Advanced Micro Devices

Advanced Media Framework –Video Decoder

Programming Guide

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1 Introduction

This document provides a complete description of the AMD Advanced Media Framework (AMF) Video Decoder Component. This component exposes the AMD Unified Video Decoder (UVD), which provides hardware accelerated video decoding functionality for the following codecs:

- MPEG2
- MPEG4
- WMV3
- VC1
- H.264 (including SVC and MVC)
- Motion JPEG
- H.265 (HEVC)

2 AMF Video Decoder Component

Video Decoder accepts elementary streams of the above codecs as input and produces output in a sequence of DirectX 9 surfaces or DirectX 11.1 textures.

The AMF Video Decoder component does not deal with multimedia container formats or demultiplexing of video, audio and other streams. The application using AMF Video Decoder must deal with these tasks on its own.

Include *public/include/components/VideoDecoderUVD.h*

2.1 Component Initialization

The AMF Video Decoder Component should be initialized using the following sequence:

1. Create an AMF Context and initialize it for one of the following:
    a. DirectX 11.1
    b. DirectX 9
    c. OpenGL
    d. OpenCL
2. Determine the codec and create an instance of the AMF Video Decoder object using the *AMFFactory::CreateComponent* method passing the above *AMFContext* interface as parameter. Use the following component IDs depending on the codec selected:

Component ID	**Description**
AMFVideoDecoderUVD_MPEG2	MPEG-2
AMFVideoDecoderUVD_MPEG4	MPEG-4 including MPEG-4 part 2
AMFVideoDecoderUVD_WMV3	WMV3
AMFVideoDecoderUVD_VC1	VC1
AMFVideoDecoderUVD_H264_AVC	h.264 AVC
AMFVideoDecoderUVD_H264_MVC	h.264 MVC (multi-stream)
AMFVideoDecoderUVD_H264_SVC	h.264 SVC (scalable video codec)
AMFVideoDecoderUVD_MJPEG	Motion JPEG
AMFVideoDecoderHW_H265_HEVC	h.265/HEVC (8-bit 4:2:0 sampling)
AMFVideoDecoderHW_H265_MAIN10	h.265/HEVC with Main 10 profile (8- or 10-bit 4:2:0 sampling)

3. Configure the decoder component by setting the necessary properties using the *AMFPropertyStorage::SetProperty* method on the decoder object.
4. Call the *AMFComponent::Init* method of the decoder object. The *format* parameter must be set to *AMF_SURFACE_NV12* for all codecs. The Motion JPEG codec supports the *AMF_SURFACE_YUY2* format in addition to *AMF_SURFACE_NV12.*

2.2 Configuring the Decoder

AMF Decoder can be configured using the following properties that need to be set before initialization:

- *AMF_VIDEO_DECODER_SURFACE_COPY*: Output samples are copied to newly allocated *AMFSurface* objects. This reduces decoder performance, but avoids the *AMF_DECODER_NO_FREE_SURFACES* error. Enable when the rest of the pipeline is significantly slower than the rate of submission of input samples.
- *AMF_VIDEO_DECODER_EXTRADATA*: Set SPS/PPS on the output stream. The property contains a pointer to an *AMFBuffer* object containing the data
- *AMF_VIDEO_DECODER_FRAME_RATE*: Optional property of type *amf_double* containing the frame rate in FPS
- *AMF_TIMESTAMP_MODE*:

  - *AMF_TS_PRESENTATION* – timestamps are generated based on the set frame rate (default). Use of this mode is necessary when decoding elementary streams with no timestamps on input frames. This is the most reliable option.
  - *AMF_TS_SORT* – timestamps are transferred from input samples to output samples and then sorted to ensure that timestamps on output frames appear in ascending order
  - *AMF_TS_DECODE* – timestamps are transferred from input samples to output samples. No sorting is performed.
- *AMF_VIDEO_DECODER_ADAPTIVE_RESOLUTION_CHANGE*: Boolean: when set to *false* (default) output surfaces will be reallocated on re-initialization when input resolution changes. When set to *true*, output surfaces will be reused if the new resolution is lower
- *AMF_VIDEO_DECODER_REORDER_MODE*: Determines frame reordering policy, which defines the decoder latency, i.e. the number of frames to be submitted before output becomes available:
  - *AMF_VIDEO_DECODER_MODE_REGULAR* – number of reference frames+1
  - AMF_VIDEO_DECODER_MODE_COMPLIANT – based on the profile, up to 16 frames
  - AMF_VIDEO_DECODER_MODE_LOW_LATENCY – low latency mode, output becomes available immediately. The decoder expects a stream with no frame reordering. B- and P-frames are allowed as long as they do not cause frame reordering
- *AMF_VIDEO_DECODER_DPB_SIZE*: the minimum required number of surfaces for frame reordering

The following read-only properties can be read to obtain information about the current stream, as well as decoder capabilities:

- *AMF_VIDEO_DECODER_ALLOC_SIZE*: Read-only, *AMFSize*: allocated output surface size
- *AMF_VIDEO_DECODER_CURRENT_SIZE*: Read-only, *AMFSize*: current resolution
- *AMF_VIDEO_DECODER_CAP_NUM_OF_STREAMS*: Read-only, retrieved through the *AMFCaps* interface, *amf_int64*: the maximum number of streams the decoder can support simultaneously

2.3 Submitting Input and Retrieving Output

Once the Decoder component is successfully initialized, you may start submitting input samples to it. Input samples must be submitted as *AMFBuffer* objects.

At the same time poll for output by calling *AMFComponent::QueryOutput* on the Decoder object. Polling for output samples can be done either from the same thread or from another thread.

Suspend submission of input samples when *AMFComponent::SubmitInput* returns *AMF_INPUT_FULL* or *AMF_DECODER_NO_FREE_SURFACES*. Continue to poll for output samples and process them as they become available.

2.4 Terminating the Decoder Component

To terminate the Decoder component, call the *Terminate* method, or simply destroy the object. Ensure that the context used to create the Decoder component still exists during termination.

3 Sample Applications

A sample application demonstrating the use of the Decoder component in AMF is available as part of the AMF SDK in *public/samples/CPPSample/SimpleDecoder*. The sample takes a file with an h.264 or an h.265 elementary stream and decodes it to a file containing uncompressed raw frames.

To run the sample, execute the '*SimpleDecoder.exe <input file name>*' command at the command prompt. Note that the output file can be large, ensure there's sufficient disk space available.