** ISO/IEC JTC 1/SC 29/WG 03 N0734**

**ISO/IEC JTC 1/SC 29/WG 03  
MPEG Systems   
Convenorship: KATS (Korea, Republic of)**

**Document type:** Output Document

**Title:** Draft text of ISO/IEC 23009-1 5th edition CDAM 3 Segment sequences for random access and switching

**Status:** Approved

**Date of document:** 2022-10-28

**Source:** ISO/IEC JTC 1/SC 29/WG 03

**Expected action:**  None

**Action due date:** None

**No. of pages:** 44 (with cover page)

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**Committee URL:** <https://isotc.iso.org/livelink/livelink/open/jtc1sc29wg3>

**INTERNATIONAL ORGANISATION FOR STANDARDISATION**

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**ISO/IEC JTC1/SC29/WG11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC 1/SC 29/WG 03 N** **0098**

**July 2023, Geneva, CH**

|  |  |
| --- | --- |
| **Title** | **Draft text of ISO/IEC 23009-1 5th edition CDAM 3 Segment sequences for random access and switching** |
| **Source** | **WG 03, MPEG Systems** |
| **Status** | **Approved** |
| **Serial Number** | **XXXXX** |

**ISO/IEC 23009-1:2022/DAM2**

ISO/IEC TC JTC 1/SC 29/WG 11

Secretariat: JISC

**Information technology —** **Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats, Amendment 3: Segment sequences for random access and switching**

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**Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats, Amendment 3: Segment sequences for random access and switching**

***Modify an entry in subclause 3.1***

### 3.1.48 Segment Sequence sequence of all *Partial* *Segments* (3.1.35) that are sharing a common address prefix

***Add a new entry at the end of the subclause 3.1:***

### 3.1.35 Partial Segment a Media Segment (3.1.28) included in a Segment Sequence Representation.

### 3.1.49 Segment Sequence Representation a Representation (3.1.41) using Segment Sequences (3.1.48)

***Add a new entry in subclause 3.2:***

|  |  |
| --- | --- |
| SSR | Segment Sequence Representation |

***Add to Table 2 in subclause 4.7:***

|  |  |  |
| --- | --- | --- |
| urn:mpeg:dash:ssr:2023 | 5.3.5.7 | Scheme Identifier for Segment Sequence Representation. |

***Update clause 5.2.3.6:***

#### 5.2.3.6 Elements and Attributes added in the sixth edition (ISO/IEC 23009-1:202x)

This revision adds the following elements and attributes to the schema defined in Annex B compared to the 2023 revision (ISO/IEC 23009-1:2023) of this document:

— **MPD.ContentSteering**

— **Location**@serviceLocation

— **PatchLocation**@serviceLocation

— **RepresentationBase.SegmentSequenceProperties**

***Update clause 5.3.3.5:***

#### 5.3.3.5 Switching across Adaptation Sets

Representations in two or more Adaptation Sets may provide the same content or the content may be offered such that seamless switching is desired (for example in case of multiple viewpoints). In addition, the content may be time-aligned and may be offered such that seamless switching across Representations in different Adaptation Sets is simplified. Typical examples are the offering of the same content with different codecs, for example H.264/AVC and H.265/HEVC and the content author wants to provide such information to the receiver in order to seamlessly switch Representations (as defined in subclause 4.5.1) across different Adaptation Sets.

A content author may signal such seamless switching property across Adaptation Sets by providing a Supplemental Descriptor along with an Adaptation Set with @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.

If the content author signals the ability of Adaptation Set switching and as @segmentAlignment or @subsegmentAlignment are set to TRUE, the (Sub)Segment alignment element shall be valid for *all* Representations in *all* Adaptation Sets for which the @id value is included in the @value attribute of the Supplemental descriptor.

For Adaptation Sets containing Representations, when two Adaptation Sets signal Adaptation Set switching, then for any two Representations, X and Y, within the union of the two Adaptation Sets, the *m-*th Subsegment of X and the *n-*th Subsegment of Y shall be non-overlapping (as defined in subclause 4.5.3) whenever *m* is not equal to *n*.

If the content author signals the ability of Adaptation Set switching and Switching element is provided, the signalled switch points apply for *all* Representations in *all* Adaptation Sets for which the @id value is included in the @value attribute of the Supplemental descriptor.

As an example, a content author may signal that seamless switching across an H.264/AVC Adaptation Set with AdaptationSet@id="4" and an HEVC Adaptation Set with AdaptationSet@id="5" is possible by adding a Supplemental Descriptor to the H.264/AVC Adaptation Set with @schemeIdURI set to urn:mpeg:dash:adaptation-set-switching:2016 and the @value="5" and by adding a Supplemental Descriptor to the HEVC Adaptation Set with @schemeIdURI set to urn:mpeg:dash:adaptation-set-switching:2016 and the @value="4".

In addition, if the content author signals the ability of Adaptation Set switching for any Adaptation Sets then the parameters as defined for an Adaption Set shall also hold for all Adaptation Sets that are included in the @value attribute. This constraint may result that the switching may only be signalled with one Adaptation Set, but not with both as for example one Adaptation Set signalling may include all spatial resolutions of another one, whereas it is not the case the other way around.

Finally, if the content author signals the ability of Adaptation Set switching for any Adaptation Sets and intends to use @qualityRanking attributes in such Adaptations Sets, then such attributes shall be defined in all Adaptation Sets that are included in @value attribute. Additionally, such attributes shall be assigned by using equivalent ranking method applied to all representations in the included adaptation sets, and such equivalence should be signaled by including Quality Equivalence Descriptor (clause 5.8.5.13) listing the same group of Adaptation Sets in its @value attribute.

***Add new clause 5.3.5.7:***

#### 5.3.5.7 Segment Sequence Representation

A Segment Sequence Representation (SSRs) is a regular Representation for which the included Segments are offered with different SAP types, typically in some pattern. A typical pattern is referred to as Segment Sequence comprised of a sequence of Segments, for which typically the first one can be randomly accessed, and the remaining may be not. The Segments of a Segment Sequence are referred to as *Partial Segments*.

Segment Sequences may efficiently be signalled using the Segment Sequence signaling defined in clause 5.3.9.6.4. The signaling shall only be used if either the profile explicitly allows the usage of Segment sequences, or the Representation is explicitly signaled as a Segment Sequence Representation using an Essential Descriptor with @schemeIdURI set to "urn:mpeg:dash:ssr:2023". The above descriptor shall appear within the **Representation** element unless the Adaptation Set contains only Segment Sequence Representation. In the latter case, the above Essential descriptor shall appear within the corresponding **AdaptationSet** element.

In addition, to support signaling of patterns of different SAP types, the @startWithSAP attribute and and the **SegmentSequence** element as defined in clause 5.3.7.2 may be used. Details on the semantics of the **SegmentSequence** element are provided in Table 13, the XML snippet is provided below.

Table 13 — Semantics of SegmentSequenceProperties element

| **Element or Attribute Name** | | **Use** | **Description** |
| --- | --- | --- | --- |
| SegmentSequence | |  |  |
| SAP | | 0..N | specifies Segment Sequence SAP properties for all or a subset of the Partial Segments, if different from information inferred from @startWithSAP.  Multiple SAP elements may be present to differentiate different SAP types and/or cadences |
|  | @type | M | specifies a SAP type for the selected Partial Segments indicated by the @cadence in a Segment Sequence.  For more detailed semantics, refer to @startWithSAP.  This value shall be between 1 and 7.  NOTE 1: The functionality of SAP type 0 (“unknown”) can be signaled using the @startWithSAP attribute. The intent of this attribute is to override the above signaling when more information is available.  NOTE 2: this value cannot exceed 7 due to the definition of SAP types in ISO/IEC 14496-12 |
|  | @cadence | OD  default=0 | Specifies the subset of Partial Segments within a Segment Sequence for which the value of the @type attribute applies.  If the value is set to 0, the SAP type value as specified in the @type attribute only holds for the first Partial Segment of the Segment Sequence.  If the value is positive, for a Segment Sequence with Partial Segments PS(1)…PS(k), and the cadence C, the subset of Partial Segments PS(C\*n + 1) for any unsigned integer n = 0, 1, … such that C\*n + 1 < k start with SAP types inferred from the @type attribute.  If the value of this attribute exceeds the value of the @k attribute in the associated **S** element(s), then this is identical as if the value is set to 0. |
| |  | | --- | | **Key**  For attributes: M=Mandatory, O=Optional, OD=Optional with Default Value, CM=Conditionally Mandatory  For elements: <minOccurs>..<maxOccurs> (N=unbounded)  Elements are bold; attributes are non-bold and preceded with an @. | | | | |

<xs:complexType name="SegmentSequencePropertiesType">

<xs:annotation>

<xs:documentation xml:lang="en">

**Segment Sequence properties**

</xs:documentation>

</xs:annotation>

<xs:sequence>

<xs:element name="SAP" type="SapWithCadenceType" minOccurs="0" maxOccurs="unbounded"/>

<xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>

</xs:sequence>

<xs:anyAttribute namespace="##other" processContents="lax"/>

</xs:complexType>

<xs:complexType name="SapWithCadenceType">

<xs:annotation>

<xs:documentation xml:lang="en">

**Segment Sequence SAP properties**

</xs:documentation>

</xs:annotation>

<xs:sequence>

<xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>

</xs:sequence>

<xs:attribute name="type" type="SAPType" use="required"/>

<xs:attribute name="cadence" type="xs:unsignedInt" default="0"/>

<xs:anyAttribute namespace="##other" processContents="lax"/>

</xs:complexType>

Segment Sequence Representations may be provided to support frequent random access, i.e. each Partial Segment is randomly accessible. This may be signaled by setting @startWithSAP to 1 or 2.

In different configuration, only the initial Partial Segments may be randomly accessible. This may be expressed by setting the value of the @startWithSAP attribute to 0 (unknown), the value of the **SegmentSequence.SAP**@type attribute to 1 or 2 and the value of **SegmentSequence.SAP**@cadence to the default value 0 indicating that only the initial Partial Segment has a special value.

A combination of the two cases above is also possible. For example, the initial Partial Segment may start with an IDR frame (e.g., SAP type 1) and thus be randomly accessible, while the remaining segments may use open GOP coding structure and start with non-IDR frames. In this case, the attribute @startWithSAP will be set to 3 (open GOP), while the **SegmentSequence.SAP**@type attribute will be set to 1 (IDR). The latter will indicate the SAP of the initial Partial Segment since it is different from the one in @startWithSAP. The value of **SegmentSequence.SAP**@cadence to the default value 0 indicating that only the initial Partial Segment has a special SAP type different from @startWithSAP.

Settings of **SegmentSequence.SAP**@cadence to some value *c > 0* indicates that each *c*-th Partial Segment adheres to the type signalled in **SegmentSequence.SAP**@type with *c* the value of the attribute @cadence. In this clause, adherence means that the SAP type of each c-th Partial Segment will be equal or lower than what is signaled in **SegmentSequence.SAP**@type if the type

If the descriptor with @schemeIdURI set to "urn:mpeg:dash:ssr:2023" is present on Adaptaton Set level, then all Representations included in the Adaptation Set are SSRs.

The descriptor with @schemeIdURI set to "urn:mpeg:dash:ssr:2023" may include a @value attribute to indicate *associated Representations*. Associated regular Representations are regular Representations for which all Segments are time-aligned and non-overlapping as defined in clause 4.5.3 with the all Segment Sequences of the SSR. If the associated Representation is an SSR itself, then all Segment Sequences are time-aligned and non-overlapping as defined in clause 4.5.3 with the all Segment sequences of the SSR. This property allows seamless switching Segment boundaries of the regular Representations.

If the descriptor with @schemeIdURI set to "urn:mpeg:dash:ssr:2023" is present on Representation level, then the value of the @value provides a space-separated list of Representation identifiers of the Representations that are associated to this SSR. Any Representation included in this list shall be time-aligned to the Segment Sequences in this SSR.

If the descriptor with @schemeIdURI set to "urn:mpeg:dash:ssr:2023" is present on Adaptaton Set level, then the value of the @value provides a space-separated list of Adaptation Set identifiers for which all Representations in this Adaptation Set are associated to all SSRs in the associated Adaptation Set. As a consequence, if the above descriptor is present in one Adaptation Set of a Period, all **AdaptationSet** elements within this **Period** element shall have the **AdaptationSet**@id attribute present.

Furthermore, if SSRs are signaled in the same Adaptation Set, then the same content is included. In additition, switching across Adaptation Sets can be further supported by using the methodologies defined in clause 5.3.3.5 including the descriptor urn:mpeg:dash:adaptation-set-switching:2016.

***Update clause 5.3.7.2:***

#### 5.3.7.2 Semantics

Table 15 — Common Adaptation Set, Representation and Sub-Representation attributes and elements

| **Element or Attribute Name** | | | | | | **Use (see subclause 5.3.7.1)** | **Description** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Common attributes and elements*** | | | |  |  |
|  |  |  | | @profiles | | O | specifies the profiles which the associated Representation(s) conform to of the list of Media Presentation profiles as described in 8. The value shall be a subset of the respective value in any higher level of the document hierarchy (Representation, Adaptation Set, MPD).  If not present, the value is inferred to be the same as in the next higher level of the document hierarchy. For example, if the value is not present for a Representation, then @profiles at the Adaptation Set level is valid for the Representation.  The same syntax as defined in 5.3.1.2 shall be used. |
|  |  |  | | @width | | O | specifies the horizontal visual presentation size of the video media type on a grid determined by the  @sar attribute.  In the absence of @sar width and height are specified as if the value of @sar were "1:1"  NOTE   The visual presentation size of the video is equal to the number of horizontal and vertical samples used for presentation after encoded samples are cropped in response to encoded cropping parameters, “overscan” signalling, or “pan/scan” display parameters, e.g. SEI messages.  If not present on any level, the value is unknown. |
|  |  |  | | @height | | O | specifies the vertical visual presentation size of the video media type, on a grid determined by the @sar attribute.  If not present on any level, the value is unknown. |
|  |  |  | | @sar | | O | specifies the sample aspect ratio of the video media component type, in the form of a string consisting of two integers separated by ':', e.g.,"10:11". The first number specifies the horizontal size of the encoded video pixels (samples) in arbitrary units. The second number specifies the vertical size of the encoded video pixels (samples) in the same units as the horizontal size.  If not present on any level, the value is unknown. |
|  |  |  | | @frameRate | | O | specifies the output frame rate (or in the case of interlaced, half the output field rate) of the video media type in the Representation. If the frame or field rate is varying, the value is the average frame or half the average field rate field rate over the entire duration of the Representation.  The value is coded as a string, either containing two integers separated by a "/", ("F/D"), or a single integer "F". The frame rate is the division F/D, or F, respectively, per second (i.e. the default value of D is "1").  If not present on any level, the value is unknown. |
|  |  |  | | @audioSamplingRate | | O | Either a single decimal integer value specifying the sampling rate or a whitespace-separated pair of decimal integer values specifying the minimum and maximum sampling rate of the audio media component type. The values are in samples per second.  If not present on any level, the value is unknown. |
|  |  |  | | @mimeType | | M | specifies the MIME type of the concatenation of the Initialization Segment, if present, and all consecutive Media Segments in the Representation. |
|  |  |  | | @segmentProfiles | | O | specifies the profiles of Segments that are essential to process the Representation. The detailed semantics depend on the value of the @mimeType attribute.  The contents of this attribute shall conform to either the pro-simple or pro-fancy productions of 4.5 of IETF RFC 6381:2011, without the enclosing DQUOTE characters, i.e. including only the unencodedv or encodedv elements respectively. As profile identifier, the brand identifier for the Segment as defined in 6 shall be used.  4CC may contain characters that must be escaped in XML. 4CC strings shall be escaped according to W3C Extensible Markup Language (XML):2008, Section 2.4.  If not present on any level, the value may be deducted from the value of the @profiles attribute. |
|  |  |  | | @codecs | | O | specifies the codecs present within the Representation. The codec parameters shall also include the profile and level information where applicable.  For segment formats defined in this document, this element shall be present and the contents of this attribute shall conform to either the simp-list or fancy-list productions of IETF RFC 6381:2011, subclause 3.2, without the enclosing DQUOTE characters. The codec identifier for the Representation's media format, mapped into the name space for codecs as specified in IETF RFC 6381:2011, subclause 3.3, shall be used. |
|  |  |  | | @containerProfiles | | O | specifies the container profiles of Representations that are essential to process it. The detailed semantics depend on the value of the @mimeType attribute.  The contents of this attribute shall conform to either the pro-simple or pro-fancy productions ofIETF RFC 6381:2011, subclause 4.5, without the enclosing DQUOTE characters, i.e. including only the unencodedv or encodedv elements respectively.  4CC may contain characters that must be escaped in XML. 4CC strings shall be escaped according to W3C Extensible Markup Language (XML):2008, Section 2.4. |
|  |  |  | | @maximumSAPPeriod | | O | when present, specifies the maximum SAP interval in seconds of all contained media streams, where the SAP interval is the maximum time interval between the TSAP of any two successive SAPs of types 1 to 3 inclusive of one media stream in the associated Representations.  If not present on any level, the value is unknown. |
|  |  |  | | @startWithSAP | | O | when present and greater than 0, specifies that in the associated Representations, each Media Segment starts with a SAP of type less than or equal to the value of this attribute value in each media stream.  A Media Segment starts with a SAP in a media stream if the stream contains a SAP in that Media Segment, ISAU is the index of the first access unit that follows ISAP and ISAP is contained in the Media Segment.  If not present on any level, the value is unknown. |
|  |  |  | | @maxPlayoutRate | | O | specifies the maximum playout rate as a multiple of the regular playout rate, which is supported with the same decoder profile and level requirements as the normal playout rate.  If not present on any level, the value is 1. |
|  |  |  | | @codingDependency | | O | When present and 'true', for all contained media streams, specifies that there is at least one access unit that depends on one or more other access units for decoding. When present and 'false', for any contained media stream, there is no access unit that depends on any other access unit for decoding (e.g. for video all the pictures are intra coded). If not specified on any level, there may or may not be coding dependency between access units. |
|  |  |  | | @scanType | | O | specifies the scan type of the source material of the video media component type. The value may be equal to one of "progressive", "interlaced" and "unknown". If not specified on any level, the scan type is "progressive". |
|  |  |  | | @selectionPriority | | OD  default=1 | specifies the selection priority for the described data structures, i.e. the one described by the containing element. In the absence of other information, higher numbers are the preferred selection over lower numbers. |
|  |  |  | | @tag | | O | specifies the tag of the Representation, Adaptation Set or Preselection which may be used for selection purposes towards the decoder.  NOTE   This attribute is primarily introduced for the usage of Pre-Selections and Adaptation Sets, but future use for Representation and Sub-Representations is not precluded. |
|  |  |  | | FramePacking | | 0 … N | specifies frame-packing arrangement information of the video media component type.  When no FramePacking element is provided for a video component, frame-packing shall not used for the video media component.  For details, see subclauses 5.8.1 and 5.8.4.6. |
|  |  |  | | AudioChannelConfiguration | | 0 … N | specifies the audio channel configuration of the audio media component type.  For details, see subclauses 5.8.1 and 5.8.4.7. |
|  |  |  | | ContentProtection | | 0 … N | specifies information about content protection schemes used for the associated Representations.  For details, see subclauses 5.8.1 and 5.8.4.1. |
|  |  |  | | OutputProtection | | 0 … 1 | specifies information about output protection schemes required for presenting the associated Representations  For details, see subclauses 5.8.4.12. |
|  |  |  | | EssentialProperty | | 0 … N | specifies information about the containing element that is considered essential by the Media Presentation author for processing the containing element.  For details, see subclause 5.8.4.8. |
|  |  |  | | SupplementalProperty | | 0 … N | specifies supplemental information about the containing element that may be used by the DASH Client optimizing the processing.  For details, see subclause 5.8.4.9. |
|  |  |  | | InbandEventStream | | 0 … N | specifies the presence of an inband event stream in the associated Representations.  For details, refer to subclause 5.10. |
|  |  |  | | Switching | | 0 … N | Specifies a switch-to times and types for the associated Representations. For more details, refer to subclause 0.  These elements shall only be present if the  @timescale value is the same for all Representations in one Adaptation Set and if the Segment Timeline is used for segment duration signalling. |
|  |  |  | | RandomAccess | | 0 … N | Specifies a random access times and types for the associated Representations. For more details, refer to subclause 5.3.5.5.  These elements shall only be present if the  @timescale value is the same for all Representations in one Adaptation Set and if the Segment Timeline is used for segment duration signalling. |
|  |  |  | | GroupLabel | | 0 … N | specifies a summary label for a group of Labels. For more details, refer to subclause 5.3.10. |
|  |  |  | | Label | | 0 … N | specifies a textual description of the element that may be used for annotation and selection purposes. For more details, refer to subclause 5.3.10. |
|  |  |  | | **ProducerReferenceTime** | | 0 … N | specifies the presence of and possibly values of producer reference time in the associated Representations.  For details refer to subclause 5.12. |
|  |  |  | | **ContentPopularityRate** | | 0 … N | indicates a level of popularity of the containing entity (i.e., the Adaptation Set, Representation or Preselection) within the Media Presentation. For details, see subclause 5.14.  NOTE   This element is primarily introduced for the usage of Pre-Selections and Adaptation Sets but use for Representation and Sub-Representations is not precluded. |
|  |  |  | | Resync | | 0 … N | Specifies information on Segments’ resynchronization points.  For details refer to subclause 5.3.13. |
|  |  | |  | | SegmentSequence | 0 … 1 | Specifies properties of a segment sequence. For details refer to subclause 5.3.9.6.4.  If not associated with a Segment Sequence Representation, the element should not be present and is expected to be ignored by the client. |
| **Key**  For attributes: M=mandatory, O=optional, OD=optional with default value, CM=conditionally mandatory  For elements: <minOccurs>..<maxOccurs> (N=unbounded)  Elements are bold; attributes are non-bold and preceded with an @. | | | | | | | |

***Update clause 5.3.7.3:***

#### 5.3.7.3 XML syntax

<xs:complexType name="RepresentationBaseType">

<xs:annotation>

<xs:documentation xml:lang="en">

**Representation base (common attributes and elements)**

</xs:documentation>

</xs:annotation>

<xs:sequence>

<xs:element name="FramePacking" type="DescriptorType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="AudioChannelConfiguration" type="DescriptorType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="ContentProtection" type="ContentProtectionType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="OutputProtection" type="DescriptorType" minOccurs="0"/>

<xs:element name="EssentialProperty" type="DescriptorType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="SupplementalProperty" type="DescriptorType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="InbandEventStream" type="EventStreamType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="Switching" type="SwitchingType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="RandomAccess" type="RandomAccessType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="GroupLabel" type="LabelType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="Label" type="LabelType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="ProducerReferenceTime" type="ProducerReferenceTimeType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="ContentPopularityRate" type="ContentPopularityRateType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="Resync" type="ResyncType" minOccurs="0" maxOccurs="unbounded"/>

<xs:element name="SegmentSequence" type="SegmentSequencePropertiesType" minOccurs="0" maxOccurs="1"/>

<xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>

</xs:sequence>

<xs:attribute name="profiles" type="ListOfProfilesType"/>

<xs:attribute name="width" type="xs:unsignedInt"/>

<xs:attribute name="height" type="xs:unsignedInt"/>

<xs:attribute name="sar" type="RatioType"/>

<xs:attribute name="frameRate" type="FrameRateType"/>

<xs:attribute name="audioSamplingRate" type="AudioSamplingRateType"/>

<xs:attribute name="mimeType" type="xs:string"/>

<xs:attribute name="segmentProfiles" type="ListOf4CCType"/>

<xs:attribute name="codecs" type="CodecsType"/>

<xs:attribute name="containerProfiles" type="ListOf4CCType"/>

<xs:attribute name="maximumSAPPeriod" type="xs:double"/>

<xs:attribute name="startWithSAP" type="SAPType"/>

<xs:attribute name="maxPlayoutRate" type="xs:double"/>

<xs:attribute name="codingDependency" type="xs:boolean"/>

<xs:attribute name="scanType" type="VideoScanType"/>

<xs:attribute name="selectionPriority" type="xs:unsignedInt" default="1"/>

<xs:attribute name="tag" type="TagType"/>

<xs:anyAttribute namespace="##other" processContents="lax"/>

</xs:complexType>

<xs:simpleType name="AudioSamplingRateType">

<xs:annotation>

<xs:documentation xml:lang="en">

**Audio Sampling Rate**

</xs:documentation>

</xs:annotation>

<xs:restriction base="UIntVectorType">

<xs:minLength value="1"/>

<xs:maxLength value="2"/>

</xs:restriction>

</xs:simpleType>

<xs:simpleType name="VideoScanType">

<xs:annotation>

<xs:documentation xml:lang="en">

**Video Scan type enumeration**

</xs:documentation>

</xs:annotation>

<xs:restriction base="xs:string">

<xs:enumeration value="progressive"/>

<xs:enumeration value="interlaced"/>

<xs:enumeration value="unknown"/>

</xs:restriction>

</xs:simpleType>

<xs:simpleType name="CodecsType">

<xs:restriction base="xs:string">

<xs:pattern value="&charset;&squote;&language;&squote;&id\_list;">

<xs:annotation>

<xs:documentation>**RFC6381 fancy-list without enclosing double quotes**</xs:documentation>

</xs:annotation>

</xs:pattern>

<xs:pattern value="&id\_simple;(,&id\_simple;)\*">

<xs:annotation>

<xs:documentation>**RFC6381 simp-list without enclosing double quotes**</xs:documentation>

</xs:annotation>

</xs:pattern>

</xs:restriction>

***Update clause 5.3.9.4.4:***

##### 5.3.9.4.4 Template-based Segment URL construction

The SegmentTemplate@media attribute, the SegmentTemplate@index attribute*,* the SegmentTemplate@initialization attribute and the SegmentTemplate@bitstreamSwitching attribute each contain a string that may contain one or more of the identifiers as listed in Table 22.

In each URL, the identifiers from Table 20 shall be replaced by the substitution parameter defined in Table 16. Identifier matching is case-sensitive. If the URL contains unescaped $ symbols which do not enclose a valid identifier, then the result of URL formation is undefined. In this case, it is expected that the DASH Client ignores the entire containing Representation element and the processing of the MPD continues as if this Representation element was not present. The format of the identifier is also specified in Table 22.

Each identifier may be suffixed, within the enclosing '$' characters, with an additional format tag aligned with the printf format tag as defined in IEEE 1003.1-2008[10] following this prototype:

%0[width]d

The width parameter is an unsigned integer that provides the minimum number of characters to be printed. If the value to be printed is shorter than this number, the result shall be padded with zeros. The value is not truncated even if the result is larger.

The Media Presentation shall be authored such that the application of the substitution process results in valid Segment URLs.

Strings outside identifiers shall only contain characters that are permitted within URLs according to IETF RFC 3986.

Table 22 — Identifiers for URL templates

| **$<Identifier>$** | **Substitution parameter** | **Format** |
| --- | --- | --- |
| *$$* | Is an escape sequence, i.e. "$$" is replaced with a single "$" | not applicable |
| *$RepresentationID$* | This identifier is substituted with the value of the attribute Representation@id of the containing Representation. | The format tag shall not be present. |
| *$Number$* | This identifier is substituted with the *number* of the corresponding Segment, if *$SubNumber$* is not present in the same string.  If *$SubNumber$* is present, this identifier is substituted with the *number* of the corresponding Segment sequence. For details, refer to subclauses 5.3.9.6.4 and 5.3.9.6.5. | The format tag may be present.  If no format tag is present, a default format tag with width=1 shall be used. |
| $*Bandwidth*$ | This identifier is substituted with the value of Representation@bandwidth attribute value. | The format tag may be present.  If no format tag is present, a default format tag with width=1 shall be used. |
| $*Time*$ | This identifier is substituted with the value of the MPD start time of the Segment being accessed. For the Segment Timeline, this means that this identifier is substituted with the value of the SegmentTimeline@t attribute for the Segment being accessed. Either $Number$ or $Time$ may be used but not both at the same time. | The format tag may be present.  If no format tag is present, a default format tag with width=1 shall be used. |
| *$SubNumber$* | This identifier is substituted with the *sub-number* of the corresponding Partial Segment in a Seqment Sequence. This identifier shall only be present if either *$Number$* or *$Time$* are present as well. For details, refer to subclauses 5.3.9.6.4 and 5.3.9.6.5. | The format tag may be present.  If no format tag is present, a default format tag with width=1 shall be used. |

***Update clause 5.3.9.6.4:***

##### 5.3.9.6.4 Segment Sequences

Segment sequences provide the ability to signal in a compact manner Segment Sequence Representations as defined in clause 5.3.5.7. Segment Sequences may be signalled using the Segment Timeline by including the @k attribute in the S element of the SegmentTimeline element. The @k attribute shall not be present unless all of the following requirements are fulfilled:

— the addressing scheme for the associated Representation is using Segment template with either $Number$ or hierarchical templating and sub-numbering as defined in subclause 5.3.9.6.5,

— the profile explicitly allows the usage of Segment Sequences, or the Representation(s) are explicitly signaled as a Segment Sequence Representation as defined in clause 5.3.5.7 using an Essential Descriptor.

If @k is present and greater than 1, then it specifies that sequence duration described by @d is accurate in timing but contains @k Partial Segments.

The MPD duration of the Partial Segments is determined as the integer value of @d divided by the value of @k and determines the MPD start time and therefore the Segment availability start time. MPD duration of the Partial Segments is not required to exactly match the media duration of the Segments. The maximum difference between the MPD duration and media duration of any sequence of one or more consecutive Partial Segments shall never exceed the value of the **SegmentTimeline**@tolerance attribute. If the latter is absent, the above difference shall never exceed 50% of the MPD duration of a Partial Segment.

NOTE: irrespective of the differences between the MPD and the media duration of any given subset of Partial Segments, the MPD duration of the Segment Sequence as defined by @d matches the duration of the concatenation of all its Partial Segments precisely.

The integer of the quotient of the value of @d and the value of @k of any S element shall not exceed the quotient of @d and the value of @k minus 1 of any other S element in the Segment Timeline.

The concatenation of all Segments in a Segment sequence shall have an accurate segment duration according of the value of @d.

Any Partial Segment in a Segment sequence may carry inband events and Producer Reference Time (‘prft’) boxes.

***Update clause 5.3.9.6.5:***

##### 5.3.9.6.5 Hierarchical Templating and Sub-Numbering

If the Segment template contains a $SubNumber$ value and a Segment Timeline signalling with Segment Sequence is used, then

— if $Time$ is present, the $Time$ is replaced with the earliest presentation time of the Segment Sequence for all Partial Segments in the Segment Sequence,

— if $Number$ is present, the $Number$ is replaced with the number of the Segment Sequence, i.e. with the number as if every Segment sequence in the Segment timeline is treated as single Segment (e.g., as inferred from **SegmentTemplate**@startNumber or **S**@n),

— and in both cases the $SubNumber$ is replaced with the Partial Segment sub-number in the Segment Sequence (as inferred from the **S**@k attribute), with 1 being the sub-number of the first Partial Segment in the sequence.

NOTE The earliest presentation time of the next Segment Sequence in the same Representation can be derived from the sum of the earliest presentation time of the current Segment Sequence and the duration of the Segment resulting from the concatenation of all Media Segments in a Segment Sequence. In case of ISO BMFF, this can be accomplished by summing the track runs of segments in the seqment sequence.