



**UNIVERSITÀ
DEGLI STUDI
DI TRIESTE**

Cloud Computing

Final Exam Exercise

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Goal

The goal is to assess and compare the performance of a cluster of two virtual nodes in different environment:

- Virtualbox
- Docker

Benchmarks:

- hpcc
- stress-ng
- sysbench
- IOZone
- iperf

(Virtual) Hardware Specification

Host Machine:

CPU Intel Core i7-8550U CPU @ 1.80GHz,
4 Cores / 8 Threads

Memory 8 GB

Disk 256 GB SSD

OS Ubuntu 24.04.2 LTS

Cluster Nodes:

CPU 2 Cores

Memory 2048 MB

Disk 20 GB

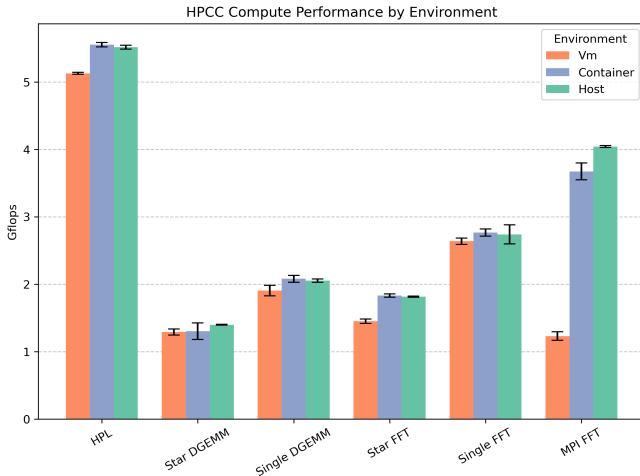
OS Ubuntu 22.04.5 live server (amd64)

Computational: HPL, DGEMM, FFT

Memory: STREAM, PTRANS, RandomAccess

Communication: PingPong, (PTRANS)

HPCC: Computational Performance

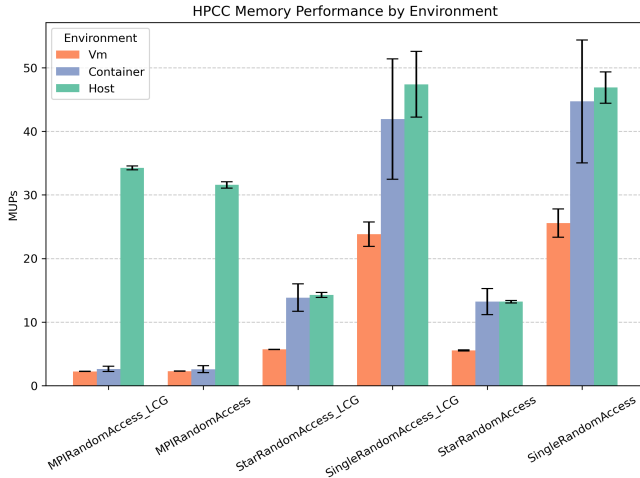


HPCC: Memory Performance (1/3)

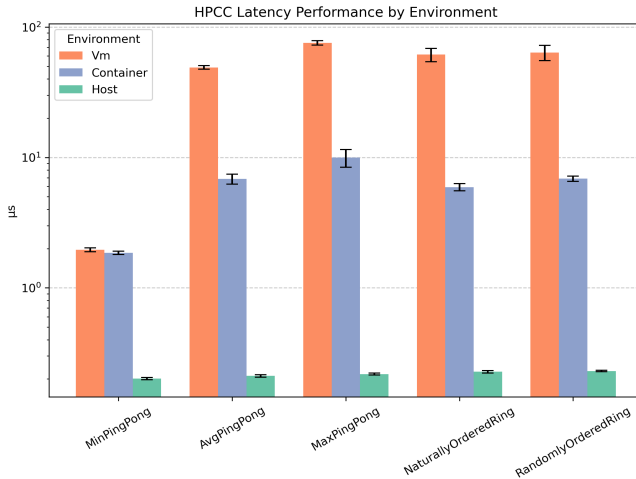
Benchmark	VM	Container	Host
SingleSTREAM (GB/s)			
Copy	22.30 \pm 0.32	24.11 \pm 0.20	23.44 \pm 0.06
Scale	13.26 \pm 0.19	14.23 \pm 0.06	14.06 \pm 0.12
Add	14.40 \pm 0.24	15.38 \pm 0.16	15.06 \pm 0.14
Triad	14.44 \pm 0.28	15.48 \pm 0.13	15.22 \pm 0.05
StarSTREAM (GB/s)			
Copy	5.03 \pm 0.03	5.41 \pm 0.03	5.39 \pm 0.02
Scale	3.34 \pm 0.03	3.55 \pm 0.01	3.56 \pm 0.01
Add	3.75 \pm 0.01	4.08 \pm 0.02	4.07 \pm 0.01
Triad	3.72 \pm 0.04	4.02 \pm 0.02	4.00 \pm 0.02

A comment about the nominal bandwidth of the memory

HPCC: Memory Performance (3/3)

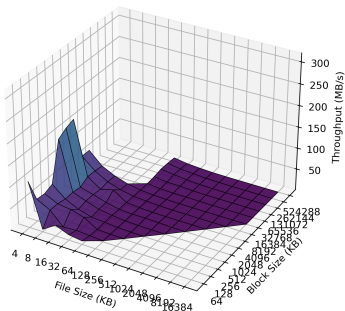


HPCC: Communication Performance

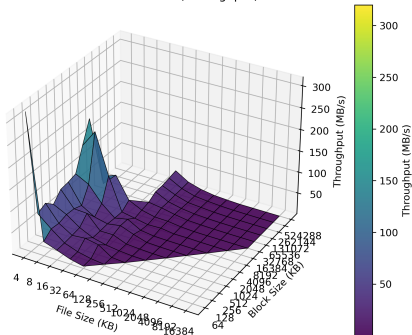


IOZone: write local

VM local writer (Throughput)

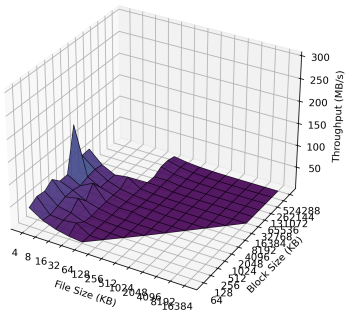


Container local writer (Throughput)

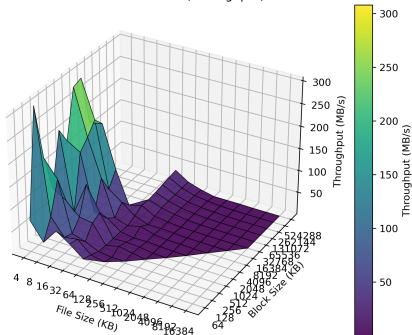


IOZone: write shared

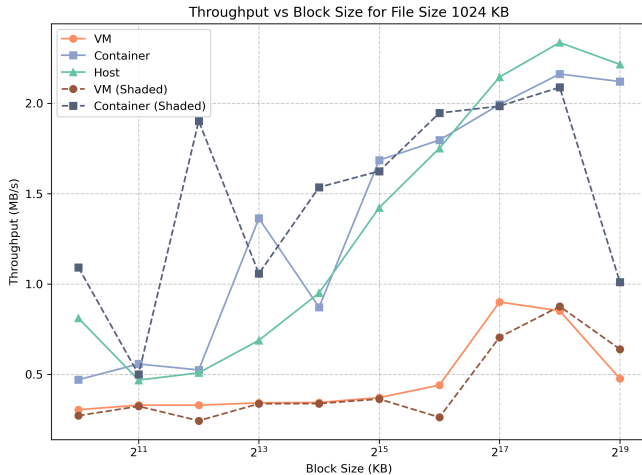
VM shared writer (Throughput)



Container shared writer (Throughput)



IOZone: write



Conlusion

- Docker are easier to configure
- better performace

Thank You!