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# Introduction

In the V-PCC draft specification revision d40 [1], several EOM attribute patches may be instantiated where each of these patches may refer to a subgroup of patches present in the occupancy map. Such a dependence implies that during EOM decoding stage, all EOM attribute patches should be completely decoded to figure out the mapping between geometry patches (associated to a patch in the occupancy map) and associated EOM attributes in the appropriate EOM patch.

This contribution comprises three alternative proposals to enable selective decoding of EOM patches and (patch level) parallel decoding of EOM attribute information. Namely, the first one suggests to specify a unique EOM attribute patch for all corresponding geometry patches. The second one proposes to specify an EOM attribute patch per geometry patch. The third one consists of indicating the use of either the first or second alternative.

# Limitation of the existing EOM mode

In the current V-PCC draft specification [1], the geometry of intermediate[[1]](#footnote-1) points is coded in the (enhanced) occupancy map, where a codeword signals the presence of points in-between depth D0 and depth D1 (see [m44853]). The attribute of those intermediate points is mapped to contiguous blocks of the texture image (see [m47477]), grouped in a so-called EOM (attribute) patch.



Figure 1 Attribute image of sequence "longdress", frame #0, encoded using TMC2 v7 in lossless mode with EOM patch appearing at the bottom

The figure below shows a schematic representation of the EOM attribute patch, where the attribute corresponding to the intermediate points of the patches is mapped into the EOM patch. For each patch, the corresponding bounding box is processed in raster-scan order, and the texture of intermediate points mapped into the texture patch in block-based scan order. The blue circles from the figure indicate the starting position of each patch – information coded in as patch metadata.

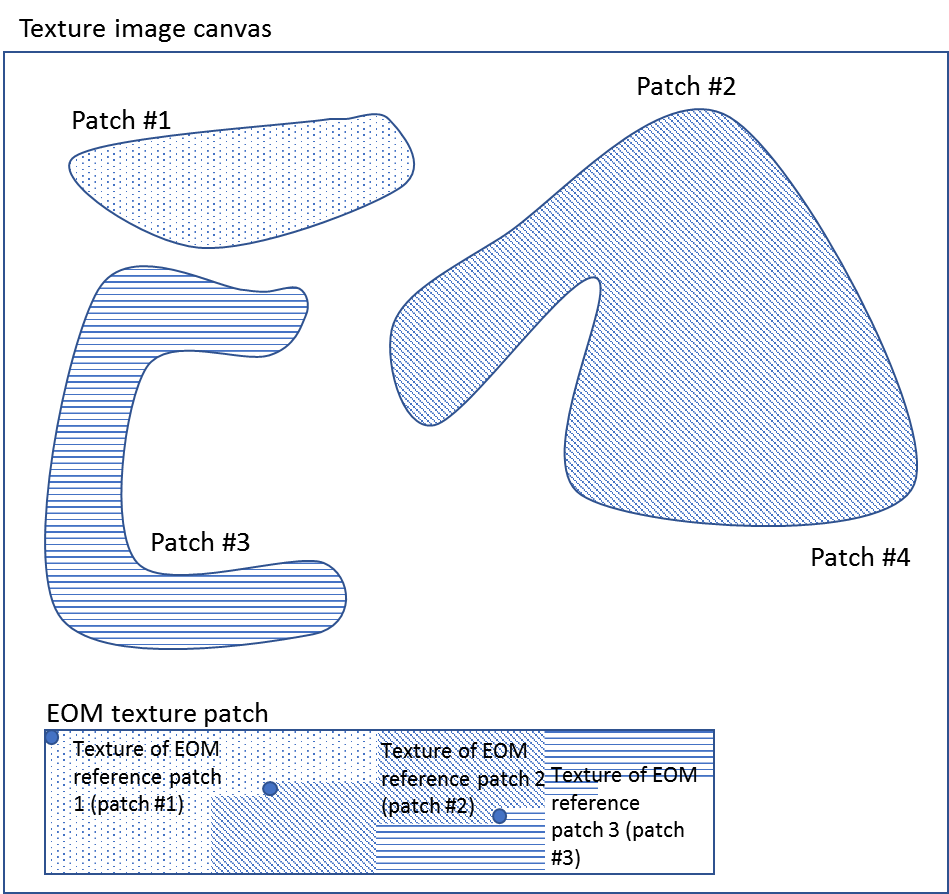


Figure 2 Schematic representation of an EOM attribute patch.

The current version of the draft specification enables the generation of several EOM patches with for each one a set of contiguous associated geometry patches, it is complex to access directly to EOM attribute information associated to a specific geometry patch (and its associated occupancy map information).

The Figure 3 is an illustration of this case.

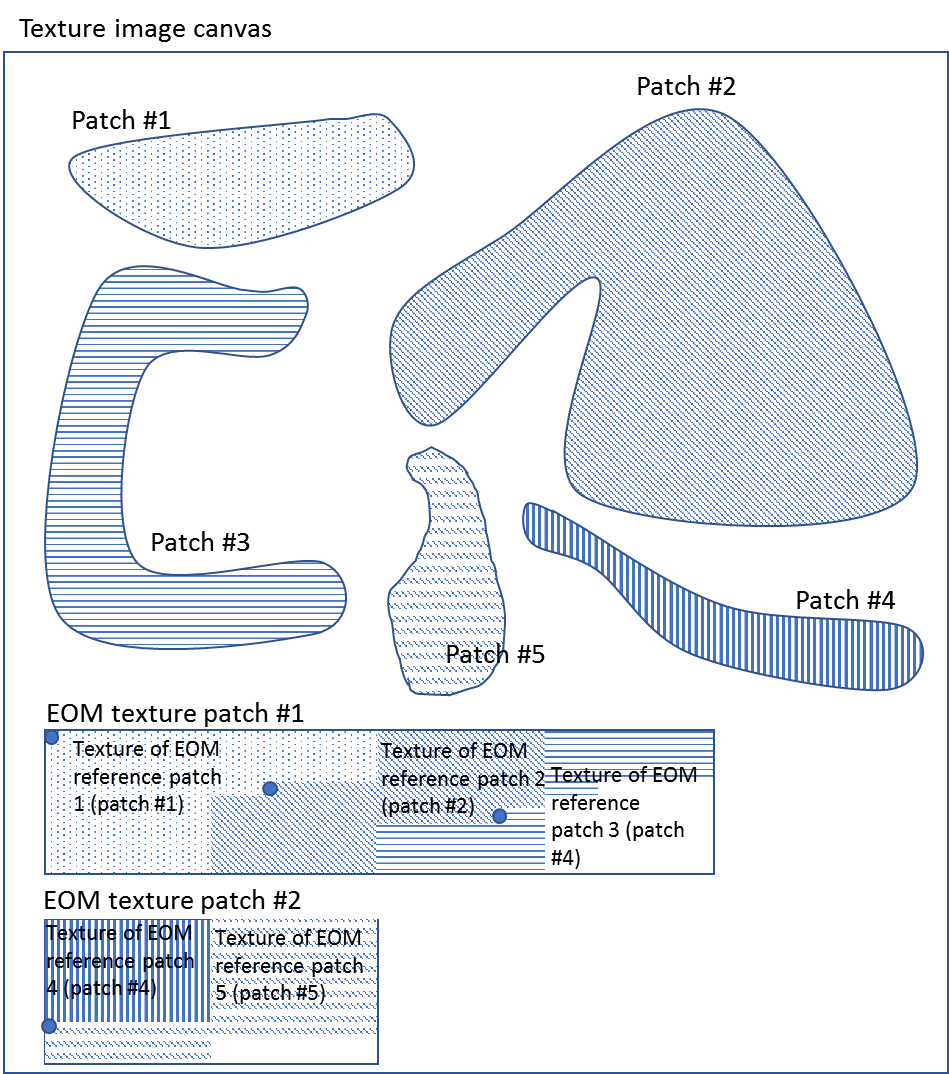


Figure 3. Example of two EOM attribute patches associated with 5 GEO patches

# Proposal: one EOM texture patch per geometry patch

Option 1:

The first proposition consists in specifying the creation of a unique EOM attribute patch for all corresponding geometry patches (associated to the occupancy map in which EOM intermediate points location is coded).

Option 2:

The second alternative proposition is to specify an EOM attribute patch per geometry patch. This arrangement enables direct access to the attributes of intermediate points of a patch.

Figure 3 shows the same example as Figure 2, but using one EOM attribute patch per GEO patch – visible at the bottom of the image. The information provided in the EOM attribute patch syntax structure provides direct access to the attributes of intermediate points of any given patch.

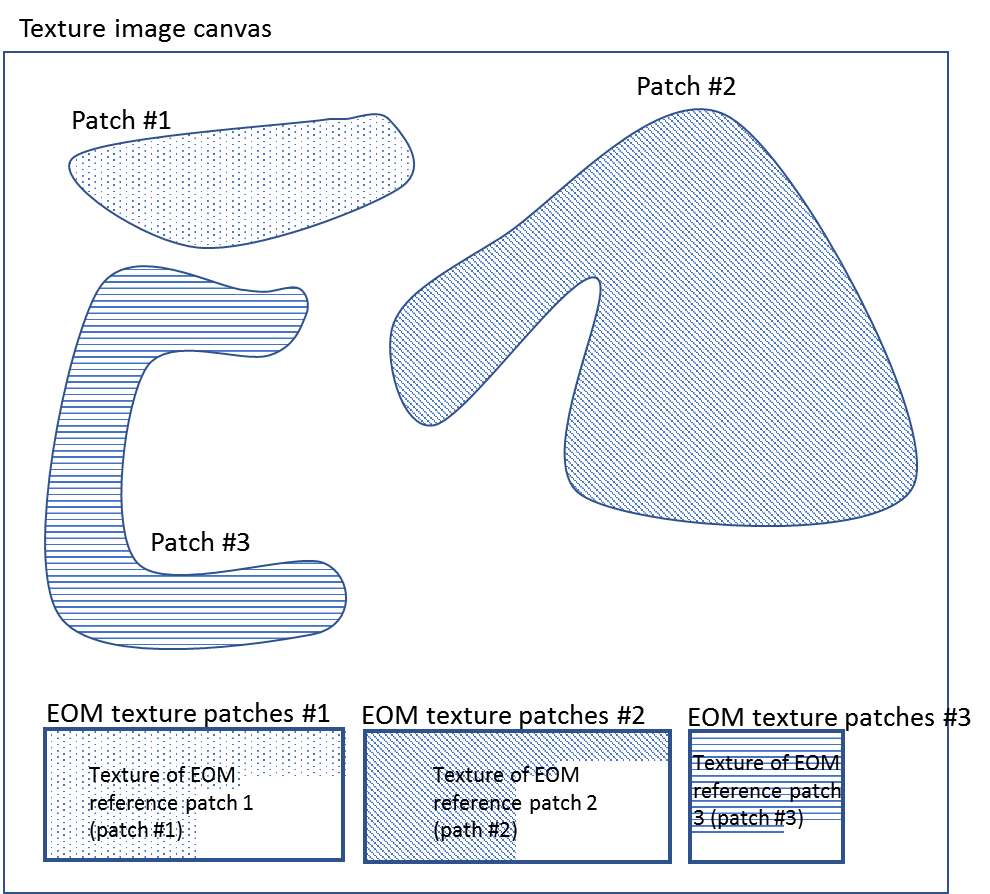


Figure 4 Schematic representation of several EOM texture patches – one per GEO patch

Option 3:

The third alternative consists of indicating whether proposal 1 or proposal 2 is used.

## Syntactic elements for the EOM texture patch

The following tables provide the required syntactic elements to include the proposed EOM texture patch in the V-PCC syntax.

### Option 3: Modified Atlas sequence parameter set

Syntax and description for the new parameters and parsing operations for the modified atlas sequence parameter set is provided in this section.

|  |  |
| --- | --- |
| if( asps\_enhanced\_occupancy\_map\_for\_depth\_flag ) { |  |
| if( vpcc\_map\_count\_minus1[ asps\_atlas\_sequence\_parameter\_set\_id ] = = 0 ) |  |
| **asps\_enhanced\_occupancy\_map\_fix\_bit\_count\_minus1** | u(4) |
| **asps\_enhanced\_occupancy\_map\_patch\_mode\_flag** | u(1) |
| } |  |

Table 1. Modified atlas sequence parameter set unit.

The **asps\_enhanced\_occupancy\_map\_patch\_mode\_flag** parameter indicates whether the EOM attribute patch is unique, or EOM attribute patches are defined per geometry patch. When the parameter equal to 0, the attribute of all intermediate points is available in the single EOM attribute patch. When the parameter equal to 1, the number of EOM texture patches shall be equal to the number of geometry patches.

### Updated eom\_patch\_data\_unit

Syntax and description for the new enhanced occupancy map texture patch data unit is provided in this section (option 3).

|  |  |
| --- | --- |
| eom\_patch\_data\_unit( patchIdx ) { | **Descriptor** |
| **epdu\_2d\_shift\_x**[ patchIdx  ] | u(v) |
| **epdu\_2d\_shift\_y**[ patchIdx  ] | u(v) |
| **epdu\_2d\_delta\_size\_x**[ patchIdx   ] | se(v) |
| **epdu\_2d\_delta\_size\_y**[ patchIdx   ] | se(v) |
| if (asps\_enhanced\_occupancy\_map\_patch\_mode\_flag = = 0 ) { |  |
| **epdu\_patch\_count\_minus1**[ patchIdx ] | u(v) |
| for( i = 0; i < epdu\_patch\_count\_minus1[ patchIdx ] + 1; i++ ) |  |
| **epdu\_points**[patchIdx **]**[ i ] | u(v) |
| } else |  |
| **epdu\_geo\_patch\_idx**[ patchIdx ] | u(v) |
| } |  |

Table 2. Proposed ‘enhanced occupancy map texture patch’ data unit.

**epdu\_geo\_patch\_idx**[ patchIdx ] indicates the corresponding index of the associated geometry patch.

**epdu\_points**[ patchIdx ] parameter specifies the number of attribute points in the EOM texture patch.

It is worth noting that option 1 would require no change to the V-PCC draft specification d40 current syntax. Option 2 would consist of only keeping the last "else" assertion (epdu\_geo\_patch\_id[ patchIdx ]).

## Changes to the decoding and reconstruction processes

Option 1 would require a bitstream conformance constraint allowing only one EPDU per geometry frame.

Option 2 would modify the section 9.4.4, step 6 of [1] as follows:

Add as input: epdu[p], the eom\_patch\_data\_unit which is associated to the patch p,

At step 3:

nBlock = eomCntInCurrentPatch/ ( PatchPackingBlockSize \* PatchPackingBlockSize )

xBlock = **epdu\_2d\_shift\_x[peom]** + nBlock % **epdu\_2d\_delta\_size\_x[peom]**

yBlock = **epdu\_2d\_shift\_y[peom]** + nBlock / **epdu\_2d\_delta\_size\_x[peom]**

xx = xBlock \* PatchPackingBlockSize + eomCntInCurrentBlock % PatchPackingBlockSize

yy = yBlock \* PatchPackingBlockSize + eomCntInCurrentBlock / PatchPackingBlockSize

eomCntInCurrentPatch is incremented and reset to 0 for each new patch p

eomCntInCurrentBlock is incremented and reset to 0 for each new block

Option 3 is similar to option 2 but with a conditional flag asps\_enhanced\_occupancy\_map\_patch\_mode\_flag upstream step 3.

# References

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

[m44853] Improvements to enhanced delta depth coding for V-PCC

[m47477] Texture patch for Enhanced Occupancy Map for Depth

1. An intermediate point projected at location (u,v) of the 2D canvas is a point whose depth is in-between the depth of the points projected in the near layer and the point of the far layer, known as D0(u,v) and D1(u,v). [↑](#footnote-ref-1)