GPU compressor exploration

Stefan Rua

Why?

- Data from the HLT is compressed
- This is done on CPUs
- GPUs can be very fast

What I've been doing

- Looking for GPU compressor implementations
- Adding them to a benchmarking program
- Comparing them to CPU compressors

Benchmarking

lzbench[1]

- Everything is compiled with the same options
- In-memory: excludes disk read/write times
- Already has a bunch of compressors

[1] https://github.com/inikep/lzbench

Compressors

bsc[2]

Block-**s**orting **c**ompressor by Ilya Grebnov.

[2] https://github.com/IlyaGrebnov/libbsc

Compressors

dietgpu[3]

Asymmetric numeral systems (ANS)[4] implementation by Facebook.

[3] https://github.com/facebookresearch/dietgpu
[4] https://arxiv.org/pdf/1311.2540.pdf

Compressors

libnxz[5,6]

- IBM's POWER9 processors have a hardware accelerator, NX, for gzip
- libnxz is the library for compressing on it

[5] https://dl.acm.org/doi/pdf/10.1109/ISCA45697.2020.00012
[6] https://github.com/libnxz/power-gzip

Compressors

nvcomp[7,8]

Compression library by Nvidia, unfortunately made proprietary in version 2.3.

[7] https://developer.nvidia.com/nvcomp
[8] https://github.com/NVIDIA/nvcomp

Data

100 PP events

- HadronsTaus stream from 2022
- pileup ≈ 50
- 100 files
- 170 MB
- 1.4 MB to 2.1 MB each

Data

100 HI events

- from 2018
- 100 files
- 131 MB
- 644 KB to 5.5 MB each

Machines

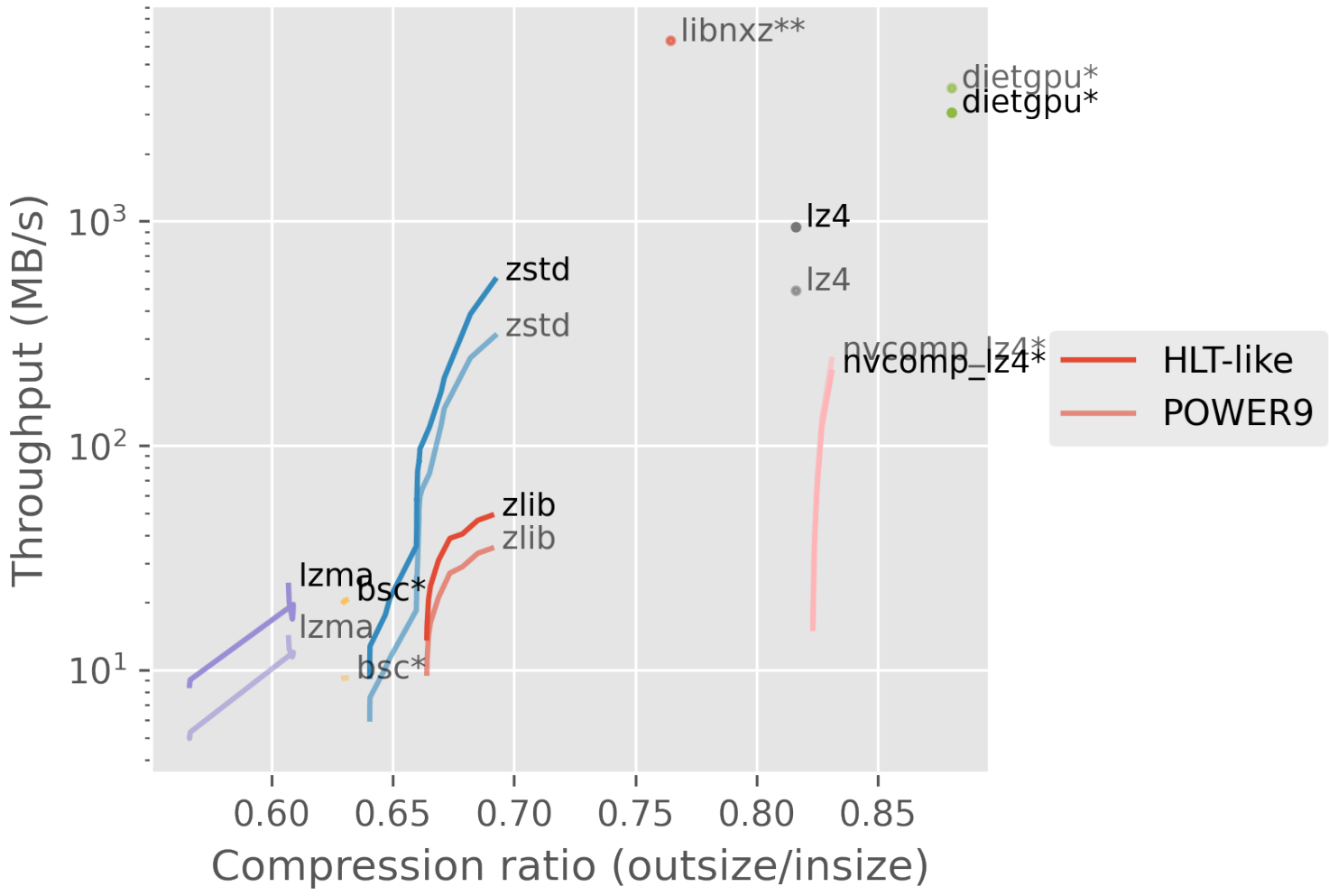
HLT-like

- AMD EPYC 75F3
- Nvidia Tesla T4

POWER9

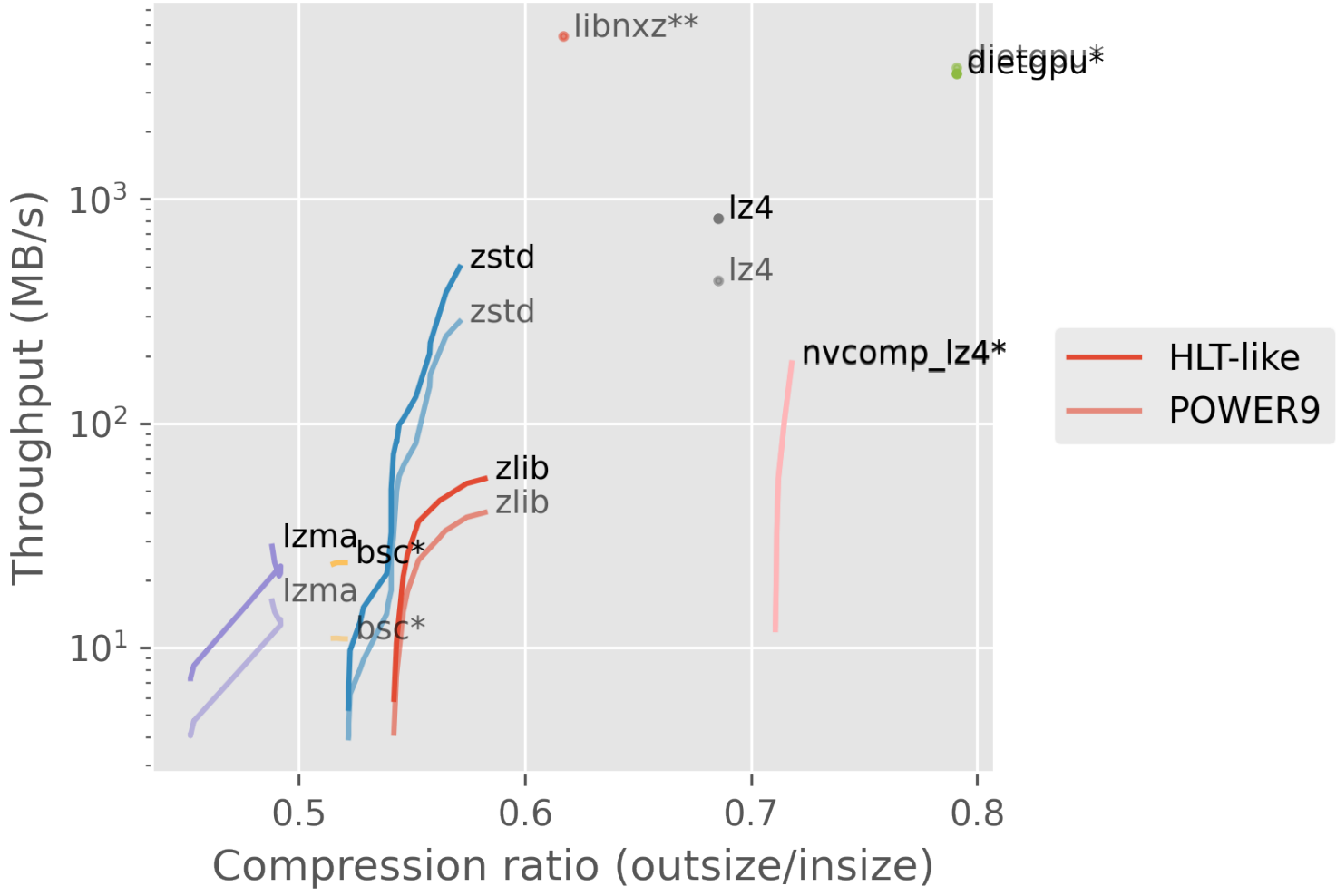
- IBM POWER9
- 4 x Nvidia Tesla V100

Results - PP



* = GPU
** = NX

Results - HI

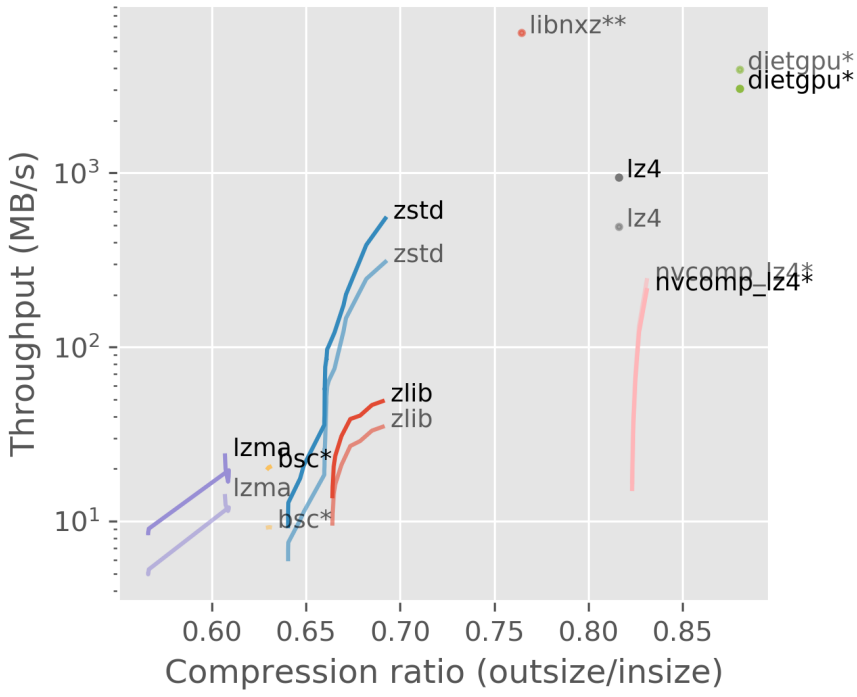


* = GPU
** = NX

Conclusion

None of them seem to fit our needs all that well

That's it



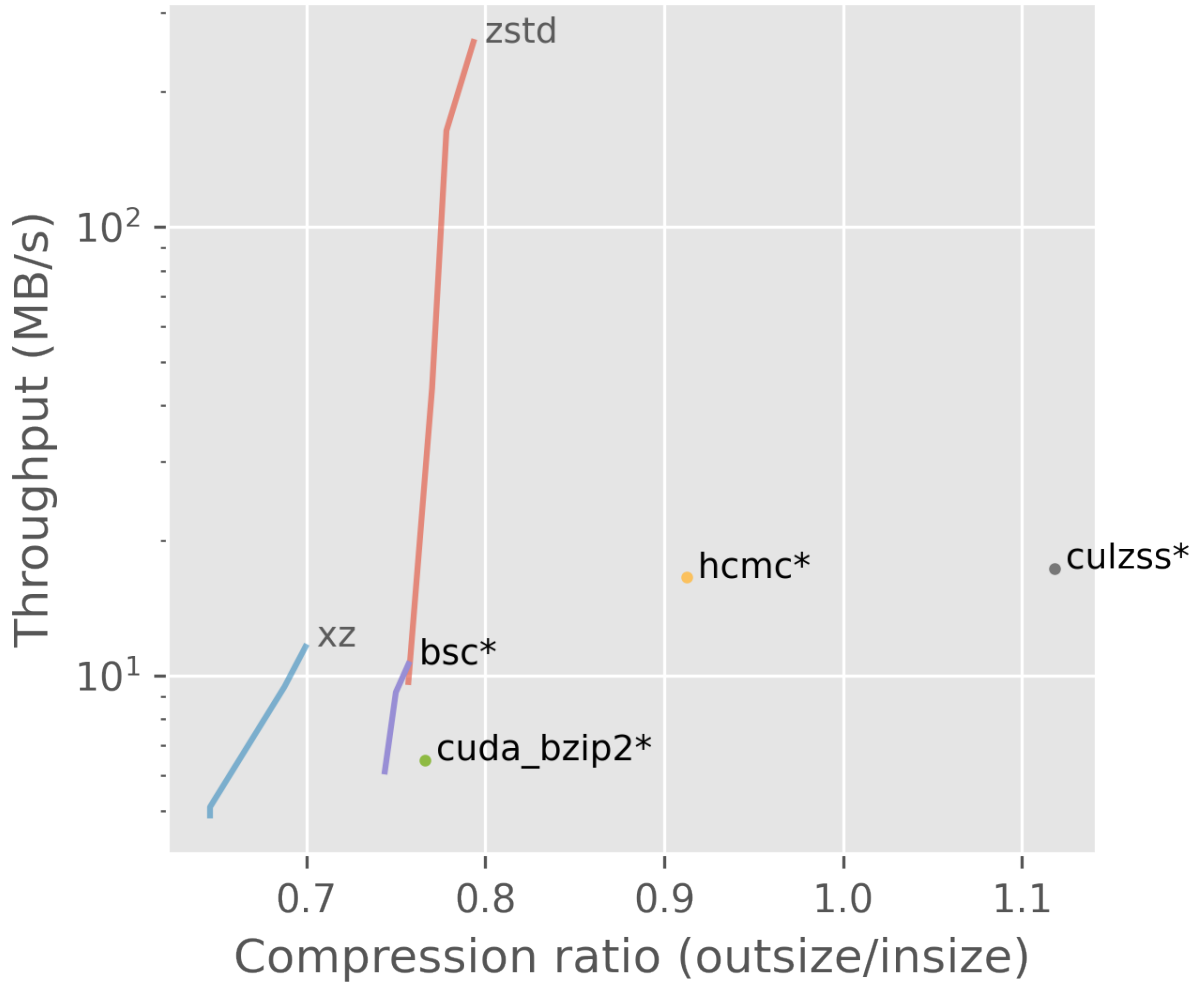
Contact

`stefan.elias.rua@cern.ch`

`stefan.rua@iki.fi`

Extra - less promising ones

These were just run from the command line and timed using the `time` command.



Extra - problems

Nvidia

From version 2.3 onwards, the compression / decompression source code will not be released. We'll continue to maintain this Github for documentation and code sample purposes.

Researchers

Hi Stefan

It has been a while that we have worked on that. The best I can find is this code for CULZSS not for bit one, but it might be working or not, i am not sure.

hope that helps.

Extra - machine details

HLT-like

- AMD EPYC 75F3
  - 32 cores
  - max. 4 GHz
  - 256 MB L3 cache
- Nvidia Tesla T4
  - 2560 CUDA cores
  - 16 GB GDDR6
  - 8.1 TFLOPS

Extra - machine details

POWER9

- 8335-GTH / IBM Power System AC922
- IBM POWER9
  - 32 cores
  - max. 4 GHz
  - 320 MB L3 cache
- 4 x Nvidia Tesla V100
  - 5120 CUDA cores
  - 32 GB HBM2
  - 15.7 TFLOPS