International Standard

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

Part 1: Media presentation description and segment formats

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

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Foreword

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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 or www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This sixth edition cancels and replaces the fifth edition (ISO/IEC 23009-1:2022), which has been technically revised.

The main changes are as follows:

— Introduction of Media Presentation Insertion events.

— Introduction of List MPDs.

— Significant overhaul of segment sequences, offering new functionality for low-latency and low-delay applications.

— Introduction of segment duration patterns.

— Updates to Annex I, including new pre-defined parameters.

— Introduction of Content Steering.

— Introduction of reporting using CTA-5004 (CMCD).

— Introduction of ARI (Addressable Resource Index) Tracks.

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— Introduction of supplemental video services.

— Introduction of non-linear timelines.

A list of all parts in the ISO/IEC 23009 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Dynamic adaptive streaming over HTTP (DASH) is intended to support a media-streaming model for delivery of media content in which control lies primarily with the client. Clients may request data using the HTTP protocol from standard web servers that have no DASH-specific capabilities. Consequently, this document focuses not on client or server procedures but on the data formats used to provide a DASH Media Presentation.

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

Part 1: Media presentation description and segment formats

1 Scope

This document primarily specifies formats for the Media Presentation Description and Segments for dynamic adaptive streaming delivery of MPEG media over HTTP. It is applicable to streaming services over the Internet.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 13818-1, *Information technology — Generic coding of moving pictures and associated audio information — Part 1: Systems*

ISO/IEC 14496-12, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 23000-19, *Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media*

ISO/IEC 23091-2, *Information technology — Coding-independent code points — Part 2: Video*

ISO/IEC 23091-3, *Information technology — Coding-independent code points — Part 3: Audio*

IETF RFC 2397, *The "data" URL scheme*

IETF RFC 3629, *UTF-8, a transformation format of ISO 10646*

IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*

IETF RFC 4337, *MIME Type Registration for MPEG-4*

IETF RFC 4648, *The Base16, Base32, and Base64 Data Encodings*

IETF RFC 5234, *Augmented BNF for Syntax Specifications: ABNF*

IETF RFC 5261, *An Extensible Markup Language (XML) Patch Operations Framework Utilizing XML Path Language (XPath) Selectors*

IETF RFC 5646, *Tags for Identifying Languages*

IETF RFC 6381, *The 'Codecs' and 'Profiles' Parameters for "Bucket" Media Types*

IETF RFC 6838, *Media Type Specifications and Registration Procedures*

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IETF RFC 8141, *URN Syntax*

IETF RFC 8673, *HTTP Random Access and Live Content*

IETF RFC 9110, *HTTP Semantics*

IETF RFC 9562, *Universally Unique IDentifiers (UUIDs)*

HTML 4.01 Specification, W3C Recommendation, 24 December 1999

ETSI TS 103 998, *DASH-IF: Content Steering for DASH*

W3C, *Canonical XML*, Version 1.1

W3C, *Extensible Markup Language (XML)*, Version 1.0

W3C, *XML Linking Language (XLink)*, Version 1.1

W3C, *Media Fragments URI*, Version 1.0

CTA-5004, Web Application Video Ecosystem, *Common Media Client Data (CMCD)*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23000-19 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
access unit
unit of a *media stream* (3.1.31) with an assigned Media Presentation time

3.1.2
accessibility
degree to which a media content or certain *media content components* (3.1.23) are available to as many people as possible

3.1.3
Adaptation Set
set of interchangeable encoded versions of one or several *media content components* (3.1.23)

3.1.4
asset
content including media and metadata together with the rights to use the content by the content provider

3.1.5
associated Representation
Representation (3.1.43) which provides supplemental or descriptive information for at least one other Representation

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3.1.6
available Segment
Segment (3.1.45) that is accessible at its assigned *HTTP-URL* (3.1.17) and a possibly assigned byte range that is the request with an HTTP GET results in a reply of the Segment and 2xx status code

3.1.7
Bitstream Switching Segment
Segment (3.1.45) that if present contains essential data to switch to the *Representation* (3.1.43) it is assigned to

3.1.8
complementary Representation
Representation (3.1.43) which complements at least one *dependent Representation* (3.1.12)

3.1.9
continuous media
media with an inherent notion of time

EXAMPLE Speech, audio, video, timed text or timed metadata.

3.1.10
DASH metric
metric computed by the DASH Client and uniquely identified by a key

3.1.11
data URL
URL with a fixed scheme “data”

3.1.12
dependent Representation
Representation (3.1.43) for which *Segments* (3.1.45) from its *complementary Representations* (3.1.8) are necessary for presentation and/or decoding of the contained *media content components* (3.1.23)

3.1.13
earliest presentation time
smallest *presentation time* (3.1.41) of any *access unit* (3.1.1) of a *Media Segment* (3.1.30) or *Subsegment* (3.1.57) for a *media stream* (3.1.31)

3.1.14
event
aperiodic sparse media-time related auxiliary information to the DASH Client or to an application

3.1.15
event stream
sequence of related *events* (3.1.14)

3.1.16
group
collection of *Adaptation Sets* (3.1.3) that are not expected to be presented simultaneously

3.1.17
HTTP-URL
URL with a fixed scheme of “http” or “https”

3.1.18
Index Segment
Segment (3.1.45) that primarily contains indexing information for *Media Segments* (3.1.30)

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3.1.19
Initialization Segment
Segment (3.1.45) containing metadata that is necessary to present the *media streams* (3.1.31) encapsulated in *Media Segments* (3.1.30)

3.1.20
Listen Mode
mode of operation where media time elapses (i.e. playhead moves normally), certain operational data is processed, but no media is rendered

3.1.21
Main Adaptation Set
Adaptation Set (3.1.3) in a *Preselection* (3.1.40) that contains the *Initialization Segment* (3.1.19) for the complete experience

3.1.22
media content
single *media content period* (3.1.25) or contiguous sequence of media content periods

3.1.23
media content component
single continuous component of the *media content* (3.1.22) with an assigned *media content component type* (3.1.24)

3.1.24
media content component type
single type of *media content* (3.1.22)

EXAMPLE Audio, video, or text.

3.1.25
media content period
set of *media content components* (3.1.23) that have a common timeline as well as relationships on how they can be presented

3.1.26
Media Presentation
collection of data that establishes a bounded or unbounded presentation of *media content* (3.1.21)

3.1.27
Media Presentation Description
MPD
formalized description for a *Media Presentation* (3.1.26) for the purpose of providing a streaming service

3.1.28
Media Presentation Insertion
Insertion of media content from a second *Media Presentation* (3.1.26) in the timeline of a first *Media Presentation* (3.1.26)

3.1.29
Media Presentation timeline
concatenation of the timeline of all *Periods* (3.1.37) which itself is common to all *Representations* (3.1.43) in the Period

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3.1.30
Media Segment
Segment (3.1.45) that complies with media format in use and enables playback when combined with zero or more preceding Segments and an *Initialization Segment* (3.1.19) (if any)

3.1.31
media stream
encoded version of a *media content component* (3.1.23)

3.1.32
Media Subsegment
Subsegment (3.1.57) that only contains media data but no *Segment Index* (3.1.49)

3.1.33
message
part of an *event* (3.1.14) containing information that is exclusively handled by the event handler

3.1.34
MPD start time
approximate presentation start time of a *Media Segment* (3.1.30) signalled in *MPD* (3.1.26)

3.1.35
MPD duration
approximate presentation duration of a *Media Segment* (3.1.30) signalled in *MPD* (3.1.26)

3.1.36
Partial Segment
Media Segment (3.1.30) included in a Segment Sequence Representation

3.1.37
Period
interval of the *Media Presentation* (3.1.24), where a contiguous sequence of all Periods constitutes the *Media Presentation*

3.1.38
playhead
current media time provided by the media engine that can be mapped to a time on the Media Presentation timeline

3.1.39
Preroll
on-demand content which is played before start of playback of a live content

3.1.40
Preselection
set of *media content components* (3.1.23) that are intended to be consumed jointly

3.1.41
presentation time
time associated to an *access unit* (3.1.1) that maps it to the *Media Presentation timeline* (3.1.29)

3.1.42
remote element entity
entity that contains one or more elements and is referenced in the *MPD* (3.1.27) with an *HTTP-URL* (3.1.17) contained in an @xlink:href attribute, referred to as "remote resource" by XLink

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3.1.43
Representation
collection and encapsulation of one or more *media streams* (3.1.31) in a delivery format and associated with descriptive metadata

3.1.44
Resynchronization Point
point within a Segment from which it is possible to start processing the Representation

3.1.45
Segment
unit of data associated with an *HTTP-URL* (3.1.17) and optionally a byte range that are specified by an *MPD* (3.1.27), or with a *data URL* (3.1.11)

3.1.46
Segment availability start time
latest time instant in *wall-clock time* (3.1.60) at which a *Segment* (3.1.45) becomes an *available Segment* (3.1.6)

3.1.47
adjusted Segment availability start time
time instant in *wall-clock time* (3.1.60) at which a *Segment* (3.1.45) becomes an *available Segment* (3.1.6)

3.1.48
Segment availability end time
time instant in *wall-clock time* (3.1.60) at which a *Segment* (3.1.45) ceases to be an *available Segment* (3.1.6)

3.1.49
Segment Index
compact index of the time range to byte range mapping within a *Media Segment* (3.1.30) separately from the *MPD* (3.1.27)

3.1.50
Segment Sequence
sequence of all *Partial Segments* (3.1.36) that are sharing a common address prefix

3.1.51
Segment Sequence Representation
Representation (3.1.43) using *Segment Sequences* (3.1.50)

3.1.52
Segment Track
concatenation of *Segments* (3.1.45) forming a track with potential conformance properties

3.1.53
Service Location
collection of network resources that share commonalities and can be referred to by a common label

3.1.54
spatial object
media content component (3.1.23) corresponding to a region in a coordinate system associated to this media content component

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3.1.55
stream access point
SAP
position in a *Representation* (3.1.43) enabling playback of a *media stream* (3.1.31) to be started using only the information contained in Representation data starting from that position onwards preceded by initializing data in the *Initialization Segment* (3.1.19), if any

3.1.56
sub-asset
media content component (3.1.23) (or part thereof) identified as corresponding to a part of an *asset* (3.1.4)

3.1.57
Sub-Representation
part of a *Representation* (3.1.43) described in the *MPD* (3.1.27) that is present in the entire *Period* (3.1.37)

3.1.58
Subsegment
unit within *Media Segments* (3.1.30) that is indexed by a *Segment Index* (3.1.49)

3.1.59
valid Segment URL
HTTP-URL (3.1.17) that is promised to reference a *Segment* (3.1.45) during its Segment availability period

3.1.60
wall-clock time
time as stated by UTC

3.2 Symbols and abbreviated terms

4CC	four character code
ABNF	augmented Backus-Naur form
ACK	acknowledgement message in TCP
AEMS	application event or metadata streams
API	application programming interface
ARI	addressable resource index
AVC	advanced video coding
CAT	conditional access table
CDN	content delivery network
CMAF	common media application format
CMCD	common media client data
DASH	dynamic adaptive streaming over HTTP
DCSM	DASH Content Steering Manifest
DM	DASH metrics
DOM	document object model
DRM	digital rights management
ECM	entitlement control message
EDRAP	extended dependent random access point

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EIDR	entertainment identifier registry
EME	encrypted media extensions
EMIO	event/metadata internal object
EMM	entitlement management message
EPT	earliest presentation time
ESR	external stream Representation
GAA	generic authentication architecture
GBA	generic bootstrapping architecture
GDR	gradual decoding refresh
GMT	Greenwich Mean Time
GOP	group of pictures
GPS	global positioning system
HDCP	high-bandwidth digital content protection
HDMI	high definition multimedia interface
HEVC	high efficiency video coding
HLS	HTTP Live Streaming
HTML	hypertext markup language
HTTP	hypertext transfer protocol
HTTPS	secure hypertext transfer protocol
IAB	interactive advertising bureau
IDR	instantaneous decoding refresh
IP	internet protocol
ISO BMFF	ISO base media file format
KPI	Key Performance Indicator
LAT	Latest Arrival Time
LL-DASH	Low Latency DASH
MBT	minimum buffer time
MIME	multipurpose internet mail extensions
MPD	media presentation description
MPP	MPD patch
MSR	main stream Representation
MVC	multi-view video coding
NGA	next generation audio
NTP	network time protocol
OATC	open authentication technical committee
OAuth	open standard for authorization
OMAP	online multimedia authorization protocol

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OTT	over-the-top
PAT	program association table
PCR	program clock reference
PES	packetized elementary stream
PID	packet identifier
PMT	program map table
PR	popularity rate
PSI	program specific information
PTS	presentation time stamp
QoE	Quality of Service
QoS	Quality of Service
RAP	random access point
SAML	security assertion markup language
SAP	stream access point
SEI	supplementary enhancement information
SNTP	simple NTP
SPS	sequence parameter set
SRD	spatial relationship description
SSR	Segment Sequence Representation
SVC	scalable video coding
TCP	transmission control protocol
TLS	transport layer security
TS	transport stream
URI	uniform resource identifier
URL	uniform resource locator
URN	uniform resource name
UTC	coordinated universal time
UUID	universally unique identifier
VAST	video ad serving template
VOD	video-on-demand
VVC	Versatile Video Coding
XML	extensible mark-up language

3.3 Conventions

The following naming conventions apply in this document.

— Elements in an XML document are identified by an upper-case first letter and in bold face as **`Element`**. To express that an element **`Element1`** is contained in another element **`Element2`**, the following format is

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used: **`Element2.Element1`**. If an element's name consists of two or more combined words, camel-casing is typically used, e.g. **`ImportantElement`**. Elements may be present either exactly once, or the minimum and maximum occurrence is defined by <minOccurs> ... <maxOccurs>.

— Attributes in an XML document are identified by a lower-case first letter as well as they are preceded by an '`@`'-sign, e.g. `@attribute`. To point to a specific attribute `@attribute` contained in an element **`Element`**, one may write **`Element`**`@attribute`. If an attribute's name consists of two or more combined words, camel-casing is typically used after the first word, e.g. `@veryImportantAttribute`. Attributes may have assigned a status in the XML as mandatory (M), optional (O), optional with default value (OD) and conditionally mandatory (CM).

— Namespace qualification of elements and attributes is used as per XML standards, in the form of **`namespace:Element`** or `@namespace:attribute`. The fully qualified namespace is provided in the schema fragment associated with the declaration. External specifications extending the namespace of DASH are expected to document the element name in the semantic table with an extension namespace prefix.

— Variables defined in the context of this document are specifically highlighted with *italics,* e.g. *InternalVariable*.

— Structures that are defined as part of the hierarchical data model are identified by an upper-case first letter, e.g. Period, Adaptation Set, Representation, Segment, etc.

— The term "this clause" refers to the entire clause included within the same first heading number. The term "this subclause" refers to all text contained in the subclause with the lowest hierarchy heading.

— For improved interoperability, this document uses ABNF notation according to IETF RFC 5234 to specify certain underdefined values of XML attributes and elements.

4 Overview

4.1 System description

Dynamic adaptive streaming over HTTP (DASH) specifies XML and binary formats that enable delivery of continuous media content from standard HTTP servers to HTTP clients and enable caching of content by standard HTTP caches.

This document primarily defines two formats:

— The Media Presentation Description (MPD) describes a *Media Presentation*, i.e. a bounded or unbounded presentation of continuous media content. In particular, it defines formats to announce resource identifiers for *Segments* and to provide the context for these identified resources within a Media Presentation. These resource identifiers are HTTP-URLs possibly combined with a byte range, or with a data URL.

— The Segment formats specify the formats of the entity body of the HTTP response to an HTTP GET request or a partial HTTP GET with the indicated byte range using HTTP as defined in IETF RFC 9110 to a resource identified in the MPD. Segments typically contain efficiently coded media data and metadata conforming to or at least closely aligned with common media formats.

The MPD provides sufficient information for a client to provide a streaming service to the user by accessing the Segments through the protocol specified in the scheme of the defined resources. In the context of this document, the assumed protocol is HTTP. Such a client is referred to as a DASH Client in the remainder of this document. However, this document does not provide a normative specification for such a client.

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