JCTVC-N0210
ADAPTATION PARAMETER SET FOR SHVC

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Introduction

- APS was used to carry picture level adaptive data (ALF/SAO)
- APS is a good match to convey parameters
  - Frequently changed picture level parameters
  - Keep slice header syntax intact
  - Enable parallelism of BL codec, inter-layer processing and EL codec operations
- APS parameters
  - Inter-layer adaptive filtering coefficients
  - Sample and motion prediction syntax elements

Proposed APS syntax structure and semantics

aps_rbsp( ) {	Descriptor
aps_pic_order_cnt_lsb	u (4)
inter_layer_information()	
aps_extension_flag	u (1)
if(aps_extension_flag)	
while(more_rbsp_data( ))	
aps_extension_data_flag	u (1)
rbsp_trailing_bits( )	
}	

- **aps_pic_order_cnt_lsb** identifies the picture to which the inter layer processing information in the current adaptation parameter set is associated.

- **aps_extension_flag** equal to 0 specifies that no aps_extension_data_flag syntax elements are present in the adaptation parameter set RBSP syntax structure. aps_extension_flag shall be equal to 0 in bitstreams conforming to this Recommendation | International Standard. The value of 1 for aps_extension_flag is reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore all data that follow the value 1 for aps_extension_flag in an aps_extension_flag parameter set NAL unit.

- **aps_extension_data_flag** may have any value. Its value does not affect decoder conformance to profiles specified in this Recommendation | International Standard.

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APS for Chroma Sample Enhancement Filter (SCE3.4)

inter_layer_information ( ) {	Descriptor
chroma_cb_filtering_flag	u (1)
if (chroma_cb_filtering_flag) {	
for (i = 0; i < number_of_coefficents; i++)	
chroma_cb _filter_coefficients[i]	u (4)
chroma_cb_scaling_factor_abs_minus1	u (10)
chroma_cb_scaling_factor_sign	u (1)
chroma_cb _shifting	u (5)
}	
chroma_cr_filtering_flag	u (1)
if (chroma_cr_filtering_flag) {	
chroma_filter_identical_flag	
if (chroma_filter_identical_flag == 0) {	
for (i = 0; i < number_of_coefficents; i++)	
chroma_cr_filter_coefficients[i]	u (4)
chroma_cr_scaling_factor_abs_minus1	u (10)
chroma_cr_scaling_factor_sign	u (1)
chroma_cr_shifting	u (5)
}	
}	
}	

APS for sample/motion prediction syntax

inter_layer_information ( ) {	Descriptor
NumActiveRefLayerPics = 0	
inter_layer_pred_enabled_flag	u(1)
if(inter_layer_pred_enabled_flag) {	
num_inter_layer_ref_pics_minus1	u(v)
NumActiveRefLayerPics = num_inter_layer_ref_pics_minus1 + 1	
for(i = 0; i < NumActiveRefLayerPics; i++)	
inter_layer_pred_layer_idc[i]	u(v)
}	
if(NumActiveRefLayerPics > 0)	
inter_layer_sample_pred_only_flag	u(1)
if(nuh_layer_id > 0)	
alt_collocated_indication_flag	u(1)
if(alt_collocated_indication_flag)	
collocated_ref_layer_idx	ue(v)
else {	
if(slice_type = = B)	
collocated_from_l0_flag	u(1)
if((collocated_from_l0_flag && num_ref_idx_l0_active_minus1 > 0) || (!collocated_from_l0_flag && num_ref_idx_l1_active_minus1 > 0))	
collocated_ref_idx	ue(v)
}	
}	

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Simulation Results (anchor SHM2.0)

	AI HEVC 2x			AI HEVC 1.5x		
	Y	U	V	Y	U	V
Class A	-0.9%	-7.8%	-6.2%			
Class B	-0.8%	-6.3%	-8.4%	-0.7%	-8.2%	-10.4%
Overall (Test vs Ref)	-0.9%	-6.8%	-7.8%	-0.7%	-8.2%	-10.4%
Overall (Test vs single layer)	11.8%	7.3%	6.1%	9.7%	1.1%	-1.1%
Overall (Ref vs single layer)	12.8%	14.9%	14.6%	10.5%	9.8%	9.3%
EL only (Test vs Ref)	-1.6%	-8.0%	-8.9%	-2.2%	-11.2%	-13.6%
Enc Time[%]	114.3%			108.8%		
Dec Time[%]	111.0%			104.5%		
BL Match	Matched			Matched		

	RA HEVC 2x			RA HEVC 1.5x			RA HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-0.5%	-11.3%	-7.7%				-0.4%	-9.0%	-5.2%
Class B	-0.3%	-8.1%	-9.7%	-0.3%	-10.4%	-11.9%	-0.3%	-7.6%	-8.2%
Overall (Test vs Ref)	-0.4%	-9.0%	-9.1%	-0.3%	-10.4%	-11.9%	-0.3%	-8.0%	-7.4%
Overall (Test vs single layer)	18.8%	20.9%	20.4%	15.9%	15.7%	14.6%	14.0%	21.4%	24.6%
Overall (Ref vs single layer)	19.2%	33.3%	32.0%	16.2%	28.8%	29.1%	14.4%	32.1%	34.1%
EL only (Test vs Ref)	-0.6%	-9.7%	-9.7%	-0.7%	-11.8%	-13.3%	-0.6%	-8.9%	-8.1%
Enc Time[%]	118.2%			123.9%			126.3%		
Dec Time[%]	124.2%			129.5%			132.1%		
BL Match	Matched			Matched			Matched		

	LD-B HEVC 2x			LD-B HEVC 1.5x			LD-B HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-0.2%	-9.9%	-5.8%				-0.3%	-7.9%	-5.0%
Class B	-0.2%	-5.1%	-6.6%	-0.2%	-8.1%	-10.7%	-0.2%	-5.6%	-6.7%
Overall (Test vs Ref)	-0.2%	-6.5%	-6.4%	-0.2%	-8.1%	-10.7%	-0.3%	-6.3%	-6.2%
Overall (Test vs single layer)	28.3%	29.5%	30.8%	24.6%	22.5%	21.8%	24.0%	26.1%	30.7%
Overall (Ref vs single layer)	28.5%	39.0%	39.7%	24.8%	33.0%	35.9%	24.3%	34.7%	39.5%
EL only (Test vs Ref)	-0.3%	-6.7%	-6.5%	-0.4%	-8.7%	-11.3%	-0.4%	-6.8%	-6.7%
Enc Time[%]	108.1%			105.0%			103.7%		
Dec Time[%]	109.2%			108.5%			105.3%		
BL Match	Matched			Matched			Matched		

- We thank Huawei for cross-checking the results

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Simulation results (anchor SCE3.4.1)

	AI HEVC 2x			AI HEVC 1.5x		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%			
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs Ref)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs single layer)	11.8%	7.3%	6.1%	9.7%	1.1%	-1.1%
Overall (Ref vs single layer)	11.8%	7.3%	6.1%	9.7%	1.1%	-1.1%
EL only (Test vs Ref)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BL Match	Matched			Matched		

	RA HEVC 2x			RA HEVC 1.5x			RA HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%				0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs Ref)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs single layer)	18.8%	20.9%	20.4%	15.9%	15.7%	14.6%	14.0%	21.4%	24.6%
Overall (Ref vs single layer)	18.7%	20.9%	20.4%	15.8%	15.7%	14.5%	14.0%	21.4%	24.6%
EL only (Test vs Ref)	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
BL Match	Matched			Matched			Matched		

	LD-B HEVC 2x			LD-B HEVC 1.5x			LD-B HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%				0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs Ref)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall (Test vs single layer)	28.3%	29.5%	30.8%	24.6%	22.5%	21.8%	24.0%	26.1%	30.7%
Overall (Ref vs single layer)	28.2%	29.4%	30.8%	24.5%	22.4%	21.7%	24.0%	26.1%	30.7%
EL only (Test vs Ref)	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
BL Match	Matched			Matched			Matched		

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Conclusion

- Adaptation Parameter Set (APS) is a good carriage to convey picture level adaptive parameters
  - Keep the existing PPS and slice header intact
  - Achieve additional parallelism for codec operations
  - No additional cost for single slice per picture, more saves for multiple slices per picture
- Suggest to adopt APS into SHVC