CableLabs® Specifications
Web Technology

Mapping from MPEG-2 Transport to HTML5

CL-SP-HTML5-MAP-I03-140207

ISSUED

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Key to Document Status Codes

Work in Progress	An incomplete document, designed to guide discussion and generate feedback that may include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A generally public document that has undergone Member and Technology Supplier review, cross-vendor interoperability, and is for Certification testing if applicable. Issued Specifications are subject to the Engineering Change Process.
Closed	A static document, reviewed, tested, validated, and closed to further engineering change requests to the specification through CableLabs.

Trademarks

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1 SCOPE

1.1 Introduction and Purpose

HTML5 user agents (UAs), per [HTML5], may playback MPEG-2 TS media resources that contain a multiplex of video, audio, text, and private data elementary streams. Television program providers and distributors use these streams to deliver services associated with the primary video and audio in the multiplexed stream. These services are collectively termed "TV Services". A common HTML representation of these TV services tracks is essential in order for these TV Services to be made available to Web content in a consistent way. This specification defines requirements for how these MPEG-2 TS elementary streams should be translated by the HTML5 UA into the equivalent HTML5 video, audio, and text track elements. Figure 1 illustrates the relationship of this translation function in the context of MPEG-2 TS media resources delivered to a Web page by a UA in a client application.

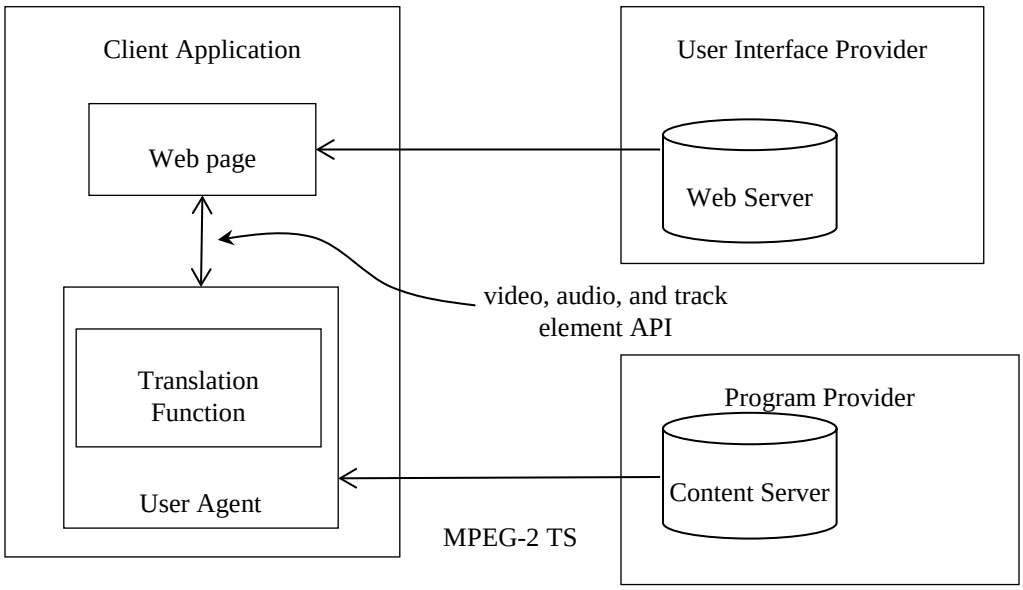

Figure 1 - Sourcing In-band Media Resource Tracks

Note that the Web page providing the user interface (e.g., program guide) is often not provided by the originator of the program content. For example, the guide may be provided by the television manufacturer or the cable or satellite TV provider, while the multiplexed streams are provided by hundreds of independent television program providers. Therefore, the Web page has no a prior knowledge of which streams are in the programs at any given time.

1.2 Requirements

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"MUST"	This word means that the item is an absolute requirement of this specification.
"MUST NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word 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 weighed before choosing a different course.
"SHOULD NOT"	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.
"MAY"	This word 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.

2 REFERENCES

2.1 Normative References

In order to claim compliance with this specification, it is necessary to conform to the following standards and other works as indicated, in addition to the other requirements of this specification. Notwithstanding, intellectual property rights may be required to use or implement such normative references.

[ATSC_53] AC-3 Audio System Characteristics, ATSC Standard A/53, Part 5:2010.

[ATSC_65] Program and System Information for Terrestrial Broadcast and Cable (PSIP), ATSC Standard A/65.

[BCP 47] IETF BCP 47, Tags for Identifying Languages, http://tools.ietf.org/html/bcp47.

[CEA_708] Digital Television (DTV) Closed Captioning, Doc. CEA-708-D.

[CEA_766] U.S. and Canadian Rating Region Tables (RRT) and Content Advisory Descriptors for Transport of Content Advisory Information Using ATSC Program and System Information Protocol (PSIP), Doc. ANSI/CEA-766-C.

[EISS] OpenCable™ Enhanced TV Application Messaging Protocol 1.0, OC-SP-ETV-AM1.0.1-120614, June 14, 2012, Cable Television Labs, Inc.

[H.222.0] ISO/IEC 13818-1|ITU-T H.222.0 5/2006, Infrastructure of audiovisual services – Transmission multiplexing and synchronization, http://www.itu.int/rec/T-REC-h.222.0/en.

[HTML5] HTML5 - A vocabulary and associated APIs for HTML and XHTML, http://www.w3.org/TR/html5/.

[RFC 3555] IETF RFC 3555, MIME Type Registration of RTP Payload Formats, http://tools.ietf.org/html/rfc3555.

[SCTE_27] ANSI/SCTE 27 2011, Subtitling Methods for Broadcast Cable.

[SCTE_35] ANSI/SCTE 35 2012, Digital Program Insertion Cueing Message for Cable.

[SCTE_54] ANSI/SCTE 54 2006, Digital Video Service Multiplex and Transport System Standard for Cable.

2.2 Informative References

This specification does not contain informative references.

3 TERMS AND DEFINITIONS

This specification uses the following terms:

Descriptor	Structure, used to extend the definitions of programs and streams, consisting of an 8-bit tag followed by an 8-bit descriptor length and data fields.
Elementary Stream	A generic term for a coded video, audio, or other data stream carried in a sequence of PES packets with the same stream id.
Media Resource Timeline	Maps times (in seconds) to positions in the media resource. The origin of a timeline is its earliest defined position. The duration of a timeline is its last defined position. Identical to the media timeline defined in [HTML5].
Packet Identifier	A number that uniquely identifies an elementary stream in a program.
Packetized Elementary Stream	An elementary stream encoded in sequence of PES packets where each packet consists of a header followed by a number of contiguous bytes from the elementary stream.
Program Map Table	Specifies the PID stream type, PID, and optional stream descriptors that identify the elementary streams that form each program.
Program Stream	A generic term for an elementary stream that is part of a program.
User Agent	The function that conforms to the HTML specification as defined in [HTML5]. A Web browser is a common example of a user agent.

4 ABBREVIATIONS AND ACRONYMS

This specification uses the following abbreviations:

DASH	Dynamic adaptive streaming over HTTP
HTML	Hypertext markup language
MPEG-2 TS	MPEG-2 transport stream
PES	Packetized elementary stream
PID	Packer identifier
PMT	Program map table
UA	user agent

5 REQUIREMENTS

This specification defines the requirements for an HTML5 user agent (UA) to recognize and make available to Web content all elementary streams in an MPEG-2 TS media resource so that the following set of TV Services can be provided:

Closed Captioning	Textual representation of the media resource audio dialogue intended for the hearing impaired.
Subtitles	Alternate language textual representation of the media resource audio dialogue.
Content Advisories	Content rating information used by parental control applications.
Synchronized Content	Signaling messages to control the execution of a client application in a manner synchronized with the media resource playback.
Client ad insertion	Signaling messages that convey advertisement insertion opportunities to a client application.
Audio translations	Alternate language representation of the primary audio track.
Audio descriptions	Audio descriptions of the video intended for the visually impaired.

The requirements in this specification only apply to single program MPEG-2 transport streams; multi-program MPEG-2 transport streams are out of scope for this specification.

The following sub-sections define requirements for how the UA is required to recognize MPEG-2 TS video, audio, and other data tracks, and how the HTML5 elements representing those tracks are to be created.

HTML5 VideoTrack, AudioTrack and TextTrack elements have additional attributes, beyond those referenced in this specification that SHOULD be set by the UA, consistent with user preferences.

If a user seeks backward (in time) in a media resource and resumes playback, the UA replays tracks it has previously played. In this case, the UA MUST NOT create duplicate TextTrackCues for TextTracks in the media resource. This requirement is because TextTrackCues are not deleted from TextTracks and will still exist in the TextTrack that is being replayed. Creation of new TextTrackCues when the TextTrack is replayed will result in duplicate TextTrackCues. How the UA accomplishes this is implementation-specific.

5.1 Video, Audio and Text Track Creation

HTML5 VideoTracks, AudioTracks, and TextTracks MUST be created by the UA as defined in [HTML5].

5.1.1 Program Description TextTrack

Different types of video, audio, and text elementary streams will be present in a MPEG-2 TS media resource, depending on geographical region, or service or content provider. In order that UA implementations are independent of region and provider, UAs MUST make program map table (PMT) metadata in the MPEG-2 TS [H.222.0] media resource available so that a Web page script can be used to interpret elementary stream types not recognized by the UA.

The UA MUST create a TextTrack in the media resource TextTrack List and set the TextTrack attributes using the following rules:

1) kind = "metadata"
2) id = "video/mp2t track-description", i.e., the string concatenation of the MPEG-2 TS MIME type [RFC 3555] and " track-description"
3) language = "" (empty string)
4) mode = TextTrack DISABLED

For each PMT received in the program stream by the UA, the UA MUST create a DataCue only in the case where the PMT differs from the PMT represented by the previously created DataCue. This is in recognition of the fact that the PMT is received at a minimum rate of every 140 msec but rarely changes.

For each new PMT, a UA MUST create a new DataCue in the text track as described in [HTML5] section "Text track model" with attributes set as follows:

1) startTime is set to the current time in the media resource timeline
2) endTime = startTime
3) data is set to the PMT data in its unparsed binary form
4) text is set to null
5) pauseOnExit=false

5.1.2 VideoTrack

For all MPEG-2 video stream types that the UA can render, the UA MUST create a new VideoTrack in the VideoTrackList of the media resource.

The UA MUST create VideoTracks in the VideoTrackList in the same order as they appear in the PMT. This is to comply with VideoTrackList creation requirements in [HTML5].

The UA MUST set the VideoTrack id attribute to the string representation of the PID in the PMT, interpreted as a decimal number, of the elementary stream represented by this track.

The UA MUST set VideoTrackList[0]. VideoTrack.kind = "main".

If the UA cannot determine the values for the VideoTrack kind and language attributes [HTML5], it MUST set them to the empty string.

5.1.3 AudioTrack

For all MPEG-2 audio stream types that the UA can render, the UA MUST create a new AudioTrack in the AudioTrackList of the media resource.

The UA MUST create AudioTracks in the AudioTrackList in the same order as they appear in the PMT. This is to comply with AudioTrackList creation requirements in [HTML5].

For each AudioTrack created, the UA MUST set the id attribute to the string representation of the PID in the PMT, interpreted as a decimal number, of the elementary stream represented by this track.

The UA MUST set AudioTrackList[0].AudioTrack.kind = "main".

If the AudioTrack contains an associated service for the visually impaired [ATSC_53] the UA SHOULD set AudioTrack.kind = “main-desc” and AudioTrack.language to the BCP47 formatted[BCP 47] value of the ISO_639 language descriptor[H.222.0].

For AudioTracks that are not at AudioTrackList[0] and are a main audio service [ATSC_53], the UA SHOULD set AudioTrack.kind = “translation” and AudioTrack.language to the BCP47 formatted [BCP 47] value of the ISO_639 language descriptor[H.222.0].

If the UA cannot determine values for the AudioTrack kind and language attributes [HTML5], it MUST set them to the empty string.

5.1.4 Other TextTracks

For stream types 0x05 and 0x80 – 0xFF [H.222.0], the UA MUST create a new TextTrack in the TextTrackList of the media resource.

The UA MUST create TextTracks in the TextTrackList in the same order as they appear in the PMT. This is to comply with TextTrackList creation requirements in [HTML5].

The UA MUST set the TextTrack kind and language attributes for the elementary stream as defined in Table 1.

Table 1 - Text Track Kind

Stream Description	Kind	language
Content advisory descriptor [SCTE_54]	metadata	''
Region rating table [CEA_766]	metadata	''
Enhanced TV messaging [EISS]	metadata	''
Program insertion Cue messages [SCTE_35]	metadata	''
Subtitles [SCTE_27] rendered by the UA	subtitle	BCP47 [BCP 47] formatted contents of the ISO 639 Language Descriptor [H.222.0]
Subtitles [SCTE_27] not rendered by the UA	metadata	''
Any other private user elementary streams (stream_type == 0x05, 0x80 – 0xFF) containing private sections (payload_unit_start_indicator == 1) [H.222.0]	metadata	''

The UA MUST set the TextTrack id and mode attributes as follows:

1. id = the string representation of the PID in the PMT interpreted as a decimal number of the elementary stream represented by this track.
2. mode = TextTrack DISABLED

The MPEG-2 TS packets with the PID corresponding to the TextTrack contain private data packets as defined in [H.222.0]. The UA MUST create a cue containing one or more complete private data packets in the elementary stream. A cue must be created within at most 100 milli-seconds of the detection of the first private data packet in the elementary stream.

For each private data packet in the elementary stream represented by the TextTrack, the UA MUST create a cue in the TextTrack as described in [HTML5] section "Text track model." The type of cue depends on the value of the kind attribute. For kind == metadata the UA MUST create a DataCue.

The UA MUST set the following attributes for all DataCues:

1. startTime is set to the current time in the media resource timeline.
2. endTime is set to startTime.
3. pauseOnExit is set to false.
4. data is set to the contents of the unparsed private data packet.
5. text is set to null.

It is important to note that the semantics of metadata TextTrack and TextTrackCue are opaque to the UA. So, for example, if the UA does not recognize a subtitle track but creates a generic metadata text track as defined above, the UA behavior defined in [HTML5] for subtitle tracks will not occur since the UA is not aware this is a subtitle track. It is up to a Web page script to identify the subtitle track and process the subtitle messages in the TextTrackCues in a manner appropriate for the subtitle format

5.2 Closed Captioning

Video elementary streams contain closed captioning data as indicated by a caption_service_descriptor [ATSC_53], [SCTE_54], or closed-caption type (cc_type) in the User Data [CEA_708]. For all MPEG-2 video stream types that the UA can render, closed captioning, if present, MUST be made available by the UA as follows:

1. Create a new TextTrack as defined in [HTML5] section "Sourcing in-band text tracks" with the track element attributes set as follows:
   a. kind="caption"
   b. language is set to a [BCP 47]-conformant representation of the caption data language
   c. id is set to a text string of the decimal representation of the PID of the MPEG-2 video program stream containing the caption data
   d. mode = TextTrack DISABLED

5.3 Subtitles

[SCTE_27] subtitles may be made available by the UA as follows:

1. Create a new TextTrack as defined in [HTML5] section “Sourcing in-band text tracks” with the track element attributes set as follows:
   a. kind=”subtitle”
   b. language is set to a [BCP 47]-conformant representation of the caption data language
   c. id is set to a text string of the decimal representation of the PID of the MPEG-2 video program stream containing the caption data
   d. mode = TextTrack DISABLED

Appendix I Revision History (Informative)

I.1 Engineering Changes for CL-SP-HTML5-MAP-I02-120510

The following Engineering Changes were incorporated into CL-SP-HTML5-MAP-I02-120510:

ECN	ECN Date	Summary
HTML5-MAP-N-12.0108-1	03/16/12	Clarification and editorial changes

I.2 Engineering Changes for CL-SP-HTML5-MAP-I03-140207

The following Engineering Changes were incorporated into CL-SP-HTML5-MAP-I03-140207:

ECN	ECN Date	Summary
HTML5-MAP-N-14.0117-3	02/06/14	Closed Captioning clarifications