
JVET-J0036

Thread Parallel Processing

Reported JEM-7.0 Runtime vs HM

From JVET-H0001

Test configuration	BD-rate			Time	
	Y	U	V	Enc.	Dec.
All Intra	-20%	-28%	-27%	×36	×2
Random Access	-29%	-35%	-34%	×10	×7
Low Delay-B	-22%	-28%	-29%	×9	×7
Low Delay-P	-26%	-31%	-32%	×7	×5

Speed-Ups Required – Approaches

- Algorithmic
 - Reducing the number of tested encoding options
 - Heuristics, Convolutional Neural Networks
 - Results reuse
- Code-Optimization
 - SIMD-Intrinsics
 - Memory and Cache Access Optimization
- Parallelization

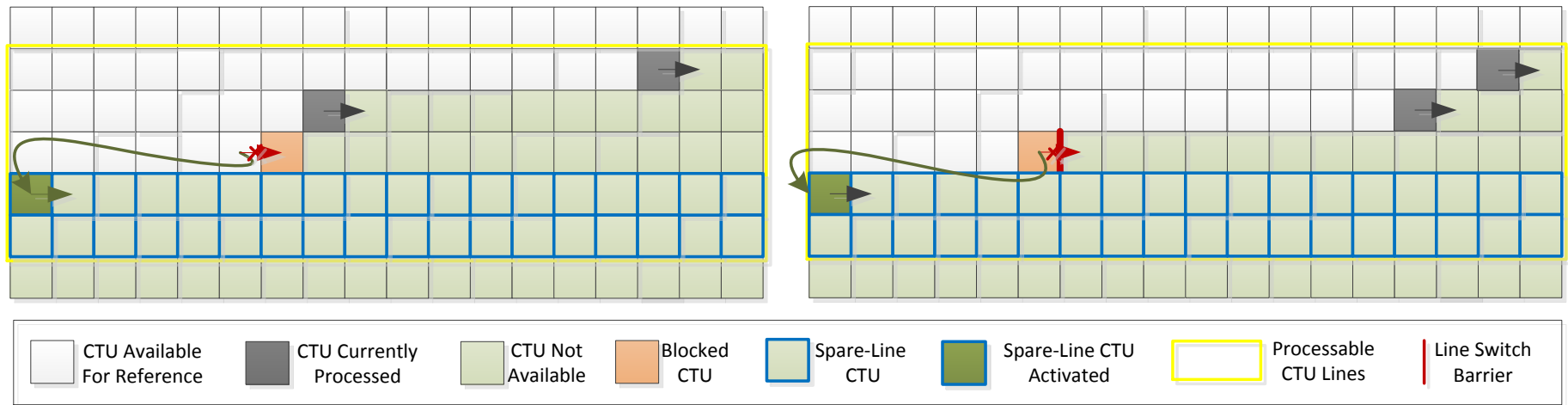
Parallelization – Demands and Challenges

- Identification of possible parallelization points
 - WPP and split based approaches
- Identification and elimination of race-conditions
 - Mostly elimination of static variables
 - Well-structured code and data-flow helpful
- Parallelization only in the RD-search, invisible to decoder
 - Decoupling of encoding order from bit-stream order
- Load-Balancing

WPP-Based Parallelization

- Parallel encoding of CTU-lines with CTU-offset of 2
- Adaptations
 - Line-wise inter-frame CABAC context initialization
 - Neighbor-only based QP-prediction
- Load-Balancing
 - Extra-Lines allocated, available for encoding by blocked workers
- Effective, transparent, scalable approach

WPP Extra-Line Logic



Split Parallelization

How many proposals allow less than 4 splits?

- Approach: testing split modes in parallel
- No normative adaptations required, encoder only-speedup
- Processing of split modes independently at a specified *parallelization point*
 - Definition very challenging – important for load balancing
 - Works better with many tools, due to easier balancing
- Due to independent split processing, some speed-up rules are unavailable
 - Overall workload increases
 - RD-performance increases

Results

Reference: Adapted CABAC Initialization, no Parallelization

		QP values 22, 27, 32, 37				QP values 27, 32, 37, 42			
		PSNR-Y	PSNR-U	PSNR-V	EncT	PSNR-Y	PSNR-U	PSNR-V	EncT
AI	WPP (4)	0.00%			34%	0.00%			34%
	Split (4)				49%				52%
	Both (4×4)	-0.13%	-0.44%	-0.46%	18%	-0.20%	-0.48%	-0.52%	19%
RA	WPP (4)	0.00%			37%	0.00%			38%
	Split (4)				76%				83%
	Both (4×4)	-0.52%	-0.50%	-0.41%	28%	-0.54%	-0.62%	-0.73%	30%
LD	WPP (4)	0.00%			41%	0.00%			43%
	Split (4)				69%				78%
	Both (4×4)	-0.56%	-0.16%	-0.66%	28%	-0.54%	-0.33%	-0.71%	33%