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| **Title** | **Clarification of Patch Data Group Unit types** |
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# Abstract

A contribution on V-PCC track random access [3] was discussed during the AHG meeting in Palo Alto, whereby it was concluded that ambiguities related to Patch Data Group Unit types and their update frequencies can complicate random accessibility of the V-PCC track. In order to effectively encapsulate Patch Data Group Units in the V-PCC Track, further clarification on the use of different Patch Data Group Unit types was requested.

# Background

MPEG-I Systems is working to encapsulate V-PCC content in ISOBMFF. The main design principle is to map V-PCC units in a V-PCC bitstream to individual tracks within the container file based on their types. The V-PCC track is a new type of track for carrying volumetric visual information. The 2D video tracks are coded as defined by their specifications and encapsulated in the restricted video schemes [2].

The current working draft for storage of V-PCC in ISOBMFF describes how V-PCC units are stored in multiple tracks [2]. Random accessibility using Sync Samples is well defined for traditional planar 2D video tracks. However, the current design of the V-PCC track is not optimal from a random access point of view. The main reasons are:

1. Different Patch Data Group Unit types, which are stored in V-PCC track samples, have different update frequencies.
2. A random access sample cannot be dependent on any previous sample and all samples after a random access sample must be decodable. Hence all metadata required to render a frame must be present in a random access sample.
3. Replicating all Patch Data Group Unit types in every sample is far from being optimal and is also undesirable.

A solution to balance V-PCC track sample updates/replication and enable efficient random access is therefore required. During the ad hoc group meeting, two approaches for random access were discussed. The first approach focused on usage of Sync Samples to define random access points for the V-PCC track. The main drawback of this approach is the requirement to replicate infrequently changing Patch Data Group Unit payloads for each Sync Sample.

This approach was made less ideal after the changes made in the Sequence Parameter Set syntax after MPEG #126, whereby several parameter sets were moved to Patch Data Groups. Table 1 describes different Patch Data Group Unit types as defined by the current Study of CD [1] V-PCC text. In practice, all Patch Data Group Unit payloads would need to be present in a sample for it to be considered as a Sync Sample. Replicating them for each intra period may constitute a significant overhead.

Table 1: Patch Data Group Unit Types [1]

|  |  |  |  |
| --- | --- | --- | --- |
| **pdg\_unit\_type** | **Identifier** | **Patch Data Group Unit Type** | **Description** |
| 0 | PDG\_PSPS | Patch sequence parameter set | Sequence level parameters |
| 1 | PDG\_PFPS | Patch frame parameter set | Frame level parameters |
| 2 | PDG\_PFGPS | Patch frame geometry parameter set | Frame level geometry type parameters |
| 3 | PDG\_PFAPS | Patch frame attribute parameter set | Frame level attribute type parameters |
| 4 | PDG\_GPPS | Geometry patch parameter set | Patch level geometry type parameters |
| 5 | PDG\_APPS | Attribute patch parameter set | Patch level attribute type parameters |
| 6 | PDG\_PTGLU | Patch tile group layer unit | Patch tile group layer unit |
| 7 | PDG\_PREFIX\_SEI | Prefix SEI message | Prefix SEI message |
| 8 | PDG\_SUFFIX\_SEI | Suffix SEI message | Suffix SEI message |
| 9…31 | PDG\_RSVD | Reserved | - |

A potentially improved design is to consider an approach that utilizes Sample Grouping. In such a design rarely changing Patch Data Group Units are stored in Sample Groups, thus avoiding replication at each intra period. Sample Grouping mechanism is not a new concept for ISOBMFF. For making an informed decision on how to best handle random access in the context of V-PCC, a better understanding on the need and use of different Patch Data Group Unit Types is required.

# Proposal

During the Ad Hoc Group meeting in Palo Alto, it was discussed that not all Patch Data Group (PDG) unit types would necessarily be needed as they generate challenges for ISOBMFF encapsulation and complicate the overall V-PCC specification. Also within the group there were uncertainties on the actual use of some PDG unit types. As such, it was requested that this topic is raised for discussion in the next MPEG 3DG meeting in Göteborg.

* Discuss the need for different PDG unit types.
* Define and describe the concept of a V-PCC patch access unit.
* Provide further information on expected usage and the update frequencies of each PDG unit type.

# References

1. N18180, Study Text for ISO/IEC 23090-5:2019 CD “Information technology — Coded Representation of Immersive Media — Part 5: Video-based Point Cloud Compression”, MPEG#125, Marrakech, Morocco, Jan, 2019.
2. W18413, “Information technology — Coded representation of immersive media— Part 10: WD of ISO/IEC 23090-10 Carriage of PC data”, MPEG #126, Geneva, Mar, 2019.
3. M48112, “On random access of ISOBMFF encapsulated V-PCC”, MPEG-I Systems & 3DG AHG, Palo Alto, USA, June 2019.