

SMPTE STANDARD

Dynamic Metadata for Color
Volume Transform –
Core Components



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE ST 2094-1 was prepared by Technology Committee 10E.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

When image essence mastered with High Dynamic Range (HDR) and Wider Color Gamut (WCG) is transformed for presentation on a display having a smaller color volume such as a Standard Dynamic Range (SDR) display, the color volume transform process can be optimized through the use of content-dependent, dynamic color volume transform metadata rather than using only static display color volume metadata.

As the image essence characteristics change from scene to scene, the optimal transform that best reproduces the content creator's artistic intent can change. For example, the color volume transform parameters used for a very dark scene could be quite different from those used for a very bright scene.

As an alternative to archiving and managing multiple, transformed masters, one for each targeted system, the transforms can be represented as metadata synchronized with the images of the HDR master. The metadata is captured or generated as a part of the mastering process, during which images are creatively approved, and later applied as color volume transforms to the HDR master, therefore enabling alternate output encodings in the distribution stage.

Provisions are included for supporting different models of color volume transforms with associated metadata sets, herein called applications. Metadata sets from multiple applications and for multiple targeted systems can coexist, but are individually applied to the HDR master to create one or more output signals. Operational details about use and selection of metadata sets are not part of this document.

Figure 1 shows an example workflow using content-dependent, dynamic color volume transform metadata. In this example, the solid arrows represent the flow of complete image data with or without metadata and the dashed arrows represent the flow of metadata and/or image data from which metadata can be extracted. Two approved image versions are provided, one HDR master and one SDR rendition. Some applications use an actual SDR master. Other applications use an interactive SDR rendering, where, during a grading process, the colorist interactively changes a color volume transform while viewing the resulting image on an SDR display. Content-dependent, dynamic metadata is extracted from the approved versions. Mastering display metadata (such as the color volume and dynamic range) is obtained for the HDR and the SDR reference mastering displays. The metadata is carried (here marked as "+m") with the HDR master content for distribution. On playout, the metadata is utilized to transform the HDR content to the color volume and dynamic range of the consumer display device. The metadata can be applied in the distribution facility for different output media, in a consumer playout device, in the consumer display, or not at all, depending on the needs and capabilities of the distribution channel and consumer equipment.

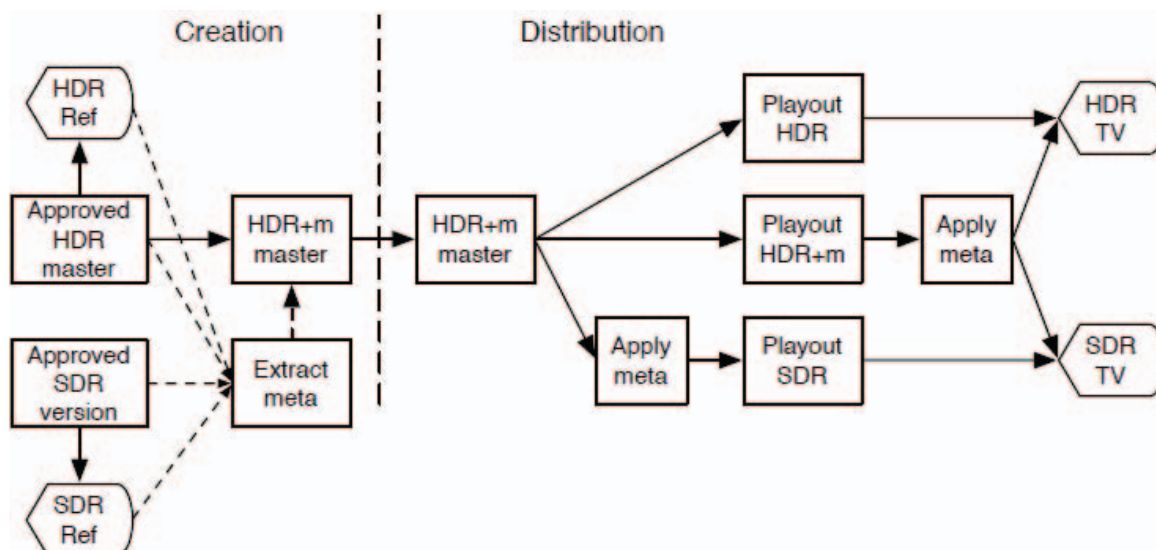


Figure 1 – Example Dynamic Metadata Workflow

1 Scope

The SMPTE ST 2094 suite of documents define metadata for use in color volume transforms of content. The metadata are content-dependent and can vary scene-by-scene or image-by-image. The metadata are intended to transform High Dynamic Range and Wide Color Gamut (HDR/WCG) image essence for presentation on a display having a smaller color volume than that of the mastering display used for mastering the image essence. Multiple applications provide particular color volume transforms.

This standard, a part of the 2094 suite, specifies common definitions, including a transform metadata set, and metadata parameters, for use by other parts of the 2094 suite.

Other parts of the 2094 suite provide representation for carriage and additional application-specific metadata parameters for color volume transforms.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative Reference

The following standard contains provisions which, through reference in this text, constitute provisions of this engineering document. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this engineering document are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

ISO 11664-3:2012 / CIE S 014-3/E:2011, Colorimetry – Part 3: CIE Tristimulus Values