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Information technology — Generic coding of moving pictures and associated audio information: Systems

AMENDMENT 3: Transport of scalable video over Rec. ITU-T H.222.0 | ISO/IEC 13818-1

Technologies de l'information — Codage générique des images animées et du son associé: Systèmes

AMENDEMENT 3: Transport de vidéos extensibles sur Rec. UIT-T H.222.0 | ISO/CEI 13818-1

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Foreword

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Amendment 3 to ISO/IEC 13818-1:2007 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information,* in collaboration with ITU-T. The identical text is published as ITU-T Rec. H.222.0 (2006)/Amd.3 (03/2009).

This corrected version modifies the title of the amendment to align with that of ITU-T Rec. H.222.0 (2006)/Amd.3 (03/2009).

INTERNATIONAL STANDARD
RECOMMENDATION ITU-T

Information technology – Generic coding of moving pictures and associated audio information: Systems

Amendment 3

Transport of scalable video over Rec. ITU-T H.222.0 | ISO/IEC 13818-1

1) Subclause 1.2.2

Replace in subclause 1.2.2:

ITU-T Recommendation H.264 (2005), *Advanced video coding for generic audiovisual services.*

ISO/IEC 14496-10:2005, *Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding*.

by:

ITU-T Recommendation H.264 (2007), *Advanced video coding for generic audiovisual services.*

ISO/IEC 14496-10:2008, *Information technology – Coding of audio-visual objects – Part 10: Advanced video coding*.

2) Subclause 2.1 *(Definitions)*

a) Replace subclause 2.1.7:

2.1.7 AVC video stream (system): An ITU-T Rec. H.264 | ISO/IEC 14496-10 stream. An AVC video stream consists of one or more AVC video sequences.

by:

2.1.7 AVC video stream (system): An ITU-T Rec. H.264 | ISO/IEC 14496-10 stream. An AVC video stream consists of one or more AVC video sequences. An AVC video stream may also result from re-assembling video sub-bitstreams.

b) Add after subclause 2.1.76 (New subclauses 2.1.77 – 2.1.81):

2.1.77 video sub-bitstream: A video sub-bitstream is defined to be all VCL NAL units associated with the same value of dependency_id of an AVC video stream which conforms to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10 and all associated non-VCL NAL units in decoding order as defined in ITU-T Rec. H.264 | ISO/IEC 14496-10. Re-assembling video sub-bitstreams in a consecutive order of dependency_id, starting from the dependency_id equal to 0 up to any value of dependency_id, results in an AVC video stream. A video sub-bitstream shall have the AVC byte stream format as defined in Annex B of ITU-T Rec. H.264 | ISO/IEC 14496-10.

2.1.78 AVC video sub-bitstream: The video sub-bitstream that contains the base layer as defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10 and that shall additionally contain NAL units with nal_unit_type equal to 14 (prefix NAL units). The AVC video sub-bitstream contains all VCL NAL units associated with dependency_id equal to 0.

2.1.79 SVC video sub-bitstream: The video sub-bitstream that contains VCL NAL units with nal_unit_type equal to 20 with the same NAL unit header syntax element dependency_id not equal to 0.

2.1.80 SVC dependency representation: The VCL NAL units of an AVC access unit associated with the same value of dependency_id which is provided as part of the NAL unit header or the associated prefix NAL unit header, and the associated non-VCL NAL units. Re-assembling SVC dependency representations in a consecutive order of dependency_id starting from the lowest value of dependency_id present in the access unit up to any value of dependency_id present in the access unit, while reordering the non-VCL NAL units conforming to the order of NAL units within an access unit as defined in ITU-T Rec. H.264 | ISO/IEC 14496-10, results in an AVC access unit.

2.1.81 SVC slice (system): A byte_stream_nal_unit as defined in ITU-T Rec. H.264 | ISO/IEC 14496-10 with nal_unit_type equal to 20.

3) Subclause 2.4.2.8 *(T-STD extensions for carriage of ITU-T Rec. H.264 | ISO/IEC 14496-10 Video)*

Replace in subclause 2.4.2.8:

To define the decoding in the T-STD of ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams carried in a Transport Stream, the T-STD model needs to be extended. The T-STD extension and T-STD parameters for decoding of ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams are defined in 2.14.3.1.

by:

To define the decoding in the T-STD of ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams carried in a Transport Stream, the T-STD model needs to be extended. The T-STD extension and T-STD parameters for decoding of AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 are defined in 2.14.3.1 and T-STD extension and T-STD parameters for decoding of AVC video streams conforming to one ore more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10 are defined in 2.14.3.5.

4) Subclause 2.4.3.5 *(Semantic definition of fields in adaptation field)*

Replace in Discontinuity_indicator:

For the purpose of this clause, an elementary stream access point is defined as follows:

- ISO/IEC 11172-2 video and ITU-T Rec. H.262 | ISO/IEC 13818-2 video – The first byte of a video sequence header.
- ISO/IEC 14496-2 visual – The first byte of the visual object sequence header.
- ITU-T Rec. H.264 | ISO/IEC 14496-10 video – The first byte of an AVC access unit. The SPS and PPS parameter sets referenced in this and all subsequent AVC access units in the coded video stream shall be provided after this access point in the byte stream and prior to their activation.
- Audio – The first byte of an audio frame.
- ISO/IEC 14496-17 text stream – The first byte of a text access unit. In case in-band sample descriptions are used, each in-band sample description shall be provided in the ISO/IEC 14496-17 stream after this access point and prior to its use by an access unit.

by:

For the purpose of this clause, an elementary stream access point is defined as follows:

- ISO/IEC 11172-2 video and ITU-T Rec. H.262 | ISO/IEC 13818-2 video – The first byte of a video sequence header.
- ISO/IEC 14496-2 visual – The first byte of the visual object sequence header.
- AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 – The first byte of an AVC access unit. The SPS and PPS parameter sets referenced in this and all subsequent AVC access units in the coded video stream shall be provided after this access point in the byte stream and prior to their activation.
- Video sub-bitstreams of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10 – The first byte of an SVC dependency representation is an elementary stream access point if the following conditions are met:
  - The subset sequence parameter sets and picture parameter sets referenced in this and all subsequent SVC dependency representation in the video sub-bitstream shall be provided after this access point in the byte stream and prior to their activation.
  - If this SVC video sub-bitstream access point requires the elementary stream access point of the same AVC access unit, if any, contained in the corresponding elementary stream that needs to be present in decoding order before decoding the elementary stream associated with this elementary stream access point, then the corresponding elementary stream shall also include an elementary stream access point.

    NOTE 1 – If the hierarchy descriptor is present for this SVC video sub-bitstream then the video sub-bitstream of which the hierarchy_layer_index equals the hierarchy_embedded_layer_index of this SVC sub-bitstream should have an elementary stream access point in the same access unit.
- Audio – The first byte of an audio frame.

- ISO/IEC 14496-17 text stream – The first byte of a text access unit. In case in-band sample descriptions are used, each in-band sample description shall be provided in the ISO/IEC 14496-17 stream after this access point and prior to its use by an access unit.

5) Subclauses 2.4.3.6 *(PES packet)* and 2.4.3.7 *(Semantic definition of fields in PES packet)*

a) TREF

Change Table 2-21 as indicated below:

--- Unchanged initial part of Table 2-21 ---		
---		
if (PES_extension_flag_2 == '1') {		
marker_bit	**1**	**bslbf**
PES_extension_field_length	**7**	**uimsbf**
stream_id_extension_flag	**1**	**bslbf**
if (stream_id_extension_flag == '0') {		
stream_id_extension	**7**	**uimsbf**
}		
else {		
reserved	**6**	**bslbf**
tref_extension_flag	**1**	**bslbf**
if (tref_extension_flag == '0') {		
reserved	**4**	**bslbf**
TREF[32..30]	**3**	**bslbf**
marker_bit	**1**	**bslbf**
TREF[29..15]	**15**	**bslbf**
marker_bit	**1**	**bslbf**
TREF[14..0]	**15**	**bslbf**
marker_bit	**1**	**bslbf**
}		
}		
for (i = 0; i < N3; i++) {		
reserved	**8**	**bslbf**
}		
}		

--- Unchanged trailing part of Table 2-21 ---		
---		

b) stream_id

Replace in subclause 2.4.3.7:

stream_id – In Program Streams, the stream_id specifies the type and number of the elementary stream as defined by the stream_id Table 2-22. In Transport Streams, the stream_id may be set to any valid value which correctly describes the elementary stream type as defined in Table 2-22. In Transport Streams, the elementary stream type is specified in the Program Specific Information as specified in 2.4.4.

by:

stream_id – In Program Streams, the stream_id specifies the type and number of the elementary stream as defined by the stream_id Table 2-22. In Transport Streams, the stream_id may be set to any valid value which correctly describes the elementary stream type as defined in Table 2-22. In Transport Streams, the elementary stream type is specified in the Program Specific Information as specified in 2.4.4.

For AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10, all video sub-bitstreams of the same AVC video stream shall have the same stream_id value.

c) PTS (presentation time stamp)

Replace in subclause 2.4.3.7:

For ITU-T Rec. H.264 | ISO/IEC 14496-10 video, if a PTS is present in the PES packet header, it shall refer to the first AVC access unit that commences in this PES packet. An AVC access unit commences in a PES packet if the first byte of the AVC access unit is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each decoded AVC access unit, the PTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal DPB output time in the HRD, defined herein as $t_{o,n,dpb}(n) = t_{r,n}(n) + t_c * dpb\_output\_delay(n)$, where $t_{r,n}(n)$, t_c, and dpb_output_delay(n) are defined as in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

by:

For AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10, if a PTS is present in the PES packet header, it shall refer to the first AVC access unit that commences in this PES packet. An AVC access unit commences in a PES packet if the first byte of the AVC access unit is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each decoded AVC access unit, the PTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal DPB output time in the HRD, defined herein as $t_{o,n,dpb}(n) = t_{r,n}(n) + t_c * dpb\_output\_delay(n)$, where $t_{r,n}(n)$, t_c, and dpb_output_delay(n) are defined as in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

For video sub-bitstreams of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10, if a PTS is present in the PES packet header, it shall refer to the first SVC dependency representation that commences in this PES packet. An SVC dependency representation commences in a PES packet if the first byte of the SVC dependency representation is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each re-assembled and decoded AVC access unit, the PTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal DPB output time in the HRD, defined herein as $t_{o,n,dpb}(n) = t_{r,n}(n) + t_c *$ dpb_output_delay(n), where $t_{r,n}(n)$, t_c, and dpb_output_delay(n) are defined as in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

d) DTS (decoding time stamp)

Replace in subclause 2.4.3.7:

For ITU-T Rec. H.264 | ISO/IEC 14496-10 video, if a DTS is present in the PES packet header, it shall refer to the first AVC access unit that commences in this PES packet. An AVC access unit commences in a PES packet if the first byte of the AVC access unit is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each AVC access unit the DTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal CPB removal time $t_{r,n}(n)$ in the HRD, as defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

by:

For AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10, if a DTS is present in the PES packet header, it shall refer to the first AVC access unit that commences in this PES packet. An AVC access unit commences in a PES packet if the first byte of the AVC access unit is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each AVC access unit the DTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal CPB removal time $t_{r,n}(n)$ in the HRD, as defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

For video sub-bitstreams of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10, if a DTS is present in the PES packet header, it shall refer to the first SVC dependency representation that commences in this PES packet. An SVC dependency representation commences in a PES packet if the first byte of the SVC dependency representation is present in the PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10, for each re-assembled AVC access unit the DTS value in the STD shall, within the accuracy of their respective clocks, indicate the same instant in time as the nominal CPB removal time $t_{r,n}(n)$ in the HRD, as defined in Annex C of ITU-T Rec. H.264 | ISO/IEC 14496-10.

e) P-STD_buffer_size

Replace in subclause 2.4.3.7:

The size BS_n shall be larger than or equal to the size of the CPB signalled by the CpbSize[cpb_cnt_minus1] specified by the NAL hrd_parameters() in the AVC video stream. If the NAL hrd_parameters() are not present in the AVC video stream, then BS_n shall be larger than or equal to the size of the NAL CPB for the byte stream format defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 as 1200 × MaxCPB for the applied level.

by:

For AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10, the size BS_n shall be larger than or equal to the size of the CPB signalled by the CpbSize[cpb_cnt_minus1] specified by the NAL hrd_parameters() in the AVC video stream. If the NAL hrd_parameters() are not present in the AVC video stream, then BS_n shall be larger than or equal to the size of the NAL CPB for the byte stream format defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 as 1200 × MaxCPB for the applied level.

For video sub-bitstreams of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10, the size BS_n shall be larger than or equal to the size of the CPB signalled by the CpbSize[cpb_cnt_minus1] specified by the NAL hrd_parameters() for the video sub-bitstream carried in elementary stream ES_n as defined in 2.14.3.6. If the NAL hrd_parameters() are not present in the video sub-bitstream, the size BS_n shall be larger than or equal to the size of the NAL CPB for the byte stream format defined in ITU-T Rec. H.264 | ISO/IEC 14496-10 as 1200 × MaxCPB for the applied level for the elementary stream ES_n.

f) TREF semantics

Add in subclause 2.4.3.7:

tref_extension_flag – A 1-bit flag, which when set to '0' indicates that a TREF field is present in the PES packet header. The value of '1' for this flag is reserved.

TREF (timestamp reference) – The TREF is a 33-bit number coded in three separate fields. It indicates the decoding time value, $td_n(j)$, in the system target decoder as indicated by the DTS, or in absence of the DTS, by the PTS of the PES header of the same j-th access unit in a corresponding elementary stream n.

6) Subclause 2.4.4.9 *(Semantic definition of fields in Transport Stream program map section)*

Replace Table 2-34 by:

Table 2-34 – Stream type assignments

Value	Description
0x00	ITU-T | ISO/IEC Reserved
0x01	ISO/IEC 11172-2 Video
0x02	ITU-T Rec. H.262 | ISO/IEC 13818-2 Video or ISO/IEC 11172-2 constrained parameter video stream
0x03	ISO/IEC 11172-3 Audio
0x04	ISO/IEC 13818-3 Audio
0x05	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 private_sections
0x06	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 PES packets containing private data
0x07	ISO/IEC 13522 MHEG
0x08	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 Annex A DSM-CC
0x09	ITU-T Rec. H.222.1
0x0A	ISO/IEC 13818-6 type A
0x0B	ISO/IEC 13818-6 type B
0x0C	ISO/IEC 13818-6 type C
0x0D	ISO/IEC 13818-6 type D
0x0E	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 auxiliary
0x0F	ISO/IEC 13818-7 Audio with ADTS transport syntax
0x10	ISO/IEC 14496-2 Visual
0x11	ISO/IEC 14496-3 Audio with the LATM transport syntax as defined in ISO/IEC 14496-3
0x12	ISO/IEC 14496-1 SL-packetized stream or FlexMux stream carried in PES packets

Table 2-34 – Stream type assignments

Value	Description
0x13	ISO/IEC 14496-1 SL-packetized stream or FlexMux stream carried in ISO/IEC 14496_sections
0x14	ISO/IEC 13818-6 Synchronized Download Protocol
0x15	Metadata carried in PES packets
0x16	Metadata carried in metadata_sections
0x17	Metadata carried in ISO/IEC 13818-6 Data Carousel
0x18	Metadata carried in ISO/IEC 13818-6 Object Carousel
0x19	Metadata carried in ISO/IEC 13818-6 Synchronized Download Protocol
0x1A	IPMP stream (defined in ISO/IEC 13818-11, MPEG-2 IPMP)
0x1B	AVC video stream conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 or AVC video sub-bitstream as defined in 2.1.78
0x1C	ISO/IEC 14496-3 Audio, without using any additional transport syntax, such as DST, ALS and SLS
0x1D	ISO/IEC 14496-17 Text
0x1E	Auxiliary video stream as defined in ISO/IEC 23002-3
0x1F	SVC video sub-bitstream of an AVC video stream conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10
0x20-0x7E	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 Reserved
0x7F	IPMP stream
0x80-0xFF	User Private

7) Subclause 2.5.2.7 *(P-STD extensions for carriage of ITU-T Rec. H.264 | ISO/IEC 14496-10 Video)*

Replace in subclause 2.5.2.7:

For decoding of ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams carried in a Program Stream in the P-STD model, see 2.14.3.2.

by:

For decoding of AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10 carried in a Program Stream in the P-STD model, see 2.14.3.2 and for decoding of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10 carried in a Program Stream in the P-STD model, see 2.14.3.6

8) Subclause 2.5.3.6 *(Semantic definition of fields in system header)*

Replace in subclause 2.5.3.6, in the semantic definition of the field **system_video_lock_flag***:*

For ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams, the frequency of the AVC time base is defined by the AVC parameter time_scale. If the system_video_lock_flag is set to '1' for an AVC video stream, then the frequency of the AVC time base shall be locked to the STC and shall be exactly equal to N times system_clock_frequency divided by K, with N and K integers that have a fixed value within each AVC video sequence, with K greater than or equal to N.

by:

For ITU-T Rec. H.264 | ISO/IEC 14496-10 video streams, the frequency of the AVC time base is defined by the AVC parameter time_scale. If the system_video_lock_flag is set to '1' for an AVC video stream or for a video sub-bitstream, then the frequency of the AVC time base shall be locked to the STC and shall be exactly equal to N times system_clock_frequency divided by K, with N and K integers that have a fixed value within each AVC video sequence, with K greater than or equal to N.

9) Subclause 2.5.5 (Program Stream directory)

Replace in subclause 2.5.5:

Directory entries may be required to reference IDR picture or pictures associated with a recovery point SEI message in an AVC video stream. Each such directory entry shall refer to the first byte of an AVC access unit.

by:

For AVC video streams conforming to one or more profiles defined in Annex A of ITU-T Rec. H.264 | ISO/IEC 14496-10, directory entries may be required to reference IDR picture or pictures associated with a recovery point SEI message in an AVC video stream. Each such directory entry shall refer to the first byte of an AVC access unit.

For video sub-bitstreams of AVC video streams conforming to one or more profiles defined in Annex G of ITU-T Rec. H.264 | ISO/IEC 14496-10, directory entries may be required to reference IDR picture or pictures to be re-assembled from video sub-bitstreams and associated with a recovery point SEI message present in a video sub-bitstream. Each such directory entry shall refer to the first byte of an SVC dependency representation.

10) Subclause 2.6.1 *(Semantic definition of fields in program and program element descriptors)*

Replace Table 2-45 by:

Table 2-45 – Program and program element descriptors

descriptor_tag	TS	PS	Identification
0	n/a	n/a	Reserved
1	n/a	X	Forbidden
2	X	X	video_stream_descriptor
3	X	X	audio_stream_descriptor
4	X	X	hierarchy_descriptor
5	X	X	registration_descriptor
6	X	X	data_stream_alignment_descriptor
7	X	X	target_background_grid_descriptor
8	X	X	video_window_descriptor
9	X	X	CA_descriptor
10	X	X	ISO_639_language_descriptor
11	X	X	system_clock_descriptor
12	X	X	multiplex_buffer_utilization_descriptor
13	X	X	copyright_descriptor
14	X		maximum_bitrate_descriptor
15	X	X	private_data_indicator_descriptor
16	X	X	smoothing_buffer_descriptor
17	X		STD_descriptor
18	X	X	IBP_descriptor
19-26	X		Defined in ISO/IEC 13818-6
27	X	X	MPEG-4_video_descriptor
28	X	X	MPEG-4_audio_descriptor
29	X	X	IOD_descriptor
30	X		SL_descriptor
31	X	X	FMC_descriptor
32	X	X	external_ES_ID_descriptor
33	X	X	MuxCode_descriptor
34	X	X	FmxBufferSize_descriptor
35	X		multiplexBuffer_descriptor
36	X	X	content_labeling_descriptor