INTERNATIONAL STANDARD

ISO/IEC 13818-1

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

Part 1:
Systems

iTeh STANDARD PREVIEW AMENDMENT 3: Transport of HEVC video over MPEG-2 systems
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Technologies de l'information — Codage générique des images animées et du son associé —

Partie 1:
Systèmes

AMENDEMENT 3: Transport de vidéo HEVC sur les systèmes MPEG-2

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INTERNATIONAL STANDARD
RECOMMENDATION ITU-T

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

Amendment 3

Transport of HEVC video over MPEG-2 systems

1) Clause 1.2.2

Add the following references:

– Recommendation ITU-T H.265 (2013), *High efficiency video coding.*

ISO/IEC 23008-2:2013, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding.*

2) Clauses 2.1.95 to 2.1.109

Add the following definitions after clause 2.1.94:

2.1.95   HEVC video stream: A byte stream as specified in Rec. ITU-T H. 265 | ISO/IEC 23008-2 Annex B.

2.1.96   HEVC access unit: An access unit as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 with the constraints specified in 2.17.1.

2.1.97   HEVC 24-hour picture (system): An *HEVC access unit* with a presentation time that is more than 24 hours in the future. For the purpose of this definition, *HEVC access unit* n has a presentation time that is more than 24 hours in the future if the difference between the initial arrival time $t_{ai}(n)$ and the DPB output time $t_{o,dpb}(n)$ is more than 24 hours.

2.1.98   HEVC slice: An *HEVC independent slice segment* and zero or more subsequent *HEVC dependent slice segments* preceding the next *HEVC independent slice segment* (if any) within the same *HEVC access unit*.

2.1.99   HEVC slice segment: A byte_stream_nal_unit with nal_unit_type in the range of 0 to 9 and 16 to 23, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.100 HEVC dependent slice segment: An *HEVC slice segment* with the syntax element dependent_slice_segment_flag in the slice header set to a value equal to 1, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.101 HEVC independent slice segment: An *HEVC slice segment* with the syntax element dependent_slice_segment_flag in the slice header set to a value 0 or inferred to be equal to 0, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.102 HEVC tile of slices: One or more consecutive *HEVC slices* which form the coded representation of a tile, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.103 HEVC still picture (system): An HEVC still picture consists of an *HEVC access unit* containing an IDR picture preceded by VPS, SPS and PPS NAL units, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2, that carry sufficient information to correctly decode this IDR picture. Preceding an HEVC still picture, there shall be another HEVC still picture or an end of sequence NAL unit terminating a preceding coded video sequence, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.104 HEVC video sequence (system): A coded video sequence as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.105 HEVC video sub-bitstream: A subset of the NAL units of an HEVC video stream in their original order.

2.1.106   HEVC temporal video sub-bitstream: An *HEVC video sub-bitstream* that contains all VCL NAL units and associated non-VCL NAL units of the temporal sub-layer, as specified in Rec. ITU-T H.265 | ISO/IEC 23008-2, associated with TemporalId equal to 0 and which may additionally contain all VCL NAL units and associated non-VCL NAL units of all temporal sub-layers associated with a contiguous range of TemporalId from 1 to a value equal to or smaller than sps_max_sub_layers_minus1 included in the active sequence parameter set, as specified in Rec. ITU-T H.265 | ISO/IEC 23008-2.

2.1.107   HEVC temporal video subset: An *HEVC video sub-bitstream* that contains all VCL NAL units and the associated non-VCL NAL units of one or more temporal sub-layers, as specified in Rec. ITU-T H.265 | ISO/IEC 23008-2, with each temporal sub-layer not being present in the corresponding *HEVC temporal video sub-bitstream* and TemporalId associated with each temporal sub-layer forming a contiguous range of values.

> NOTE – According to the constraints for the transport of HEVC specified in 2.17.1, each temporal sub-layer of an *HEVC video stream* is present either in the *HEVC temporal video sub-bitstream* or in exactly one *HEVC temporal video subset* which is carried in a set of elementary streams that are associated by hierarchy descriptors. This prevents the multiple inclusion of the same temporal sub-layer and allows aggregation of the *HEVC temporal video sub-bitstream* with associated *HEVC temporal video subsets* according to the hierarchy descriptors, as specified in 2.17.3.

2.1.108   HEVC highest temporal sub-layer representation: The sub-layer representation of the temporal sub-layer with the highest value of TemporalId, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2, in the associated *HEVC temporal video sub-bitstream* or *HEVC temporal video subset*.

2.1.109   HEVC complete temporal representation: A sub-layer representation as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 that contains all temporal sub-layers up to the temporal sub-layer with TemporalId equal to sps_max_sub_layers_minus1+1 as included in the active sequence parameter set, as specified in Rec. ITU-T H.265 | ISO/IEC 23008-2.

3)   Clause 2.4.2.6

Replace the following two paragraphs:

Replace:

The delay of any data through the system target decoder buffers shall be less than or equal to one second except for still picture video data and ISO/IEC 14496 streams. Specifically: $td_n(j) - t(i) \leq 1$ second for all j, and all bytes i in access unit $A_n(j)$.

with:

The delay of any data through the system target decoder buffers shall be less than or equal to one second except for still picture video data, ISO/IEC 14496 and ISO/IEC 23008-2 streams. Specifically: $td_n(j) - t(i) \leq 1$ second for all j, and all bytes i in access unit $A_n(j)$.

Replace:

For ISO/IEC 14496 streams, the delay is constrained by $td_n(j) - t(i) \leq 10$ seconds for all j, and all bytes i in access unit $A_n(j)$.

with:

For ISO/IEC 14496 and ISO/IEC 23008-2 streams, the delay is constrained by $td_n(j) - t(i) \leq 10$ seconds for all j, and all bytes i in access unit $A_n(j)$.

4)   Clause 2.4.2.11

Add the following new clause immediately after clause 2.4.2.10:

2.4.2.11   T-STD extensions for carriage of HEVC

T-STD extensions and T-STD parameters for the decoding of HEVC video streams are defined in 2.17.2 and 2.17.3. Program stream support including P-STD extensions and P-STD parameters are not specified for HEVC video streams.

5) Clause 2.4.3.5

In the paragraph specifying the discontinuity_indicator, add at the end of the bulleted list introduced by "For the purpose of this clause, an elementary stream access point is defined as follows":

• HEVC video streams or HEVC temporal video sub-bitstreams – The first byte of an HEVC access unit. The VPS, SPS and PPS parameter sets, as defined in Rec. ITU-T H.265 | ISO/IEC 23008-2, referenced in this and all subsequent HEVC access units in the HEVC video sequence shall be provided after this access point in the byte stream and prior to their activation.

In the paragraph specifying the elementary_stream_priority_indicator, add:

In the case of HEVC video streams or HEVC temporal video sub-bitstreams or HEVC temporal video subsets, this field may be set to '1' only if the payload contains one or more bytes from a slice with slice_type set to 2. A value of '0' indicates that the payload has the same priority as all other packets which do not have this bit set to '1'.

6) Clause 2.4.3.7

In Table 2-22, replace the following line:

1110 xxxx	Rec. ITU-T H.262	ISO/IEC 13818-2, ISO/IEC 11172-2, ISO/IEC 14496-2 or Rec. ITU-T H.264	ISO/IEC 14496-10 video stream number xxxx

with:

1110 xxxx	Rec. ITU-T H.262	ISO/IEC 13818-2, ISO/IEC 11172-2, ISO/IEC 14496-2, Rec. ITU-T H.264	ISO/IEC 14496-10 or Rec. ITU-T H.265	ISO/IEC 23008-2 video stream number xxxx

At the end of the clause specifying the PTS (presentation time stamp), add:

For HEVC video streams, HEVC temporal video sub-bitstreams and HEVC temporal video subsets, if a PTS is present in the PES packet header, it shall refer to the first HEVC access unit that commences in this PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of Rec. ITU-T H.265 | ISO/IEC 23008-2, for each HEVC 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, as defined in Annex C of Rec. ITU-T H.265 | ISO/IEC 23008-2.

At the end of the clause specifying the DTS (decoding time stamp), add:

For HEVC video streams, HEVC temporal video sub-bitstreams and HEVC temporal video subsets, if a DTS is present in the PES packet header, it shall refer to the first HEVC access unit that commences in this PES packet. To achieve consistency between the STD model and the HRD model defined in Annex C of Rec. ITU-T H.265 | ISO/IEC 23008-2, for each HEVC 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 in the HRD, as defined in Annex C of Rec. ITU-T H.265 | ISO/IEC 23008-2.

7) Clause 2.4.4.9

In Table 2-34, Stream type assignments, replace the following line:

0x24-0x7E	Rec. ITU-T H.222.0	ISO/IEC 13818-1 Reserved

with:

0x24	HEVC video stream or an HEVC temporal video sub-bitstream
0x25	HEVC temporal video subset of an HEVC video stream conforming to one or more profiles defined in Annex A of Rec. ITU-T H.265	ISO/IEC 23008-2
0x26-0x7E	Rec. ITU-T H.222.0	ISO/IEC 13818-1 Reserved

8) Clause 2.6.1

Replace Table 2-45 with:

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
37	X	X	metadata_pointer_descriptor
38	X	X	metadata_descriptor
39	X	X	metadata_STD_descriptor
40	X	X	AVC video descriptor
41	X	X	IPMP_descriptor (defined in ISO/IEC 13818-11, MPEG-2 IPMP)
42	X	X	AVC timing and HRD descriptor
43	X	X	MPEG-2_AAC_audio_descriptor
44	X	X	FlexMuxTiming_descriptor
45	X	X	MPEG-4_text_descriptor
46	X	X	MPEG-4_audio_extension_descriptor
47	X	X	Auxiliary_video_stream_descriptor
48	X	X	SVC extension descriptor
49	X	X	MVC extension descriptor
50	X	n/a	J2K video descriptor
51	X	X	MVC operation point descriptor

Table 2-45 – Program and program element descriptors

descriptor_tag	TS	PS	Identification
52	X	X	MPEG2_stereoscopic_video_format_descriptor
53	X	X	Stereoscopic_program_info_descriptor
54	X	X	Stereoscopic_video_info_descriptor
55	X	n/a	Transport_profile_descriptor
56	X	n/a	HEVC video descriptor
57-62	n/a	n/a	Rec. ITU-T H.222.0	ISO/IEC 13818-1 Reserved
63	X	X	Extension_descriptor
64-255	n/a	n/a	User Private

9) Clause 2.6.7

In Table 2-50, replace the description for value 15 as shown below:

Table 2-50 – Hierarchy_type field values

Value	Description
15	Base layer or MVC base view sub-bitstream or AVC video sub-bitstream of MVC or HEVC temporal video sub-bitstream.

10) Clause 2.6.11

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Add the following immediately after Table 2-54:

Table 2-54bis describes the alignment type for HEVC when the data_alignment_indicator in the PES packet header has a value of '1'.

Table 2-54bis – HEVC video stream alignment values

Alignment type	Description
00	Reserved
01	HEVC access unit
02	HEVC slice
03	HEVC access unit or slice
04	HEVC tile of slices
05	HEVC access unit or tile of slices
06	HEVC slice or tile of slices
07	HEVC access unit or slice or tile of slices
08	HEVC slice segment
09	HEVC slice segment or access unit
10	HEVC slice segment or slice
11	HEVC slice segment or access unit or slice
12	HEVC slice segment or tile of slices
13	HEVC slice segment or access unit or tile of slices
14	HEVC slice segment or slice or tile of slices
15	HEVC slice segment or access unit or slice or tile of slices
16-255	Reserved

11)   Clause 2.6.90

Replace Table 2-103bis with:

Table 2-103bis – Extension descriptor

Syntax	No. of bits	Mnemonic
Extension_descriptor () {		
descriptor_tag	**8**	**uimsbf**
descriptor_length	**8**	**uimsbf**
extension_descriptor_tag	**8**	**uimsbf**
if (extension_descriptor_tag == 0x02) {		
ObjectDescriptorUpdate()		
}		
else if (extension_descriptor_tag == 0x03) {		
HEVC_timing_and_HRD_descriptor()		
}		
else {		
for (i=0; i<N; i++) {		
reserved	**8**	**bslbf**
}		
}		
}		

12)   Clause 2.6.91

Add the following immediately before Table 2-103ter:

HEVC_timing_and_HRD_descriptor() – This structure is defined in clauses 2.6.95 and 2.6.96.

Replace Table 2-103ter with:

Table 2-103ter – Extension descriptor tag values

Extension_descriptor_tag	TS	PS	Identification
0	n/a	n/a	Reserved
1	n/a	X	Forbidden
2	X	X	ODUpdate_descriptor
3	X	n/a	HEVC_timing_and_HRD_descriptor()
3-255	n/a	n/a	Rec. ITU-T H.222.0	ISO/IEC 13818-1 Reserved

13)   Clauses 2.6.95 to 2.6.98

Add the following new clauses immediately after clause 2.6.94:

2.6.95   HEVC video descriptor

For an HEVC video stream, the HEVC video descriptor provides basic information for identifying coding parameters, such as profile and level parameters of that HEVC video stream. For an HEVC temporal video sub-bitstream or an HEVC temporal video subset, the HEVC video descriptor provides information such as the associated HEVC highest temporal sub-layer representation contained in the elementary stream to which it applies.

Table 2-103sexiens – HEVC video descriptor

Syntax	No. Of bits	Mnemonic
HEVC_descriptor() {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
profile_space	2	uimsbf
tier_flag	1	bslbf
profile_idc	5	uimsbf
profile_compatibility_indication	32	bslbf
progressive_source_flag	1	bslbf
interlaced_source_flag	1	bslbf
non_packed_constraint_flag	1	bslbf
frame_only_constraint_flag	1	bslbf
reserved_zero_44bits	44	bslbf
level_idc	8	uimsbf
temporal_layer_subset_flag	1	bslbf
HEVC_still_present_flag	1	bslbf
HEVC_24hr_picture_present_flag	1	bslbf
reserved	5	bslbf
if (temporal_layer_subset_flag == '1') {		
reserved	5	bslbf
temporal_id_min	3	uimsbf
reserved	5	bslbf
temporal_id_max	3	uimsbf
}		
}		

2.6.96 Semantic definition of fields in HEVC video descriptor

profile_space, tier_flag, profile_idc, profile_compatibility_indication, progressive_source_flag, interlaced_source_flag, non_packed_constraint_flag, frame_only_constraint_flag, reserved_zero_44bits, level_idc – When the HEVC video descriptor applies to an HEVC video stream or to an HEVC complete temporal representation, these fields shall be coded according to the semantics defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 for *general_profile_space*, *general_tier_flag*, *general_profile_idc*, *general_profile_compatibility_flag[i]*, *general_progressive_source_flag*, *general_interlaced_source_flag*, *general_non_packed_constraint_flag*, *general_frame_only_constraint_flag*, *general_reserved_zero_44bits*, *general_level_idc*, respectively, for the corresponding HEVC video stream or HEVC complete temporal representation, and the entire HEVC video stream or HEVC complete temporal representation to which the HEVC video descriptor is associated shall conform to the information signalled by these fields.

When the HEVC video descriptor applies to an HEVC temporal video sub-bitstream or HEVC temporal video subset of which the corresponding HEVC highest temporal sub-layer representation is not an HEVC complete temporal representation, these fields shall be coded according to the semantics defined in Rec. ITU-T H.265 | ISO/IEC 23008-2 for *sub_layer_profile_space*, *sub_layer_tier_flag*, *sub_layer_profile_idc*, *sub_layer_profile_compatibility_flag[i]*, *sub_layer_progressive_source_flag*, *sub_layer_interlaced_source_flag*, *sub_layer_non_packed_constraint_flag*, *sub_layer_frame_only_constraint_flag*, *sub_layer_reserved_zero_44bits*, *sub_layer_level_idc*, respectively, for the corresponding HEVC highest temporal sub-layer representation, and the entire HEVC highest temporal sub-layer representation to which the HEVC video descriptor is associated shall conform to the information signalled by these fields.

NOTE 1 – In one or more sequences in the HEVC video stream the level may be lower than the level signalled in the HEVC video descriptor, while also a profile may occur that is a subset of the profile signalled in the HEVC video descriptor. However, in the entire HEVC video stream, only subsets of the entire bitstream syntax shall be used that are included in the profile signalled in the HEVC video descriptor, if present. If the sequence parameter sets in an HEVC video stream signal different profiles, and no additional constraints are signalled, then the stream may need examination to determine which profile, if any, the entire stream conforms to. If an HEVC video descriptor is to be associated with an HEVC video stream that does not conform to a single profile, then the HEVC video stream should be partitioned into two or more sub-streams, so that HEVC video descriptors can signal a single profile for each such sub-stream.

temporal_layer_subset_flag – This 1-bit flag, when set to '1', indicates that the syntax elements describing a subset of temporal layers are included in this descriptor. This field shall be set to 1 for HEVC temporal video subsets and for HEVC temporal video sub-bitstreams. When set to '0', the syntax elements temporal_id_min and temporal_id_max are not included in this descriptor.