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**ISO/IEC JTC 1/SC 29/WG 11**

**CODING OF MOVING PICTURES AND AUDIO**

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**Brussels, BE – January 2020**

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# Abstract

This document provides a description of Core Experiment 13.15 on LoD generation for spatial scalability.

# Introduction

The goal of Core Experiment 13.15 is to evaluate the Level of Details generation method for the lifting scheme for the spatial scalability.

The performance of the technique m52315[3], m52823[4], m52332[5], and m52331[6] are evaluated in the scope of the CE 13.15, in terms of RD performance, on top of TMC13 release-v9.0[1] with CTC condition [2].

# Mandates

The mandates for CE are as follows:

1. To study the coding performance compared with the anchor scalable lifting algorithm
2. To study the computational complexity compared with the anchor scalable lifting algorithm
3. To study the difference of coding performance of luma/chroma channels depending sequences

# Participants

|  |  |  |  |
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(P=proponent, C=crosss checker)

# Methods to be evaluated

## m52315 [G-PCC][New Proposal] on geometry reconstruction for spatial scalability

When geometry is partially decoded, the proposed procedures to reconstruct geometry positions is following.

* If *s* = 1, reconstruct geometry with the left/bottom/front position of the octree node.
* If *s* > 1, reconstruct geometry with the center position of the octree node

*s* is the number of LoDs skipped from the bottom of octree.

## m52823 [G-PCC][New Proposal] on weight derivation of spatial scalability

The level of detail l, , is obtained by taking the union of the refinement levels . The nearest neighbours for the points in are searched from , which is the union of . The proposed weight factor for scalable lifting is derived with , because is actually effected from .

The proposed weight for is the following.

## m52332 [G-PCC](New Proposal) CE13.15 Related on improved weight derivation for spatial scalability

In partial octree decoding process, to determine which weight method to use for a Lod, the information of the upper level can be used. In proposed method, the Lod quantization weight of target Lod and the Lod quantization weight of upper Lod is compared.

If the target quantization weight is larger than upper one. This Lod and bottom Lod are applied to alternative weight derivation method.

## m52331 [G-PCC](New Proposal) CE13.15 Related on improved LoD generation for spatial scalability

In LoD generation process for spatial scalability, one predictor node is selected in 2x2x2 area. The 2x2x2 area is defined by intermediate position. GPCC Test Model v8’s node is always a first predictor node of Morton order. m51408 chose a first or last node depending on Lod.

The proposal method decides retained node using occupied voxel in 2x2x2 area. Basically, the nearest node from the centroid of occupied voxels in 2x2x2 is picked up as the retained node. If there are two or more nodes which are nearest to the centroid, the first or the last node in the Morton order is chosen. The first or the last is selected by Lod.

# Evaluation

## Item

1. CTC anchor (w/o spatial scalability)
2. anchor enabling spatial scalability (in TMC13 release-v9.0[1])
   1. with --skipOctreeLayers= 0
   2. with --skipOctreeLayers= 1
   3. with --skipOctreeLayers= 2
3. m52315 method on reconstruction
   1. with --skipOctreeLayers= 1
   2. with --skipOctreeLayers= 2
4. m52823 method on weight derivation
5. m52332 method on weight derivation according to LoD levels
   1. anchor weight derivation and weight derivation in m47352[7]
   2. anchor weight derivation and weight derivation in m52823
6. m52331 method on LoD generation by distance from centroid

## Test

|  |  |  |
| --- | --- | --- |
| ***Test No*** | ***Tested*** | ***Reference*** |
| Test 1: overhead of scalability | Item 2-A | Item 1 |
| Test 2: reconstruction | Item 3-A | Item 2-B |
| Item 3-B | Item 2-C |
| Test 3: weight derivation | Item 4 | Item 2-A |
| Test 4: different weight derivation according to LoD levels | Item 5 | Item 2-A |
| Test 5: LoD generation by distance from centroid | Item 6 | Item 2-A |

## BDBR performance

The coding efficiency and runtime is evaluated between 2 items. For the full decoded point cloud, the BDBR in the CTC spreadsheet is used for evaluation. For the partial octree decoded point cloud, either the BDBR in the CTC spreadsheet or the BDPSNR in the spreadsheet of m52315 (when the BDBR is not applicable) is used for evaluation.

# Timeline

* 2020-01-31: Expected date for release of cross-verified TMC13v9 software and anchors
* 2020-03-27: CE Software and results are released to cross-checkers
* 2020-04-08: Preliminary feedback from cross-checkers to proponents
* 2020-04-15: MPEG document upload deadline

# References

1. “G-PCC Test Model v9”, ISO/IEC JTC1/SC29/WG11 MPEG2020 Doc. w19083, Brussels, BE, January 2020
2. “Common Test Conditions for PCC” ISO/IEC JTC1/SC29 WG11 MPEG2020 Doc, w1 9084, Brussels, BE, January 2020
3. “[G-PCC][New Proposal] on geometry reconstruction for spatial scalability”, ISO/IEC JTC1/SC29 WG11 (MPEG) input document m52315, Brussels, BE, January 2020
4. “[G-PCC][New Proposal] on weight derivation of spatial scalability”, ISO/IEC JTC1/SC29 WG11 (MPEG) input document m52823, Brussels, BE, January 2020
5. “[G-PCC](New Proposal) CE13.15 Related on improved weight derivation for spatial scalability”, ISO/IEC JTC1/SC29 WG11 (MPEG) input document m52332, Brussels, BE, January 2020
6. “[G-PCC](New Proposal) CE13.15 Related on improved LoD generation for spatial scalability”, ISO/IEC JTC1/SC29 WG11 (MPEG) input document m52331, Brussels, BE, January 2020
7. “[G-PCC] (New proposal) Spatial scalability support for G-PCC”, ISO/IEC JTC1/SC29 WG11 (MPEG) input document m47352, Geneva, CH, March 2019