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Information technology — Multimedia application format (MPEG-A) —

Part 9:
Digital Multimedia Broadcasting application format

AMENDMENT 2: Harmonization on MPEG-2 TS storage

Technologies de l'information — Format pour application multimédia (MPEG-A) —

Partie 9: Format pour application de diffusion générale multimédia numérique

AMENDEMENT 2: Harmonisation sur stockage MPEG-2 TS

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AMENDMENT 2: Harmonization on MPEG-2 TS storage

Replace 6.5 with the following:

6.5   Storage and playback of transport stream

6.5.1   Introduction

A simple storage and playback method of MPEG-2 TS is defined by utilizing a subset of MPEG-2 TS Reception Hint Track functionalities defined in the ISO-FF (more specifically, ISO/IEC 14496-12:2008/Amd.1:2009, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format — AMENDMENT 1: General improvements including hint tracks, metadata support, and sample groups*. Thus, if otherwise mentioned in this standard, the restrictions in the ISO-FF shall apply.

6.5.2   File structure and track type definition

An MPEG-2 TS is stored sequentially (i.e., untouched) as a sample data. A sample can be the whole TS to be stored or a segment of it. All the sample boundaries shall be aligned with the TS packet boundaries.

A handler type of 'hint' (hint track) is used for the stored MPEG-2 TS and the matching media information header shall be 'hmhd' (hint media header). The maxPDUsize and avgPDUsize fields in the 'hmhd' of the TS hint track shall take the value of 188 (the TS packet size).

MPEG-2 TS hint tracks can be used in two contexts; one is to guide streaming servers to easily generate a transport stream from the stored MPEG-2 TS and the other is to guide players for local playback or preview of stored (or recorded) MPEG-2 TS. Note that this standard defines the latter one only.

In this standard, an MPEG-2 TS is always stored as 'already-prepared' samples regardless of whether it is from direct reception or from content providers. Thus the MPEG-2 TS hint track defined in this standard does not refer to other media tracks for dynamic composition of MPEG-2 TS from the media data. The track header flags in the tkhd (track header box) would normally be set as follows:

—   track_enabled = 1

—   track_in_movie = 1

—   track_in_preview = 1.

6.5.3 Sample format

In this standard, the MPEG-2 TS sample format defined in the ISO-FF standard is restricted to be some group of complete MPEG-2 TS packets.

In case `stss` (sync sample box) is absent, a sample is defined as a group of TS packets containing independently decodable group of video or audio access units. More specifically, following rules apply;

— If video exist in the TS to be stored, then TS packets corresponding to a GOP (Group of Pictures) are defined as one sample. The `random_access_indicator` inside the adaptation_field() of TS packet can be used to identify the starting TS packet corresponding to a GOP; In this case, a sample starts from a TS packet having `random_access_indicator`=1 and ends just before the firstly encountered another TS packet having `random_access_indicator`=1.

— If video does not exist in the TS to be stored, then TS packets corresponding to an audio frame are defined as one sample.

In case `stss` box exists, then the `entry_count` in the `stss` box shall take the value of 0, which means that the sync sample positions are unknown and a sample is defined as the whole TS packets.

Note that the Player should check the existence of `stss` box to determine which sample definition should be applied.

6.5.4 Sample description format

The MPEG-2 TS sample description format defined in ISO-FF shall apply except the following restrictions.

— `MPEG2TSServerSampleEntry` is not used and only `MPEG2TSReceptionSampleEntry` with code point of 'rm2t' is used for this standard.

— When using `MPEG2TSReceptionSampleEntry`, the following restrictions apply;

    — `precedingbyteslen` = 0

    — `trailingbyteslen` = 0

    — `precomputed_only_flag` = 1

    — Exactly one `PMTBox` and one `TSTimingBox` shall be included in `additionaldata[]`. At most one `ODBox`, `BIFSBox`, and `InitialSampleTimeBox` may be present in `additionaldata[]`. If other box appears in `additionaldata[]`, it may be ignored and discarded.

— The syntax of the `BIFSBox` is defined in this standard as follows:

```
aligned(8) class BIFSBox () extends Box ('tBFS') {
  uint(3)  reserved;
  uint(13) PID;
  uint(8)  sectiondata[];
```

— For the `ODBox` and `BIFSBox`, the following restrictions shall apply;

    — `PID` is the PID of the MPEG-2 TS packets correspond only to the non-dependent OD (BIFS) stream; The non-dependent OD (BIFS) stream is defined as the OD (BIFS) stream whose `streamDependenceFlag` value in the corresponding ES_Descriptor/IOD/PMT is set to 0.

— `sectiondata` contains the concatenated OD (BIFS) AUs (access units) of the non-dependent OD (BIFS) stream, where only the first AU in the starting section is random-accessible. To further specify the start time of each AU, the following syntax shall apply:

```
uint(8) sectiondata[] {
  uint(8) AU_count;
  for (count=1; count<=AU_count; count++) {
    uint(32) start_time;
    uint(32) AU_length;
    uint(8)  AU[];
  }
}
```
`start_time = ` *UINT32(MSB32(PCR_base_AU))*, where *PCR_base_AU* stands for the `'program_clock_reference_base'` value corresponding to the STC value of the first TS packet of the AU.

— The random-accessibility of an OD (BIFS) AU can be identified by checking if the first TS packet corresponding to the AU has `random_access_indicator=1`. Note that for supporting random access to audio and video samples, the non-dependent random-accessible OD (BIFS) AUs before and nearest to the starting sample is necessary to be stored.

— In the `TSTimingBox`, the following restriction applies;

— `timing_derivation_method` = 0x1

— `PID` value is ignored for this standard.

— In the `InitialSampleTimeBox`, the following relation between `initialsampletime` and PCR shall apply;

— `initialsampletime` = *MSB32(PCR_base(1))*, where *PCR_base*(n) stands for the `'program_clock_reference_base'` value corresponding to the first TS packet in the nth sample and *MSB32*(x) stands for 'most significant 32-bit' of x.

— In case `stss` box is absent, `InitialSampleTimeBox` shall be present for sample time derivation. Otherwise, `InitialSampleTimeBox` may not be present and can be ignored and discarded if present.

— In case `stss` box is absent, the PCR (Program Clock Reference) value for each sample is stored in the `'stts'` box with the following conversion rule;

— *DT*(n) = *UINT32(MSB32(PCR_base(n))* – `initialsampletime`), where *DT*(n) stands for 'decoding time' for the nth sample and *UINT32*(x) stands for '32-bit unsigned integer interpretation' of x. Note that, due to the wrap-around (i.e., %2^{33}), *PCR_base*(n) can be less than *PCR_base*(n+m) for m>0. To handle this, *DT*(n) shall always be interpreted as non-negative integer value whether the subtraction result is positive or not.

— To randomly access and playback an `'rm2t'` sample, the PCR value corresponding to the first TS packet in the sample should be reconstructed to initialize the STC (System Time Clock) of the player. The reconstruction procedure is as follows: *PCR*(n) = (*PCR_base*(n) «9) + *PCR_ext*(n) ≈ (*DT*(n) + `initialsampletime`) «10, where '«x' denotes x-bit left shift operation and '≈' denotes approximation.

— The time scale field in `'mdhd'` shall take the value equal to 45,000, which is a half of the time scale of `program_clock_reference_base`.

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