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Digital Video Subcommittee

SCTE STANDARD

ANSI/SCTE 214-1 2024

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

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Document Tags

☒ Specification	☐ Checklist	☐ Facility
☐ Test or Measurement	☐ Metric	☒ Access Network
☐ Architecture or Framework	☒ Cloud	☐ Customer Premises
☐ Procedure, Process or Method		

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1. Introduction

1.1. Executive Summary

This document is part of a suite of documents related to MPEG DASH for IP-Based cable services and is referred to SCTE 214. Part 1 describes general MPD constraints and common features supported by both the DASH TS profile and DASH ISOBMFF profile. Part 2 contains further constraints for the DASH TS profile. Part 3 (*deprecated*) contains further constraints for the DASH ISOBMFF profile. Part 4 provides an instance MPD template for the DASH TS profile. Part 5 which replaces Part 3 (*deprecated*) extends the features and constraints but only for ISOBMFF DASH Profiles.

1.2. Scope

This document describes general media presentation description (MPD) constraints and common features supported by both the DASH TS profile and DASH ISOBMFF profile. This will allow a common feature parity between DASH Profile and ISOBMFF Profile versions of the service and includes multiplexed segments. SCTE 214-1 and [SCTE 214-2] are used together to support DASH TS Profile delivery which is beneficial while transitioning from traditional broadcast MPEG-2 TS delivery structures using an ATS structured stream. Additional features developed in later DASH editions and needed for CABLE IP Services will be supported in SCTE 214-5 but only for constrained DASH ISOBMFF Profiles with non-multiplexed segments. Profile URNs for DASH/TS and DASH/FF appear in SCTE 214-2 and SCTE 214-5.

1.3. Benefits

This document assists in the transition between a broadcast cable infrastructure to a unicast IP based cable services while allowing for a gradual transition of backend systems supporting these services.

1.4. Intended Audience

This document is intended for the development, operations, and maintenance of IP based cable services. It is useful for those creating, ingesting, and delivering content for adaptive streaming services.

1.5. Areas for Further Investigation or to be Added in Future Versions

Additional developments in this document are limited to including additional features that can co-exist with features and constructs define in [DASH] edition 5 that enable parity between DASH MPEG-TS and DASH ISOBMFF [ISOBMFF] profiles which includes the use of multiplexed segments.

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

[SCTE 35] ANSI/SCTE 35 2023, Digital Program Insertion Cueing Message for Cable

- [SCTE 128-1] ANSI/SCTE 128-1 2020, AVC Video Constraints for Cable Television Part 1: Coding.
- [SCTE 130-10] ANSI/SCTE 130-10 2020, Digital Program Insertion – Advertising Systems Interfaces, Part 10 – Stream Restriction Data Model (SRDM).
- [SCTE 193-1] ANSI/SCTE 193-1 2020, MPEG-4 AAC Family Audio System – Part 1: Coding Constraints for Cable Television.
- [SCTE 193-2] ANSI/SCTE 193-2 2020, MPEG-4 AAC Family Audio System – Part 2: Constraints for Carriage over MPEG-2 Transport.
- [SCTE 194-1] ANSI/SCTE 194-1 2018, DTS-HD Audio System – Part 1: Coding Constraints for Cable Television.
- [SCTE 194-2] ANSI/SCTE 194-2 2018, DTS-HD Audio System – Part 2: Constraints for Carriage over MPEG-2 Transport.
- [SCTE 215-1] ANSI/SCTE 215-1 202x, HEVC Video Constraints for Cable Television, Part 1 – Coding.
- [SCTE 223] ANSI/SCTE 223 2018, Adaptive Transport Stream.
- [SCTE 281-1] SCTE 281-1 2023, VVC Video Constraints for Cable Television Part 1- Coding.

2.2. Standards from Other Organizations

- [ATSC A/52] ATSC A/52: 2018 Digital Audio Compression (AC-3) (E-AC-3) Standard.
- [ATSC A/53] ATSC A/53 Part 5: 2014 ATSC Digital Television Standard.
- [ATSC A/65] ATSC A/65:2013 ATSC Standard: Program and System Information Protocol for Terrestrial Broadcast and Cable.
- [DASH] ISO/IEC 23009-1:2021 5th Ed., Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats.
- [CMAF] ISO/IEC 23000-19: 2020, Common media application format (CMAF) for segmented media, AMENDMENT 1: Additional CMAF HEVC media profiles.
- [AVC] ITU-T Recommendation H.264: 2020 "Advanced video coding for generic audio-visual services" | ISO/IEC 14496-10: "Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding."
- [ISO/BMFF] ISO/IEC 14496-12: 2020, Information technology – Coding of audio-visual objects – Part 12: ISO base media file format.
- [ISO/BMFF-NAL] ISO/IEC 14496-15: 2019, Information technology – Coding of audio-visual objects – Part 15: Carriage of network abstraction layer (NAL) unit structured video in ISO base media file format.

[HEVC]	ITU-T Recommendation H.265: 2021, "Advanced video coding for generic audio-visual services" ISO/IEC 23008-2: " High Efficiency Coding and Media Delivery in Heterogeneous Environments – Part 2: High Efficiency Video Coding."
[VVC]	ITU-T Rec. H.266 ISO/IEC 23090-3:2020 – MPEG-I Part 3: Versatile Video Coding.
[CICP-Video]	ISO/IEC 23091-2: 2019, "Information technology – MPEG systems technologies – Part 8: Coding-independent code points."
[CTA 608-E]	ANSI/CTA-608-E S-2019: Line 21 Data Services. Note that for backwards compatibility this standard is referred to as a CEA document even though the official name is now CTA.
[CTA 708-E]	ANSI/CTA-708-E R-2018: Digital Television (DTV) Closed Captioning. Note that for backwards compatibility this standard is referred to as a CEA document even though the official name is now CTA.
[CTA 708.1-E]	ANSI/CTA-708-1 R-2017: Digital Television (DTV) Closed Captioning: 3D Extensions. Note that for backwards compatibility this standard is referred to as a CEA document even though the official name is now CTA.
[ISO 639-3]	ISO 639-3:2007, Codes for the representation of names of languages-Part3: Alpha-3 code for comprehensive coverage of languages – First Edition.
[RFC 7826]	IETF RFC 7826, Real Time Streaming Protocol (RTSP) Version 2.0, December 2016.
[RFC 3339]	IETF RFC 3339, Date and Time on the Internet: Timestamps, July 2002.
[RFC 8141]	IETF RFC 8141, Uniform Resource Names (URNs), April 2017.
[RFC 6874]	IETF RFC 6874, Representing IPV6 Zone Identifiers in Address Literals and Uniform Resource Identifiers, February 2013.
[RFC 4648]	IETF RFC 4648, The Base16, Base32, and Base64 Data Encodings, October 2006.
[RFC 7405]	IETF RFC 7405, Case-Sensitive String Support in ABNF, December 2014.
[RFC 6381]	IETF RFC 6381, The 'Codecs' and 'Profiles' Parameters for 'Bucket' Media Types, August 2011.
[RFC 9110]	IETF RFC 9110, HTTP Semantics, June 2022.
[RFC 9111]	IETF RFC 9111, HTTP Caching, June 2022.
[RFC 9112]	IETF RFC 9112, HTTP/1.1, June 2022.
[RFC 5646]	IETF RFC 5646, Tags for Identifying Languages, September 2009.
[RFC 4647]	IETF RFC 4647, Matching of Language Tags, September 2006.

- [BCP 47] IETF BCP 47, Best Common Practice of Language Tags, IETF RFC 5646, IETF 4647.
- [DASH-IF IOP] DASH-IF Implementation Guidelines: Interoperability Points; Version 4.3, 2018, <http://dashif.org/wp-content/uploads/2015/10/DASH-IF-IOP-v4.3.pdf>.
- [XML] Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Recommendation 26 November 2008, available at <http://www.w3.org/TR/REC-xml/>.
- [XLINK] XML Linking Language (XLink) Version 1.0, W3C Recommendation 27 June 2001, available at <http://www.w3.org/TR/xlink/>.
- [XML Schema] XML Schema Part 2: Datatypes Second Edition, W3C Recommendation 28 October 2004, available at <http://www.w3.org/TR/xmlschema-2/>.
- [ISOBMFF-TT] ISO/IEC 14496-30: 2018, Information technology- Coding of audio-visual objects- Part 30: Timed text and other visual overlays in ISO base media file format- Second Edition.
- [IMSC 1] W3C TTML Profiles for Internet Media Subtitles and Captions 1.0 (IMSC1), 2020.

2.3. Other Published Materials

No normative references are applicable

- [MP4RA] MP4RA – Official Registration Authority for the ISOBMFF family of standards, mp4ra.org.

3. Informative References

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

3.1. SCTE References

- [SCTE 243-1] SCTE 243-1 Next Generation Audio Carriage Constraints for Cable Systems: Part-1 _Common Transport Signaling.
- [SCTE 243-2] SCTE 243-2 Next Generation Audio Carriage Constraints for Cable Systems: Part-2 _AC-4 Audio Carriage Constraints.
- [SCTE 243-3] SCTE 243-3 Next Generation Audio Carriage Constraints for Cable Systems: Part-3 _MPEG-H Audio Carriage Constraints.
- [SCTE 243-4] SCTE 243-4 Next Generation Audio Carriage Constraints for Cable Systems: Part-4 DTS-UHD Audio Carriage Constraints.

3.2. Standards from Other Organizations

- [ATSC T/300] ATSC Technology Group Report: ATSC 3.0 Launch – DASH Timeline and IMSC1.

- [ETSI TS 103 285] ETSI TS 103 285 V1.3.1 (2020-02): "MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks."
- [ETSI 103 190-1] ETSI TS 103 190-1 V1.3.1 (2018-02): Digital Audio Compression (AC-4) Standard; Part 2: Channel based coding.
- [ETSI 103 190-2] ETSI TS 103 190-2 V1.2.1 (2018-02): Digital Audio Compression (AC-4) Standard; Part 2: Immersive and personalized audio.
- [ETSI 103 491] ETSI TS 103 491 V1.1.1 (2017-04), DTS-UHD Audio Format; Delivery of Channels, Object and Ambisonic Sound Fields.
- [MPEG-H] ISO/IEC: "Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 3: 3D audio," Doc. 23008-3:2022.
- [MPEG-D] ISO/IEC: "MPEG audio technologies – Part 4: Dynamic Range Control," Doc. 23003- 4:2020.
- [NorDig] NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and managed IPTV based networks, NorDig.

3.3. Other Published Materials

- [HLS I-D] IETF RFC 8216bis, HTTP Live Streaming.
- [DV-DASH] Dolby Vision: Streams within the MPEG-DASH format,
https://professionalsupport.dolby.com/s/article/How-to-signal-Dolby-Vision-in-MPEG-DASH?language=en_US.
- [DV-HLS] Dolby Vision: Streams within the HTTP Live Streaming format,
https://professionalsupport.dolby.com/s/article/How-to-signal-Dolby-Vision-in-HLS?language=en_US.

4. Compliance Notation

<i>shall</i>	This word or the adjective “ <i>required</i> ” means that the item is an absolute requirement of this document.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this document.
<i>forbidden</i>	This word means the value specified <i>shall</i> never be used.
<i>should</i>	This word or the adjective “ <i>recommended</i> ” means that there <i>may</i> exist valid reasons in particular circumstances to ignore this item, but the full implications <i>should</i> be understood and the case carefully weighed before choosing a different course.
<i>should not</i>	This phrase means that there <i>may</i> exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications <i>should</i> 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> ” indicate a course of action permissible within the limits of the document.
deprecated	Use is permissible for legacy purposes only. Deprecated features <i>may</i> be removed from future versions of this document. Implementations <i>should</i> avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

AAC	advanced audio coding
ABNF	Augmented Backus-Naur Form
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
ATS	Adaptive Transport Stream
ATSC	Advanced Television Systems Committee
AVC	advanced video coding
BMFF	base media file format
CC	closed captioning
CEA	Consumer Electronics Association, former name of the Consumer Technology Association
CMAF	Common Media Application Format
CPB	coded picture buffer
CTA	Consumer Technology Association
DASH	[MPEG] dynamic adaptive streaming over HTTP
DRM	Digital Rights Management
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
HD	high definition
HDR	high dynamic range
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
ISOBMFF	ISO Base Media File Format
LCEVC	low complexity enhancement video coding
MBT	minimum buffer time
MPD	media presentation description
MPEG	Moving Picture Experts Group
MPEG-2 TS	MPEG-2 transport stream
NAL	network abstraction layer
PMT	program map table
SAP	stream access point(s)
SCTE	Society of Cable Telecommunications Engineers
SD	standard definition
SEI	supplemental enhancement information
TS	MPEG-2 transport stream
UHD	ultra-high definition
UPID	unique program identifier
URI	uniform resource identifier
URL	Uniform resource locator
URN	universal resource name
UTC	coordination universal time
VI	visually impaired (aka audio description or AD)
XLink	external link
XML	extensible markup language

5.2. Definitions

Definitions of terms used in this document are provided in this section. Defined terms that have specific meanings are capitalized. When the capitalized term is used in this document, the term has the specific meaning as defined in this section.

EPOCH Time	Referenceable Point in Time- 00:00:00 Thu 01 Jan 1970 UTC.
SCTE DASH Event	A DASH Event containing the payload of an SCTE message. It could be a converted SCTE Message directly from a linear stream or originated in the adaptive stream 1.

5.3. Notation

This document uses notation similar to the one of [DASH].

Extensible markup language (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.

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

Fields in ISOBMFF 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 [DASH].

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. SCTE 214 Notational Conventions

6.1. Normative XML schema

Descriptions of elements and attributes are normative and, when combined with the normative XML schema document (provided separately), comprise the full normative schema specification. Unless otherwise specified, the normative text and values assigned to elements or attributes in this specification **shall** be constrained by the bit stream equivalent field.

Non-normative schema illustrations and instance examples are included herein for informational purposes only. Any real or implied usage, semantics, or structure indicated by the schema illustrations and examples **shall not** be considered part of the specification.

No XML documents representing the structures defined in the schema are considered conformant unless they are valid according to the schema document. Additionally, other SCTE 214 standard normative parts **may** impose additional rules or restrictions that **shall** be adhered to in order for XML documents to be considered conformant to those parts.

In the case where this document and the normative schema document (i.e., the separately provided XML 'xsd' file) conflict, this document **shall** take precedence over the XML schema document.

The inclusion of a normative XML schema document does not require or imply the specific use of the schema nor a requirement that an XML document be validated.

If the SCTE 214 schema is used in combination with other schemas, it is recommended to utilize the namespace prefix of "scte214". For example, `scte214:ContentIdentifier` to reference an SCTE 214 ContentIdentifier Type.

6.1.1. XML namespace and version

The following XML namespaces and versions are defined in the normative XML schema for this specification:

Prefix	Namespace	Version
scte214	http://www.scte.org/schemas/214	YYYYMMDD

6.2. Unknown/Unrecognized/Unsupported XML elements and attributes

Generally, unknown, unrecognized or unsupported XML elements and attributes contained within SCTE 214 elements *should* be ignored during XML document processing. Specifically, these are elements or attributes which the implementation does not understand or expect. XML parsers that encounter elements or attributes which are prohibited by a namespace *should* include exception handling.

6.3. Element order

Element order is constrained by the schemas and *shall* be preserved throughout processing of the XML document. In particular, the order of elements affects the end result of the processing. Consequently, an implementation failing to preserve the order *may* cause incorrect processing results. Subsequently, the process of producing an abstract XML Information Set (InfoSet) from a concrete XML document, e.g., by parsing it, *shall* always result in the same abstract InfoSet, with the same element order per XML InfoSet (see [XML InfoSet] for additional information). Any intermediary processing *may* enhance the XML document but it *shall not* alter the abstract InfoSet element order (i.e., the XML elements comprising the document *shall* stay in document order).

7. MPD Restrictions

7.1. Restrictions on MPD elements

1. **MPD@id** *shall* be present. Consecutive updates to the MPD *shall* have the same MPD@id.
2. **MPD@minBufferTime** *shall* be present. Its value *should* be equal or larger than maximum segment (live profile) or subsegment (on demand profile) duration.
3. 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. 9.2.3 for more details.

- c. **MPD@availabilityStartTime** *shall* be present and *should* satisfy the conditions below:
 - i. **MPD@availabilityStartTime** *should* not change across MPD updates
 - ii. **MPD@availabilityStartTime** *should* be set to a fixed time in the past (e.g. the 00:00.00 GMT January 1, 1970, a.k.a. the Epoch time)

- d. **MPD@suggestedPresentationDelay** *should* be present.
- e. 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.
- f. **MPD.Location** element *should* be present.
- g. **MPD.PatchLocation** *may* be present, and **MPD.Location** *shall* be present in this case. The patch URL *should* contain the value of **MPD@publishTime** of the original MPD (verbatim) as a query parameter named **publishTime**.

7.2. 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 audio and one video **AdaptationSet** element *shall* contain a **Role** element with **@schemeIdUri="urn:mpeg:dash:role:2011"** and **@value="main"** Perceptually equivalent audio adaptation sets differing by non-linguistic characteristics such as codecs or number of channels *should* be prioritized for the players using the **@selectionPriority** attribute across the equivalent adaptation sets with a higher value indicating higher preference. The **Role** descriptor *shall* be used only to express linguistic differences.
4. If a **Period** element represents a part of a multi-period asset, this **Period** *should* contain an **AssetIdentifier** element.
5. **Period@start** *shall* be present.
6. **Period@id** *shall* be present.

7.3. Restrictions on Adaptation Set elements

1. Every adaptation set *shall* use consistent addressing. Exactly one of the following restrictions *shall* be met:
 - a. **AdaptationSet.SegmentTemplate** element is present, and no **Representation.SegmentTemplate** elements are present.
 - b. Every **Representation** element within this Adaptation Set consists of a single segment and its URL is stated in the **Representation.BaseURL** element. The MPEG DASH ISOBMFF On Demand profile satisfies this requirement.
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 is present and signals the maximum profile, level, and – when applicable tier of any representation contained in the adaptation set, and **Representation** elements within this **AdaptationSet** *may* contain the full **@codecs**

attribute including profile, level, or and – when applicable tier pertaining to that representation if these differ from the one signaled in **AdaptationSet@codecs**.

Note: As an example, no adaptation set is permitted to 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** is present as code point (4cc) only, and **Representation** elements within this **AdaptationSet** contain the full **@codecs** attribute including profile, level, and – when applicable – tier pertaining to that representation.
3. **AdaptationSet@segmentAlignment** attribute *shall* be present and have a value of `true`.

Note: Older versions of this specification allowed value of “1”, which has been *deprecated* in the latest editions of [DASH].

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`.
- b. **AdaptationSet@subsegmentStartsWithSAP** *shall* be present and *shall* have a value of `1` or `2`. Values larger than 2 are allowed if **AdaptationSet@segmentAlignment** is also present.

Note: The above *may* happen in cases such as low-latency deployment relying on CMAF chunks (subsegments).

6. For any adaptation set that contains video the following conditions *shall* apply:

- a. **@maxWidth** (or **@width** if all Representations have the same width) *shall* be present.
- b. **@maxHeight** (or **@height** if all Representations have the same height) *shall* be present.
- c. **@maxFrameRate** *shall* be present and *should* be an integer multiple of each **@frameRate** in this adaptation set. If all representations have the same frame rate, **@frameRate** rather than **@maxFrameRate** *should* be present.
- d. **@scanType** *shall* be present only if one or more of the video frames are coded as interlaced. In this case **@scanType** *shall* have value of “interlaced”.

Note: The above implies that if an adaptation set is interlaced, all representations in it are interlaced. There is no need to signal progressive content – this is the default value of the **@scanType** attribute when not present.

- e. **@sar** *shall* be present and, consequently, all representations within this adaptation set *shall* have the same aspect ratio.