

## CHANGE REQUEST

**DASH-IF IOP**    **CR 0005**    **rev -**    **Current version: 4.0**

**Status:**     Draft     Internal Review     Community Review     Editor's Proposal     Agreed

**Title:** Addition of VP9 Video to DASH-IF IOP  
**Source:** DASH-IF IOP WG  
**Supporting Companies:** Akamai, Cisco, Google, Intel, Microsoft, Netflix  
**Category:** **A**    **Date:** 2016-01-30  
*Use one of the following categories:*  
**C** (correction)  
**A** (addition of feature)  
**B** (editorial modification)

**Reason for change:** The VP9 video format is widely used for Internet streaming by Web browsers and other free software because of its open development model. It is efficient in terms of data bandwidth utilization at high special resolutions, and supports 10- and 12-bit High Dynamic Range and Wider Color Gamut, thus providing an improved user experience. It would be advantageous to specify the application of the VP9 codec in ISO Media Format and DASH Segments, and how this codec is signaled in MPD Adaptation Sets.

**Summary of change:** Signaling for video encoded with the VP9 codec is added.

**Consequences if not approved:** Not applicable.

**Sections affected:** Acronyms, Abbreviations and Definitions; References; Section 6.2 (Video); Section 8 (DASH-IF interoperability points). Section 11 (VP9).

**Other comments:**

**Disclaimer:** This document is not yet final. It is provided for public review until the deadline mentioned below. If you have comments on the document, please submit comments by one of the following means:

- at the github repository <https://github.com/Dash-IndustryForum/VP9/issues> (public at <https://gitreports.com/issue/Dash-Industry-Forum/VP9>)
- [dashif+iop@grouppaces.com](mailto:dashif+iop@grouppaces.com) with a subject tag [VP9], or

Please add a detailed description of the problem and the comment.

Based on the received comments a final document will be published latest by the expected publication date below, integrated in a new version of DASH-IF IOP if the following additional criteria are fulfilled:

- All comments from community review are addressed
- The relevant aspects for the Conformance Software are provided
- Verified IOP test vectors are provided

**Commenting Deadline:** April 15<sup>th</sup>, 2017

**Expected Publication:** May 31<sup>st</sup>, 2017

# Scope

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The scope of the DASH-IF InterOperability Points (IOPs) defined in this document is to provide support for high-quality video distribution for over the top services using H.264/AVC and H.265/HEVC. Both live and on-demand services are supported. The specified features enable relevant use cases including on-demand, live services, ad insertion, trick modes, content protection and subtitling. Extensions for multi-channel audio, [VP9 video](#), and Ultra High Definition video are defined.

Any identified bugs or missing features may be submitted through the DASH-IF issue tracker at <https://gitreports.com/issue/Dash-Industry-Forum/DASH-IF-IOP>.

# Acronyms, Abbreviations and Definitions

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[VP9](#) An open video format and open-source codec sponsored by Google.

# References

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- [81] [VP9 Bitstream & Decoding Process Specification.](https://storage.googleapis.com/downloads.webmproject.org/docs/vp9/vp9-bitstream-specification-v0.6-20160331-draft.pdf)  
<https://storage.googleapis.com/downloads.webmproject.org/docs/vp9/vp9-bitstream-specification-v0.6-20160331-draft.pdf>
- [82] [VP Codec ISO Media File Format Binding.](https://storage.googleapis.com/downloads.webmproject.org/docs/vp9/vp-codec-iso-media-file-format-binding-20160516-draft.pdf)  
<https://storage.googleapis.com/downloads.webmproject.org/docs/vp9/vp-codec-iso-media-file-format-binding-20160516-draft.pdf>
- [83] [VP9 Levels and Decoder Testing.](http://www.webmproject.org/vp9/levels/) <http://www.webmproject.org/vp9/levels/>

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# Introduction

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**Table 1 DASH-IF Interoperability Point Extensions**

Extension	Identifier	Version	Section
<b>Add at the end</b>			
<u><a href="#">DASH-IF VP9 Tier 0</a></u>	<u><a href="http://dashif.org/guidelines/dashif#vp9-tier0">http://dashif.org/guidelines/dashif#vp9-tier0</a></u>	<u><a href="#">4.0</a></u>	<u><a href="#">11.3.1</a></u>
<u><a href="#">DASH-IF VP9 Tier 1</a></u>	<u><a href="http://dashif.org/guidelines/dashif#vp9-tier1">http://dashif.org/guidelines/dashif#vp9-tier1</a></u>	<u><a href="#">4.0</a></u>	<u><a href="#">11.3.2</a></u>
<u><a href="#">DASH-IF VP9 Tier 2</a></u>	<u><a href="http://dashif.org/guidelines/dashif#vp9-tier2">http://dashif.org/guidelines/dashif#vp9-tier2</a></u>	<u><a href="#">4.0</a></u>	<u><a href="#">11.3.3</a></u>

## 6.2 Video

### 6.2.1 General

Add at the end

- [For VP9 extensions, refer to section 11.](#)

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## 11 DASH-IF VP9 Extensions

### 11.1 Introduction

VP9 is an alternative video codec is which may be used for SD, HD, and UHD spatial resolutions, as well as HDR10 and HDR12 bit depths (HDR + WCG); and frame rates of 24fps and higher. This codec provides significant bandwidth savings at equivalent qualities with respect to AVC/H.264. While not meant to replace AVC and HEVC, DASH presentations may include additional VP9 representations for playback on clients which support it.

### 11.2 DASH-Specific Aspects for VP9 Video

For the integration in the context of DASH, the following applies for VP9:

- The encapsulation of VP9 video data in ISO BMFF is defined in the VP Codec ISO-BMFF Binding specification [82]. Clients shall support both sample entries containing 'vp09' and 'vpcC' boxes, i.e. inband storage for VPCodecConfigurationBox + VPCodecConfigurationRecord.
- For delivery to consumer devices, only VP9 profile 0 (4:2:0 chroma subsampling and 8-bit pixel depth), and profile 1 (4.2.0 chroma subsampling and 10- or 12-bit pixel depths) shall be used.
- Stream Access Points shall coincide with the beginning of key frames (uncompressed header field frame\_type = 0) as defined in the VP9 Bitstream Specification [81] section 7.2. Only type-1 SAPs are supported. Fragmentation and segmentation shall occur only at these points.
- Codec and codec configuration signaling in the MPD shall occur using the codec string defined in the VP Codec Binding Specification [82], DASH Application section.

- Encryption shall be signaled by the same mechanisms as defined in Common Encryption for ISO-BMFF Containers 3<sup>rd</sup> edition. Subsample encryption is required as per the VP Codec ISO Media File Format Binding spec [82].

### 11.2.1 Bitstream Switching

For VP9 video streams, if the @bitstreamSwitching flag is set to true, then the following additional constraints shall apply:

- Edit lists shall not be used to synchronize video to audio and presentation timelines.
- Video Media Segments shall set the first presented sample's composition time equal to the first decoded sample's decode time, which equals the baseMediaDecodeTime in the Track Fragment Decode Time Box ('tfdt').
  - o Note: This requires the use of negative composition offsets in a v1 Track Run Box ('trun') for video samples, otherwise video sample reordering will result in a delay of video relative to audio.
- The @presentationTimeOffset attribute shall be sufficient to align audio, video, subtitle, and presentation timelines at presentation a Period's presentation start time. Any edit lists present in Initialization Segments shall be ignored. It is strongly recommended that the Presentation Time Offset at the start of each Period coincide with the first frame of a Segment to improve decoding continuity at the start of Periods.
- All representations within the Adaptation set shall have the same picture aspect ratio.
- All VP9 decoders are required to support dynamic video resolutions, however pixel bit-depths may not vary within an adaptation set. Because of this the encoding Profile must remain constant, but the Level may vary.
- All Representations within a video Adaptation Set shall include an Initialization Segment containing an 'vpcc' Box containing a Decoder Configuration Record with the highest, , Level, vertical and horizontal resolutions of any Media Segment in the Representation.
- The AdaptationSet@codecs attribute shall be present and contain the maximum level of any Representation contained in the Adaptation Set.
- The Representation@codecs attribute may be present and in that case shall contain the maximum level of any Segment in the Representation.

## 11.3 DASH-IF VP9 Extension IOPs

### 11.3.1 DASH-IF VP9-TIER0

The scope of the DASH-IF VP9-TIER0 extension interoperability point is basic support of high-quality video distribution over the top based on VP9 up to 1080p with 8-bit pixel depth and up to 30fps. Both, live and on-demand services are supported.

The compliance to DASH-VP9 main may be signaled by a @profiles attribute with the value "http://dashif.org/guidelines/dashif#vp9-tier0"

A DASH client conforms to this extension IOP by supporting at least the following features:

- All DASH-related features as defined in section 3 of this document.
- The requirements and guidelines in section 4.9.2 for simple live operation.
- The requirements and guidelines in section 5.6.1 for server-based ad insertion.
- Content protection based on common encryption and key rotation as defined in section 7. And specifically, the client supports MPD-based parsing parameters for common encryption.
- All VP9 DASH IF IOP requirements in section 11.2.
- VP9 Profile 0 up to level 4.1.

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### 11.3.2 DASH-IF VP9-TIER1

The scope of the DASH-IF VP9-TIER1 extension interoperability point is basic support of high-quality video distribution over the top based on VP9 up to 2160p with 8-bit pixel depth and up to 60fps. Both, live and on-demand services are supported.

The compliance to DASH-VP9 main may be signaled by a @profiles attribute with the value "http://dashif.org/guidelines/dashif#vp9-tier1"

A DASH client conforms to this extension IOP by supporting at least the following features:

- All features supported by DASH-IF VP9-TIER0 defined in section 11.3.1.
- VP9 Profile 0 up to level 5.1.

### 11.3.2 DASH-IF VP9-TIER2

The scope of the DASH-IF VP9-TIER2 extension interoperability point is basic support of high-quality video distribution over the top based on VP9 up to 2160p with 10-bit pixel depth and up to 60fps. Both, live and on-demand services are supported.

The compliance to DASH-VP9 main may be signaled by a @profiles attribute with the value http://dashif.org/guidelines/dashif#vp9-tier2

A DASH client conforms to this extension IOP by supporting at least the following features:

- All features supported by DASH-IF VP9-TIER0 defined in sections 11.3.1.
- VP9 profile 2 up to level 5.1.
- Pixel depths of 10 bits.