HDR Working Group meeting

Telecon
13 January 2021
19:00 UTC

Attendees: Luke Wallis (Apple, HDR WG chair), Lars Borg (Adobe), Craig Revie (FFEI), Chris Lilley (W3C), Chris Seeger (NBC), Simon Thompson (BBC), Chris Needham (BBC), Imane Filali (BBC), Timo Kunkel (Dolby), Phil Green (NTNU, ICC Technical Secretary)

The purpose of this meeting was to review the revised problem definition for HDR WG and the tag proposal for CICP metadata. Relevant action items from the previous meeting were:

- Revise the proposed problem definition along the lines discussed in the meeting (Craig Revie)
- Update the proposed votable proposal on CICP metadata for HDR as discussed (Lars Borg)

These documents had been completed and distributed by email. There were no further comments on the problem definition, and the meeting focused on the tag proposal.

The meeting approved the content of the revised tag proposal. The meeting discussed whether ICC profiles were a suitable carrier for CICP metadata, since in a non-ICC workflow it would require the overhead of parsing an ICC profile just to obtain the metadata. It was agreed that ICC profiles were a good candidate for carrying the metadata (which should be in a tag rather than in the header), and possibly ICC could provide code to extract the metadata for applications to use.

It was noted that ITU-T H.19 contains parameter tables which could be adopted; this is a consolidated sub-set from ITU-T H.273. This could be a recommendation from ICC rather than a constraint, limitations would likely come from those making applications and profiles, e.g. W3C.

The meeting discussed the option of defining the transform in an ICC profile, rather than passing metadata. It was noted that unlike in an ITU workflow, an ICC profile hard codes the transform and is valid for a single image state and graphics white luminance, making its use more restricted. Lars had previously circulated profiles for HDR encodings (single image state and imperfect round tripping); it would be feasible to develop more work on this in the future, but the current proposal is an initial step that addresses HDR workflows now and provides a bridge between ITU and ICC approaches.

Lars Borg undertook to revise the proposal and other documents and circulate to this group for final comment; following a 3-day review by the group Phil Green will distribute to the HDR WG for review. The next step would be a two-week technical review by ICC members followed by a Steering Committee ballot.

Attached: updated version of the votable proposal. Lars Borg also provided an informative summary of differences between ICC and ITU approaches, and a document describing the flavours of HDR video (attached).

File: CICP Votable Proposal 2021-01-13.docx

ICC Votable Proposal Submission

Title of proposal

Coding-independent code points (CICP) for video signal type identification

Proposers:

Names and member companies of proposers

Lars Borg, Adobe
Chris Seeger, NBCU

Submission date:

Date of submission to ICC Technical Secretary for distribution to membership

TBD

1. Introduction

Outline of proposal, its motivation and context

A summary

This proposal enables the linking of an ICC profile with an equivalent video signal type identification (CICP) representation.

The problem to be solved

There is currently no best practice for linking the color space encoding represented by an ICC profile with an equivalent video signal type identification (CICP) used in video equipment compliant with ITU-T H.273 and ITU-T H.265 as defined by the International Telecommunication Union (ITU) or as defined by SMPTE Universal Labels.

There is no best practice for reliably exchanging still images between graphics workflows and video workflows using the correct color space.

There is no best practice for integrating ICC-tagged still images into video presentations and rendering these stills the same way as the video is rendered.

In video equipment, a video frame can be processed as scene-referred or display-referred as needed and as prescribed by video standards, but ICC profiles allow only one such processing option per ICC profile.

The solution

The proposal adds an optional CICP tag, which includes the Coding-independent code points (CICP) for the profile’s effective color image encoding. The proposal is applicable to Input and Display profiles using the RGB or YCbCr color models.

File: CICP Votable Proposal 2021-01-13.docx

The application

A processor receiving media with a CICP tag can use the CICP tag to switch its color processing from using the ICC profile to using its video color processor. This enables the processor to render ICC-tagged content the same way that untagged video is rendered, thus providing seamless integration with video-based processing such as gamut and tone mapping and other features of its video color processor.

A video frame grabber can save the video frame as RGB or YCbCr with an embedded ICC profile and embedded CICP tag.

When saving as YCbCr, the frame is in the same color space as the original video and can be re-inserted into the same video type without any loss. The ICC profile provides an approximate color rendering (typically display-referred) for non-video equipment, while the CICP tag provides the mapping back to the original video space.

When saving as RGB, the frame is typically converted from the video's narrow range YCbCr format to full range RGB of the same color space, placing black at 0. This facilitates editing in image applications. The ICC profile provides an approximate color rendering (typically display-referred) for the graphics application, while the CICP tag enables converting back to the original video space.

Issues

Identify shortcomings

What can go wrong?

- Using the CICP tag can result in a different color appearance versus using the ICC profile. What happens if this image and profile propagates into print publishing, PDF, web pages, where only some apps support the CICP tag?

The ICC profile can only represent one of multiple possible renderings of the image content. For example, the ICC profile represents only one image state such as scene-referred or display-referred. In contrast, and in line with video industry practices, the CICP data represents the image encoding, and does not prescribe which image state to use for rendering.

2. The acceptance of this proposal will result in:

Summary of proposed changes to ICC specifications and (where required) CMM behavior

The proposal extends ICC.1 Version 4 by defining an optional Version 4 tag (cicpTag) and corresponding tag type (cicpType).

There are no required changes for CMMs.

3. Nature of the proposal

State whether tag or type(s) are being proposed, the effect on ICC resources such as registries, and consequence for ICC specification versions

The proposal extends ICC.1 Version 4 by defining an optional Version 4 tag (cicpTag) and corresponding tag type (cicpType).

This proposal does not impact ICC registries.

4. Votable Proposal

Full description of proposal

See next main section below.

5. Applications and Workflows

Usage scenarios envisaged as a result of the proposal

Workflow would include:

- Input to post-production editor, compositer, 3D software, still graphics editor
  - ICC CICP tag detected, transform applied to conform to the video space of the timeline or working space's color volume
- Input into Still Store (for static graphics playback)
  - ICC CICP tag detected, transform applied to preset still-store broadcast working space
- Input to web browser for compositing and rendering
  - ICC CICP tag detected from source graphic, broadcast video tag is detected, graphic is mapped properly into desktop working space

EXAMPLE:

Video - frame grab - PNG - editing, masking, adding text… - PNG - insert in video

The CICP information can be extracted from a profile with the following pseudo code:

Verify that the profile header is valid (Profile length, Profile version number, ICC Signature)

Search the Tag table. If 'cicp' signature is not found, exit with no CICP information

Verify that the tag type signature is correct.

Extract CICP fields.

Exit with CICP information.

File: CICP Votable Proposal 2021-01-13.docx

CICP Tag and Type proposal

1.1.1.1 Normative References

Recommendation ITU-T H.273 (12/2016), Coding-independent code points for video signal type identification, https://www.itu.int/rec/T-REC-H.273/en

1.1.1.2 Abbreviated terms

CICP Coding-independent code points for video signal type identification

1.1.1.3 cicpTag

Tag signature: ‘cicp’ (63696370h)

Permitted tag type: cicpType

This tag defines Coding-independent code points for video signal type identification (CICP).

The color image encoding specified by the CICP tag content shall be equivalent to the color image encoding represented by this ICC profile.

This tag may be present when the data colour space in the profile header is RGB or YCbCr, and the profile class in the profile header is Input or Display. The tag shall not be present for other data colour spaces or profile classes indicated in the profile header.

1.1.1.4 cicpType

The cicpType specifies Coding-independent code points for video signal type identification. The byte assignment and encoding shall be as given in Table 1.

Table 1 — cicpType encoding

Byte position	Field length (bytes)	Content	Encoded as
0 to 3	4	‘cicp’ (63696370h) type signature	
4 to 7	4	Reserved, shall be set to 0	
8	1	ColourPrimaries	uInt8Number
9	1	TransferCharacteristics	uInt8Number
10	1	MatrixCoefficients	uInt8Number
11	1	VideoFullRangeFlag	uInt8Number

The fields ColourPrimaries, TransferCharacteristics, MatrixCoefficients, and VideoFullRangeFlag shall be encoded as specified in Recommendation ITU-T H.273. Recommendation ITU-T H.273 provides detailed descriptions of the code values and their interpretation.

Widely used code point combinations are specified in Supplement 19 to ITU-T H-series Recommendations (10/2019) - Usage of video signal type code points.

NOTE: Recommendation ITU-T H.273 describes the fields as follows:

> The field ColourPrimaries indicates the chromaticity coordinates of the source colour primaries in terms of the CIE 1931 definition of x and y as specified by ISO 11664-1.
>
> The field TransferCharacteristics indicates either:
>
> - the reference opto-electronic transfer characteristic function of the source picture as a function of a source input linear optical intensity input with a nominal real-valued range of 0 to 1, or
> - the inverse of the reference electro-optical transfer characteristic function as a function of an output linear optical intensity with a nominal real-valued range of 0 to 1.
>
> The field MatrixCoefficients describes the matrix coefficients used in deriving luma and chroma signals from the red, green, and blue, or X, Y, and Z primaries.
>
> The field VideoFullRangeFlag specifies the scaling and offset values applied in association with the MatrixCoefficients, with 0 (zero) indicating “narrow-range” encoding, 1 indicating “full-range” encoding.

EXAMPLES:

Examples for RGB images.

When the data colour space in the profile header is RGB, MatrixCoefficients is always 0 (zero) and VideoFullRangeFlag is often 1.

Codes	Interpretation
1-1-0-0	RGB narrow range representation specified in Recommendation ITU-R BT.709-6, Item 3.4
1-13-0-1	RGB full range color encoding specified in IEC 61966-2-1 sRGB
9-14-0-0	R’G’B’ narrow range representation specified in Recommendation ITU-R BT.2020-2, Table 5
9-16-0-0	PQ R’G’B’ narrow range representation specified in Recommendation ITU-R BT.2100-2, Table 9
9-16-0-1	PQ R’G’B’ full range representation specified in Recommendation ITU-R BT.2100-2, Table 9
9-18-0-0	HLG R’G’B’ narrow range representation specified in Recommendation ITU-R BT.2100-2
9-18-0-1	HLG R’G’B’ full range representation specified in Recommendation ITU-R BT.2100-2

Examples for narrow-range YCbCr or ICtCp images.

When the data colour space in the profile header is YCbCr, MatrixCoefficients is always non-zero, and VideoFullRangeFlag is usually 0 (zero). ICtCp images use the YCbCr data colour space in the profile header.

Codes	Interpretation
1-1-1-0	YCbCr representation specified in Recommendation ITU-R BT.709-6, Item 3.4
9-14-9-0	Y’Cb’Cr’ narrow range representation specified in Recommendation ITU-R BT.2020-2, Table 5
9-16-9-0	PQ Y’Cb’Cr’ narrow range representation specified in Recommendation ITU-R BT.2100-2, Table 9
9-16-14-0	PQ ICtCp narrow range representation specified in Recommendation ITU-R BT.2100-2, Table 9
9-18-9-0	HLG Y’Cb’Cr’ narrow range representation specified in Recommendation ITU-R BT.2100-2
9-18-14-0	HLG ICtCp narrow range representation specified in Recommendation ITU-R BT.2100-2

Bibliography

IEC 61966-2-1 + Amd.1, Multimedia systems and equipment – Colour measurement and management – Part 2-1: Colour management – Default RGB colour space – sRGB

Recommendation ITU-R BT.709-6, Parameter values for the HDTV standards for production and international programme exchange

Recommendation ITU-R BT.2020-2, Parameter values for ultra-high definition television systems for production and international programme exchange

Recommendation ITU-R BT.2100-2, Image parameter values for high dynamic range television for use in production and international programme exchange

Supplement 19 to ITU-T H-series Recommendations (10/2019) - Usage of video signal type code points