

CHANGE REQUEST

DASH-IF IOP CR **0007** rev - **Current version:** **4.0**

Status: Draft Internal Review Community Review Agreed

Title: Annotation and Client Model for Content Selection

Source: DASH-IF IOP

Supporting Companies: Qualcomm Incorporated

Category: **A** **Date:** 2017-02-23

Use one of the following categories:

- C** (correction)
- A** (addition of feature)
- B** (editorial modification)

Reason for change: DASH supports many different aspects to add Annotation for Adaptation Sets. The reason for this is that different use cases have been defined that may be specific for specific ecosystems. However, for consistent interoperability, DASH-IF IOP misses clear guidelines for the content generation as well as for the client implementation to select audio and video tracks at startup and operations. Therefore, a consistent signalling framework is necessary.

Summary of change: Provide a list of permitted Adaptation Set annotations in DASH-IF IOP
Provide requirements and recommendations for content authoring
Provide a client reference implementation that makes use of the annotation

Consequences if not approved: Not applicable.

Sections affected: 3.2.4, 3.9 (new)

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/IOP/issues> (public at <https://gitreports.com/issue/haudiobe/DASH-IF-IOP>), or
- dashif+iop@groupspaces.com

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 documented
- IOP test cases are provided

Commenting Deadline: April 30th, 2017

Expected Publication: June 30th, 2017

FIRST CHANGE:

3.2.4 Presence of Attributes and Elements

Elements and attributes are expected to be present for certain Adaptation Sets and Representations to enable suitable initial selection and switching. [Simple rules are provided in this section. A detailed description of multi-track content offering is provided in clause 3.9.](#)

Specifically the following applies:

- For any Video Adaptation Sets as defined in **Error! Reference source not found.** the following attributes shall be present
 - @maxWidth (or @width if all Representations have the same width)
 - @maxHeight (or @height if all Representations have the same height)
 - @maxFrameRate (or @frameRate if all Representations have the same frame rate)
 - @par

Note: The attributes @maxWidth and @maxHeight should be used such that they describe the target display size. This means that they may exceed the actual largest size of any coded Representation in one Adaptation Set.

- For any Representation within an Video Adaptation Sets as defined in **Error! Reference source not found.** the following attributes shall be present:
 - @width, if not present in **AdaptationSet** element
 - @height, if not present in **AdaptationSet** element
 - @frameRate, if not present in **AdaptationSet** element
 - @sar

Note: @width, @height, and @sar attributes should indicate the vertical and horizontal sample count of encoded and cropped video samples, not the intended display size in pixels.

- For Adaptation Set or for any Representation within an Video Adaptation Sets as defined in **Error! Reference source not found.** the attribute @scanType shall either not be present or shall be set to "progressive".
- For any Audio Adaptation Sets as defined in **Error! Reference source not found.** the following attributes shall be present
 - @lang
- For any Representation within an Audio Adaptation Sets as defined in **Error! Reference source not found.** the following elements and attributes shall be present:
 - @audioSamplingRate, if not present in **AdaptationSet** element
 - **AudioChannelConfiguration**, if not present in **AdaptationSet** element

SECOND CHANGE:

3.10 Annotation and Client Model for Content Selection

3.10.1 Introduction

Beyond the ability to provide multiple Representations of the same media component in one Adaptation Set, DASH MPDs also provide the functionality to annotate Adaptation Sets, such that clients can typically select at most one Adaptation Set for each media type, based on the encoding and description provided in the MPD. The selection is based on client capabilities, client preferences, user preferences and possibly also interactive signalling with the user. Typically, the signalling and selection is independent of the codec in use. This clause provides requirements and recommendations for labelling Adaptation Sets, if multiple tracks are offered. Note that there may be cases that multiple Representations from different Adaptation Sets per media type are chosen for playback, for example if there is a dependency across Representations. In other cases, a DASH client may be asked to select more than one Adaptation Set per media type based on application decisions.

Multiple Adaptation Sets may be offered to provide the same content in different encodings, for example different codecs; or different source formats, for example one Adaptation Set encoded from a standard dynamic range master and another encoded from a high dynamic range video master. Alternatively, Adaptation Sets may describe different content, for example different languages, or different camera views of the same event that are provided in a synchronized presentation in one MPD.

Proper labelling of Adaptation Sets in MPDs conforming to DASH-IF IOPs is essential in order to enable consistent client implementations. In addition, also a model is needed on how the client makes use of the annotation for a content authors to understand the expected effect of the labelling on playback.

3.10.2 Adaptation Set Labeling Options for Selection

DASH in ISO/IEC 23009-1 [1] provides many options for labelling Adaptation Sets. In order to provide more consistency in the context of DASH-IF, Table 1 provides a restricted subset of labels for which DASH-IF IOPS provide interoperability, i.e. on how they are expected to be used by the content authors and how they are expected to be used by clients. The table provides information specific for each media type.

It is expected that DASH clients following the DASH IOPs recognize the descriptors, elements, and attributes as documented in Table 1.

Other organizations may define additional descriptors or elements, as well as processing models for clients.

Table 1 Adaptation Set Attributes and Elements and Usage in DASH-IF IOPs (see ISO/IEC 23009-1 [1])

Attribute or Element	Use for media type	Detailed Usage in DASH-IF IOPs
General Attributes and Elements for any media type		
@profiles	O	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. If not present, it is inherited from the MPD or Period. This may be used for example to signal extensions for new media profiles in the MPD. At least one of the values defined in Table 1 and Table 2 of this document shall be present, or inferred from MPD or Period higher-level.
@group	O	See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5. The attribute may be used and shall be different at least for different media type. If present, the value shall be greater than 0. For all Adaptation Sets in

		<p>the same group, the Group shall be the same.</p> <p>Only one Representation in a Group is intended to be presented at a time. However, two or multiple groups of the same media type may exist, if the content author expects simultaneous presentation of two or more Representation of the same media type.</p>
@selectionPriority	OD default =1	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>This attribute should be used to dis-ambiguate Adaptation Sets within one group for selection and expresses the preference of the MPD author on selecting Adaptation Sets for which the DASH client does make a decision otherwise. Examples include two video codecs providing the same content, but one of the two provides higher compression efficiency and is therefore preferred by the MPD author.</p>
ContentProtection	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>If this element is present, then the content is protected.</p> <p>If not present, no content protection is applied.</p> <p>For details and usage please refer to clause 7.</p>

Label	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. This element enables to provide a textual description of the content. This element should be used if content author expects that clients supports UI for selection. However, this element must not be used as the sole differentiating element as at start-up no user interaction is available.
EssentialProperty	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9 specifies information about the containing element that is considered essential by the Media Presentation author for processing the containing element. The following schemes are expected to be recognized by a DASH-IF client independent of the media type: <ul style="list-style-type: none"> • http://dashif.org/guidelines/trickmode (see clause 3.2.9)
SupplementalProperty		See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9 specifies information about the containing element that is considered supplemental by the Media Presentation author for processing the containing element. In no case this information is used for differentiation, the information may used by a DASH client for improved operation. The following schemes are expected to be recognized by a DASH-IF client independent of the media type: <ul style="list-style-type: none"> - urn:mpeg:dash:adaptation-set-switching:2016 (see clause 3.8) - http://dashif.org/guidelines/trickmode (see clause 3.2.9) - urn:mpeg:dash:period-continuity:2015 (see clause 3.2.12) - urn:mpeg:dash:period-connectivity:2015 (see clause 3.2.12)
Viewpoint	0 ... N	Provides the ability to indicate that media differentiates by a different ViewPoint. If not present, no view point is assigned and no differentiation is taken. For detailed usage of this descriptor, see below.
Attributes and Elements for media type "Video"		
@mimeType	M	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. Shall be set to "video/mp4".
@codecs	M	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. This provides the codec that is used for the Adaptation Set. It expresses the codec that is necessary to playback all Representations in one Adaption Set. The following codecs are expected to be recognized by a DASH-IF client: <ul style="list-style-type: none"> • Codecs in Table 16

		<ul style="list-style-type: none"> Codecs in Table 18
@par	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>shall be present, if the picture aspect ratio is a differentiating parameter in the MPD.</p>
@maxWidth	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>This values should be present to express the maximum width in samples after decoder sample cropping of any Representation contained in the Adaptation Set.</p> <p>The value should be the maximum horizontal sample count of any SPS in the contained bitstream.</p>
@maxHeight	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>This values should be present to express the maximum height in pixel of any Representation contained in the Adaptation Set.</p> <p>The value should be the maximum horizontal sample count of any SPS in the contained bitstream.</p>
@maxFrameRate	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>This values should be present to express the maximum frame rate, i.e. the maximum value of any entry in the Decoder configuration record of the signaled frame rate, if constant frame rate is provided. contained in the Adaptation Set.</p>
@scanType	OD Default: progressive	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>This value is expected to be not present. If present, it is expected to be set to "progressive".</p>
EssentialProperty	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>specifies information about the containing element that is considered essential by the Media Presentation author for processing the containing element.</p> <p>The following schemes are expected to be recognized by a DASH-IF client for video:</p> <ul style="list-style-type: none"> urn:mpeg:mpegB:cicp:<Parameter> as defined in ISO/IEC 23001-8 Error! Reference source not found. and <Parameter> one of the following: ColourPrimaries, TransferCharacteristics, or MatrixCoefficients
Accessibility	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>In DASH-IF IOPs two schemes for accessibility are defined.</p> <ul style="list-style-type: none"> - the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011 <p>The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type "video" together with the Accessibility descriptor:</p>

		<ul style="list-style-type: none"> o sign o captions <p>- the scheme when CEA-608 is used as defined in clause 6.4.3.3, with @schemeIdURI set to "urn:scte:dash:cc:cea-608:2015"</p>
Role	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>In DASH-IF IOPs only the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011</p> <p>The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type "video" together with the Role descriptor:</p> <ul style="list-style-type: none"> - caption - subtitle - main - alternate - supplementary - sign - emergency <p>If not present, the role is assumed to be alternate</p>
Rating	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>DASH-IF IOPs do not define a Rating scheme. If present, Adaptation Sets using this descriptor may be ignored by the DASH-IF IOP clients.</p>
Attributes and Elements for media type "Audio"		
@mimeType	M	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>Shall set to "audio/mp4".</p>
@codecs	M	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>This provides the codec that is used for the Adaptation Set. It expresses the codec that is necessary to playback all Representations in one Adaption Set.</p> <p>The following codecs are expected to be recognized by a DASH-IF client:</p> <ul style="list-style-type: none"> • Codecs in Table 19 • Codecs in Table 22 • Codecs in Table 23 • Codecs in Table 24 • Codecs in Table 25 • Codecs in Table 26

		Note: additional values need to be added with new codecs being added
@lang	O	See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5. The language should be present. If not present, the language is unknown or no language applies.
@audioSamplingRate	O	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. This attribute may be present to support output devices that may only be able to render specific values.
AudioChannelConfiguration	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. specifies information about the Audio channel configuration. The following schemes are expected to be recognized by a DASH-IF client for audio: <ul style="list-style-type: none"> • urn:mpeg:dash:23003:3:audio_channel_configuration:2011 as defined in ISO/IEC 23009-1 [1], 5.8.5.4 • urn:mpeg:mpegB:cicp:<Parameter> as defined in ISO/IEC 23001-8 Error! Reference source not found. and <Parameter> one of the following: OutputChannelPosition or ChannelConfiguration • tag:dolby.com,2014:dash:audio_channel_configuration:2011 as defined at http://dashif.org/identifiers/audio-source-data/ Note: Annotation may be different for other codecs and may be updated
EssentialProperty	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9. specifies information about the containing element that is considered essential by the Media Presentation author for processing the containing element. The following schemes are expected to be recognized by a DASH-IF client for audio: <ul style="list-style-type: none"> • urn:mpeg:dash:audio-receiver-mix:2014 as defined in ISO/IEC 23009-1, clause 5.8.5.7.
Accessibility	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5. In DASH-IF IOPs only the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011 The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type “audio” together with the Accessibility descriptor: <ul style="list-style-type: none"> • description • enhanced-audio-intelligibility
Role	0 ... N	See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5. In DASH-IF IOPs only the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5,

		<p>urn:mpeg:dash:role:2011</p> <p>The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type “audio” together with the Accessibility descriptor:</p> <ul style="list-style-type: none"> - main - alternate - supplementary - commentary - dub - emergency <p>If not present, the role is assumed to be alternate</p>
Rating	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>DASH-IF IOPs do not define a Rating scheme. If present, Adaptation Sets using this descriptor may be ignored by the DASH-IF IOP clients.</p>
Attributes and Elements for media type “Subtitle”		
@mimeType	M	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>Shall set to "application/mp4" or "application/ttml+xml"</p>
@codecs	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.7.2 Table 9.</p> <p>This provides the codec that is used for the Adaptation Set. It expresses the codec that is necessary to playback all Representations in one Adaption Set.</p> <p>The following codecs are expected to be recognized by a DASH-IF client:</p> <ul style="list-style-type: none"> • Codecs in Table 20 <p>Note: more need to be added with new codecs being added.</p>
@lang	O	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>The language should be present.</p> <p>If not present, the language is unknown or no language applies.</p>
Accessibility	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>In DASH-IF IOPs only the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011</p> <p>The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type “subtitle” together with the Accessibility descriptor:</p> <ul style="list-style-type: none"> - caption - sign

Role	0 ... N	<p>See ISO/IEC 23009-1 [1], clause 5.3.3.2 Table 5.</p> <p>In DASH-IF IOPs only the Role scheme as defined by MPEG-DASH should be used as defined in ISO/IEC 23009-1, 5.8.5.5, <code>urn:mpeg:dash:role:2011</code></p> <p>The DASH role scheme and with the following values is expected to be recognized by a DASH-IF client for media type “subtitle” together with the Accessibility descriptor:</p> <ul style="list-style-type: none"> - main - alternate - supplementary - commentary - dub - description - emergency <p>If not present, the role is assumed to be alternate</p>

3.10.3 Content Model

In order to support the content author in providing content in a consistent manner, Figure 1 provides a conceptual content model for DASH content in one Period of an MPD. The content may be described by an Asset Identifier as a whole and may contain different media types, video, audio, subtitle and application types. Signalling of media types is out of scope for this section, for details refer to section 3.2.12.

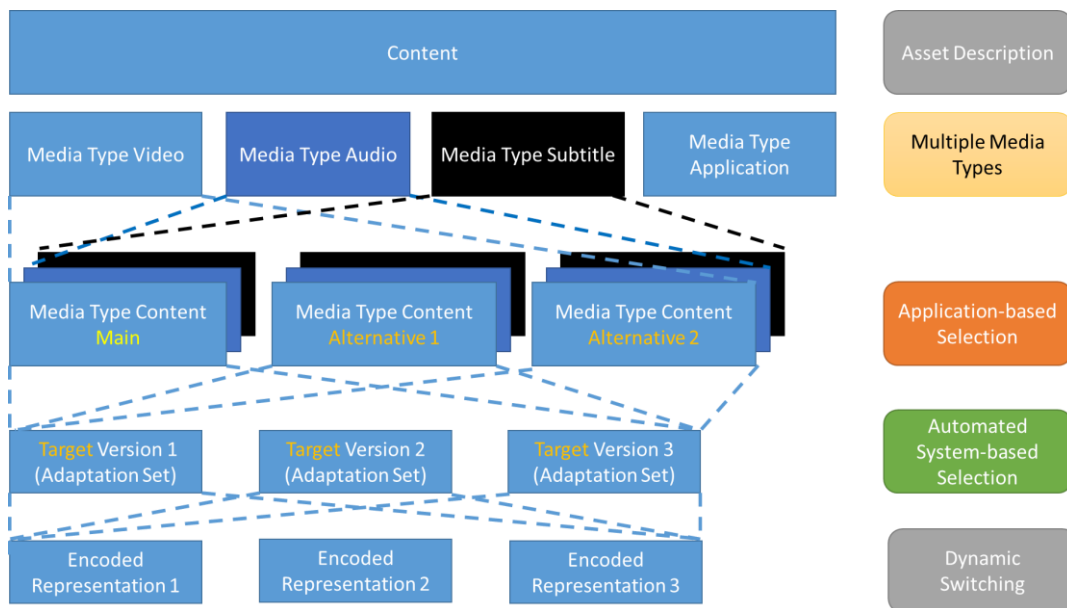


Figure 1 Content Model for DASH Multitrack

Within each media type, the content author may want to offer different content alternatives that are time-aligned, but each alternative represents different content. Automatic selection of the content alternative is not expected to be done by the DASH client as the client would not have sufficient information to make such decisions. However, the selection is

expected to be done by communication with an application or the user, typically using a user interface appropriate for selection.

However, in the absence of this external communication, or at startup, the DASH client still needs to playback content and therefore benefits from information of what is the default content. Such signalling should be provided by the content author. Such default content is referred to as main content, whereas any content that is not main is referred to as alternative. There may be multiple alternatives which may need to be distinguished. We define *main* and *alternative* content. Examples for such are synchronized camera views of one master content. The main camera view is provided as main content, all other views as alternative content.

Furthermore, it may be that content of different media type is linked by the content author, to express that two content of different media type are preferably played together. We define *associated* content for this purpose. As an example, there may be a main commentator associated with the main camera view, but for a different camera view, a different associated commentary is provided.

In addition to semantical content level differentiation, each content alternative may be prepared with different target versions, based on content preparation properties (downmix, subsampling, translation, suitable for trick mode, etc.), client preferences (decoding or rendering preferences, e.g. codec), client capabilities (DASH profile support, decoding capabilities, rendering capabilities) or user preferences (accessibility, language, etc.). In simple AV playout and in the absence of guidance from an application, a content author expects that the DASH client selects at most one target version for each Group taking into account its capabilities and preferences and the capabilities and preferences of the media subsystem. However, an application may obviously select multiple Groups and playout different video Adaptation Sets to support for example picture-in-picture, multi-angle and so on.

In addition, the content author may also provide priorities for target versions, if the receivers supports multiple of those. Typical examples are that the content is prepared for H.264/AVC and H.265/HEVC capable receivers, and the content author prefers the selection of the H.265/HEVC version as its distribution is more efficient. A device supporting both decoders may then choose the one with higher priority signalled by the content author. In a similar version, the same content may be provided in different languages. In this case it can still be expected that the language can be automatically selected by the client, so it is assigned to a target version. Again a content author may express priorities on languages, for example preferring the native language over a dubbed one. Languages may be considered as alternative content as well, but as long as automatic selection can be provided, it may be considered as different target versions. Hence for each content of one media type, different *target versions* may exist and the annotation of the content expressed that it is expected that automated selection can be done. Each target version is preferably accumulated in one Adaptation Set, with exceptions such as scalable codecs.

Finally, in the content model, each of the target version typically has multiple Representations that are prepared to enable dynamic switching. This aspect is outside the scope of this section as switching by the client is expected to be done independent of the media type as well as the target version, primarily using the bandwidth and possibly abstract quality information. However, the signalling on the target versions may provide information on how to distribute the available bitrate across different media types.

Based on this content model and the available elements, attributes and descriptors from Table 1, requirements and recommendations are provided for Adaptation Set Signalling to address main and alternative content, associated content as well as different target versions. Based on the signalling, a client decision model is developed that may serve a content provider as a reference client to test if the annotation provided in the MPD provides the proper results.

3.10.4 Signalling Requirements and Recommendations

3.10.4.1 General

Assuming the content author can map its content to the above content model, this section provides signalling requirements and recommendations for such content, such that the content author can expect proper playback of its content for DASH-IF IOP clients

In general, if multiple Adaptation Sets for one media types are provided, sufficient information should be provided such that a DASH client make proper selections, either automatically communicating with its platform or in communication with the application/user.

3.10.4.2 Alternative Content Signalling

If a Period contains alternative content for one media type, then the alternatives should be differentiated. In addition, one of the alternatives should be provided as main content. The main content is intended to be selected by the client in the absence of any other information, e.g. at startup or if the annotation of the content cannot be used.

Main content is signaled by using the Role descriptor with Role scheme as defined by MPEG-DASH in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011 with value set to main. *Alternative content* is signaled by using the Role descriptor with Role scheme as defined by MPEG-DASH in ISO/IEC 23009-1, 5.8.5.5, urn:mpeg:dash:role:2011 with value set to alternative. If an Adaptation Set does not include either of the two signals, it is assumed to be *main content*.

The alternative content may be selected by the client, if the client does have the capability to select alternatives, typically by either communicating with the application or with the user. If main and alternative content is provided in the Media Presentation, then content alternatives shall be signaled by at least one of the two:

- a **ViewPoint** descriptor. If **ViewPoint** is used for differentiation, then at least each alternative Adaptation Set of the same media type shall include a **ViewPoint** with the same value for @schemeIdURI. The content is differentiated by different values for the @value attribute in the descriptor for different content.
- a **Label** element. If **Label** is used for differentiation, then at least each alternative Adaptation Set shall include a **Label** with the same value for @id. The content is differentiated by different values for the **Label** element.

A **ViewPoint** descriptor is typically used if a target application (identified by the the value for @schemeIdURI) is expected that can make use of the values in the ViewPoint descriptor. A **Label** element is typically used if the DASH client can provide a user interaction.

3.10.4.3 Associated Content Signalling

For associated content of different media types, the **ViewPoint** descriptor is used. If different media types all belong to one content alternative, they share the same View Point descriptor, i.e. the same value for @schemeIdURI and for @value. Note also that even if the DASH client does not understand the value for @schemeIdURI it would still obey the rules for associated selection. The DASH client may for example use the labels of different video alternatives for selection, and play the audio according to ViewPoint association.

3.10.4.4 Media-type Independent Target Version Annotation

Adaptation Sets within one media type and content alternative shall differ by at least by one of the following annotation labels

- @profiles,
- **ContentProtection** (need to provide some details on what the options are: present, not-present, different schemes) → work with content protection task force
- **EssentialProperty** (not-present, trickmode, a media type specific value, unknown value, which may be extended)
- Any of those documented in section 3.10.4.5 for media type video, section 3.10.4.6 for media type audio and 3.10.4.7 for media type subtitle.

Adaptation Sets with elements **EssentialProperty** not using any of the permitted values in this document should not be present.

In addition, Adaptation Sets within one media type and content alternative should differ by different values of @selectionPriority. If not present or non-differentiating values are provided, then the content author should expect a random selection of Adaptation Sets in case it is able to handle multiple Adaptation Sets within one media type and content alternative.

3.10.4.5 Video Target Version Annotation

Video Adaptation Sets of one content alternative shall differ by at least by one of the following annotation labels:

- `@codecs`: specifies the codecs present within the Representation. The codecs parameters shall also include the profile and level information where applicable.
- `@maxWidth` and `@maxHeight` specifies the horizontal and vertical visual presentation size of the video media type
- `@maxFrameRate` specifies the maximum frame rate of the video media type
- **EssentialProperty**: specifies information about the containing element that is considered essential by the Media Presentation author selecting this component.
 - The following different options exist: not-present; generic parameters from above; list in Table 1; unknown value, which may be extended
- Accessibility descriptor with
 - Role scheme as defined by MPEG-DASH in ISO/IEC 23009-1, 5.8.5.5, `urn:mpeg:dash:role:2011` with value set to `sign`, `caption` or `subtitle`. The presence of `caption` or `subtitle` signals open (“burned in”) captions or subtitles.
 - the scheme when CEA-608 is used as defined in clause 6.4.3.3, with `@schemeIdURI` set to `"urn:scte:dash:cc:cea-608:2015"` indicating the use of CEA-608 captions carried in SEI messages.

Adaptation Sets with elements **Rating** and **FramePacking** as well with `@scanType` not set to `progressive` should not be present.

The content author should use the `@selectionPriority` attribute in order to express preference for video selection. If captions are burned in with video Adaptation Set, and other video Adaptation Sets are available as well, the content author should use the `@selectionPriority` to indicate the selection priority of this Adaptation Set compared to others without burned in captions.

3.10.4.6 Audio Target Version Annotation

Audio Adaptation Sets of one content alternative shall differ by at least by one of the following annotation labels:

- `@codecs`: specifies the codecs present within the Representation. The codecs parameters shall also include the profile and level information where applicable.
- `@lang`: specifies the dominant language of the audio
 - If not present, the language is unknown or no language applies
- `@audioSamplingRate` specifies the maximum sampling rate of the content
 - If not present, the audio sampling rate is unknown
- The **AudioChannelConfiguration** specifies support for output devices that may only be able to render specific values. This element should be present.
 - If no **AudioChannelConfiguration** is present, then this value is unknown.
 - If the codec is anyone in Table 19, Table 24, Table 25 or Table 26, then any of the following may be used
 - `urn:mpeg:dash:23003:3:audio_channel_configuration:2011` as defined in ISO/IEC 23009-1 [1], 5.8.5.4

- `urn:mpeg:mpegB:cicp:<Parameter>` as defined in ISO/IEC 23001-8 **Error! Reference source not found.** and `<Parameter>` one of the following: `OutputChannelPosition` or `ChannelConfiguration`
- If the codec is ec-3 or ac-4 according to Table 22, then the following shall be used
 - `tag:dolby.com,2014:dash:audio_channel_configuration:2011` as defined at <http://dashif.org/identifiers/audio-source-data/> (see section 9.2.1.2)
- If the codec is anyone in Table 23, then refer to DTS specification 9302K62400 **Error! Reference source not found.**
- **EssentialProperty:** specifies information about the containing element that is considered essential by the Media Presentation author selecting this component.
 - The following different options exist: not-present; generic parameters from above; unknown value, which may be extended
- Accessibility descriptor with Role scheme as defined by MPEG-DASH in ISO/IEC 23009-1, 5.8.5.5, `urn:mpeg:dash:role:2011` with value set to `description` or `enhanced-audio-intelligibility`.

Adaptation Sets with element **Rating** should not be present.

3.4.10.7 Subtitle Target Version Annotation

Subtitle Adaptation Sets of one content alternative shall differ by at least by one of the following annotation labels:

- `@codecs`: specifies the codecs present within the Representation. The codecs parameters shall also include the profile and level information where applicable.
- `@lang`: specifies the language of the subtitle
 - If not present, the language is unknown or no language applies
- **EssentialProperty:** specifies information about the containing element that is considered essential by the Media Presentation author selecting this component.
 - The following different options exist: not-present; generic parameters from above; unknown value, which may be extended
- Accessibility descriptor with Role scheme as defined by MPEG-DASH in ISO/IEC 23009-1, 5.8.5.5, `urn:mpeg:dash:role:2011` with value set to `description` or `caption`.

Adaptation Sets with element **Rating** should not be present.

3.10.4.8 Other Annotation, Auxiliary Data

In addition to selection relevant data, the Adaptation Set may also signal additional auxiliary information. Auxiliary information is expressed by

- The Role descriptor with the Role scheme as defined by MPEG-DASH as defined in ISO/IEC 23009-1, 5.8.5.5, `urn:mpeg:dash:role:2011` with the following values:
 - o `caption`
 - o `subtitle`
 - o `main`
 - o `alternate`
 - o `supplementary`
 - o `sign`

- o emergency
- o dub

- The Supplemental descriptor with the @schemeIdURI and @value pairs:

- o Trickmode: @schemeIdURI set to "http://dashif.org/guidelines/trickmode" and the @value the value of @id attribute of the Adaptation Set to which these trick mode Representations belong.
- o Period-continuous Adaptation Sets by using Aa @schemeIdUri set to "urn:mpeg:dash:period-continuity:2015" with the @value of the descriptor matching the value of an @id of a Adaptation Set that is contained in the MPD,
- o Period-connected Adaptation Sets by using Aa @schemeIdUri set to "urn:mpeg:dash:period-connectivity:2015" with the @value of the descriptor matching the value of an @id of a Adaptation Set that is contained in the MPD,
- o Switching across Adaptation Sets: @schemeIdUri set to urn:mpeg:dash:adaptation-set-switching:2016 and the @value is a comma-separated list of Adaptation Set IDs that may be seamlessly switched to from this Adaptation Set.

3.10.5 Client Processing Reference Model

3.10.5.1 Introduction

The following client model serves two purposes:

- In the absence of other information, the following client model may be implemented in a DASH client for the purpose of selection of Adaptation Set for playout
- A content author may use the model to verify that the annotation is properly done in order to get the desired client behaviour.

In the model it is assumed that the client can get sufficient information on at least the following properties:

- For each codec in the @codecs string, the DASH client can get information if the media playback platform can decode the codec as described in the string. The answer should be yes or no.
- For each DRM system in the **xxx** string, the DASH client can get information if the media playback platform can handle this **DRM** as described in the string. The answer should be yes or no.
- the DASH client can get information on the media playback platform and rendering capabilities in terms of
 - o the maximum spatial resolution for video that can be handled
 - o the maximum frame rate for video that can be handled
 - o the audio channel configuration of the audio system
 - o the audio sampling rate of the audio system
- the preferred language of the system
- Accessibility settings for captions, subtitles, audio description, enhanced audio intelligibility,
- Potentially preferences on media playback and rendering of the platform

Note of any of these functionalities are not fulfilled, then it may still be functional, but it may not result in the full experience as provided by the content author. As an example, if the DASH client cannot determine the preferred language, it may just use the selection priority for language selection.

3.10.5.2 Generic Processing Model

The DASH client uses the MPD and finds the Period that it likes to join, typically the first one for On-Demand content and the one at the live edge for live content. In order to select the media to be played, the DASH client assumes that the content is offered according to the content model above.

1. The DASH client looks for *main content*, i.e. any Adaptation Set with annotation **Role**@schemeIdURI="urn:mpeg:dash:role:2011" and **Role**@value="alternative" is excluded initially for selection. Note that in this model it is assumed that immediate startup is desired. If the DASH client wants to go over the alternatives upfront before starting the service, then the sequence is slightly different, but still follows the remaining principles.
2. DASH Client checks each Adaptation Set for the supported capabilities of the platform
 - Codec support
 - DRM support
 - Rendering capabilities

If any of the capabilities are not supported, then the Adaptation Set is excluded from the selection process.

3. The DASH client checks if it supports for CEA-608 rendering as defined in 6.4.3.3. If not supported, any accessibility descriptor with is @schemeIdURI="urn:scte:dash:cc:cea-608:2015" removed. Note that the Adaptation Set is maintained as it may be used for regular video decoding.
4. DASH Client checks if there are any specific settings for accessibility in the user preferences
 - If captions are requested by the system, the DASH client extracts
 - all video Adaptation Sets that have an **Accessibility** descriptor assigned with either the @schemeIdURI="urn:mpeg:dash:role:2011" and @value="caption" or @schemeIdURI="urn:scte:dash:cc:cea-608:2015" (burned-in captions and SEI-based), as well as
 - all subtitle Adaptation Sets that have an **Accessibility** descriptor assigned with either the @schemeIdURI="urn:mpeg:dash:role:2011" and @value="caption"
 - and makes those available for Adaptation Sets that can be selected by the DASH client for caption support.
 - If multiple caption Adaptation Sets remain, the DASH client removes all Adaptation Sets from the selection that are not in the preferred language, if language settings are provided in the system. If no language settings in the system are provided, or none of the Adaptation Sets meets the preferred languages, none of the Adaptation Sets are removed from the selection. Any Adaptation Sets that do not contain language annotation are removed, if any of the remaining Adaptation Sets provides proper language settings.
 - If still multiple caption Adaptation Sets remain, then the ones with the highest value of @selectionPriority is chosen.
 - If still multiple caption Adaptation Sets remain, then the DASH client makes a random choice on which caption to enable.
 - else if no captions are requested
 - the **Accessibility** element signaling captions may be removed from the Adaptation Set before continuing the selection.
 - If sign language is requested
 - all video Adaptation Sets that have an **Accessibility** descriptor assigned with @schemeIdURI="urn:mpeg:dash:role:2011" and @value="sign" are made available for sign language support.

- else if no sign language is requested
 - the Adaptation Set signaling sign language with the **Accessibility** element may be removed from the Adaptation Set before continuing the selection.
 - If audio descriptions are requested
 - all video Adaptation Sets that have an **Accessibility** descriptor assigned with @schemeIdURI="urn:mpeg:dash:role:2011" and @value="description" are made available for audio description support.
 - else if no audio descriptions are requested
 - the Adaptation Set signaling audio descriptions with the **Accessibility** element may be removed from the Adaptation Set before continuing the selection.
 - If enhanced audio intelligibility is requested
 - all audio Adaptation Sets that have an **Accessibility** descriptor assigned with @schemeIdURI="urn:mpeg:dash:role:2011" and @value="enhanced-audio-intelligibility" are made available for enhanced audio intelligibility support.
 - else if enhanced audio intelligibility are requested
 - the **Accessibility** element may be removed from the Adaptation Set before continuing the selection.
5. If video rendering is enabled, based on the remaining video Adaptation Sets the client selects one as follows:
- Any Adaptation Set for which an Essential Descriptor is present for which the scheme or value is not understood by the DASH client, is excluded from the selection
 - Any Adaptation Set for which an Essential Descriptor is present for which the scheme is <http://dashif.org/guidelines/trickmode>, is excluded from the initial selection
 - If still multiple video Adaptation Sets remain, then the ones with the highest value of @selectionPriority is chosen.
 - If still multiple video Adaptation Sets remain, then the DASH client makes a choice for itself, possibly on a random basis.
 - Note that an Adaptation Set selection may include multiple Adaptation Sets, if Adaptation Set Switching is signaled. However, the selection is done for only one Adaptation Set.
6. If audio rendering is enabled, based on the remaining audio Adaptation Sets the client selects one as follows:
- Any Adaptation Set for which an Essential Descriptor is present for which the scheme or value is not understood by the DASH client, is excluded from the selection
 - If multiple audio Adaptation Sets remain, the DASH client removes all Adaptation Sets from the selection that are not in the preferred language, if language settings are provided in the system. If no language settings in the system are provided, or none of the Adaptation Sets meets the preferred languages, none of the Adaptation Sets are removed from the selection. Any Adaptation Set that does not contain language annotation are removed, if any of the remaining Adaptation Sets provides proper language settings.
 - If still multiple audio Adaptation Sets remain, then the ones with the highest value of @selectionPriority is chosen.
 - If still multiple audio Adaptation Sets remain, then the DASH client makes a choice for itself, possibly on a random basis.
 - Note that an Adaptation Set may include multiple Adaptation Sets, if Adaptation Set Switching or receiver mix is signaled. However, the selection is done for only one Adaptation Set.

7. If subtitle rendering is enabled, based on the subtitle Adaptation Sets the client selects one as follows:
 - Any Adaptation Set for which an Essential Descriptor is present for which the scheme or value is not understood by the DASH client, is excluded from the selection
 - If multiple subtitle Adaptation Sets remain, the DASH client removes all Adaptation Sets from the selection that are not in the preferred language, if language settings are provided in the system. If no language settings in the system are provided, or none of the Adaptation Sets meets the preferred languages, none of the Adaptation Sets are removed from the selection. Any Adaptation Set that does not contain language annotation are removed, if any of the remaining Adaptation Sets provides proper language settings.
 - If still multiple subtitle Adaptation Sets remain, then the ones with the highest value of @selectionPriority is chosen.
 - If still multiple subtitle Adaptation Sets remain, then the DASH client makes a choice for itself, possibly on a random basis.
8. If the DASH client has the ability to possibly switch to alternative content, then alternative content may be selected either through the **Label** function or the **ViewPoint** functionality. This selection may be done dynamically during playout and the DASH client is expected to switch to the alternative content. Once all alternative content is selected, the procedures following from step 2 onwards apply.
9. At Period boundary a DASH client initially looks for a Period continuity or connectivity, i.e. does the Period include an Adaptation Set that is a continuation of the existing one. If not present it will go back to step 1 and execute the decision logic.