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# Introduction

Version d40 of the V-PCC draft specification [1] includes a "raw separate video flag" (indicated by vpcc\_raw\_separate\_video\_flag syntax element). Basically, according to the draft specfication, when the flag is enabled, attributes of raw points are coded in a separate attribute video and geometry values are coded as well in a separate geometry video. The draft specification does not reflect the code in which EOM coded points and particularly EOM attributes are arranged as well in the same separate video than the attributes raw ones. It is asserted that code behavior is the one intended and accepted by the group so that the draft specification should be updated accordingly.

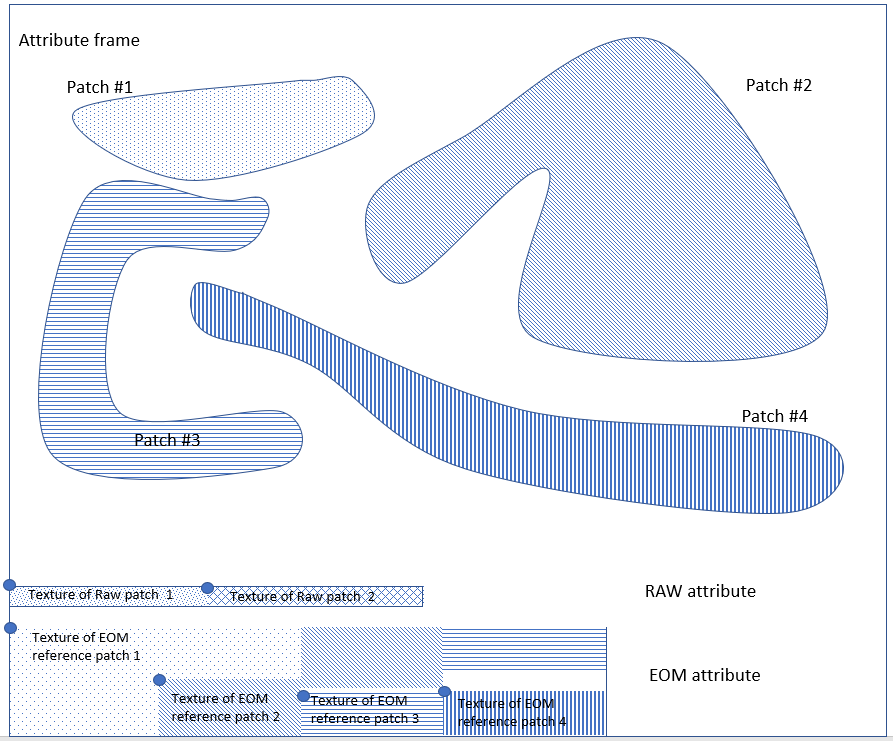
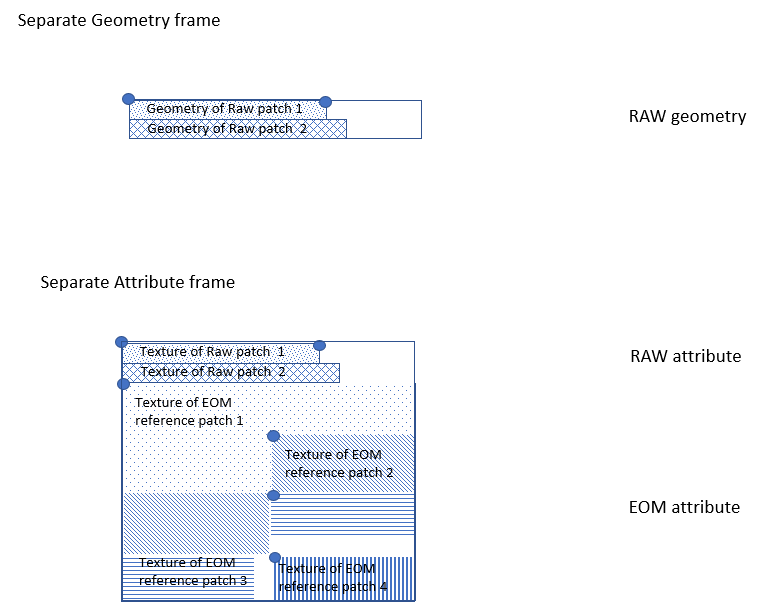


Figure 1 - ATTR frame. Raw points and EOM attributes are typically coded below other regular patches



**Figure 2 - Separate video. Raw points and EOM attribute are placed together in a separate video stream. The raw geometry patch is also put in another separate video stream. The EOM geometry is kept in the main geometry frame, by design.**

By design, EOM and raw coded points respond to different needs. Thus, their attribute format, scanning order, size and shape are different. Therefore, the way to reduce information (or encode/code/compress) for raw and EOM points may require different methods, especially when it comes to reduces spatial "intra" redundancies by video codecs. Besides, it may be of interest to code EOM points attributes with lossless video codecs while raw points (characterizing sparse points somehow less representative of the focus of a typical point cloud scene) may be subject to lossy coding or vice versa according to the application.

Consequently, the gathering of these both patches types in a common separate video may require:

- specifically (and uncommon) profiled video codecs (comprising tools adapted to efficiently code/decode the two kinds of patches types),

- specifically configured (with adapted algorithms) video codecs to identify the two kinds of patches types (which comprise unusual attribute/texture layout) and to deal with the spatially heterogeneous types of data.

Besides, there also might be applications that require to discard either EOM or raw points, having both in the same attribute frame requires anyway to decode the whole separate video attribute information.

# Proposal

It is proposed to place raw and EOM attributes points possibly in different separate video when separate video is enabled and employed (i.e. raw and EOM attributes are no more in the same separate video).

Claimed advantages of the proposal are as follows:

In case of separate flag(s) set equal to 1 resulting in raw attribute patches and EOM attribute patches put apart in different video streams:

- raw and EOM attribute patches may be encoded/decoded in parallel by video codecs

- different video codec used for raw and EOM may be tuned differently (e.g. in terms of intra/spatial algorithm) to take into account particularities of raw or EOM characteristics

- spatial coherency is improved as EOM and raw attribute patches have different characteristics in terms of format

- different video codec profiles might be used for each attribute separate video (e.g. lossless one for EOM and lossy one for raw format or inversely, 8-bit vs 10-bit, 4:2:0 vs 4:4:4, etc...) for better meeting applications constraints or requirements

- either EOM or raw attribute patches may be discarded (the one(s) in the separate video stream) according to the applications or decoder/renderer capabilities (e.g. raw points may not be helpful for Points Cloud rendered on a small display with possibly an associated low-end SoC for decoding)

It is asserted that proposal has very low impact on the current V-PCC encoder and decoder design and low editorial impact on the specification and the associated reference software.

## Proposal 1: New separate video flag for EOM (only)

It may be signaled by an additional flag in the VPCC parameter set, specific to EOM:

|  |  |
| --- | --- |
| eom\_patch\_data\_unit( patchIndex ) { | **Descriptor** |
| if(vpcc\_eom\_patch\_separate\_video\_present\_flag ) |  |
| **epdu\_patch\_in\_eom\_video\_flag[**patchIndex] |  |
| **epdu\_2d\_shift\_x**[ patchIndex  ] | u(v) |
| **epdu\_2d\_shift\_y**[ patchIndex  ] | u(v) |
| **epdu\_2d\_delta\_size\_x**[ patchIndex   ] | se(v) |
| **epdu\_2d\_delta\_size\_y**[ patchIndex   ] | se(v) |
| **epdu\_patch\_count\_minus1**[ patchIndex ] | u(v) |
| for( p = 0; p <= epdu\_patch\_count\_minus1[ patchIndex ]; p++ ) { |  |
| **epdu\_points[** patchIndex **]**[ p ] | u(v) |
| **}** |  |
| } |  |

where:

**vpcc\_eom\_patch\_separate\_video\_present\_flag**[ j ]equal to 1 indicates that EOM coded attribute information for the atlas with index j may be stored in a separate video stream. vpcc\_eom\_patch\_separate\_video\_present\_flag[ j ] equal to 0 indicates that EOM coded attribute information for the atlas with index j shall not be stored in a separate video stream. When vpcc\_eom\_patch\_separate\_video\_present\_flag[ j ] is not present, it is inferred to be equal to 0.

and

**epdu\_patch\_in\_eom\_video\_flag**[ p ] specifies whether the attribute data associated with the EOM coded patch p in the current atlas tile group is encoded in a separate video compared to those of the intra and inter coded patches. If epdu\_patch\_in\_eom\_video\_flag[ p ] is equal to 0, the attribute data associated with the EOM coded patch p in the current atlas tile group is encoded in the same video as those of the intra and inter coded patches. If epdu\_patch\_in\_eom\_video\_flag[ p ] is equal to 1, the attribute data associated with the EOM coded patch p in the current atlas tile group is encoded in a separate video from those of the intra and inter coded patches. If epdu\_patch\_in\_eom\_video\_flag[ p ] is not present, its value shall be inferred to be equal to 0.

Additionnally, a new syntax element may appear **ai\_eom\_attribute\_codec\_id[**atlas\_id**]** inthe attribute information syntaxto identify the video codec used to compress the EOM attribute separate video.

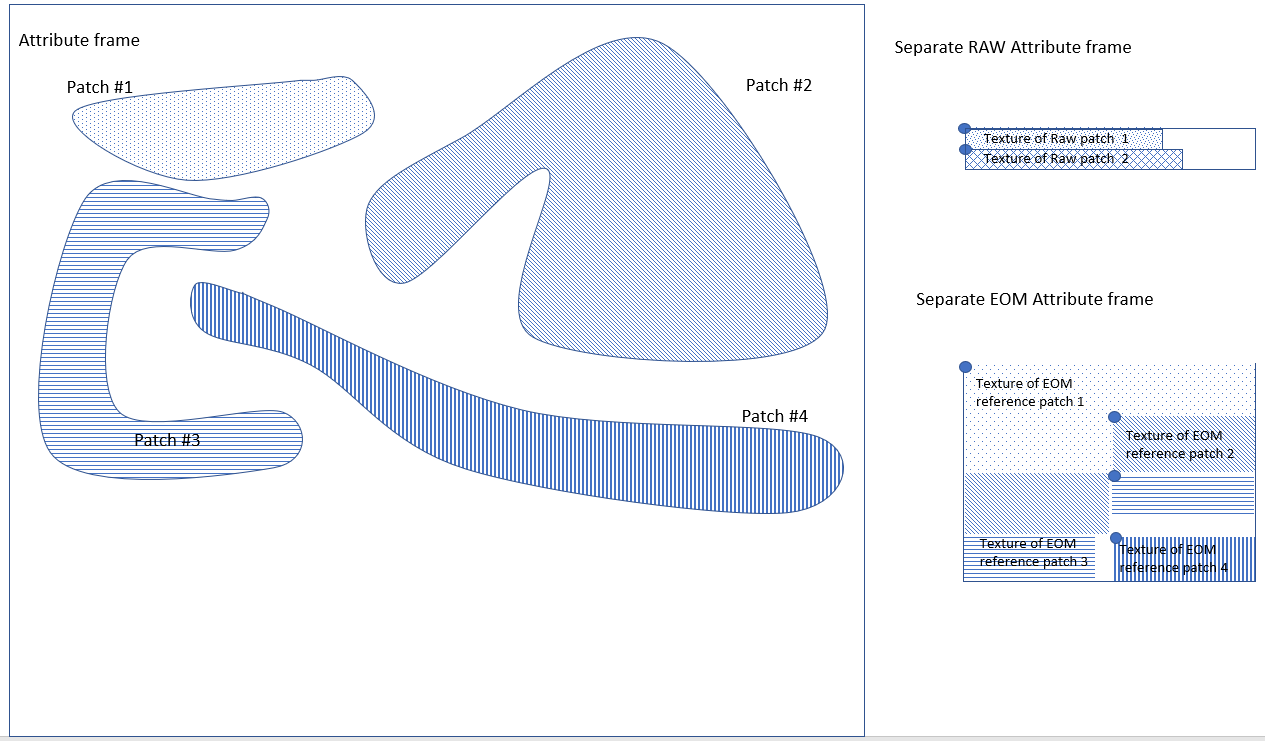


Figure 3 - Proposition: raw and EOM attribute points are placed each in a separate video when the appropriate flag is activated.

## Proposal 2: Common separate flag for both EOM and raw

In this variant, it is proposed to use a flag **vpcc\_separate\_video\_present\_flag** that is common to raw and EOM (and that would replace **vpcc\_raw\_patch\_separate\_video\_present\_flag**). The suggested semantics is as follows:

When vpcc\_separate\_video\_present\_flag[j]equal to 1 indicates that EOM coded attribute information, raw coded attribute information and raw coded geometry information for the atlas with index j may be stored in a separate video stream. vpcc\_separate\_video\_present\_flag[ j ] equal to 0 indicates that EOM coded attribute information, raw coded attribute information and raw coded geometry information for the atlas with index j shall not be stored in a separate video stream. When vpcc\_separate\_video\_present\_flag[ j ] is not present, it is inferred to be equal to 0.

Additionnally, the EOM patch data unit is the same as proposed in the proposal 1 (only **vpcc\_eom\_patch\_separate\_video\_present\_flag** is replaced by **vpcc\_separate\_video\_present\_flag** in the appropriate condition).

Additionnally, a new syntax element may appear **ai\_eom\_attribute\_codec\_id[**atlas\_id**]** inthe attribute information syntaxto identify the video codec used to compress the EOM attribute separate video.

# References

[1] Draft V-PCC specification, CD stage, revision d40