**INTERNATIONAL ORGANISATION FOR STANDARDISATION**

**ORGANISATION INTERNATIONALE DE NORMALISATION**

**ISO/IEC JTC1/SC29/WG11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC1/SC29/WG11 m53482**

**April 2020, Electronic Meeting**

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| **Source** | **InterDigital Communications, Inc.** |
| **Status** | **Input** |
| **Title** | **[PCC Systems] On Carriage of Multiple Atlas Streams in MPEG-I Part 10** |
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| **Agenda** | 33.1 |

# Introduction

The draft text of ISO/IEC DIS 23090-10 [1] includes support for partial access within a V-PCC sequence based on spatial sub-division of the 3D space. However, a V-PCC bitstream may include more than one atlas sub-bitstream. It may therefore be desirable to provide support for accessing a subset of the available atlases in the bitstream in applications that utilize a multi-atlas bitstream. One approach to provide this support was proposed in ‎[2] during the ad-hoc group meeting of the PCC Systems group in March 2020. However, that proposal introduces a new track for carrying a special atlas sub-bitstream and allows having multiple V-PCC tracks for the same CPCS. This introduces significant changes to the current file format design in the draft text of ISO/IEC DIS 23090-10 and changes the entry point to the CPCS in the container.

In this contribution we propose an alternative approach that maintains a single V-PCC track as the entry point for the CPCS bitstream in ISOBMFF containers and introduces a new track type for tracks carrying atlas information.

# Proposed Solution

When the V-PCC bitstream has more than one atlas sub-bitstream, each atlas sub-bitstream is

carried in a separate track called an atlas track. The atlas track carries only atlas NAL units that belong to the particular atlas sub-bitstream associated with the track. If the atlas sub-bitstream associated with an atlas track contains multiple atlas tile groups, NAL units associated with one or more of the tile groups may be carried in a separate atlas tile group track ‎[3].

When atlas sub-bitstreams of a V-PCC bitstream are carried in separate atlas tracks, the V-PCC track shall contain track references of a certain type, defined using a 4CC (e.g., 'pccs'), to each of the atlas tracks. This links the main track to the atlas tracks.

## V-PCC Atlas Tracks

A V-PCC atlas track is identified by a VPCCAtlasSampleEntry sample description. The sample entry type for a V-PCC atlas track shall be 'vpa1' or 'vpag'. The definition of VPCCAtlasSampleEntry is as follows:

Sample Entry Type: 'vpa1', 'vpag'   
Container: Sample Description Box ('stsd')  
Mandatory: A 'vpa1' or 'vpag' sample entry is mandatory  
Quantity: One or more sample entries may be present

class VPCCAtlasSampleEntry() extends VolumetricSampleEntry ('vpa1'){  
 VPCCAtlasConfigurationBox config(); // optional  
}

class VPCCAtlasConfigurationBox extends Box('vpaC') {  
 VPCCAtlasConfigurationRecord() vpccAtlasConfig;  
}

aligned(8) class VPCCAtlasConfigurationRecord {  
 unsigned int(8) configurationVersion = 1;  
 unsigned int(2) lengthSizeMinusOne;  
 bit(6) reserved = 1;  
 unsigned int(8) numOfSetupUnitArrays;  
 for (j=0; j < numOfSetupUnitArrays; j++) {  
 bit(1) array\_completeness;  
 bit(1) reserved = 0;  
 unsigned int(6) NAL\_unit\_type;  
 unsigned int(8) numNALUnits;  
 for (i=0; i < numNALUnits; i++) {  
 unsigned int(16) SetupUnitLength;  
 nal\_unit(SetupUnitLength) setupUnit; // as defined in ISO/IEC 23090-5  
 }  
 }  
}

This sample entry describes media samples of a V-PCC atlas track. The VPCCAtlasSampleEntry shall not contain any VPCCConfigurationBox; this box is found in the main V-PCC track's sample description. Other optional boxes may be included.

The semantics of the fields in VPCCAtlasSampleEntry are:

compressorname in the base class VolumetricSampleEntry indicates the name of the compressor used with the value "\013VPCC Coding" being recommended; the first byte is a count of the remaining bytes, here represented by \013, which (being octal 13) is 11 (decimal), the number of bytes in the rest of the string.

lengthSizeMinusOne plus 1 indicates the length in bytes of the NALUnitLength field in a sample in the atlas stream to which this configuration record applies. For example, a size of one byte is indicated with a value of 0. The value of this field shall be equal to ssnh\_unit\_size\_precision\_bytes\_minus1 in sample\_stream\_nal\_header() for the atlas substream.

numOfSetupUnitArrays indicates the number of arrays of atlas NAL units of the indicated type(s).

array\_completeness when equal to 1 indicates that all atlas NAL units of the given type are in the following array and none are in the stream; when equal to 0 indicates that additional atlas NAL units of the indicated type may be in the stream; the default and permitted values are constrained by the sample entry name.

NAL\_unit\_type indicates the type of the atlas NAL units in the following array (which shall be all of that type); it takes a value as defined in ISO/IEC 23090-5; it is restricted to take one of the values indicating a NAL\_ASPS, NAL\_AFPS, NAL\_PREFIX\_SEI, or NAL\_SUFFIX\_SEI atlas NAL unit.

numNALUnits indicates the number of atlas NAL units of the indicated type included in the configuration record for the stream to which this configuration record applies. The SEI array shall only contain SEI messages of a ‘declarative’ nature, that is, those that provide information about the stream as a whole. An example of such an SEI could be a user-data SEI.

SetupUnitLength indicates the size, in bytes, of the setupUnit field. The length field includes the size of both the NAL unit header and the NAL unit payload but does not include the length field itself.

setupUnit may contain a NAL unit of type NAL\_ASPS, NAL\_AFPS, NAL\_PREFIX\_SEI, or NAL\_SUFFIX\_SEI, as defined in ISO/IEC 23090-5, that belong to the same atlas sub-bitstream. When present in setupUnit, NAL\_PREFIX\_SEI or NAL\_SUFFIX\_SEI contains SEI messages of a ‘declarative’ nature, that is, those that provide information about the stream as a whole.

## Atlas Track Sample Format

Samples in an atlas track shall have the same sample format defined in clause 6.4.2.2 in ISO/IEC 23090-10. Samples of an atlas track shall only carry NAL units associated with a single CAS.

## Grouping Atlas Tracks

All tracks that carry information that belong to the same atlas sub-bitstream shall be grouped together using the track grouping mechanism of ISO/IEC 14496-12 and a newly defined track group type. Therefore, the track group for a particular atlas shall include the atlas track and all atlas tile group tracks and V-PCC component tracks associated with that atlas. The new track group type can be defined using a with a 'vpsg' TrackGroupTypeBox as follows (note that TrackGroupTypeBox has a track\_group\_id field defined in ‎[4] ):

aligned(8) class VPCCAtlasGroupBox extends TrackGroupTypeBox('vpsg') {   
 unsigned int(6) atlas\_id;  
 bit(2) reserved = 0;  
}

The semantics of the field(s) of VPCCAtlasGroupBox are:

atlas\_id is the index of the atlas that the tracks in the track group are associated with. The value shall be in the range of 0 to 63, inclusive.

# References

1. N19066, “Draft Text of ISO/IEC DIS 23090-10 Carriage of Video-based Point Cloud Compression Data”, MPEG 129, Brussels, Belgium, January 2020
2. m52960, “V-PCC elementary stream with multiple atlases in ISOBMFF”, MPEG 130, Electronic Meeting, April 2020
3. m53482, “Atlas Tile Group Tracks for Partial Access Support in MPEG-I Part 10”, MPEG 130, Electronic Meeting, April 2020
4. N18855, “Text of ISO/IEC 14496-12 6th Edition”, MPEG 128, Geneva, Switzerland, October 2019