User_data_registered_itu_t_t35 SEI message for ST 2094-40

Version 1.0

2016.10.09

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Revision History

Version	Date	Changing point
1.0	2016.10.09	Initial version of ST2094-40 SEI message.

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Preface

Purpose

This contribution proposes to support Dynamic Metadata for Color Volume Transform - Application #4 of SMPTE 2094-40 standard [1][2]. It will be used as user_data_registered_itu_t_t35 SEI message which had been used in HEVC or H.264 standard [3][4].

Scope

The ST 2094 suite of documents defines metadata for use in colour volume transforms of content. The metadata are content-dependent and can vary scene-by-scene or frame-by-frame. The metadata are intended to transform High Dynamic Range and Wide Colour Gamut (HDR/WCG) source content for presentation on a display having a smaller colour volume than the source content's mastering display [1].

ST 2094 Part 40 specifies the content-dependent colour volume transform metadata items for Application #4 [2]. This colour volume transform defines scene-based metadata to reproduce the original intent of the creator of High Dynamic Range (HDR) and Wider Colour Gamut (WCG) image essence on a display having a smaller colour volume, even in the case that the mastering display and the targeted system display may both have practical limits on the peak luminance they can produce.

Definition & Acronyms

For the purposes of this Recommendation | International Standard, the following definitions apply:

can A term used to refer to behaviour that is allowed, but not necessarily required.

may A term that is used to refer to behaviour that is allowed, but not necessarily required.

must A term that is used in expressing an observation about a requirement or an implication of a requirement that is specified elsewhere in this Specification (used exclusively in an informative context).

shall A term used to express mandatory requirements for conformance to this Specification.

should A term used to refer to behaviour of an implementation that is encouraged to be followed under anticipated ordinary circumstances, but is not a mandatory requirement for conformance to this Specification.

Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

HEVC High Efficiency Video Coding

SMPTE Society of Motion Picture and Television Engineers

SEI Supplemental Enhancement Information

HDR High Dynamic Range

WCG Wide Colour Gamut

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References

1. SMPTE, ST 2094-1:2016: Dynamic Metadata for Color Volume Transform – Core Components

2. SMPTE, ST 2094-40:2016: Dynamic Metadata for Color Volume Transform – Application #4, 2016/06/17

3. ITU-T, REC. T.35: Procedure for the allocation of ITU-T defined codes for non-standard facilities, 2000/02

4. ITU-T JCT-VC, ISO/IEC 23008-2: Information technology -- High efficiency coding and media delivery in heterogeneous environments -- Part 2: High efficiency video coding, 2015/09/15

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1. Syntax for ST 2094-40

1.1. User_data_registered_itu_t_t35 SEI message syntax for ST 2094-40

user_data_registered_itu_t_t35 () {	**Descriptor**
itu_t_t35_country_code	u(8)
itu_t_t35_terminal_provider_code	u(16)
itu_t_t35_terminal_provider_oriented_code	u(16)
application_identifier	u(8)
application_version	u(8)
num_windows	u(2)
for(w = 1; w < num_windows; w++) {	
window_upper_left _corner_x[w]	u(16)
window_upper_left_corner_y[w]	u(16)
window_lower_right_corner_x[w]	u(16)
window_lower_right_corner_y[w]	u(16)
center_of_ellipse_x[w]	u(16)
center_of_ellipse_y[w]	u(16)
rotation_angle[w]	u(8)
semimajor_axis_internal_ellipse[w]	u(16)
semimajor_axis_external_ellipse[w]	u(16)
semiminor_axis_external_ellipse[w]	u(16)
overlap_process_option[w]	u(1)
}	
targeted_system_display_maximum_luminance	u(27)
targeted_system_display_actual_peak_luminance_flag	u(1)
if(targeted_system_display_actual_peak_luminance_flag) {	
num_rows_targeted_system_display_actual_peak_luminance	u(5)
num_cols_targeted_system_display_actual_peak_luminance	u(5)

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for(i = 0; i < num_rows_targeted_system_display_actual_peak_luminance; i++)	
for(j = 0; j < num_cols_targeted_system_display_actual_peak_luminance; j++)	
targeted_system_display_actual_peak_luminance[i][j]	u(4)
}	
for(w = 0; w < num_windows; w++) {	
for(i = 0; i < 3; i++)	
maxscl[w][i]	u(17)
average_maxrgb[w]	u(17)
num_distribution_maxrgb_percentiles[w]	u(4)
for(i = 0; i < num_distribution_maxrgb_percentiles[w]; i++) {	
distribution_maxrgb_percentages[w][i]	u(7)
distribution_maxrgb_percentiles[w][i]	u(17)
}	
fraction_bright_pixels[w]	u(10)
}	
mastering_display_actual_peak_luminance_flag	u(1)
if(mastering_display_actual_peak_luminance_flag) {	
num_rows_mastering_display_actual_peak_luminance	u(5)
num_cols_mastering_display_actual_peak_luminance	u(5)
for(i = 0; i < num_rows_mastering_display_actual_peak_luminance; i++)	
for(j = 0; j < num_cols_mastering_display_actual_peak_luminance; j++)	
mastering_display_actual_peak_luminance[i][j]	u(4)
}	
for(w = 0; w < num_windows; w++) {	
tone_mapping_flag[w]	u(1)
if(tone_mapping_flag) {	
knee_point_x[w]	u(12)
knee_point_y[w]	u(12)
num_bezier_curve_anchors[w]	u(4)
for(i = 0; i < num_bezier_curve_anchors[w]; i++)	

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bezier_curve_anchors[w][i]	u(10)
}	
color_saturation_mapping_flag[w]	u(1)
if(color_saturation_mapping_flag) {	
color_saturation_weight[w]	u(6)
}	
}	
}	

2. Semantics for ST 2094-40

2.1. User_data_registered_itu_t_t35 SEI message semantics for ST 2094-40

This SEI message provides information to enable colour volume transformation of the reconstructed colour samples of the output pictures. The input to the indicated colour volume transform process is the linearized RGB colour components of the source content.

The information conveyed in this SEI message is intended to be adequate for purposes corresponding to the use of Society of Motion Picture and Television Engineers ST 2094-40 [2].

itu_t_t35_country_code shall be a byte having a value specified as a country code by Rec. ITU-T T.35 Annex A. The value shall be 0xB5.

itu_t_t35_terminal_provider_code shall be a fixed 16-bit field. The value shall be 0x003C.

itu_t_t35_terminal_provider_oriented_code shall be a 16-bit code. The value shall be as specified in Table 1.

Table 1 – Interpretation of the itu_t_t35_terminal_provider_oriented_code

itu_t_t35_terminal_provider_oriented_code	Indicated value
0x0000	Unspecified
0x0001	ST 2094-40
0x0002 - 0x00FF	Reserved

application_identifier identifies an application and its defining document in ST-2094 suite. application_identifier shall be set to 4.

application_version specifies the application version in the application defining document in ST-2094 suite. application_version shall be set to 0.

num_windows indicates the number of processing windows. The first processing window shall be for the entire picture. The value of num_windows shall be in the range of 1 to 3, inclusive.

window_upper_left _corner_x[w] specifies the x coordinate of the top left pixel of the w-th processing window. The value of window_upper_left _corner_x[w] shall not exceed 65535. The value of window_upper_left _corner_x[0] shall be 0.

window_upper_left_corner_y[w] specifies the y coordinate of the top left pixel of the w-th processing window. The value of window_upper_left _corner_y[w] shall not exceed 65535. The value of window_upper_left _corner_y[0] shall be 0.

window_lower_right_corner_x[w] specifies the x coordinate of the bottom right pixel of the w-th processing window. The value of window_lower_right_corner_x[w] shall not exceed 65535. The value of window_lower_right_corner_x[0] shall be (width of Picture – 1).

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window_lower_right_corner_y[w] specifies the y coordinate of the bottom pixel of the w-th processing window. The value of window_lower_right_corner_y[w] shall not exceed 65535. The value of window_lower_right_corner_y[0] shall be (height of Picture – 1).

center_of_ellipse_x[w] specifies the x coordinate of the center position of the concentric internal and external ellipses of the elliptical pixel selector in the w-th processing window. The value of center_of_ellipse_x[w] shall be in the range of 0 to (width of Picture – 1), inclusive and in multiples of 1 pixel.

center_of_ellipse_y[w] specifies the y coordinate of the center position of the concentric internal and external ellipses of the elliptical pixel selector in the w-th processing window. The value of center_of_ellipse_y[w] shall be in the range of 0 to (height of Picture – 1), inclusive and in multiples of 1 pixel.

rotation_angle[w] specifies the clockwise rotation angle in degree of arc with respect to the positive direction of the x-axis of the concentric internal and external ellipses of the elliptical pixel selector in the w-th processing window. The value of rotation_angle[w] shall be in the range of 0 to 180, inclusive and in multiples of 1.

semimajor_axis_internal_ellipse[w] specifies the semi-major axis value of the internal ellipse of the elliptical pixel selector in amount of pixels in the w-th processing window. The value of semimajor_axis_internal_ellipse[w] shall be in the range of 1 to 65535, inclusive and in multiples of 1 pixel.

semimajor_axis_external_ellipse[w] specifies the semi-major axis value of the external ellipse of the elliptical pixel selector in amount of pixels in the w-th processing window. The value of semimajor_axis_external_ellipse[w] shall not be less than semimajor_axis_internal_ellipse[w]. The value of semimajor_axis_external_ellipse[w] shall be in the range of 1 to 65535, inclusive and in multiples of 1 pixel.

semiminor_axis_external_ellipse[w] specifies the semi-minor axis value of the external ellipse of the elliptical pixel selector in amount of pixels in the w-th processing window. The value of semiminor_axis_external_ellipse[w] shall be in the range of 1 to 65535, inclusive and in multiples of 1 pixel.

overlap_process_option[w] an enumerator that indicates one of the two methods of combining rendered pixels in the w-th processing window in an image with at least one elliptical pixel selector. For overlapping elliptical pixel selectors in an image, overlap_process_option[w] shall have the same value. overlap_process_option[w] = 0 shall indicate the Weighted Averaging method and overlap_process_option[w] = 1 shall indicate the Layering method as described in Annex B of reference [2].

targeted_system_display_maximum_luminance specifies the nominal maximum display luminance of the targeted system display, in units of 0.0001 candelas per square metre. The value of targeted_system_display_maximum_luminance shall be in the range of 0 to 10000, inclusive.

targeted_system_display_actual_peak_luminance_flag, when present, shall be equal to 0 in bitstreams conforming to this version of this Specification. The value 1 for targeted_system_display_actual_peak_luminance_flag is reserved for future use. Decoders shall ignore the value of targeted_system_display_actual_peak_luminance_flag.

num_rows_targeted_system_display_actual_peak_luminance specifies the number of rows in the targeted_system_display_actual_peak_luminance array. The value of num_rows_targeted_system_display_actual_peak_luminance shall be in the range of 2 to 25, inclusive.

num_cols_targeted_system_display_actual_peak_luminance specifies the number of columns in the targeted_system_display_actual_peak_luminance array. The value of num_cols_targeted_system_display_actual_peak_luminance shall be in the range of 2 to 25, inclusive.

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targeted_system_display_actual_peak_luminance[i][j] specifies the normalized actual peak luminance of the targeted system display. The value of targeted_system_display_actual_peak_luminance[i][j] shall be in the range of 0 to 1, inclusive and in multiples of 1/15.

maxscl[w][i] specifies the maximum of the i-th colour component of linearized RGB values in the w-th processing window in the scene. The value of maxscl[w][i] shall be in the range of 0 to 1, inclusive and in multiples of 0.00001. maxscl[w][0], maxscl[w][1], and maxscl[w][2] are corresponding to R, G, B colour components respectively.

average_maxrgb[w] specifies the average of linearized maxRGB values in the w-th processing window in the scene. The value of average_maxrgb[w] shall be in the range of 0 to 1, inclusive and in multiples of 0.00001.

num_distribution_maxrgb_percentiles[w] indicates the number of linearized maxRGB values at given percentiles in the w-th processing window in the scene. The maximum value of num_distribution_maxrgb_percentiles[w] shall be 15.

distribution_maxrgb_percentages[w][i] specifies an integer percentage value corresponding to the i-th percentile linearized RGB value in the w-th processing window in the scene. The value of distribution_maxrgb_percentages[w][i] shall be in the range of 0 to100, inclusive.

distribution_maxrgb_percentiles[w][i] specifies the linearized maxRGB value at the i-th percentile in the w-th processing window in the scene. The value of distribution_maxrgb_percentiles[w][i] shall be in the range of 0 to 1, inclusive and in multiples of 0.00001.

fraction_bright_pixels[w] specifies the fraction of selected pixels in the image that contains the brightest pixel in the scene. The value of fraction_bright_pixels[w] shall be in the range of 0 to 1, inclusive and in multiples of 0.001.

mastering_display_actual_peak_luminance_flag, when present, shall be equal to 0 in bitstreams conforming to this version of this Specification. The value 1 for mastering_display_actual_peak_luminance_flag is reserved for future use. Decoders shall ignore the value of mastering_display_actual_peak_luminance_flag.

num_rows_mastering_display_actual_peak_luminance specifies the number of rows in the mastering_display_actual_peak_luminance array. The value of num_rows_mastering_display_actual_peak_luminance shall be in the range of 2 to 25, inclusive.

num_cols_mastering_display_actual_peak_luminance specifies the number of columns in the mastering_display_actual_peak_luminance array. The value of num_cols_mastering_display_actual_peak_luminance shall be in the range of 2 to 25, inclusive.

mastering_display_actual_peak_luminance[i][j] specifies the normalized actual peak luminance of the mastering display used for mastering the image essence. The value of mastering_display_actual_peak_luminance[i][j] shall be in the range of 0 to 1, inclusive and in multiples of 1/15.

tone_mapping_flag[w] equal to 1 indicates that the metadata for the tone mapping function in the w-th processing window is present.

knee_point_x[w] specifies the x coordinate of the separation point between the linear part and the curved part of the tone mapping function. The value of knee_point_x[w][i] shall be in the range of 0 to 1, excluding 0 and in multiples of 1/4095.

knee_point_y[w] specifies the y coordinate of the separation point between the linear part and the curved part of the tone mapping function. The value of knee_point_y[w][i] shall be in the range of 0 to 1, excluding 0 and in multiples of 1/4095.

num_bezier_curve_anchors[w] indicates the number of the intermediate anchor parameters of the tone mapping function in the w-th processing window. The maximim value of num_bezier_curve_anchors[w] shall be 15.

bezier_curve_anchors[w][i]

specifies the i-th intermediate anchor parameter of the tone mapping function in the w-th processing window in the scene. The value of bezier_curve_anchors[w][i] shall be in the range of 0 to 1, inclusive and in multiples of 1/1023.

color_saturation_mapping_flag[w] shall be equal to 0 in bitstreams conforming to this version of this Specification. Other values for color_saturation_mapping_flag[w] are reserved for future use. Decoders shall ignore the value of color_saturation_mapping_flag[w].

color_saturation_weight[w] specifies a number that shall adjust the colour saturation gain in the w-th processing window in the scene. The value of color_saturation_weight[w] shall be in the range of 0 to 63/8, inclusive and in multiples of 1/8. The default value shall be 1.

Note: Definitions of the metadata items and terms used in this document are provided in reference [1] and [2]. A colour volume transform method using this SEI message is described in Annex B of reference [2].

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3. Patent Rights Declaration(s)

For IPR policy on SMPTE ST 2094-40:2016: Dynamic Metadata for Color Volume Transform – Application #4 , refer to the Patent Statement Declaration With Respect to SMPTE Engineering Document located at https://kws.smpte.org/kws/public/download/38343/Samsung_Patent_Statement_ST2094_40.pdf.

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