INTERNATIONAL STANDARD

ISO/IEC 23009-1

Information technology — Dynamic adaptive streaming over HTTP (DASH) —

Part 1:
Media presentation description and segment formats

AMENDMENT 3: Authentication, MPD linking, Callback Event, Period Continuity and other Extensions

Technologies de l'information — Diffusion en flux adaptatif dynamique sur HTTP (DASH) —

Partie 1: Description de la présentation et formats de remise des médias

AMENDEMENT 3: Authentification, liaison MPD, événement de rapel, continuité de la période et autres extensions

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Amendment 3 to ISO/IEC 23009-1:2014 was prepared by ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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Page 2, Terms and definitions

Add the following definition in 3.1:

3.1.X
sub-asset
media content component (or part thereof) identified as corresponding to a part of an asset

Page 15, Table 2

Add the following identifiers in Table 2:

Scheme Identifier	Clause in this document	Informative description
urn:mpeg:dash:period-continuity:2015	5.3.2.4	Period continuity signalling
urn:mpeg:dash:period-connectivity:2015	5.3.2.4	Period connectivity signalling
urn:mpeg:dash:mpd-as-linking:2015	5.8.5.X	MPD Adaptation Set Linking scheme.
urn:mpeg:dash:sai:2015	5.8.5.Y	Sub-Asset Scheme Identifier
urn:mpeg:dash:client-authentication:2015	5.8.5.Z	Client Authentication scheme.
urn:mpeg:dash:content-authorization:2015	5.8.5.Z	Content Access Authorization scheme.
urn:mpeg:dash:event:callback:2015	5.10.4.X	DASH call back event.

Page 9, Clause 4

Add in the second paragraph of 4.3, discussing Assets:

Same asset over multiple periods may be identified by a DASH descriptor enabling DASH clients to maintain the continuity across periods' boundaries. Furthermore, sub-assets composing the same asset may also identified using a similar method. For instance, if an asset is composed of multiple video components, sub-assets enable selecting the previously selected video component after an ad insertion.

As such an asset can contain sub-assets that can be uniquely identified from one media content period to another.

Page 23, Table 4

Add at the end of Table 4:

EmptyAdaptationSet	0...N	specifies an Adaptation Set that does not contain any Representation element. The empty Adaptation Set is of the same type as a regular Adaptation Set, but shall neither contain an xlink nor may it contain any Representation element.
		This element shall only be present, if an Essential Descriptor is present with @schemeIDURI set to "urn:mpeg:dash:mpd-as-linking:2015".
		For more details, see 5.8.5.8.

Page 25, Clause 5

Add to schema:

```
<!-- Period -->
<xs:complexType name="PeriodType">
  <xs:sequence>
    <xs:element name="BaseURL" type="BaseURLType" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="SegmentBase" type="SegmentBaseType" minOccurs="0"/>
    <xs:element name="SegmentList" type="SegmentListType" minOccurs="0"/>
    <xs:element name="SegmentTemplate" type="SegmentTemplateType" minOccurs="0"/>
    <xs:element name="AssetIdentifier" type="DescriptorType" minOccurs="0"/>
    <xs:element name="EventStream" type="EventStreamType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="AdaptationSet" type="AdaptationSetType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:element name="Subset" type="SubsetType" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="SupplementalProperty" type="DescriptorType" minOccurs="0"/>
    <xs:element name="EmptyAdaptationSet" type="AdaptationSetType" minOccurs="0"
maxOccurs="unbounded"/>
    <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:attribute ref="xlink:href"/>
  <xs:attribute ref="xlink:actuate" default="onRequest"/>
  <xs:attribute name="id" type="xs:string" />
  <xs:attribute name="start" type="xs:duration"/>
  <xs:attribute name="duration" type="xs:duration"/>
  <xs:attribute name="bitstreamSwitching" type="xs:boolean" default="false"/>
  <xs:anyAttribute namespace="##other" processContents="lax"/>
</xs:complexType>
```

Page 25, Clause 5

Add new subclause:

5.3.2.4 Content Offering with multiple Periods

Content with multiple Periods may be created for different reasons, for example:

— to enable splicing of content, for example for ad insertion;

— to provide synchronization in segment numbering, e.g. compensate non-constant segment durations;

— to remove or add certain Representations in an Adaptation Set;

— to remove or add certain Adaptation Sets;

— to remove or add content offering on certain CDNs;

— to enable signalling of shorter segments, if produced by the encoder.

Periods provide opportunities for resync, for ad insertion, for adding and removing Representations. However, in certain circumstances, the content across Period boundaries is continuous and in this case, continuous playout of the client is expected.

In certain circumstances, the Media Presentation is offered such that the next Period is a continuation of the content in the previous Period (certain media components are continued), possibly in the immediately following Period of that previous Period or in a later Period (e.g. after an advertisement Period had been inserted).

The content provider may express that the media components contained in two Adaptation Sets in two different Periods are associated by assigning equivalent Asset Identifiers to both Periods and by identifying both Adaptation Sets with identical value for the attribute @id. Association expresses a logical continuation of the media component in the next Period and may, for example, be used by the client to continue playing an associated Adaptation Set in the new Period.

In addition, two Adaptation Sets in one MPD are period-continuous if all of the following holds.

— The Adaptation Sets are associated.

— The sum of the value of the @presentationTimeOffset and the presentation duration of the Representations in one Adaptation Set are identical to the value of the @presentationTimeOffset of the associated Adaptation Set in the next Period.

— If Representations in both Adaptation Sets have the same value for @id, then they shall have functionally equivalent Initialization Segments, i.e. the Initialization Segment may be used to continue the play-out of the Representation. The concatenation of the Initialization Segment of the first Period, if present, and all consecutive Media Segments in the Representation in the first Period and subsequently the concatenation with all consecutive Media Segments in the Representation of the second Period shall represent a conforming Segment sequence as defined in 4.5.4 conforming to the media type as specified in the @mimeType attribute for the Representation in the first Period. Additionally, the @mimeType attribute for the Representation in the next Period shall be the same as one of the first Period.

Media Presentations should signal period-continuous Adaptation Sets by using a supplemental descriptor on Adaptation Set level with @schemeIdUri set to "urn:mpeg:dash:period-continuity:2015" with

— the @value of the descriptor matching the value of an @id of a Period that is contained in the MPD, and

— the value of the **AdaptationSet**@id being the same in both Periods.

MPD should signal period-continuous Adaptation Sets if the MPD contains Periods with identical Asset Identifiers.

There exist special cases, for which the media in one Adaptation Set is a continuation of the previous one, but the timestamps are not continuous. Examples are timestamp wrap around, encoder reset, splicing, or other aspects. Two Adaptation Sets in one MPD are period-connected if all conditions from period-continuity from above hold, except that the timestamps across Period boundaries may be non-continuous, but adjusted by the value of the @presentationTimeOffset at the Period boundary. However, for example, the Initialization Segment is equivalent within the two Adaptation Sets. Media Presentations should signal period-connected Adaptation Sets by using a supplemental descriptor on Adaptation Set level with @schemeIdUri set to "urn:mpeg:dash:period-connectivity:2015".

Note that period continuity implies period connectivity.

For appropriate client behaviour, please refer to A.9.

Page 74, Clause 5

Add new subclause:

5.8.5.X DASH MPD Adaptation Set Linking scheme

The URN "`urn:mpeg:dash:mpd-as-linking:2015`" is defined in order to provide information that the same Adaptation Set can be found in another MPD. The scheme may be used with Essential Property Descriptors together with an **EmptyAdaptationSet** element or with Supplemental Property Descriptors. The value provides

— a URL to the MPD, including appropriate anchors for Periods and Adaptation Set as defined in C.4.2, and

— optionally, a timeline offset field to synchronize the data added as a white-space separated second item. If the value is not present, then the media time on the original MPD and the linked MPD are identical. If a `timeOffset` field is added, then this value expresses the difference between the media time of the Adaptation Set of the linked MPD and the media time in the originating MPD. Note that the number may be positive or negative. The `timeoffset` is in unit of `@timescale` of the linked Adaptation Sets.

The Descriptor shall only be used in combination with Adaptation Sets (regular or empty ones). If all information is contained in the Adaptation Set, then a Supplemental Descriptor or an Essential Descriptor may be used. If the Adaptation Set does neither contain a **Representation** element, nor an `@xlink` attribute, then an Empty Adaptation Set as well as an Essential Descriptor shall be used to indicate that the Adaptation Set is not fully described in this MPD.

NOTE   This scheme may be used for many use cases. However, one specific use case is the server-based mosaic channel as described in ISO/IEC 23009-3. The use case may be fulfilled by the combination of the Spatial Relationship Description (SRD) as defined in Annex H and this scheme.

Page 74, Clause 5

Add new subclause:

5.8.5.Y Sub-Asset Scheme Identifier

In DASH MPD, sub-assets across Periods can be identified using the sub asset Scheme Identifier. This scheme is signalled using a specific **SupplementalProperty** descriptor at the Adaptation Set or Sub-Representation level with `@schemeIdUri` attribute set to "`urn:mpeg:dash:sai:2015`".

If two different Adaptation Sets or Sub-Representation from different Periods contain Sub-Asset Identifiers descriptors with the same `@value` attribute, then the content in the Representation(s) contained in these Adaptation Sets represent, at least, the same sub-asset.

NOTE 1   The association between sub-assets and an Adaptation Set may change between Periods. For instance, an Adaptation Set may be associated with a sub-asset of an asset in one Period but with another sub-asset of the same asset in another Period.

NOTE 2   Sub-Asset Identifier descriptor may be used by DASH clients to select Representation(s) to be processed after a Period change.

A given Adaptation Set may contain more than one Sub-Asset Identifier descriptor indicating that the Representation(s) contained in this Adaptation Set represent more than one identified part of the asset.

NOTE 3   If the value for this descriptor is not recognized, the SubAsset Identifier descriptor may still be used to understand the equivalence of sub-asset identifiers across Periods. Processing of the descriptor scheme and value by the DASH client is not essential for normal operation.

Page 74, Clause 5

Add new subclause:

5.8.5.Z Client Authentication and Content Access Authorization

When client authentication and/or content access authorization functionality is needed, DASH may be used with different schemes, such as Open Authentication Technical Committee (OATC) Online Multimedia Authorization Protocol (OMAP),[13] Open Standard for Authorization (OAuth) 2.0,[14] OASIS Security Assertion Markup Language (SAML),[15] 3GPP Generic Authentication Architecture (GAA),[16] or 3GPP Generic Bootstrapping Architecture (GBA).[17] This subclause describes generic signalling to support use of various authentication and authorization schemes.

Typical access control methods include blocking HTTP requests that do not include a security token obtained by the authorization protocol wherein the security token is validated by a CDN before downloading the requested Media Segment, or encrypting Media Segments so that playback will be restricted unless the authorization protocol provides the client with a decryption key.

For client authentication, a service may limit content delivery to authenticated clients and may use client identification information such as certificates, cookies, and embedded keys to determine subscription rights, etc. required to authorize playback of the Media Presentation. The details of such a scheme are outside the scope of this document. A client that does not support the signalled content access authorization would not be able to play the content.

NOTE   This subclause does not provide any requirements on client authentication or content access authorization.

The signalling and setup of the specific scheme may be done outside the MPD level, e.g. a system applying such a scheme may only permit access to the MPD if the client is authenticated or the content access is authorized.

However, there are cases for which the MPD is provided without access control. In this case, client authentication and content access authorization methods may be signalled in the MPD using Essential Property Descriptors. The DASH client may be offered with multiple options to access the entire Media Presentation or specific parts of the Media Presentation, e.g. a specific Adaptation Set. An Essential Property descriptor may be placed at the appropriate level, and, for example, the **EssentialProperty**@schemeIdUri may signal the URN of the appropriate authentication or authorization method and the **EssentialProperty**@value attribute may carry some scheme specific information. Other signalling may be used, but the detailed signalling and semantics remain specific to a particular scheme.

There may be cases in which multiple options are provided to the client for client authentication and/or content access authorization. In this case, the **EssentialProperty**@id value may be used to signal functional equivalence of descriptors. In the absence of other information, the **EssentialProperty**@id value may contain the following URNs:

— urn:mpeg:dash:client-authentication:2015 for client authentication;

— urn:mpeg:dash:content-authorization:2015 for content access authorization.

In this case,

— each **EssentialProperty** descriptor with **EssentialProperty**@id value of urn:mpeg:dash:client-authentication:2015 indicates a supported client authentication protocol. A client may select one of possibly multiple elements with that **EssentialProperty**@id value and a scheme that it recognizes based on the @schemeIdUri attribute; and execute that protocol using any information included in the @value attribute and any extension elements defined by that particular authentication scheme;

— each **EssentialProperty** descriptor with **EssentialProperty**@id value of `urn:mpeg:dash:content-authorization:2015` indicates a supported content access authorization protocol. A client may select one of possibly multiple elements with that **EssentialProperty**@id value and a scheme that it recognizes based on the @schemeIdUri attribute; and execute that protocol using any information included in the @value attribute and any extension elements defined by that particular authorization scheme.

A DASH client that is successfully authenticated as an authenticated player and authorized for playback of some or all Representations or Adaptation Sets in the MPD may request and play the authorized content.

Page 74, Clause 5

Add new subclause:

5.10.4.X   DASH Callback Event

5.10.4.X.1   General

DASH Callback events are indications in the content that it is expected by a DASH client to issue an HTTP GET request to a given URL and ignore the HTTP response. These event schemes are identified by the URN "`urn:mpeg:dash:event:callback:2015`".

A content author may use such an event for tracking play-back of specific content on a server that is not included in the media path.

The Status-Code field of the HTTP response should be 2xx, however the client is expected to entirely ignore the response.

NOTE 1   HTTP GET (as opposed to HEAD) is used in alignment with IAB VAST.[18]

The message body of the HTTP response should be as small as possible or absent.

NOTE 2   The system adopting this functionality is expected to define appropriate means for secure handling of this feature.

5.10.4.X.2   Inband event

Table 5.10.4.X.1 defines the message data and the expected actions for different @value values when the DASH callback event is signalled as an Inband Event.

Table 5.10.4.X.1 — Message data and expected actions for DASH call back inband event

value	message_data[]	Action
1	Valid HTTP/HTTPS URL	An HTTP GET request is expected to be issued to a URL contained in `message_data[]`. The URL shall be a NULL-terminated string. HTTP response shall either not be provided or be provided such that it can be discarded.

5.10.4.X.3   MPD event

Table 5.10.4.X.2 defines the relevant parameters for a call back event signalled in the MPD.

Table 5.10.4.X.2 — Relevant parameters for a call back event signalled in the MPD

Attribute	Value
EventStream@schemeIdUri	"urn:mpeg:dash:event:callback:2015"
EventStream@value	1
Event@messageData	HTTP-URL HTTP response is expected to be discarded without parsing.

Page 114, Annex A

Add new A.9:

A.9 Playback across Period boundaries

From a client perspective, Period boundaries may require processing that makes fully continuous playout impossible or at last practically complex. For example, the content may be offered with different codecs, different language attributes, different protection and so on. The client is expected to play the content continuously across Periods, but there may be implications in terms of implementation to provide fully continuous and seamless playout. It may be the case that at Period boundaries, the presentation engine needs to be re-initialized, for example due to changes in formats, codecs or other properties. This may result in a re-initialization delay. Such a re-initialization delay should be minimized.

If the client presents media components of a certain Adaptation Set with a specific value foo for the **AdaptationSet**@id in one Period, and if the following Period has assigned an identical Asset Identifier, then the client is suggested to identify an associated Period and, in the absence of other information, continue playing the content in the associated Adaptation Set, i.e. the Adaptation Set with value foo for the **AdaptationSet**@id.

If the client presents media components of a certain Sub-Representation in one Period, and if the following Period has assigned an identical Sub-Asset Identifier, then the client is suggested to identify an associated Period and, in the absence of other information, continue playing the content in the associated Sub-Representation.

If furthermore the Adaptation Sets are *period-continuous* or *period-connected* as defined in 5.3.2.4, i.e. the presentation times are continuous and this is signalled in the MPD, then the client is expected to seamlessly play (as defined in 4.5.1) the content across the Period boundary. Most suitably, the client may continue playing the Representation in the Adaptation Set with the same @id, but there is no guarantee that this Representation is available. In this case, the client is expected to seamlessly switch (as defined in 4.5.1) to any other Representation in the Adaptation Set. If period continuity is signalled and if continuously playing, then the client should ignore the value of the @presentationTimeOffset attribute and just continuing processing the incoming Segments. If period connectivity is signalled and if continuously playing, then the client is expected to inform the media decoder on a timeline discontinuity obeying the value of @presentationTimeOffset attribute, but it may continuing processing the incoming Segments without, for example, re-initializing the media decoder.

Page 115, Annex B

Update Annex B:

Annex B
(normative)

MPD schema

The schema of the MPD for this edition of the document is provided below.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="urn:mpeg:dash:schema:mpd:2011"
attributeFormDefault="unqualified" elementFormDefault="qualified" xmlns:xs="http://www.
w3.org/2001/XMLSchema" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns="urn:mpeg:dash:schema:mpd:2011">

  <xs:import namespace="http://www.w3.org/1999/xlink" schemaLocation="xlink.xsd"/>

  <xs:annotation>
    <xs:appinfo>Media Presentation Description</xs:appinfo>
    <xs:documentation xml:lang="en">
     This Schema defines the Media Presentation Description for MPEG-DASH.
    </xs:documentation>
  </xs:annotation>

  <!-- MPD: main element -->
  <xs:element name="MPD" type="MPDtype"/>

  <!-- MPD Type -->
  <xs:complexType name="MPDtype">
    <xs:sequence>
      <xs:element name="ProgramInformation" type="ProgramInformationType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="BaseURL" type="BaseURLType" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="Location" type="xs:anyURI" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="Period" type="PeriodType" maxOccurs="unbounded"/>
      <xs:element name="Metrics" type="MetricsType" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="EssentialProperty" type="DescriptorType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="SupplementalProperty" type="DescriptorType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:element name="UTCTiming" type="DescriptorType" minOccurs="0"
maxOccurs="unbounded"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="id" type="xs:string"/>
    <xs:attribute name="profiles" type="xs:string" use="required"/>
    <xs:attribute name="type" type="PresentationType" default="static"/>
    <xs:attribute name="availabilityStartTime" type="xs:dateTime"/>
    <xs:attribute name="availabilityEndTime" type="xs:dateTime"/>
    <xs:attribute name="publishTime" type="xs:dateTime"/>
    <xs:attribute name="mediaPresentationDuration" type="xs:duration"/>
    <xs:attribute name="minimumUpdatePeriod" type="xs:duration"/>
    <xs:attribute name="minBufferTime" type="xs:duration" use="required"/>
    <xs:attribute name="timeShiftBufferDepth" type="xs:duration"/>
    <xs:attribute name="suggestedPresentationDelay" type="xs:duration"/>
    <xs:attribute name="maxSegmentDuration" type="xs:duration"/>
    <xs:attribute name="maxSubsegmentDuration" type="xs:duration"/>
    <xs:anyAttribute namespace="##other" processContents="lax"/>
  </xs:complexType>

  <!-- Presentation Type enumeration -->
  <xs:simpleType name="PresentationType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="static"/>
      <xs:enumeration value="dynamic"/>
```