```

Description

The `mfxExtVPPMirroring` structure configures the **VPP** Mirroring filter algorithm.

Members

<code>Header.BufferId</code>	Must be <u>MFX_EXTBUFF_VPP_MIRRORING</u>
<code>Type</code>	Mirroring type

Change History

This structure is available since SDK API 1.19.

mfxExtVPPColorFill

Definition

```
typedef struct {
    mfxExtBuffer Header;

    mfxU16 Enable;          /* tri-state option */
    mfxU16 reserved[11];
} mfxExtVPPColorFill;
```

Description

The `mfxExtVPPColorFill` structure configures the **VPP** ColorFill filter algorithm.



Members

Header.BufferId	Must be MFX_EXTBUFF_VPP_COLORFILL
Enable	Set to ON makes VPP fill the area between Width/Height and Crop borders. See the CodingOptionValue enumerator for values of this option.

Change History

This structure is available since SDK API 1.19.

mfxExtEncodedSlicesInfo

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16  SliceSizeOverflow;  
    mfxU16  NumSliceNonCompliant;  
    mfxU16  NumEncodedSlice;  
    mfxU16  NumSliceSizeAlloc;  
    union {  
        mfxU16  *SliceSize;  
        mfxU64  reserved1;  
    };  
  
    mfxU16 reserved[20];  
} mfxExtEncodedSlicesInfo;
```

Description

The `mfxExtEncodedSlicesInfo` is used by the SDK encoder to report additional information about encoded slices. The application can attach this buffer to the [mfxBitstream](#) structure before calling [MFXVideoENCODE EncodeFrameAsync](#) function.

Not all implementations of the SDK encoder support this extended buffer. The application has to use query mode 1 to determine if such functionality is supported. To do so, the application has to attach this extended buffer to [mfxVideoParam](#) structure and call [MFXVideoENCODE Query](#) function. If function returns `MFX_ERR_NONE` then such functionality is supported.

Members

Header.BufferId	Must be MFX_EXTBUFF_ENCODED_SLICES_INFO
SliceSizeOverflow	When mfxExtCodingOption2::MaxSliceSize is used, indicates the requested slice size was not met for one or more generated slices



NumSliceNonCompliant	When mfxExtCodingOption2::MaxSliceSize is used, indicates the number of generated slices exceeds specification limits
NumEncodedSlice	Number of encoded slices.
NumSliceSizeAlloc	<code>SliceSize</code> array allocation size. Must be specified by application.
SliceSize	Slice size in bytes. Array must be allocated by application.

Change History

This structure is available since SDK API 1.19.

mfxExtMVOverPicBoundaries

Definition

```
typedef struct {  
    mfxExtBuffer Header;  
  
    mfxU16 StickTop;        /* tri-state option */  
    mfxU16 StickBottom;    /* tri-state option */  
    mfxU16 StickLeft;      /* tri-state option */  
    mfxU16 StickRight;     /* tri-state option */  
    mfxU16 reserved[8];  
} mfxExtMVOverPicBoundaries;
```

Description

Attached to the [mfxVideoParam](#) structure instructs encoder to use or not use samples over specified picture border for inter prediction.

Members

Header.BufferId	Must be MFX_EXTBUFF_MV_OVER_PIC_BOUNDARIES .
StickTop StickBottom StickLeft StickRight	When set to OFF, one or more samples outside corresponding picture boundary may be used in inter prediction. See the CodingOptionValue enumerator for values of this option.

Change History

This structure is available since SDK API 1.19.

mfxExtDecVideoProcessing

Definition

```
typedef struct {
    mfxExtBuffer    Header;

    struct mfxIn{
        mfxU16  CropX;
        mfxU16  CropY;
        mfxU16  CropW;
        mfxU16  CropH;
        mfxU16  reserved[12];
    }In;

    struct mfxOut{
        mfxU32  FourCC;
        mfxU16  ChromaFormat;
        mfxU16  reserved1;

        mfxU16  Width;
        mfxU16  Height;

        mfxU16  CropX;
        mfxU16  CropY;
        mfxU16  CropW;
        mfxU16  CropH;
        mfxU16  reserved[22];
    }Out;

    mfxU16  reserved[13];
} mfxExtDecVideoProcessing;
```

Description

If attached to the [mfxVideoParam](#) structure during the Init() stage this buffer will instruct decoder to resize output frames via fixed function resize engine (if supported by HW) utilizing direct pipe connection bypassing intermediate memory operations. Main benefits of this mode of pipeline operation are offloading resize operation to dedicated engine reducing power consumption & memory traffic.

Members

Header.BufferId	Must be MFX_EXTBUFF_DEC_VIDEO_PROCESSING .
In	Input surface description
CropX, CropY CropW, CropH	Region of interest of the input surface Note: CropX & CropY must be 0
Out	Output surface description



FourCC	FourCC of output surface Note: Should be MFX_FOURCC_NV12
ChromaFormat	Chroma Format of output surface Note: Should be MFX_CHROMAFORMAT_YUV420
Width	Width & Height of output surface
Height	
CropX, CropY CropW, CropH	Region of interest of the output surface

Note: There are three places for crops values already (one in mfxVideoParam and two in mfxExtDecVideoProcessing); and two for Width& Height values (in mfxVideoParam and in mfxExtDecVideoProcessing). Example of relationship between structures below.

Example 1: For instance, input stream has resolution 1920x1088. Need to do resize to 352x288 resolution.

```
mfxVideoParam.Width = 1920;
mfxVideoParam.Height = 1088;
mfxVideoParam.CropX = 0;
mfxVideoParam.CropY = 0;
mfxVideoParam.CropW = 1920;
mfxVideoParam.CropH = 1088;

mfxExtDecVideoProcessing.In.CropX = 0;
mfxExtDecVideoProcessing.In.CropY = 0;
mfxExtDecVideoProcessing.In.CropW = 1920;
mfxExtDecVideoProcessing.In.CropH = 1088;

mfxExtDecVideoProcessing.Out.Width = 352;
mfxExtDecVideoProcessing.Out.Height = 288;
mfxExtDecVideoProcessing.Out.CropX = 0;
mfxExtDecVideoProcessing.Out.CropY = 0;
mfxExtDecVideoProcessing.Out.CropW = 352;
mfxExtDecVideoProcessing.Out.CropH = 288;
```

Example 2: For instance, input stream has resolution 1920x1080. Required to do (1) cropping of decoded image to 1280x720, and then to do (2) resize 352x288 (3) into surface with SD resolution like 720x480

```
mfxVideoParam.Width = 1920;
mfxVideoParam.Height = 1088;
mfxVideoParam.CropX = 0;
mfxVideoParam.CropY = 0;
mfxVideoParam.CropW = 1920;
mfxVideoParam.CropH = 1080;

mfxExtDecVideoProcessing.In.CropX = 0;
mfxExtDecVideoProcessing.In.CropY = 0;
mfxExtDecVideoProcessing.In.CropW = 1280;
mfxExtDecVideoProcessing.In.CropH = 720;
```



```
mfxExtDecVideoProcessing.Out.Width = 720;  
mfxExtDecVideoProcessing.Out.Height = 480;  
mfxExtDecVideoProcessing.Out.CropX = 0;  
mfxExtDecVideoProcessing.Out.CropY = 0;  
mfxExtDecVideoProcessing.Out.CropW = 352;  
mfxExtDecVideoProcessing.Out.CropH = 288;
```

Change History

This structure is available since SDK API 1.22.

Enumerator Reference

BitstreamDataFlag

Description

The `BitstreamDataFlag` enumerator uses bit-ORed values to itemize additional information about the bitstream buffer.

Name/Description

<code>MFX_BITSTREAM_COMPLETE_FRAME</code>	<p>The bitstream buffer contains a complete frame or complementary field pair of data for the bitstream. For decoding, this means that the decoder can proceed with this buffer without waiting for the start of the next frame, which effectively reduces decoding latency.</p> <p>If this flag is set, but the bitstream buffer contains incomplete frame or pair of field, then decoder will produce corrupted output.</p>
<code>MFX_BITSTREAM_EOS</code>	<p>The bitstream buffer contains the end of the stream. For decoding, this means that the application does not have any additional bitstream data to send to decoder.</p>

Change History

This enumerator is available since SDK API 1.0.
 SDK API 1.6 adds `MFX_BITSTREAM_EOS` definition.

ChromaFormatIdc

Description

The `ChromaFormatIdc` enumerator itemizes color-sampling formats.

Name/Description

<code>MFX_CHROMAFORMAT_MONOCHROME</code>	Monochrome
<code>MFX_CHROMAFORMAT_YUV420</code>	4:2:0 color
<code>MFX_CHROMAFORMAT_YUV422</code>	4:2:2 color



<code>MF_X_CHROMAFORMAT_YUV444</code>	4:4:4 color
<code>MF_X_CHROMAFORMAT_YUV400</code>	equal to monochrome
<code>MF_X_CHROMAFORMAT_YUV411</code>	4:1:1 color
<code>MF_X_CHROMAFORMAT_YUV422H</code>	4:2:2 color, horizontal subsampling. It is equal to 4:2:2 color.
<code>MF_X_CHROMAFORMAT_YUV422V</code>	4:2:2 color, vertical subsampling

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.4 adds `MF_X_CHROMAFORMAT_YUV400`, `MF_X_CHROMAFORMAT_YUV411`, `MF_X_CHROMAFORMAT_YUV422H` and `MF_X_CHROMAFORMAT_YUV422V` definitions.

CodecFormatFourCC

Description

The `CodecFormatFourCC` enumerator itemizes codecs in the FourCC format.

Name/Description

<code>MF_X_CODEC_AVC</code>	AVC, H.264, or MPEG-4, part 10 codec
<code>MF_X_CODEC_MPEG2</code>	MPEG-2 codec
<code>MF_X_CODEC_VC1</code>	VC-1 codec
<code>MF_X_CODEC_HEVC</code>	HEVC codec
<code>MF_X_CODEC_VP9</code>	VP9 codec

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.8 added `MF_X_CODEC_HEVC` definition.

SDK API 1.19 added `MF_X_CODEC_VP9` definition.

CodecLevel

Description

The `CodecLevel` enumerator itemizes codec levels for all codecs.

Name/Description

<code>MFX_LEVEL_UNKNOWN</code>	Unspecified codec level
<code>MFX_LEVEL_AVC_1</code> <code>MFX_LEVEL_AVC_1b</code> <code>MFX_LEVEL_AVC_11</code> <code>MFX_LEVEL_AVC_12</code> <code>MFX_LEVEL_AVC_13</code>	H.264 level 1-1.3
<code>MFX_LEVEL_AVC_2</code> <code>MFX_LEVEL_AVC_21</code> <code>MFX_LEVEL_AVC_22</code>	H.264 level 2-2.2
<code>MFX_LEVEL_AVC_3</code> <code>MFX_LEVEL_AVC_31</code> <code>MFX_LEVEL_AVC_32</code>	H.264 level 3-3.2
<code>MFX_LEVEL_AVC_4</code> <code>MFX_LEVEL_AVC_41</code> <code>MFX_LEVEL_AVC_42</code>	H.264 level 4-4.2
<code>MFX_LEVEL_AVC_5</code> <code>MFX_LEVEL_AVC_51</code> <code>MFX_LEVEL_AVC_52</code>	H.264 level 5-5.2
<code>MFX_LEVEL_MPEG2_LOW</code> <code>MFX_LEVEL_MPEG2_MAIN</code> <code>MFX_LEVEL_MPEG2_HIGH</code> <code>MFX_LEVEL_MPEG2_HIGH1440</code>	MPEG-2 levels
<code>MFX_LEVEL_VC1_LOW</code> <code>MFX_LEVEL_VC1_MEDIAN</code> <code>MFX_LEVEL_VC1_HIGH</code>	VC-1 Level Low (simple & main profiles)
<code>MFX_LEVEL_VC1_0</code> <code>MFX_LEVEL_VC1_1</code> <code>MFX_LEVEL_VC1_2</code> <code>MFX_LEVEL_VC1_3</code> <code>MFX_LEVEL_VC1_4</code>	VC-1 advanced profile levels
<code>MFX_LEVEL_HEVC_1</code> <code>MFX_LEVEL_HEVC_2</code> <code>MFX_LEVEL_HEVC_21</code> <code>MFX_LEVEL_HEVC_3</code> <code>MFX_LEVEL_HEVC_31</code> <code>MFX_LEVEL_HEVC_4</code> <code>MFX_LEVEL_HEVC_41</code> <code>MFX_LEVEL_HEVC_5</code> <code>MFX_LEVEL_HEVC_51</code>	HEVC levels and tiers



```
MFX_LEVEL_HEVC_52
MFX_LEVEL_HEVC_6
MFX_LEVEL_HEVC_61
MFX_LEVEL_HEVC_62

MFX_TIER_HEVC_MAIN
MFX_TIER_HEVC_HIGH
```

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.8 added HEVC level and tier definitions.

CodecProfile

Description

The `CodecProfile` enumerator itemizes codec profiles for all codecs.

Name/Description

<code>MFX_PROFILE_UNKNOWN</code>	Unspecified profile
<code>MFX_PROFILE_AVC_BASELINE</code> <code>MFX_PROFILE_AVC_MAIN</code> <code>MFX_PROFILE_AVC_EXTENDED</code> <code>MFX_PROFILE_AVC_HIGH</code> <code>MFX_PROFILE_AVC_CONstrained_BASELINE</code> <code>MFX_PROFILE_AVC_CONstrained_HIGH</code> <code>MFX_PROFILE_AVC_PROGRESSIVE_HIGH</code>	H.264 profiles
<code>MFX_PROFILE_AVC_CONSTRAINT_SET0</code> <code>MFX_PROFILE_AVC_CONSTRAINT_SET1</code> <code>MFX_PROFILE_AVC_CONSTRAINT_SET2</code> <code>MFX_PROFILE_AVC_CONSTRAINT_SET3</code> <code>MFX_PROFILE_AVC_CONSTRAINT_SET4</code> <code>MFX_PROFILE_AVC_CONSTRAINT_SET5</code>	Combined with H.264 profile these flags impose additional constraints. See H.264 specification for the list of constraints.
<code>MFX_PROFILE_MPEG2_SIMPLE</code> <code>MFX_PROFILE_MPEG2_MAIN</code> <code>MFX_PROFILE_MPEG2_HIGH</code>	MPEG-2 profiles
<code>MFX_PROFILE_VC1_SIMPLE</code> <code>MFX_PROFILE_VC1_MAIN</code> <code>MFX_PROFILE_VC1_ADVANCED</code>	VC-1 profiles
<code>MFX_PROFILE_HEVC_MAIN</code> <code>MFX_PROFILE_HEVC_MAIN10</code> <code>MFX_PROFILE_HEVC_MAINSP</code>	HEVC profiles



MFX_PROFILE_HEVC_REXT

MFX_PROFILE_VP9_0
MFX_PROFILE_VP9_1
MFX_PROFILE_VP9_2
MFX_PROFILE_VP9_3

VP9 profiles

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.3 adds MFX_PROFILE_AVC_EXTENDED.

SDK API 1.4 adds MFX_PROFILE_AVC_CONstrained_BASELINE, MFX_PROFILE_AVC_CONstrained_HIGH, MFX_PROFILE_AVC_PROGRESSIVE_HIGH and six constrained flags MFX_PROFILE_AVC_CONSTRAINT_SET.

SDK API 1.8 added HEVC profile definitions.

SDK API 1.16 adds MFX_PROFILE_HEVC_REXT.

SDK API 1.19 added VP9 profile definitions.

CodingOptionValue

Description

The CodingOptionValue enumerator defines a three-state coding option setting.

Name/Description

MFX_CODINGOPTION_UNKNOWN	Unspecified
MFX_CODINGOPTION_ON	Coding option set
MFX_CODINGOPTION_OFF	Coding option not set
MFX_CODINGOPTION_ADAPTIVE	Reserved

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.6 adds MFX_CODINGOPTION_ADAPTIVE option.

ColorFourCC

Description

The ColorFourCC enumerator itemizes color formats.



Name/Description

MFX_FOURCC_YV12	YV12 color planes
MFX_FOURCC_NV12	NV12 color planes
MFX_FOURCC_NV16	4:2:2 color format with similar to NV12 layout.
MFX_FOURCC_RGB4	RGB4 (RGB32) color planes
MFX_FOURCC_YUY2	YUY2 color planes
MFX_FOURCC_P8	<p>Internal SDK color format. The application should use one of the functions below to create such surface, depending on Direct3D version.</p> <p>Direct3D9</p> <p style="text-align: right;">IDirectXVideoDecoderService::CreateSurface()</p> <p>Direct3D11</p> <p style="text-align: right;">ID3D11Device::CreateBuffer()</p>
MFX_FOURCC_P8_TEXTURE	<p>Internal SDK color format. The application should use one of the functions below to create such surface, depending on Direct3D version.</p> <p>Direct3D9</p> <p style="text-align: right;">IDirectXVideoDecoderService::CreateSurface()</p> <p>Direct3D11</p> <p style="text-align: right;">ID3D11Device::CreateTexture2D()</p>
MFX_FOURCC_P010	<p>P010 color format. This is 10 bit per sample format with similar to NV12 layout.</p> <p>This format should be mapped to DXGI_FORMAT_P010.</p>
MFX_FOURCC_P210	10 bit per sample 4:2:2 color format with similar to NV12 layout
MFX_FOURCC_BGR4	ABGR color format. It is similar to MFX_FOURCC_RGB4 but with interchanged R and B channels. 'A' is 8 MSBs, then 8 bits for 'B' channel, then 'G' and 'R' channels.
MFX_FOURCC_A2RGB10	<p>10 bits ARGB color format packed in 32 bits. 'A' channel is two MSBs, then 'R', then 'G' and then 'B' channels.</p> <p>This format should be mapped to DXGI_FORMAT_R10G10B10A2_UNORM or D3DFMT_A2R10G10B10.</p>



<code>MFx_FOURCC_ARGB16</code>	<p>10 bits ARGB color format packed in 64 bits. 'A' channel is 16 MSBs, then 'R', then 'G' and then 'B' channels.</p> <p>This format should be mapped to <code>DXGI_FORMAT_R16G16B16A16_UINT</code> or <code>D3DFMT_A16B16G16R16</code> formats.</p>
<code>MFx_FOURCC_R16</code>	<p>16 bits single channel color format.</p> <p>This format should be mapped to <code>DXGI_FORMAT_R16_TYPELESS</code> or <code>D3DFMT_R16F</code>.</p>
<code>MFx_FOURCC_ABGR16</code>	<p>10 bits ABGR color format packed in 64 bits. 'A' channel is 16 MSBs, then 'B', then 'G' and then 'R' channels.</p> <p>This format should be mapped to <code>DXGI_FORMAT_R16G16B16A16_UINT</code> or <code>D3DFMT_A16B16G16R16</code> formats.</p>
<code>MFx_FOURCC_AYUV</code>	<p>YUV 4:4:4, AYUV color format.</p> <p>This format should be mapped to <code>DXGI_FORMAT_AYUV</code>.</p>
<code>MFx_FOURCC_AYUV_RGB4</code>	<p>RGB4 stored in AYUV surface.</p> <p>This format should be mapped to <code>DXGI_FORMAT_AYUV</code>.</p>
<code>MFx_FOURCC_UYVY</code>	<p>UYVY color planes. Same as YUY2 except the byte order is reversed.</p>

Change History

This enumerator is available since SDK API 1.0.

The SDK API 1.1 adds `MFx_FOURCC_P8`.

The SDK API 1.6 adds `MFx_FOURCC_P8_TEXTURE`.

The SDK API 1.9 adds `MFx_FOURCC_P010`, `MFx_FOURCC_BGR4`, `MFx_FOURCC_A2RGB10`, `MFx_FOURCC_ARGB16` and `MFx_FOURCC_R16`.

The SDK API 1.11 adds `MFx_FOURCC_NV16` and `MFx_FOURCC_P210`.

The SDK API 1.17 adds `MFx_FOURCC_ABGR16`, `MFx_FOURCC_AYUV`, `MFx_FOURCC_AYUV_RGB4`, and `MFx_FOURCC_UYVY`.

Corruption

Description

The `Corruption` enumerator itemizes the decoding corruption types. It is a bit-OR'ed



value of the following.

Name/Description

<code>MXF_CORRUPTION_MINOR</code>	Minor corruption in decoding certain macro-blocks
<code>MXF_CORRUPTION_MAJOR</code>	Major corruption in decoding the frame
<code>MXF_CORRUPTION_REFERENCE_FRAME</code>	Decoding used a corrupted reference frame.
<code>MXF_CORRUPTION_REFERENCE_LIST</code>	The reference list information of this frame does not match what is specified in the Reference Picture Marking Repetition SEI message.
<code>MXF_CORRUPTION_ABSENT_TOP_FIELD</code>	Top field of frame is absent in bitstream. Only bottom field has been decoded.
<code>MXF_CORRUPTION_ABSENT_BOTTOM_FIELD</code>	Bottom field of frame is absent in bitstream. Only top field has been decoded.

Change History

This enumerator is available since SDK API 1.3. The SDK API 1.6 added `MXF_CORRUPTION_ABSENT_TOP_FIELD` and `MXF_CORRUPTION_ABSENT_BOTTOM_FIELD` definitions.

ExtendedBufferID

Description

The `ExtendedBufferID` enumerator itemizes and defines identifiers (`BufferId`) for extended buffers or video processing algorithm identifiers.

Name/Description

<code>MXF_EXTBUFF_AVC_REFLIST_CTRL</code>	This extended buffer defines additional encoding controls for reference list. See the mfxExtAVCRefListCtrl structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding & decoding initialization, or the mfxEncodeCtrl structure for per-frame encoding configuration.
<code>MXF_EXTBUFF_AVC_TEMPORAL_LAYERS</code>	This extended buffer configures the structure of temporal layers inside the encoded H.264 bitstream. See the mfxExtAvcTemporalLayers structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
<code>MXF_EXTBUFF_</code>	This extended buffer defines additional encoding controls. See the



<code>CODING_OPTION</code>	mfxExtCodingOption structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
<code>MFX_EXTBUFF_CODING_OPTION_SPPS</code>	This extended buffer defines sequence header and picture header for encoders and decoders. See the mfxExtCodingOptionSPSPS structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization, and for obtaining raw headers from the decoders and encoders.
<code>MFX_EXTBUFF_CODING_OPTION2</code>	This extended buffer defines additional encoding controls. See the mfxExtCodingOption2 structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
<code>MFX_EXTBUFF_CODING_OPTION3</code>	This extended buffer defines additional encoding controls. See the mfxExtCodingOption3 structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
<code>MFX_EXTBUFF_ENCODED_FRAME_INFO</code>	This extended buffer is used by the SDK encoder to report additional information about encoded picture. See the mfxExtAVCEncodedFrameInfo structure for details. The application can attach this buffer to the mfxBitstream structure before calling MFXVideoENCODE EncodeFrameAsync function.
<code>MFX_EXTBUFF_ENCODER_CAPABILITY</code>	This extended buffer is used to retrieve SDK encoder capability. See the mfxExtEncoderCapability structure for details. The application can attach this buffer to the mfxVideoParam structure before calling MFXVideoENCODE Query function.
<code>MFX_EXTBUFF_ENCODER_RESET_OPTION</code>	This extended buffer is used to control encoder reset behavior and also to query possible encoder reset outcome. See the mfxExtEncoderResetOption structure for details. The application can attach this buffer to the mfxVideoParam structure before calling MFXVideoENCODE Query or MFXVideoENCODE Reset functions.
<code>MFX_EXTBUFF_OPAQUE_SURFACE_ALLOCATION</code>	This extended buffer defines opaque surface allocation information. See the mfxExtOpaqueSurfaceAlloc structure for details. The application can attach this buffer to decoding, encoding, or video processing initialization.
<code>MFX_EXTBUFF_PICTURE_TIMING_SEI</code>	This extended buffer configures the H.264 picture timing SEI message. See the mfxExtPictureTimingSEI structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization, or the mfxEncodeCtrl structure for per-frame encoding configuration.
<code>MFX_EXTBUFF_VIDEO_SIGNAL_INFO</code>	This extended buffer defines video signal type. See the mfxExtVideoSignalInfo structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization, and for retrieving such information from the decoders.



<code>MFX_EXTBUFF_VPP_AUXDATA</code>	This extended buffer defines auxiliary information at the VPP output. See the mfxExtVPPAuxData structure for details. The application can attach this buffer to the mfxEncodeCtrl structure for per-frame encoding control.
<code>MFX_EXTBUFF_VPP_DENOISE</code>	The extended buffer defines control parameters for the VPP denoise filter algorithm. See the mfxExtVPPDenoise structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_DETAIL</code>	The extended buffer defines control parameters for the VPP detail filter algorithm. See the mfxExtVPPDetail structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_DONOTUSE</code>	This extended buffer defines a list of VPP algorithms that applications should not use. See the mfxExtVPPDoNotUse structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_DOUSE</code>	This extended buffer defines a list of VPP algorithms that applications should use. See the mfxExtVPPDoUse structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_FRAME_RATE_CONVERSION</code>	This extended buffer defines control parameters for the VPP frame rate conversion algorithm. See the mfxExtVPPFrameRateConversion structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_IMAGE_STABILIZATION</code>	This extended buffer defines control parameters for the VPP image stabilization filter algorithm. See the mfxExtVPPImageStab structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_PICSTRUCT_DETECTION</code>	Deprecated.
<code>MFX_EXTBUFF_VPP_PROCAAMP</code>	The extended buffer defines control parameters for the VPP ProcAmp filter algorithm. See the mfxExtVPPProcAmp structure for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization.
<code>MFX_EXTBUFF_VPP_SCENE_CHANGE</code>	Deprecated.
<code>MFX_EXTBUFF_VPP_FIELD_PROCESSING</code>	The extended buffer defines control parameters for the VPP field-processing algorithm. See the mfxExtVPPFieldProcessing structure



PROCESSING	for details. The application can attach this buffer to the mfxVideoParam structure for video processing initialization or to the mfxFrameData structure during runtime.
MFX_EXTBUFF_MBQP	This extended buffer defines per-macroblock QP. See the mfxExtMBQP structure for details. The application can attach this buffer to the mfxEncodeCtrl structure for per-frame encoding configuration.
MFX_EXTBUFF_MB_FORCE_INTRA	This extended buffer defines per-macroblock force intra flag. See the mfxExtMBForceIntra structure for details. The application can attach this buffer to the mfxEncodeCtrl structure for per-frame encoding configuration.
MFX_EXTBUFF_CHROMA_LOC_INFO	This extended buffer defines chroma samples location information. See the mfxExtChromaLocInfo structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
MFX_EXTBUFF_HEVC_PARAM	See the mfxExtHEVCParam structure for details.
MFX_EXTBUFF_HEVC_TILES	This extended buffer defines additional encoding controls for HEVC tiles. See the mfxExtHEVCTiles structure for details. The application can attach this buffer to the mfxVideoParam structure for encoding initialization.
MFX_EXTBUFF_MB_DISABLE_SKIP_MAP	This extended buffer defines macroblock map for current frame which forces specified macroblocks to be non skip. See the mfxExtMBDisableSkipMap structure for details. The application can attach this buffer to the mfxEncodeCtrl structure for per-frame encoding configuration.
MFX_EXTBUFF_DECODED_FRAME_INFO	This extended buffer is used by SDK decoders to report additional information about decoded frame. See the mfxExtDecodedFrameInfo structure for more details.
MFX_EXTBUFF_TIME_CODE	See the mfxExtTimeCode structure for more details.
MFX_HEVC_REGION_SLICE	This extended buffer instructs HEVC encoder to encode only one region. The application can attach this buffer to the mfxVideoParam structure for HEVC encoding initialization.
MFX_EXTBUFF_THREADS_PARAM	See the mfxExtThreadsParam structure for details.
MFX_EXTBUFF_PRED_WEIGHT_TABLE	See the mfxExtPredWeightTable structure for details.



<code>MFX_EXTBUFF_DIRTY_RECTANGLES</code>	See the mfxExtDirtyRect structure for details.
<code>MFX_EXTBUFF_MOVING_RECTANGLES</code>	See the mfxExtMoveRect structure for details.
<code>MFX_EXTBUFF_CODING_OPTION_VPS</code>	See the mfxExtCodingOptionVPS structure for details.
<code>MFX_EXTBUFF_VPP_ROTATION</code>	See the mfxExtVPPRotation structure for details.
<code>MFX_EXTBUFF_ENCODED_SLICES_INFO</code>	See the mfxExtEncodedSlicesInfo structure for details.
<code>MFX_EXTBUFF_MV_OVER_PIC_BOUNDARIES</code>	See the mfxExtMVOverPicBoundaries structure for details.
<code>MFX_EXTBUFF_VPP_SCALING</code>	See the mfxExtVPPScaling structure for details.
<code>MFX_EXTBUFF_VPP_MIRRORING</code>	See the mfxExtVPPMirroring structure for details.
<code>MFX_EXTBUFF_VPP_COLORFILL</code>	See the mfxExtVPPColorFill structure for details.
<code>MFX_EXTBUFF_DEC_VIDEO_PROCESSING</code>	See the mfxExtDecVideoProcessing structure for details.

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.6 adds `MFX_EXTBUFF_VPP_IMAGE_STABILIZATION`, `MFX_EXTBUFF_VPP_PICSTRUCT_DETECTION`, `MFX_EXTBUFF_CODING_OPTION2` and deprecates `MFX_EXTBUFF_VPP_SCENE_CHANGE`.

SDK API 1.7 adds `MFX_EXTBUFF_ENCODED_FRAME_INFO`, `MFX_EXTBUFF_ENCODER_CAPABILITY`, `MFX_EXTBUFF_ENCODER_RESET_OPTION`.

SDK API 1.11 adds `MFX_EXTBUFF_CODING_OPTION3` and `MFX_EXTBUFF_VPP_FIELD_PROCESSING`.

SDK API 1.13 adds `MFX_EXTBUFF_MBQP`, `MFX_EXTBUFF_HEVC_TILES`, `MFX_EXTBUFF_MB_DISABLE_SKIP_MAP` and `MFX_EXTBUFF_CHROMA_LOC_INFO`.



SDK API 1.14 adds `MXF_EXTBUFF_HEVC_PARAM`, `MXF_EXTBUFF_HEVC_TILES`, `MXF_EXTBUFF_MB_DISABLE_SKIP_MAP`, `MXF_EXTBUFF_DECODED_FRAME_INFO` and `MXF_EXTBUFF_TIME_CODE`.

SDK API 1.15 adds `MXF_HEVC_REGION_SLICE` and `MXF_EXTBUFF_THREADS_PARAM`.

SDK API 1.16 adds `MXF_EXTBUFF_PRED_WEIGHT_TABLE`, `MXF_EXTBUFF_DIRTY_RECTANGLES` and `MXF_EXTBUFF_MOVING_RECTANGLES`.

SDK API 1.17 adds `MXF_EXTBUFF_CODING_OPTION_VPS` and `MXF_EXTBUFF_VPP_ROTATION` and deprecates `MXF_EXTBUFF_VPP_PICSTRUCT_DETECTION`.

SDK API 1.19 adds `MXF_EXTBUFF_ENCODED_SLICES_INFO`, `MXF_EXTBUFF_MV_OVER_PIC_BOUNDARIES`, `MXF_EXTBUFF_VPP_SCALING`, `MXF_EXTBUFF_VPP_MIRRORING`, `MXF_EXTBUFF_VPP_COLORFILL`.

SDK API 1.22 adds `MXF_EXTBUFF_DEC_VIDEO_PROCESSING`, and "ROI Mode & DeltaQP" fields to the `MXF_EXTBUFF_ENCODER_ROI`

SDK API 1.23 adds `MXF_EXTBUFF_MB_FORCE_INTRA`.

See additional change history in the structure definitions.

ExtMemBufferType

Description

The `ExtMemBufferType` enumerator specifies the buffer type. It is a bit-ORed value of the following.

Name/Description

<code>MXF_MEMTYPE_PERSISTENT_MEMORY</code>	Memory page for persistent use
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Change History

This enumerator is available since SDK API 1.0.

ExtMemFrameType

Description

The `ExtMemFrameType` enumerator specifies the memory type of frame. It is a bit-ORed value of the following. For information on working with video memory surfaces, see the section Working with hardware acceleration.



Name/Description

<code>MFX_MEMTYPE_VIDEO_MEMORY_DECODER_TARGET</code>	Frames are in video memory and belong to video decoder render targets.
<code>MFX_MEMTYPE_VIDEO_MEMORY_PROCESSOR_TARGET</code>	Frames are in video memory and belong to video processor render targets.
<code>MFX_MEMTYPE_SYSTEM_MEMORY</code>	The frames are in system memory.
<code>MFX_MEMTYPE_FROM_ENCODE</code>	Allocation request comes from an ENCODE function
<code>MFX_MEMTYPE_FROM_DECODE</code>	Allocation request comes from a DECODE function
<code>MFX_MEMTYPE_FROM_VPPIN</code>	Allocation request comes from a VPP function for input frame allocation
<code>MFX_MEMTYPE_FROM_VPPOUT</code>	Allocation request comes from a VPP function for output frame allocation
<code>MFX_MEMTYPE_FROM_ENC</code>	Allocation request comes from an ENC function
<code>MFX_MEMTYPE_FROM_PAK</code>	Reserved
<code>MFX_MEMTYPE_INTERNAL_FRAME</code>	Allocation request for internal frames
<code>MFX_MEMTYPE_EXTERNAL_FRAME</code>	Allocation request for I/O frames
<code>MFX_MEMTYPE_OPAQUE_FRAME</code>	Allocation request for opaque frames
<code>MFX_MEMTYPE_EXPORT_FRAME</code>	Application requests frame handle export to some associated object. For Linux frame handle can be considered to be exported to DRM Prime FD, DRM FLink or DRM FrameBuffer Handle. Specifics of export types and export procedure depends on external frame allocator implementation
<code>MFX_MEMTYPE_SHARED_RESOURCE</code>	For DX11 allocation use shared resource bind flag.

Remarks

The application may use macro `MFX_MEMTYPE_BASE` to extract the base memory types, one of `MFX_MEMTYPE_VIDEO_MEMORY_DECODER_TARGET`, `MFX_MEMTYPE_VIDEO_MEMORY_PROCESSOR_TARGET`, and `MFX_MEMTYPE_SYSTEM_MEMORY`.

Change History

This enumerator is available since SDK API 1.0. SDK API 1.3 extended the `MFX_MEMTYPE_OPAQUE_FRAME` definition and the `MFX_MEMTYPE_BASE` macro definition.



SDK API 1.17 adds `MFx_MEMTYPE_EXPORT_FRAME`.

SDK API 1.19 adds `MFx_MEMTYPE_SHARED_RESOURCE`.

FrameDataFlag

Description

The `FrameDataFlag` enumerator uses bit-ORed values to itemize additional information about the frame buffer.

Name/Description

<code>MFx_FRAMEDATA_ORIGINAL_TIMESTAMP</code>	Indicates the time stamp of this frame is not calculated and is a pass-through of the original time stamp.
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Change History

This enumerator is available since SDK API 1.3.

FrameType

Description

The `FrameType` enumerator itemizes frame types. Use bit-ORed values to specify all that apply.

Name/Description

<code>MFx_FRAMETYPE_I</code>	This frame or the first field is encoded as an I frame/field.
<code>MFx_FRAMETYPE_P</code>	This frame or the first field is encoded as a P frame/field.
<code>MFx_FRAMETYPE_B</code>	This frame or the first field is encoded as a B frame/field.
<code>MFx_FRAMETYPE_S</code>	This frame or the first field is either an SI- or SP-frame/field.
<code>MFx_FRAMETYPE_REF</code>	This frame or the first field is encoded as a reference.
<code>MFx_FRAMETYPE_IDR</code>	This frame or the first field is encoded as an IDR.
<code>MFx_FRAMETYPE_xI</code>	The second field is encoded as an I-field.
<code>MFx_FRAMETYPE_xP</code>	The second field is encoded as a P-field.



<code>MFX_FRAMETYPE_xB</code>	The second field is encoded as a B-field.
<code>MFX_FRAMETYPE_xS</code>	The second field is an SI- or SP-field.
<code>MFX_FRAMETYPE_xREF</code>	The second field is encoded as a reference.
<code>MFX_FRAMETYPE_xIDR</code>	The second field is encoded as an IDR.

Change History

This enumerator is available since SDK API 1.0. SDK API 1.3 extended the second field types.

FrcAlgm

Description

The `FrcAlgm` enumerator itemizes frame rate conversion algorithms. See description of [mfxExtVPPFrameRateConversion](#) structure for more details.

Name/Description

<code>MFX_FRCALGM_PRESERVE_TIMESTAMP</code>	Frame dropping/repetition based frame rate conversion algorithm with preserved original time stamps. Any inserted frames will carry <code>MFX_TIMESTAMP_UNKNOWN</code> .
<code>MFX_FRCALGM_DISTRIBUTED_TIMESTAMP</code>	Frame dropping/repetition based frame rate conversion algorithm with distributed time stamps. The algorithm distributes output time stamps evenly according to the output frame rate.
<code>MFX_FRCALGM_FRAME_INTERPOLATION</code>	Frame rate conversion algorithm based on frame interpolation. This flag may be combined with <code>MFX_FRCALGM_PRESERVE_TIMESTAMP</code> or <code>MFX_FRCALGM_DISTRIBUTED_TIMESTAMP</code> flags.

Change History

This enumerator is available since SDK API 1.3.

GopOptFlag

Description



The `GopOptFlag` enumerator itemizes special properties in the GOP (Group of Pictures) sequence.

Name/Description

<code>MFx_GOP_CLOSED</code>	<p>The encoder generates closed GOP if this flag is set. Frames in this GOP do not use frames in previous GOP as reference.</p> <p>The encoder generates open GOP if this flag is not set. In this GOP frames prior to the first frame of GOP in display order may use frames from previous GOP as reference. Frames subsequent to the first frame of GOP in display order do not use frames from previous GOP as reference.</p> <p>The AVC encoder ignores this flag if <code>IdrInterval</code> in mfXInfoMFx structure is set to 0, i.e. if every GOP starts from IDR frame. In this case, GOP is encoded as closed.</p> <p>This flag does not affect long-term reference frames. See Appendix C: Long-term Reference frame for more details.</p>
<code>MFx_GOP_STRICT</code>	<p>The encoder must strictly follow the given GOP structure as defined by parameter <code>GopPicSize</code>, <code>GopRefDist</code> etc in the mfXVideoParam structure. Otherwise, the encoder can adapt the GOP structure for better efficiency, whose range is constrained by parameter <code>GopPicSize</code> and <code>GopRefDist</code> etc. See also description of <code>AdaptiveI</code> and <code>AdaptiveB</code> fields in the mfXExtCodingOption2 structure.</p>

Change History

This enumerator is available since SDK API 1.0.

IOPattern

Description

The `IOPattern` enumerator itemizes memory access patterns for SDK functions. Use bit-ORed values to specify an input access pattern and an output access pattern.

Name/Description

<code>MFx_IOPATTERN_IN_VIDEO_MEMORY</code>	Input to SDK functions is a video memory surface
<code>MFx_IOPATTERN_IN_SYSTEM_MEMORY</code>	Input to SDK functions is a linear buffer directly in system memory or in system memory through an external allocator



<code>MFx_IOPATTERN_IN_OPAQUE_MEMORY</code>	Input to SDK functions maps at runtime to either a system memory buffer or a video memory surface.
<code>MFx_IOPATTERN_OUT_VIDEO_MEMORY</code>	Output to SDK functions is a video memory surface
<code>MFx_IOPATTERN_OUT_SYSTEM_MEMORY</code>	Output to SDK functions is a linear buffer directly in system memory or in system memory through an external allocator
<code>MFx_IOPATTERN_OUT_OPAQUE_MEMORY</code>	Output to SDK functions maps at runtime to either a system memory buffer or a video memory surface.

Change History

This enumerator is available since SDK API 1.0. SDK API 1.3 extended the `MFx_IOPATTERN_IN_OPAQUE_MEMORY` and `MFx_IOPATTERN_OUT_OPAQUE_MEMORY` definitions.

mfxHandleType

Description

The `mfxHandleType` enumerator itemizes system handle types that SDK implementations might use.

Name/Description

<code>MFx_HANDLE_D3D9_DEVICE_MANAGER</code>	Pointer to the IDirect3DDeviceManager9 interface. See Working with Microsoft* DirectX* Applications for more details on how to use this handle.
<code>MFx_HANDLE_D3D11_DEVICE</code>	Pointer to the ID3D11Device interface. See Working with Microsoft* DirectX* Applications for more details on how to use this handle.
<code>MFx_HANDLE_VA_DISPLAY</code>	Pointer to VADisplay interface. See Working with VA API Applications for more details on how to use this handle.
<code>MFx_HANDLE_ENCODE_CONTEXT</code>	Pointer to VAContextID interface. It represents encoder context.

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.4 added `MFx_HANDLE_D3D11_DEVICE` definition.



SDK API 1.8 added `MFx_HANDLE_VA_DISPLAY` and `MFx_HANDLE_ENCODE_CONTEXT` definitions.

mfXIMPL

Description

The `mfXIMPL` enumerator itemizes SDK implementation types. The implementation type is a bit OR'ed value of the base type and any decorative flags.

Name/Description

<code>MFx_IMPL_AUTO</code>	Find the best SDK implementation automatically. It includes either hardware-accelerated implementation on the default acceleration device or software implementation. This value is obsolete and it is recommended to use <code>MFx_IMPL_AUTO_ANY</code> instead.
<code>MFx_IMPL_SOFTWARE</code>	Use the software implementation
<code>MFx_IMPL_HARDWARE</code>	Use the hardware-accelerated implementation on the default acceleration device
<code>MFx_IMPL_RUNTIME</code>	This value cannot be used for session initialization. It may be returned by <code>MFxQueryIMPL</code> function to show that session has been initialized in run time mode.
<code>MFx_IMPL_UNSUPPORTED</code>	Failed to locate the desired SDK implementation

If the acceleration device is not default device, use the following values to initialize the SDK libraries on an alternative acceleration device.

<code>MFx_IMPL_AUTO_ANY</code>	Find the SDK implementation on any acceleration device including the default acceleration device and the SDK software library.
<code>MFx_IMPL_HARDWARE_ANY</code>	Find the hardware-accelerated implementation on any acceleration device including the default acceleration device.
<code>MFx_IMPL_HARDWARE2</code>	Use the hardware-accelerated implementation on the second acceleration device.
<code>MFx_IMPL_HARDWARE3</code>	Use the hardware-accelerated implementation on the third acceleration device.



`MXF_IMPL_HARDWARE4`

Use the hardware-accelerated implementation on the fourth acceleration device.

Use the following decorative flags to specify the OS infrastructure that hardware acceleration should base on.

`MXF_IMPL_VIA_D3D9`

Hardware acceleration goes through the Microsoft* Direct3D9* infrastructure.

`MXF_IMPL_VIA_D3D11`

Hardware acceleration goes through the Microsoft* Direct3D11* infrastructure.

`MXF_IMPL_VIA_VAAPI`

Hardware acceleration goes through the Linux* VA API infrastructure.

`MXF_IMPL_VIA_ANY`

Hardware acceleration can go through any supported OS infrastructure. This is default value, it is used by the SDK if none of `MXF_IMPL_VIA_XXX` flag is specified by application.

`MXF_IMPL_AUDIO`

Load audio library. It can be used only together with `MXF_IMPL_SOFTWARE`, any other combinations lead to error.

Change History

This enumerator is available since SDK API 1.0.

SDK API 1.1 added support of multiple devices.

SDK API 1.3 added support of OS infrastructure definitions.

SDK API 1.6 changed defaults OS infrastructure from `MXF_IMPL_VIA_D3D9` to `MXF_IMPL_VIA_ANY`.

SDK API 1.8 added support of `MXF_IMPL_AUDIO` and `MXF_IMPL_VIA_VAAPI`.

Remarks

The application can use the macro `MXF_IMPL_BASETYPE(x)` to obtain the base implementation type.

It is recommended that the application use `MXF_IMPL_VIA_ANY` if the application uses system memory or opaque surface for I/O exclusively.

mfxPriority

Description

The `mfxPriority` enumerator describes the session priority.

Name/Description

<code>MFX_PRIORITY_LOW</code>	Low priority: the session operation halts when high priority tasks are executing and more than 75% of the CPU is being used for normal priority tasks.
<code>MFX_PRIORITY_NORMAL</code>	Normal priority: the session operation is halted if there are high priority tasks.
<code>MFX_PRIORITY_HIGH</code>	High priority: the session operation blocks other lower priority session operations.

Change History

This enumerator is available since SDK API 1.1.

mfxSkipMode

Description

The `mfxSkipMode` enumerator describes the decoder skip-mode options.

Name/Description

<code>MFX_SKIPMODE_NONE</code>	Do not skip any frames.
<code>MFX_SKIPMODE_MORE</code>	Skip more frames.
<code>MFX_SKIPMODE_LESS</code>	Skip less frames.

Change History

This enumerator is available since SDK API 1.0.

mfxStatus

Description

The `mfxStatus` enumerator itemizes status codes returned by SDK functions.

When an SDK function returns an error status code, it generally expects a **Reset** or **Close** function to follow, (with the exception of [MFX_ERR_MORE_DATA](#) and [MFX_ERR_MORE_SURFACE](#) for asynchronous operation considerations) See section Decoding Procedures, section Encoding Procedures, and section Video Processing Procedures for more information about recovery procedures.

When an SDK function returns a warning status code, the function has performed necessary operations to continue the operation without interruption. In this case, the output might be unreliable. The application must check the validity of the output generated by the function.

Name/Description

Successful operation

<code>MFX_ERR_NONE</code>	No error
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Reserved status code

<code>MFX_ERR_UNKNOWN</code>	An unknown error occurred in the library function operation. This is a reserved status code.
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Programming related errors

<code>MFX_ERR_NOT_INITIALIZED</code>	Member functions called without initialization.
<code>MFX_ERR_INVALID_HANDLE</code>	Invalid session or MemId handle
<code>MFX_ERR_NULL_PTR</code>	NULL pointer in the input or output arguments
<code>MFX_ERR_UNDEFINED_BEHAVIOR</code>	The behavior is undefined.
<code>MFX_ERR_NOT_ENOUGH_BUFFER</code>	Insufficient buffer for input or output.
<code>MFX_ERR_NOT_FOUND</code>	Specified object/item/sync point not found.

Memory related errors

<code>MFX_ERR_MEMORY_ALLOC</code>	Failed to allocate memory.
<code>MFX_ERR_LOCK_MEMORY</code>	Failed to lock the memory block (external allocator).
<code>MFX_ERR_REALLOC_SURFACE</code>	Bigger output surface required.



Configuration related errors or warnings

<code>MFx_ERR_UNSUPPORTED</code>	Unsupported configurations, parameters, or features
<code>MFx_ERR_INVALID_VIDEO_PARAM</code>	Invalid video parameters detected. Init and Reset functions return this status code to indicate either that mandated input parameters are unspecified, or the functions failed to correct them.
<code>MFx_ERR_INCOMPATIBLE_VIDEO_PARAM</code>	Incompatible video parameters detected. If a Reset function returns this status code, a component—decoder, encoder or video preprocessor—cannot process the specified configuration with existing structures and frame buffers. If the function MFxVideoDECODE DecodeFrameAsync returns this status code, the bitstream contains an incompatible video parameter configuration that the decoder cannot follow.
<code>MFx_WRN_VIDEO_PARAM_CHANGED</code>	The decoder detected a new sequence header in the bitstream. Video parameters may have changed.
<code>MFx_WRN_VALUE_NOT_CHANGED</code>	The parameter has been clipped to its value range.
<code>MFx_WRN_OUT_OF_RANGE</code>	The parameter is out of valid value range.
<code>MFx_WRN_INCOMPATIBLE_VIDEO_PARAM</code>	Incompatible video parameters detected. SDK functions return this status code to indicate that there was incompatibility in the specified parameters and has resolved it.
<code>MFx_WRN_FILTER_SKIPPED</code>	The SDK VPP has skipped one or more optional filters requested by the application. To retrieve actual list of filters attach mfxExtVPPDoUse to mfxVideoParam and call MFxVideoVPP GetVideoParam . The application must ensure that enough memory is allocated for filter list.

Asynchronous operation related errors or warnings

<code>MFx_ERR_ABORTED</code>	The asynchronous operation aborted.
<code>MFx_ERR_MORE_DATA</code>	Need more bitstream at decoding input, encoding input, or video processing input frames.
<code>MFx_ERR_MORE_SURFACE</code>	Need more frame surfaces at decoding or video processing output
<code>MFx_ERR_MORE_BITSTREAM</code>	Need more bitstream buffers at the encoding output



`MXF_WRN_IN_EXECUTION` Synchronous operation still running

Hardware device related errors or warnings

<code>MXF_ERR_DEVICE_FAILED</code>	Hardware device returned unexpected errors. SDK was unable to restore operation. See section <i>Hardware Device Error Handling</i> for more information.
<code>MXF_ERR_DEVICE_LOST</code>	Hardware device was lost; See the <i>Hardware Device Error Handling</i> section for further information.
<code>MXF_WRN_DEVICE_BUSY</code>	Hardware device is currently busy. Call this function again in a few milliseconds.
<code>MXF_WRN_PARTIAL_ACCELERATION</code>	The hardware does not support the specified configuration. Encoding, decoding, or video processing may be partially accelerated. Only SDK HW implementation may return this status code.
<code>MXF_ERR_GPU_HANG</code>	Hardware device operation failure caused by GPU hang.

Change History

This enumerator is available since SDK API 1.0. SDK API 1.3 added the `MXF_ERR_MORE_BITSTREAM` return status. SDK API 1.6 added the `MXF_WRN_FILTER_SKIPPED` return status.

The SDK API 1.19 added `MXF_ERR_GPU_HANG` and `MXF_ERR_REALLOC_SURFACE`.

PicStruct

Description

The `PicStruct` enumerator itemizes picture structure. Use bit-OR'ed values to specify the desired picture type.

Name/Description

<code>MXF_PICSTRUCT_UNKNOWN</code>	Unspecified or mixed progressive/interlaced/field pictures
<code>MXF_PICSTRUCT_PROGRESSIVE</code>	Progressive picture
<code>MXF_PICSTRUCT_FIELD_TFF</code>	Top field in first interlaced picture



<code>MFx_PICSTRUCT_FIELD_BFF</code>	Bottom field in first interlaced picture
<code>MFx_PICSTRUCT_FIELD_REPEATED</code>	First field repeated: <code>pict_struct</code> = 5 or 6 in H.264
<code>MFx_PICSTRUCT_FRAME_DOUBLING</code>	Double the frame for display: <code>pict_struct</code> = 7 in H.264
<code>MFx_PICSTRUCT_FRAME_TRIPLING</code>	Triple the frame for display: <code>pict_struct</code> = 8 in H.264
<code>MFx_PICSTRUCT_FIELD_SINGLE</code>	Single field in a picture
<code>MFx_PICSTRUCT_FIELD_TOP</code>	Top field in a picture: <code>pict_struct</code> = 1 in H.265
<code>MFx_PICSTRUCT_FIELD_BOTTOM</code>	Bottom field in a picture: <code>pict_struct</code> = 2 in H.265
<code>MFx_PICSTRUCT_FIELD_PAIRED_PREV</code>	Paired with previous field: <code>pict_struct</code> = 9 or 10 in H.265
<code>MFx_PICSTRUCT_FIELD_PAIRED_NEXT</code>	Paired with next field: <code>pict_struct</code> = 11 or 12 in H.265

Change History

This enumerator is available since SDK API 1.0. SDK API 1.3 added support of combined display attributes. SDK API 1.20 added support of single fields.

Remarks

It is possible to combine the above picture structure values to indicate additional display attributes. If `ExtendedPicStruct` in the [mfxInfoMFX](#) structure is true, **DECODE** outputs extended picture structure values to indicate how to display an output frame as shown in the following table:

Extended <code>PicStruct</code> Values	Description
<code>MFx_PICSTRUCT_PROGRESSIVE MFx_PICSTRUCT_FRAME_DOUBLING</code>	The output frame is progressive; Display as two identical progressive frames.
<code>MFx_PICSTRUCT_PROGRESSIVE MFx_PICSTRUCT_FRAME_TRIPLING</code>	The output frame is progressive; Display as three identical progressive frames.
<code>MFx_PICSTRUCT_PROGRESSIVE </code>	The output frame is progressive; Display as two

MFX_PICSTRUCT_FIELD_TFF	fields, top field first.
MFX_PICSTRUCT_PROGRESSIVE MFX_PICSTRUCT_FIELD_BFF	The output frame is progressive; Display as two fields, bottom field first
MFX_PICSTRUCT_PROGRESSIVE MFX_PICSTRUCT_FIELD_TFF MFX_PICSTRUCT_FIELD_REPEATED	The output frame is progressive; Display as three fields: top, bottom, and top.
MFX_PICSTRUCT_FIELD_TOP MFX_PICSTRUCT_FIELD_BFF MFX_PICSTRUCT_FIELD_REPEATED	The output frame is progressive; Display as three fields: bottom, top, bottom.
MFX_PICSTRUCT_FIELD_TOP MFX_PICSTRUCT_FIELD_PAIRERD_PREV	Top field paired with previous bottom field in output order
MFX_PICSTRUCT_FIELD_TOP MFX_PICSTRUCT_FIELD_PAIRERD_NEXT	Top field paired with next bottom field in output order
MFX_PICSTRUCT_FIELD_BOTTOM MFX_PICSTRUCT_FIELD_PAIRERD_PREV	Bottom field paired with previous bottom field in output order
MFX_PICSTRUCT_FIELD_BOTTOM MFX_PICSTRUCT_FIELD_PAIRERD_NEXT	Bottom field paired with next bottom field in output order

In the above cases, **VPP** processes the frame as a progressive frame and passes the extended picture structure values from input to output. **ENCODE** encodes the frame as a progressive frame and marks the bitstream header properly according to the extended picture structure values.

RateControlMethod

Description

The `RateControlMethod` enumerator itemizes bitrate control methods.

Name/Description

MFX_RATECONTROL_CBR	Use the constant bitrate control algorithm
MFX_RATECONTROL_VBR	Use the variable bitrate control algorithm
MFX_RATECONTROL_CQP	Use the constant quantization parameter algorithm.
MFX_RATECONTROL_AVBR	Use the average variable bitrate control algorithm
MFX_RATECONTROL_LA	Use the VBR algorithm with look ahead. It is a special bitrate control mode in the SDK AVC encoder that has



been designed to improve encoding quality. It works by performing extensive analysis of several dozen frames before the actual encoding and as a side effect significantly increases encoding delay and memory consumption.

The only available rate control parameter in this mode is [`mfxInfoMFX::TargetKbps`](#). Two other parameters, `MaxKbps` and `InitialDelayInKB`, are ignored. To control LA depth the application can use [`mfxExtCodingOption2::LookAheadDepth`](#) parameter.

This method is not HRD compliant.

<code>MFX_RATECONTROL_ICQ</code>	Use the Intelligent Constant Quality algorithm. This algorithm improves subjective video quality of encoded stream. Depending on content, it may or may not decrease objective video quality. Only one control parameter is used - quality factor, specified by <code>mfxInfoMFX::ICQQuality</code> .
<code>MFX_RATECONTROL_VCM</code>	Use the Video Conferencing Mode algorithm. This algorithm is similar to the VBR and uses the same set of parameters <code>mfxInfoMFX::InitialDelayInKB</code> , <code>TargetKbps</code> and <code>MaxKbps</code> . It is tuned for IPPP GOP pattern and streams with strong temporal correlation between frames. It produces better objective and subjective video quality in these conditions than other bitrate control algorithms. It does not support interlaced content, B frames and produced stream is not HRD compliant.
<code>MFX_RATECONTROL_LA_ICQ</code>	Use intelligent constant quality algorithm with look ahead. Quality factor is specified by <code>mfxInfoMFX::ICQQuality</code> . To control LA depth the application can use <code>mfxExtCodingOption2::LookAheadDepth</code> parameter. This method is not HRD compliant.
<code>MFX_RATECONTROL_LA_EXT</code>	Use extended look ahead rate control algorithm. It is intended for one to N transcode scenario and requires presence of <code>mfxExtLAFFrameStatistics</code> structure at encoder input at runtime.
<code>MFX_RATECONTROL_LA_HRD</code>	Use HRD compliant look ahead rate control algorithm.
<code>MFX_RATECONTROL_QVBR</code>	Use the variable bitrate control algorithm with constant quality. This algorithm trying to achieve the target subjective quality with the minimum number of bits,



while the bitrate constraint and HRD compliancy are satisfied. It uses the same set of parameters as VBR and quality factor specified by [mfxExtCodingOption3::QVBRQuality](#).

Change History

This enumerator is available since SDK API 1.0.

The SDK API 1.1 added the constant quantization parameter algorithm.

The SDK API 1.3 added the average variable bitrate control algorithm.

The SDK API 1.7 added the look ahead algorithm.

The SDK API 1.8 added the intelligent constant quality and video conferencing mode algorithms.

The SDK API 1.10 added the extended look ahead rate control algorithm.

The SDK API 1.11 added the HRD compliant look ahead and variable bitrate with constant quality rate control algorithms.

TimeStampCalc

Description

The `TimeStampCalc` enumerator itemizes time-stamp calculation methods.

Name/Description

<code>MFX_TIMESTAMPCALC_UNKNOWN</code>	The time stamp calculation is to base on the input frame rate, if time stamp is not explicitly specified.
<code>MFX_TIMESTAMPCALC_TELECINE</code>	Adjust time stamp to 29.97fps on 24fps progressively encoded sequences if telecining attributes are available in the bitstream and time stamp is not explicitly specified. (The input frame rate must be specified.)

Change History

This enumerator is available since SDK API 1.3.

TargetUsage

Description

The `TargetUsage` enumerator itemizes a range of numbers from `MFX_TARGETUSAGE_1`, best quality, to `MFX_TARGETUSAGE_7`, best speed. It indicates trade-offs between quality and speed. The application can use any number in the range. The actual number of supported target usages depends on implementation. If specified target usage is not supported, the SDK encoder will use the closest supported value.

Name/Description

<code>MFX_TARGETUSAGE_1</code>	Target usage
<code>MFX_TARGETUSAGE_2</code>	
<code>MFX_TARGETUSAGE_3</code>	
<code>MFX_TARGETUSAGE_4</code>	
<code>MFX_TARGETUSAGE_5</code>	
<code>MFX_TARGETUSAGE_6</code>	
<code>MFX_TARGETUSAGE_7</code>	
<code>MFX_TARGETUSAGE_UNKNOWN</code>	Unspecified target usage
<code>MFX_TARGETUSAGE_BEST_QUALITY</code>	Best quality, mapped to <code>MFX_TARGETUSAGE_1</code>
<code>MFX_TARGETUSAGE_BALANCED</code>	Balanced quality and speed, mapped to <code>MFX_TARGETUSAGE_4</code>
<code>MFX_TARGETUSAGE_BEST_SPEED</code>	Fastest speed, mapped to <code>MFX_TARGETUSAGE_7</code>

Change History

This enumerator is available since SDK API 1.0.

The SDK API 1.7 adds `MFX_TARGETUSAGE_1` .. `MFX_TARGETUSAGE_7` values.

TrellisControl

Description

The `TrellisControl` enumerator is used to control trellis quantization in AVC encoder. The application can turn it on or off for any combination of I, P and B frames by combining different enumerator values. For example, "`MFX_TRELLIS_I | MFX_TRELLIS_B`" turns it on for I and B frames.

Due to performance reason on some target usages trellis quantization is always turned off and this control is ignored by the SDK encoder.



Name/Description

<code>MFx_TRELLIS_UNKNOWN</code>	Default value, it is up to the SDK encoder to turn trellis quantization on or off.
<code>MFx_TRELLIS_OFF</code>	Turn trellis quantization off for all frame types.
<code>MFx_TRELLIS_I</code>	Turn trellis quantization on for I frames.
<code>MFx_TRELLIS_P</code>	Turn trellis quantization on for P frames.
<code>MFx_TRELLIS_B</code>	Turn trellis quantization on for B frames.

Change History

This enumerator is available since SDK API 1.7.

BRefControl

Description

The `BRefControl` enumerator is used to control usage of B frames as reference in AVC encoder.

Name/Description

<code>MFx_B_REF_UNKNOWN</code>	Default value, it is up to the SDK encoder to use B frames as reference.
<code>MFx_B_REF_OFF</code>	Do not use B frames as reference.
<code>MFx_B_REF_PYRAMID</code>	Arrange B frames in so-called "B pyramid" reference structure.

Change History

This enumerator is available since SDK API 1.8.

LookAheadDownSampling

Description

The `LookAheadDownSampling` enumerator is used to control down sampling in look ahead bitrate control mode in AVC encoder.

Name/Description



<code>MFX_LOOKAHEAD_DS_UNKNOWN</code>	Default value, it is up to the SDK encoder what down sampling value to use.
<code>MFX_LOOKAHEAD_DS_OFF</code>	Do not use down sampling, perform estimation on original size frames. This is the slowest setting that produces the best quality.
<code>MFX_LOOKAHEAD_DS_2x</code>	Down sample frames two times before estimation.
<code>MFX_LOOKAHEAD_DS_4x</code>	Down sample frames four times before estimation. This option may significantly degrade quality.

Change History

This enumerator is available since SDK API 1.8.

VPPFieldProcessingMode

Description

The `VPPFieldProcessingMode` enumerator is used to control **VPP** field processing algorithm.

Name/Description

<code>MFX_VPP_COPY_FRAME</code>	Copy the whole frame.
<code>MFX_VPP_COPY_FIELD</code>	Copy only one field.
<code>MFX_VPP_SWAP_FIELDS</code>	Swap top and bottom fields.

Change History

This enumerator is available since SDK API 1.11.

PicType

Description

The `PicType` enumerator itemizes picture type.

Name/Description

<code>MFX_PICTYPE_UNKNOWN</code>	Picture type is unknown.
<code>MFX_PICTYPE_FRAME</code>	Picture is a frame.



<code>MFx_PICTYPE_TOPFIELD</code>	Picture is a top field.
<code>MFx_PICTYPE_BOTTOMFIELD</code>	Picture is a bottom field.

Change History

This enumerator is available since SDK API 1.11.

SkipFrame

Description

The `SkipFrame` enumerator is used to define usage of [`mfXEncodeCtrl::SkipFrame`](#) parameter.

Name/Description

<code>MFx_SKIPFRAME_NO_SKIP</code>	Frame skipping is disabled, <code>mfXEncodeCtrl::SkipFrame</code> is ignored
<code>MFx_SKIPFRAME_INSERT_DUMMY</code>	Skipping is allowed, when <code>mfXEncodeCtrl::SkipFrame</code> is set encoder inserts into bitstream frame where all macroblocks are encoded as skipped. Only non-reference P and B frames can be skipped. If <code>GopRefDist = 1</code> and <code>mfXEncodeCtrl::SkipFrame</code> is set for reference P frame, it will be encoded as non-reference.
<code>MFx_SKIPFRAME_INSERT_NOTHING</code>	Similar to <code>MFx_SKIPFRAME_INSERT_DUMMY</code> , but when <code>mfXEncodeCtrl::SkipFrame</code> is set encoder inserts nothing into bitstream.
<code>MFx_SKIPFRAME_BRC_ONLY</code>	<code>mfXEncodeCtrl::SkipFrame</code> indicates number of missed frames before the current frame. Affects only BRC, current frame will be encoded as usual.

Change History

This enumerator is available since SDK API 1.11.

The SDK API 1.13 adds `MFx_SKIPFRAME_BRC_ONLY`.

DeinterlacingMode

Description



The `DeinterlacingMode` enumerator itemizes VPP deinterlacing modes.

Name/Description

<code>MFX_DEINTERLACING_BOB</code>	BOB deinterlacing mode.
<code>MFX_DEINTERLACING_ADVANCED</code>	Advanced deinterlacing mode.
<code>MFX_DEINTERLACING_AUTO_DOUBLE</code>	Auto mode with deinterlacing double framerate output.
<code>MFX_DEINTERLACING_AUTO_SINGLE</code>	Auto mode with deinterlacing single framerate output.
<code>MFX_DEINTERLACING_FULL_FR_OUT</code>	Deinterlace only mode with full framerate output.
<code>MFX_DEINTERLACING_HALF_FR_OUT</code>	Deinterlace only Mode with half framerate output.
<code>MFX_DEINTERLACING_24FPS_OUT</code>	24 fps fixed output mode.
<code>MFX_DEINTERLACING_FIXED_TELECINE_PATTERN</code>	Fixed telecine pattern removal mode.
<code>MFX_DEINTERLACING_30FPS_OUT</code>	30 fps fixed output mode.
<code>MFX_DEINTERLACING_DETECT_INTERLACE</code>	Only interlace detection.
<code>MFX_DEINTERLACING_ADVANCED_NO_REF</code>	Advanced deinterlacing mode without using of reference frames.
<code>MFX_DEINTERLACING_ADVANCED_SCD</code>	Advanced deinterlacing mode with scene change detection.
<code>MFX_DEINTERLACING_FIELD_WEAVING</code>	Field weaving.

Change History

This enumerator is available since SDK API 1.13.

The SDK 1.17 adds `MFX_DEINTERLACING_ADVANCED_NOREF`.

The SDK 1.19 adds `MFX_DEINTERLACING_ADVANCED_SCD`,
`MFX_DEINTERLACING_FIELD_WEAVING`.

TelecinePattern

Description

The `TelecinePattern` enumerator itemizes telecine patterns.

Name/Description

<code>MF_X_TELECINE_PATTERN_32</code>	3:2 telecine
<code>MF_X_TELECINE_PATTERN_2332</code>	2:3:3:2 telecine
<code>MF_X_TELECINE_PATTERN_FRAME_REPEAT</code>	One frame repeat telecine
<code>MF_X_TELECINE_PATTERN_41</code>	4:1 telecine
<code>MF_X_TELECINE_POSITION_PROVIDED</code>	User must provide position inside a sequence of 5 frames where the artifacts start.

Change History

This enumerator is available since SDK API 1.13.

HEVCRegionType

Description

The `HEVCRegionType` enumerator itemizes type of HEVC region.

Name/Description

<code>MF_X_HEVC_REGION_SLICE</code>	Slice.
-------------------------------------	--------

Change History

This enumerator is available since SDK API 1.15.

GPUCopy

Description

The `GPUCopy` enumerator controls usage of GPU accelerated copying between video and system memory in the SDK components.

Name/Description



<code>MFX_GPUCOPY_DEFAULT</code>	Use default mode for the current SDK implementation.
<code>MFX_GPUCOPY_ON</code>	Enable GPU accelerated copying.
<code>MFX_GPUCOPY_OFF</code>	Disable GPU accelerated copying.

Change History

This enumerator is available since SDK API 1.16.

WeightedPred

Description

The `WeightedPred` enumerator itemizes weighted prediction modes.

Name/Description

<code>MFX_WEIGHTED_PRED_UNKNOWN</code>	Allow encoder to decide.
<code>MFX_WEIGHTED_PRED_DEFAULT</code>	Use default weighted prediction.
<code>MFX_WEIGHTED_PRED_EXPLICIT</code>	Use explicit weighted prediction.
<code>MFX_WEIGHTED_PRED_IMPLICIT</code>	Use implicit weighted prediction (for B-frames only).

Change History

This enumerator is available since SDK API 1.16.

ScenarioInfo

Description

The `ScenarioInfo` enumerator itemizes scenarios for the encoding session.

Name/Description

<code>MFX_SCENARIO_UNKNOWN</code>
<code>MFX_SCENARIO_DISPLAY_REMOTING</code>
<code>MFX_SCENARIO_VIDEO_CONFERENCE</code>
<code>MFX_SCENARIO_ARCHIVE</code>
<code>MFX_SCENARIO_LIVE_STREAMING</code>



MFX_SCENARIO_CAMERA_CAPTURE

Change History

This enumerator is available since SDK API 1.16.

ContentInfo

Description

The `ContentInfo` enumerator itemizes content types for the encoding session.

Name/Description

MFX_CONTENT_UNKNOWN
MFX_CONTENT_FULL_SCREEN_VIDEO
MFX_CONTENT_NON_VIDEO_SCREEN

Change History

This enumerator is available since SDK API 1.16.

PRefType

Description

The `PRefType` enumerator itemizes models of reference list construction and DPB management when `GopRefDist=1`.

Name/Description

MFX_P_REF_DEFAULT	Allow encoder to decide.
MFX_P_REF_SIMPLE	Regular sliding window used for DPB removal process.
MFX_P_REF_PYRAMID	Let N be the max reference list's size. Encoder treat each N's frame as "strong" reference and the others as "weak" references. Encoder uses "weak" reference only for prediction of the next frame and removes it from DPB right after. "Strong" references removed from DPB by sliding window.

Change History

This enumerator is available since SDK API 1.16.

GeneralConstraintFlags

Description

The `GeneralConstraintFlags` enumerator uses bit-ORed values to itemize HEVC bitstream indications for specific profiles.

Name/Description

<code>MFX_HEVC_CONSTR_REXT_MAX_12BIT</code>	Indications for format range extensions profiles.
<code>MFX_HEVC_CONSTR_REXT_MAX_10BIT</code>	
<code>MFX_HEVC_CONSTR_REXT_MAX_8BIT</code>	
<code>MFX_HEVC_CONSTR_REXT_MAX_422CHROMA</code>	
<code>MFX_HEVC_CONSTR_REXT_MAX_420CHROMA</code>	
<code>MFX_HEVC_CONSTR_REXT_MAX_MONOCHROME</code>	
<code>MFX_HEVC_CONSTR_REXT_INTRA</code>	
<code>MFX_HEVC_CONSTR_REXT_ONE_PICTURE_ONLY</code>	
<code>MFX_HEVC_CONSTR_REXT_LOWER_BIT_RATE</code>	

Change History

This enumerator is available since SDK API 1.16.

Angle

Description

The `Angle` enumerator itemizes valid rotation angles.

Name/Description

<code>MFX_ANGLE_0</code>	0°
<code>MFX_ANGLE_90</code>	90°
<code>MFX_ANGLE_180</code>	180°
<code>MFX_ANGLE_270</code>	270°

Change History

This enumerator is available since SDK API 1.17.



PlatformCodeName

Description

The `PlatformCodeName` enumerator itemizes Intel® processor microarchitecture codenames. For details about any particular codename, see ark.intel.com.

Name/Description

<code>MFx_PLATFORM_UNKNOWN</code>	Unknown platform
<code>MFx_PLATFORM_SANDYBRIDGE</code>	Sandy Bridge
<code>MFx_PLATFORM_IVYBRIDGE</code>	Ivy Bridge
<code>MFx_PLATFORM_HASWELL</code>	Haswell
<code>MFx_PLATFORM_BAYTRAIL</code>	Bay Trail
<code>MFx_PLATFORM_BROADWELL</code>	Broadwell
<code>MFx_PLATFORM_CHERRYTRAIL</code>	Cherry Trail
<code>MFx_PLATFORM_SKYLAKE</code>	Skylake

Change History

This enumerator is available since SDK API 1.19.

PayloadCtrlFlags

Description

The `PayloadCtrlFlags` enumerator itemizes additional payload properties.

Name/Description

<code>MFx_PAYLOAD_CTRL_SUFFIX</code>	Insert this payload into HEVC Suffix SEI NAL-unit.
--------------------------------------	--

Change History

This enumerator is available since SDK API 1.19.

IntraRefreshTypes

Description

The `IntraRefreshTypes` enumerator itemizes additional types of intra refresh. The major goal of intra refresh is improvement of error resilience without significant impact on encoded bitstream size caused by I frames. The SDK encoder achieves this by encoding part of each frame in refresh cycle using intra MBs.

Name/Description

<code>MFX_REFRESH_NO</code>	Encode without refresh.
<code>MFX_REFRESH_VERTICAL</code>	Vertical refresh, by column of MBs.
<code>MFX_REFRESH_HORIZONTAL</code>	Horizontal refresh, by rows of MBs.
<code>MFX_REFRESH_SLICE</code>	Horizontal refresh by slices without overlapping.

Change History

This enumerator is available since SDK API 1.23.

Appendices

Appendix A: Configuration Parameter Constraints

The [mfxFrameInfo](#) structure is used by both the [mfxVideoParam](#) structure during SDK class initialization and the [mfxFrameSurface1](#) structure during the actual SDK class function. The following constraints apply:

Constraints common for **DECODE**, **ENCODE** and **VPP**:

Parameters	During SDK initialization	During SDK operation
FourCC	Any valid value	The value must be the same as the initialization value. The only exception is VPP in composition mode, where in some cases it is allowed to mix RGB and NV12 surfaces. See mfxExtVPPComposite for more details.
ChromaFormat	Any valid value	The value must be the same as the initialization value.

Constraints for **DECODE**:

Parameters	During SDK initialization	During SDK operation
Width Height	Aligned frame size	The values must be the equal to or larger than the initialization values.
CropX, CropY CropW, CropH	Ignored	DECODE output. The cropping values are per-frame based.
AspectRatioW AspectRatioH	Any valid values or unspecified (zero); if unspecified, values from the input bitstream will be used; see note below the table	DECODE output.
FrameRateExtN	Any valid values or unspecified (zero);	DECODE output.



FrameRateExtD	if unspecified, values from the input bitstream will be used; see note below the table	
PicStruct	Ignored	DECODE output.

Note about priority of initialization parameters.

If application explicitly sets FrameRateExtN/FrameRateExtD or AspectRatioW/ AspectRatioH during initialization then decoder uses these values during decoding regardless of values from bitstream and does not update them on new SPS. If application sets them to 0, then decoder uses values from stream and update them on each SPS.

Constraints for **VPP**:

Parameters	During SDK initialization	During SDK operation
Width Height	Any valid values	These values must be the same or larger than the initialization values.
CropX, CropY CropW, CropH	Ignored	These parameters specify the region of interest from input to output.
AspectRatioW AspectRatioH	Ignored	Aspect ratio values will be passed through from input to output.
FrameRateExtN FrameRateExtD	Any valid values	Frame rate values will be updated with the initialization value at output.
PicStruct	MFX_PICSTRUCT_UNKNOWN, MFX_PICSTRUCT_PROGRESSIVE, MFX_PICSTRUCT_FIELD_TFF, MFX_PICSTRUCT_FIELD_BFF, MFX_PICSTRUCT_FIELD_SINGLE, MFX_PICSTRUCT_FIELD_TOP or MFX_PICSTRUCT_FIELD_BOTTOM	The base value must be the same as the initialization value unless MFX_PICSTRUCT_UNKNOWN is specified during initialization. Other decorative picture structure flags are passed through or added as needed. See the PicStruct enumerator for details.



Constraints for **ENCODE**:

Parameters	During SDK initialization	During SDK operation
Width Height	Encoded frame size	The values must be the same or larger than the initialization values
CropX, CropY CropW, CropH	H.264: Cropped frame size MPEG-2: CropW and CropH specify the real width and height (maybe unaligned) of the coded frames. CropX and CropY must be zero.	Ignored
AspectRatioW AspectRatioH	Any valid values	Ignored
FrameRateExtN FrameRateExtD	Any valid values	Ignored
PicStruct	MFX_PICSTRUCT_UNKNOWN, MFX_PICSTRUCT_PROGRESSIVE, MFX_PICSTRUCT_FIELD_TFF, or MFX_PICSTRUCT_FIELD_BFF.	The base value must be the same as the initialization value unless MFX_PICSTRUCT_UNKNOWN is specified during initialization. Add other decorative picture structure flags to indicate additional display attributes. Use MFX_PICSTRUCT_UNKNOWN during initialization for field attributes and MFX_PICSTRUCT_PROGRESSIVE for frame attributes. See the PicStruct enumerator for details.

The following table summarizes how to specify the configuration parameters during initialization and during encoding, decoding and video processing:

		ENCODE		DECODE		VPP	
		Init	Encoding	Init	Decoding	Init	Processing
mfxVideoParam							
	Protected	R	-	R	-	R	-
	IOPattern	M	-	M	-	M	-
	ExtParam	O	-	O	-	O	-



		ENCODE		DECODE		VPP	
		Init	Encoding	Init	Decoding	Init	Processing
	NumExtParam	O	-	O	-	O	-
mfxInfoMFX							
	CodecId	M	-	M	-	-	-
	CodecProfile	O	-	O	-	-	-
	CodecLevel	O	-	O	-	-	-
	NumThread	O	-	O	-	-	-
	TargetUsage	O	-	-	-	-	-
	GopPicSize	O	-	-	-	-	-
	GopRefDist	O	-	-	-	-	-
	GopOptFlag	O	-	-	-	-	-
	IdrInterval	O	-	-	-	-	-
	RateControlMethod	O	-	-	-	-	-
	InitialDelayInKB	O	-	-	-	-	-
	BufferSizeInKB	O	-	-	-	-	-
	TargetKbps	M	-	-	-	-	-
	MaxKbps	O	-	-	-	-	-
	NumSlice	O	-	-	-	-	-
	NumRefFrame	O	-	-	-	-	-
	EncodedOrder	M	-	-	-	-	-
mfxFrameInfo							
	FourCC	M	M	M	M	M	M
	Width	M	M	M	M	M	M
	Height	M	M	M	M	M	M
	CropX	M	Ign	Ign	/U	Ign	M
	CropY	M	Ign	Ign	/U	Ign	M
	CropW	M	Ign	Ign	/U	Ign	M
	CropH	M	Ign	Ign	/U	Ign	M
	FrameRateExtN	M	Ign	O	/U	M	/U
	FrameRateExtD	M	Ign	O	/U	M	/U
	AspectRatioW	O	Ign	O	/U	Ign	PT
	AspectRatioH	O	Ign	O	/U	Ign	PT



		ENCODE		DECODE		VPP	
		Init	Encoding	Init	Decoding	Init	Processing
	PicStruct	O	M	Ign	/U	M	M/U
	ChromaFormat	M	M	M	M	Ign	Ign
Remarks							
	Ign	Ignored	PT	Pass Through	-	Does Not Apply	
	M	Mandated	R	Reserved			
	O	Optional	/U	Updated at output			

Appendix B: Multiple-Segment Encoding

Multiple-segment encoding is useful in video editing applications when during production; the encoder encodes multiple video clips according to their time line. In general, one can define multiple-segment encoding as dividing an input sequence of frames into segments and encoding them in different encoding sessions with the same or different parameter sets, as illustrated in Figure 6. (Note that different encoders can also be used.)

The application must be able to:

1. Extract encoding parameters from the bitstream of previously encoded segment;
2. Import these encoding parameters to configure the encoder.

Encoding can then continue on the current segment using either the same or the similar encoding parameters.

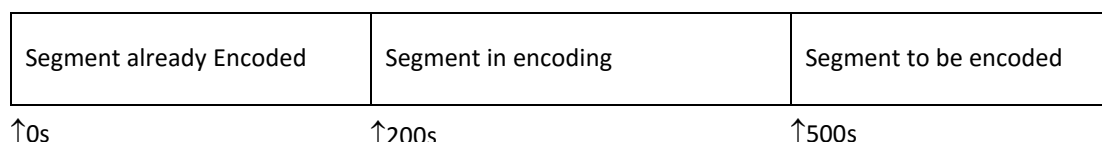


Figure 6: Multiple-Segment Encoding

Extracting the header containing the encoding parameter set from the encoded bitstream is usually the task of a format splitter (de-multiplexer). Nevertheless, the SDK [MFXVideoDECODE DecodeHeader](#) function can export the raw header if the application attaches the [mfxExtCodingOptionSPSPPS](#) structure as part of the parameters.

The encoder can use the [mfxExtCodingOptionSPSPPS](#) structure to import the encoding parameters during [MFXVideoENCODE Init](#). The encoding parameters are in the encoded bitstream format. Upon a successful import of the header parameters, the encoder will generate bitstreams with a compatible (not necessarily bit-exact) header. Table 9 shows all functions that can import a header and their error codes if there are unsupported parameters in the header or the encoder is unable to achieve compatibility with the imported header.

Table 9: Multiple-Segment Encoding Functions

Function Name	Error Code if Import Fails
MFXVideoENCODE Init	MFX_ERR_INCOMPATIBLE_VIDEO_PARAM
MFXVideoENCODE QueryIOSurf	MFX_ERR_INCOMPATIBLE_VIDEO_PARAM
MFXVideoENCODE Reset	MFX_ERR_INCOMPATIBLE_VIDEO_PARAM
MFXVideoENCODE Query	MFX_ERR_UNSUPPORTED

The encoder must encode frames to a GOP sequence starting with an IDR frame for H.264 (or I frame for MPEG-2) to ensure that the current segment encoding does not refer to any frames in the previous segment. This ensures that the encoded segment is self-contained, allowing the application to insert it anywhere in the final bitstream. After encoding, each encoded segment is HRD compliant. However, the concatenated segments may not be HRD compliant.

Example 14 shows an example of the encoder initialization procedure that imports H.264 sequence and picture parameter sets.

```

mfxStatus init_encoder(...) {
    mfxExtCodingOptionSPSPPS option, *option_array;

    /* configure mfxExtCodingOptionSPSPPS */
    memset(&option, 0, sizeof(option));
    option.Header.BufferId=MF_X_EXTBUFF_CODING_OPTION_SPSPPS;
    option.Header.BufferSz=sizeof(option);
    option.SPSBuffer=sps_buffer;
    option.SPSBufSize=sps_buffer_length;
    option.PPSBuffer=pps_buffer;
    option.PPSBufSize=pps_buffer_length;

    /* configure mfxVideoParam */
    mfxVideoParam param;
    ...
    param.NumExtParam=1;
    option_array=&option;
    param.ExtParam=&option_array;

    /* encoder initialization */
    mfxStatus status;
    status=MF_XVideoENCODE_Init(session, &param);
    if (status==MF_X_ERR_INCOMPATIBLE_VIDEO_PARAM) {
        printf("Initialization failed\n");
    } else {
        printf("Initialized\n");
    }
    return status;
}

```

Example 14: Pseudo-code to Import H.264 SPS/PPS Parameters

Appendix C: Streaming and Video Conferencing Features

The following sections address a few aspects of additional requirements that streaming or video conferencing applications may use in the encoding or transcoding process. See also Configuration Change chapter.

Dynamic Bitrate Change

The SDK encoder supports dynamic bitrate change differently depending on bitrate control mode and HRD conformance requirement. If HRD conformance is required, i.e. if application sets **NalHrdConformance** option in **mfxExtCodingOption** structure to ON, the only allowed bitrate control mode is VBR. In this mode, the application can change **TargetKbps** and **MaxKbps** values. The application can change these values by calling the [MFXVideoENCODE_Reset](#) function. Such change in bitrate usually results in generation of a new key-frame and sequence header. There are some exceptions though. For example, if HRD Information is absent¹ in the stream then change of **TargetKbps** does not require change of sequence header and as a result the SDK encoder does not insert a key frame.

If HRD conformance is not required, i.e. if application turns off **NalHrdConformance** option in **mfxExtCodingOption** structure, all bitrate control modes are available. In CBR and AVBR modes the application can change **TargetKbps**, in VBR mode the application can change **TargetKbps** and **MaxKbps** values. Such change in bitrate will not result in generation of a new key-frame or sequence header.

The SDK encoder may change some of the initialization parameters provided by the application during initialization. That in turn may lead to incompatibility between the parameters provided by the application during reset and working set of parameters used by the SDK encoder. That is why it is strongly recommended to retrieve the actual working parameters by [MFXVideoENCODE_GetVideoParam](#) function before making any changes to bitrate settings.

In all modes, the SDK encoders will respond to the bitrate changes as quickly as the underlying algorithm allows, without breaking other encoding restrictions, such as HRD compliance if it is enabled. How soon the actual bitrate can catch up with the specified bitrate is implementation dependent.

Alternatively, the application may use the CQP (constant quantization parameter) encoding mode to perform customized bitrate adjustment on a per-frame base. The application may use any of the encoded or display order modes to use per-frame CQP.

¹ HRD information is absent in the stream if both **VuiVclHrdParameters** and **VuiNalHrdParameters** options in **mfxExtCodingOption** structure are OFF.

Dynamic resolution change

The SDK encoder supports dynamic resolution change in all bitrate control modes. The application may change resolution by calling [MFXVideoENCODE_Reset](#) function. The application may decrease or increase resolution up to the size specified during encoder initialization.

Resolution change always results in insertion of key IDR frame and new sequence parameter set header. The SDK encoder does not guarantee HRD conformance across resolution change point.

The SDK encoder may change some of the initialization parameters provided by the application during initialization. That in turn may lead to incompatibility of parameters provide by the application during reset and working set of parameters used by the SDK encoder. That is why it is strongly recommended to retrieve the actual working parameters set by [MFXVideoENCODE_GetVideoParam](#) function before making any resolution change.

Forced Key Frame Generation

The SDK supports forced key frame generation during encoding. The application can set the **FrameType** parameter of the [mfxEncodeCtrl](#) structure to control how the current frame is encoded, as follows:

- If the SDK encoder works in the display order, the application can enforce any current frame to be a key frame. The application cannot change the frame type of already buffered frames inside the SDK encoder.
- If the SDK encoder works in the encoded order, the application must exactly specify frame type for every frame thus the application can enforce the current frame to have any frame type that particular coding standard allows.

Reference List Selection

During streaming or video conferencing, if the application can obtain feedbacks about how good the client receives certain frames, the application may need to adjust the encoding process to use or not use certain frames as reference. The following paragraphs describe how to fine-tune the encoding process based on such feedbacks.

The application can specify the reference window size by specifying the parameter [mfxInfoMFX::NumRefFrame](#) during encoding initialization. Certain platform may have limitation on how big the size of the reference window is. Use the function [MFXVideoENCODE_GetVideoParam](#) to retrieve the current working set of parameters.

During encoding, the application can specify the actual reference list lengths by attaching the [mfxExtAVCRefListCtrl](#) structure to the [MFXVideoENCODE_EncodeFrameAsync](#) function. The



NumRefIdxL0Active parameter of the [mfxExtAVCRefListCtrl](#) structure specifies the length of the reference list L0 and the **NumRefIdxL1Active** parameter specifies the length of the reference list L1. These two numbers must be less or equal to the parameter [mfxInfoMFX::NumRefFrame](#) during encoding initialization.

The application can instruct the SDK encoder to use or not use certain reference frames. To do this, there is a prerequisite that the application must uniquely identify each input frame, by setting the [mfxFrameData::FrameOrder](#) parameter. The application then specifies the preferred reference frame list **PreferredRefList** and/or the rejected frame list **RejectedRefList** in the [mfxExtAVCRefListCtrl](#) structure, and attach the structure to the [MFXVideoENCODE EncodeFrameAsync](#) function. The two lists fine-tune how the SDK encoder chooses the reference frames of the current frame. The SDK encoder does not keep **PreferredRefList** and application has to send it for each frame if necessary. There are a few limitations:

- The frames in the lists are ignored if they are out of the reference window.
- If by going through the lists, the SDK encoder cannot find a reference frame for the current frame, the SDK encoder will encode the current frame without using any reference frames.
- If the GOP pattern contains B-frames, the SDK encoder may not be able to follow the [mfxExtAVCRefListCtrl](#) instructions.

Low Latency Encoding and Decoding

The application can set [mfxVideoParam::AsyncDepth=1](#) to disable any decoder buffering of output frames, which is aimed to improve the transcoding throughput. With **AsyncDepth=1**, the application must synchronize after the decoding or transcoding operation of each frame.

The application can adjust [mfxExtCodingOption::MaxDecFrameBuffering](#), during encoding initialization, to improve decoding latency. It is recommended to set this value equal to number of reference frames.

Reference Picture Marking Repetition SEI message

The application can request writing the reference picture marking repetition SEI message during encoding initialization, by setting the **RefPicMarkRep** flag in the [mfxExtCodingOption](#) structure. The reference picture marking repetition SEI message repeats certain reference frame information in the output bitstream for robust streaming.

The SDK decoder will respond to the reference picture marking repetition SEI message if such message exists in the bitstream, and check with the reference list information specified in the sequence/picture headers. The decoder will report any mismatch of the SEI message with the reference list information in the [mfxFrameData::Corrupted](#) field.

Long-term Reference frame

The application may use long-term reference frames to improve coding efficiency or robustness for video conferencing applications. The application controls the long-term frame marking process by attaching the [mfxExtAVCRefListCtrl](#) extended buffer during encoding. The SDK encoder itself never marks frame as long-term.

There are two control lists in the [mfxExtAVCRefListCtrl](#) extended buffer. The **LongTermRefList** list contains the frame orders (the **FrameOrder** value in the [mfxFrameData](#) structure) of the frames that should be marked as long-term frames. The **RejectedRefList** list contains the frame order of the frames that should be unmarked as long-term frames. The application can only mark/unmark those frames that are buffered inside encoder. Because of this, it is recommended that the application marks a frame when it is submitted for encoding. Application can either explicitly unmark long-term reference frame or wait for IDR frame, there all long-term reference frames will be unmarked.

The SDK encoder puts all long-term reference frames at the end of a reference frame list. If the number of active reference frames (the **NumRefIdxL0Active** and **NumRefIdxL1Active** values in the [mfxExtAVCRefListCtrl](#) extended buffer) is smaller than the total reference frame number (the **NumRefFrame** value in the [mfxInfoMFX](#) structure during the encoding initialization), the SDK encoder may ignore some or all long term reference frames. The application may avoid this by providing list of preferred reference frames in the **PreferredRefList** list in the [mfxExtAVCRefListCtrl](#) extended buffer. In this case, the SDK encoder reorders the reference list based on the specified list.

Temporal scalability

The application may specify the temporal hierarchy of frames by using the [mfxExtAvcTemporalLayers](#) extended buffer during the encoder initialization, in the display-order encoding mode. The SDK inserts the prefix NAL unit before each slice with a unique temporal and priority ID. The temporal ID starts from zero and the priority ID starts from the **BaseLayerPID** value. The SDK increases the temporal ID and priority ID value by one for each consecutive layer.

If the application needs to specify a unique sequence or picture parameter set ID, the application must use the [mfxExtCodingOptionSPSPPS](#) extended buffer, with all pointers and sizes set to zero and valid **SPSId**/**PPSId** fields. The same SPS and PPS ID will be used for all temporal layers.

Each temporal layer is a set of frames with the same temporal ID. Each layer is defined by the **Scale** value. **Scale** for layer N is equal to ratio between the frame rate of subsequence consisted of temporal layers with temporal ID lower or equal to N and frame rate of base



temporal layer. The application may skip some of the temporal layers by specifying the `scale` value as zero. The application should use an integer ratio of the frame rates for two consecutive temporal layers.

For example, 30 frame per second video sequence typically is separated by three temporal layers, that can be decoded as 7.5 fps (base layer), 15 fps (base and first temporal layer) and 30 fps (all three layers). `scale` for this case should have next values `{1,2,4,0,0,0,0,0}`.

Appendix D: Switchable Graphics and Multiple Monitors

The following sections address a few aspects of supporting switchable graphics and multiple monitors configurations.

Switchable Graphics

Switchable Graphics refers to the machine configuration that multiple graphic devices are available (integrated device for power saving and discrete devices for performance.) Usually at one time or instance, one of the graphic devices drives display and becomes the active device, and others become inactive. There are different variations of software or hardware mechanisms to switch between the graphic devices. In one of the switchable graphics variations, it is possible to register an application in an affinity list to certain graphic device so that the launch of the application automatically triggers a switch. The actual techniques to enable such a switch are outside the scope of this document. This document discusses the implication of switchable graphics to the SDK and the SDK applications.

As the SDK performs hardware acceleration through Intel graphic device, it is critical that the SDK can access to the Intel graphic device in the switchable graphics setting. If possible, it is recommended to add the application to the Intel graphic device affinity list. Otherwise, the application must handle the following cases:

- 1> By the SDK design, during the SDK library initialization, the function [MFXInit](#) searches for Intel graphic devices. If a SDK implementation is successfully loaded, the function [MFXInit](#) returns [MFX_ERR_NONE](#) and the [MFXQueryIMPL](#) function returns the actual implementation type. If no SDK implementation is loaded, the function [MFXInit](#) returns [MFX_ERR_UNSUPPORTED](#).

In the switchable graphics environment, if the application is not in the Intel graphic device affinity list, it is possible that the Intel graphic device is not accessible during the SDK library initialization. The fact that the [MFXInit](#) function returns [MFX_ERR_UNSUPPORTED](#) does not mean that hardware acceleration is not possible permanently. The user may switch the graphics later and by then the Intel graphic device will become accessible. It is recommended that the application initialize the SDK



library right before the actual decoding, video processing, and encoding operations to determine the hardware acceleration capability.

- 2> During decoding, video processing, and encoding operations, if the application is not in the Intel graphic device affinity list, the previously accessible Intel graphic device may become inaccessible due to a switch event. The SDK functions will return [MFX_ERR_DEVICE_LOST](#) or [MFX_ERR_DEVICE_FAILED](#), depending on when the switch occurs and what stage the SDK functions operate. The application needs to handle these errors and exits gracefully.

Multiple Monitors

Multiple monitors refer to the machine configuration that multiple graphic devices are available. Some of the graphic devices connect to a display, they become active and accessible under the Microsoft* DirectX* infrastructure. For those graphic devices not connected to a display, they are inactive. Specifically, under the Microsoft Direct3D9* infrastructure, those devices are not accessible.

The SDK uses the adapter number to access to a specific graphic device. Usually, the graphic device that drives the main desktop becomes the primary adapter. Other graphic devices take subsequent adapter numbers after the primary adapter. Under the Microsoft Direct3D9 infrastructure, only active adapters are accessible and thus have an adapter number.

The SDK extends the implementation type [mfxIMPL](#) as follows

Implementation Type	Definition
MFX_IMPL_HARDWARE	The SDK should initialize on the primary adapter
MFX_IMPL_HARDWARE2	The SDK should initialize on the 2 nd graphic adapter
MFX_IMPL_HARDWARE3	The SDK should initialize on the 3 rd graphic adapter
MFX_IMPL_HARDWARE4	The SDK should initialize on the 4 th graphic adapter

The application can use the above definitions to instruct the SDK library to initialize on a specific graphic device. The application can also use the following definitions for automatic detection:

Implementation Type	Definition
<code>MFx_IMPL_HARDWARE_ANY</code>	The SDK should initialize on any graphic adapter
<code>MFx_IMPL_AUTO_ANY</code>	The SDK should initialize on any graphic adapter. If not successful, load the software implementation.

If the application uses the Microsoft* DirectX* surfaces for I/O, it is critical that the application and the SDK works on the same graphic device. It is recommended that the application use the following procedure:

- 1> The application uses the [MFxInit](#) function to initialize the SDK library, with option [MFx_IMPL_HARDWARE_ANY](#) or [MFx_IMPL_AUTO_ANY](#). The [MFxInit](#) function returns [MFx_ERR_NONE](#) if successful.
- 2> The application uses the [MFxQueryImpl](#) function to check the actual implementation type. The implementation type [MFx_IMPL_HARDWARE](#)...[MFx_IMPL_HARDWARE4](#) indicates the graphic adapter the SDK works on.
- 3> The application creates the DirectX* device on the respective graphic adapter, and passes it to the SDK through the [MFxVideoCORE_SetHandle](#) function.

Finally, similar to the switchable graphics cases, it is possible that the user disconnects monitors from the graphic devices or remaps the primary adapter thus causes interruption. If the interruption occurs during the SDK library initialization, the [MFxInit](#) function may return [MFx_ERR_UNSUPPORTED](#). This means hardware acceleration is currently not available. It is recommended that the application initialize the SDK library right before the actual decoding, video processing, and encoding operations to determine the hardware acceleration capability.

If the interruption occurs during decoding, video processing, or encoding operations, the SDK functions will return [MFx_ERR_DEVICE_LOST](#) or [MFx_ERR_DEVICE_FAILED](#). The application needs to handle these errors and exit gracefully.

Appendix E: Working directly with VA API for Linux*

The SDK takes care of all memory and synchronization related operations in VA API. However, in some cases the application may need to extend the SDK functionality by working directly with VA API for Linux*. For example, to implement customized external allocator or **USER** functions (also known as "plug-in"). This chapter describes some basic memory management and synchronization techniques.



To create VA surface pool the application should call `vaCreateSurfaces` as it is shown in Example 15.

```
VASurfaceAttrib attrib;
attrib.type = VASurfaceAttribPixelFormat;
attrib.value.type = VAGenericValueTypeInteger;
attrib.value.value.i = VA_FOURCC_NV12;
attrib.flags = VA_SURFACE_ATTRIB_SETTABLE;

#define NUM_SURFACES 5;
VASurfaceID surfaces[NUMSURFACES];

vaCreateSurfaces(va_display, VA_RT_FORMAT_YUV420,
                width, height,
                surfaces, NUM_SURFACES,
                &attrib, 1);
```

Example 15: Creation of VA surfaces

To destroy surface pool the application should call `vaDestroySurfaces` as it is shown in Example 16.

```
vaDestroySurfaces(va_display, surfaces, NUM_SURFACES);
```

Example 16: Destroying of VA surfaces

If the application works with hardware acceleration through the SDK then it can access surface data immediately after successful completion of `MFXVideoCORE_SyncOperation` call. If the application works with hardware acceleration directly then it has to check surface status before accessing data in video memory. This check can be done asynchronously by calling `vaQuerySurfaceStatus` function or synchronously by `vaSyncSurface` function.

After successful synchronization the application can access surface data. It is performed in two steps. At the first step `VAImage` is created from surface and at the second step image buffer is mapped to system memory. After mapping `VAImage.offsets[3]` array holds offsets to each color plain in mapped buffer and `VAImage.pitches[3]` array holds color plain pitches, in bytes. For packed data formats, only first entries in these arrays are valid. Example 17 shows how to access data in NV12 surface.

```
VAImage image;
unsigned char *buffer, Y, U, V;

vaDeriveImage(va_display, surface_id, &image);
vaMapBuffer(va_display, image.buf, &buffer);

/* NV12 */
Y = buffer + image.offsets[0];
U = buffer + image.offsets[1];
V = U + 1;
```

Example 17: Accessing data in VA surface

After processing data in VA surface the application should release resources allocated for mapped buffer and VAIImage object. Example 18 shows how to do it.

```
vaUnmapBuffer(va_display, image.buf);
vaDestroyImage(va_display, image.image_id);
```

Example 18: unmapping buffer and destroying VAIImage

In some cases, for example, to retrieve encoded bitstream from video memory, the application has to use VABuffer to store data. Example 19 shows how to create, use and then destroy VA buffer. Note, that vaMapBuffer function returns pointers to different objects depending on mapped buffer type. It is plain data buffer for VAIImage and VACodedBufferSegment structure for encoded bitstream. The application cannot use VABuffer for synchronization and in case of encoding it is recommended to synchronize by input VA surface as described above.

```
/* create buffer */
VABufferID buf_id;
vaCreateBuffer(va_display, va_context,
               VAEncCodedBufferType, buf_size,
               1, NULL, & buf_id);

/* encode frame */
...

/* map buffer */
VACodedBufferSegment *coded_buffer_segment;

vaMapBuffer(va_display, buf_id, (void **)( & coded_buffer_segment));

size    = coded_buffer_segment->size;
offset  = coded_buffer_segment->bit_offset;
buf     = coded_buffer_segment->buf;

/* retrieve encoded data*/
...

/* unmap and destroy buffer */
vaUnmapBuffer(va_display, buf_id);
vaDestroyBuffer(va_display, buf_id);
```

Example 19: Working with encoded bitstream buffer

Appendix F: CQP HRD mode encoding

Application can configure AVC encoder to work in CQP rate control mode with HRD model parameters. SDK will place HRD information to SPS/VUI and choose appropriate profile/level. It's responsibility of application to provide per-frame QP, track HRD conformance and insert required SEI messages to the bitstream.



Example 21 shows how to enable CQP HRD mode. Application should set `RateControlMethod` to CQP, `VuiNalHrdParameters` to ON, `NalHrdConformance` to OFF and set rate control parameters similar to CBR or VBR modes (instead of QPI, QPP and QPB). SDK will choose CBR or VBR HRD mode based on `MaxKbps` parameter. If `MaxKbps` is set to zero, SDK will use CBR HRD model (write `cbr_flag = 1` to VUI), otherwise VBR model will be used (and `cbr_flag = 0` is written to VUI).

```
mfxExtCodingOption option, *option_array;

/* configure mfxExtCodingOption */
memset(&option, 0, sizeof(option));
option.Header.BufferId      = MFX_EXTBUFF_CODING_OPTION;
option.Header.BufferSz      = sizeof(option);
option.VuiNalHrdParameters  = MFX_CODINGOPTION_ON;
option.NalHrdConformance    = MFX_CODINGOPTION_OFF;

/* configure mfxVideoParam */
mfxVideoParam param;
...
param.mfx.RateControlMethod    = MFX_RATECONTROL_CQP;
param.mfx.FrameInfo.FrameRateExtN = <valid_non_zero_value>;
param.mfx.FrameInfo.FrameRateExtD = <valid_non_zero_value>;
param.mfx.BufferSizeInKB      = <valid_non_zero_value>;
param.mfx.InitialDelayInKB    = <valid_non_zero_value>;
param.mfx.TargetKbps          = <valid_non_zero_value>;

if (<write cbr_flag = 1>)
    param.mfx.MaxKbps = 0;
else /* <write cbr_flag = 0> */
    param.mfx.MaxKbps = <valid_non_zero_value>;

param.NumExtParam = 1;
option_array      = &option;
param.ExtParam    = &option_array;

/* encoder initialization */
mfxStatus sts;
sts = MFXVideoENCODE_Init(session, &param);
...

/* encoding */
mfxEncodeCtrl ctrl;
memset(&ctrl, 0, sizeof(ctrl));
ctrl.QP = <frame_qp>

sts=MFXVideoENCODE_EncodeFrameAsync(session, &ctrl, surface2, bit
s, &syncp);
...
```

Example 21: Pseudo-code to enable CQP HRD mode