

m53497

On interaction between Implicit QTBT and Scalable lifting

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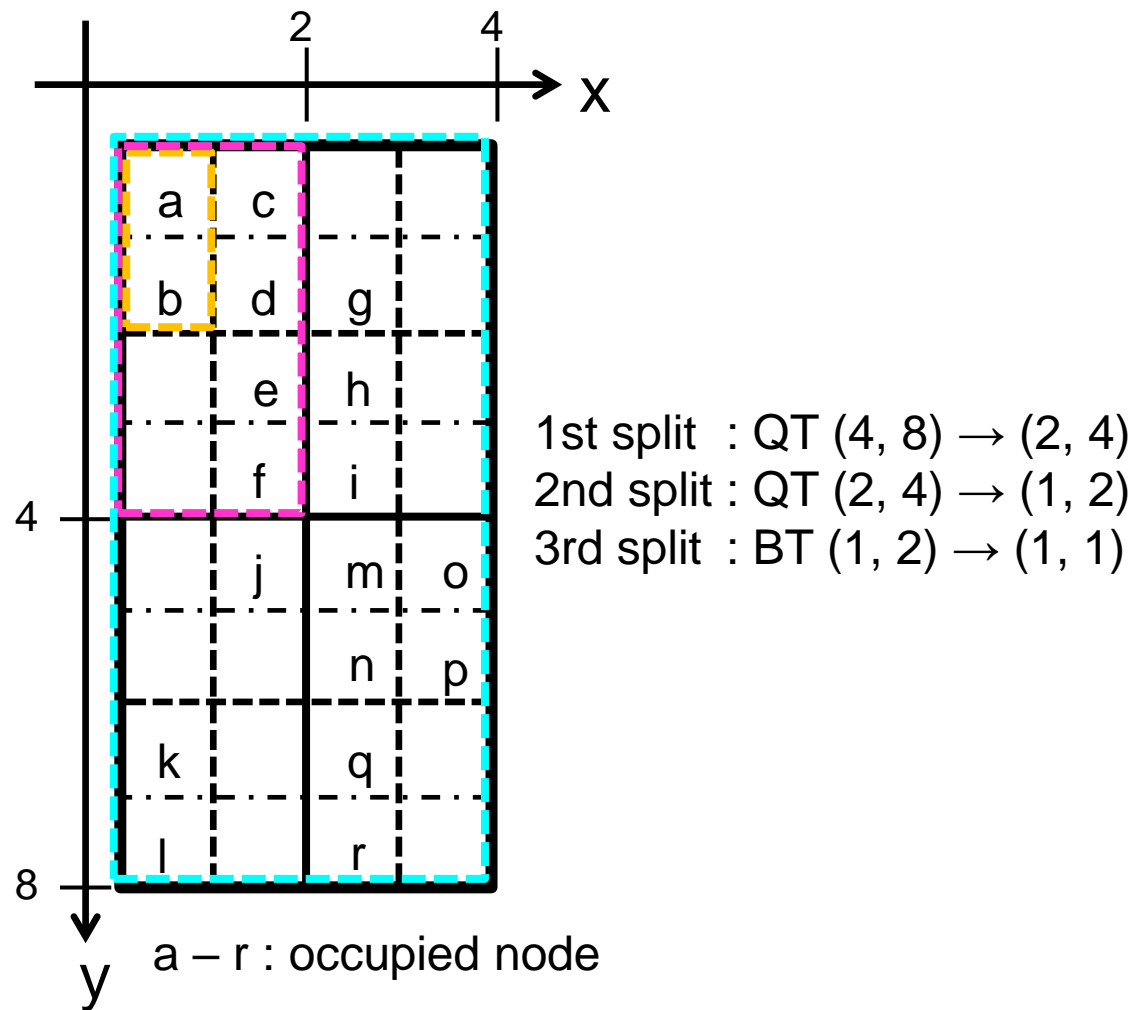
■ Problem statement

- **In the current spec, the scalable lifting process assumes only pure Octree case.**
 - A node shape is always considered as a cube.
- **Therefore, scalable lifting does not work correctly with QtBt in below processes.**
 - LoD generation
 - Coordinate quantization for kNN calculation

■ Proposal

- **Method 1**
 - Add high-level constraint that scalable lifting and QtBt cannot use simultaneously.
- **Method 2**
 - Modify the scalable lifting process.

Desirable behavior



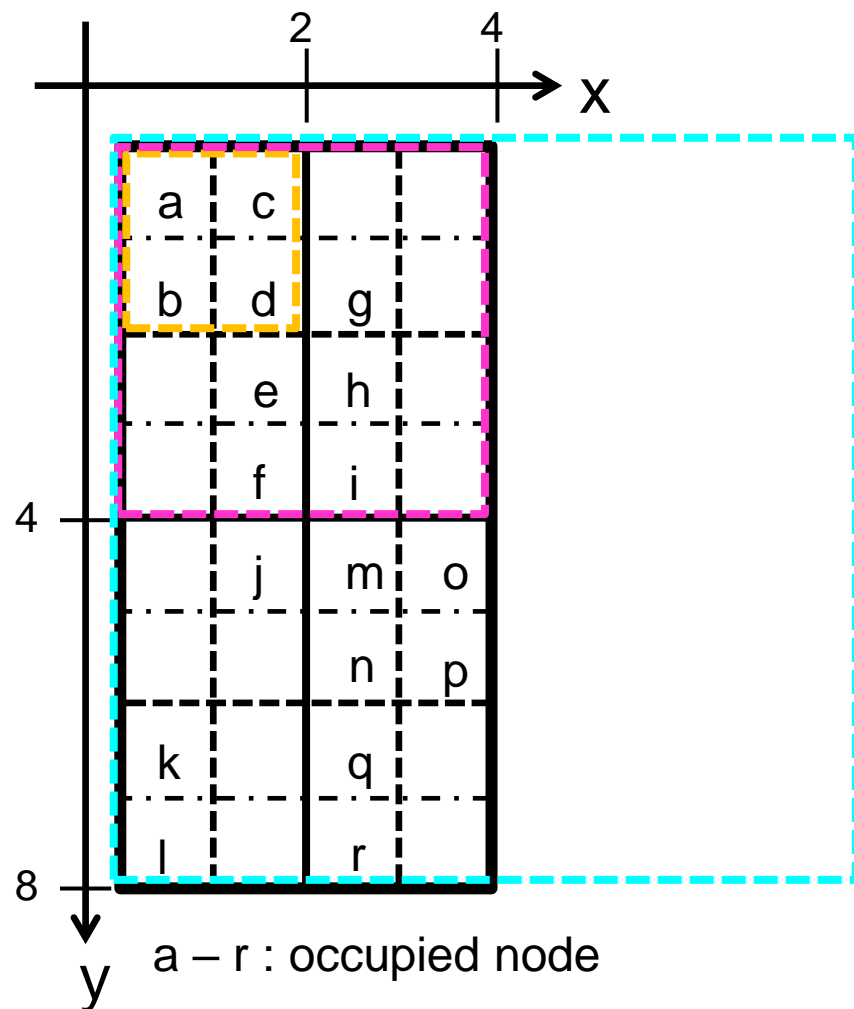
A retained node is selected among nodes belongs the same parent node.

Number of nodes for each LoD

skipOctree Layers	LoD 0	LoD 1	LoD 2	LoD 3
0	8	6	3	1
1	-	6	3	1
2	-	-	3	1
3	-	-	-	1

Number of nodes for each LoD is not changed regardless of skioOctree Layers ☺

■ Actual behavior of the current design



Node size is always considered as a square (in 2D case).
→ Only one node can be retained from multiple parent nodes.

Number of nodes for each LoD

skipOctree Layers	LoD 0	LoD 1	LoD 2	LoD 3
0	10	6	1	1
1	-	8	1	1
2	-	-	3	1
3	-	-	-	1

Number of nodes for each LoD may be changed depending on skipOctree Layers ☹

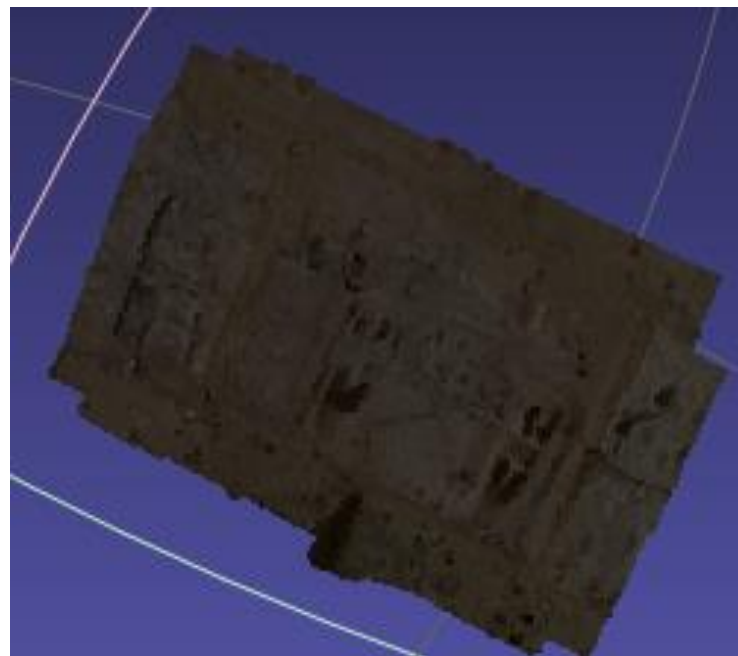
→ It can be a cause of mismatch between a geometry data and corresponding attributes.

Example of problem in LoD generation

■ ex) Facade_00064_vox11

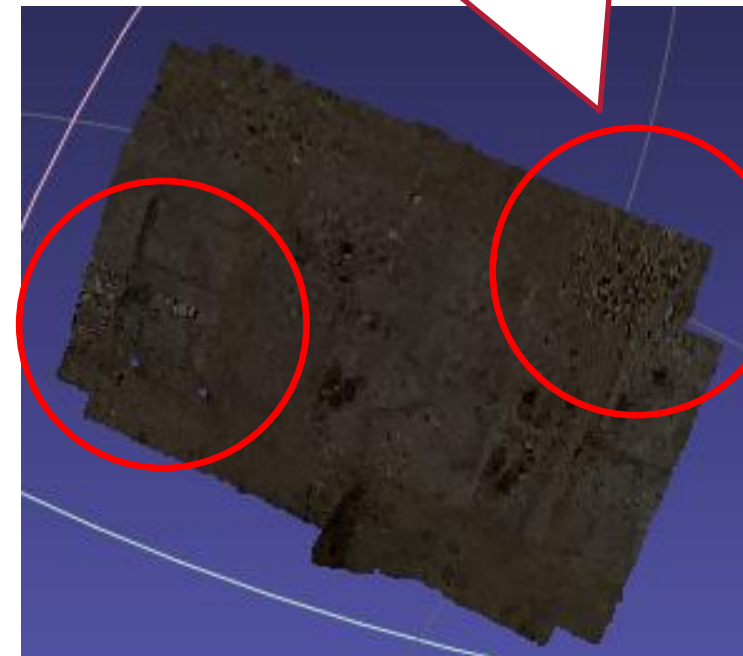
No. of nodes of 1st slice : K=0, M=0

LoD	S=0	S=2	S=4
11	1	1	1
10	2	2	2
9	4	4	4
8	9	9	9
7	41	41	41
6	142	142	142
5	561	561	561
4	2143	2143	13648
3	8294	8294	-
2	32426	77319	-
1	125323	-	-
0	456359	-	-



OK case : K=4, M=0

Mismatch between geometries
and attributes may occur



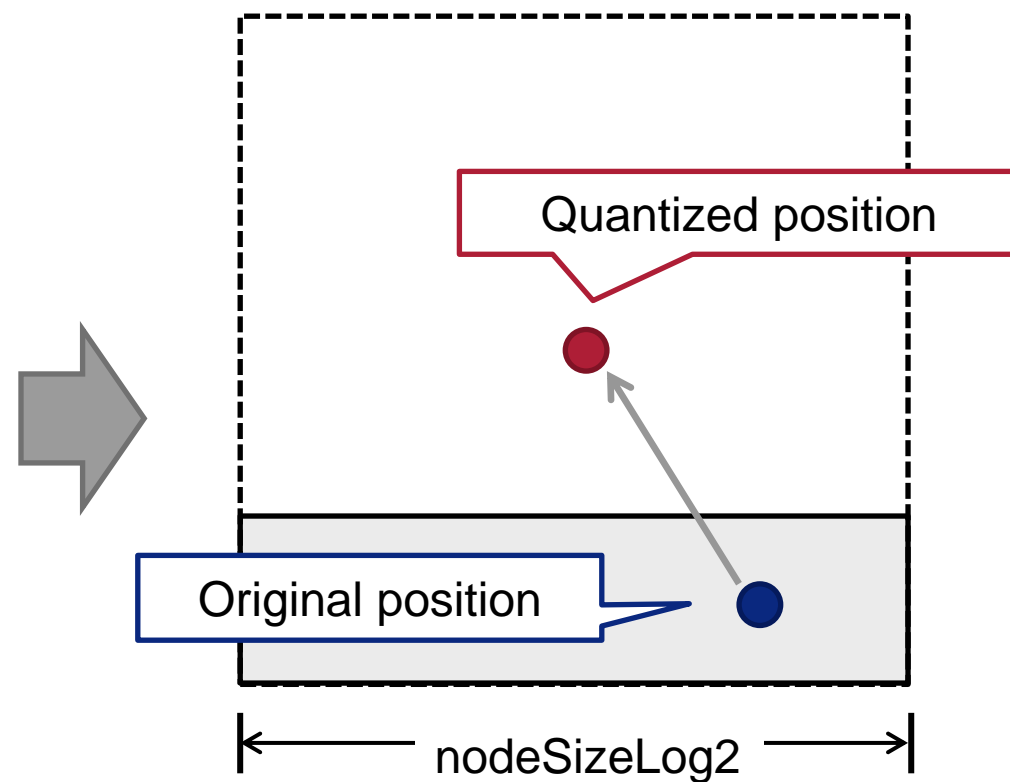
NG case : K=0, M=0

Decoded ply with S=4

■ Quantized position can go out from parent node

$\text{Dist} = (\text{Quant}(\mathbf{P}_{\text{ref}}, \text{LoD}) - \text{Quant}(\mathbf{P}_i))^2$,
where $Q(x, \text{LoD})$ is defined as $((x \gg \text{LoD}) \ll \text{LoD})$.

```
inline point_t  
clacIntermediatePosition(  
    bool enabled, int32_t nodeSizeLog2, const point_t& point)  
{  
    if (!enabled || !nodeSizeLog2)  
        return point;  
  
    uint32_t mask = (uint32_t(-1)) << nodeSizeLog2;  
    int32_t centerX = (point.x() & mask) + (1 << (nodeSizeLog2 - 1));  
    int32_t centerY = (point.y() & mask) + (1 << (nodeSizeLog2 - 1));  
    int32_t centerZ = (point.z() & mask) + (1 << (nodeSizeLog2 - 1));  
  
    point_t newPoint{centerX, centerY, centerZ};  
    return newPoint;  
}
```



■ Method 1 : Add high level constraint

- Scalable lifting and QtBt can be used only exclusively.

lifting_scalability_enabled_flag equal to 1 specifies that the attribute decoding process allows the pruned octree decode result for the input geometry points. lifting_scalability_enabled_flag equal to 0 specifies that the attribute decoding process requires the complete octree decode result for the input geometry points. When not present, the value of lifting_scalability_enabled_flag is inferred to be equal to 0. When the value of log2_trisoup_node_size is greater than 0, the value of lifting_scalability_enabled_flag shall be 0. When the value of gps_implicit_geom_partition_flag is equal to 1, the value of lifting_scalability_enabled_flag shall be 0.

- If Method 1 is acceptable, we recommend to adopt Method 1.

■ Method 2 : Modify the scalable lifting process

- If Method 1 is unacceptable, the scalable lifting process should be fixed.
- Further study is recommended about how to modify the process.

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 - If method 1 is acceptable, we recommend to adopt Method 1.
- **Method 2**
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 - Further study is recommended about how to modify the process.