



EE2.1: Quad-Tree plus Binary Tree structure integration with JEM tools

H. Huang, K. Zhang, Y.-W. Huang,
S. Lei



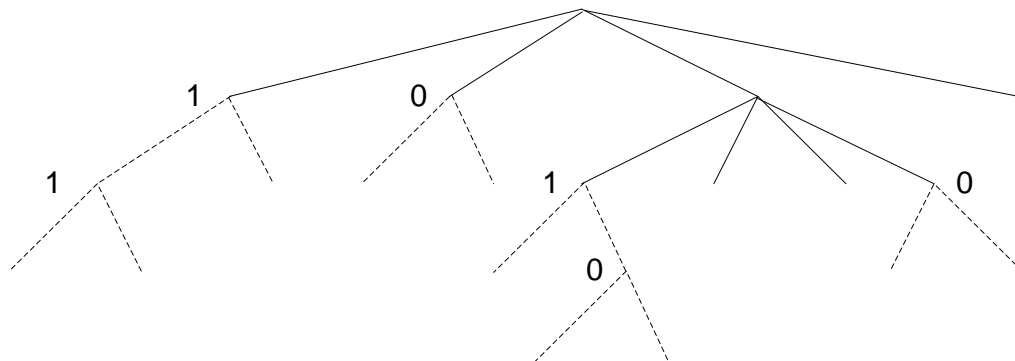
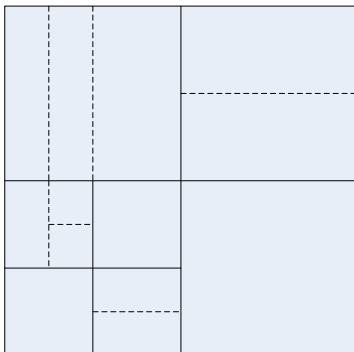
Summary

- Gains are around 4%.
- Decoder time increases are only 5%-12%.

	Y BD-rate	U BD-rate	V BD-rate	Enc. Time	Dec. Time
AI	-3.28%	-5.56%	-4.55%	561%	110%
RA	-3.78%	-8.89%	-8.73%		
LB	-4.49%	-5.02%	-5.77%	241%	106%
LP	-4.39%	-5.30%	-5.57%	221%	118%

Quad-Tree plus Binary Tree structure

- Partition of a CTB:
 - Quad-tree is first applied, always square partition
 - Binary tree is applied at quad-tree leaf node, can be symmetric horizontal or vertical partition
 - $CB=PB=TB$
 - Separated Luma CTB and Chroma CTB for I Slice



Quad-Tree plus Binary Tree structure

- Pro:
 - Much more flexible block partition → gains
 - Unified structure → simplicity
- Con:
 - Big changes

Once you get familiar with QTBT, you will embrace its benefits!

Exploration Experiment 2.1

- m37524/COM16–C966
 - QTBT is integrated on top of HM-13.0
- JVET-B0023
 - Two coding tools of JEM were not enabled.
- EE2.1
 - QTBT is integrated on top of JEM-2.0.
 - All coding tools are enabled.
 - Support tool on/off.
 - Support CTU size 256 (Default off).

QTBT summary results on top of HM-13.0

- QTBT settings:

QTBT high level parameters	I slice	P and B slice
MinQTSIZE	16x16	16x16 (init)
MaxBTSIZE	32x32	128x128 (init)
MaxBTDepth	4	4
MinBTSIZE	4	4

- Results:

	Y BD-rate	U BD-rate	V BD-rate	Enc. Time	Dec. Time
AI	-4.26%	-14.18%	-15.63%	677%	108%
RA	-5.97%	-13.89%	-15.29%	158%	106%
LB	-6.39%	-13.42%	-14.98%	157%	108%
LP	-6.78%	-15.05%	-16.46%	142%	108%

EE2.1 summary results

- Default QTBT settings:

QTBT high level parameters	I slices		P and B slices
CTUSize	128x128		128x128
	Luma	Chroma	
MinQTSIZE	16x16	4x4	16x16
MaxBTSIZE	32x32	16x16	128x128(init)
MaxBTDepth	4	0	4
MinBTSIZE	4	4	4

- Results:

	Y BD-rate	U BD-rate	V BD-rate	Enc. Time	Dec. Time
AI	-3.28%	-5.56%	-4.55%	561%	110%
RA	-3.78%	-8.89%	-8.73%		
LB	-4.49%	-5.02%	-5.77%	241%	106%
LP	-4.39%	-5.30%	-5.57%	221%	118%

EE2.1 detailed results

	All Intra Main10									
	Over HM-16.6-JEM-2					Over HM-16.9 with QP_ALIGN_LAMBDA and GOP16 for RA				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	-2.76%	-6.89%	-0.85%	573%	122%	-19.91%	-21.58%	-19.29%	9143%	222%
Class A2	-3.58%	-6.35%	-3.34%	562%	121%	-21.27%	-20.87%	-13.71%	7395%	202%
Class B	-3.58%	-5.50%	-6.67%	606%	120%	-16.69%	-13.21%	-11.57%	11459%	209%
Class C	-2.74%	-4.83%	-4.90%	534%	105%	-16.85%	-15.63%	-18.84%	11671%	172%
Class D	-2.18%	-2.81%	-3.00%	531%	117%	-13.45%	-10.41%	-11.85%	13350%	194%
Class E	-5.26%	-7.48%	-9.14%	484%	99%	-19.76%	-17.76%	-21.61%	6464%	172%
Overall	-3.28%	-5.56%	-4.55%	552%	114%	-17.86%	-16.38%	-15.72%	9826%	196%
Class F (optional)	-3.98%	-7.01%	-7.41%	550%	104%	-16.14%	-17.49%	-17.78%	8474%	157%

	Random Access Main 10									
	Over HM-16.6-JEM-2					Over HM-16.9 with QP_ALIGN_LAMBDA and GOP16 for RA				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	-3.83%	-13.19%	-10.37%	#NUM!	#NUM!	-25.35%	-31.17%	-32.12%	#NUM!	#NUM!
Class A2	-4.02%	-7.81%	-6.55%	#NUM!	#NUM!	-31.64%	-33.99%	-27.23%	#NUM!	#NUM!
Class B	-3.75%	-8.49%	-10.00%	#NUM!	#NUM!	-24.73%	-27.70%	-23.15%	#NUM!	#NUM!
Class C	-3.81%	-7.41%	-7.72%	#NUM!	#NUM!	-23.76%	-24.79%	-27.25%	#NUM!	#NUM!
Class D	-3.51%	-8.11%	-8.72%	#NUM!	#NUM!	-23.99%	-22.62%	-23.92%	#NUM!	#NUM!
Class E										
Overall (Ref)	-3.78%	-8.98%	-8.73%	#NUM!	#NUM!	-25.84%	-28.04%	-26.56%	#NUM!	#NUM!
Class F (optional)	-5.23%	-8.84%	-9.42%	#NUM!	#VALUE!	-20.11%	-23.66%	-23.59%	#NUM!	#VALUE!

	Low delay B Main10									
	Over HM-16.6-JEM-2					Over HM-16.9 with QP_ALIGN_LAMBDA and GOP16 for RA				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1										
Class A2										
Class B	-3.81%	-5.49%	-6.47%	262%	112%	-18.93%	-26.03%	-25.27%	1029%	580%
Class C	-4.46%	-5.15%	-5.71%	238%	94%	-19.92%	-24.25%	-26.67%	1053%	558%
Class D	-4.46%	-4.44%	-5.86%	221%	98%	-20.09%	-21.26%	-22.32%	977%	659%
Class E	-5.67%	-4.81%	-4.56%	157%	82%	-24.85%	-30.46%	-33.68%	392%	497%
Overall (Ref)	-4.49%	-5.02%	-5.77%	222%	98%	-20.58%	-25.22%	-26.46%	852%	576%
Class F (optional)	-8.02%	-10.02%	-10.04%	219%	100%	-23.12%	-31.33%	-30.93%	682%	346%

	Low delay P Main10									
	Over HM-16.6-JEM-2					Over HM-16.9 with QP_ALIGN_LAMBDA and GOP16 for RA				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1										
Class A2										
Class B	-3.76%	-6.10%	-7.08%	247%	118%	-24.08%	-30.29%	-28.76%	886%	336%
Class C	-4.44%	-5.36%	-5.83%	220%	108%	-22.04%	-25.47%	-27.97%	890%	325%
Class D	-4.37%	-4.32%	-5.08%	199%	117%	-21.69%	-22.27%	-22.49%	795%	377%
Class E	-5.40%	-5.22%	-3.38%	147%	100%	-27.37%	-33.91%	-35.37%	333%	274%
Overall (Ref)	-4.39%	-5.30%	-5.57%	206%	112%	-23.59%	-27.76%	-28.24%	719%	330%
Class F (optional)	-7.93%	-9.59%	-9.15%	211%	104%	-23.84%	-31.70%	-31.54%	614%	250%

EE2.1 low complexity settings

- Example for AI

QTBT high level parameters	I slices	
CTUSize	128x128	
	Luma	Chroma
MinQTSIZE	8x8	4x4
MaxBTSIZE	32x32	16x16
MaxBTDepth	2	2
MinBTSIZE	4	4

	All Intra Main10				
	Over HM-16.6-JEM-2.0 (Seq)				
	Y	U	V	EncT	DecT
Class A1	-1.91%	-10.36%	-4.76%	268%	107%
Class A2	-2.33%	-10.81%	-7.83%	256%	100%
Class B	-2.33%	-10.59%	-12.12%	256%	107%
Class C	-1.34%	-10.56%	-11.67%	240%	116%
Class D	-1.00%	-9.31%	-10.20%	232%	129%
Class E	-3.40%	-10.60%	-12.23%	254%	105%
Overall	-2.01%	-10.37%	-9.80%	251%	110%
Class F (optional)	-2.13%	-11.29%	-12.20%	240%	108%

EE2.1 low complexity settings

Comparison

Default

QTBT high level parameters	I slices	
CTUSize	128x128	
	Luma	Chroma
MinQTSIZE	16x16	4x4
MaxBTSIZE	32x32	16x16
MaxBTDepth	4	0
MinBTSIZE	4	4

Low complexity

QTBT high level parameters	I slices	
CTUSize	128x128	
	Luma	Chroma
MinQTSIZE	8x8	4x4
MaxBTSIZE	32x32	16x16
MaxBTDepth	2	2
MinBTSIZE	4	4

	All Intra Main10				
	Over HM-16.6-JEM-2 (Seq)				
	Y	U	V	EncT	DecT
Class A1	-2.76%	-6.89%	-0.85%	524%	105%
Class A2	-3.58%	-6.35%	-3.34%	511%	106%
Class B	-3.58%	-5.50%	-6.67%	561%	104%
Class C	-2.74%	-4.83%	-4.90%	629%	115%
Class D	-2.18%	-2.81%	-3.00%	600%	127%
Class E	-5.26%	-7.48%	-9.14%	543%	103%
Overall	-3.28%	-5.56%	-4.55%	561%	110%
Class F (optional)	-3.98%	-7.01%	-7.41%	608%	108%

	All Intra Main10				
	Over HM-16.6-JEM-2.0 (Seq)				
	Y	U	V	EncT	DecT
Class A1	-1.91%	-10.36%	-4.76%	268%	107%
Class A2	-2.33%	-10.81%	-7.83%	256%	100%
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Class C	-1.34%	-10.56%	-11.67%	240%	116%
Class D	-1.00%	-9.31%	-10.20%	232%	129%
Class E	-3.40%	-10.60%	-12.23%	254%	105%
Overall	-2.01%	-10.37%	-9.80%	251%	110%
Class F (optional)	-2.13%	-11.29%	-12.20%	240%	108%

EE2.1 conclusion

- Gains are substantial, around 4%.
- Decoder time increases are only 5%-12%.
- Harmonization with other existing tools are solicited to provide better trade-offs.
- Suggest to adopt QTBT into JEM-3.0.

Thank you!

Comments?



everyday genius