



703078 PS Parallel Programming SS2021

Introduction & Administrative Stuff

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Organizational Stuff

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▶ Groups 1, 2, 3

- ▶ Tue, 08:15-09:00
- ▶ Tue, 12:15-13:00
- ▶ Tue, 13:15-14:00

▶ Group 4

- ▶ Tue, 14:15-15:00

▶ Groups 5, 6

- ▶ Tue, 08:15-09:00
- ▶ Tue, 12:15-13:00

Covid-specific information

- ▶ Discord server for weekly proseminar sessions and any discussion
 - ▶ please change your nickname to your full name (can be done per-server)
 - ▶ mute any channels you're not interested in (e.g. of other groups)
 - ▶ make sure you have a working audio setup and that you can share your screen for discussing any measurements, source code, etc.

More Organizational Stuff

▶ Prerequisites

- ▶ Interest in parallel programming
- ▶ Programming in C or C++

▶ Language

- ▶ Groups 1, 2, 3, 5, 6: German, unless there are non-German speakers?
- ▶ Group 4: English

▶ Content

- ▶ General concepts of parallel programming
 - ▶ Concepts apply to many parallel programming models
 - ▶ As an example, we will mainly discuss OpenMP

Grading: Proseminar

- ▶ Weekly assignments, published on OLAT
 - ▶ Link to GitHub
 - ▶ 3 points per week
- ▶ Teamwork is permitted and encouraged
 - ▶ 3 people max. per team
 - ▶ **Every** team member must be able to present and discuss solution
- ▶ Solutions have to be handed in until Mon 17:00!
 - ▶ Solutions of assignments on the LCC2 cluster **must work** on LCC2
 - ▶ Copying solutions (e.g. off the Internet) is acceptable **if cited properly and understood**
 - ▶ Grade is 50 % solutions, 50 % presentations/discussion – both must be $\geq 50\%$!

Literature

- ▶ **www.internet.com**
 - ▶ <https://www.openmp.org/resources/> (incl. video tutorials)
 - ▶ stackoverflow
 - ▶ Google
 - ▶ ...
- ▶ **Old school: Printed books**
 - ▶ Let us know and we will look up some references...

What are we all doing here?

- ▶ Discuss key concepts of parallel computing
 - ▶ Hardware **and** software aspects
 - ▶ Multiple non-functional aspects – there's more than just speed
 - ▶ Portability, usability, maintainability, sustainability
- ▶ We still need to actually do some concrete work
 - ▶ (Mostly) OpenMP for implementing and evaluating distributed-memory parallelism concepts
 - ▶ We'll also use LCC2 for running experiments



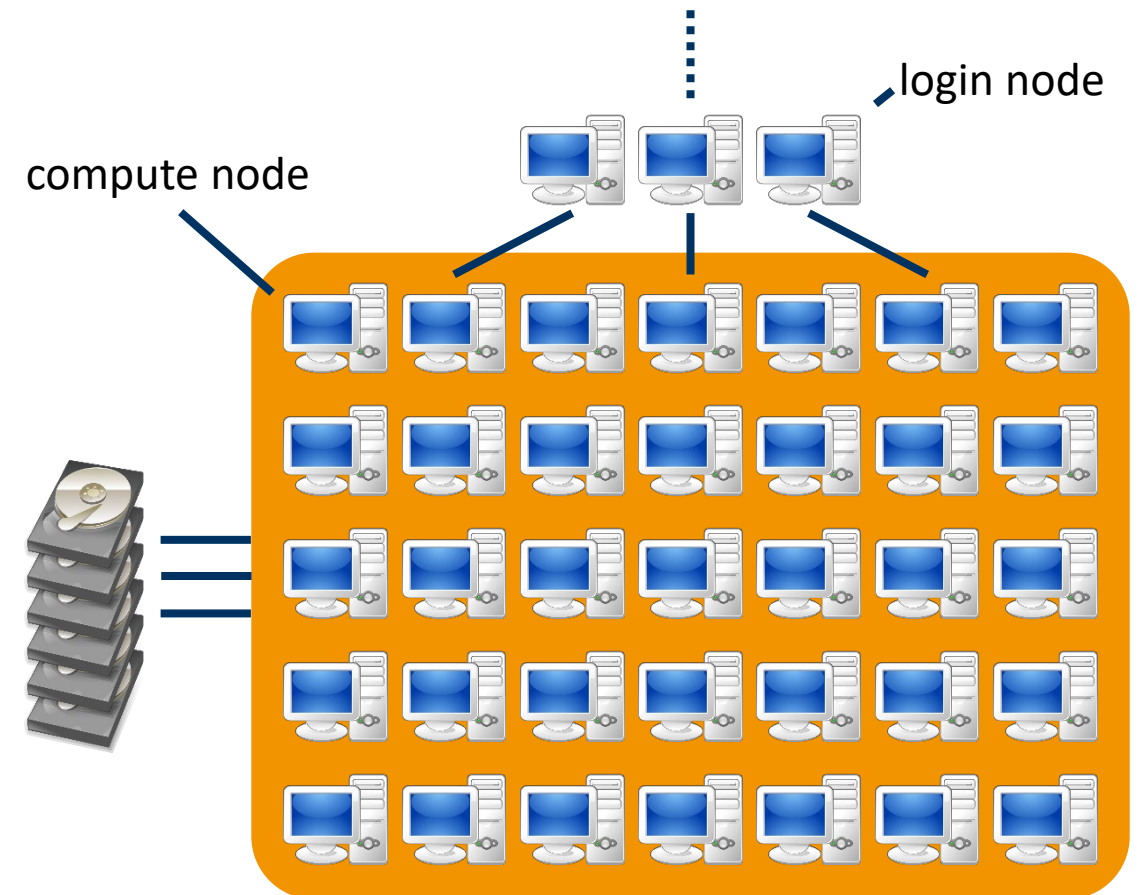
Hints (not only) for this Course

- ▶ choose a suitable source code editor / IDE and choose it wisely!
- ▶ get acquainted with your toolchain
 - ▶ debuggers, version control (git), etc.
- ▶ use common sense and sanity checks!



Clusters and Supercomputers

- Looks like:



Get User Credentials, Log in and Change Your Password!

- ▶ `ssh cbxxxxxx@lcc2.uibk.ac.at`
- ▶ Change password with `passwd`
- ▶ You are responsible for your account!
 - ▶ don't use these credentials for anything other than this course
 - ▶ coin mining isn't worth it anyways...

Submission Systems

- ▶ Responsible for resource management and job orchestration
 - ▶ used to submit or cancel “jobs”, query their status, get information about cluster, ...
- ▶ Very popular: SLURM
 - ▶ modern, complex but very capable
 - ▶ de-facto standard on most systems these days
- ▶ On LCC2: Sun Grid Engine (SGE)
 - ▶ older and deprecated ☹️
 - ▶ switch to SLURM currently in progress



Jobs: Submission, Deletion, Status

▶ `qsub name_of_script`

- ▶ allocates resources
- ▶ sets up environment
- ▶ executes application
- ▶ frees allocation

▶ `qdel job_id_list`

- ▶ terminates application
- ▶ frees up resources

▶ `qstat`

- ▶ queries for job status
- ▶ `qstat -u '*'` for all users (mind the quotes!)

```
[cb761011@login.lcc2 ~]$ qsub job.script
Your job 30369 ("my_test_job") has been submitted
[cb761011@login.lcc2 ~]$ qdel 30369
cb761011 has deleted job 30369
[cb761011@login.lcc2 ~]$ qsub job.script
Your job 30370 ("my_test_job") has been submitted
[cb761011@login.lcc2 ~]$ qstat
```

job-ID	prior	name	user	state	submit/start at	queue	slots	ja-task-ID
30370	0.00000	my_test_jo	cb761011	qw	09/30/2019 15:02:01		8	



Questions?

Image Sources

- ▶ LCC2: <https://www.uibk.ac.at/zid/systeme/hpc-systeme/lcc/hardware/>
- ▶ Sandbox: <http://www.googblogs.com/open-sourcing-sandboxed-api/>
- ▶ Cluster Photo: https://forschungsinfrastruktur.bmbwf.gv.at/de/fi/hpc-compute-cluster-leo3-leo3e_513
- ▶ SLURM: https://justjimsthoughts.blogspot.com/2017/07/trivia_24.html