DirectX Video Acceleration Specification of Additional Restricted-Mode Profiles for MPEG-1 VLD and Combined MPEG-1 and MPEG-2 VLD Video Decoding

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Applies to:

- DirectX Video Acceleration

Summary: Defines extensions to DirectX Video Acceleration (DXVA) to support variable-length decoding (VLD) modes for MPEG-1 and MPEG-2 video.

Contents

1. Introduction and Scope

This specification defines DirectX Video Acceleration (DXVA) operations for MPEG-1 video decoding and combined MPEG-1 and MPEG-2 video decoding, using only accelerator-based VLD-mode bitstream decoding operations. The specification defines new restricted-mode DXVA profiles for MPEG-1 VLD decoding. In these profiles, the accelerator performs bitstream parsing, inverse quantization scaling, inverse transform processing, and motion compensation, according to the MPEG-1 specification.

The MPEG-1 specification, ISO/IEC 11172-2:1993, *Information technology — Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s — Part 2: Video*, is available at http://www.iso.org/iso/catalogue_detail.htm?csnumber=22411.

All aspects of DXVA operation that are not specified herein are identical to the prior specification for MPEG-1 and MPEG-2 DXVA usage, as specified in the Windows SDK and DDK. The meanings of the structure members are unchanged for MPEG-1 VLD video decoding. The DXVA syntax structures are documented in the DXVA 1.0 and DXVA 2.0 documentation (see “For More Information,” in this specification).

2. Modifications Common to the Additional Modes

This section describes modifications to the DXVA specifications that apply to all the restricted-mode profiles described in this document.

2.1 Configuration Parameters

This section describes the configuration parameters for MPEG-1 VLD video decoding. Configuration is performed by using the same "probe and lock" process that was defined previously for DXVA. The existing DXVA configuration structures are used:

- DXVA 1 configuration uses the **DXVA_ConfigPictureDecode** structure.
- DXVA 2 configuration uses the **DXVA2_ConfigPictureDecode** structure.

The meaning of the structure members is unchanged for MPEG-1 VLD DXVA. The following table lists restrictions on the structure members in this context.

Structure Member	Value
ConfigBitstreamRaw	1
ConfigMBcontrolRasterOrder	0 (because ConfigBitstreamRaw is 1)
ConfigResidDiffHost	0 (because ConfigBitstreamRaw is 1)
ConfigSpatialResid8	0 (because ConfigResidDiffHost is 0)
ConfigResid8Subtraction	0 (because ConfigResidDiffHost is 0)
ConfigSpatialHost8or9Clipping	0 (because ConfigResidDiffHost is 0)
ConfigSpatialResidInterleaved	0 (because ConfigResidDiffHost is 0)
ConfigIntraResidUnsigned	0 (because ConfigResidDiffHost is 0)
ConfigResidDiffAccelerator	0 (because ConfigBitstreamRaw is 1)
ConfigHostInverseScan	0 (because ConfigResidDiffAccelerator is 0)
ConfigSpecificIDCT	0 (because ConfigResidDiffAccelerator is 0)
Config4GroupedCoefs	0 (because ConfigResidDiffAccelerator is 0)
ConfigDecoderSpecific	0

2.2 Revisions to the DXVA_PictureParameters Data Structure

For the **DXVA_PictureParameters** data structure, the following member semantics are replaced as follows:

bReservedBits

Must be zero for all video types other than the new MPEG1_VLD and MPEG2and1_VLD modes involving MPEG-1 (see Section 3). If MPEG1_VLD or MPEG2and1_VLD mode is used, this structure member is interpreted as follows:

- 0: The associated bitstream data buffers are encoded in the MPEG-2 format.
- 1: The associated bitstream data buffers are encoded in the MPEG-1 formats.

wBitstreamPCEelements

If the **bConfigBitstreamRaw** member of the **DXVA_ConfigPictureDecode** structure is 1, this member contains a set of flags for the bitstream decoding process for MPEG-1 or MPEG-2 video.

If **bConfigBitstreamRaw** is zero, **wBitstreamPCEelements** is not used and must be zero. For all video types other than MPEG-2 and the new MPEG1_VLD and MPEG2and1_VLD modes involving MPEG-1, **wBitstreamPCEelements** is not used and must be zero.

When **wBitstreamPCEelements** is used, the bits are defined by their correspondence with bitstream elements of the MPEG-2 picture coding extension and MPEG-1 syntax, as follows:

Bits	Description	Value for MPEG-1
14,15	Equal to intra_dc_precision.	0
12,13	Equal to picture_structure. The value must be equal to the **bPicStructure** member of the **DXVA_PictureParameters** structure.	picture_structure
11	Equal to top_field_first.	1
10	Equal to frame_pred_frame_dct.	1
9	Equal to concealment_motion_vectors.	0
8	Equal to q_scale_type.	0
7	Equal to intra_vlc_format.	0
6	Equal to alternate_scan.	0
5	Equal to repeat_first_field. (This value is not needed by the accelerator.)	0
4	Equal to chroma_420_type. For MPEG-2, it is restricted to be equal to progressive_frame. (This value is not needed by the accelerator.)	1
3	Equal to progressive_frame.	1
2	For MPEG-2, this bit is reserved and should equal zero. For MPEG-1, this bit is equal to full_pel_forward_vector.	full_pel_forward_vector
1	For MPEG-2, this bit is reserved and should equal zero. For MPEG-1, this bit is equal to full_pel_backward_vector.	full_pel_backward_vector
0	Reserved bit. Should equal zero.	0

3. Restricted-Mode Specifications

This section describes the new restricted-mode profiles.

3.1 MPEG1_VLD profile

The MPEG1_VLD restricted-mode profile contains a set of features required to support MPEG-1 video (ISO/IEC 11172-2). In this profile, the accelerator performs bitstream parsing, inverse quantization scaling, inverse transform processing, and motion compensation according to the MPEG-1 specification.

In this mode, the bitstream data buffers shall not contain MPEG-1 D-pictures. If present in a source bitstream, the host software decoder shall remove any such pictures before passing bitstream data buffers to the accelerator. However, the accelerator shall ignore any such pictures if present, without affecting the decoding and output of any other pictures.

The GUID and restricted-mode constant for this profile are currently not defined in the Windows SDK. To use this profile, use the following declarations:

```
// {6F3EC719-3735-42cc-8063-65CC3CB36616}
DEFINE_GUID(DXVA_ModeMPEG1_VLD,
0x6f3ec719, 0x3735, 0x42cc, 0x80, 0x63, 0x65, 0xcc, 0x3c, 0xb3, 0x66,
0x16);

#define DXVA_RESTRICTED_MODE_MPEG1_VLD  0x10
```

The MPEG1_VLD profile has the same restrictions on DXVA data structure values as the existing MPEG1_A profile (http://go.microsoft.com/fwlink/?LinkId=210874), except as specified herein. The following additional constraints are also imposed.

Restrictions on DXVA_ConnectMode

The following restriction on the **DXVA_ConnectMode** structure applies when the *bDXVA_Func* variable defined in the **dwFunction** member of the **DXVA_ConfigPictureDecode** structure is equal to 1.

Structure Member	Value
wRestrictedMode	DXVA_RESTRICTED_MODE_MPEG1_VLD

3.2 MPEG2and1_VLD Profile

The MPEG2and1_VLD restricted-mode profile contains a set of features required to support MPEG-2 Main Profile video (H.262; ISO/IEC 13818-2) and MPEG-1 video (ISO/IEC 11172-2). In this profile, the accelerator performs bitstream parsing, inverse quantization scaling, inverse transform processing, and motion compensation according to the MPEG-2 Main Profile or MPEG-1 specification.

In this mode, the bitstream data buffers shall not contain MPEG-1 D-pictures. If present in a source bitstream, the host software decoder shall remove any such pictures before passing bitstream data buffers to the accelerator. However, the accelerator shall ignore any such pictures if present, without affecting the decoding and output of any other pictures.

When this profile is used, the accelerator shall support seamless switching between the MPEG-2 Main Profile and MPEG-1 video formats for picture decoding and output.

The GUID and restricted-mode constant for this profile are currently not defined in the Windows SDK. To use this profile, use the following declarations:

```
// {86695F12-340E-4f04-9FD3-9253DD327460}
DEFINE_GUID(DXVA_ModeMPEG2and1_VLD,
0x86695f12, 0x340e, 0x4f04, 0x9f, 0xd3, 0x92, 0x53, 0xdd, 0x32, 0x74,
0x60);

#define DXVA_RESTRICTED_MODE_MPEG2and1_VLD  0x11
```

In the MPEG2and1_VLD profile, when the **bReservedBits** member of **DXVA_PictureParameters** is 0, the profile has the same restrictions on DXVA data structure values as the existing MPEG2_C profile (http://go.microsoft.com/fwlink/?LinkId=210875), except as specified herein.

When the **bReservedBits** member of **DXVA_PictureParameters** is 1, the profile has the same restrictions on DXVA data structure values as the existing MPEG1_A profile (http://go.microsoft.com/fwlink/?LinkId=210874), except as specified herein.

The following additional constraints are also imposed.

Restrictions on DXVA_ConnectMode

The following restriction on the **DXVA_ConnectMode** structure applies when the *bDXVA_Func* variable defined in the **dwFunction** member of the **DXVA_ConfigPictureDecode** structure is equal to 1.

Structure Member	Value
wRestrictedMode	DXVA_RESTRICTED_MODE_MPEG2and1_VLD

The requirements for supporting this profile are a superset of those needed to support the MPEG-1 video restricted-mode profile and the MPEG-2 Main Profile restricted-mode profile in VLD operation. Therefore, if a hardware accelerator driver supports this profile, it should also indicate support for DXVA_ModeMPEG1_VLD restricted-mode profile. In addition, it should indicate support for either DXVA2_ModeMPEG2_VLD or DXVA_ModeMPEG2_C restricted-mode profile.

For More Information

- DXVA 1.0 specification: http://go.microsoft.com/fwlink/?LinkId=93647
- DXVA interfaces: http://go.microsoft.com/fwlink/?LinkId=210876
- DXVA configuration: http://go.microsoft.com/fwlink/?LinkId=210877
- Windows Driver Kit (WDK) documentation for DXVA: http://msdn.microsoft.com/en-us/library/ff55386.aspx
- DXVA 2.0: http://go.microsoft.com/fwlink/?LinkId=94771

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