Mali-V61 HEVC Decode Bandwidth

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Thinkforce Questions

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Mali-V61 HEVC Decode AXI bandwidth

Content (10bit, YUV 4:2:0)

- https://media.xiph.org/video/derf/Chimera/Netflix_Aerial_4096x2160_60fps_10bit_420.y4m
- https://media.xiph.org/video/derf/ElFuente/Netflix_Tango_4096x2160_60fps_10bit_420.y4m
- https://media.xiph.org/video/derf/Chimera/Netflix_ToddlerFountain_4096x2160_60fps_10bit_420.y4m

Cropped to 2160p

Bitstreams encoded using x265

- `ffmpeg -pix_fmt yuv420p10le -s 3840x2160 -framerate 60 -f rawvideo -i input.yuv -vframes 50 -c:v libx265 -s:v 3840x2160 -preset veryslow output.265`

Resulting average bitrate for the first 16 frames (at 60fps)

- Netflix_Aerial 16.7Mbit/s
- Netflix_Tango 10.6Mbit/s
- Netflix_ToddlerFountain 52.6Mbit/s

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Mali-V61 HEVC Decode AXI bandwidth

The streams are decoded on a 3-core Mali-V61

- REF64 and REF128 configurations are tested
- Read and write AXI bandwidth are measured for the 16 first frames
- Burst length histogram is captured
  - Provides the percentage of number of bursts of each burst length. Separate histogram for read and write.
- The results are summarized on the following slides

Reference frame cache configuration (64byte or 128byte)

- Mali-V61 supports configurable reference frame cacheline size
  - REF64 configuration: 64byte cachelines
  - REF128 configuration: 128byte cachelines
- The configuration decides whether 64byte or 128byte bursts are used when reading the reference frame data
- The configuration is selected at synthesis time using a RTL (Verilog) parameter

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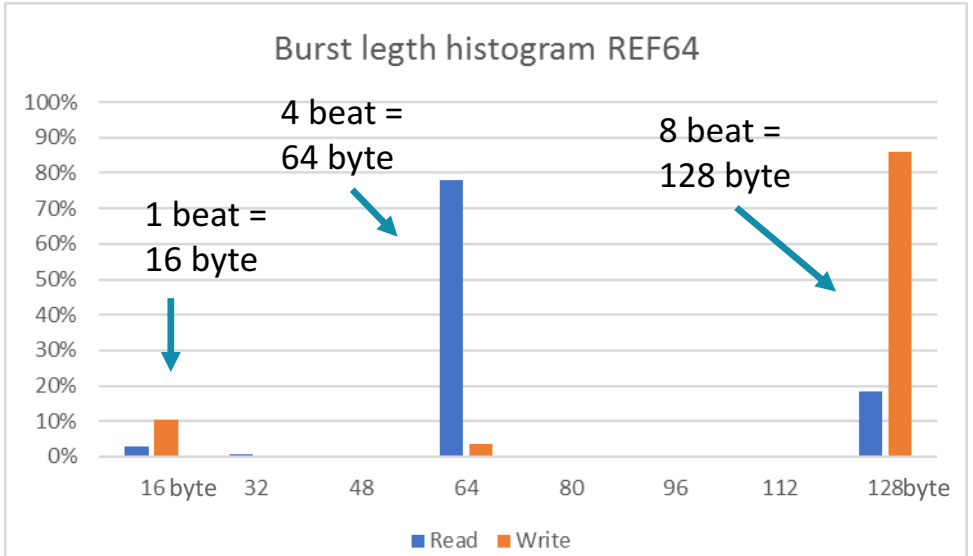
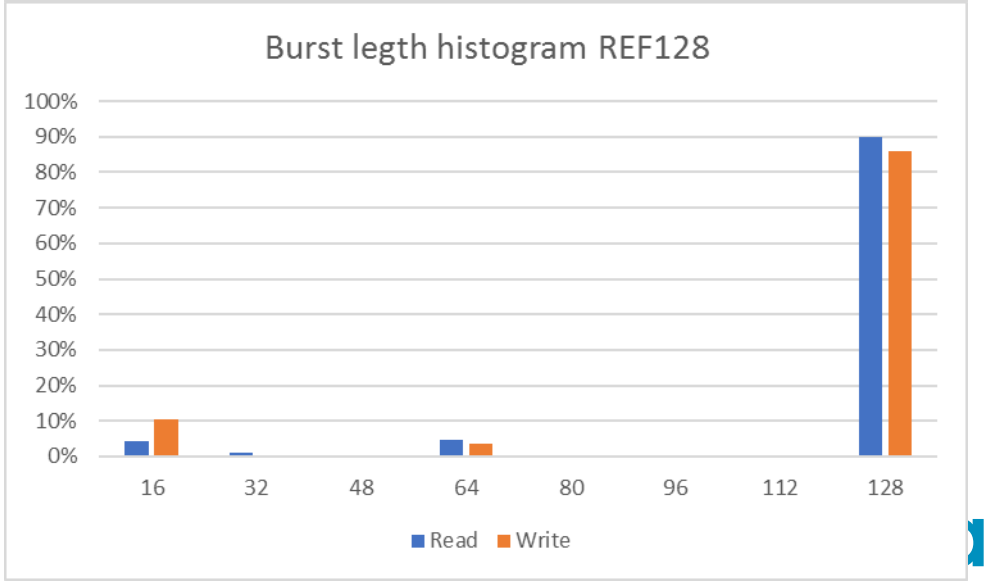
Netflix_Aerial_3840x2160_60fps_10bit_420

	Netflix_Aerial_3840x2160_60fps_10bit_420.265								
			REF64 mode				REF128 mode		
#	Type	Bitstream [kbit]	Read [MByte]	Write [MByte]	Total [MByte]		Read [MByte]	Write [MByte]	Total [MByte]
0	I	3354	5.2	11.1	16.3		5.2	11.1	16.3
1	P	462	14.9	12.6	27.5		15.3	12.6	27.9
2	B	18	17.0	10.4	27.4		18.1	10.4	28.5
3	B	9	16.2	9.7	25.9		17.2	9.7	26.8
4	B	11	17.5	9.7	27.2		18.5	9.7	28.2
5	B	10	15.6	9.7	25.4		16.7	9.7	26.4
6	B	6	18.7	9.7	28.4		19.6	9.7	29.3
7	B	7	15.9	9.7	25.6		16.8	9.7	26.5
8	P	474	15.2	9.7	24.8		17.0	9.7	26.6
9	B	42	18.9	9.7	28.5		20.6	9.7	30.3
10	B	10	16.6	9.5	26.1		17.7	9.5	27.1
11	B	9	17.5	9.3	26.9		18.7	9.3	28.0
12	B	9	15.6	9.3	24.9		16.6	9.3	25.9
13	B	9	14.9	9.3	24.3		15.8	9.3	25.1
14	B	8	16.2	9.4	25.5		17.1	9.4	26.5
15	B	8	15.3	9.7	25.0		16.2	9.7	25.9
	Average	277.9	15.7	9.9	25.6		16.7	9.9	26.6
	Max	3354.0	18.9	12.6	28.5		20.6	12.6	30.3





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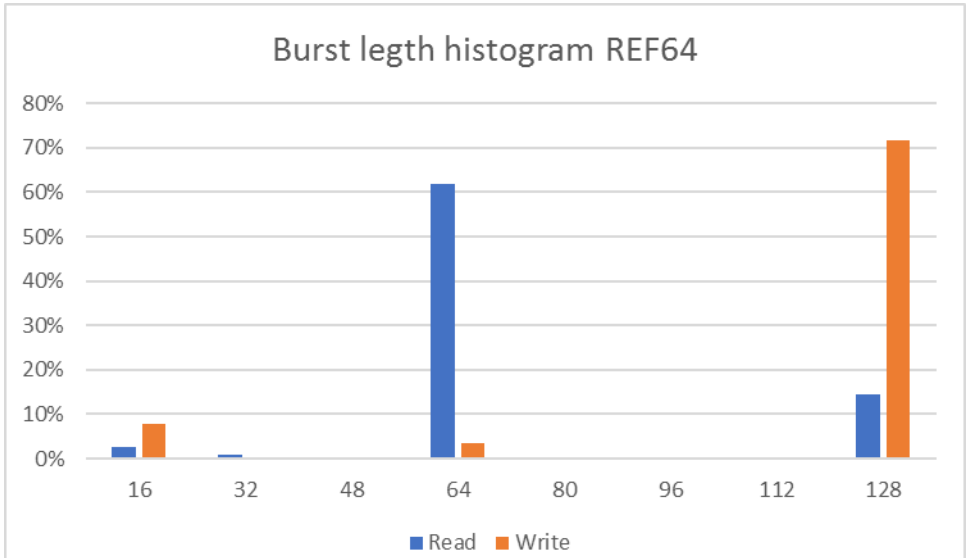
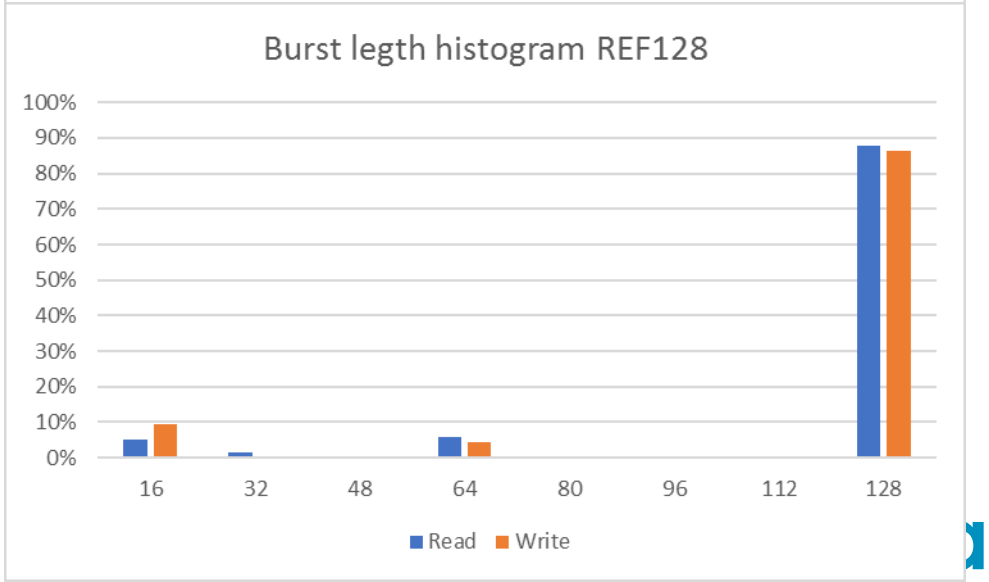
Netflix_Tango_3840x2160_60fps_10bit_420

	Netflix_Tango_3840x2160_60fps_10bit_420.265								
			REF64 mode				REF128 mode		
#	Type	Bitstream [kbit]	Read [MByte]	Write [MByte]	Total [MByte]		Read [MByte]	Write [MByte]	Total [MByte]
0	I	422	5.1	10.2	15.3		5.1	10.2	15.3
1	P	417	6.1	7.6	13.7		6.6	7.6	14.2
2	B	179	12.5	7.4	19.9		13.7	7.4	21.1
3	B	66	14.2	7.1	21.4		15.4	7.1	22.5
4	B	69	13.0	7.5	20.5		14.2	7.5	21.6
5	B	70	12.4	7.3	19.7		13.5	7.3	20.8
6	B	63	11.3	7.4	18.7		12.2	7.4	19.6
7	P	429	8.3	7.7	16.0		9.2	7.7	16.9
8	B	192	13.1	7.6	20.8		14.5	7.6	22.1
9	B	63	13.6	7.6	21.3		14.8	7.6	22.5
10	B	63	12.7	7.6	20.2		13.9	7.6	21.5
11	B	60	12.5	7.7	20.2		13.5	7.7	21.3
12	B	56	11.9	7.9	19.8		13.0	7.9	20.9
13	P	425	9.6	7.9	17.5		10.6	7.9	18.5
14	B	186	14.0	7.9	21.8		15.2	7.9	23.1
15	B	59	13.5	8.0	21.5		14.8	8.0	22.8
	Average	176.2	11.5	7.8	19.3		12.5	7.8	20.3
	Max	429.0	14.2	10.2	21.8		15.4	10.2	23.1





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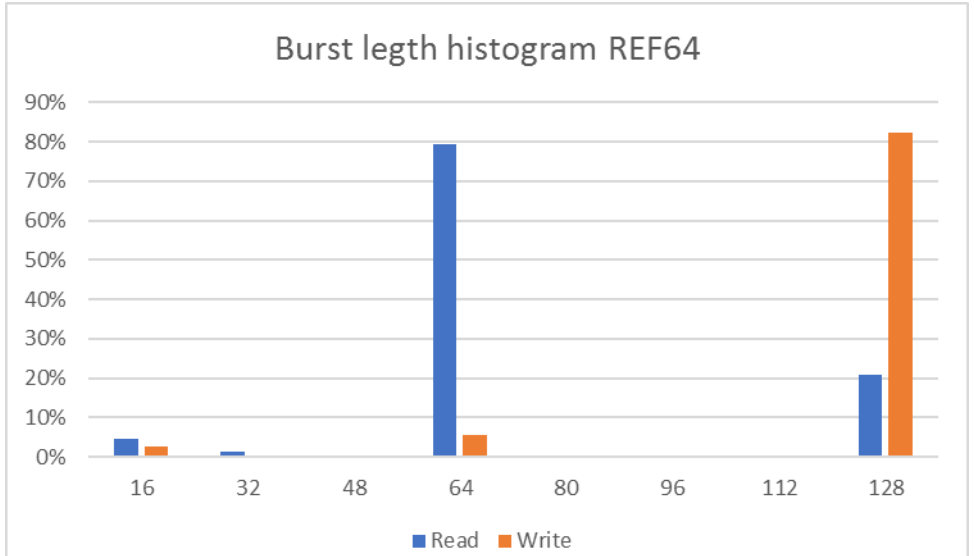
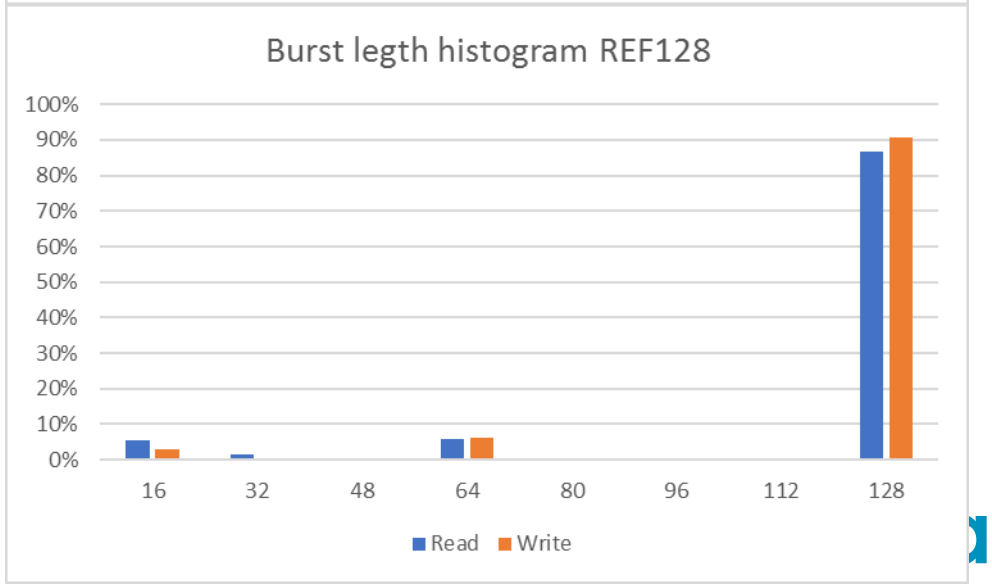
Netflix_ToddlerFountain_3840x2160_60fps_10bit_420

	Netflix_ToddlerFountain_3840x2160_60fps_10bit_420.265								
			REF64 mode				REF128 mode		
#	Type	Bitstream [kbit]	Read [MByte]	Write [MByte]	Total [MByte]		Read [MByte]	Write [MByte]	Total [MByte]
0	I	1340	3.7	9.8	13.5		3.7	9.8	13.5
1	P	1289	10.1	10.4	20.5		10.7	10.4	21.1
2	B	935	17.6	10.6	28.2		19.4	10.5	29.9
3	B	750	18.9	10.5	29.4		21.1	10.5	31.6
4	B	769	17.2	9.5	26.7		19.4	9.6	28.9
5	B	767	16.2	9.1	25.2		18.3	9.1	27.3
6	B	759	16.2	9.0	25.2		18.2	9.0	27.2
7	B	750	16.4	9.0	25.4		18.2	9.0	27.3
8	B	762	16.6	9.0	25.6		18.5	9.0	27.6
9	B	738	16.4	9.0	25.4		18.3	9.0	27.3
10	P	1285	10.2	9.1	19.3		11.5	9.1	20.6
11	B	922	16.9	9.1	26.0		19.5	9.1	28.6
12	B	730	18.8	9.0	27.8		21.7	9.0	30.8
13	B	743	18.7	9.2	27.9		21.7	9.2	30.8
14	B	746	18.3	9.2	27.5		21.0	9.2	30.2
15	B	746	18.1	9.1	27.2		20.6	9.1	29.7
	Average	876.9	15.6	9.4	25.1		17.6	9.4	27.0
	Max	1340.0	18.9	10.6	29.4		21.7	10.5	31.6





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