

# **JCTVC-N0212**

## **ON INTER-LAYER PARAMETER SET (IPS)**

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# Introduction

- Majority SPS parameters shared among multiple layers are identical
- Save bits to remove the redundancy in SPS
  - SPS to SPS prediction approaches
  - VPS to SPS prediction approaches
  - Pros and cons
- Inter-layer Parameter Set (IPS)
  - Does not impact base layer sub-stream size
  - Improve signaling efficiency and save out-of-band transmission bit rate
  - Further resolve parsing dependency

# Group of parameters

- Video format parameters (~50 bits)  
Chroma\_format\_idc, pic\_width\_in\_luma\_samples, pic\_height\_in\_luma\_samples, conf\_win\_xxx\_offset
- Coding parameters(~35 bits)  
log2\_max\_pic\_order\_cnt\_lsb\_minus4, sps\_max\_dec\_pic\_buffering\_minus1[i], sps\_max\_num\_reorder\_pics[i], sps\_max\_latency\_increase\_plus1 [ i ], log2\_min\_luma\_coding\_block\_size\_minus3, log2\_diff\_max\_min\_luma\_coding\_block\_size, log2\_min\_transform\_block\_size\_minus2, log2\_diff\_max\_min\_transform\_block\_size, max\_transform\_hierarchy\_depth\_inter, max\_transform\_hierarchy\_depth\_intra
- Scaling list parameters
- PCM parameters
- Scaled ref layer offset parameters (~10 bits)
- RPS parameters (~140 bits)
- VUI parameters

# Proposed IPS structure

Inter_layer_parameter_set_rbsp() {	Descriptor
<b>ips_inter_layer_parameter_set_id</b>	u(4)
<b>num_video_format_subsets</b>	ue(v)
for ( idx = 0; idx < num_video_format_subsets; idx++ )	
ips_video_format_subset(idx)	
<b>num_coding_param_subsets</b>	ue(v)
for ( idx = 0; idx < num_coding_param_subsets; idx++ )	
ips_coding_param_subset(idx)	
<b>num_pcm_param_subsets</b>	ue(v)
for ( i = 0; i < num_pcm_param_subsets; i++ )	
ips_pcm_param_subset(i)	
<b>num_scaling_list_subsets</b>	ue(v)
for ( idx = 0; idx < num_scaling_list_subsets; idx++ )	
ips_scaling_list_subset(idx)	
<b>num_short_term_ref_pic_sets</b>	ue(v)
for ( i = 0; i < num_short_term_ref_pic_sets; i++ )	
short_term_ref_pic_set( i )	
<b>num_long_term_ref_pic_sets</b>	ue(v)
for ( i = 0; i < num_long_term_ref_pic_sets; i++ ) {	
<b>num_long_term_ref_pics_sps[i]</b>	ue(v)
for ( j = 0; j < num_long_term_ref_pics_sps[i]; j++ ) {	
<b>lt_ref_pic_poc_lsb_sps[i][j]</b>	u(v)
<b>used_by_curr_pic_lt_sps_flag[i][j]</b>	u(1)
}	
}	
<b>num_scaled_ref_layer_offset_subsets</b>	ue(v)
for ( idx = 0; idx < num_scaled_ref_layer_offset_subsets; idx++ )	
ips_scaled_ref_layer_offset_subset(idx)	
<b>num_vui_param_subsets</b>	ue(v)
for ( i = 0; i < num_vui_param_subsets; i++ )	
ips_vui_param_subset(i)	
<b>num_vui_extension_param_subsets</b>	ue(v)
for ( i = 0; i < num_vui_extension_param_subsets; i++ )	
ips_vui_extension_param_subset(i)	
rbsp_trailing_bits( )	
}	

# Proposed EL SPS changes

seq_parameter_set_rbsp() {	<b>Descriptor</b>
sps_video_parameter_set_id	u(4)
if (nuh_layer_id > 0) {	
sps_inter_layer_parameter_set_id	u(4)
ips_video_format_subsets_index	ue(v)
ips_coding_param_subsets_index	ue(v)
ips_scaling_list_subsets_index	ue(v)
amp_enabled_flag	u(1)
sample_adaptive_offset_enabled_flag	u(1)
pcm_enabled_flag	u(1)
if( pcm_enabled_flag )	
ips_pcm_param_subsets_index	ue(v)
sps_temporal_mvp_enabled_flag	u(1)
strong_intra_smoothing_enabled_flag	u(1)
ips_vui_param_subsets_index	ue(v)
}	
sps_extension_flag	u(1)
if( sps_extension_flag ) {	
sps_extension( )	
sps_extension2_flag	u(1)
if( sps_extension2_flag )	
while( more_rbsp_data( ) )	
sps_extension_data_flag	u(1)
}	
rbsp_trailing_bits()	
}	

# Proposed SPS extension changes

sps_extension() {	Descriptor
inter_view_mv_vert_constraint_flag	u(1)
ips_vui_extension_param_subsets_index	ue(v)
<del>sps_extension_vui_parameters()</del>	
ips_scaled_ref_layer_offset_subsets_index	ue(v)
<del>num_scaled_ref_layer_offsets</del>	<del>ue(v)</del>
<del>for(i = 0; i &lt; num_scaled_ref_layer_offsets; i++) {</del>	
<del>    scaled_ref_layer_left_offset[i]</del>	<del>se(v)</del>
<del>    scaled_ref_layer_top_offset[i]</del>	<del>se(v)</del>
<del>    scaled_ref_layer_right_offset[i]</del>	<del>se(v)</del>
<del>    scaled_ref_layer_bottom_offset[i]</del>	<del>se(v)</del>
<del>}</del>	
}	

# Simulation results

	Video format	Coding	PCM	Scaling list	stRPS	ltRPS	Scaled ref layer offsets	VUI	Total SPS (bits)
RA (960x540)	50	35	1	1	139	1	0	1	245
RA (1920x1080)	52	35	1	1	139	1	10	1	257
LDB/LDP(960x540)	50	31	1	1	130	1	0	1	232
LDB/LDP(1920x1080)	52	31	1	1	130	1	10	1	244

		Anchor	N0212			Bit saving Percentage
# ELs		SPS (bit)	SPS (bit)	IPS(bit)	Total (bit)	
2	RA	502	56	302	358	28.7%
	LDP/LDB	476	30	289	319	33%
3	RA	761	86	302	388	49%
	LDP/LDB	722	47	289	336	53.5%
4	RA	1020	116	302	418	59%
	LDP/LDB	968	64	289	353	63.5%

# Conclusion

- Inter-layer Parameter Set (IPS) can save the bit rate for out-of-band transmission
- The size of SPS can be reduced significant
- Maintain VPS design philosophy and syntax structure intact
- No impact on base layer sub-stream
- Suggest to adopt IPS into SHVC