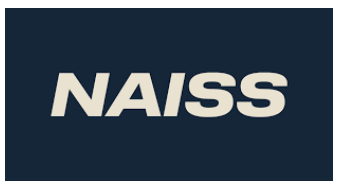
Introduction to HPC2N, Kebnekaise and HPC

Birgitte Brydsö,
Pedro Ojeda May, and others at HPC2N

HPC2N
Umeå University

21. September 2023



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HPC2N

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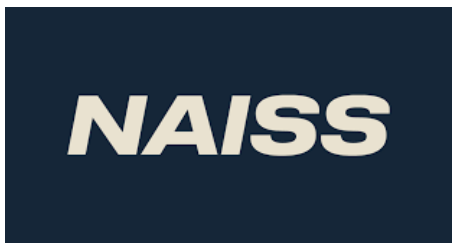
- A part of **National Academic Infrastructure for Supercomputing in Sweden (NAISS)**



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- All levels of user support
  - Primary, advanced, dedicated
  - Application Experts (AEs)

HPC2N

Primary objective: to raise the national and local level of HPC competence and transfer HPC knowledge and technology to new users in academia and industry.

HPC2N (partners)

HPC2N is hosted by

UMEÅ UNIVERSITY

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  - Parallel programming and tools (OpenMP, MPI, debugging, perf. analyzers, Matlab, R, MD simulation, ML, GPU, . . .)
    - **Using Python in an HPC environment**, 1 December 2023
    - **Introduction to Git**, 13-17 November 2023
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- NGSSC / SeSE & university courses

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Management

- Paolo Bientinesi, director
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System and support

- Erik Andersson
- **Birgitte Brydsö**
- Niklas Edmundsson (Tape coord)
- Ingemar Fällman
- Magnus Jonsson
- Roger Oscarsson
- **Åke Sandgren**
- Mattias Wadenstein (NeIC, Tier1)
- **Lars Viklund**

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- Contact through regular support
  - If you have a specific problem/question and/or need consultation

HPC2N (users by discipline)

- Users from several scientific disciplines:
  - Biosciences and medicine
  - Chemistry
  - Computing science
  - Engineering
  - Materials science
  - Mathematics and statistics
  - Physics including space physics
  - ML, DL, and other AI

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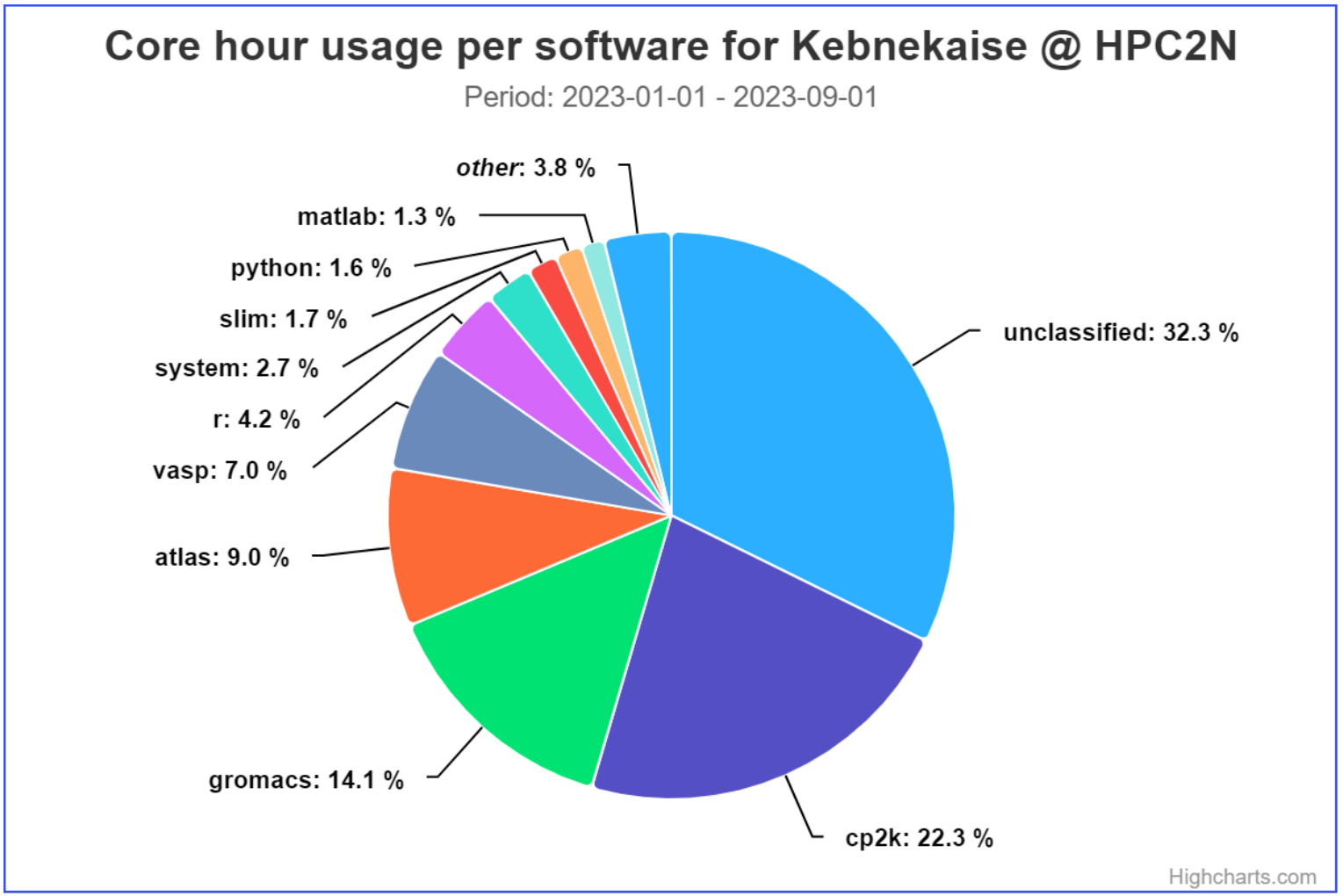
  - Machine learning and artificial intelligence (several new projects)

HPC2N (users by software)



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  - 2 dual NVIDIA A100 GPU nodes
  - one many-core AMD Zen3 CPU node

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- Also SweStore — disk based (dCache)
  - Research Data Storage Infrastructure, for active research data and operated by NAISS, WLCG

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- I will cover more details in the next section, where we go more into detail about HPC2N and Kebnekaise.

What is HPC?

High Performance Computing (definition)

"High Performance Computing most generally refers to the practice of **aggregating computing power** in a way that delivers much **higher performance** than one could get out of a typical desktop computer or workstation in order to **solve large problems** in science, engineering, or business."[1]

[1] https://insidehpc.com/hpc-basic-training/what-is-hpc/

High Performance Computing (opening the definition)

- **Aggregating computing power**
  - 533 nodes in 15 racks totalling 16504 cores
  - Compared to 4 cores in a modern laptop

[2] 728 trillion (billion)
[3] 200 billion (milliard)

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- **Solve large problems**
  - When does a problem become large enough for HPC?
  - Are there other reasons for using HPC resources? (Memory, software, support, etc.)

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High Performance Computing (large problems)

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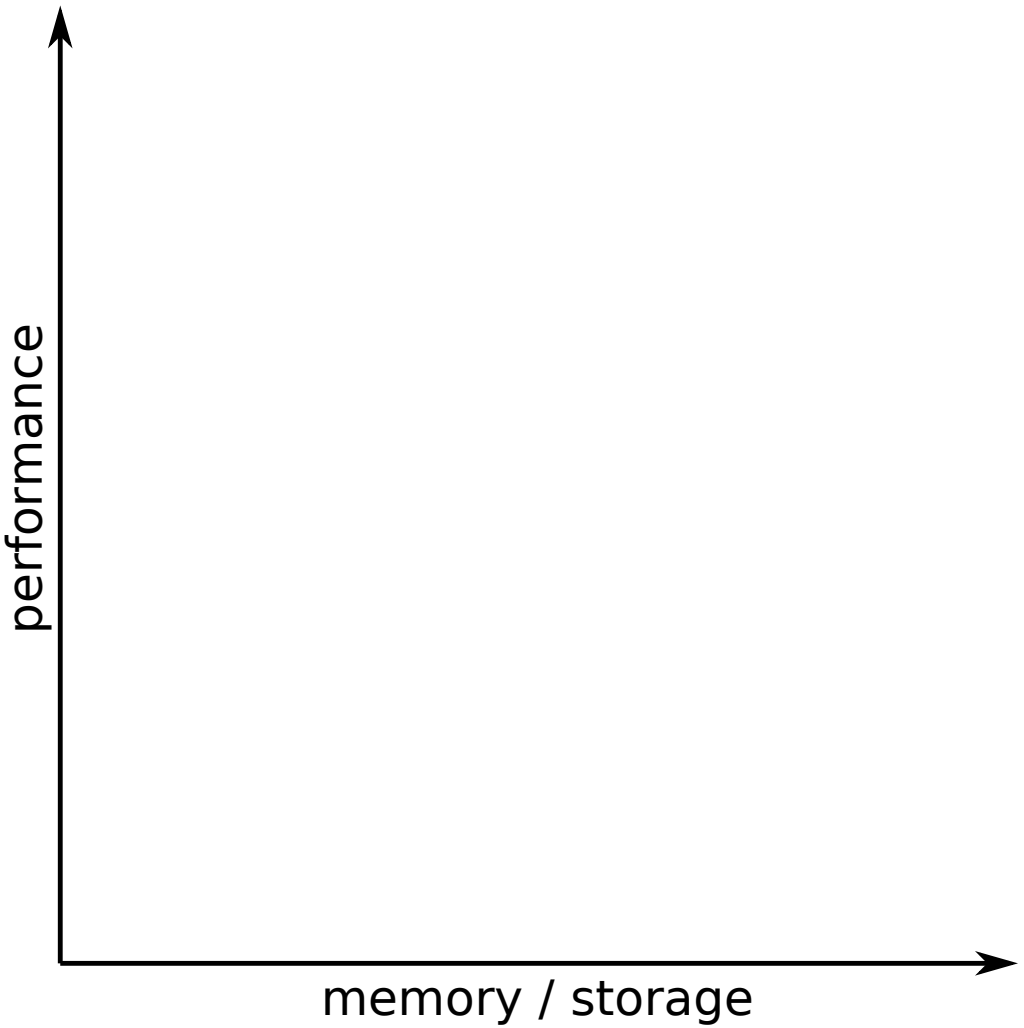
- The former can be remedied by **increasing the performance**
  - More cores, more nodes, GPUs, ...
- The latter by **adding more memory / storage**
  - More memory per node (including large memory nodes), more nodes, ...
  - Kebnekaise: 128GB - 192GB, 512GB, 3TB
  - Large storage solutions, ...

High Performance Computing (what counts as HPC)



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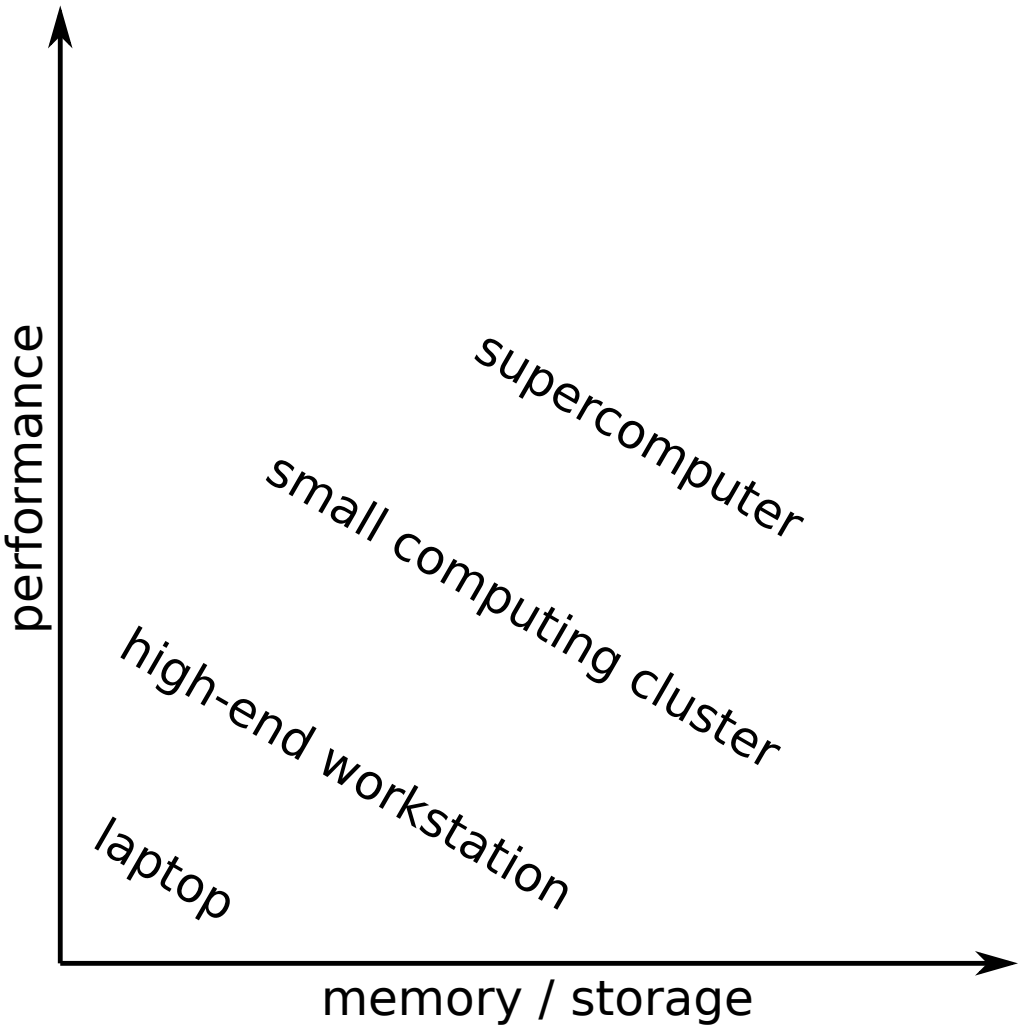

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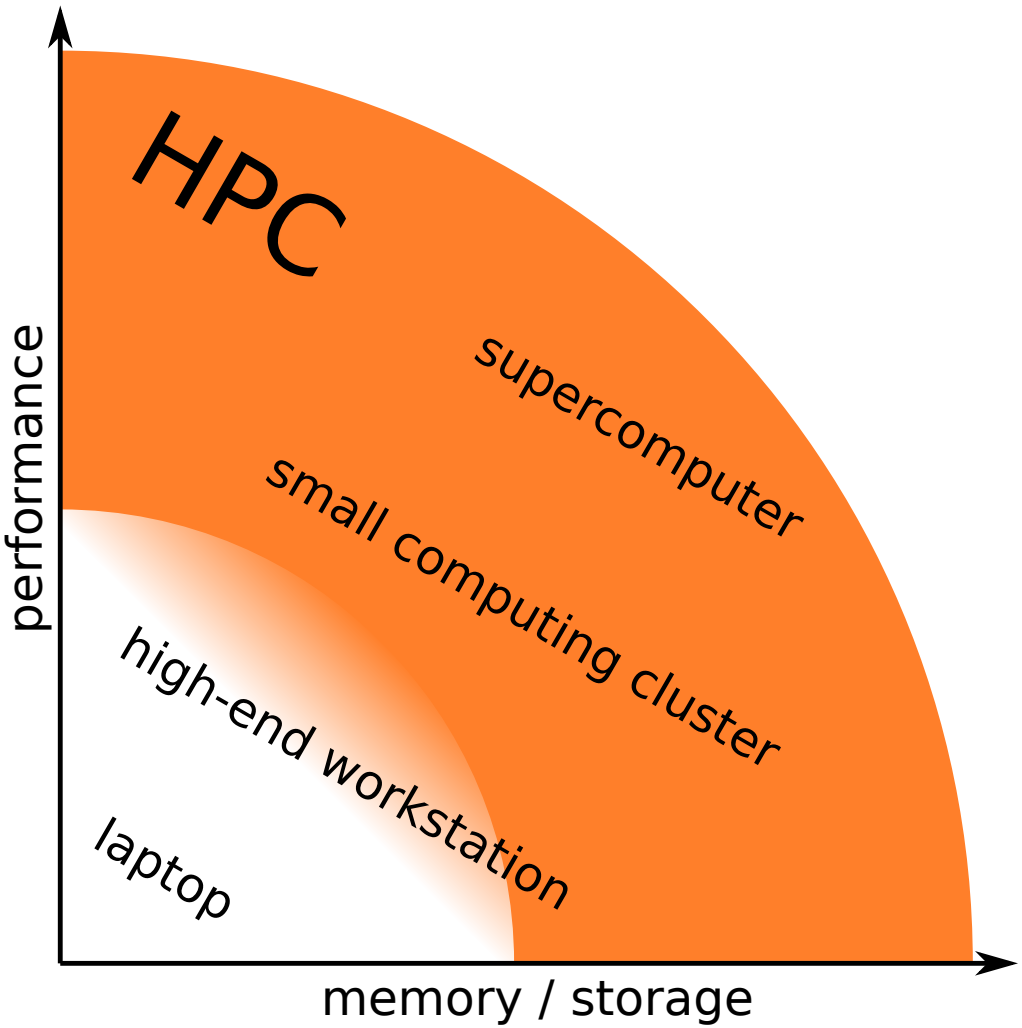

High Performance Computing (other reasons)

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  - GPUs, **Nvidia Tesla V100/A100 GPUs** are optimized for AI

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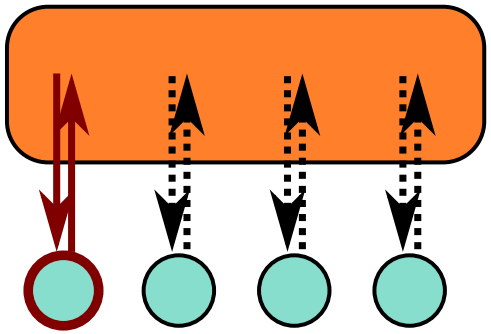

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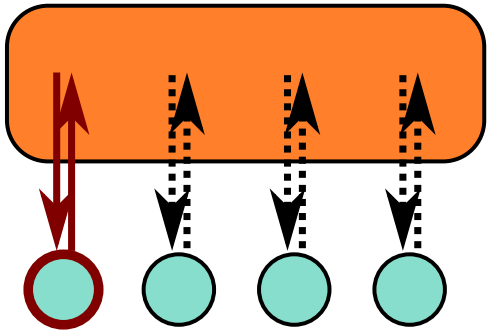

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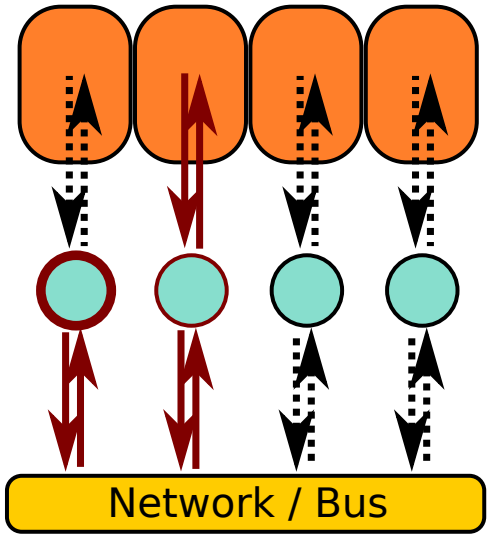
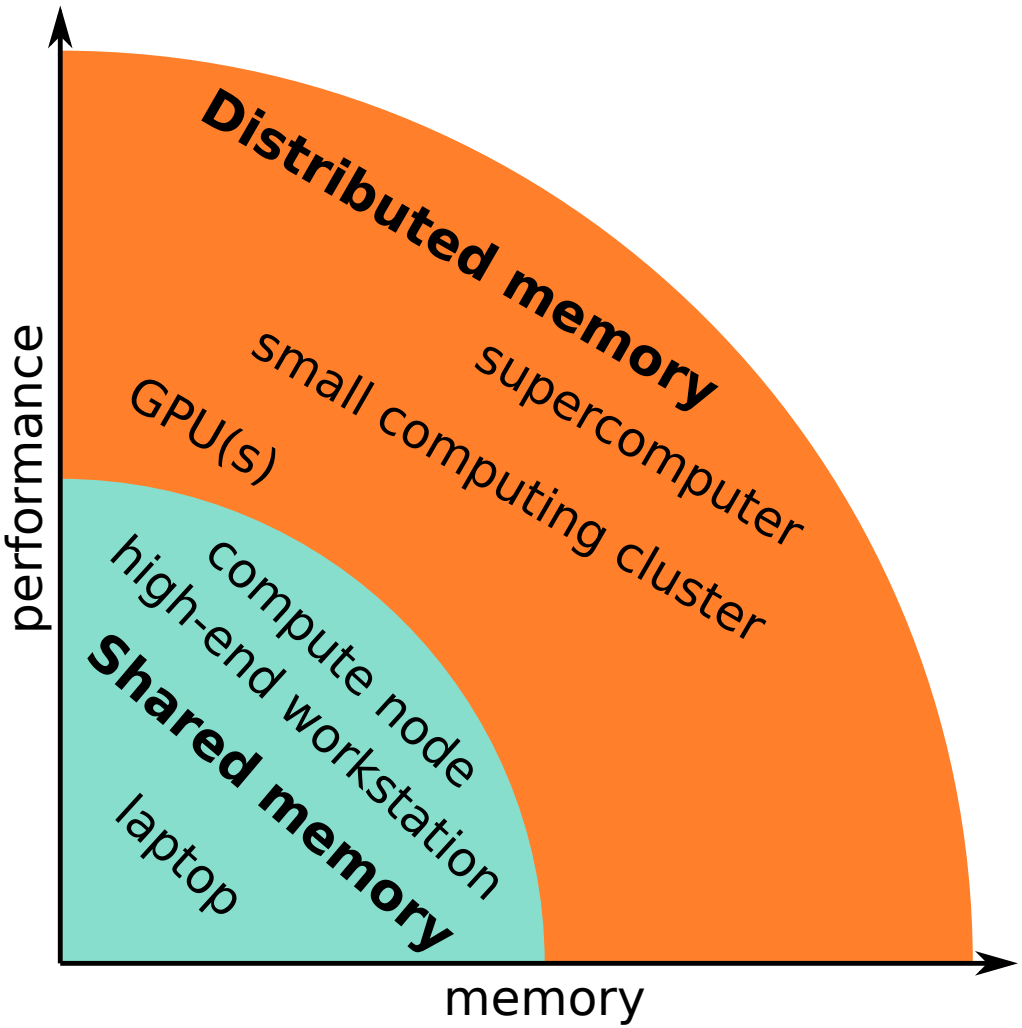
  - Distributed memory: Multiple **distinct** memory spaces.



  - Everyone has direct access **only to the local data**
  - Requires **communication**

High Performance Computing (memory models)



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- GPUs: MAGMA, TensorFlow, ...
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End (questions?)

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