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| *Title:* | **Parallel random-access encoding with HM** | | |
| *Status:* | Input document to JCT-VC | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Karl Sharman | Email: | Karl.sharman@sony.com |
| *Source:* | Sony Europe Ltd | | |

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# Abstract

It is proposed to patch the HM encoder so that the JVET-scheme for parallel encoding of random-access configurations can be used. It is also proposed that the patch (which includes an enabling command line option) is turned on for CTCs. BD-rate changes are claimed to be negligible for RExt and HM420 CTCs.

A patch is provided in the contribution for HM16.19.

# Introduction

JVET allows a method for random-access intra-periods to be encoded in parallel. The scheme used is to split the encoding into intra-periods, with subsequent intra periods including an initial IDR frame. This IDR frame (and associated SEIs and parameter sets) can be removed, with the aim to produce a bitstream “bin” file that is identical to encoding the random-access sequence in one encoding process.

For example, for a 50Hz sequence, which would have an intra-period of 48, the encodings would be:

Encoding #1: frames 0-48 (inclusive)

Encoding #2: frames 48-96 (inclusive).

Encoding #3: frames 96-144 (inclusive)

…

During the parallel “bin” file concatenation process, the NALUs associated with the first POC of encodings #2, #3… would be dropped.

Note that JVET also permits the collation of result logs instead of the concatenation of bin files, noting that errors are typically at the 4th decimal place for PSNRs and bitrates.

When first introduced to JVET, a patch for HM was supplied to fix the reliance on frames prior to the IDR in SAO. However, it was noticed that this did not function correctly when the intra period was 16 (which it is for one of the current CTC sequences). Note there is no such issue in VTM.

However, there is also a further part of HM that needs to be corrected: cabac\_init\_flag depends on the previously coded inter slice, disregarding any reset across the IDR boundary.

Therefore it is proposed that HM be modified so that both features are reset, in a way that works with small intra periods. The patch is also consistent to the mechanism used in VTM. The patch includes changing the command line switch “SAOResetEncoderStateAfterIRAP" to “ResetEncoderStateAfterIRAP”

In addition, it is proposed that the 4:2:0 and RExt random-access configurations be changed to always set ResetEncoderStateAfterIRAP to 1. This means that there is consistency if users wish to parallel encode random-access simulations.

# Results

The full results are included in the contribution. All-intra and low-delay configurations are unaffected. The anchor is HM16.19.

## 4:2:0 results

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Random Access Main** | | | **Random Access Main 10** | | |
|  | Y | U | V | Y | U | V |
| Class A1 | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% |
| Class A2 | 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% | 0.1% | 0.0% | 0.0% | 0.0% |
| Class E |  |  |  |  |  |  |
| **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 D | 0.0% | 0.0% | 0.1% | 0.0% | 0.1% | -0.1% |
| Class F | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 101% | | | 100% | | |
| Dec Time[%] | 100% | | | 99% | | |

## RExt results

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Random Access Main-tier** | | | **Random Access High-tier** | | |
|  | Y | U | V | Y | U | V |
| RGB 4:4:4 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| YCbCr 4:4:4 | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| YCbCr 4:2:2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 100% | | | 100% | | |
| Dec Time[%] | 100% | | | 100% | | |

## 4:2:0 parallel encoding

The results below compare random-access main 10 using parallel encoding techniques as anchor, with the proposed “ResetEncoderStateAfterIRAP”. The parallel encoding anchor was generated by using the values in the individual log files, removing the influence of POC0, and combining the different intra periods.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Random Access Main 10** | | |
|  | Y | U | V |
| Class A1 | 0.0000% | -0.0004% | -0.0002% |
| Class A2 | 0.0002% | 0.0000% | 0.0004% |
| Class B | 0.0003% | -0.0003% | -0.0003% |
| Class C | -0.0002% | -0.0002% | 0.0000% |
| Class E |  |  |  |
| **Overall** | 0.0001% | -0.0002% | -0.0001% |
|  | 0.0002% | -0.0003% | 0.0000% |
| Class D | 0.0000% | -0.0002% | -0.0003% |
| Class F | -0.0001% | 0.0000% | 0.0000% |
| Enc Time[%] | 101% | | |
| Dec Time[%] | 102% | | |

As expected, and commonly reported in JVET, there are differences between the two methods, typically at the fourth decimal place. This is due to rounding in the calculations used for combining log files.

It has been verified (with class F), that combining the binary files produced using parallel encodings using the “parcat” program supplied by JVET (having set “HEVC\_VPS” at the top of the main parcat source file), produces identical bin files as that produced by single random-access encoder simulations.

# Conclusion

It is proposed to patch the HM software so that parallel encoding of random-access configurations can be used. It is also proposed that the random-access configurations for HM4:2:0 and RExt are also adjusted to enable this feature by default.

# Patent rights declaration(s)

**Sony Corporation or Sony Group Companies do not have any current or pending patent rights relating to the technology described in this contribution.**