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| *Title:* | AHG4: Cross-verification of JCTVC-I0427 entitled category-prefixed data batching for tiles and wavefronts | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
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# Abstract

This contribution reports cross-check results for JCTVC-I0427 on “Category-prefixed data batching (CPDB ) for tiles and wavefronts”. In the proposal, the proponents advocate for the data in each category to be chopped up into batches, and for each batch to be prefixed with a batch type identifier and a batch size indicator. The different categories of data can then be interleaved with each other instead of being placed sequentially into the bitstream data. Experiments have been carried out for tiles (with 2x2 tile partitions) and wavefronts (with four substreams) to quantify the CPDB overhead. It is confirmed that the BD-rate results match the ones reported by proponents. The source code was also studied to verify its consistency with the proposal description.

# Test Settings and Conditions

The simulations of this document have used HM6.1 based software provided by proponents, the simulation platform is LSF equipped with Intel(R) Xeon(R) CPU X5570 64 bits Linux machines of different frequencies, the common test conditions and reference configurations specified in [1] are followed. In the simulation, the maximum batch size is set to 8192 bytes.

# Experimental results

The experimental results for 2x2 tiles and 4 wpps are summarized in Table 1 and Table 2, respectively. The results perfectly match the ones reported by proponents. Please be advised that runtime here may not be accurate.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **All Intra Main** | | | **All Intra HE10** | | |
|  | 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% |
| Class C | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class D | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class E | 0.1% | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% |
| **Overall** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
|  | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class F | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 100% | | | 100% | | |
| Dec Time[%] | 102% | | | 100% | | |
|  |  |  |  |  |  |  |
|  | **Random Access Main** | | | **Random Access HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class D | 0.4% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E |  |  |  |  |  |  |
| **Overall** | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
|  | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class F | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Enc Time[%] | 100% | | | 100% | | |
| Dec Time[%] | 98% | | | 100% | | |
|  |  |  |  |  |  |  |
|  | **Low delay B Main** | | | **Low delay B HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Class D | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E | 0.5% | 0.4% | 0.4% | 0.5% | 0.4% | 0.4% |
| **Overall** | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
|  | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Class F | 0.3% | 0.2% | 0.3% | 0.3% | 0.2% | 0.2% |
| Enc Time[%] | 100% | | | 100% | | |
| Dec Time[%] | 97% | | | 98% | | |
|  |  |  |  |  |  |  |
|  | **Low delay P Main** | | | **Low delay P HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.1% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Class D | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E | 0.4% | 0.4% | 0.4% | 0.5% | 0.4% | 0.4% |
| **Overall** | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
|  | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Class F | 0.2% | 0.2% | 0.2% | 0.3% | 0.2% | 0.2% |
| Enc Time[%] | 99% | | | 100% | | |
| Dec Time[%] | 99% | | | 98% | | |

Table 1. Experimental results for the CPDB case of 2x2 tiles.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **All Intra Main** | | | **All Intra HE10** | | |
|  | 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% |
| Class C | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class D | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class E | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| **Overall** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
|  | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class F | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 101% | | | 101% | | |
| Dec Time[%] | 101% | | | 100% | | |
|  |  |  |  |  |  |  |
|  | **Random Access Main** | | | **Random Access HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Class D | 0.4% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E |  |  |  |  |  |  |
| **Overall** | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
|  | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Class F | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Enc Time[%] | 102% | | | 101% | | |
| Dec Time[%] | 104% | | | 100% | | |
|  |  |  |  |  |  |  |
|  | **Low delay B Main** | | | **Low delay B HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Class D | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E | 0.5% | 0.4% | 0.4% | 0.5% | 0.4% | 0.4% |
| **Overall** | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
|  | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Class F | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Enc Time[%] | 100% | | | 99% | | |
| Dec Time[%] | 100% | | | 101% | | |
|  |  |  |  |  |  |  |
|  | **Low delay P Main** | | | **Low delay P HE10** | | |
|  | Y | U | V | Y | U | V |
| Class A |  |  |  |  |  |  |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class C | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Class D | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Class E | 0.4% | 0.4% | 0.4% | 0.5% | 0.4% | 0.4% |
| **Overall** | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
|  | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Class F | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Enc Time[%] | 100% | | | 101% | | |
| Dec Time[%] | 99% | | | 103% | | |

Table 2. Experimental results for the CPDB case of WPPs

# Additional experimental results

Additional tests are carried out for the following test conditions:

•                   TileMarkerFlag = 1

•                   MaxTileMarkerEntryPoints = 4

•                   UniformSpacingIdc = 1

•                   TileLocationInSliceHeaderFlag = 0

•                   NumTileColumnsMinus1 = determine from table below

•                   NumTileRowsMinus1 = determine from table below

|  |  |  |  |
| --- | --- | --- | --- |
| Class | NumTileColumnsMinus1 | NumTileRowsMinus1 | Number of Tiles |
| A | 4 | 4 | 25 |
| B | 5 | 2 | 18 |
| C | 1 | 1 | 4 |
| D | 0 | 0 | 1 |
| E | 3 | 2 | 12 |
| F | 3 | 2 | 12 |

The results for Main configurations are summarized in Table 3. It is confirmed that the results in Table 3 match the results reported by the proponents.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **All Intra Main** | | |
|  | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% |
| Class B | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% |
| Class D | 0.0% | 0.0% | 0.0% |
| Class E | 0.0% | 0.0% | 0.0% |
| **Overall** | 0.0% | 0.0% | 0.0% |
|  | 0.0% | 0.0% | 0.0% |
| Class F | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 112% | | |
| Dec Time[%] | 113% | | |
|  |  |  |  |
|  | **Random Access Main** | | |
|  | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% |
| Class B | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% |
| Class D | -0.1% | -0.1% | -0.1% |
| Class E |  |  |  |
| **Overall** | 0.0% | 0.0% | 0.0% |
|  | 0.0% | 0.0% | 0.0% |
| Class F | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 103% | | |
| Dec Time[%] | 103% | | |
|  |  |  |  |
|  | **Low delay B Main** | | |
|  | Y | U | V |
| Class A |  |  |  |
| Class B | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% |
| Class D | -0.1% | -0.1% | -0.1% |
| Class E | -0.3% | -0.3% | -0.3% |
| **Overall** | -0.1% | -0.1% | -0.1% |
|  | -0.1% | -0.1% | -0.1% |
| Class F | -0.1% | -0.1% | -0.1% |
| Enc Time[%] | 98% | | |
| Dec Time[%] | 92% | | |

Table 3. Experimental results for the CPDB case of tile markers

# Conclusions

This report confirmed the experimental results and software implementation of JCTVC-I0427.

For multi-core decoder parallelism, it is required that sub-bitstreams be sent in interleaved manner for low-latency purpose. It is also helpful that each data batch can carry an ID, which can eventually be used to guide decoder to properly dispatch data to cores for achieving pixel-rate balancing.

It is recommended to discuss this proposal together with other proposals in the same category.

# References

[1] F. Bossen, “Common test conditions and software reference configurations,” JCT-VC Document, JCTVC-G1100, San Jose, CA, USA, February 2012.

[2] [B. Bross](mailto:benjamin.bross@hhi.fraunhofer.de), [W.-J. Han](mailto:wjhan.han@samsung.com), [J.-R. Ohm](mailto:ohm@ient.rwth-aachen.de), [G. J. Sullivan](mailto:garysull@microsoft.com), [T. Wiegand](mailto:thomas.wiegand@hhi.fraunhofer.de) “High Efficiency Video Coding (HEVC) Test Model 6 (HM 6) Encoder Description,” JCT-VC Document, JCTVC-G1003, San Jose, CA, USA, February 2012.

[3] [S. Kanumuri](mailto:skanumu@microsoft.com), [G. J. Sullivan](mailto:garysull@microsoft.com), [Y. Wu](mailto:yongjunw@microsoft.com), J. Xu, “AHG4: Category-prefixed data batching for tiles and wavefronts,” JCT-VC Document, JCTVC-I0427, 9th Meeting: Geneva, Switzerland, 27 April – 07 May, 2012