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ANSI/SCTE 214-1 2016

MPEG DASH for IP-Based Cable Services
Part 1: MPD Constraints and Extensions

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140 Philips Road
Exton, PA 19341

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1. Scope

This standard is part of a suite documenting usage of MPEG DASH in IP-based cable networks. It specifies restrictions on MPD and codecs that apply to both MPEG-2 TS and ISO-BMFF segments. Thus, DASH/TS profile is a combination of part 1 (this standard) and Part 2 (which defines aspects specific to MPEG-2 TS), and, analogously, DASH/FF profile is a combination of Part 1 and Part 3 (which defines aspects specific to ISO-BMFF). The DASH/TS profile is also very similar to the adaptive transport stream source description defined in SCTE 215.

Profile URNs for DASH/TS and DASH/FF appear in SCTE 214-2 and SCTE 214-3.

2. Normative References

2.1. SCTE References

ANSI/SCTE 35 2014, Digital Program Insertion Cueing Message for Cable

ANSI/SCTE 128-1 2013, AVC Video Constraints for Cable Television Part 1: Coding

ANSI/SCTE 130-10, Digital Program Insertion – Advertising Systems Interfaces, Part 10 – Stream Restriction Data Model (SRDM)

ANSI/SCTE 193-1 2014, MPEG-4 AAC Family Audio System – Part 1: Coding Constraints for Cable Television

ANSI/SCTE 193-2 2014, MPEG-4 AAC Family Audio System – Part 2: Constraints for Carriage over MPEG-2 Transport

ANSI/SCTE 194-1 2013, DTS-HD Audio System – Part 1: Coding Constraints for Cable Television

ANSI/SCTE 194-2 2014, DTS-HD Audio System – Part 2: Constraints for Carriage over MPEG-2 Transport

ANSI/SCTE 215-1 2015, HEVC Video Constraints for Cable Television, Part 1 – Coding

2.2. Standards from other Organizations

ATSC A/52 Digital Audio Compression (AC-3) (E-AC-3) Standard

ATSC A/53 ATSC Digital Television Standard

ATSC A/65 ATSC Standard: Program and System Information Protocol for Terrestrial Broadcast and Cable

ISO/IEC 23009-1:2014 2nd Ed., Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats (including Corrigenda 1 and 2, and Amendments 1 and 2).

ISO/IEC 23009-3:2014: Information technology -- Dynamic adaptive streaming over HTTP (DASH) – Part 3: Implementation Guidelines

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ITU-T Recommendation H.264 (02/2015): "Advanced video coding for generic audio-visual services" | ISO/IEC 14496-10:2015: "Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding".

ISO/IEC 14496-12:2014 Information technology – Coding of audio-visual objects – Part 12: ISO base media file format.

ISO/IEC 14496-15:2014: Information technology – Coding of audio-visual objects – Part 15: Carriage of network abstraction layer (NAL) unit structured video in ISO base media file format.

ITU-T Recommendation H.265 (04/2015): "Advanced video coding for generic audio-visual services" | ISO/IEC 23008-2:2015: "High Efficiency Coding and Media Delivery in Heterogeneous Environments – Part 2: High Efficiency Video Coding"

ISO/IEC 23001-8:2013, "Information technology – MPEG systems technologies – Part 8: Coding-independent code points"

ANSI/CEA-608-E, Line 21 Data Services, April 2008

ANSI/CEA-708-E, Digital Television (DTV) Closed Captioning, August 2013

ANSI/CEA-708.1, Digital Television (DTV) Closed Captioning: 3D Extensions, October 2012

IETD RFC 2141, URN Syntax, May 1997

IETF RFC 2326, Real Time Streaming Protocol (RTSP), April 1998

IETF RFC 3339, Date and Time on the Internet: Timestamps, July 2002

IETF RFC 3406, Uniform Resource Names (URN) Namespace Definition Mechanisms, October 2002

IETF RFC 3986, Uniform Resource Identifier (URI): Generic Syntax, January 2005

IETF RFC 4648, The Base16, Base32, and Base64 Data Encodings, October 2006

IETF RFC 5234, Augmented BNF for Syntax Specifications: ABNF, January 2008.

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

IETF RFC 7230, Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing, June 2014.

IETF RFC 7231, Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content, June 2014.

IETF RFC 7232, Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests, June 2014.

IETF RFC 7233, Hypertext Transfer Protocol (HTTP/1.1): Range Requests, June 2014.

IETF RFC 7234, Hypertext Transfer Protocol (HTTP/1.1): Caching, June 2014.

DASH-IF Implementation Guidelines: Interoperability Points; Version 3.1, <http://dashif.org/wp-content/uploads/2015/10/DASH-IF-IOP-v3.1.pdf>

Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Recommendation, 26 November 2008, available at <http://www.w3.org/TR/REC-xml/>

XML Linking Language (XLink) Version 1.0, W3C Recommendation 27 June 2001, available at <http://www.w3.org/TR/xlink/>

XML Schema Part 2: Datatypes Second Edition, W3C Recommendation 28 October 2004, available at <http://www.w3.org/TR/xmlschema-2/>

3. Informative References

The following documents may provide valuable information to the reader but are not required when complying with this standard.

3.1. SCTE References

No informative reference applicable

3.2. Standards from other Organizations

ETSI TS 103 285 V1.1.1 (2015-05): "MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks"

3.3. Published Materials

[HLS I-D] R. Pantos, W. May, HTTP Live Streaming, <https://tools.ietf.org/html/draft-pantos-http-live-streaming-17>

4. Compliance Notation

<i>shall</i>	This word or the adjective “ <i>required</i> ” means that the item is an absolute requirement of this specification.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this specification.
<i>forbidden</i>	This word means the value specified shall never be used.
<i>should</i>	This word or the adjective “ <i>recommended</i> ” means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
<i>should not</i>	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
<i>may</i>	This word or the adjective “ <i>optional</i> ” means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
<i>deprecated</i>	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of the standard. Implementations should avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

AAC	advanced audio coding
AC-3	Audio Codec 3 or Advanced Codec 3 (also Dolby Digital)
AES-CBC	Advanced Encryption Standard cipher block chaining
ANSI	American National Standards Institute
ATSC	Advanced Television Systems Committee
AVC	advanced video coding
BMFF	base media file format
BSS	bitstream switching segment
CBR	constant bit rate
CC	closed captioning
CEA	Consumer Electronics Association
CPB	coded picture buffer
DASH	[MPEG] dynamic adaptive streaming over HTTP
DTS	trademark for DTS, Inc. audio (originally Digital Theater Systems, Inc.)
DTV	digital television
DVB	Digital Video Broadcasting [Project]
DVS	[SCTE] Digital Video Subcommittee
e.g.	for example (<i>exempli gratia</i>)
ETSI	European Telecommunications Standards Institute
FF	file format
HEVC	high efficiency video coding
HI	hearing impaired
HLS	HTTP live streaming
HRD	hypothetical reference decoder
HTTP	hypertext transfer protocol
i.e.	that is (<i>id est</i>)
IEC	International Electrotechnical Commission
IP	Internet protocol
ISO	International Organization for Standardization
ISO-BMFF	ISO Base Media File Format
MBT	minimum buffer time
MPD	media presentation description
MPEG	Moving Picture Experts Group
MPEG-2 TS	MPEG-2 transport stream
NAL	network abstraction layer
PAT	program association table
PCR	program clock reference
PMT	program map table
PTS	presentation time stamp
SAP	stream access point(s)
SCTE	Society of Cable Telecommunications Engineers
SEI	supplemental enhancement information

TS	MPEG-2 transport stream
UPID	unique program identifier
URI	uniform resource identifier
URN	universal resource name
VCL	video coding layer
VI	visually impaired
XLink	external link
XML	extensible markup language

5.2. Notation

This document uses notation similar to the one of ISO/IEC 23009-1.

XML elements are written in bold face, e.g. **Element1**.

Child XML elements are separated from parent elements by a dot ('.'), e.g. **Element2.Element1**.

XML attributes are prefixed by an at-sign ('@'), e.g. @attribute. Attributes of an element are separated from the name of the containing element by at-sign, e.g. **Element**@attribute.

ISO-BMFF boxes are written as box names enclosed in backquote ('`) signs, e.g. `box0`

Fields in ISO-BMFF boxes are separated from box names by a dot ('.'), e.g. `box0`.field0

In cases where an element has the same name as a concept it describes, when the name is written in bold face, it refers to the syntactic element. For example, **Representation** refers to an XML element named "Representation", while "representation" refers to the concept of a representation as defined in ISO/IEC 23009-1.

XML elements and attributes defined in SCTE 214 are prefixed with `scte214:`

URLs that do not fit into a single line are escaped with `\\` character.

6. MPD Restrictions

6.1. Restrictions on MPD elements

1. **MPD**@minBufferTime *shall* be present. Its value *should* be equal or larger than maximum segment (live profile) or subsegment (on demand profile) duration.
2. If the **MPD**@type is "dynamic":
 - a. **MPD**@minimumUpdatePeriod *shall* be present;
 - b. **MPD**@maxSegmentDuration *shall* be present.

Note: It is unsafe to base player buffer allocation on the attributes above whenever XLink is used, or MPD type is "dynamic". See sec. 8.2.3 for more details.

- c. If it is expected that at some point in the future a media segment *may* become unavailable, then the @timeShiftBufferDepth attribute *shall* be present, or @timeShiftBufferDepth *shall* be present as a part of segment information.

6.2. Restrictions on Period elements

1. The **Subset** element *shall not* be present.
2. The **Period.SegmentList** element *shall not* be present
3. At least one **AdaptationSet** element *shall* contain a **Role** element with @schemeIdUri="urn:mpeg:dash:role:2011" and @value="main" and each Adaptation Set containing such a **Role** element *shall* provide perceptually equivalent media components.

Note: Perceptually equivalent media components differing in subtitle or closed captioning language are still considered perceptually equivalent.

4. If a **Period** element represents a part of a multi-period asset, this **Period** *shall* contain an **AssetIdentifier** element.

6.3. Restrictions on Adaptation Set elements

1. Every adaptation set *shall* use consistent addressing. Exactly one of the following restrictions *shall* be met:
 - a. Every Representation within this Adaptation Set has a **Representation.SegmentTemplate** element, and **AdaptationSet.SegmentTemplate** is not present.
 - b. **AdaptationSet.SegmentTemplate** element is present, and no **Representation.SegmentTemplate** elements are present;

- c. The **Representation.SegmentList** element is present in every representation in this **AdaptationSet**, and all media segments are MPEG-2 TS segments
 - d. Every Representation within this Adaptation Set consists of a single segment.
2. All Representations within an Adaptation Set *shall* use the same codecs, but not necessarily the same profiles and levels. Therefore, exactly one of the following restrictions *shall* be met:
 - a. The **AdaptationSet@codecs** attribute *shall be* present and equal the maximum profile and level of any Representation contained in the Adaptation Set

Note: As an example, no adaptation set *may* contain both `avc1` (AVC) and `hev1` (HEVC) video, however avc1.64Y01F (Progressive [High@L3.1](#)) and avc1.64Y028 (Progressive [High@L4.0](#)) can be in the same AVC adaptation set.
 - b. **AdaptationSet@codecs** *shall* be present, and **Representation** elements within this **AdaptationSet** *shall not* contain the @codecs attribute.
3. **AdaptationSet@segmentAlignment** attribute *shall* be present and have a value of `true` or `1`.
4. **AdaptationSet@startWithSAP** *shall* be present and its value *shall* be 1 or 2.
5. If indexing (`sidx`) is used, then
 - a. @subsegmentAlignment *shall be* present and have value of `true` or `1`.
 - b. **AdaptationSet@subsegmentStartsWithSAP** *shall* be present and have a value of `1` or `2`.
6. For any adaptation set that contains video the following attributes *shall* be present:
 - a. @maxWidth (or @width if all Representations have the same width)
 - b. @maxHeight (or @height if all Representations have the same height)
 - c. @maxFrameRate *shall* be an integer multiple of each @frameRate in this adaptation set. If all representations have the same frame rate, @frameRate rather than @maxFrameRate *shall* be present
 - d. @scanType *shall* be present and have value "interlaced" if at least some of the pictures are interlaced.

Note: This implies that if an adaptation set is interlaced, all representations in it are interlaced.
 - e. @sar *shall* be present and, consequently, all representations within this adaptation set *shall* have the same aspect ratio.
7. There *shall* be at most one video media component in a single **AdaptationSet**.