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| ***Title:***  | Reproducing AV1 Test Results |
|  |  |
| ***Source to WG:*** | Google, Facebook |
|  |  |
| ***Work item code:*** | FS\_5GVideo |  | ***Date:*** | 2022-05-10 |

Reproducing AV1 test results

May 10, 2022

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## Overview

The submission from Google updating TR 26.955 (S4-220732) references bitstreams and metrics generated by Facebook. Google has been independently verifying the Facebook generated bitstreams, reconstructions and metrics for each scenario, as required for full verification, as per clause 5.9.2 of TR 26.955.

At this time Facebook results for scenarios 1 and 2 have been fully verified. We expect all scenarios to be verified in the next two weeks.

## Introduction

In order to move the cross-check process forward as quickly as possible, we suggest that we first concentrate on verifying the results for a single test case. This document suggests a step-by-step process for how we might verify that the cross-checker can produce exactly the same bitstream, and exactly the same decoded output as those produced by AOMedia.

Once we can establish that the encode & decode match, we can move on to verify the calculation of the metrics from the agreed decoded frames and anchors is also in agreement.

The hope is that by addressing any issues for this single test case, we can solve the problem for all test cases, and thereby bring the cross-check activity to a successful conclusion.

We have picked a test case where the cross-checker reports a discrepancy with the AOMedia results, but where independent runs from two AOMedia companies have reported exactly the same results.

These instructions assume a Linux platform which we believe the cross-checker is using.

We are available to provide help where it is needed, please reach out to director@aomedia.org, ryanlei@fb.com, agrange@google.com.

## Process

### **Test Case**

Scenario 1, Brest-Sedof-FHD.yuv, quantizer level = 39.

### **Step 1** - Check the MD5 of the source file

Compute the MD5 of the source file Brest-Sedof-FHD.yuv (‘md5sum Brest-Sedof-FHD.yuv’) and check that it matches: **db37ba190d781427010dac061d06b6b2**

### **Step 2** - Clone the code

Create three sub-directories at the same level in the file system (referred to as **‘root’** hereafter):

* **root/aom** - to contain the code (e.g. ~/aom)
* **root/aom\_build** - where the build files and executables will be created (e.g. ~/aom\_build)
* **root/aom\_test** - where the bitstreams & log files will be created (e.g. ~/aom\_test)

Run this command from the ‘root’ directory:

mk

(code should appear in root/aom)

### **Step 3** - Build encoder & decoder

Run the following commands:

$ cd root/aom\_build (**Note:** this must be an empty directory)

$ **cmake** ../aom -DCMAKE\_BUILD\_TYPE=Release -DCONFIG\_DOCS=0 -DCONFIG\_SHARED=0 -DENABLE\_TESTS=0 -DCONFIG\_UNIT\_TESTS=0 -DCONFIG\_AV1\_HIGHBITDEPTH=1 -DCONFIG\_EXCLUDE\_SIMD\_MISMATCH=1

$ **make** (or **make** -j16)

aomenc & aomdec executables should now be created in root/aom\_build.

### **Step 4** - Run the encode

Run the following commands:

$ cd ../aom\_test

$ ../aom\_build/aomenc \

 --verbose \

 --codec=av1 \

 -v \

 --psnr \

 --obu \

 --frame-parallel=0 \

 --cpu-used=0 \

 --limit=300 \

 --passes=1 \

 --end-usage=q \

 --i420 \

 --enable-tpl-model=0 \

 --fps=60000/1000 \

 --input-bit-depth=10 \

 --bit-depth=10 \

 -w 1920 \

 -h 1080 \

 --cq-level=39 \

 --tile-columns=0 \

 --threads=1 \

 --disable-kf \

 --enable-keyframe-filtering=0 \

 --min-gf-interval=32 \

 --max-gf-interval=32 \

 --gf-min-pyr-height=5 \

 --gf-max-pyr-height=5 \

 --fwd-kf-dist=64 \

 --lag-in-frames=35 \

 --auto-alt-ref=1 \

 --use-fixed-qp-offsets=1 \

 --deltaq-mode=0 \

 --enable-intrabc=0 \

 --enable-palette=0 \

 -o test.obu \

 **<path-to-yuv-source-file>**/Brest-Sedof-FHD.yuv &> test.log

Check that the log file text matches the highlighted text in Appendix 1.

### **Step 5** - Check the MD5 of the output file

Compute the MD5 of the output bitstream test.obu (‘md5sum test.obu’) and check that it matches: **69951a73ff71e3873b378eac958c0184**

### **Step 6** - Decode the bitstream

../aom\_build/aomdec --codec=av1 --rawvideo test.obu -o output.yuv

### **Step 7** - Verify the decoded stream

Check that the MD5 of the decoded sequence output.yuv (‘md5sum output.yuv’) matches: **7236bd98485ba52d8f339d27c15278e6**

## Appendix 1 - Log File

Codec: AOMedia Project AV1 Encoder **3.2.0-129-g551c490f4**

Source file: /3gpp\_base/ReferenceSequences/Brest-Sedof/brest-sedof-FHD.yuv File Type: RAW Format: I42016

Destination file: /3gpp\_enc\_v19\_551c490f/run\_area\_v19\_S1-HM-01\_av1/S1-A01-AV1/S1-A01-AV1\_39.obu

Coding path: HBD

Encoder parameters:

 g\_usage = 0

 g\_threads = 1

 g\_profile = 0

 g\_w = 1920

 g\_h = 1080

 g\_bit\_depth = 10

 g\_input\_bit\_depth = 10

 g\_timebase.num = 1000

 g\_timebase.den = 60000

 g\_error\_resilient = 0

 g\_pass = 0

 g\_lag\_in\_frames = 35

 large\_scale\_tile = 0

 rc\_dropframe\_thresh = 0

 rc\_resize\_mode = 0

 rc\_resize\_denominator = 8

 rc\_resize\_kf\_denominator = 8

 rc\_superres\_mode = 0

 rc\_superres\_denominator = 8

 rc\_superres\_kf\_denominator = 8

 rc\_superres\_qthresh = 63

 rc\_superres\_kf\_qthresh = 32

 rc\_end\_usage = 3

 rc\_target\_bitrate = 256

 rc\_min\_quantizer = 0

 rc\_max\_quantizer = 63

 rc\_undershoot\_pct = 25

 rc\_overshoot\_pct = 25

 rc\_buf\_sz = 6000

 rc\_buf\_initial\_sz = 4000

 rc\_buf\_optimal\_sz = 5000

 rc\_2pass\_vbr\_bias\_pct = 50

 rc\_2pass\_vbr\_minsection\_pct = 0

 rc\_2pass\_vbr\_maxsection\_pct = 2000

 fwd\_kf\_enabled = 0

 kf\_mode = 0

 kf\_min\_dist = 0

 kf\_max\_dist = 9999

Pass 1/1 frame 1/0 0B 0 us 0.00 fpm [ETA unknown] [K

Pass 1/1 frame 2/0 0B 99266 us 20.15 fps [ETA unknown] [K

Pass 1/1 frame 3/0 0B 101113 us 29.67 fps [ETA unknown] [K

Pass 1/1 frame 4/0 0B 102793 us 38.91 fps [ETA unknown] [K

Pass 1/1 frame 5/0 0B 104499 us 47.85 fps [ETA unknown] [K

Pass 1/1 frame 6/0 0B 106181 us 56.51 fps [ETA unknown] [K

Pass 1/1 frame 7/0 0B 107808 us 64.93 fps [ETA unknown] [K

Pass 1/1 frame 8/0 0B 109477 us 73.07 fps [ETA unknown] [K

Pass 1/1 frame 9/0 0B 111132 us 80.98 fps [ETA unknown] [K

Pass 1/1 frame 10/0 0B 112768 us 88.68 fps [ETA unknown] [K

Pass 1/1 frame 11/0 0B 114474 us 96.09 fps [ETA unknown] [K

Pass 1/1 frame 12/0 0B 116076 us 103.38 fps [ETA unknown] [K

Pass 1/1 frame 13/0 0B 117685 us 110.46 fps [ETA unknown] [K

Pass 1/1 frame 14/0 0B 119314 us 117.34 fps [ETA unknown] [K

Pass 1/1 frame 15/0 0B 121023 us 123.94 fps [ETA unknown] [K

Pass 1/1 frame 16/0 0B 122798 us 130.30 fps [ETA unknown] [K

Pass 1/1 frame 17/0 0B 124392 us 136.66 fps [ETA unknown] [K

Pass 1/1 frame 18/0 0B 126073 us 142.77 fps [ETA unknown] [K

Pass 1/1 frame 19/0 0B 127686 us 148.80 fps [ETA unknown] [K

Pass 1/1 frame 20/0 0B 129268 us 154.72 fps [ETA unknown] [K

Pass 1/1 frame 21/0 0B 130846 us 160.49 fps [ETA unknown] [K

Pass 1/1 frame 22/0 0B 132453 us 166.10 fps [ETA unknown] [K

Pass 1/1 frame 23/0 0B 134021 us 171.61 fps [ETA unknown] [K

Pass 1/1 frame 24/0 0B 135620 us 176.97 fps [ETA unknown] [K

Pass 1/1 frame 25/0 0B 137292 us 182.09 fps [ETA unknown] [K

Pass 1/1 frame 26/0 0B 138924 us 187.15 fps [ETA unknown] [K

Pass 1/1 frame 27/0 0B 140516 us 192.15 fps [ETA unknown] [K

Pass 1/1 frame 28/0 0B 142189 us 196.92 fps [ETA unknown] [K

Pass 1/1 frame 29/0 0B 143731 us 201.77 fps [ETA unknown] [K

Pass 1/1 frame 30/0 0B 145404 us 206.32 fps [ETA unknown] [K

Pass 1/1 frame 31/0 0B 147044 us 210.82 fps [ETA unknown] [K

Pass 1/1 frame 32/0 0B 148684 us 215.22 fps [ETA unknown] [K

Pass 1/1 frame 33/0 0B 150257 us 219.62 fps [ETA unknown] [K

Pass 1/1 frame 34/0 0B 151844 us 223.91 fps [ETA unknown] [K

Pass 1/1 frame 35/0 0B 153445 us 228.09 fps [ETA unknown] 42.948 42.529 44.284 43.606 484892F [K

Pass 1/1 frame 36/1 484892B 65648 ms 32.90 fpm [ETA 5:32:13] 37.529 36.314 42.786 41.395 684389F [K

Pass 1/1 frame 37/2 1169281B 1201385 ms 1.85 fpm [ETA 6:22:03] 37.085 35.872 42.327 40.936 5F [K

Pass 1/1 frame 38/3 1169286B 1201388 ms 1.90 fpm [ETA 7:30:00] 36.627 35.380 42.104 40.757 16387F [K

Pass 1/1 frame 39/4 1185673B 1434767 ms 1.63 fpm [ETA 9:08:08] 37.193 36.040 41.947 40.667 5F [K

Pass 1/1 frame 40/5 1185678B 1434770 ms 1.67 fpm [ETA 10:14:35] 36.273 35.014 41.831 40.515 50909F [K

Pass 1/1 frame 41/6 1236587B 2056921 ms 1.20 fpm [ETA 11:40:00] 36.603 35.406 41.714 40.351 5F [K

Pass 1/1 frame 42/7 1236592B 2056924 ms 1.23 fpm [ETA 13:33:53] 36.405 35.188 41.689 40.275 16314F [K

Pass 1/1 frame 43/8 1252906B 2284012 ms 1.13 fpm [ETA 16:13:20] 37.362 36.250 41.813 40.598 5F [K

Pass 1/1 frame 44/9 1252911B 2284015 ms 1.16 fpm [ETA 20:12:30] 36.475 35.277 41.622 40.202 107232F [K

Pass 1/1 frame 45/10 1360143B 3365497 ms 0.80 fpm [ETA 26:51:06] 36.539 35.348 41.617 40.231 5F [K