m54616
Signaling of the number of points at each depth for spatial scalability

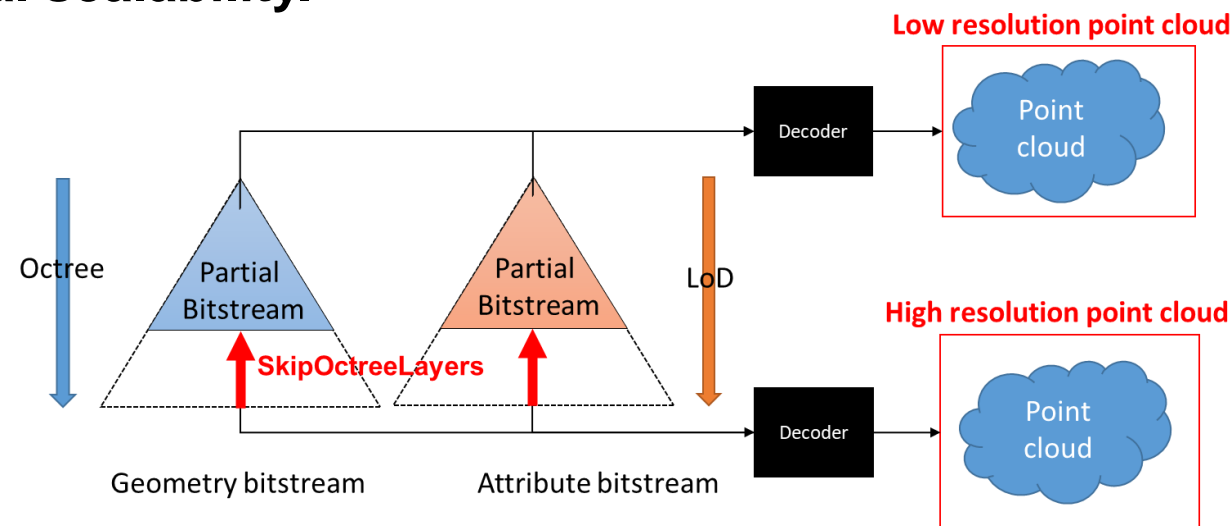**Ryosuke Watanabe, Kyohei Unno, Kei Kawamura**

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Overview
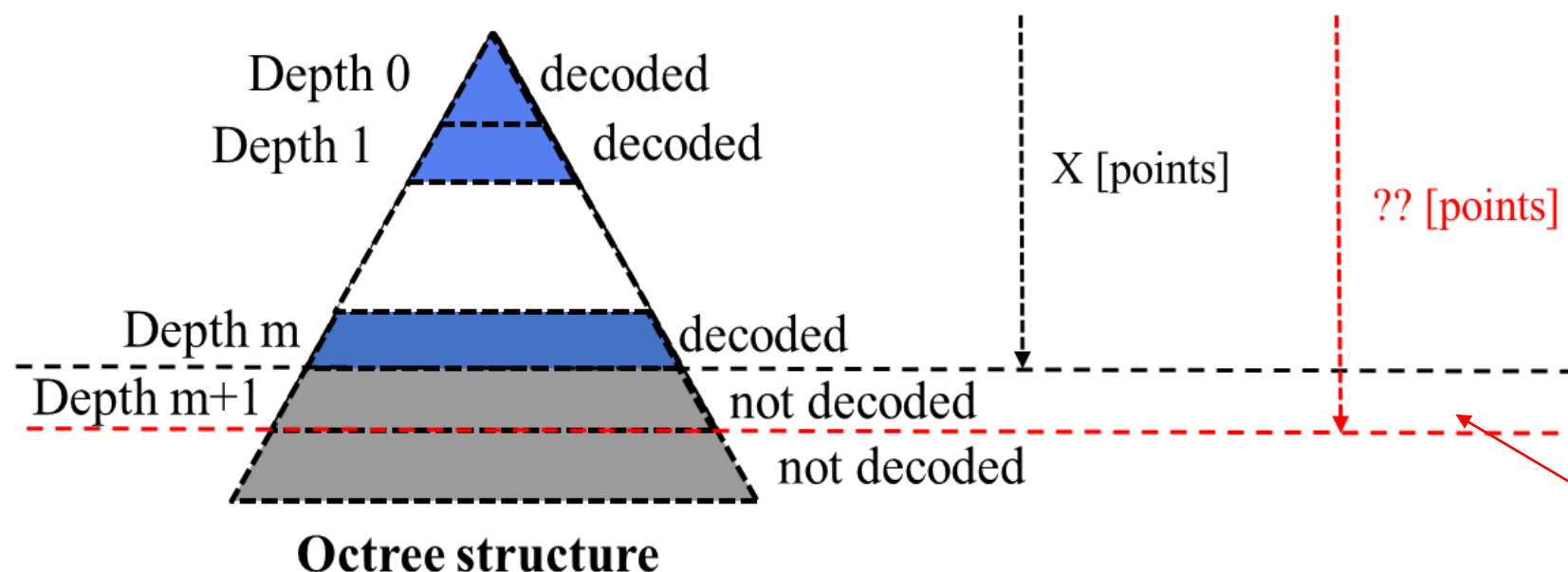
- **Motivation and Problem statement**
  - **In the current design, low resolution point clouds are decoded with scalable decoding function.**
  - **However, the number of decoded points cannot be estimated in advance when scalable decoding is executed.**

- **Proposal**
  - **The number of points at each depth in octree structure is signaled as additional syntax elements for spatial scalability.**

■ **In the current design, the number of skipped layers is determined in the decoder side using <u>SkipOctreeLayers</u> option.**

  ● **The number of decoded points cannot be estimated in advance when scalable decoding is executed.**

■ **If the number of decoded points can be known, it is possible to estimate the data size after decoding.**

Octree structure
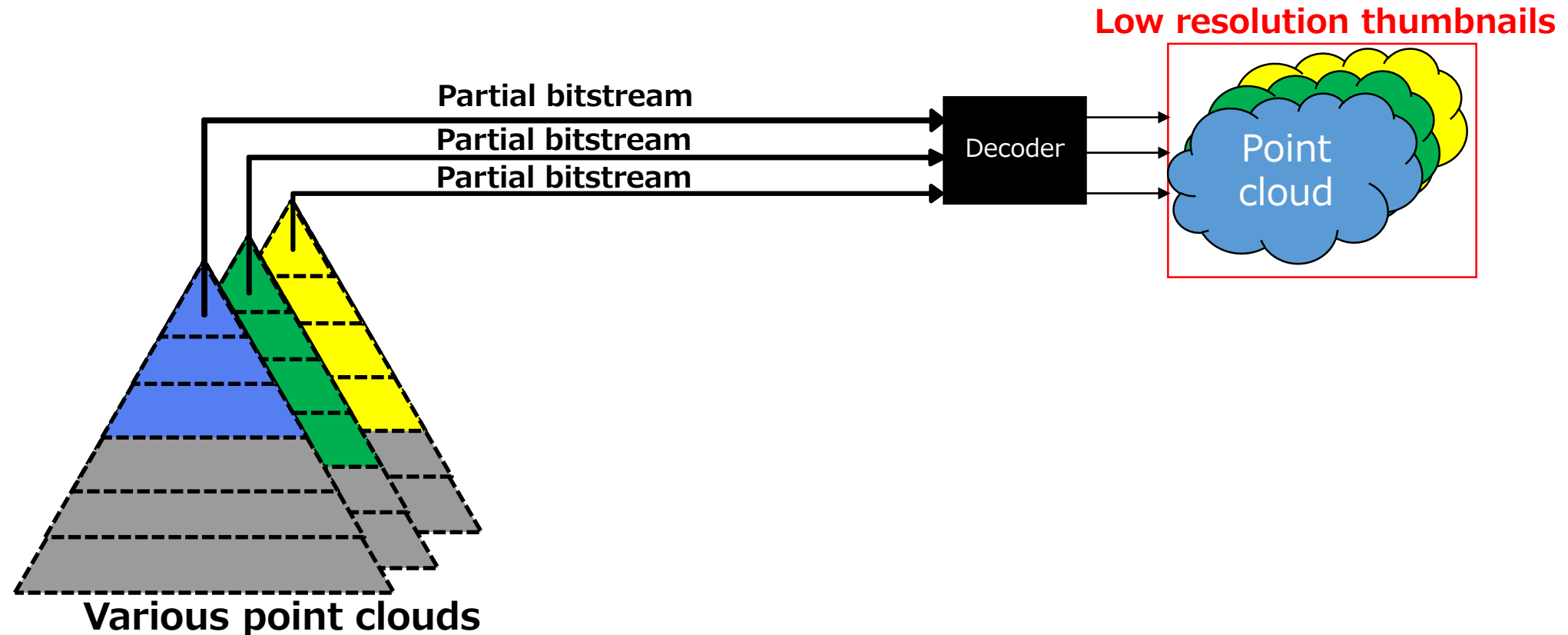
【Example】

Target:10000 [points]

Current depth:9000 [points]
Next depth : 9000 + ? [points]

More than 10000 points? or not?

Motivation and Problem Statement (2/2)

■ **When thumbnails are generated with spatial scalability, it is possible to control output data size and decoding time by limiting the number of decoded points.**

<u>(ex : usecase)</u> Generating many thumbnails at the same time

Low resolution thumbnails

Partial bitstream
Partial bitstream
Partial bitstream

Decoder

Point cloud

Various point clouds

Proposal(1/2)

■ **Add two syntax elements to GPS and Geometry slice footer**

1. **geom_num_points_in_depth_list_present_flag equal to 1 indicates that the number of points at each depth is added to syntax elements for scalable decoding.**

2. **geom_num_points_in_depth_minus1[lvl] plus 1 indicates the number of points when decoding from 0th depth to *lvl*-th depth.**

Geometry parameter set syntax

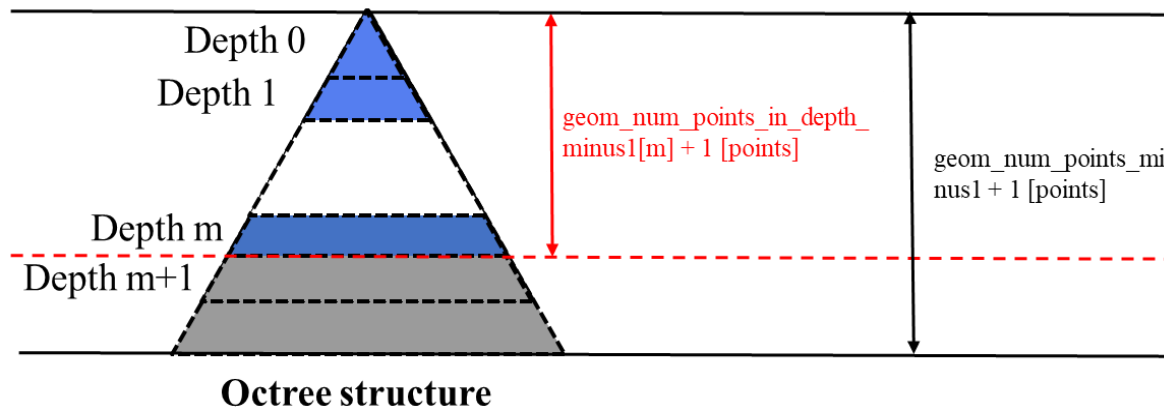| geometry_parameter_set( ) {	Descriptor
gps_geom_parameter_set_id	ue(v)
gps_seq_parameter_set_id	ue(v)
......	
......	
geom_tree_coded_axis_list_present_flag	u(1)
geom_num_points_in_depth_list_present_flag	u(1)
gps_extension_flag	u(1)
......	
byte_alignment( )	
}	

■ **Add two syntax elements to GPS and Geometry slice footer**

1. **geom_num_points_in_depth_list_present_flag** equal to 1 indicates that the number of points at each depth is added to syntax elements for scalable decoding.

2. **geom_num_points_in_depth_minus1[lvl]** plus 1 indicates the number of points when decoding from 0th depth to *lvl*-th depth.

Geometry data unit footer syntax

geometry_data_unit_footer( ) {	Descriptor
byte_alignment( )	
geom_num_points_minus1	u(24)
if(geom_num_points_in_depth_list_present_flag) {	
for(lvl = 0; lvl < geom_tree_depth_minus1; lvl++)	
geom_num_points_in_depth_minus1 [lvl]	u(24)
}	

Octree structure

Conclusion

- **Motivation and Problem statement**
  - **The number of decoded points cannot be estimated in advance when scalable decoding is executed.**
  - **If the number of points at each depth is added in syntax elements, it is possible to control output data size and decoding time by limiting the number of decoded points.**

- **Proposal**
  - **The number of points at each depth in octree structure is signaled as additional syntax elements for spatial scalability.**
    1. geom_num_points_in_depth_list_present_flag equal to 1 indicates that the number of points at each depth is added to syntax elements for scalable decoding.
    2. geom_num_points_in_depth_minus1[lvl] plus 1 indicates the number of points when decoding from 0th depth to *lvl*-th depth.

- **It is recommended to adopt the proposal to the next draft.**