HPCA project

Batch Sort and Merge Path Sort

RUN TIME

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Problem to solve

Is it better to sort **using GPU** rather than **using CPU**?

variable names :

- A,B and M are integer array
- A,B are sorted
- M contains all results
- M is not sort at the beginning

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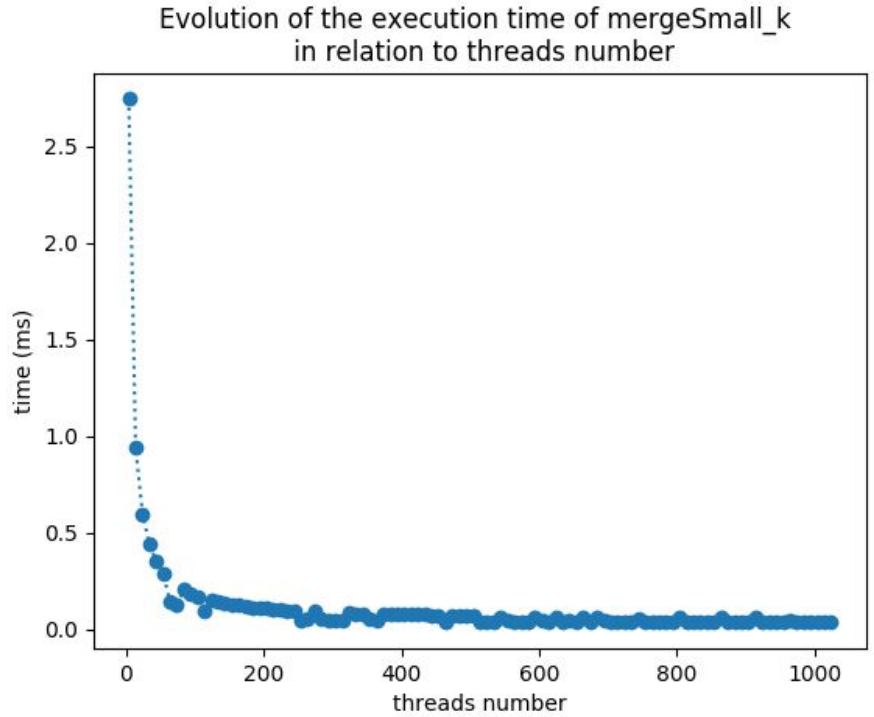
01

MERGE ON ONE BLOCK

ALGO mergeSmall_k



KEY ELEMENTS

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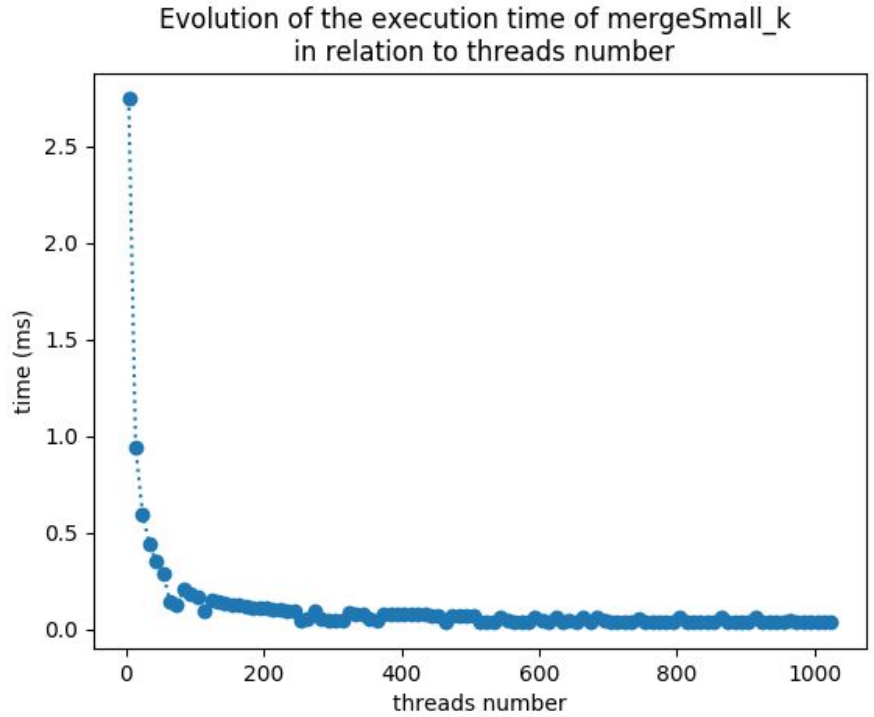

KEY ELEMENTS

- As the number of threads increases, the execution time decreases.

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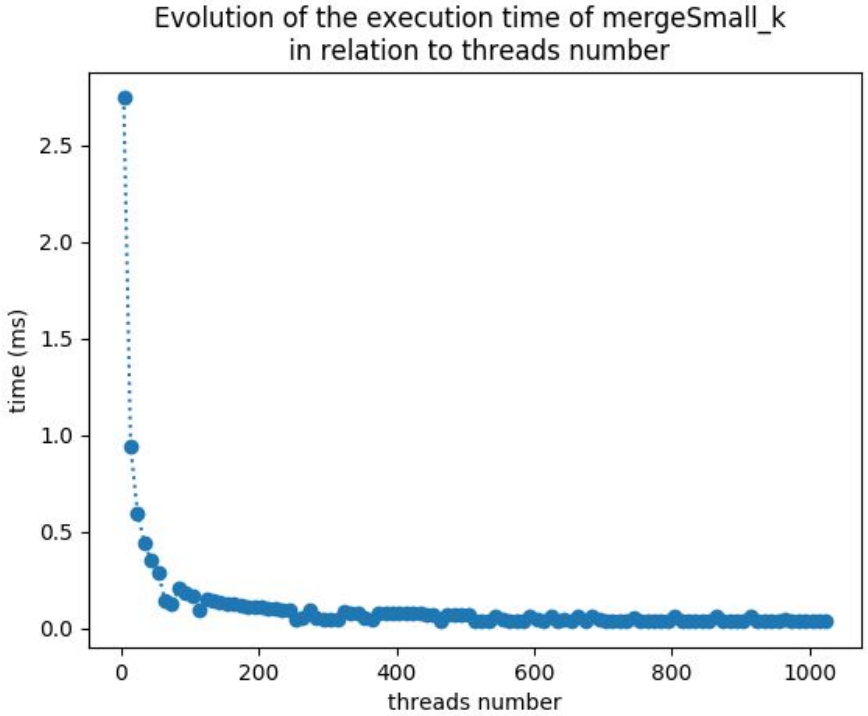

KEY ELEMENTS

- As the number of threads increases, the execution time decreases.
- Small difference between execution time without mentioning the use of shared memory and imposing the use of shared memory

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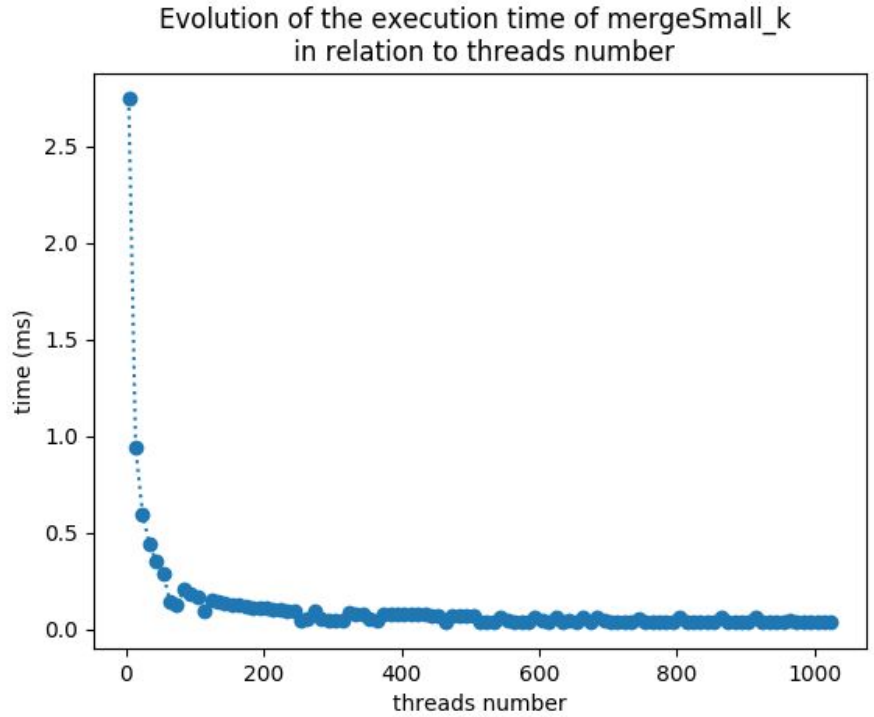

COMMENTS

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- Limit of 1024 elements

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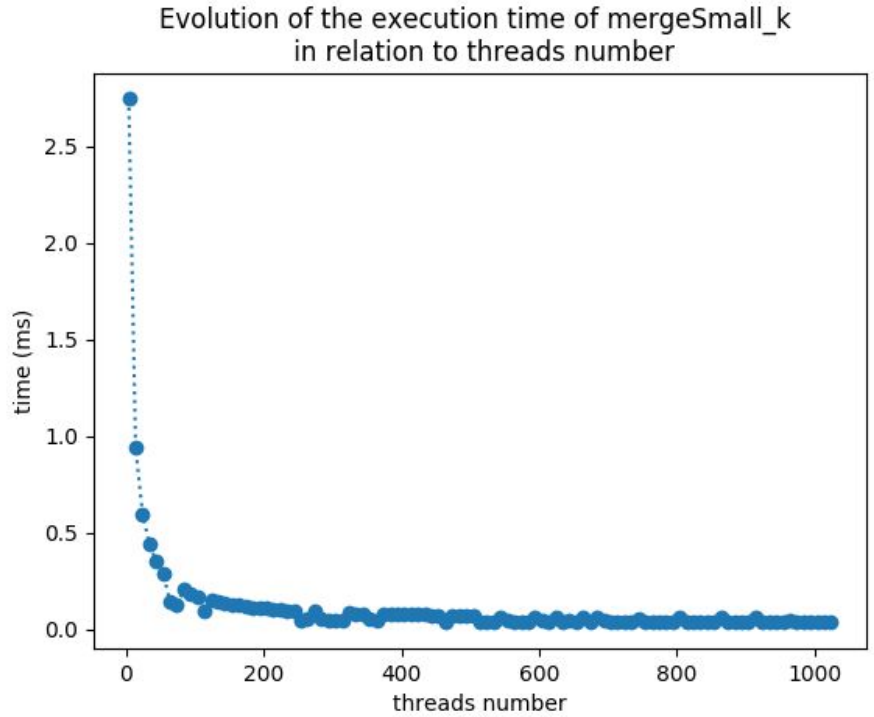
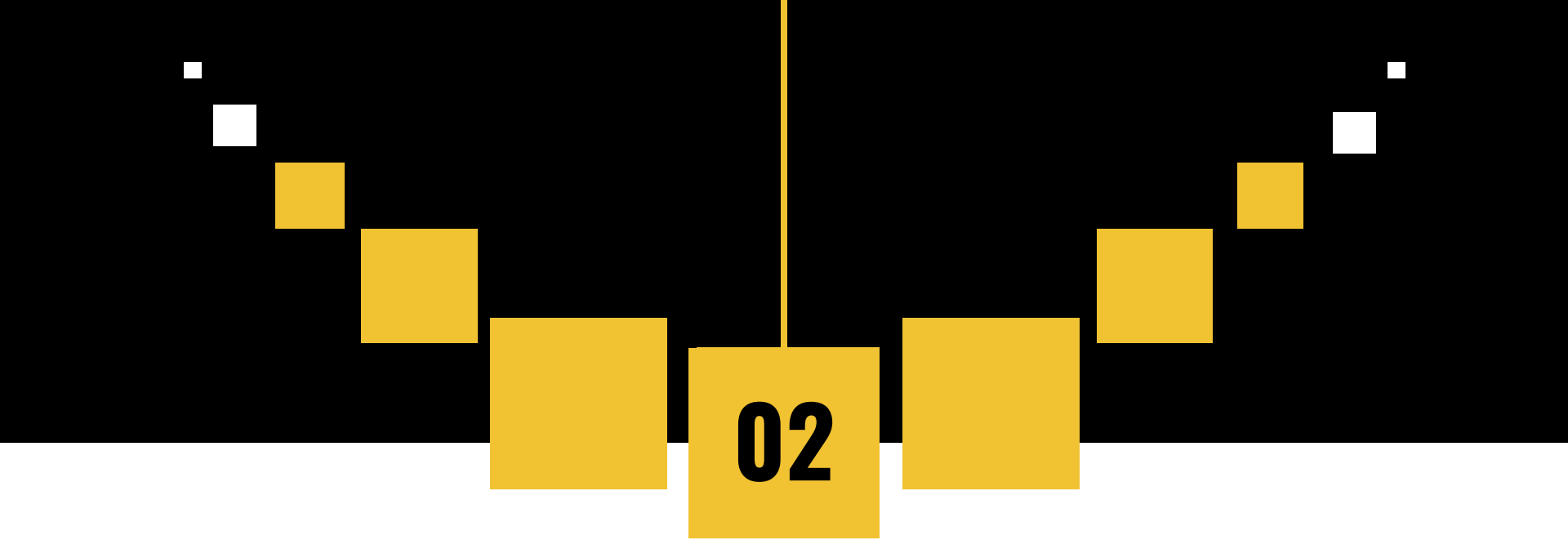


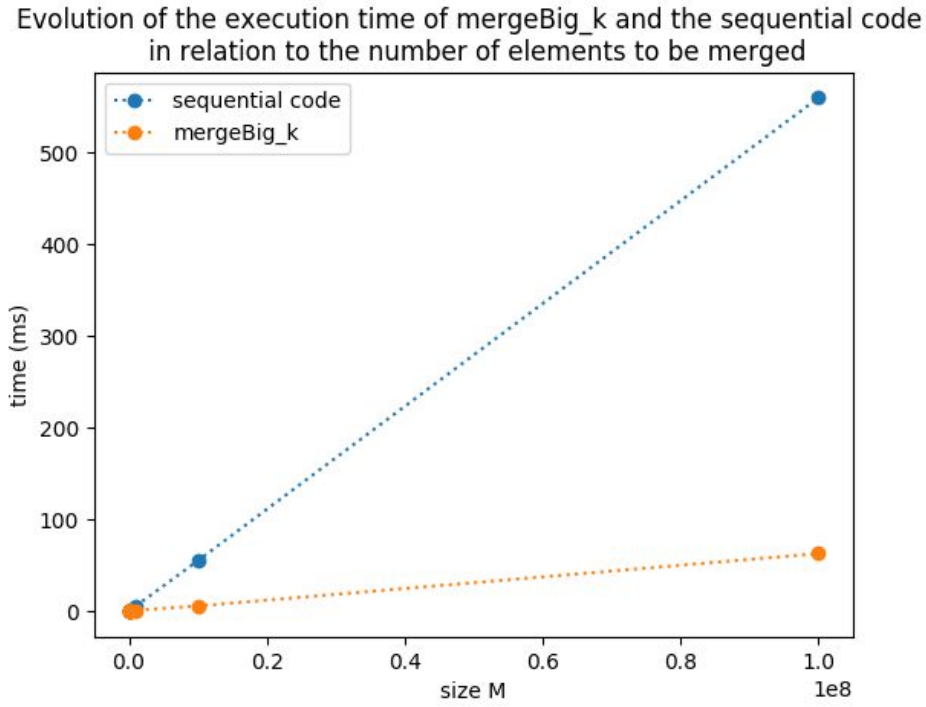
KEY ELEMENTS

- As the number of threads increases, the execution time decreases.
- Small difference between execution time without mentioning the use of shared memory and imposing the use of shared memory
- Limit of 1024 elements
- Sequential code faster : 0.01379ms vs. 0.03517ms (difference negligeable)



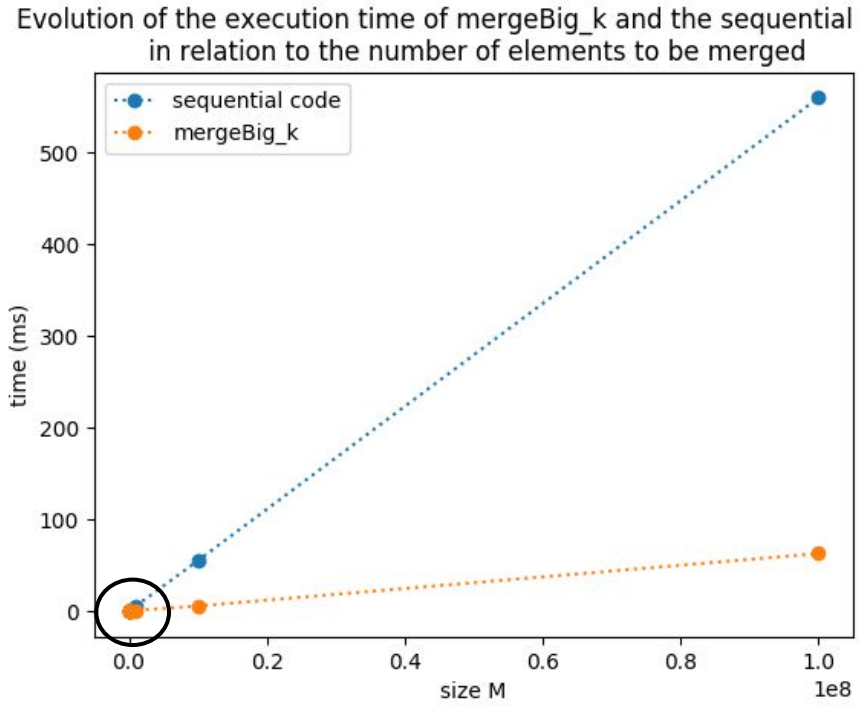
MERGE ON SEVERAL BLOCKS

ALGO mergeBig_k



KEY ELEMENTS

ALGO mergeBig_k



KEY ELEMENTS

- Interesting to switch to GPU with sizes of more than 150 000

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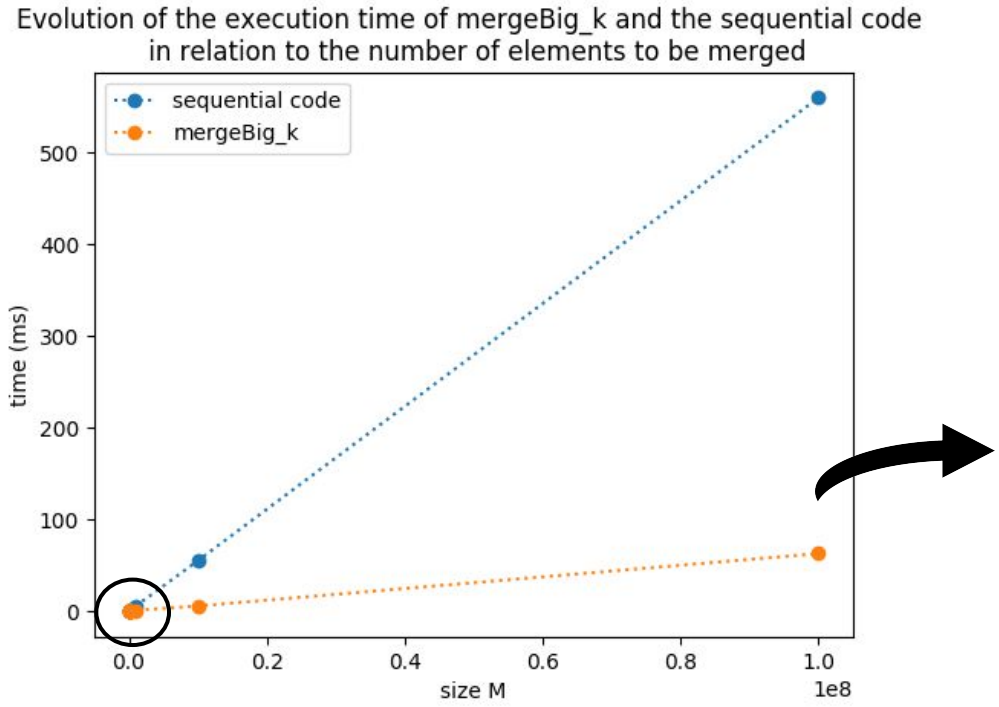

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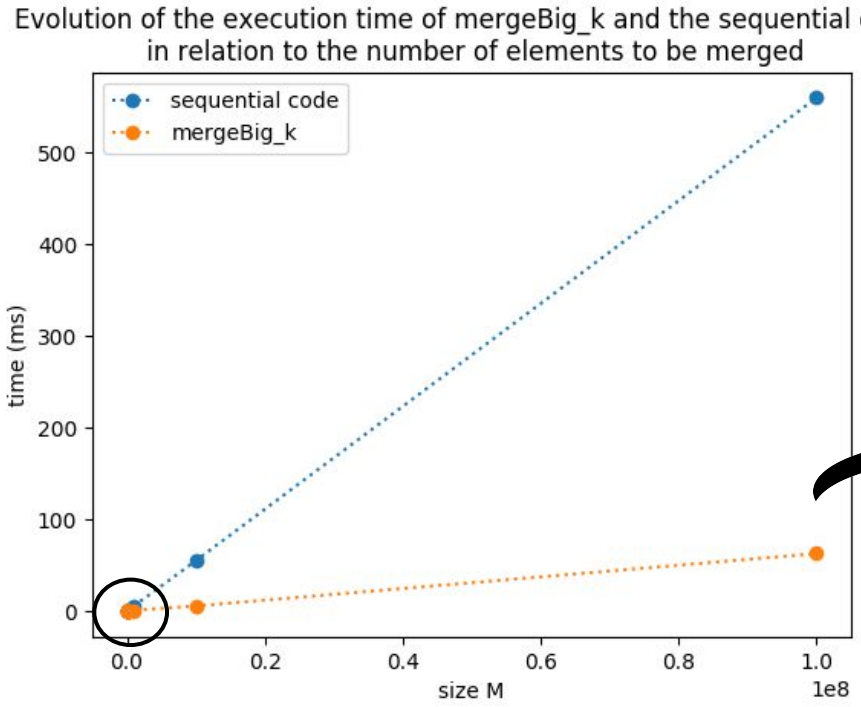

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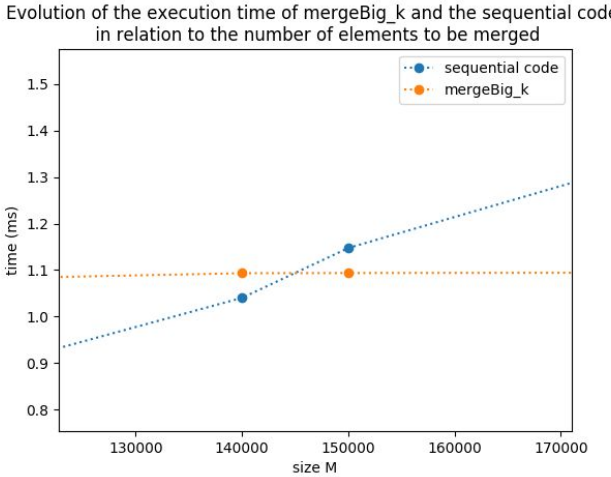

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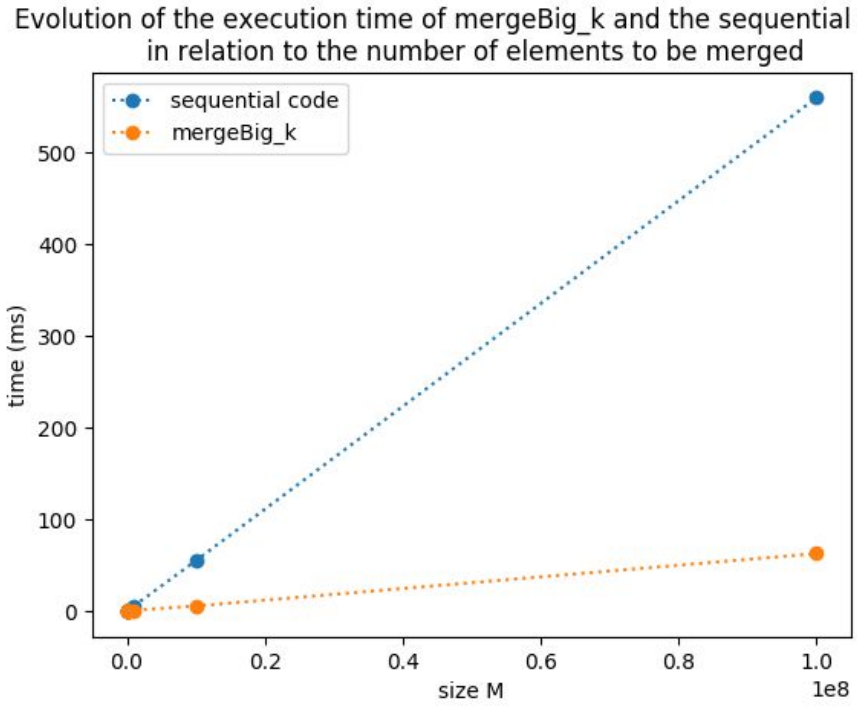
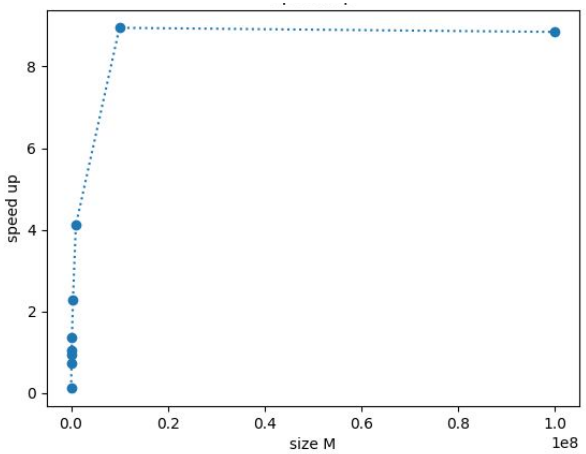


KEY ELEMENTS

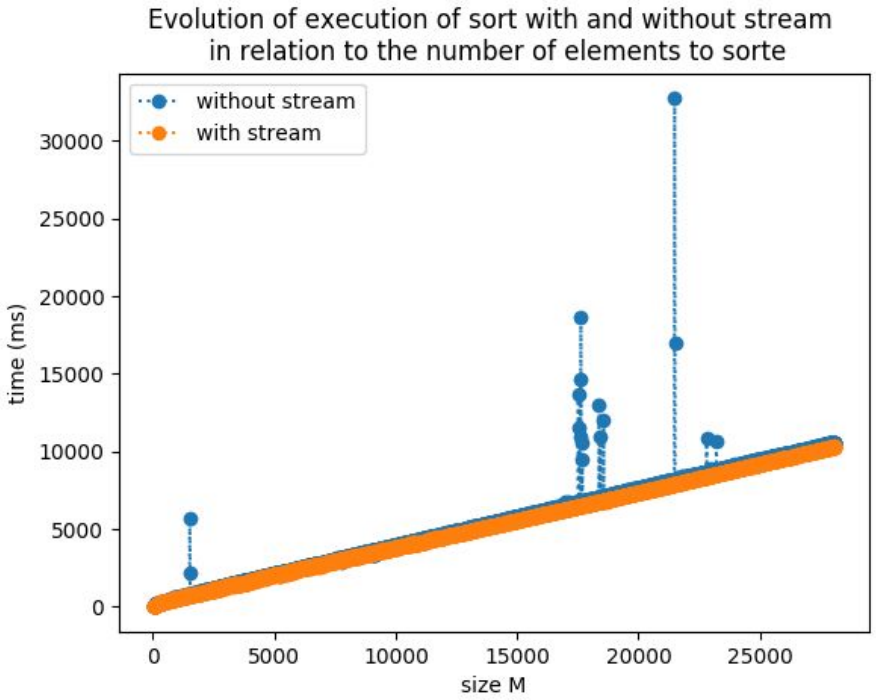
- Interesting to switch to GPU with sizes of more than 150 000
- Speed up of more than 8.



03

“MERGE SORT” ON GPU

SORT ON GPU



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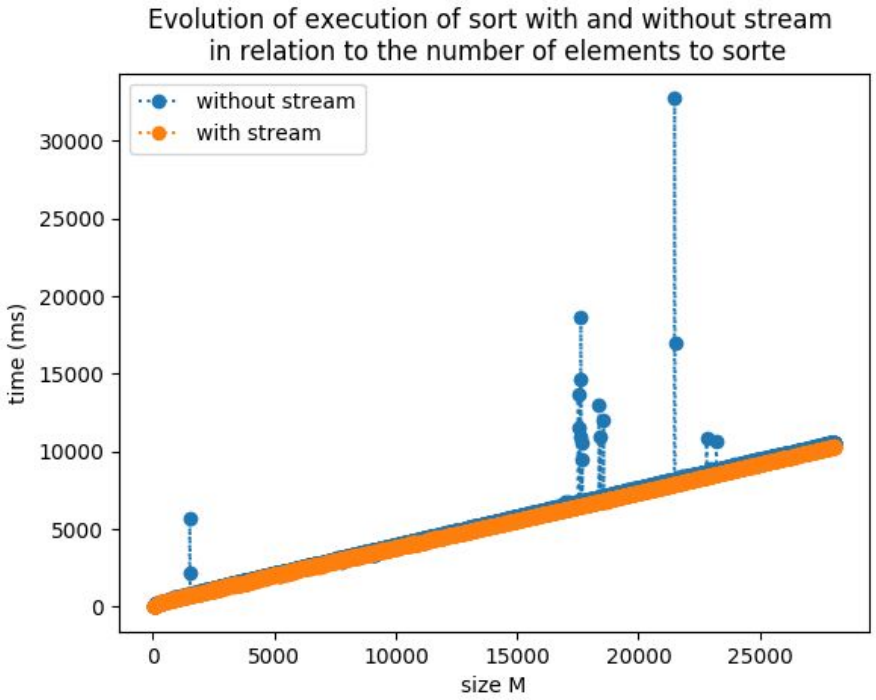
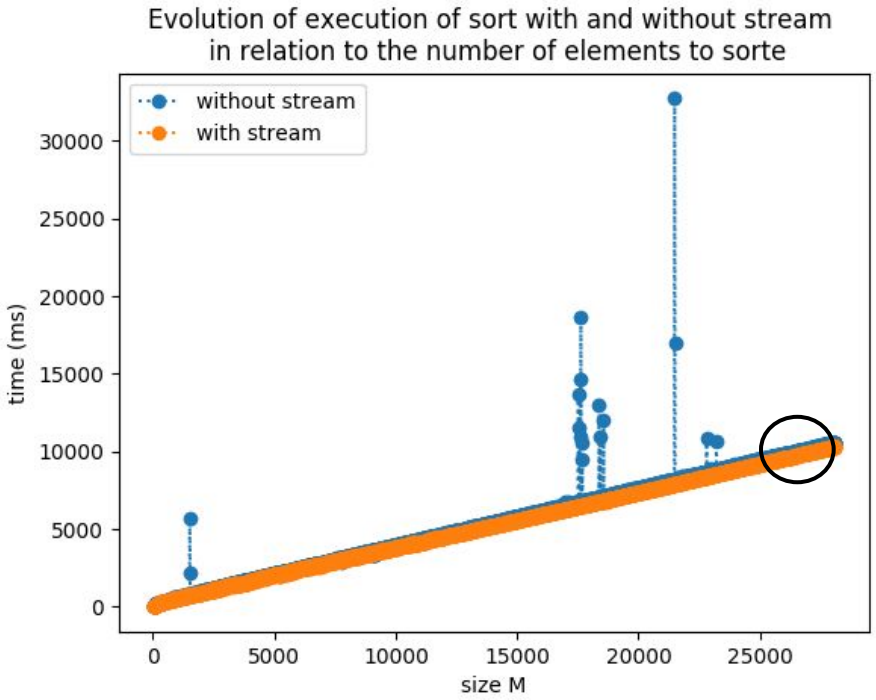


KEY ELEMENTS

- Better runtime stability with streams

SORT ON GPU



KEY ELEMENTS

- Better runtime stability with streams
- Slight improvement in execution time with streams (streams need larger and longer computations to be profitable)

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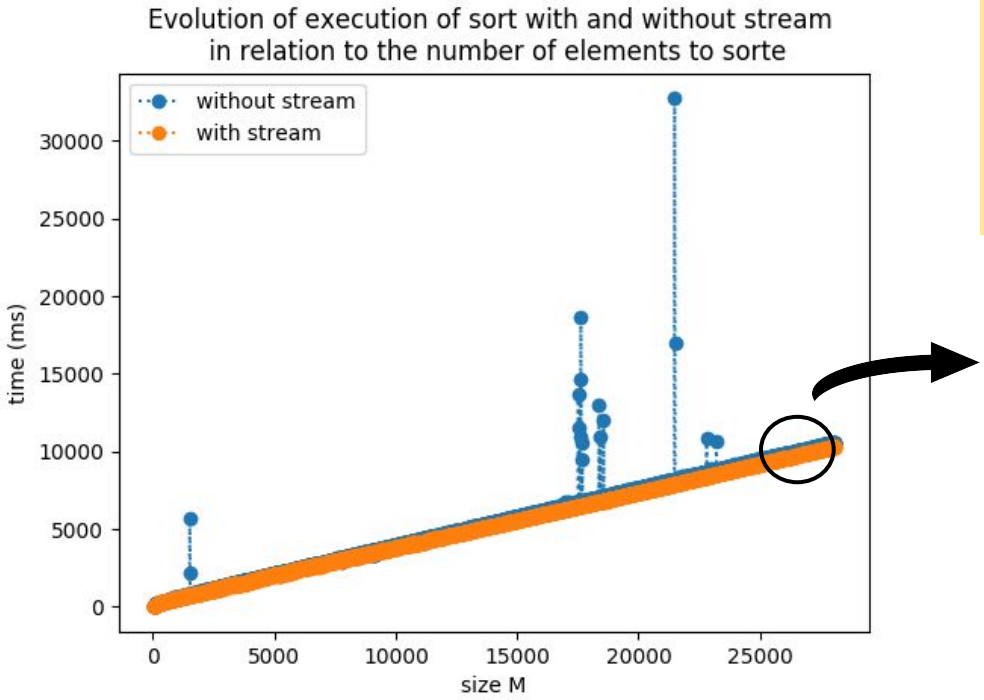

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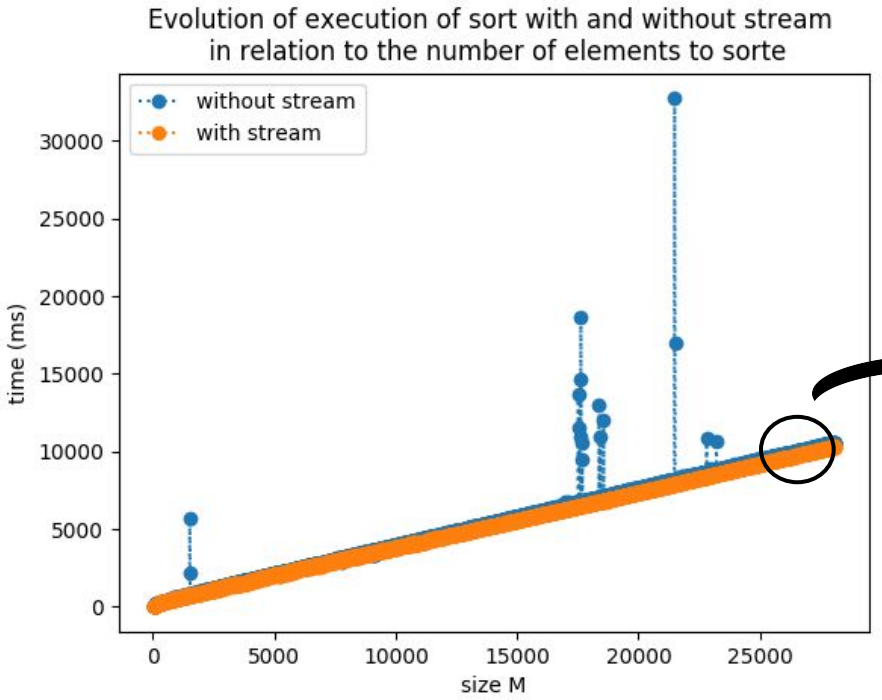

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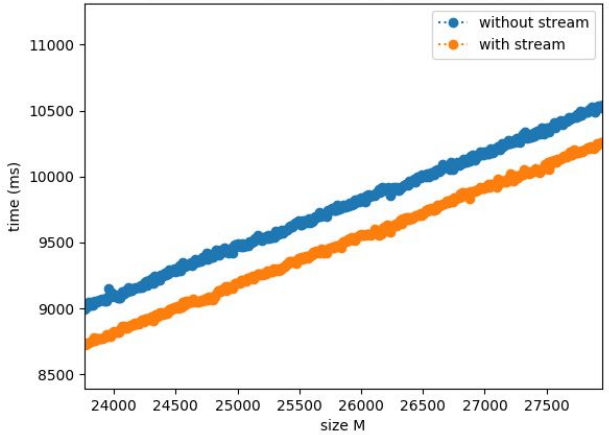
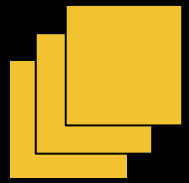
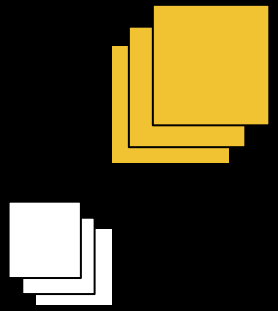


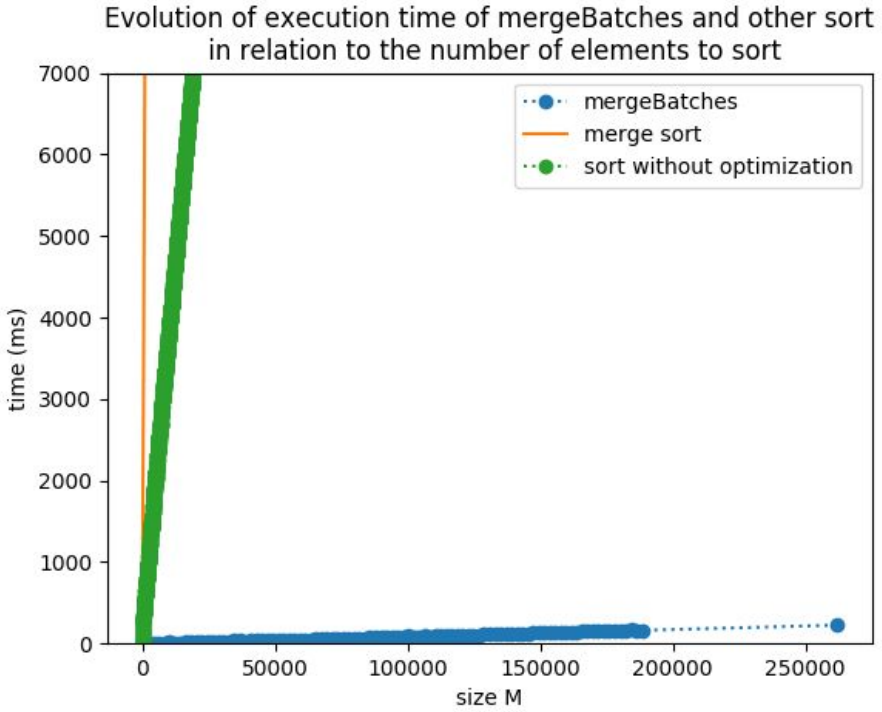




04

SORT WITH BATCHES

SORT GPU WITH STREAM



KEY ELEMENTS

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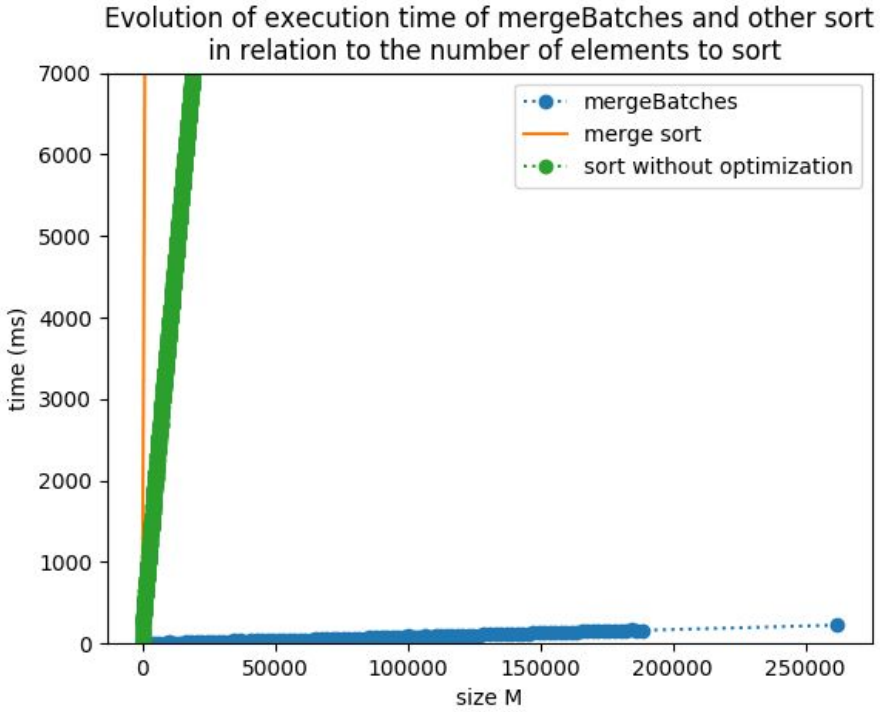
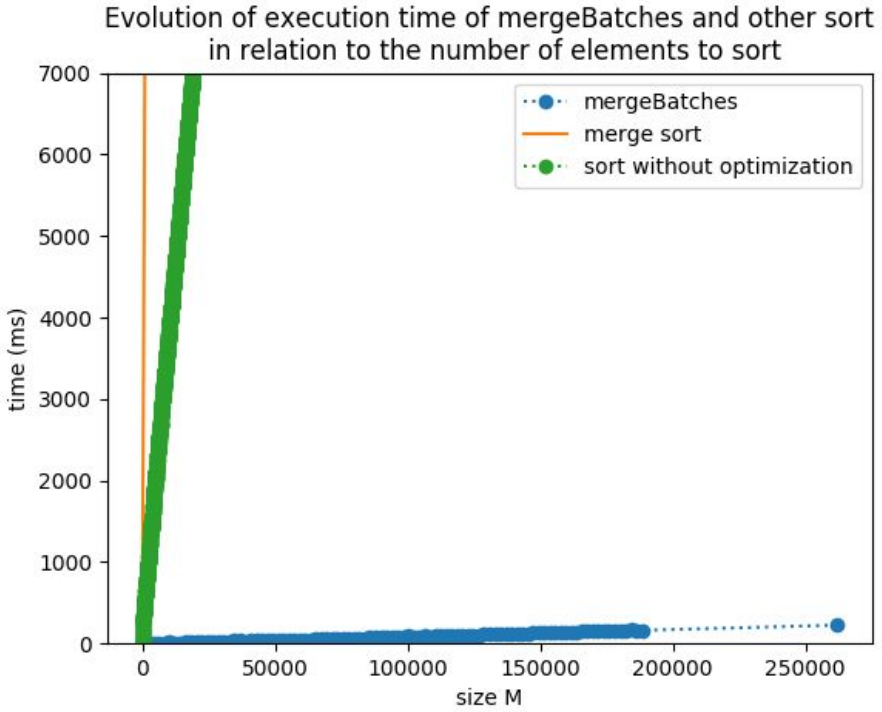


KEY ELEMENTS

- Improvement in execution time compared to merge sort and sort on GPU without optimization

SORT GPU WITH STREAM



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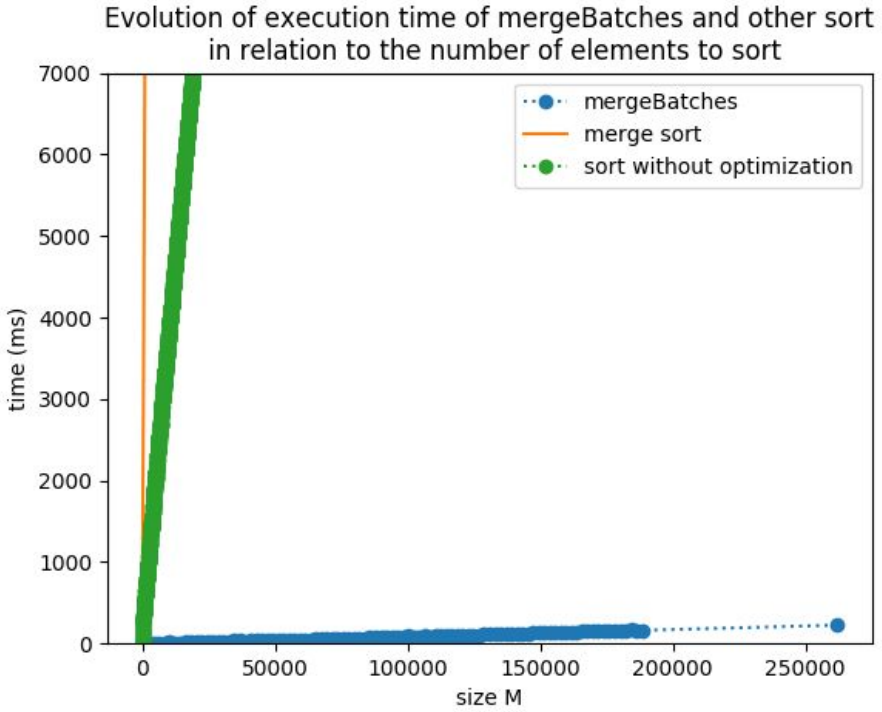
- Improvement in execution time compared to merge sort and sort on GPU without optimization
- The runtime of mergeBatches increase but really slowly compare to merge sort or sort without optimization (400 speed up to run)

SORT GPU WITH STREAM



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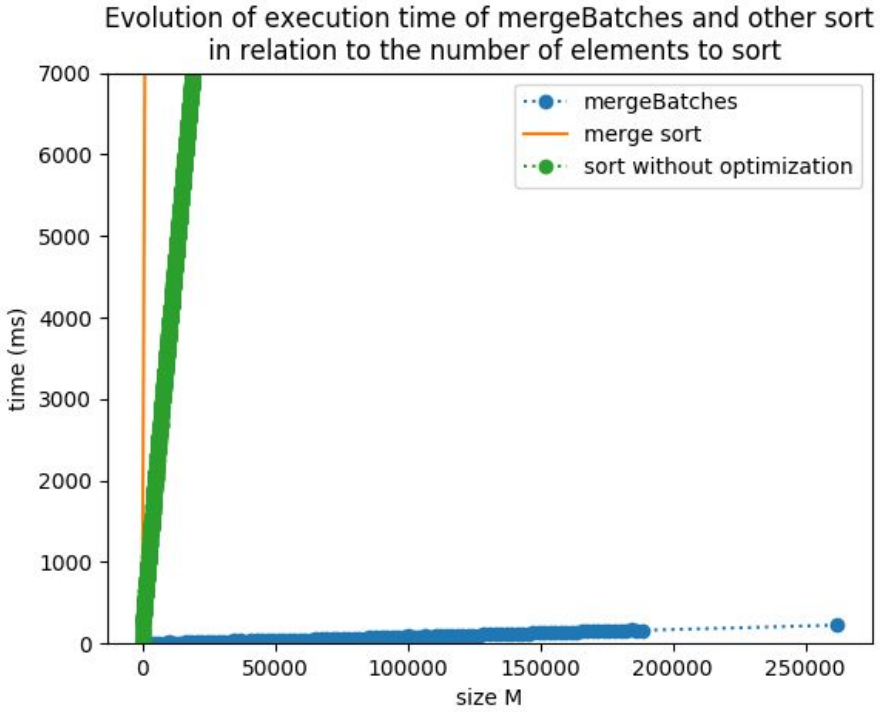

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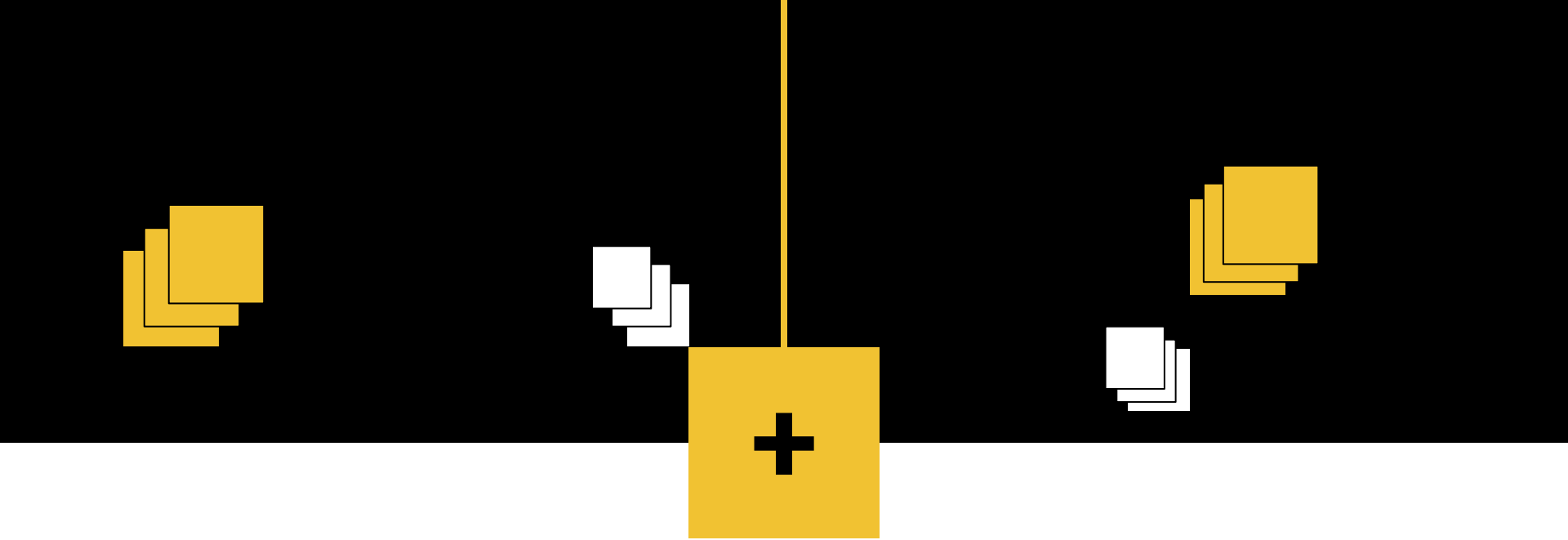
- The runtime of mergeBatches increase but really less than merge sort or sort without optimization (400 speed up to run)
- Importance of adapting the advantages of small sizes (shared and mergeSmall_k algorithm)
- Benefit of parallelizing kernels with large compute (streams)



REAL CASE

Why sort an array?

- Some data search algorithms need to have array sorted (like dichotomous)

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- To insert an element in an array

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- Accelerated data filtering algorithms
- Improvement of data readability
- Ranking
- Ordering experiment value otherwise

THANK YOU