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| **Title** | **Description of Exploration Experiment 13.44 on fine granularity slices (including scalability)** |
| **Source** | **WG 7, MPEG 3D Graphics and Haptics Coding** |
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# Abstract

This document provides a description of G-PCC exploratory experiment (EE) 13.44 on fine granularity slices (FGSs) into G-PCC. Based on the geometry layer-group structure in the TuC in G-PCC [1], FGS methods for attribute coding will be examined in this EE.

# Background

The goal of the EE 13.44 is to investigate the fine granularity slicing as a method of partitioning the occupancy tree as several sliced bitstream with the aim of permitting features such as parallel coding, practical packetization, error resilience, partial decoding, spatial random access, and scalable transmission [2].

To support those features, layer-group structure based geometry bitstream segmentation method is included in TuC in G-PCC [1]. In the layer-group structure, the group of occupancy tree layers are defined as a layer-group, and the spatially connected subset of the layer-groups is defined as a subgroup. Each subgroup is contained in separate slice to ensure the partial decoding independent to the spatially adjacent subgroups. To minimize the coding loss due to the segmentation, the parent-child subgroup relationship is utilized [3].

In the previous meetings, attribute slicing methods were proposed based on the geometry layer-group structure. In one method [4,5], the attribute data is separated into several subgroups and LoD generation and attribute coding is performed for each subgroup independently. In another method [6-9], the separation is performed in the process of the attribute coding as the geometry slicing method. In this EE, the attribute slicing methods which utilize the geometry layer-group structure will be examined.

# Information on the proposed methods

# Method 1 [4, 5]

In [4], attribute slicing based on separated LoD and inter-subgroup prediction was proposed. This method consists of color transfer for intermediate nodes encoded by geometry slicing, overlapped LoD building and inter-subgroup prediction of attribute values. Each attribute values shall be encoded as independent/dependent attribute data unit based on overlapped partial LoD build based on geometry nodes in the corresponding geometry data unit. The LoD of each dependent data units shall be built as completely overlapped with the LoD of its parent data unit, therefore, attribute values in the coarsest level of the target LoD can be inherited from the finest levels of parent LoD. To control compression gain and quality loss of each slice, QP delta adaptation method is also proposed based on the number of points in each subgroup [5].

# Method 2 [6-9]

Based on the current attribute coding tools in G-PCC v1, modifications on the LoD generation and nearest neighbor search methods were proposed to consider the subgroup boundaries and dependency between layer-groups [6]. Also, the context state inheritance structure for the attribute slices was proposed with the implicit and explicit signaling mechanisms [7]. In the consideration of the coding performance, subgroup weight adjustment is proposed which compensates the quantization weights in case of the missing descendent subgroups [8].

In addition, it was proposed to consider IDCM nodes by appending the direct coded nodes to the LoD corresponding to the geometry coding depth [9]. This makes ensure that the geometry and attribute coding layers are matched when a direct coded node is present.

# Description of exploration experiments

# Mandates

The mandate of the experiment are as follows:

* Evaluate the coding efficiency of the proposed tools
* Evaluate the impact on decoder resources and complexity
* Study further investigation on the fine granularity slicing methods

# Participants

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| --- | --- | --- | --- |
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# Software

The proposed tools shall be implemented on top of EE software [10] and TMC13 v19.0[11].

# Evaluation

The provided software shall be performed using octree geometry with FGS configuration based on G-PCC common test conditions [12]. It shall be evaluated against the anchor software performed using octree geometry with tile partitioning configuration based on CTC. The anchor software is a variant of TMC13, which has been modified to handle huge number of tiles [12]. Slicing parameters and tiling parameters should be varied to evaluate the relationship between slice size and codec performance.

* + Anchor : TMC13 v19.0 with modification for large scale contents [13]
  + Test contents : Large scale MPEG test contents (Landscape, Stanford, cat3-fused)
  + Configuration : tileSize/subgroup size adaptive to the source resolution
    - Anchor : CTC with modification for tile partitioning [13]

aps\_scalable\_enable\_flag = 0 (CW, CY)

* + - Proposed : FGS test configuration based on the CTC

number of layers in layer-group (from root to leaf) is 8-3-X

qtbtEnabled = 0, aps\_scalable\_enable\_flag = 0, lodDecimator = 0

For method 2, two tests will be conducted. Details on the test methods and the additional configuration are given as follows.

* Test 2-1 : LoD generation (with NN search) [6] + context reference [7] + subgroup weight adjustment [8]
  + - Configuration : inferredDirectCodingMode is disabled
* Test 2-2 : Test 2-1 + IDCM node processing [9]
  + - Configuration : inferredDirectCodingMode is set by the CTC.

# Timeline

|  |  |
| --- | --- |
| 2022-08-31 | Expected date for release of TMC13v19 software |
| 2022-10-10 | Expected delivery date of source codes and results for cross-check |
| 2022-10-14 | Report of preliminary cross-check results |
| 2022-10-17 | MPEG140 / WG7 08 document upload deadline |

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