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Digital Program Insertion Cueing Message for Cable

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Digital Program Insertion Cueing Message for Cable

1 Scope

This standard supports the splicing of MPEG-2 streams for the purpose of Digital Program Insertion, which includes advertisement insertion and insertion of other content types. An in-stream messaging mechanism is defined to signal splicing and insertion opportunities and it is not intended to ensure seamless splicing. As such, this recommendation does not specify the splicing method used or constraints applied to the streams being spliced, nor does it address constraints placed on splicing devices. This standard also supports accurate signaling of events in the stream.

A fully compliant MPEG-2 transport stream (either Multi Program Transport Stream or Single Program Transport Stream) is assumed. No further constraints beyond the inclusion of the defined cueing messages are placed upon the stream.

This standard specifies a technique for carrying notification of upcoming Splice Points and other timing information in the transport stream. A splice information table is defined for notifying downstream devices of splice events, such as a network break or return from a network break. The splice information table, which pertains to a given program, is carried in one or more PID(s) referred to by that program's Program Map Table (PMT). In this way, splice event notification can pass through most transport stream remultiplexers without need for special processing.

2 References

2.1 Normative references

The following standards contain provisions that, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ISO 15706:2002 – Information and Documentation - International Standard Audiovisual Number (ISAN)

ISO 15706-2:200x (In Process) – Information and Documentation - International Standard Audiovisual Number (V-ISAN)

ITU-T Recommendation H.222.0 / ISO/IEC 13818-1 (2000), Information Technology ---- Generic Coding of Moving Pictures and Associated Audio Information: Systems

MD-SP-ADI2.0-AS-I03-070105 – Metadata Specifications - ADI 2.0 Specification Asset Structure

SMPTE 330M-2004 – SMPTE Standard for Television - Unique Material Identifier

FIPS PUB 46-3, 1999 October 25, Data Encryption Standard

FIPS PUB 81, 1980 December 2, DES Modes of Operation

2.2 Informative References

Advertising Digital Identification, LLC - <http://www.ad-id.org/>

ISAN (International Standard Audiovisual Number) website – <http://www.isan.org>

ITU-T Recommendation H.262 / ISO/IEC 13818-2 (2000), Information Technology ---- Generic Coding of Moving Pictures and Associated Audio Information: video

ISO/IEC 13818-4: 2004 – Information Technology – Generic coding of moving pictures and associated audio information – Part 4: Conformance testing

SCTE 30 2006 – Digital Program Insertion Splicing API

SCTE 67 2006 – Digital Program Insertion Cueing Message for Cable – Interpretation for SCTE 35

SCTE 118-2 2006 – Program-Specific Ad Insertion – Content Provider to Traffic Communication Applications Data Model

SMPTE Registration Authority, LLC – <http://www.smp-te-ra.org/>

SMPTE 312M – 2001 - SMPTE STANDARD for Television - Splice Points for MPEG-2 Transport Streams

3 Definition of terms

Throughout this standard the terms below have specific meanings. Because some of the terms that are defined in ISO/IEC 13818 have very specific technical meanings, the reader is referred to the original source for their definition. For terms defined by this standard, brief definitions are given below.

Access Unit: A coded representation of a presentation unit (see ITU-T H.262 / ISO/IEC 13818-1 2.1.1).

Advertisement (also called “ad”): an inducement to buy or patronize. As used in the cable industry, usually with a duration under 2 minutes (sometimes called “short-form” content).

Analog Cue Tone: in an analog system, a signal that is usually either a sequence of DTMF tones or a contact closure that denotes to ad insertion equipment that an advertisement avail is about to begin or end.

Avail: time space provided to cable operators by cable programming services during a program for use by the CATV operator; the time is usually sold to local advertisers or used for channel self promotion.

Break: avail or an actual insertion in progress.

Chapter: a short section of a longer program, usually situated to permit a viewer to easily locate a scene or section of the program.

Component Splice Mode: a mode of the cueing message whereby the `program_splice_flag` is set to '0' and indicates that each PID/component that is intended to be spliced will be listed separately by the syntax that follows. Components not listed in the message are not to be spliced.

Content: Generic term for television material, either advertisements or programs.

Cueing Message: see message.

Event: a splice event or a viewing event.

In Point: a point in the stream, suitable for entry, that lies on an elementary presentation unit boundary. An In Point is actually between two presentation units rather than being a presentation unit itself.

In Stream Device: A device that receives the transport stream directly and is able to derive timing information directly from the transport stream.

Message: in the context of this document a message is the contents of any `splice_info_section`.

Multi Program Transport Stream: A transport stream with multiple programs.

Out of Stream Device: A device that receives the cue message from an in stream device over a separate connection from the transport stream. An out of stream device does not receive or pass the transport stream directly.

Out Point: a point in the stream, suitable for exit, that lies on an elementary presentation unit boundary. An Out Point is actually between two presentation units rather than being a presentation unit itself.

payload_unit_start_indicator: a bit in the transport packet header that signals, among other things, that a section begins in the payload that follows (see ITU-T H.222.0 / ISO/IEC 13818-1).

PID: Packet identifier; a unique 13-bit value used to identify the type of data stored in the packet payload (see ITU-T H.222.0 / ISO/IEC 13818-1).

PID stream: All the packets with the same PID within a transport stream.

pointer_field: the first byte of a transport packet payload, required when a section begins in that packet (see ITU-T H.222.0 / ISO/IEC 13818-1).

Presentation Time: the time that a presentation unit is presented in the system target decoder (see ITU-T H.222.0 / ISO/IEC 13818-1).

Presentation Unit: A decoded Audio Access Unit or a decoded picture (see ITU-T H.262 / ISO/IEC 13818-1 2.1.40).

Program: A collection of video, audio, and data PID streams that share a common program number within an MPTS (see ITU-T H.222.0 / ISO/IEC 13818-1). As used in the context of the segmentation descriptor, a performance or informative presentation broadcast on television, typically with a duration over 5 minutes (sometimes called “long-form” content).

Program In Point: a group of PID stream In Points that correspond in presentation time.

Program Out Point: a group of PID stream Out Points that correspond in presentation time.

Program Splice Mode: a mode of the cueing message whereby the `program_splice_flag` is set to ‘1’ and indicates that the message refers to a Program Splice Point and that all PIDs/components of the program are to be spliced.

Program Splice Point: a Program In Point or a Program Out Point.

Receiving Device: A device that receives or interprets sections conforming to this standard. Examples of these devices include splicers, ad servers, segmenters and satellite receivers.

Registration Descriptor: carried in the PMT of a program to indicate that, when signaling splice events, `splice_info_sections` shall be carried in a PID stream within this program. The presence of the Registration Descriptor signifies a program’s compliance with this standard.

reserved: The term “reserved”, when used in the clauses defining the coded bit stream, indicates that the value may be used in the future for extensions to the standard. Unless otherwise specified, all reserved bits shall be set to ‘1’ and this field shall be ignored by receiving equipment.

Segment: either a *Program*, a *Chapter*, a *Provider Advertisement*, a *Distributor Advertisement*, or an *Unscheduled Event* as listed in Table 8-7, `segmentation_type_id`.

Single Program Transport Stream: A transport stream containing a single MPEG program.

Splice Event: an opportunity to splice one or more PID streams.

Splice Immediate Mode: a mode of the cueing message whereby the splicing device shall choose the nearest opportunity in the stream, relative to the `splice_info_table`, to splice. When not in this mode, the message gives a “`pts_time`” that, when modified by `pts_adjustment`, gives a presentation time for the intended splicing moment.

Splice Point: a point in a PID stream that is either an Out Point or an In Point.

Viewing Event: a television program or a span of compressed material within a service; as opposed to a splice event, which is a point in time.

4 Abbreviations

This document uses the following abbreviations:

ADI: Asset Distribution Interface

Ad-ID: Advertisement Identifier

ATSC: Advanced Television Systems Committee.

bslbf: Bit string, left bit first, where left is the order in which bit strings are written.

DVB: Digital Video Broadcast

FIPS: Federal Information Processing Standard

ISAN: International Standard Audiovisual Number (see ISO 15706)

ISCI: Industry Standard Commercial Identifier

MPTS: a Multi Program Transport Stream.

PMT: Program Map Table (see ITU-T H.222.0 / ISO/IEC 13818-1).

PTS: Presentation Time Stamp (see ITU-T H.222.0 / ISO/IEC 13818-1).

rpchof: Remainder polynomial coefficients, highest order first.

SPTS: a Single Program Transport Stream.

STC: System Time Clock

TI: Turner Identifier

TID: Tribune Identifier

uimsbf: Unsigned integer, most significant bit first.

UMID: Unique Material Identifier

V-ISAN: Version-ISAN (core ISAN number plus a version number) (see ISO 15706-2)

5 Introduction

5.1 Splice points (Informative)

To enable the splicing of compressed bit streams, this standard defines Splice Points. Splice Points in an MPEG-2 transport stream provide opportunities to switch elementary streams from one source to another. They indicate a place to switch or a place in the bit stream where a switch can be made. Splicing at such splice points may or may not result in good visual and audio quality. That is determined by the performance of the splicing device.

Transport streams are created by multiplexing PID streams. In this standard, two types of Splice Points for PID streams are defined: Out Points and In Points. In Points are places in the bit streams where it is acceptable to enter, from a splicing standpoint. Out Points are places where it is acceptable to exit the bit stream. The grouping of In Points of individual PID streams into Program In Points in order to enable the switching of entire programs (video with audio) is defined. Program Out Points for exiting a program are also defined.

Out Points and In Points are imaginary points in the bit stream located between two elementary stream presentation units. Out Points and In Points are not necessarily transport packet aligned and are not necessarily PES packet aligned. An Out Point and an In Point may be co-located; that is, a single presentation unit boundary may serve as both a safe place to leave a bit stream and a safe place to enter it.

The output of a simple switching operation will contain access unit data from one stream up until its Out Point followed by data from another stream starting with the first access unit following an In Point. More complex splicing operations may exist whereby data prior to an Out Point or data after an In Point are modified by a splicing device. Splicing devices may also insert data between one stream's Out Point and the other stream's In Point. The behavior of splicing devices will not be specified or constrained in any way by this standard.

5.2 Program Splice Points (Informative)

Program In Points and Program Out Points are sets of PID stream In Points or Out Points that correspond in presentation time.

Although Splice Points in a Program Splice Point correspond in presentation time, they do not usually appear near each other in the transport stream. Because compressed video takes much longer to decode than audio, the audio Splice Points may lag the video Splice Points by as much as hundreds of milliseconds and by an amount that can vary during a program.

This standard defines two ways of signaling which splice points within a program are to be spliced. A `program_splice_flag`, when true, denotes that the Program Splice Mode is active and that all PIDs of a program may be spliced (the splice information table PID is an exception; splicing or passage of these messages is beyond the scope of this standard). A `program_splice_flag`, when false, indicates that the Component Splice Mode is active and that the message will specify unambiguously which PIDs are to

be spliced and may give a unique splice time for each. This is required to direct the splicing device to splice or not to splice various unspecified data types as well as video and audio.

While this standard allows for a unique splice time to be given for each component of a program, it is expected that most Component Splice Mode messages will utilize one splice time (a default splice time) for all components as described in section 7. The facility for optionally specifying a separate splice time for each component is intended to be used when one or more components differ significantly in their start or stop time relative to other components within the same message. An example would be a downloaded applet that must arrive at a set-top box several seconds prior to an advertisement.

5.3 Splice events (Informative)

This standard provides a method for in-band signaling of splice events using splice commands to downstream splicing equipment. Signaling a splice event identifies which Splice Point within a stream to use for a splice. A splicing device may choose to act or not act upon a signaled event (a signaled event should be interpreted as an opportunity to splice; not a command). A splice information table carries the notice of splice event opportunities. Each signaled splice event is analogous to an analog cue tone. The splice information table incorporates the functionality of cue tones and extends it to enable the scheduling of splice events in advance.

This standard establishes that the splice information table is carried on a per-program basis in one or more PID stream(s) with a designated stream_type. The program's splice information PID(s) are designated in the program's program map table (PMT). In this way, the splice information table is switched with the program as it goes through remultiplexing operations. A common stream_type identifies all PID streams that carry splice information tables. Remultiplexers or splicers may use this stream_type field to drop splice information prior to sending the transport stream to the end-user device.

The cue injection equipment may send messages at intervals that do not indicate a splice point to be used as heartbeat messages which help insure the proper operation of the system. This could be performed by periodically issuing splice_null() messages or by sending encrypted splice_insert messages generated with a key that is not distributed. Since cues are currently sent twice per hour on a typical network, an average interval of 5 minutes would be a reasonable interval. If a message was not received in a 10 minute interval, a receiving device could alarm an operator to a possible system malfunction (such behavior would be implementer dependent).

5.4 Content Storage Considerations (Informative)

The requirements for identifier uniqueness are written expecting the content to be playing in real time. If the content is stored, then the playback of the content does not place requirements upon the playback equipment to alter any of these identifiers (such as splice_event_id or segmentation_event_id). Downstream equipment parsing the identifiers should keep this in mind and, if applicable, rely upon other confirming information before reacting adversely to a seeming violation of the identifier uniqueness requirements of this standard.

This standard provides optional tools to assist with segmenting content into shorter sections which may be either chapters or advertisements. See Section 8.3.3.

5.5 PID selection

5.5.1 PID Selection (Normative)

Splice Information can be carried in multiple PIDs. The maximum number of PIDs that can carry splice information shall not exceed 8. These PIDs can be either in the clear (where the transport scrambling_control bits are set to '00') or scrambled by a CA system. Each cue message PID may include the cue_identifier_descriptor defined in section 6.2 to describe the splice commands included in the PID. When multiple PIDs are used to carry splice information, the first cue message PID in the Program Map Table shall only contain the splice command types 0x00 (splice_null), 0x04 (splice_schedule) and 0x05 (splice_insert). In addition, the splice_event_id shall be unique in all splice information PIDs within the program.

5.5.2 PID Selection (Informative)

While the use of multiple cue message PIDs is an allowed practice, it should be noted that not all equipment may respond in the same manner to a stream that contains multiple cue message PIDs. Some equipment may limit the number of PIDs that the equipment can pass or receive. If a system utilizes multiple PIDs through various devices with the intention of reaching the set-top, it is suggested that thorough end-end testing be performed.

In many systems, the delivery of PIDs that carry splice information beyond the ad insertion equipment in the head-end is not desired. In these systems, the splicing or multiplexing device will drop any or all of these messages (PIDs) so they will not be delivered to the set-top. In other systems it may selectively pass certain PIDs to the set top to enable set-top functionality. A third possibility is that the splicing or multiplexing device will aggregate the multiple PIDs that carry splice information into a single PID to handle downstream, set-top, issues with multiple PIDs. The action of ignoring or passing the message is recommended to be a user provisioned item, with a suitable default behavior chosen by the implementer.

The default operation if a splicing or multiplexing device receives a PID based on this specification with the scrambling bits set in the header should be to drop that PID and not pass it through to the output. This ideally should be a user provisioned operation, as in some instances this PID may be descrambled by a downstream device.

The delivery of messages outside of the receive location to the customer may be based on business agreements. An example would be that one programmer wants the cue messages passed to set-tops to enable a targeted advertising method while a different programmer insists that the messages be dropped to insure that a commercial killer may not utilize the messages.

When multiple splicing PIDs are identified in the PMT, the splicing device should process all of these PIDs. If the cue_identifier_descriptor is utilized, the splicing or multiplexing device may use that information to be more selective of the PIDs on which it will act.

Some possible reasons for utilizing multiple PIDs for this message include selective delivery of cue messages for different tiers of advertising or for separating cue messages from segmentation messages. While one possible method of handling these issues is to use the encryption methods built in to this