

**PA4 Analysis Report**1920x1080 photo: *fox.ppm*3840x2160 photo: *4K-Ultra-HD.ppm*

It was unclear what parts of the code should be timed. Therefore, the times reported measure the amount of time it takes to virtually the execute the entire program. Specifically, the start and stop timing points are allocation of memory for the images, and writing to the final image and deallocation of memory, respectively.

**Table 1.** Computation time, in seconds, of blurring filter for different numbers of threads, and different photo sizes. Blur filter was of radius 10.

Number of processes	Number of pixels in photo	
	1920x1080	3840x2160
1	89.79	207.98
2	32.48	118.47
4	13.6	35.47
8	13.05	38.17
16	11.09	27.31
32	4.14	13.25

**Table 2.** Speedup calculation of data from Table 1.

Number of processes	Number of pixels in photo	
	1920x1080	3840x2160
1	1	1
2	2.764470443	1.755549928
4	6.602205882	5.863546659
8	6.88045977	5.448781766
16	8.096483318	7.615525449
32	21.6884058	15.69660377

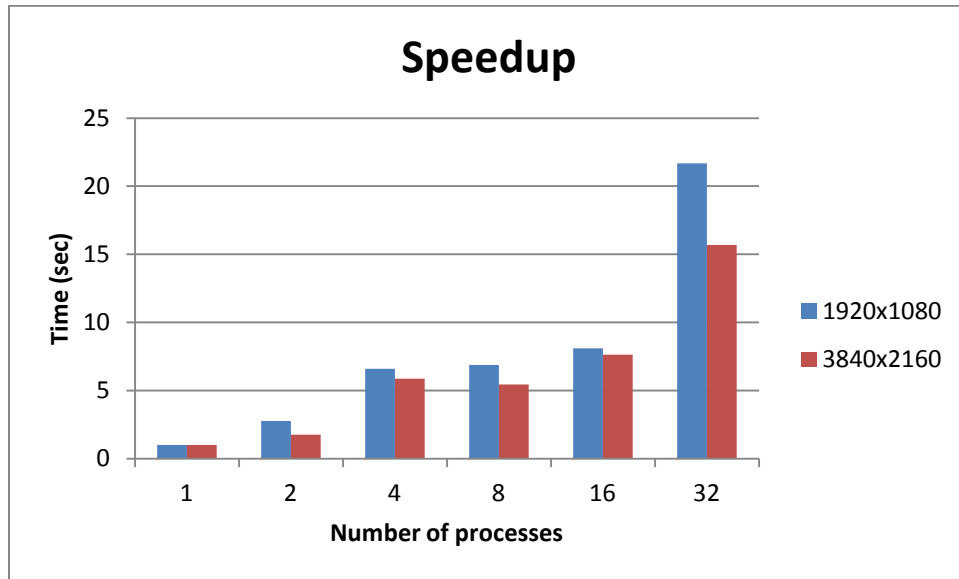


Figure 1. Speedup of blur filter ( $r = 10$ ).

Table 3. Efficiency calculation of data from Table 1.

Number of processes	Number of pixels in photo	
	1920x1080	3840x2160
1	1	1
2	1.382235222	0.877774964
4	1.650551471	1.465886665
8	0.860057471	0.681097721
16	0.506030207	0.475970341
32	0.677762681	0.490518868

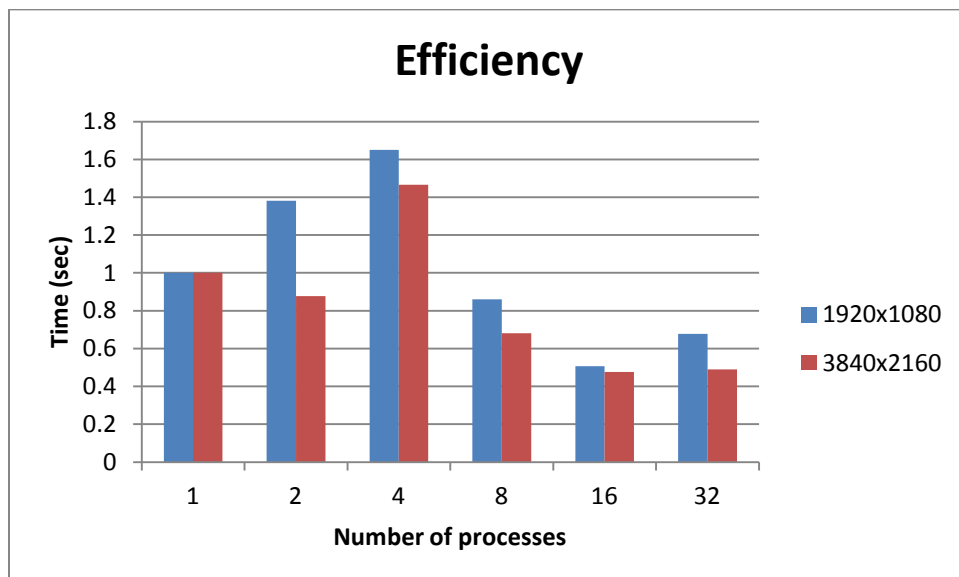


Figure 2. Efficiency of blur filter ( $r = 10$ ).

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Definitions of scalability:

Strongly scalable = constant efficiency for a varying number of processes, and a constant problem size.

Weakly scalable = constant efficiency for a varying number of processes, for a fixed problem size *per processor*.

Because there was a decrease in efficiency as the number of threads increased (while maintaining a fixed problem size per thread), this indicates that the program is not strongly scalable. (Table 3 and Figure 2)

Because there was a significant increase in speedup as the number of threads increased, the program is not weakly scalable either. (Table 2 and Figure 1)