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**Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format — Amendment 2: Support for tone map derived items and other improvements**

Preliminary WD stage

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Foreword

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Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format — Amendment 2: Support for tone map derived items and other improvements

# Coding Constraints box related changes

In clause 7.2.3.4, renumber NOTE2 to NOTE3.

In clause 7.2.3.4, add the following text after NOTE1:

NOTE 2 When a track contains inter-predicted images and the value of all\_ref\_pics\_intra is equal to 0, it is possible for inter-predicted images to be derived from non-intra coded images. In such cases, derived specifications can suggest guidelines for the frequency of sync samples.

Add the following text as a new subclause after subclause 7.2.3.4:

7.2.3.5 Recommendations for CodingConstraintsBox

Encoding image sequences complying with the constraint that either all samples are sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox can be set to one is suggested in the following cases:

1. For ensuring compatibility with players implementing codec brands in annexes B, E, L and M specified in an earlier edition of this document, which required all samples to be sync samples or to have the all\_ref\_pics\_intra field in the CodingConstraintsBox to be equal to 1.
2. In applications and usages where fast random access is essential, the constraint ensures random access to any image in the image sequence by decoding at most up to two images.
3. In image sequences that have an edit list causing backward playback, the constraint makes backward playback possible with an approach that each displayed image is obtained by decoding a compliant bitstream of up to two images.

In clause B.3.2, replace the following paragraph

For a track containing an HEVC image sequence, either all samples shall be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 shall be set to one.

with the following text

For a track containing an HEVC image sequence, either all samples should be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 should be set to one.

NOTE: Clause 7.2.3.5 contains recommendations that are important for backwards compatibility.

In clause E.3.2, replace the following paragraph

For a track containing an AVC image sequence, either all samples shall be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 shall be set to one.

with the following text

For a track containing an AVC image sequence, either all samples should be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 should be set to one.

NOTE: Clause 7.2.3.5 contains recommendations that are important for backwards compatibility.

In clause L.3.2, replace the following paragraph

For a track containing an VVC image sequence, either all samples shall be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in ‎7.2.3 shall be set to one.

with the following text

For a track containing an VVC image sequence, either all samples should be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 should be set to one.

NOTE: Clause 7.2.3.5 contains recommendations that are important for backwards compatibility.

In clause M.3.2, replace the following paragraph

For a track containing an EVC image sequence, either all samples shall be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in ‎7.2.3 shall be set to one.

with the following text

For a track containing an EVC image sequence, either all samples should be sync samples or the all\_ref\_pics\_intra field in the CodingConstraintsBox specified in 7.2.3 should be set to one.

NOTE: Clause 7.2.3.5 contains recommendations that are important for backwards compatibility.

# New tone-map derivation item

Add the following new subclause after subclause 6.6.2.3:

EDITORS NOTE:The 21496-1 document is under active development and a recent 21496-1 draft proposal suggest that the text below is outdated. It will be updated once the outcome of the Tokyo TC42 meeting in February is known.

EDITORS NOTE2: There was agreement during MPEG 145 to add an example file outline to Annex J. This is probably best done after the Tokyo TC42 meeting, when we know how the 'tmap' box will change. There was also agreement that we should add a brand to indicate that a file contains a 'tmap' item, but no concrete proposal on where to place it or what it should look like. Both of these should be addressed in a future update to this text.

## Tone-map derivation

### 6.6.2.4.1 Definition

An item with an item\_type value of 'tmap' defines a derived image item whose reconstructed image is formed from one base input image and a secondary input image that will be referred to as a gain map input image.

The input images are given by the SingleItemTypeReferenceBox/ SingleItemTypeReferenceBoxLarge of type 'dimg' for this derived image item within the ItemReferenceBox. In the SingleItemTypeReferenceBox/ SingleItemTypeReferenceBoxLarge of type 'dimg', the value of from\_item\_ID identifies the derived image item of type 'tmap', the value of reference\_count shall be equal to 2, and the values of to\_item\_ID identify the input images, of which the first shall be the base input image and the second shall be the gain map input image. The gain map input image may have different dimensions than the base as documented in ISO 21496-1 section 4.2.

Reconstruction is done by applying the gain map to the base image according to ISO 21496-1 section 6. As described in ISO 21496-1 section 6.3, the gain map may be scaled by a weight during application to adjust for local viewing conditions.

The base input image shall be associated with a 'colr' item property. This corresponds to the colorimetry metadata described in ISO 21496-1 section 5.3.1.

The gain map input image shall be associated with a 'colr' item property of type 'nclx' which indicates any transformations that the encoder has done to improve compression. In this item property, colour\_primaries and transfer\_characteristics shall be set to 2.

EDITORS NOTE: A question has been raised on whether transfer\_characteristics should be set to 2, 2 or 8, or 8. Input contributions on this are welcome. The justifications for mandating a value of 2 was:  
1. A value of 8 could be confusing since that might give the impression that the 21496-1 gamma field is also 1.0, whereas a value of 2 more clearly communicates that "gamma is handled elsewhere, do nothing".  
2. It would be confusing to have the color primaries be 2 but transfer characteristics not be 2.

A 'tmap' derived item shall be associated with a 'colr' item property. This corresponds to the colorimetry metadata described in ISO 21496-1 section 5.3.2, which describes the colour properties of the reconstructed image if the gain map input item is fully applied according to ISO 21496-1 section 6.3.

When a 'tmap' derived item is the input to another derived item, that derived item shall treat the reconstructed image of the 'tmap' derived item as if the gain map has been fully applied and has the colour properties of the 'colr' item property associated with the 'tmap' derived item.

The base input image and the 'tmap' derived item should be associated with 'clli' item properties as appropriate to further document the optimal viewing conditions of each representation.

A 'tmap' derived item should be associated with a PixelInformationProperty item property. This property provides a hint to decoders on the approximate amount of colour resolution available after fully applying the gain map.

The number of channels in the gain map input item may be different than the number of channels in the channels field in the body of the 'tmap' derived item. If the gain map input item is single channel while the channels field is multi-channel, the gain map input item shall be treated as if it has three identical colour channels. If the gain map input item is multi-channel while the channels field is single channel, the channels field shall be treated as if it is multi-channel with identical values for all channels.

The gain map input image should be marked as hidden by setting (flags & 1) equal to 0 in its infe entry.

NOTE: Backwards compatibility with parsers that do not support the tone-map derivation can be achieved by placing the base input image item and the 'tmap' derived item in an 'altr' entity group.

### Syntax

struct SignedRational {  
 signed int(32) numerator;  
 unsigned int(32) denominator;  
}

struct UnsignedRational {  
 unsigned int(32) numerator;  
 unsigned int(32) denominator;  
}

struct ToneMapChannelCommonDenominator {  
 int(32) gain\_map\_min\_numerator;  
 int(32) gain\_map\_max\_numerator;  
 unsigned int(32) gamma\_numerator;  
 int(32) base\_offset\_numerator;  
 int(32) alternate\_offset\_numerator;  
}

struct ToneMapChannel {  
 SignedRational gain\_map\_min;  
 SignedRational gain\_map\_max;  
 UnsignedRational gamma;  
 SignedRational base\_offset;  
 SignedRational alternate\_offset;  
}

aligned(8) class ToneMapImage {  
 unsigned int(8) version = 0;  
 if(version == 0) {  
 unsigned int(8) flags;  
 // temp/nonparsable variable  
 int channel\_count = (flags & 1)\*2 + 1;  
 Boolean use\_base\_colour\_space = (flags & 2) != 0;  
 Boolean use\_common\_denominator = (flags & 4) != 0;  
 if (use\_common\_denominator) {  
 unsigned int(32) common\_denominator;  
 unsigned int(32) base\_hdr\_headroom\_numerator;  
 unsigned int(32) alternate\_hdr\_headroom\_numerator;  
 ToneMapChannelCommonDenominator channels[channel\_count];  
 }  
 else {  
 UnsignedRational base\_hdr\_headroom;  
 UnsignedRational alternate\_hdr\_headroom;  
 ToneMapChannel channels[channel\_count];  
 }  
 }  
}

### Semantics

version shall be equal to 0. Readers shall not process a ToneMapImage with an unrecognized version number.

(flags & 1) equal to 1 specifies that the channel count of the gain map per-channel metadata is 3, while a value of 0 specifies that the channel count is 1.

(flags & 2) equal to 2 specifies that the colour space of the base input shall be used as the gain map application space as described in ISO 21496-1 section 5.3.3. If not equal to 2, the colour space of the 'tmap' derived item is used as the gain map application space instead.

(flags & 4) equal to 4 specifies that all rational fields in the 'tmap' metadata share a common denominator.

common\_denominator expresses a common denominator shared by all metadata fields. common\_denominator shall not be 0.

channels specifies the per-channel metadata. If multi-channel, the order of the channels is R, G, B.

base\_hdr\_headroom\_numerator specifies the numerator of the Baseline HDR headroom (ISO 21496-1 section 5.2.9) when common\_denominator is used.

base\_hdr\_headroom specifies the numerator and denominator of the Baseline HDR headroom (ISO 21496-1 section 5.2.9) when common\_denominator is not used. base\_hdr\_headroom.denominator shall not be 0.

alternate\_hdr\_headroom\_numerator specifies the numerator of the Alternate HDR headroom (ISO 21496-1 section 5.2.10) when common\_denominator is used.

alternate\_hdr\_headroom specifies the numerator and denominator of the Alternate HDR headroom (ISO 21496-1 section 5.2.10) when common\_denominator is not used. alternate\_hdr\_headroom.denominator shall not be 0.

gain\_map\_min\_numerator specifies the numerator of the Per component gain map min value (ISO 21496-1 section 5.2.4) when common\_denominator is used.

gain\_map\_min specifies the numerator and denominator of the Per component gain map min value (ISO 21496-1 section 5.2.4) when common\_denominator is not used. gain\_map\_min.denominator shall not be 0.

gain\_map\_max\_numerator specifies the numerator of the Per component gain map max value (ISO 21496-1 section 5.2.5) when common\_denominator is used.

gain\_map\_max specifies the numerator and denominator of the Per component gain map max value (ISO 21496-1 section 5.2.5) when common\_denominator is not used. gain\_map\_max.denominator shall not be 0.

gamma\_numerator specifies the numerator of the Per component gamma value (ISO 21496-1 section 5.2.8) when common\_denominator is used.

gamma specifies the numerator and denominator of the Per component gamma value (ISO 21496-1 section 5.2.8) when common\_denominator is not used. gamma.denominator shall not be 0.

base\_offset\_numerator specifies the numerator of the Per component baseline offset (ISO 21496-1 section 5.2.6) when common\_denominator is used.

base\_offset specifies the numerator and denominator of the Per component baseline offset (ISO 21496-1 section 5.2.6) when common\_denominator is not used. base\_offset.denominator shall not be 0.

alternate\_offset\_numerator specifies the numerator of the Per component alternate offset (ISO 21496-1 section 5.2.7) when common\_denominator is used.

alternate\_offset specifies the numerator and denominator of the Per component alternate offset (ISO 21496-1 section 5.2.7) when common\_denominator is not used. alternate\_offset.denominator shall not be 0.

# New colour format enhancement derived item

Add the following new subclause after subclause 6.6.2.4:

## Colour format enhancement derivation

### Definition

An item with an item\_type value of 'cfen' is a colour format enhancement derived image item whose reconstructed image is formed from one or more input images that carry components in the luma plane that are used to reconstruct a picture with an enhanced colour format.

The input images are ordered using the reference type 'dimg' for this colour format enhancement derived image item within the ItemReferenceBox, where the value of from\_item\_ID identifies the colour format enhancement derived image item, and the values of to\_item\_ID identify the input images. The reference\_count gives the number of input image items and shall be greater or equal to one.

The colour format enhancement derived image item shall:

* have a Pixel Information property, an Image Spatial Extents property, and a Colour Information property with colour\_type set to 'nclx'.

EDITORS NOTE: Version 1 of 'pixi' property could be mandated for the use with 'cfen'.

The input image item(s):

* shall not signal duplicate entries for channel\_id greater than 1.
* shall each have a Pixel Information property and an Image Spatial Extents property.
* can have a Colour Information property that shall match the signaling from the Colour Information property of the colour formant enhancement derived image item.

EDITORS NOTE: It should be investigated if this restriction should only apply for version 0 of 'cfen'

The colour format enhancement derived image item should be signaled as a displayable item. The first entry signaled by the reference\_count array may be signaled as a displayable item. All remaining items signaled by the reference\_count array shall be hidden.

NOTE: Both, the colour format enhancement derived image item and the first entry signaled by the reference\_count array can be incorporated into an 'altr' alternative group to signify that both image items are interlinked alternatives of each other. The colour format enhancement derived image item can be signaled as the first item in the 'altr' alternative group to allow backwards compatibility, while the second item in the group can store a 4:2:0 coded image.

### Syntax

aligned(8) class ColourFormatEnhancement {  
 unsigned int(8) version = 0;  
 for (i=0; i<reference\_count; i++) {  
 bit(7) reserved = 0;  
 unsigned int(1) is\_packed\_flag;  
 if(is\_packed\_flag == 1) {  
 // packed replacement of components  
 unsigned int(3) num\_cols\_minus1;  
 unsigned int(3) num\_rows\_minus1;  
 unsigned int(5) hor\_guard\_band\_log2;  
 unsigned int(5) ver\_guard\_band\_log2;  
 for(i=0; i<num\_cols\_minus1+num\_rows\_minus1+2; i++) {  
 unsigned int(8) channel\_id;  
 }  
 }  
 else {  
 unsigned int(8) channel\_id;  
 }  
 }  
}

### Semantics

version shall be equal to 0.

is\_packed\_flag this flag determines if the picture channels are packed in the referenced image item. When set to 1 the picture channels are packed into the first channel, i.e. the luma channel, using a packing method based on a matrix. When set to 0 the picture channels are stored in separate image items.

num\_cols\_minus1 plus 1 specifies the number of columns partitioning the picture.

num\_rows\_minus1 plus 1 specifies the number of rows partitioning the picture.

hor\_guard\_band\_log2 specifies if a horizontal guard band region is present between two picture channels and, if present, its size. If hor\_guard\_band\_log2 is equal to 0, then no horizontal guard band is present. If hor\_guard\_band\_log2 is larger than 0, then the horizontal guard band between two picture channels is equal to (1 << hor\_guard\_band\_log2).

ver\_guard\_band\_log2 specifies if a vertical guard band region is present between two picture channels and, if present, its size. If ver\_guard\_band\_log2 is equal to 0, then no vertical guard band is present. If ver\_guard\_band\_log2 is larger than 0, then the vertical guard band between two picture channels is equal to (1 << ver\_guard\_band\_log2).

channel\_id provides the identifier for the channel for the referenced items.

|  |  |  |
| --- | --- | --- |
| channel\_id | Mapping (depending on the 'colr' box) | |
| 0 | Unused | |
| 1 | Unspecified | |
| 2 | Y | R |
| 3 | Cb | G |
| 4 | Cr | B |
| 5 | Alpha | |
| 6 | Depth | |
| 7-255 | Reserved for future use. | |

# New constrained extents grid property

Add the following new subclause after subclause 6.5.36:

## Constrained Extents Grid Property

### Definition

Box type: 'cexg'

Property type: Descriptive item property

Container: ItemPropertyContainerBox

Mandatory (per item): No

Quantity (per item): At most one

The ConstrainedExtentsGridProperty descriptive item property indicates that each extent of the associated image item in the itemLocationBox is constrained to enclose data units of the item that are extractable as a contiguous byte range and are independently decodable and renderable as image tiles.

All data units or properties required to configure the decoder and decode an image tile shall be declared in the decoder configuration and initialization properties associated with the image item.

The reconstructed image of the associated image item is formed from one or more image tiles in a given grid order within a larger canvas.

The image tiles corresponding to the extents are inserted in row-major order, top-row first, left to right, in the order of the extents for the associated image item within the ItemLocationBox. The value of extent\_count within the ItemLocationBox shall be equal to (1+rows\_minus\_one)\*(1+columns\_minus\_one). All image tiles shall have exactly the same width and height, image\_tile\_width and image\_tile\_height. The reconstructed image is formed by tiling the image tiles into a grid with a column width equal to image\_tile\_width and a row height equal to image\_tile\_height, without gap or overlap. The grid of image tiles shall completely “cover” the reconstructed image of the associated image item, where image\_tile\_width\*columns is greater than or equal to image\_width and image\_tile\_height\*rows is greater than or equal to image\_height, where image\_width and image\_height are signalled in the ImageSpatialExtentsProperty associated with the image item.

### Syntax

aligned(8) class ConstrainedExtentsGridProperty  
extends ItemFullProperty('cexg', version = 0, flags) {  
 // this is a temporary,non-parsable variable  
 unsigned int FieldLength = ((flags & 1) + 1) \* 16;  
 unsigned int(16) rows\_minus\_one;  
 unsigned int(16) columns\_minus\_one;  
 unsigned int(FieldLength ) image\_tile\_width;  
 unsigned int(FieldLength ) image\_tile\_height;  
}

### Semantics

(flags & 1) equals to 0 specifies that the length of the fields image\_tile\_width and image\_tile\_height is 16 bits. (flags & 1) equals to 1 specifies that the length of the fields image\_tile\_width and image\_tile\_height is 32 bits. The values of flags greater than 1 are reserved.

image\_tile\_width, image\_tile\_height: specify respectively the width and height in pixels of the image tiles.

rows\_minus\_one, columns\_minus\_one: specify the number of rows of image tiles, and the number of image tiles per row. The value is one less than the number of rows or columns respectively. Image tiles enclosed in extents populate the top row first, followed by the second row and following rows, in the order of extents.

# New disparity adjustment information property

Add the following new subclause after subclause 6.5.37:

## Disparity adjustment information

### Definition

|  |  |
| --- | --- |
| Box type: | 'dadj' |
| Property type: | Descriptive item property |
| Container: | ItemPropertyContainerBox |
| Mandatory (per associated identifier value): | No |
| Quantity (per associated identifier value): | At most one |
|  |  |

The disparity adjustment descriptive item property defines the suggested global disparity adjustment amount for a stereo pair.

This item property should only be associated with an item or entity group that describes a stereo pair. If associated with a stereo pair entity group, the FileTypeBox or the ExtendedTypeBox associated with the FileTypeBox shall indicate that the requirements of the 'unif' brand apply in the file.

EDITORS NOTE: See TuC on frame-packed stereo items

### Syntax

aligned(8) class DisparityAdjustmentProperty  
extends ItemFullProperty('dadj', version = 0, flags = 0) {  
 signed int(32) disparity\_adjustment;  
}

### Semantics

disparity\_adjustment in units of 1/10000 image widths. Positive values denote increased disparity with respect to parallel view direction.

# New HDR signaling aligning with ISO 22028-5

Add the following new subclauses after subclause 6.5.38:

EDITORS NOTE: Do we need these properties for video as well?

## Reference viewing environment

### Definition

|  |  |
| --- | --- |
| Box type: | 'reve' |
| Property type: | Descriptive item property |
| Container: | ItemPropertyContainerBox |
| Mandatory (per item): | No |
| Quantity (per item): | At most one |

The reference viewing environment applies to display-viewing colorimetry, not to scene-referred colorimetry. It specifies the luminance and chromaticity parameters for the “surround” and “periphery” of the display. The “surround” is the area surrounding a display that can affect the adaptation of the eye, typically the wall or curtain behind the display, while “periphery” is the remaining environment outside of the surround.

### Syntax

class ReferenceViewingEnvironmentBox extends ItemFullProperty('reve', 0, 0){  
 unsigned int(32) surround\_luminance;  
 unsigned int(16) surround\_light\_x;  
 unsigned int(16) surround\_light\_y;  
 unsigned int(32) periphery\_luminance;  
 unsigned int(16) periphery\_light\_x;  
 unsigned int(16) periphery\_light\_y;  
}

### Semantics

surround\_luminance specifies the luminance of the surround in units of 0.0001 candelas per square metre.

[Ed. note]: disallowing 0 could be considered.

surround\_light\_x and surround\_light\_y specify the normalized x and y chromaticity coordinates, respectively, of the environmental reference surround light in the nominal viewing environment. These parameters are according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15) and are in normalized increments of 0.0001. The values of surround\_light\_x and surround\_light\_y shall be in the range of 0 to 10 000, inclusive.

periphery\_luminance specifies the luminance of the periphery in units of 0.0001 candelas per square metre.

[Ed. note]: disallowing 0 could be considered.

periphery\_light\_x and periphery\_light\_y specify the normalized x and y chromaticity coordinates, respectively, of the environmental reference periphery light in the nominal viewing environment. These parameters are according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15) and are in normalized increments of 0.0001. The values of periphery\_light\_x and periphery\_light\_y shall be in the range of 0 to 10 000, inclusive.

## Nominal Diffuse White

### Definition

|  |  |
| --- | --- |
| Box type: | 'ndwt' |
| Property type: | Descriptive item property |
| Container: | ItemPropertyContainerBox |
| Mandatory (per item): | No |
| Quantity (per item): | At most one |

### Syntax

class NominalDiffuseWhiteBox extends ItemFullProperty('ndwt', 0, 0){  
 unsigned int(32) diffuse\_white\_luminance;  
 unsigned int(16) diffuse\_white\_light\_x;  
 unsigned int(16) diffuse\_white\_light\_y;  
}

### Semantics

diffuse\_white\_luminance indicates the default nominal diffuse white luminance in units of 0.0001 candelas per square metre.

[Ed. note]: disallowing 0 could be considered.

diffuse\_white\_light\_x and diffuse\_white\_light\_y specify the normalized x and y chromaticity coordinates, respectively, of the environmental reference periphery light in the nominal viewing environment. These parameters are according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15) and are in normalized increments of 0.0001. The values of periphery\_light\_x and periphery\_light\_y shall be in the range of 0 to 10 000, inclusive and should be the same as the chromaticity coordinates of the white point of the content.

[Ed. note]: We could also add a note mentioning that values diffuse\_white\_light\_x = 3 127 and diffuse\_white\_light\_y = 3 290 could be used to signal D65.

# Unified identifier handling clarifications

Replace the word "item\_ID" in clauses 6.5.27.1, 6.5.18.1, 6.5.19.1, 6.5.35.1 with the phrase "identifier value"

Append the following text as a new paragraph in clauses 6.5.27.1, 6.5.18.1, 6.5.19.1, 6.5.35.1:

If this property is associated with an entity group, the FileTypeBox or the ExtendedTypeBox associated with the FileTypeBox shall indicate that the requirements of the 'unif' brand apply in the file.

# Overview images

Add the following new subclause after subclause 6.4.9:

## Overview images

An overview image is a grid derived image item or a tiled pre-derived coded image item whose reconstructed image is formed from generating a lower resolution, ‘binned’ version of a base image item. The base image item is also a tiled image item. The tiling may be implemented using a feature of a specific codec, or by using a grid derived image item. When a grid derived image item is used, the input items to the grid define the tiles. Derived image items shall not be used as inputs to the image grid, due to the need for in place byte range accessing of content. Individual tiles shall be written contiguously in memory, thereby allowing access with a single read or write action.

A pre-defined coded image representing an overview image or an image item representing the base image that are tiled using a feature of a specific codec shall be stored in such a way that each extent identifies that data range corresponding to a tile, and shall be associated with a ConstrainedExtentsGridProperty indicating the constraint on the extents and describing the tiling grid.

An overview image shall be tiled using the same tiling scheme as the base image, i.e. if tiles in the base image are X by Y pixels, they are X by Y pixels in the overview image. In cases where the binned resolution results in a fractional, or incomplete tile at the end of a row (column), the last tile in a row (column) of tiles shall be padded with the value zero at the end of the row (column) to complete the last tile in the row (column). If necessary, the clean aperture transformative property ('clap') may be applied to crop padded rows and/or columns. The number of tiles in a row (column) of tiles is determined by dividing the width (height) of the overview image by the tile size in X (tile size in Y) and rounding up.

An image pyramid is generated by stacking a series of progressively binned overview images and creating an ImagePyramidEntityGroup. Each overview image is associated with the original full resolution base image, using a reference of type 'base'. The amount of binning of each overview image is indicated in the ImagePyramidEntityGroup. The image format of the overviews is the same as the base image item. i.e. number of bands, bit depth, color format, etc.

Region items associated with the base image may be replicated for individual overviews using an appropriate scaling associated with the level of binning for a particular overview and referenced to the specific overview.

NOTE 1: In this version of the document, the exact derivation process (approaches such as the sum, average, median, minimum, or maximum value of a binned region) used to produce an overview from the base image is left to the implementer.

NOTE 2: When removing (or modifying) an item that is marked as the base image of an overview image, the content of associated image overview items might need to be removed (or rewritten).

Add the following new subclause after subclause 6.8.9:

## Image Pyramid Entity Group

### Definition

Box Type: 'pymd'

Container: GroupsListBox in a MetaBox at file level

Mandatory: No

Quantity: Zero or more

The ImagePyramidEntityGroup indicates a set of image items, formed as a base image item and a series of progressively binned overview image items, which together form an image pyramid.

Each overview image item has a reference to the original full resolution base image item, using a reference of type 'base'.

The ImagePyramidEntityGroup also provides overall information for the individual tiles inside the overview image items and base image item of the image pyramid.

The image format of the overview images shall be the same as the base image (i.e. number of bands, bit depth, color format, etc).

This entity group shall contain entity\_id values that point to a base image item and a set of overview image items and shall contain no entity\_id values that point to tracks. The entities shall be listed in the order of lowest resolution overview image item to the highest resolution overview image item, followed finally by the base image item of the image pyramid.

There may be multiple ImagePyramidEntityGroups in the same file with different group\_id values.

NOTE All the entities of a same ImagePyramidEntityGroup, or only some of them, can also be members of a same entity group of type 'prgr' if they are stored in the file for allowing a progressive refinement. They can also be members of a same entity group of type 'altr' if they are proposed by the content creator as alternatives to be displayed for players not supporting the ImagePyramidEntityGroup.

### Syntax

aligned(8) class ImagePyramidEntityGroup  
extends EntityToGroupBox ('pymd', version = 0, flags = 0) {  
 unsigned int(16) tile\_size\_x;  
 unsigned int(16) tile\_size\_y;  
 for(i=0; i<num\_entities\_in\_group;i++) {  
 unsigned int(16) layer\_binning;  
 unsigned int(16) tiles\_in\_layer\_row\_minus1;  
 unsigned int(16) tiles\_in\_layer\_column\_minus1;  
 }  
}

### Semantics

num\_entities\_in\_group: as defined for EntityToGroupBox. In addition, it also specifies the number of layers of the image pyramid.

tile\_size\_x, tile\_size\_y: indicate the size in pixels of a tile in the width and height dimension, respectively, for all layers of the image pyramid.

layer\_binning: Indicates for each layer of the pyramid the level of binning between the base image and the overview image. A 2x2 binning is defined to be a layer\_binning of 2, a 4x4 binning is defined to be 4, etc. The width and height for an overview image with layer\_binning of 2 is half the width and half the height of the base image, etc. A base image has a layer\_binning of 1.

tiles\_in\_layer\_row\_minus1, tiles\_in\_layer\_column\_minus1: Indicate the number of tiles minus one in a row and a column, respectively, of a specific layer. If the layer is represented by a grid derived image item, tiles\_in\_layer\_row\_minus1 is equal to rows\_minus\_one and tiles\_in\_layer\_column\_minus1 is equal to columns\_minus\_one. If the layer is represented by a tiled pre-derived coded image item with a ConstrainedExtentsGridProperty, then tiles\_in\_layer\_row\_minus1 is equal to rows\_minus\_one and tiles\_in\_layer\_column\_minus1 is equal to columns\_minus\_one.

# Region partition group

Add the following new subclause after subclause 6.8.10:

EDITORS NOTE: How do partitions and pyramids interact?

## Region Partition Group

### Definition

Box Type: 'rgpa'

Container: GroupsListBox in a MetaBox at file level

Mandatory: No  
Quantity: Zero or more

A region partition group lists region items that are contained inside an area of an image. This area is the area covered by the region partition group and is defined as a rectangle in the image.

The region partition group is associated with the image item containing the region items it groups through an item reference of type 'rpds' from the image item to the region partition group.

The area covered by a region partition group is either defined in the region partition group structure itself or is the area of the image item the region partition group is associated with through an item reference of type 'rpds'.

A diagram of a diagram

Description automatically generated with medium confidence

Figure 1: Example of two region partition groups ('rgpa') associated with an image, the area of the top group is the whole image, while the area of the bottom group is the bottom-center part of the image

A region partition group associated with an image item should only contain region items associated with the image item or with another image item that this image item is a part of.

A diagram of a grid

Description automatically generated

Figure 2: Example of two region partition groups ('rgpa') related to a grid, the top group is associated with the grid and its area is the whole image, the bottom group is associated with an input item of the grid and its area is the whole input item

When a region item is contained in a region partition group, at least one of its regions shall intersects the area covered by the region partition group.

A region partition group shall list only region items it contains. A region partition group may list all the region items it contains. A region partition group may list only the region items it contains and that are adapted to being rendered when the rendered size of the area covered by the region partition group is greater than or equal to the display area.

When rendering a part of an image item, a renderer may use region partition groups to select which region items to parse and render. The renderer may use region partition groups matching the area to display. When several region partition groups correspond to the area to render, the renderer may use those matching the scale of the rendered area. The renderer may use region partition groups associated with the image item to render or associated with items corresponding to parts of the image item to render.

When using region partition groups jointly with an image pyramid, the area covered by a region partition group should correspond to the area of a tile of the image pyramid.

### Syntax

aligned(8) class RegionPartitionGroupBox  
extends EntityToGroupBox('rgpa', version, flags) {  
 unsigned int field\_size = ((flags & 1) + 1) \* 16;  
 if (flags & 2 == 2) {  
 unsigned int(field\_size) reference\_width;  
 unsigned int(field\_size) reference\_height;  
 unsigned int(field\_size) top;  
 unsigned int(field\_size) left;  
 unsigned int(field\_size) width;  
 unsigned int(field\_size) height;  
 }  
}

### Semantics

The following flags values are defined to describe the area covered by a group of region annotation items contained in a region partition group:

* Value 0x000001, when set specifies that the length of the fields reference\_width, reference\_height, top, left, width, and height is 32 bits. When not set, it specifies that the length of the fields reference\_width, reference\_height, top, left, width, and height is 16 bits.
* Value 0x000002, when set, specifies that the fields reference\_width, reference\_height, top, left, width, and height are present. When not set, it specifies that the fields reference\_width, reference\_height, top, left, width, and height are not present. In this case, the area covered by the region partition group is the area of the image it is associated with.

reference\_width, reference\_height specify, in pixel units, the width and height, respectively, of the reference space in which the region partition group is specified.

top, left specify the coordinates of the top-left corner of the area covered by the region partition group relatively to the reference space.

width, height specify the coordinates of the width and the height of the area covered by the region partition group relatively to the reference space.

# Change all mention of SingleItemTypeReferenceBox to include SingleItemTypeReferenceBoxLarge

EDITORS NOTE: Once we have the text for HEIF 3ed, make sure that we have not missed any mention of SingleItemTypeReferenceBox.

In subclause 6.6.1 replace:

The number of SingleItemTypeReferenceBoxes with the box type 'dimg' and with the same value of from\_item\_ID shall not be greater than 1.

*With:*

The number of SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge entries with the box type 'dimg' and with the same value of from\_item\_ID shall not be greater than 1.

In subclause 6.6.2.2.1 replace:

The input images are listed in the order they are layered, i.e. the bottom-most input image first and the top-most input image last, in the SingleItemTypeReferenceBox of type 'dimg' for this derived image item within the ItemReferenceBox.

With:

The input images are listed in the order they are layered, i.e. the bottom-most input image first and the top-most input image last, in the SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge of type 'dimg' for this derived image item within the ItemReferenceBox.

In subclause 6.6.2.2.3 replace:

reference\_count is obtained from the SingleItemTypeReferenceBox of type 'dimg' where this item is identified by the from\_item\_ID field.

With:

reference\_count is obtained from the SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge of type 'dimg' where this item is identified by the from\_item\_ID field.

In subclause 6.6.2.3.1 replace:

The input images are inserted in row-major order, top-row first, left to right, in the order of SingleItemTypeReferenceBox of type 'dimg' for this derived image item within the ItemReferenceBox. In the SingleItemTypeReferenceBox of type 'dimg', the value of from\_item\_ID identifies the derived image item of type 'grid', the value of reference\_count shall be equal to rows\*columns, and the values of to\_item\_ID identify the input images.

With:

The input images are inserted in row-major order, top-row first, left to right, in the order of SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge of type 'dimg' for this derived image item within the ItemReferenceBox. In the SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge of type 'dimg', the value of from\_item\_ID identifies the derived image item of type 'grid', the value of reference\_count shall be equal to rows\*columns, and the values of to\_item\_ID identify the input images.

In subclause 6.11.1 replace:

The number of SingleItemTypeReferenceBoxes with the box type 'drgn' and with the same value of from\_item\_ID shall not be greater than 1.

With:

The number of SingleItemTypeReferenceBox or SingleItemTypeReferenceBoxLarge entries with the box type 'drgn' and with the same value of from\_item\_ID shall not be greater than 1.

# Add T.35 metadata to Annex A

In subclause A.1 replace:

This annex specifies the format to store metadata complying with Exif (JEITA CP-3451E), XMP (ISO 16684-1), or MPEG-7 (ISO/IEC 15938-3) in files conforming to the Image File Format. When Exif, XMP, or MPEG-7 metadata is associated with items or tracks conforming to the Image File Format, the metadata shall follow the specifications of this annex. However, it is not required for a reader conforming to this document to understand Exif, XMP, or MPEG-7 metadata.

With:

This annex specifies the format to store metadata complying with Exif (JEITA CP-3451E), XMP (ISO 16684-1), ITU-T T.35, or MPEG-7 (ISO/IEC 15938-3) in files conforming to the Image File Format. When Exif, XMP, ITU-T T.35, or MPEG-7 metadata is associated with items or tracks conforming to the Image File Format, the metadata shall follow the specifications of this annex. However, it is not required for a reader conforming to this document to understand Exif, XMP, ITU-T T.35, or MPEG-7 metadata.

Add the following after subclause A.4:

## A.5 ITU-T T.35 metadata

ITU-T T.35 metadata as specified may be associated with image items using an item type of 'it35' as defined in ISO/IEC 14496-12.

For image sequences, ITU-T T.35 metadata may be embedded within samples and signalled using an ITU-T T.35 sample group or may be stored in an ITU-T T.35 sample group as defined in ISO/IEC 14496-12.

Add the following in the Bibliography:

*[xx]* Recommendation ITU-T T.35*, Procedure for the allocation of ITU-T defined codes for non-standard facilities*