REDEFINING MOBILITY

JCT3V-F0024: CE4 summary report

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Proposal List

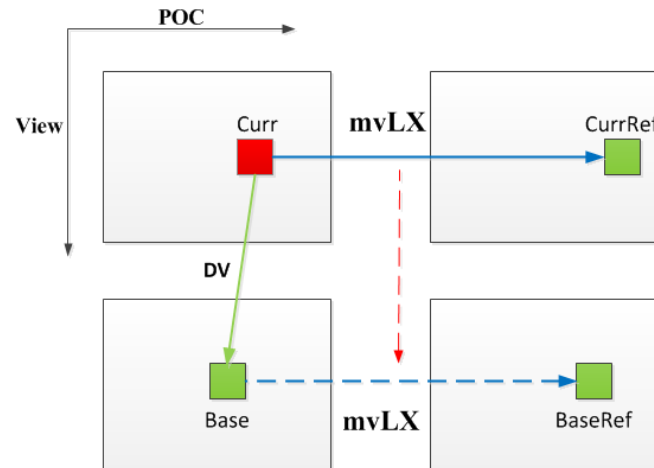| Category	Proposal	Crosscheck report
CE proposal	JCT3V-F0108	JCT3V-F0238
	JCT3V-F0123	JCT3V-F0231, JCT3V-F0247
	JCT3V-F0145	JCT3V-F0216
CE related proposal	JCT3V-F0189	N/A
	JCT3V-F0190	N/A
	JCT3V-F0161	JCT3V-F0206
	JCT3V-F0105	JCT3V-F0199
	JCT3V-F0112	JCT3V-F0209

Proposed methods

- Topics in CE 4
    - Topic #1: ARP for inter-view residual
    - Topic #2: More accurate DV for ARP to temporal residual
    - Topic #3: Joint optimization of ic_flag and ARP weighting factors
    - Topic #4: Restriction of ARP

- CE-related topics
    - Topic #5: More accurate motion information utilized by ARP
    - Topic #6: CABAC context design
    - Topic #7: ARP fixed reference picture

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Introduction

- Advanced residual prediction in 3D-HEVC
  - Applied to temporal residual with the disparity vector (DV) derived from NBDV
  - Residual predictor generation
    - The difference between two reference blocks in a reference view (Base – BaseRef)
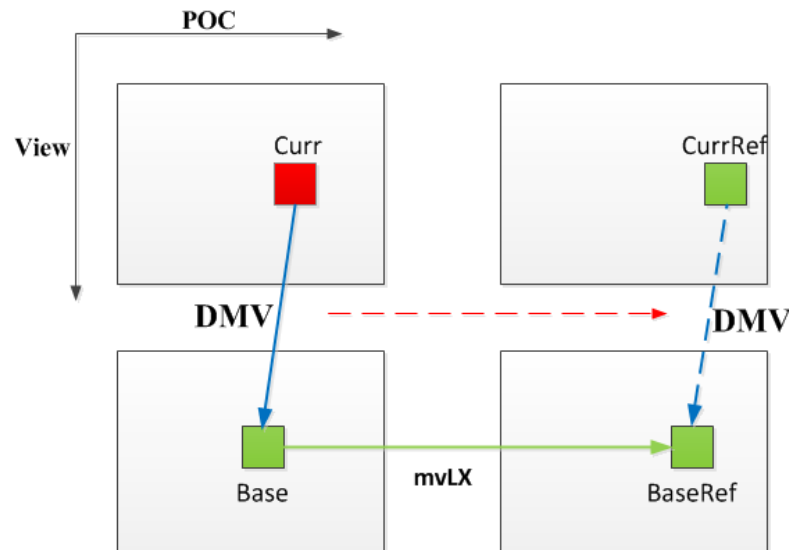 - Temporal motion vector of current block is inherited

  - A weighting factor index is signaled in CU-level

Topics in CE 4

- Topic #1: ARP for inter-view residual

- Topic #2: More accurate DV for ARP to temporal residual

- Topic #3: Joint optimization of ic_flag and ARP weighting factors

- Topic #4: Restriction of ARP

ARP for inter-view residual

- Extension of ARP to inter-view residual
  - Residual predictor generation
    - The difference between two reference blocks in a different access unit (CurrRef – BaseRef)
  - Disparity motion vector of current block is inherited
  - Temporal motion vector (mvLX) of the block covering the center position of Base is utilized.
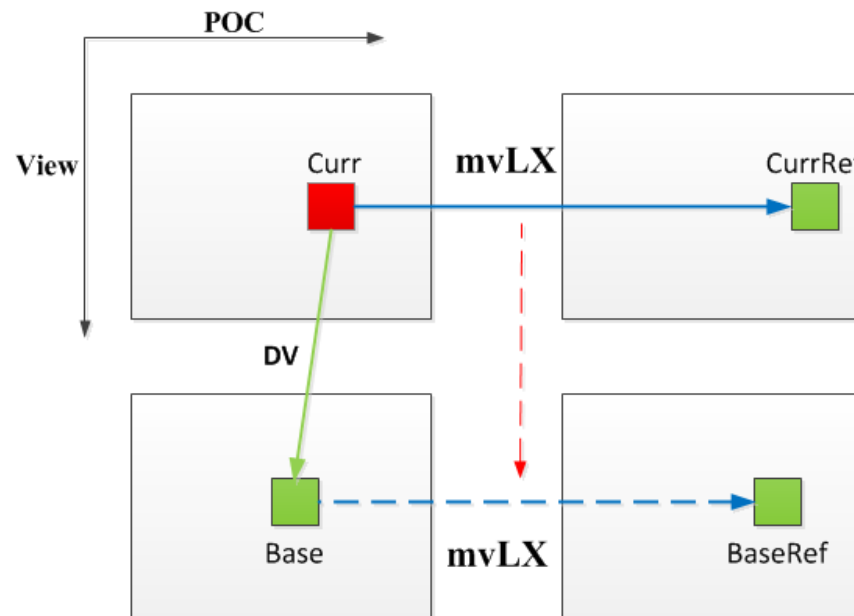
ARP for inter-view residual

- Simulation results reported in CE proposals

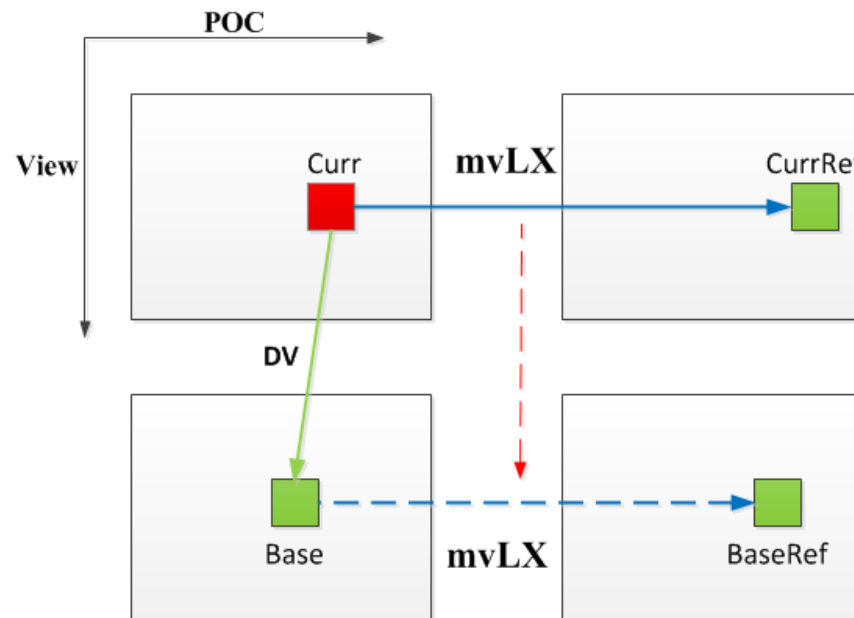|	Proposal	Video 1	Video 2	Texture	Coded	Syn	Enc	Dec
ARP for inter-view residual	#2 in JCT3V-F0108	-0.56%	-0.56%	-0.20%	-0.16%	-0.18%	101%	102%
	#1 in JCT3V-F0123	-0.58%	-0.54%	-0.23%	-0.20%	-0.17%	104%	100%

More accurate DV for ARP to temporal residual

- Adaptive Disparity Vector Derivation (ADVD) in JCT3V-F0108 (#1)
  - Three unique DV candidates are derived from temporal/spatial neighbouring blocks.
  - A new DV candidate is appended into the list only if it is not equal to any DV candidate already in the list. If the DV candidate list is not fulfilled after exploiting neighbouring blocks, default DVs will be added.
  - The best DV candidate index is selected according to RDO criterion and signaled in the bitstream.

More accurate DV for ARP to temporal residual

- DV refinement in JCT3V-F0123 (#2)
  - The DV is replaced by a disparity motion vector (DMV) contained by the reference block for residual predictor generation.
  - Only the DMV of the block covering the center position of CurrRef is utilized.

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Joint optimization of ic_flag and ARP weighting factors

- **Proposed methods**
  - ic_flag is not signaled when ARP weighting factor is unequal to 0
    - (#3 in JCT3V-F0123, #3 in JCT3V-F0145)
  - ARP weighting factor is not signaled when ic_flag is unequal to 0
    - (#2 in JCT3V-F0145)

- **Simulation Results**
  - No separate results, the following table includes both joint optimization and restriction of ARP to merge mode

Test cases	Proposal	Video 1	Video 2	Video PSNR / Video bitrate	Video PSNR / total bitrate	Synth PSNR / total bitrate	Enc. time	Dec. time
ARP restriction disable ARP when ic_flag = 1	#1 and #2 in JCT3V-F0145	-0.06%	-0.08%	-0.04%	-0.03%	-0.04%	96%	95%
ARP restriction disable IC when ARP WF > 0	#1 and #3 in JCT3V-F0145	0.00%	-0.01%	-0.02%	-0.01%	-0.02%	96%	97%

Restriction of ARP

- It is proposed in JCT3V-F0145 (#1)

- Simulation results

Test cases	Proposals	Simulation Results						
		Video 1	Video 2	Video PSNR / Video bitrate	Video PSNR / total bitrate	Synth PSNR / total bitrate	Enc. time	Dec. time
ARP restriction	#1 in JCT3V-F0145	0.04%	0.01%	0.01%	0.01%	-0.01%	98%	95%

Summary of CE results

Table 1: Summary of simulation results compared to 3D-HTM

Test cases	Proposals	Simulation Results						
		Video 1	Video 2	Video PSNR / Video bitrate	Video PSNR / total bitrate	Synth PSNR / total bitrate	Enc. time	Dec. time
ADVD	#1 in JCT3V-F0108	-0.96%	-0.91%	-0.40%	-0.37%	-0.29%	110%	101%
ARP for inter-view residual	#2 in JCT3V-F0108	-0.56%	-0.56%	-0.20%	-0.16%	-0.18%	101%	102%
	#1 in JCT3V-F0123	-0.58%	-0.54%	-0.23%	-0.20%	-0.17%	104%	100%
PU-level ARP	#1, #2 and #3 in JCT3V-F0123	-0.90%	-0.87%	-0.37%	-0.33%	-0.27%	102%	100%
ARP restriction	#1 in JCT3V-F0145	0.04%	0.01%	0.01%	0.01%	-0.01%	98%	95%
ARP restriction disable ARP when ic_flag = 1	#1 and #2 in JCT3V-F0145	-0.06%	-0.08%	-0.04%	-0.03%	-0.04%	96%	95%
ARP restriction disable IC when ARP WF > 0	#1 and #3 in JCT3V-F0145	0.00%	-0.01%	-0.02%	-0.01%	-0.02%	96%	97%

CE4 related topics

- Topic #5: More accurate motion information utilized by ARP

- Topic #6: CABAC context design

- Topic #7: ARP fixed reference picture

More accurate motion information utilized by ARP

- Aligned Temporal DV (ATDV) in JCT3V-F0108 (#4)

  - On top of ADVD, a new DV candidate, i.e., ATDV, is obtained from the aligned block, which is located by a scaled MV to the collocated picture.

  - Two collocated pictures are utilized, which are also used in the NBDV derivation.

  - ATDV is checked before DV candidates from neighbouring blocks when it is used.

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More accurate motion information utilized by ARP

- **Combination of ADVD and ATRP in JCT3V-F0108 (#3)**

  - Similar to ADVD, when ARP is applied to inter-view residual, a temporal motion vector candidate list is constructed

    - Three MV candidates are derived for ATRP just like three DV candidates are derived for ARP in ADVD.

    - DMV is put into the MV candidate list if it can be found.

    - Then spatial/temporal neighbouring blocks are checked to find more MV candidates like finding a merging candidate. If the MV candidate list is not fulfilled after exploiting neighbouring blocks, default MVs will be added.

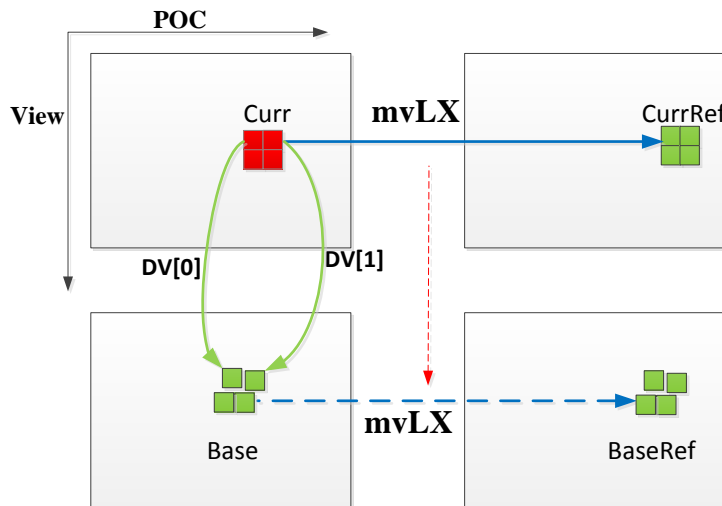   - The best MV candidate index is selected according to RDO criterion and signaled in the bitstream.

More accurate motion information utilized by ARP

- Weighting factor removal in JCT3V-F0108 (#5)
  - Removal of one weighting factor: the weighting factor equal to ½ is removed.
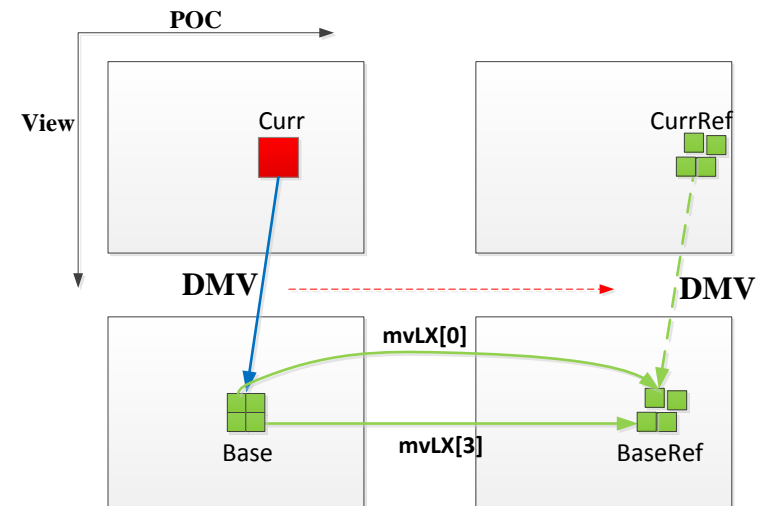 - Therefore, only two weighting factors (i.e., 0 and 1) are kept in ARP.

More accurate motion information utilized by ARP

- **Block-level ARP in** JCT3V-F0123
  - One PU is split into several 8x8 blocks and for each 8x8 block, the proposed ARP method is applied.
    - When ARP is applied to temporal residual, DV may be different among 8x8 blocks while temporal motion information is kept unchanged.
    - When ARP is applied to temporal residual, temporal motion information may be different among 8x8 blocks while disparity motion information is kept unchanged.
  - Residual of chroma components are not coded

Prediction structure of block-level ARP: (a) temporal residual (b) inter-view residual.

More accurate motion information utilized by ARP

- Explicit disparity vector oriented inter-view motion prediction and residual prediction (JCT3V-F0189)

  - The explicit disparity vector is coded in the bitstream and it is used for both inter-view motion prediction and ARP for inter-view residual.

  - When it is used in ARP for inter-view residual, a corresponding block in the inter-view reference picture is located using the explicit DV instead of the disparity motion vector of current PU. In addition, the temporal motion information of the corresponding block is utilized for residual predictor generation.

More accurate motion information utilized by ARP

- Motion vector oriented disparity vector derivation for residual prediction (JCT3V-F0190)

  - A motion vector oriented disparity vector (DV) derivation from the temporal reference picture for advance residual prediction.

  - The DV is derived from the motion parameters in the coded reference block located by motion parameters of current PU.

  - If no such DV is found, the original DV derived from NBDV is utilized.

CABAC context design

- It is proposed in JCT3V-F0161.
  - The initialization table for the contexts used for coding weighting factors is modified.

Summary of CE related simulation results compared to 3D-HTM

Test cases	Proposals	Simulation Results						
		Video 1	Video 2	Video PSNR / Video bitrate	Video PSNR / total bitrate	Synth PSNR / total bitrate	Enc. time	Dec. time
ADVD with 2 weighting factors	#1 and #5 in JCT3V-F0108	-1.24%	-1.24%	-0.47%	-0.41%	-0.37%	103%	100%
ADVD + ATRP with 2 weighting factors	#3 and #5 in JCT3V-F0108	-1.56%	-1.52%	-0.58%	-0.51%	-0.45%	103%	102%
Overall performance	JCT3V-F0108	-1.90%	-1.98%	-0.76%	-0.66%	-0.58%	103%	102%
	JCT3V-F0123	-1.82%	-1.92%	-0.66%	-0.58%	-0.52%	104%	104%
	JCT3V-F0189	-0.75%	-0.79%	-0.29%	-0.23%	-0.23%	-	-
	JCT3V-F0190	-0.1%	-0.1%	-0.1%	-0.1%	-0.07%	-	-
	JCT3V-F0161	-0.81%	-0.84%	-0.26%	-0.22%	-0.26%	100%	98%

ARP fixed reference picture

- ARP reference picture selection and its availability check (JCT3V-F0105)

  - Use the first temporal reference picture instead of the first entry in each reference picture list (RefPicListX). *(same as proposed in JCT3V-F0123)*

  - Check whether ARP fixed reference picture is in DPB marked as "used for reference", which is explicated indicated in reference layer's RPS.

  - No coding performance changed in CTC

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On complexity reduction of bi-prediction for advanced residual prediction

- It is proposed in JCT3V-F0112.

  - Clipping operation is applied for both uni-prediction and bi-prediction on the motion compensated signal after adding the predicting residual signal.

  - Simulation results show that there are 0.1% and 0.0% bitrate increase for texture views and synthesized views, respectively.

- Modify derivation method of ARP fixed reference picture:

  - For reference picture list X (with X being 0 or 1), the first entry of reference picture list 0 and reference picture list 1 are selected and the one with a POC closer to the list X reference picture of the current PU.

  - Simulation results show that there is almost no impact on the coding performance.

Thank you!