

Validation Challenge: Hardware Track

Deucalion and Inductiva

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INSTITUTE FOR
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www.crheo.or

Deucalion: the largest Portuguese supercomputer

- Top500 List
 - 219th in Nov 2024
 - 297th in Jun 2025
- Green500 list (Arm partition)
 - 80th in Nov 2024
 - 117th in Jun 2025



10 PFlops

Arm Partition

- FUJITSU Supercomputer PRIMEHPC FX700
- CPU: A64FX (48 core/chip, 1 chip/node)
- Memory: 32GiB (HBM2: 8GiB x4)
- 1632 nodes (78336 cores)
- RPeak: 5013 PFlops

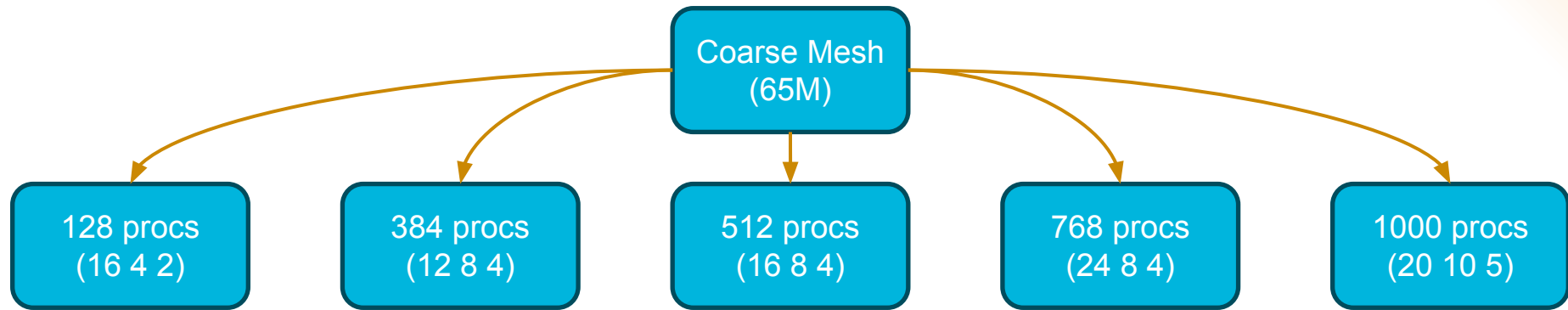
x86 Partition

- Bull Sequana X440 A5
- CPU: 2x AMD EPYC 7742 (2.25GHz, 64 Cores)
- Memory: 256GB DDR4
- 500 nodes (64000 cores)
- RPeak: 2304 PFlops

GPU Partition

- 4x NVIDIA Ampere A100 40GB GPUs on 17 nodes and A100 80GB GPUs on 16 nodes
- 33 nodes (4224 cores)
- RPeak: CPU: 0.152 PFlops, GPU: 2.572 PFlops

Coarse Mesh - Cases Overview



x86 (128 proc/node)

1 node
(128)

3 nodes
(128)

4 nodes
(128)

6 nodes
(128)

8 nodes
(125)

ARM (48 proc/node)

8 nodes
(16)

8 nodes
(48)

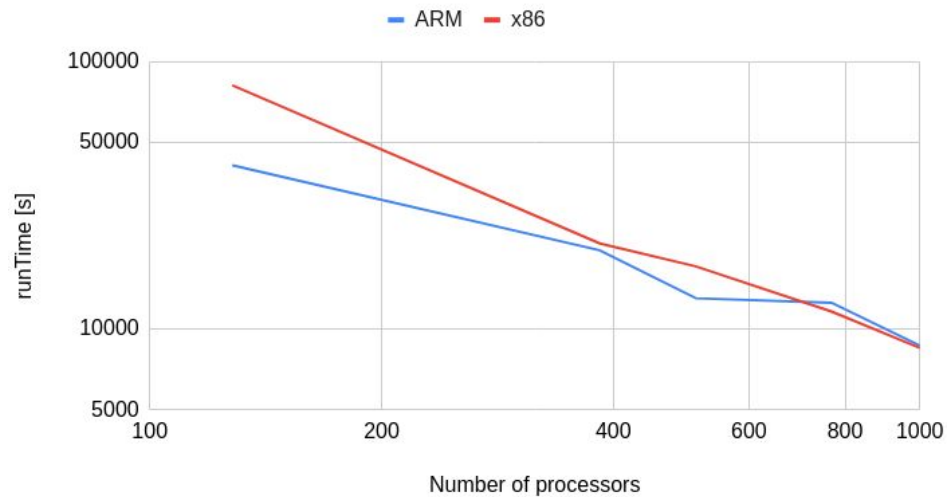
16 nodes
(32)

16 nodes
(48)

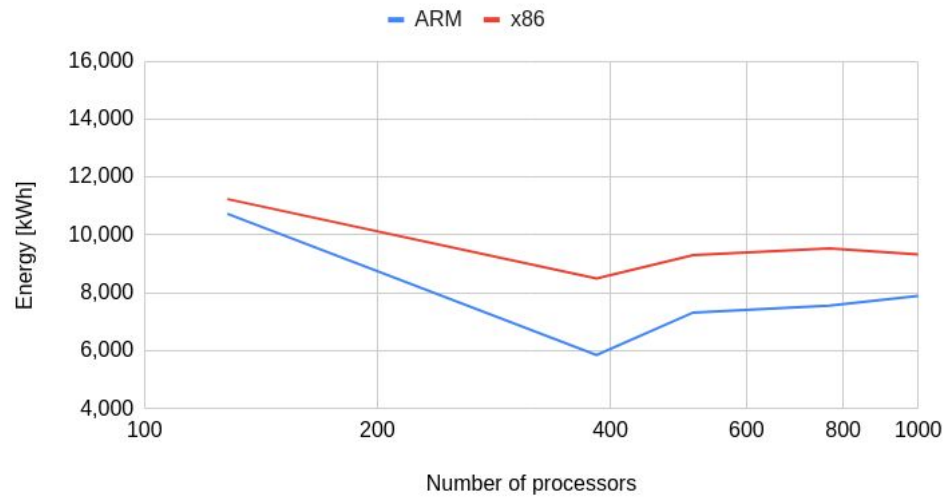
25 nodes
(40)

Coarse Mesh - Results

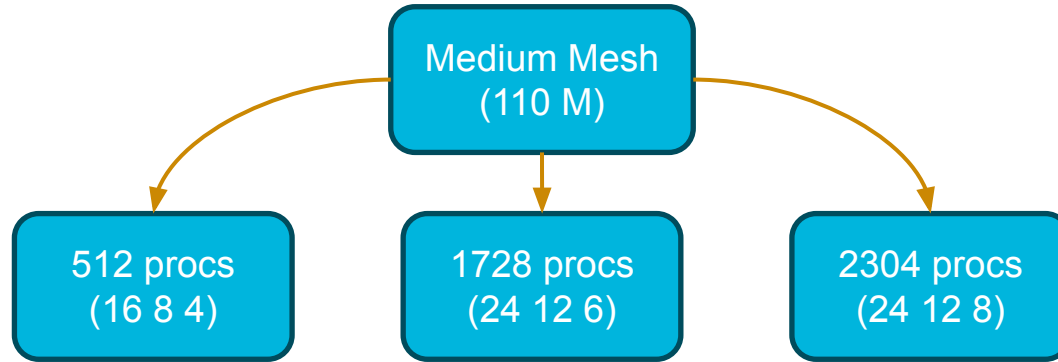
Runtime [s] - Coarse Mesh (65M)



Energy CPU - Coarse Mesh (65M)



Medium Mesh - Cases Overview



x86 (128 proc/node)

4 nodes
(128)

16 nodes
(108)

18 nodes
(128)

ARM (48 proc/node)

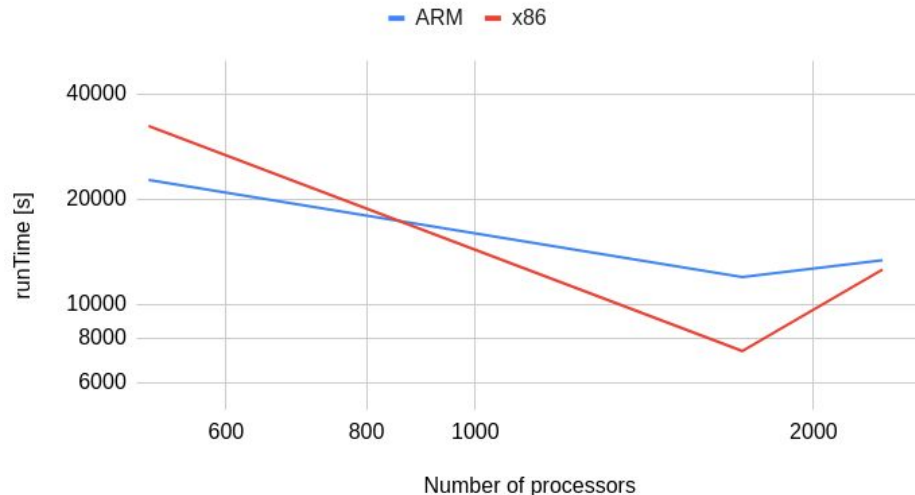
16 nodes
(32)

36 nodes
(48)

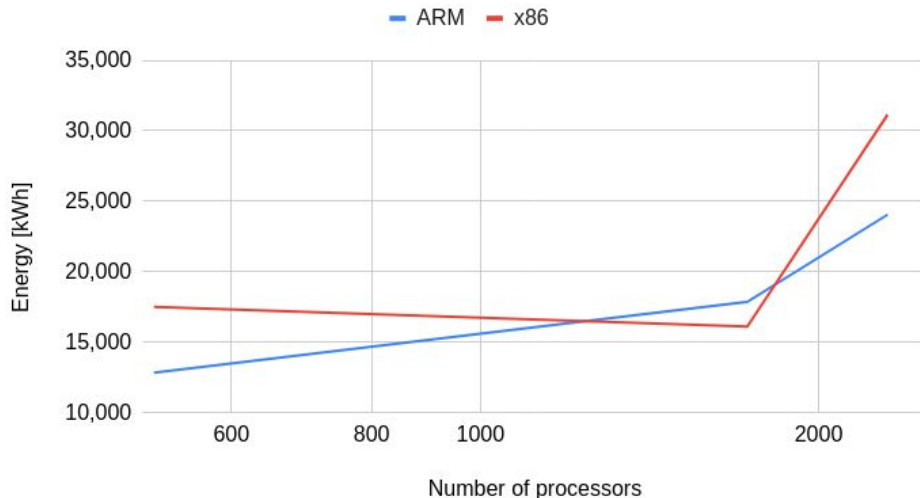
48 nodes
(48)

Medium Mesh - Results

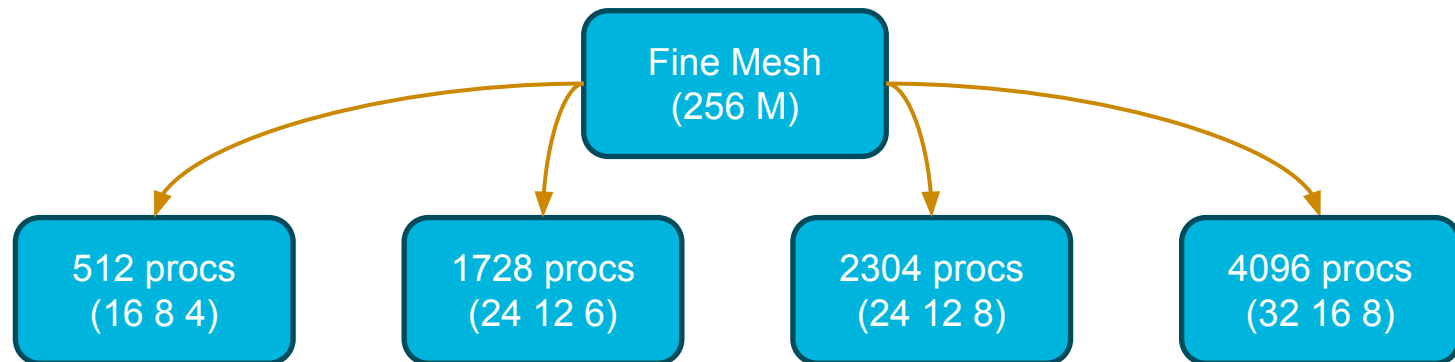
Runtime [s] - Medium Mesh (110M)



Energy CPU - Medium Mesh (110M)



Fine Mesh - Cases Overview



x86 (128 proc/node)

4 nodes
(128)

16 nodes
(108)

18 nodes
(128)

ARM (48 proc/node)

16 nodes
(32)

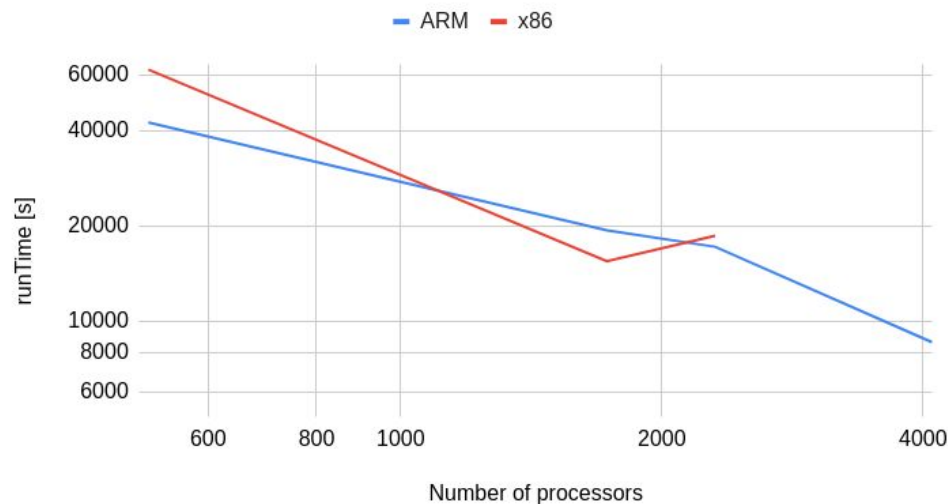
36 nodes
(48)

48 nodes
(48)

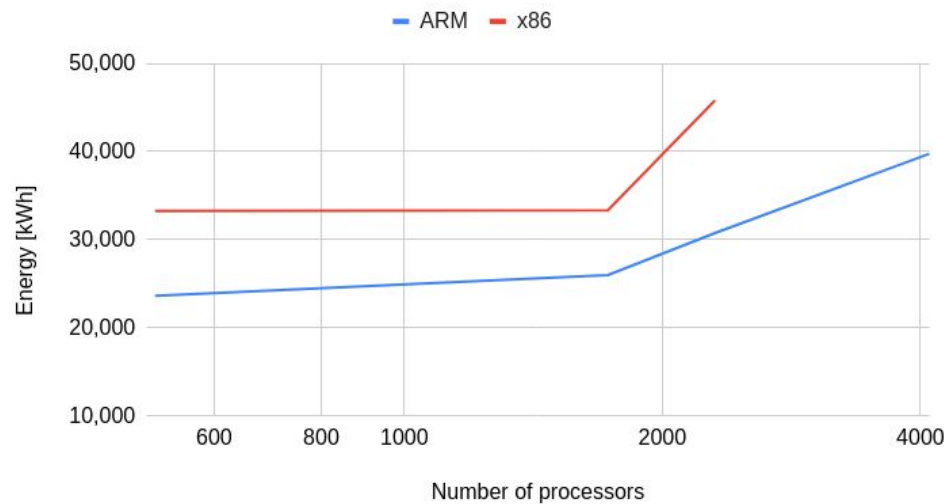
128 nodes
(32)

Fine Mesh - Results

Runtime [s] - Fine Mesh (256M)



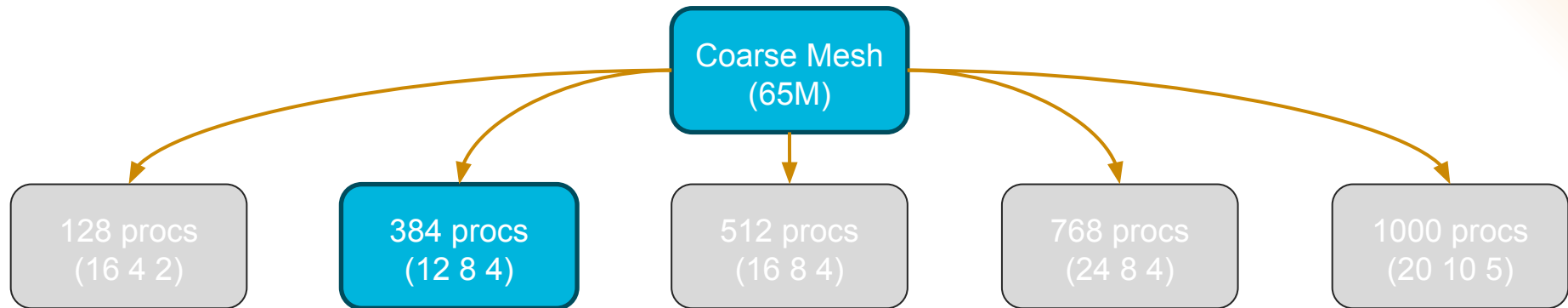
Energy CPU - Fine Mesh (256M)



Takeaways

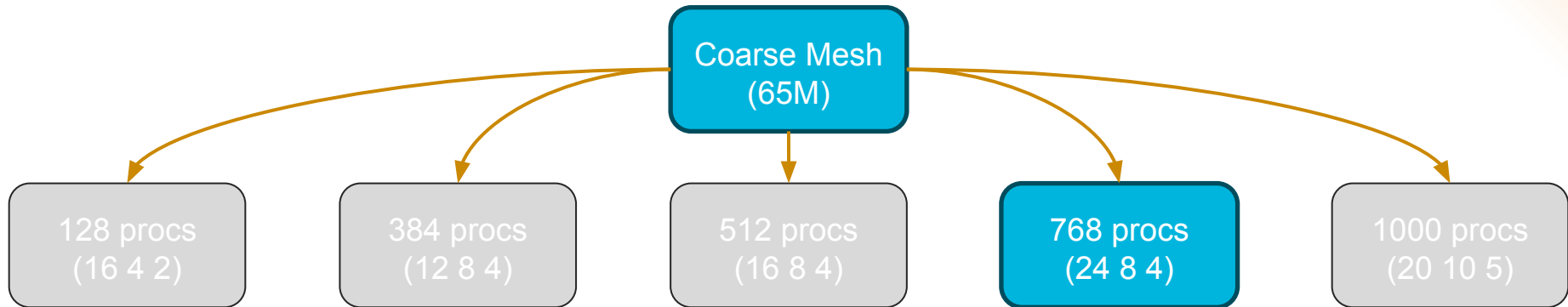
- ARM nodes have a small memory. It requires to run the most expensive operations by using more nodes
- ARM is more energy efficient than x86 in most of the cases
- In configurations with saturated node, the performance of ARM is almost the same of x86

Extra: Running on Inductiva Cloud-HPC



VM Type	Nodes	Hyperthreading	vCPUs	Physical Cores	Execution Time	Cost
c4-highcpu-96	8	OFF	384	384	3h 42min	\$54.03
c4-highcpu-192	4	OFF	384	384	4h 00min	\$57.96
c4-highcpu-192	2	ON	384	192	5h 03min	\$36.54
c4-highcpu-96	4	ON	384	192	5h 34min	\$40.71
c2d-highcpu-112	4	ON	448	224	6h 16min	\$15.97
c2d-highcpu-56	8	ON	448	224	8h 10min	\$21.78

Extra: Running on Inductiva Cloud-HPC



VM Type	Nodes	Hyperthreading	vCPUs	Cores	Execution Time	Cost
c4-highcpu-192	8	OFF	768	768	2h 38min	\$76.53
c4-highcpu-96	8	ON	768	384	3h 54min	\$57.06
c4-highcpu-96	16	OFF	768	768	4h 26min	\$130.65
c2d-highcpu-112	8	ON	768	448	4h 33min	\$23.15
c4-highcpu-192	4	ON	768	384	5h 33min	\$80.41

Extra: Running on Inductiva Cloud-HPC



Main Takeaways:

- Hyper-threading tends to hurt “raw” performance (not a surprise)
- “Cheap” VMs (e.g. AMD EPYC 7003) offer excellent cost-performance
 - hyper-threading on!
- Cloud-based HPC viable up to ~8 nodes, still on the hundreds of cores