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

Part 1:
Systems

AMENDMENT 9: Ultra-low latency and 4k and higher resolution support for transport of JPEG 2000 video

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

Partie 1: Systèmes

AMENDEMENT 9: Support de résolution 4k et supérieure et latence ultrafaible pour le transfert de vidéos JPEG 2000

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This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*. The identical text is published as ITU-T H.222.0 (2014).

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

Part 1:
Systems —
Amendment 9:

Ultra-Low Latency and 4k and higher resolution support for transport of JPEG 2000 video

Clause 2

Replace 2.1.89 with the following:

2.1.89 JPEG 2000 (J2K) video access unit: The JPEG 2000 codestream or codestreams comprising a decodable and randomly accessible (portion of) image, preceded by all the parameters required to decode the access unit and display the decoded data.

Clause 2

Add new 2.1.93, 2.1.94, 2.1.95, 2.1.96 and update other subclauses numbering accordingly:

2.1.93 J2K block: The JPEG 2000 codestream or codestreams corresponding to a rectangular portion of a video frame, as detailed in S.3.

> NOTE   Usage of J2K blocks requires J2K block mode (defined in 2.1.94) to be enabled in the J2K video descriptor. Such usage facilitates the support of 4k and higher resolutions.

2.1.94 J2K block mode: optional mode defined in S.3, dividing each frame of a J2K video stream in a certain amount of rectangular blocks, each encoded as an independent J2K block (defined in 2.1.93).

2.1.95 J2K stripe: The JPEG 2000 codestream or codestreams comprising a decodable horizontally divided portion of an image, as detailed in S.4.

> NOTE   Usage of J2K stripes requires J2K stripe mode (defined in 2.1.96) to be enabled in the J2K video descriptor. Such usage enables transport of a J2K video stream with a low end-to-end latency.

2.1.96 J2K stripe mode: optional mode defined in S.4, dividing the (portion of) image transported in a J2K video access unit in a succession of horizontal stripes, each encoded as an independent J2K stripe (defined in 2.1.95).

Clause 2, 2.6.80
Replace Table 2-99 with the following:

Table 2-99 – J2K video descriptor

Syntax	No. of bits	Mnemonic
J2K_video_descriptor() {		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
extended_capability_flag	1	bslbf
profile_and_level	15	bslbf
horizontal_size	32	uimsbf
vertical_size	32	uimsbf
max_bit_rate	32	uimsbf
max_buffer_size	32	uimsbf
DEN_frame_rate	16	bslbf
NUM_frame_rate	16	bslbf
if (extended_capability_flag == '1') {		
stripe_flag	1	bslbf
block_flag	1	bslbf
mdm_flag	1	bslbf
reserved (all bits to be set to '0')	5	bslbf
} else {		
color_specification	8	bslbf
}		
still_mode	1	bslbf
interlaced_video	1	bslbf
reserved	6	bslbf
if (extended_capability_flag == '1') {		
colour_primaries	8	uimsbf
transfer_characteristics	8	uimsbf
matrix_coefficients	8	uimsbf
video_full_range_flag	1	bslbf
reserved	7	bslbf
if (stripe_flag == '1') {		
strp_max_idx	8	uimsbf
strp_height	16	uimsbf
}		
if (block_flag == '1') {		
full_horizontal_size	32	uimsbf
full_vertical_size	32	uimsbf
blk_width	16	uimsbf
blk_height	16	uimsbf
max_blk_idx_h	8	uimsbf
max_blk_idx_v	8	uimsbf
blk_idx_h	8	uimsbf
blk_idx_v	8	uimsbf
}		
if (mdm_flag == '1') {		
X_c0, Y_c0, X_c1, Y_c1, X_c2, Y_c2	16x6	uimsbf
X_wp	16	uimsbf
Y_wp	16	uimsbf
L_max	32	uimsbf
L_min	32	uimsbf
MaxCLL	16	uimsbf
MaxFALL	16	uimsbf
}		
}		
for (i=0; i<N; i++) {		
private_data_byte	8	bslbf
}		
}		

Clause 2

Replace 2.6.81 with the following:

2.6.81 Semantics of fields in J2K video descriptor

extended_capability_flag – This 1-bit field indicates that the J2K video stream uses extended color specification (through three bytes defining the chromaticity parameters, as described below), and that it might have one or several of the following capabilities enabled: stripes (through the J2K stripe mode), blocks (through the J2K block mode), or inclusion of mastering display metadata. The exact list of enabled capabilities is set through subsequent flags in the video descriptor (see below).

profile_and_level – This 15-bit field shall correspond to the 15 least significant bits of the 2-bytes Rsiz value included in all J2K codestream main headers of this J2K video stream. Rsiz values that are defined in Table A.10 of Rec. ITU T T.800 | ISO/IEC 15444-1 and do set to '0' their most significant bit are allowed.

NOTE   The combination of the extend_capability_flag and the profile_and_level field ensures backward and forward compatibility with legacy devices conforming to previous versions of this Recommendation | International Standard. Having the extended_capability_flag set to '1' leads indeed to a 16-bit value outside the range accepted by previous versions of this Recommendation | International Standard. This way, J2K video streams with extended capabilities can be unequivocally identified by both legacy and new devices.

horizontal_size – This 32-bit field indicates the horizontal size of the frame (for progressive) or field (for interlaced) comprised in each J2K access unit. If J2K block mode is enabled, this frame or field corresponds to a spatial rectangular block of the entire video frame or field. It shall be coded the same as the Xsiz parameter found in all J2K codestream main headers of this J2K video stream, as defined in Annex A of Rec. ITU-T T.800 | ISO/IEC 15444-1.

vertical_size – This 32-bit field indicates the vertical size of the frame (for progressive) or field (for interlaced) comprised in each J2K access unit. If J2K block mode is enabled, this frame or field corresponds to a spatial rectangular block of the entire video frame or field. If J2K stripe mode is disabled, it shall be coded the same as the Ysiz parameter found in all J2K codestream main headers of this J2K video stream. If J2K stripe mode is enabled, it shall be coded as the sum of the Ysiz parameters found in all J2K codestreams composing the frame (for progressive) or a field (for interlaced) comprised in each J2K access unit. Ysiz parameters are defined in Annex A of Rec. ITU-T T.800 | ISO/IEC 15444-1.

max_bit_rate – This field may be coded the same as the *brat_max_br* field specified in Table S.1 and shall not exceed the maximum compressed bit rate value for the profile and level specified in Table S.2. This field shall be set appropriately and signalled when profile_and_level = '000 0011 0000 0111', where no maximum bit rate is specified.

max_buffer_size – This field shall not exceed the Maximum buffer size value for the profile and level specified in Table S.2. When profile_and_level = '000 0011 0000 0111', the max_buffer_size shall be set appropriately and shall not exceed (max_bit_rate/1.60E5), where max_bit_rate is expressed in bit/s.

DEN_frame_rate – This field shall be coded the same as frat_denominator field specified in Table S.1 (see Annex S).

NUM_frame_rate – This field shall be coded the same as frat_numerator field specified in Table S.1 (see Annex S).

NOTE   J2K frame rate is derived from the DEN_frame_rate and NUM_frame_rate values. Table 2-100 lists examples of typical broadcast frame rates with associated values of DEN_frame_rate and NUM_frame_rate.

Table 2-100 – Example frame rates based on DEN_frame_rate and NUM_frame_rate values

DEN_frame_rate	NUM_frame_rate	Frame rate ratio (decimal representation)	Frame rate
0000 0000 0000 0000			Forbidden
0000 0011 1110 1001	0101 1101 1100 0000	24 000 / 1001	23.976
0000 0000 0000 0001	0000 0000 0001 1000	24 / 1	24.0
0000 0000 0000 0001	0000 0000 0001 1001	25 / 1	25.0
0000 0011 1110 1001	0111 0101 0011 0000	30 000 / 1001	29.97
0000 0000 0000 0001	0000 0000 0001 1110	30 / 1	30.0
0000 0000 0000 0001	0000 0000 0011 0010	50 / 1	50.0
0000 0011 1110 1001	1110 1010 0110 0000	60 000 / 1001	59.94
0000 0000 0000 0001	0000 0000 0011 1100	60 / 1	60.00

stripe_flag – This 1-bit field is included only if the extended_capability_flag is set to '1'. It indicates whether the J2K video stream has J2K stripe mode enabled. When this flag is set to '1' the J2K access unit elementary stream header (see Table S.1) shall not include the syntax element j2k_tcod, shall include the syntax element j2k_strp, and the corresponding J2K access unit shall be made of a succession of J2K stripes. When this flag is set to '0', the J2K access unit elementary stream header shall include the syntax element j2k_tcod, shall not include the syntax element j2k_strp, and the corresponding J2K access unit shall be made of one J2K codestream in case of progressive content and two J2K codestreams in case of interlaced content.

block_flag – This 1-bit field is included only if the extended_capability_flag is set to '1'. When set to '1', it indicates that the J2K video stream has J2K block mode enabled, meaning that this J2K video stream actually corresponds to a spatial rectangular block of the full video stream. Subdivision of each frame into rectangular independent blocks is further defined in Section S.3. When set to '0', then the associated J2K video stream shall not have J2K block mode enabled.

mdm_flag – This 1-bit field is included only if the extended_capability_flag is set to '1'. When set to '1', it indicates that the J2K video descriptor contains the characteristics of the Mastering Display Metadata, as described in SMPTE ST 2086:2014 (see below corresponding fields). When set to '0', then the J2K video descriptor shall not contain the characteristics of the Mastering Display Metadata.

color_specification – This 8-bit field is included only if the extended_capability_flag is set to '0' and corresponds to the legacy color specification method. It shall be coded the same as the bcol_colcr 8-bit field of the j2k_bcol box as specified in Table S.1 (see Annex S).

still_mode – This 1-bit field, when set to '1', indicates that the J2K video stream may include J2K still pictures. When set to '0', then the associated J2K video stream shall not contain J2K still pictures.

interlaced_video – This 1-bit field indicates whether the J2K video stream contains interlaced video. When this flag is set to '1' the J2K access unit elementary stream header (see Table S.1) shall include the syntax elements brat_auf2, fiel_box_code, fiel_fic and fiel_fio. When this flag is set to '0', these syntax elements shall not be present in the J2K access unit elementary stream header.

color_primaries, transfer_characteristics, matrix_coefficients, video_full_range_flag – These four fields (three 8-bit fields and one 1-bit field) are included only if the extended_capability_flag is set to '1' and correspond to a color specification method allowing a broader set of color code points than the legacy method (see color_specification field above). These fields shall be coded according to the semantics with the same name defined in Rec. ITU-T H.273 | ISO/IEC 23001-8.**strp_max_idx** – This 8-bit field is included only if J2K stripe mode is enabled. It shall be in the range 0x01-0xff and indicates the maximum value of the stripe index. It corresponds to the number of stripes in the

block/field/frame, minus one. Value 0x00 is forbidden as a minimum of 2 stripes is required (otherwise J2K stripe mode shall be disabled).

strp_height – This 16-bit field is included only if J2K stripe mode is enabled. It indicates the default vertical size of a stripe. Depending on the vertical_size field value, the last stripe might have a different height, as detailed in S.4.

full_horizontal_size – This 32-bit field is included only if J2K block mode is enabled. It indicates the horizontal size of the entire video frame of this J2K video stream.

full_vertical_size – This 32-bit field is included only if J2K block mode is enabled. It indicates the vertical size of the entire video frame of this J2K video stream.

blk_width – This 16-bit field is included only if J2K block mode is enabled. It indicates the default width of a J2K block. Depending on the full_horizontal_size field value, the last block of a row might have a different width, as detailed in S.3.

blk_height – This 16-bit field is included only if J2K block mode is enabled. It indicates the default height of a J2K block. Depending on the full_vertical_size field value, the last block of a column might have a different height, as detailed in S.3.

max_blk_idx_h – This 8-bit field is included only if J2K block mode is enabled and indicates the maximum value of the horizontal block index for this video frame. It corresponds to the total number of blocks in the horizontal direction, minus one.

max_blk_idx_v – This 8-bit field is included only if J2K block mode is enabled and indicates the maximum value of the vertical block index for this video frame. It corresponds to the total number of blocks in the vertical direction, minus one.

blk_idx_h – This 8-bit field is included only if J2K block mode is enabled and indicates the horizontal block index of the current block.

blk_idx_v – This 8-bit field is included only if J2K block mode is enabled and indicates the vertical block index of the current block.

The following fields X_c0, Y_c0, X_c1, Y_c1, X_c2, Y_c2, X_wp, Y_wp, L_max and L_min correspond to the fields defined in SMPTE ST2086:2014 "Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images". The fields MaxFALL and MaxCLL correspond to the fields defined in ANSI/CTA 861-G:2016 "A DTV Profile for Uncompressed High Speed Digital Interfaces". If these 12 fields have unknown values at the time of generating the stream, they shall not be included in the descriptor and the mdm_flag shall be set to '0'.

X_c0, Y_c0, X_c1, Y_c1, X_c2, Y_c2 – These 16-bit fields are included only if the mdm_flag is set to '1'. They specify the normalized x and y chromaticity coordinates of the colour primary components of the mastering display in increments of 0.00002, according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15). For describing mastering displays that use red, green, and blue colour primaries, it is suggested that index value c0 should correspond to the green primary, c1 should correspond to the blue primary, and c2 should correspond to the red colour primary. The values of these 6 fields shall be in the range of 0 to 50 000, inclusive.

X_wp and **Y_wp** – These 16-bit fields are included only if the mdm_flag is set to '1'. They specify the normalized x and y chromaticity coordinates of the white point of the mastering display in normalized increments of 0.00002, according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15). The values of X_wp and Y_wp shall be in the range of 0 to 50 000.

L_max and **L_min** – These 32-bit fields are included only if the mdm_flag is set to '1'. They specify the nominal maximum and minimum display luminance, respectively, of the mastering display in units