



# Intel<sup>®</sup> Screen Capture Decoder

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## Developer Reference

API Version 1.20



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## Overview

The Intel® Media SDK Screen Capture is a development library that exposes the media acceleration capabilities of Intel platforms for Windows Desktop front frame buffer capturing. The API library covers a wide range of Intel platforms.

The Intel® Media SDK Screen Capture package includes a hardware accelerated (HW) plug-in library exposing graphics acceleration capabilities, implemented as Intel® Media SDK Decode plug-in. The plug-in can be loaded into/used with only Intel Media SDK Hardware Library (see [mediasdkusr-man.pdf](#) document for plugin loading and more details). The package also includes a simple console sample showing how to use the Intel Media SDK Screen Capture plug-in.

This document describes Intel Media SDK Screen Capture API. To learn more about general Intel Media SDK API definition and Decode component see [mediasdk-man.pdf](#).

## Document Conventions

The Intel Screen Capture 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 (`mxfsStatus` and `MFxInit`). 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 [CodecFormatFourCC](#).

## Acronyms and Abbreviations

<b>API</b>	Application Programming Interface
<b>Direct3D9</b>	Microsoft* Direct3D* version 9
<b>Direct3D11</b>	Microsoft* Direct3D* version 11.1
<b>DXVA2</b>	Microsoft DirectX* Video Acceleration standard 2.0
<b>RGB4</b>	Thirty-two-bit RGB color format. Also known as RGB32
<b>NV12</b>	A color format for raw video frames
<b>SDK</b>	Intel® Media SDK
<b>SDK execution</b>	Intel® Media SDK execution
<b>SDK functions</b>	Intel® Media SDK functions
<b>SDK library</b>	Intel® Media SDK library
<b>SDK session</b>	Intel® Media SDK session
<b>video memory</b>	memory used by hardware acceleration device, also known as GPU, to hold frame and other types of video data



## Architecture

Intel® Media SDK functions fall into the following categories:

- DECODE**      Decode compressed video streams into raw video frames
- CORE**        Auxiliary functions for synchronization
- Misc**         Global auxiliary functions

## Screen capturing

Screen capture plug-in implemented through typical decoder interface with some additional features. Table 1 shows the Screen Capture features. The application can configure supported video decoding features through the video decoding initialization parameters. The application can also configure optional features through hints (additional extended buffer parameters). See [Screen capture procedure using decode plug-in / Configuration](#) for more details on how to configure decoder.

**Table 1: Screen capturing supported features**

Screen Capturing Features	Configuration
Capture display front buffer in NV12 format	initialization parameters
Capture display front buffer in RGB4 format	initialization parameters
Display selection	hint
Dirty rectangles detection	hint



## Programming Guide

This chapter describes the concepts used in programming the Intel® Media SDK and the Screen Capture.

The application must use the include file, `mfxvideo.h` (for C programming), or `mfxvideo++.h` (for C++ programming), and link the Intel Media SDK static dispatcher library, `libmfx.lib`.

Include these files:

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

Link this library:

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

## Screen capture procedure using decode plug-in

Example 1 shows the pseudo code of the video screen capturing procedure using plugin. The following describes a few key points:

- Typical decoder function [MFXVideoDECODE DecodeHeader](#) is not available for screen capture plug-in since no input stream is provided to the decoder.
- 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, without the bitstream buffer (pointer to the bitstream structure must be set to NULL), and a free unlocked working frame surface (`work`) as input parameters. If decoding output is not available, the function returns a status code requesting additional working frame surface as follows:

**[MFX\\_ERR\\_MORE\\_SURFACE](#)**: The function needs one more frame surface to produce any output.

- 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.



```
mfxSession session;
MFXInit(MFX_IMPL_HARDWARE, 1.17, &session);
MFXVideoUSER_Load(session, MFX_PLUGINID_CAPTURE_HW, version);
mfxVideoParam *in;// input parameters structure
mfxVideoParam *out;// output parameters structure
/* allocate structures and fill input parameters structure, zero unused fields */
MFXVideoDECODE_Query(session, in, out);
/* check supported parameters */
MFXVideoDECODE_QueryIOSurf(session, &in, &request);
allocate_pool_of_frame_surfaces(request.NumFrameSuggested);
MFXVideoDECODE_Init(session, &in);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    find_unlocked_surface_from_the_pool(&work);
    sts=MFXVideoDECODE_DecodeFrameAsync(session, NULL, work, &disp, &syncp);
    if (sts==MFX_ERR_MORE_SURFACE) continue;
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_decoded_frame(disp);
    }
}
MFXVideoDECODE_Close(session);
free_pool_of_frame_surfaces();
MFXClose(session)
```

**Example 1: Video decoding pseudo code**

## Configuration

The Screen Capture plug-in configures the screen capturing pipeline operation based on parameters specified in the [mfxVideoParam](#) structure.

Example 2 shows how to configure the SDK screen capturing.

```
/* configure the mfxVideoParam structure */
mfxVideoParam conf;

memset(&conf, 0, sizeof(conf));
conf.IOPattern=MFX_IOPATTERN_OUT_VIDEO_MEMORY;

conf.mfx.CodecId=MFX_CODEC_CAPTURE;
conf.mfx.FrameInfo.FourCC=MFX_FOURCC_NV12;
conf.mfx.FrameInfo.ChromaFormat=MFX_CHROMAFORMAT_YUV420;
conf.mfx.FrameInfo.Width=conf.mfx.FrameInfo.CropW=1920;
conf.mfx.FrameInfo.Height=1088;
conf.mfx.FrameInfo.CropH=1080;

/* video decoding initialization */
MFXVideoDECODE_Init(session, &conf);
```

**Example 2: Screen capture configuration pseudo code**



## Transcoding Procedures

The application can use other Intel Media SDK components and Screen Capture plugin together for transcoding operations. For example, video processing functions to resize with resolution less than initial content and then encode to H.264 or H.265, or directly encode to JPEG in RGB32. For more details on building transcoding pipelines please see [mediasdk-man.pdf](#).

For more details and pseudo code examples, please refer to [Transcoding Procedures](#) section in the [mediasdk-man.pdf](#).

Plug-in does not support capturing with a specified frame rate, so that frame is captured immediately after plug-in's [MFXVideoDECODE DecodeFrameAsync](#) function call. This means that one frame could be captured several times and some other frame could be skipped. It is application responsibility to call plug-in with constant frequency to get a constant FPS.

## Screen capture with DirtyRect detection using decode plug-in

Example 3 shows the pseudo code of the video screen capturing with DirtyRect feature usage procedure using plugin. The following describes a few key points:

- Capturing procedure with DirtyRect detection is almost like typical screen capture pipeline described by [Screen capture procedure using decode plug-in](#) section above;
- DirtyRect feature should be turned on during [MFXVideoDECODE Init](#) function call by setting corresponded parameter (`EnableDirtyRect`) in the provided extended buffer [mfxExtScreenCaptureParam](#);
- [mfxExtDirtyRect](#) extended buffer should be attached to the provided surfaces into the [MFXVideoDECODE DecodeFrameAsync](#) function. Detected dirty rectangles will be reported into this extended buffer after [MFXVideoCORE SyncOperation](#) function call.

```
mfxSession session;
MFXInit(MFX_IMPL_HARDWARE, 1.17, &session);
MFXVideoUSER_Load(session, MFX_PLUGINID_CAPTURE_HW, version);
mfxVideoParam par; //input parameters structure
mfxExtScreenCaptureParam extScPar; //input extended parameters structure
    extScPar.Header.BufferId = MFX_EXTBUFF_SCREEN_CAPTURE_PARAM;
    extScPar.Header.BufferSz = sizeof(extPar);
    extScPar.EnableDirtyRect = 1;

//Attach extended parameter structure to the input parameters:
mfxExtBuffer* buffers = (mfxExtBuffer*) &extScPar;
par.ExtParam = &buffers;
par.NumExtParam = 1;

MFXVideoDECODE_QueryIOSurf(session, &in, &request);

//allocate surface pool with mfxExtDirtyRect buffer attached to each surface
allocate_pool_of_frame_surfaces_and_attach_dirtyrect_buf(request.NumFrameSuggested);

MFXVideoDECODE_Init(session, &in);
sts=MFX_ERR_MORE_DATA;
for (;;) {
    find_unlocked_surface_from_the_pool(&work);
    sts=MFXVideoDECODE_DecodeFrameAsync(session, NULL, work, &disp, &syncp);
    if (sts==MFX_ERR_MORE_SURFACE) continue;
    ... // other error handling
    if (sts==MFX_ERR_NONE) {
        MFXVideoCORE_SyncOperation(session, syncp, INFINITE);
        do_something_with_decoded_frame_and_dirty_rect_info(disp);
    }
}
MFXVideoDECODE_Close(session);
free_pool_of_frame_surfaces();
MFXClose(session)
```

**Example 3: Video decoding with DirtyRect detection pseudo code**

## Screen capture with display selection

Screen capture plug-in supports display selection for systems with enabled virtual display. The following describes a few key points:

- Capturing procedure with display selection is exactly like typical screen capture pipeline described by [Screen capture procedure using decode plug-in](#) section above, the only difference is initialization;
- Display selection is done during [MFXVideoDECODE\\_Init](#) function call by setting corresponded parameter (DisplayIndex) in the provided extended buffer [mfxExtScreenCaptureParam](#);
- DisplayIndex represents the id field in the DISPLAYCONFIG\_PATH\_TARGET\_INFO structure reported by QueryDisplayConfig function;



- Display selection feature is available on systems with virtual displays only (without physical display connected) and RGB4 output fourcc format. For more information about supported configurations please refer to the release notes.

## Known limitations

There are several known issues and limitations in usage models of screen capture:

### Constant frame rate capturing

Plug-in does not support capturing with a specified frame rate, so that frame is captured immediately after plug-in's [MFXVideoDECODE DecodeFrameAsync](#) function call. This means that one frame could be captured several times and some other frame could be skipped. It is application responsibility to call plug-in with constant frequency to get a constant FPS.

### DirectX 11 and RGB4 output fourcc configuration particularity

Please note that in case of DirectX 11 implementation, video memory type, and RGB4 surface format usage, the application frame allocator needs to allocate the surfaces using DXGI\_FORMAT\_AYUV format because OS runtime will block RGB surface allocation with BIND\_DECODER flag and decoder output view. In any other configuration cases, e.g. DirectX 9 implementation, system or opaque memory type, or NV12 output format, special frame allocation is not needed.

### Capturing through regular DXGI DesktopDuplication or DirectX 9 front buffer capturing method

Plug-in supports screen capturing by slow regular DXGI DesktopDuplication or DirectX 9 front buffer capturing methods. This mode is used when [MFXVideoDECODE Init](#) function call returns warning [MFX WRN PARTIAL ACCELERATION](#) or if the current decoder library session was initialized as a software-based session ([MFX\\_IMPL\\_SOFTWARE](#)).

In case if regular DXGI DesktopDuplication or DirectX 9 front buffer capturing and HW accelerated encoding is required, Decoder should be initialized in a separated SW session and then joined to the Encoder HW session by [MFXJoinSession](#) SDK function. For more details, please refer to [Multiple Sessions](#) section in the [mediasdk-man.pdf](#).

### Protected content capturing

Plug-in does not support protected content capturing. Performance degradations might be observed if there is running application with OPM (Output Protection Manager) session even without actual protected content playing is open.

Capturing through regular DXGI DesktopDuplication or DirectX 9 front buffer capturing methods mode is activated during runtime (after initialization) if plug-in fails to perform HW accelerated screen capturing because of OPM session presence in the system.



## Performance decrease during entering and exiting fullscreen mode

A performance decrease for a several frames might be observed during starting and stopping fullscreen mode of any application.

## Resolution change up

Resolution change up (with bigger resolution values than on initialization) is not supported during runtime. Decoder re-initialization ([MFXVideoDECODE Close](#) and then [MFXVideoDECODE Init](#) with new parameters) is required.



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## Function Reference

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The Screen Capture does not define any new functions in addition to standard Intel Media SDK function set, please check [mediasdk-man.pdf](#) and [mediasdkusr-man.pdf](#) for the SDK functions description.



## Structure Reference

For a complete list of standard Intel Media SDK structure set, please check [mediasdk-man.pdf](#) and [mediasdkusr-man.pdf](#) for the SDK structures' description.

### mfxExtScreenCaptureParam

#### Definition

```
typedef struct
{
    mfxExtBuffer    Header;

    mfxU32          DisplayIndex;
    mfxU16          EnableDirtyRect;
    mfxU16          EnableCursorCapture;
    mfxU16          reserved[24];
} mfxExtScreenCaptureParam;
```

#### Description

The `mfxExtScreenCaptureParam` additional options for screen capturing.

#### Members

<code>Header.BufferId</code>	Must be <a href="#">MFX_EXTBUFF_SCREEN_CAPTURE_PARAM</a>
<code>Header.BufferSz</code>	Must be <code>sizeof(mfxExtScreenCaptureParam)</code>
<code>DisplayIndex</code>	Display index for screen capturing; this value is reserved and must be zero.
<code>EnableDirtyRect</code>	Enable DirtyRect detection feature.
<code>EnableCursorCapture</code>	Enable cursor capturing; this value is reserved and must be zero.

#### Change History

This structure is available since SDK API 1.17.



## Enumerator Reference

For a complete list of standard Intel Media SDK enumerator set, please check [mediasdk-man.pdf](#) and [mediasdkusr-man.pdf](#) for the SDK enumerators' description.

### CodecFormatFourCC

#### Description

The `CodecFormatFourCC` enumerator itemizes codecs in the FourCC format.

#### Name/Description

<code>MFX_CODEC_AVC</code>	AVC, H.264, or MPEG-4, part 10 codec
<code>MFX_CODEC_MPEG2</code>	MPEG-2 codec
<code>MFX_CODEC_VC1</code>	VC-1 codec
<code>MFX_CODEC_HEVC</code>	HEVC codec
<code>MFX_CODEC_CAPTURE</code>	Screen capture pseudo-codec id

#### Change History

This enumerator is available since SDK API 1.0.

SDK API 1.8 added `MFX_CODEC_HEVC` definition.

SDK API 1.15 added `MFX_CODEC_CAPTURE` definition.

### ExtendedBufferID

#### Description

The `ExtendedBufferID` enumerator itemizes and defines identifiers (`BufferId`) for extended buffers or video processing algorithm identifiers.

#### Name/Description

<code>MFX_EXTBUFF_SCREEN_CAPTURE_PARAM</code>	This extended buffer defines additional control parameters for screen capturing. See the <a href="#">mfxExtScreenCaptureParam</a> structure for details. The application can attach this buffer to the <a href="#">mfxVideoParam</a> structure for screen capture initialization.
---	---

This enumerator is available since SDK API 1.0.



SDK API 1.17 adds `MFX_EXTBUFF_SCREEN_CAPTURE_PARAM`.