

JVET-N0354

AHG12: conformance of temporally independent tile groups

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Background HEVC for 360 video

PTL/HRD for MCTS fully specified in 360 video streaming applications based on HEVC

- Encoding:
 - Joint (PTL/HRD in SEI messages)
 - Separate (PTL/HRD of bitstreams)
- Packaging:
 - Individual (PTL/HRD in bitstreams)
 - Combinations (PTL/HRD in bitstream/container)
- Client Decode:
 - Individual (PTL/HRD of bitstream)
 - Joint (PTL/HRD of bitstream)

VVC Current State and Outlook

Tile groups for independent coded picture regions

- VVC draft 4 includes numerous simplifications of Tile design wrt HEVC for merging use cases:
 - Rectangular tiles
 - Mapping of tile group ids to tile groups
 - Tile group id length explicitly signalled
- More adjustments towards 360 video use cases are proposed:
 - Flexible/hierarchical Tiling (N0111,N0348)
 - Conformance (N0354)

Conformance for VVC with MCTS

Proposal N0350:

- Start with basic **stripped-down HEVC HRD model**:
 - No DU timing
 - No alternative timing

Proposal N0354:

- **Output Tile Sets** in VVC similar to HEVC output layer sets
- **PTL/HRD** per tile output set
- **Extraction process** on tile output sets

Output Tile Sets

Define **format sets**

- For 360 video, OTS are expected to share many parameters:
Width/Height/PTL

Define **Output Tile Sets**

- Via included tile group ids
- HRD per OTS

Joint CPB/DPB

seq_parameter_set_rbsp() {	Descriptor
sps_video_parameter_set_id	u(4)
[...]	
output_tile_sets_present_flag	u(1)
if(output_tile_sets_present_flag) {	
tile_group_id_length_minus1	ue(v)
num_ots_format_sets	ue(v)
for(i = 0; i < num_ots_format_sets - 1 ; i++) {	
ots_width_in_luma_samples[i]	ue(v)
ots_height_in_luma_samples[i]	ue(v)
profile_tier_level(sps_max_sub_layers_minus1)[i]	
}	
num_output_tile_sets	ue(v)
for(i = 0; i < num_output_tile_sets - 1 ; i++) {	
num_tiles_in_output_tile_set[i]	ue(v)
ots_format_set_idx[i]	ue(v)
for(j = 0; j < num_tile_groups_in_output_tile_set - 1 ; j++) {	
tile_group_id_in_sps[i][j]	u(v)
}	
hrd_parameters(1, sps_max_sub_layers_minus1)	
}	
[...]	

Output Tile Set extraction process

- Inputs to this process are a bitstream, **and** a target highest TemporalId value tIdTarget **and** a target **tile group identifier list tileGroupIdListTarget**.
- Output of this process is a sub-bitstream.
- It is a requirement of bitstream conformance for the input bitstream that any output sub-bitstream that is the output of the process specified in this clause with the bitstream, tIdTarget equal to any value in the range of 0 to 6, inclusive, **and tileGroupIdListTarget either equal to the tile group identifier list associated with a output tile set specified in the active SPS or consisting of all the tile_group_id values of the VCL NAL units present in the input bitstream as inputs, and that satisfies the following condition shall be a conforming bitstream:**
 - – **The output sub-bitstream contains at least one VCL NAL unit with tile_group_id equal to every value in tileGroupIdListTarget.**
 - – The output sub-bitstream contains at least one VCL NAL unit with TemporalId equal to tIdTarget.
 - NOTE – A conforming bitstream contains one or more coded tile group NAL units with TemporalId equal to 0.
 - The output sub-bitstream is derived as follows:
 - – Remove all NAL units with TemporalId greater than tIdTarget **or tile_group_id not equal to any value in tileGroupIdListTarget.**

Summary and Discussion

- **Output Tile Sets** for PTL and HRD of MCTS
- OTS based sub-bitstream **extraction process**

Discussion:

- MCTS indication?
- tiles_fixed_structure_flag vs SPS-level signaling of MCTS