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# Introduction

ISO/IEC 23090-10 (Carriage of Point Cloud Data) reached committee draft (CD) stage in the MPEG#127 meeting ‎[1]. The CD specifies how to carry V-PCC and G-PCC bitstreams in ISOBMFF containers. As described in the CD document, the components of a V-PCC bitstream may be carried in separate tracks within the ISOBMFF container, where a V-PCC track carries the atlas sub-stream information, as well as common parameter sets, and restricted video tracks carry information for the video-coded components (occupancy map, geometry, and attributes).

In MPEG#127 meeting, 3DG also adopted a proposal to replace the concept of patch data group (PDG) with a concept equivalent to the network abstraction layer (NAL) used for the video sub-streams ‎in the V-PCC bitstream ‎[2]. These units are referred to as atlas NAL units. Similar to video NAL units, each atlas unit includes a header that contains the unit type as well as additional information such as layer identification. However, the sample format for the V-PCC track is not currently optimized to support a new design for the atlas information sub-stream adopted by the 3DG workgroup for the ISO/IEC 23090-5 standard.

In this contribution, we propose some updates to the VPCCDecoderConfigurationRecord and the sample format for the V-PCC to address this issue and aligns the carriage of the atlas sub-stream with the carriage of video-coded sub-streams.

# Proposal

To support carriage of a patch information sub-stream that is structured as a sequence of atlas network abstraction layer (NAL) units, as presented in ‎[7], it is proposed to update the VPCCDecoderConfigurationRecord and sample format syntax for the V-PCC track as follows.

## Changes to VPCCDecoderConfigurationRecord

The VPCCDecoderConfigurationRecord is updated to include a new field lengthSizeMinusOne. The value assigned to this field determines the length (in bytes) of the field determining the size of NAL units in atlas samples. Moreover, since the decoder configuration record carries different types of parameter sets, it is proposed to follow an approach similar to that used in video decoder configuration records and separate setup units array into a number of arrays (one for each type of parameter sets).

The updated syntax is therefore as follows.

aligned(8) class VPCCDecoderConfigurationRecord {

unsigned int(8) configurationVersion = 1;

unsigned int(2) lengthSizeMinusOne;

bit(1) reserved = 1;  
 unsigned int(5) numOfSequenceParameterSets;  
 for (i=0; i<numOfSequenceParameterSets; i++) {  
 sequence\_parameter\_set() spsUnit; // as defined in 23090-5  
 }

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) nalUnitLength;

bit(8\*nalUnitLength) nalUnit;

}

}

// additional fields

}

The semantics for the new fields are:

lengthSizeMinusOne plus 1 indicates the length in bytes of the NALUnitLength field in a V-PCC sample in the 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 one of 0, 1, or 3 corresponding to a length encoded with 1, 2, or 4 bytes, respectively.

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 PUP\_PSPS, PUP\_PREFIX\_SEI, or PUP\_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.

nalUnitLength indicates the length in bytes of the atlas NAL unit.

nalUnit contains a PUP\_PSPS or declarative SEI atlas NAL unit, as specified in ISO/IEC 23090-5.

## Changes to V-PCC Track Sample Format

Based on the updated VPCCDecoderConfigurationRecord syntax in the previous section, it is proposed to update the sample format for samples in the V-PCC track as follows.

aligned(8) class VPCCSample {  
 unsigned int PointCloudPictureLength = sample\_size; // size of sample (e.g., from SampleSizeBox)

for (i=0; i<PointCloudPictureLength; )

{

unsigned int((VPCCDecoderConfigurationRecord.lengthSizeMinusOne+1)\*8) NALUnitLength;

bit(NALUnitLength \* 8) NALUnit;

i += (VPCCDecoderConfigurationRecord.lengthSizeMinusOne+1) + NALUnitLength;  
 }  
}

The semantics of the fields defined in VPCCSample are:

VPCCDecoderConfigurationRecord indicates the decoder configuration record in the matching V-PCC sample entry.

NALUnitLength indicates the size of an atlas NAL unit measured in bytes. The length field includes the size of both the atlas NAL unit header and the atlas NAL unit payload but does not include the length field itself.

NALUnit contains a single atlas NAL unit. The syntax of an atlas NAL unit is defined in the appropriate specification (e.g., ISO/IEC 23090-5).

# References

1. N18606, “Text of ISO/IEC CD 23090-10 Carriage of PC Data”, MPEG 127, July 2019
2. m49590, “Video-based Point Cloud Coding High Level Syntax: Updates and Unification with the Working Draft on Metadata for Immersive Video”, MPEG 127, July 2019