m55322
On decoding process of NodeQp

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Overview

■ Problem statement

1. **NodeQp value can be negative in spec-wise.**
    - Because some components of NodeQp are signalled as signed values and valid ranges are undefined.
2. **NodeQp value can be non-zero even though geometry scaling is disabled.**
    - node_qp_offset may be signalled when geometry scaling is disabled.

■ Proposal

1. **The minimum value of NodeQp is clipped by zero. Or a conformance requirement is added.**
2. **node_qp_offset is not signalled when geometry scaling is disabled, and it is inferred to be 0.**

Problem statement : Aspect 1

Aspect 1 : NodeQp value can be negative. (It should be zero or positive.)

The variable NodeQp is derived as follows:

– When depth is equal to GeomScalingDepth:

```
NodeQp = (geom_base_qp + geom_slice_qp_offset + nodeQpOffset) << geom_qp_multiplier_log2
```

– When depth is greater than GeomScalingDepth:

```
NodeQp = NodeQpMap[depth][nodeIdx]
```

Otherwise, when depth is less than GeomScalingDepth:

```
let dcmQp = (geom_base_qp + geom_direct_coding_mode_qp_offset) << geom_qp_multiplier_log2
NodeQp = Min(minScalingNodeDimLog2 × 8, dcmQp)
```

- **For example, geom_slice_qp_offset is signalled by se(v), and its valid range is not defined.**

if(geom_scaling_enabled_flag) {	
geom_slice_qp_offset	se(v)

geom_slice_qp_offset specifies an offset to the base geometry quantisation parameter geom_base_qp. When not present, geom_slice_qp_offset is inferred to be 0.

Proposal : Aspect 1

■ Method 1-1

● The minimum value of NodeQp is clipped.

The variable NodeQp is derived as follows:

– When depth is equal to GeomScalingDepth:

```
NodeQp = Max(geom_base_qp + geom_slice_qp_offset + nodeQpOffset, 0) << geom_qp_multiplier_log2
```

– When depth is greater than GeomScalingDepth:

```
NodeQp = NodeQpMap[depth][nodeIdx]
```

Otherwise, when depth is less than GeomScalingDepth:

```
let dcmQp = Max(geom_base_qp + geom_direct_coding_mode_qp_offset, 0) << geom_qp_multiplier_log2
NodeQp = Min(minScalingNodeDimLog2 × 8, dcmQp)
```

■ Method 1-2

● A conformance requirement is added.

- The requirement for the maximum value have already been existed.

It is a requirement of bitstream conformance that NodeQp is less than or equal to minScalingNodeDimLog2 × 8 and NodeQp is greater than or equal to zero.

Problem statement : Aspect 2

- **Aspect 2 : NodeQp value can be non-zero even though geometry scaling is disabled. ("NodeQP is equal to zero" is equivalent to "Quantization step size is equal to 1")**
  - **Definition of NodeQp**

The variable NodeQp is derived as follows:

– When depth is equal to GeomScalingDepth:

```
NodeQp = (geom_base_qp + geom_slice_qp_offset + nodeQpOffset) << geom_qp_multiplier_log2
```

  - **Definition of nodeQpOffset**

```
if (geom_node_qp_offset_eq0_flag)
  nodeQpOffset = 0
else
  nodeQpOffset = (2 × geom_node_qp_offset_sign_flag − 1) × (geom_node_qp_offset_abs_minus1 + 1)
```

geometry_node(depth, nodeIdx, sN, tN, vN) {	**Descriptor**
if(depth = = GeomScalingDepth) {	
geom_node_qp_offset_eq0_flag	ae(v)
if(! geom_node_qp_offset_eq0_flag) {	
geom_node_qp_offset_sign_flag	ae(v)
geom_node_qp_offset_abs_minus1	ae(v)
}	
}	
…	
}	

Proposal : Aspect 2

- nodeQpOffset is not signalled when geometry scaling is disabled.

geometry_node(depth, nodeIdx, sN, tN, vN) {	**Descriptor**
if(depth = = GeomScalingDepth && geom_scaling_enabled_flag) {	
geom_node_qp_offset_eq0_flag	ae(v)
if(! geom_node_qp_offset_eq0_flag) {	
geom_node_qp_offset_sign_flag	ae(v)
geom_node_qp_offset_abs_minus1	ae(v)
}	
}	
…	
}	

- geom_node_qp_offset_eq0_flag is inferred to be zero.

7.4.3.5 Geometry octree node semantics

geom_node_qp_offset_eq0_flag equal to 1 specifies that the current node's quantization parameter is offset from the slice quantization parameter. geom_node_qp_offset_eq0_flag equal to 0 specifies that the current node quantization parameter inherits the quantization parameter of the parent node. When not present, geom_node_qp_offset_eq0_flag is inferred to be 1.

Conclusion

■ Problem statement

1. **NodeQp value can be negative in spec-wise.**
   - Because some components of NodeQp are signalled as signed values and valid ranges are undefined.
2. **NodeQp value can be non-zero even though geometry scaling is disabled.**
   - node_qp_offset may be signalled when geometry scaling is disabled.

■ Proposal

1-1. The minimum value of NodeQp is clipped by zero.

1-2. A conformance requirement is added.

2. node_qp_offset is not signalled when geometry scaling is disabled, and it is inferred to be 0.

■ Recommendation

- ● **Adopt method 1-1 or 1-2.**
- ● **Adopt the solution for Aspect 2.**