Preamble

AFDI standards reference.

Version 1.0

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Abstract:
This document describes a standard for metadata for distribution of sequences of frames. This work was initiated by and at the IMERSA Best Practices and Standards Summit in Denver in March 2014.

Status of this Document:
First release.

Revision History:
2014-04-03: Version 1.0.
2014-03-26: Release candidate.
2014-03-12: First draft.

Included Standards

Dome Master / Dome Original Metadata Standard for distribution of sequences of frames.

Encoded Movie and Audio file for direct playback.

Goals of the Association of Fulldome Innovators.

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Specification of Dome Master / Dome Original Metadata

Notes

This metadata standard defines an xml schema that should be saved into a file with extension *.dml (dome master markup language / dome original markup language) that accompanies frames in distributions.

The purpose of the metadata is to describe the contents of a hard drive or other distribution medium, and the intention is that a metadata file is associated with all distributed files from all major distributors, old and new titles alike.

Tags

show	
Definition:	Top level element
Notes:	There can only ever be one show element in a metadata file.
Format:	
Example:	<show>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	root

video	
Definition:	Zero or more second level element(s) containing all video related metadata.
Notes:	If the metadata describes source data that include multiple show versions, whether different in resolution, frame rate, revision or any other difference, each such version will be described inside its own video element. Compare to audio element.
Format:	
Example:	<video>
Mandatory:	No
Valid in:	show

videoname	
Definition:	User defined name of the video
Notes:	The name is completely user defined, however a highly descriptive string is recommended.
Format:	xs:string
Example:	<videoname>My Show in 4K, 60 fps</videoname>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	video

framerate	
Definition:	Frames per second
Notes:	Should describe the frequency at which the image is completely redrawn. A stereoscopic image sequence with 60 frames per second for each eye, displayed using either active or passive stereo, should still have this tag set to 60.
Format:	xs:integer
Example:	<framerate>60</framerate>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	video

framecount	

Definition:	Total number of frames in video
Notes:	This optional element should equal the total number of frames that match the naming convention (see path) in all framesequences within the video element. The element is provided to ensure no source data is lost. The element is not mandatory as the information is already available by counting files.
Format:	xs:integer
Example:	<framecount>22000</framecount>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	video

resolution	
Definition:	the square resolution of every frame in every frame sequence
Notes:	Frames must be squares and all squares must be equal resolution. It is up to the implementation to handle variable resolution. The element is not mandatory as the information is already available by inspecting the image file(s).
Format:	xs:integer
Example:	<resolution>2048</resolution>
Mandatory:	No, at most one occurrence in parent element
Valid in:	video

colorbitdepth	
Definition:	number of bits for each pixel in the uncompressed data representation of the file
Notes:	This tag is intended to represent bits per color per pixel in the final pixel data and should not be confused with variable bit depth from chroma subsampling or similar. The element is not mandatory as the information is already available by inspecting the image file(s).
Format:	xs:integer
Example:	<colorbitdepth>8</colorbitdepth>
Mandatory:	No, at most one occurrence in parent element
Valid in:	video

preview	
Definition:	path to a preview encoded movie file for reference
Notes:	This optional element provides a path to a reference movie that a producer may want to ship with source frames, to provide a mechanism for quality control. Producers are encouraged to make previews low resolution, with audio, and include frame count and watermarks. The path is relative to the location of the metadata xml file. Characters that are not legal in filenames in common operating systems such as "?", "%", "*", ":", "|", """, "<", ">" must not be used. Note that characters illegal in xml such as "&", or "'" must be escaped using the normal xml escape syntax. The delimiting character between folders should be slash ("/") or escaped backslash ("\\"). All paths are relative to location of xml file, absolute paths will invalidate the data.
Format:	xs:string
Example:	<preview>preview/1k-video.mp4</preview>
Mandatory:	No
Valid in:	video

frames	
Definition:	parent level element including all frame sequences
Notes:	Element is mandatory, in other words there must be at least one frames element for a video element to be valid.

Format:	
Example:	<frames>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	video

stereoscopic	
Definition:	Left or right eye designation of frames
Notes:	If element is missing, the frames are assumed to be 2D. If element is either "left" or "right" the video element must contain another frames element with the other stereoscopic tag.
Format:	xs:enumeration value="left" | "right"
Example:	<stereoscopic>left</stereoscopic>
Mandatory:	No, at most one occurrence in parent element
Valid in:	frames

framesequence	
Definition:	parent level element for a sequence of image files (frames)
Notes:	
Format:	
Example:	<framesequence>
Mandatory:	Yes
Valid in:	frames

path	
Definition:	path to a folder or a file for image frames
Notes:	Path is a mandatory element inside each framesequence and is written according to the IEEE printf specification with integer format specifiers. At any point in a path, place a %d followed by a number to represent a zero-padded sequence of integers starting from 0. Characters that are not legal in filenames in common operating systems such as "?", "%", "*", ":", "|", """, "<", ">" must not be used. Note that characters illegal in xml such as "&", or "'" must be escaped using the normal xml escape syntax. The delimiting character between folders should be slash ("/") or escaped backslash ("\\"). All paths are relative to location of xml file, absolute paths will invalidate the data. Example: frames/1/video_%05d.png will point to files in the folder 1, relative to the xml metadata file, named 00000.png, 00001.png and so on. Path string must contain exactly one %d format specifier, that represents frame count. The format of the images is not set by this standard. It is up to the encoding system to identify file format from file extension, file headers or any other information. Note on missing frames: if a path points to a folder with sequentially numbered image files, and one image in a sequence is missing, only the files numbered lower than the missing file will be included in the framesequence, which will most likely cause a mismatch between the framecount element and the included frames.
Format:	xs:string
Example:	<path>frames/1/video_%05d.png</path>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	Framesequence

firstframe	
Definition:	first frame number to include in encoding

Notes:	This optional element will tell the encoder what starting frame number is. This number is typically 0 or 1 in the first framesequence, and a much higher number in a second framesequence. The value must contain at most the same number of zero-padding as the format specifier (see path element).
Format:	
Example:	<firstframe>0</firstframe>
Mandatory:	No, at most one occurrence in parent element
Valid in:	framesequence

lastframe	
Definition:	Last frame number to include in encoding
Notes:	This optional element will tell the encoder what the ending frame number is. If left out, all consecutively numbered frames that match the path should be included by the system. Frames with a higher frame number than this element should be ignored by the system.
Format:	
Example:	<lastframe>10000</lastframe>
Mandatory:	No, at most one occurrence in parent element
Valid in:	framesequence

audio	
Definition:	Zero or more second level element(s) containing all audio related metadata.
Notes:	If the metadata describes source data that include multiple show versions, whether different in sample rate, mix, language or any other difference, each such version will be described inside its own audio element. Compare to video element.
Format:	
Example:	<audio>
Mandatory:	No
Valid in:	show

audioname	
Definition:	User defined name of the audio
Notes:	The name is completely user defined, however a highly descriptive string is recommended.
Format:	xs:string
Example:	<audioname>My Show in 5.1 English</audioname>
Mandatory:	No, at most one occurrence in parent element
Valid in:	audio

pictureframerate	
Definition:	the intended video framerate for which the audio is produced
Notes:	This mandatory tag describes the framerate of the video that matches the audio. Different lengths of audio and video will not invalidate the metadata, but it is assumed that the first sample of the audio is intended to match the first frame of the video.
Format:	xs:decimal
Example:	<pictureframerate>30.0</pictureframerate>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	audio

language	
Definition:	An IETF BCP 47 language tag.

Notes:	This mandatory element describes the language of the audio element. All channels within an audio element have the same language indicator. This standard includes and fully supports the ISO 639-2 standard.
Format:	
Example:	<language>en</language>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	audio

channel	
Definition:	parent level element per audio channel
Notes:	At least one channel element must be present in every audio element.
Format:	
Example:	<channel>
Mandatory:	Yes
Valid in:	audio

speaker	
Definition:	enumeration of speakers
Notes:	Mapping of channel to speaker, according to enumeration limited to: SPEAKER_FRONT_LEFT SPEAKER_FRONT_CENTER SPEAKER_FRONT_RIGHT SPEAKER_LOW_FREQUENCY SPEAKER_BACK_LEFT SPEAKER_BACK_RIGHT SPEAKER_FRONT_LEFT_OF_CENTER SPEAKER_FRONT_RIGHT_OF_CENTER SPEAKER_BACK_CENTER SPEAKER_SIDE_LEFT SPEAKER_SIDE_RIGHT SPEAKER_LEFT_HIGH SPEAKER_RIGHT_HIGH STEREO_MIX Each enumeration represents a single speaker (SPEAKER_FRONT_LEFT, SPEAKER_FRONT_RIGHT, SPEAKER_FRONT_CENTER, SPEAKER_LOW_FREQUENCY, SPEAKER_BACK_LEFT, SPEAKER_BACK_RIGHT represents a standard 5.1 configuration). The exception is STEREO_MIX, through which producers can provide a multiplexed stereo audio track.
Format:	xs:enumeration
Example:	<speaker>SPEAKER_FRONT_LEFT</speaker>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	channel

path	
Definition:	Audio file path of the channel, path relative to location of xml metadata file
Notes:	This standard imposes no limitations on file formats. It is up to each implementation to support and identify formats based on file extension, headers or by other means. Characters that are not legal in filenames in common operating systems such as "?", "%", "*", ":", "|", """, "<", ">" must not be used. Note that characters illegal in xml such as "&", or "'" must be escaped using the normal xml escape syntax. The delimiting character between folders should be slash ("/") or escaped

	backslash ("\\"). All paths are relative to location of xml file, absolute paths will invalidate the data.
Format:	
Example:	<path>audio/surround/LFE.wav</path>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	channel

subtitles	
Definition:	One or more second level element(s) containing subtitles
Notes:	Element is optional. If more than one subtitles elements are present, they must be uniquely identified by their language element and two subtitle elements with the same language tag invalidates the xml.
Format:	
Example:	<subtitles>
Mandatory:	No
Valid in:	show

path	
Definition:	path to a supported subtitles file
Notes:	Path is mandatory in every subtitles element. This standard makes no recommendations or suggestions as to how subtitles should be provided. It is up to the implementation to identify format from file extension, headers or by other means. Characters that are not legal in filenames in common operating systems such as "?", "%", "*", ":", "|", """, "<", ">" must not be used. Note that characters illegal in xml such as "&", or "'" must be escaped using the normal xml escape syntax. The delimiting character between folders should be slash ("/") or escaped backslash ("\\"). All paths are relative to location of xml file, absolute paths will invalidate the data.
Format:	
Example:	<path>subtitles/german.srt</path>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	subtitles

language	
Definition:	An IETF BCP 47 language tag.
Notes:	This mandatory element describes the language of the audio element. All channels within an audio element have the same language indicator. This standard includes and fully supports the ISO 639-2 standard.
Format:	
Example:	<language>en</language>
Mandatory:	Yes, at most one occurrence in parent element
Valid in:	subtitles

information	
Definition:	A single second level element(s) containing information from the producer.
Notes:	Optional element to allow producers to add notes to the metadata.
Format:	
Example:	<information>
Mandatory:	No, at most one occurrence in parent element
Valid in:	show

producer	
Definition:	String identifying the producer of the show
Notes:	
Format:	xs:string
Example:	<producer>Studio Name</producer>
Mandatory:	No, at most one occurrence in parent element
Valid in:	notes

copyright	
Definition:	String identifying the copyright terms of the show
Notes:	
Format:	xs:string
Example:	<copyright>Legal notice</copyright>
Mandatory:	No, at most one occurrence in parent element
Valid in:	notes

publicationdate	
Definition:	Date of publication of the show with metadata
Notes:	
Format:	xs:date
Example:	<notes>Misc notes</notes>
Mandatory:	No
Valid in:	notes

description	
Definition:	String with misc notes from producer, intended for display to end user.
Notes:	
Format:	xs:string
Example:	<description>Misc notes about the show itself</description>
Mandatory:	No
Valid in:	notes

Schema

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://domestandards.org/">
    <xs:element name="show">
        <xs:complexType>
            <xs:sequence>
                <xs:element name="video" minOccurs="0" maxOccurs="unbounded">
                    <xs:complexType>
                        <xs:sequence>
                            <xs:element name="videoname" type="xs:string"/>
                            <xs:element name="framerate" type="xs:decimal"/>
                            <xs:element name="framecount" type="xs:integer"/>
                            <xs:element name="resolution" type="xs:integer" minOccurs="0"/>
                            <xs:element name="frames">
                                <xs:complexType>
                                    <xs:sequence>
                                        <xs:element name="stereoscopic" minOccurs="0">
                                            <xs:simpleType>
                                                <xs:restriction base="xs:string">
                                                        <xs:enumeration value="left"/>
                                                        <xs:enumeration value="right"/>
                                                </xs:restriction>
                                            </xs:simpleType>
                                        </xs:element>
                                        <xs:element name="framesequence" maxOccurs="unbounded">
                                            <xs:complexType>
```

```xml
                        <xs:sequence>
                            <xs:element name="path" type="xs:string"/>
                            <xs:element name="firstframe" type="xs:integer" minOccurs="0"/>
                            <xs:element name="lastframe" type="xs:integer" minOccurs="0"/>
                        </xs:sequence>
                      </xs:complexType>
                    </xs:element>
                  </xs:sequence>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="audio" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="audioname" type="xs:string"/>
              <xs:element name="pictureframerate" type="xs:decimal"/>
              <xs:element name="language" type="xs:string"/>
              <xs:element name="channel" maxOccurs="unbounded">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="speaker">
                      <xs:simpleType>
                        <xs:restriction base="xs:string">
                          <xs:enumeration value="SPEAKER_FRONT_LEFT"/>
                          <xs:enumeration value="SPEAKER_FRONT_CENTER"/>
                          <xs:enumeration value="SPEAKER_FRONT_RIGHT"/>
                          <xs:enumeration value="SPEAKER_LOW_FREQUENCY"/>
                          <xs:enumeration value="SPEAKER_BACK_LEFT"/>
                          <xs:enumeration value="SPEAKER_BACK_RIGHT"/>
                          <xs:enumeration value="SPEAKER_FRONT_LEFT_OF_CENTER"/>
                          <xs:enumeration value="SPEAKER_FRONT_RIGHT_OF_CENTER"/>
                          <xs:enumeration value="SPEAKER_BACK_CENTER"/>
                          <xs:enumeration value="SPEAKER_SIDE_LEFT"/>
                          <xs:enumeration value="SPEAKER_SIDE_RIGHT"/>
                          <xs:enumeration value="SPEAKER_LEFT_HIGH"/>
                          <xs:enumeration value="SPEAKER_RIGHT_HIGH"/>
                          <xs:enumeration value="STEREO_MIX"/>
                        </xs:restriction>
                      </xs:simpleType>
                    </xs:element>
                    <xs:element name="path" type="xs:string"/>
                  </xs:sequence>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="subtitles" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="path" type="xs:string" minOccurs="0"/>
              <xs:element name="language" type="xs:string" minOccurs="0"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="information" minOccurs="0" maxOccurs="unbounded">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="producer" type="xs:string" minOccurs="0"/>
              <xs:element name="copyright" type="xs:string" minOccurs="0"/>
              <xs:element name="publicationdate" type="xs:date" minOccurs="0"/>
              <xs:element name="description" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Encoded Movie and Audio file for direct playback.

The Encoded Movie and Audio file for direct playback is a standard to allow sharing of medium resolution media for direct playback without pre-processing, across sites using any compliant system.

Video codec: MPEG2 with Hi420 profile (for maximum backward compatibility)

Audio codec: AAC in stereo or 5.1

Container: MPEG

Maximum bit rate: Not included in specification

Source resolution: 2048x2048, 8 bits x 3 channels

Legal notice: Producers should be aware that this standard does not include encryption.

Roadmap

Topics under consideration include;

- <framesequencepatch> element to describe subsets of frames, customized for example to local cultures, languages or metrics, that can replace original frames.
- <metadatapath> element to allow inclusion of one metadata file in another.
- Adding SPEAKER_ZENITH enumeration to the <speaker> element.
- Describing audio duration using <time> tag rather than the current <pictureframerate> tag that is used to describe the framerate at which the producer intended the audio to match (the specification does not require audio and video to be of identical length).
- Recommended 2k pre-encoded codec, as a quality vs. backwards compatibility trade-off.

In the future, this standard might evolve into another container such as MKV with a standard for containing additional assets, subtitles, etc, and also including encryption and licensing data.