

Slurm 101

How to use the HPC-infrastructure at the CIMH

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Outline

- 1 Parallel Computing
- 2 Our HPC-Cluster
- 3 Basic Tools
- 4 Requesting Resources
- 5 Using the cluster
- 6 Kerberos
- 7 Examples

Parallel Computing

Computer Programs contain multiple steps. Some steps can only be run **serially**, some can be run in **parallel**. Serial parts are hard to speed up. Parallel parts can be speed up fairly easy.

Careful!

Trying to parallelize serial steps can lead to a decrease in performance, crashes and wrong results!

Knowing which part of a program can be parallelized requires knowledge of the workload and your program. Parallelization can cause **Race Conditions** and **Deadlocks**.

Don't waste resources

Simply adding more computational resources won't increase calculation speed.

There are multiple ways to parallelize your program:

- ① Vectorization
- ② **Multi-Processing**
- ③ **Multi-Threading**
- ④ Multi-Streaming with GPUs

Right tool for the job

Choosing the right tool for the job is important. In these slides I will focus mainly on Multi-Processing and Multi-Threading.

Parallel Computing

Parallel Computation requires to split up a **larger problem** into **smaller sub-problems**, which can be calculated independently. May this be in a shared memory space or separate memory spaces.

Vectors, Matrices, Tensors

Vectors, Matrices and Tensors operations can be parallelized very easily as each element can be calculated independently from the others.

Splitting up a large dataset into smaller independent datasets is key for parallel execution. Each dataset can be calculated on different Nodes inside the cluster.

- 24 virtual nodes and many other hardware nodes (old hardware getting reused)
- Access via your RDS-Machines
- Local storage and Flstorage+Home shared
- Resources are CPU, RAM and GPU

- sinfo/squeue Status
- salloc/srun/sbatch Nutzung
- sacct Analyse

Requesting Resources

- Default Values
- Absolute/relative
- CPU/RAM/GPU

Interactive Mode

- Interactive mode for testing
- srun to run commands on cluster
- salloc for longer session

Batch Processing

- Kinit -i copy input -i process -i Kinit -i mv output
- Request ressources in script
- Mail

- Kerberos on RDS (Login -i no manual kinit needed)
- Create Keytab
- Kinit in script

Examples

- Normal
- Array

Thank You!