Master Course
High Performance Computing
MCS, MSI, MAI, MFT, MSDE

Prof. Olaf Schenk (CI, INF)

Organization

- Prof. Olaf Schenk
  Institute of Computing, INF Faculty
  USI, Lugano
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- PostDocs:
  Juraj Kardos, juraj.kardos@usi.ch
  Parryuksh Bansal, pratyuksh.bansal@usi.ch

- TA PhD Students:
  Tim Holt, timothy.holt@usi.ch
  Malik Lechekhab. malik.lechekhab@usi.ch

- Software Atelier - High Performance Computing
  Tuesday, 4:30pm-6:15pm, MS Teams, room D1.14
  Wednesday, 2:30pm - 4:15pm, MS Teams, room D1.15

- Registration:
  - Please enroll within one week until September 24 on teaching.inf.usi.ch, and
  - On ICORSI, https://www.icorsi.ch/course/view.php?id=12615

Your Background?

- MSc CS? MSc FinTEC? MSc AI? MSc INF? Other?

- Programming experience & languages?

- Parallel programming languages?

- Operating systems?

- Working at the command line in Unix-like shells (e.g., Linux or a Mac OSX terminal)?

- Scientific libraries or mathematical libraries?

- Latex?

- Version control systems, particularly git, and the use of Github repositories?

- Piz Daint at CSCS?

- Please fill-in the questionnaire form: https://forms.gle/QF4aShDcSucfu4xg9

About this course (or better this lab)

- In depth understanding of:

- When is parallel computing useful?

- Understanding of parallel computing hardware options.

- Overview of programming models (software) and tools, and experience using some of them

- Some important parallel applications and the algorithms

- Performance analysis and tuning

- Ability to implement parallel numerical algorithms efficiently in C/C++ using mathematical libraries on a cluster

- C/C++, MPI, OpenMP, Matlab

Course Organization

- The course is a **HPC software atelier**

- In-class HPC projects on USI HPC cluster (please always bring your laptop to the class).

- 7 to 8 projects & reading assignments (support and discussion in class)

- Course grading
  - All projects (40% of the grade)
  - no midterm (but much more emphasis on scientific programming)
  - Final oral exam (60% of the grade)

- Late day policy: All assignments are due in class on the assigned due date. ONE free assignment that we will not count for the final grading of the projects.

- Date for the exam (during the official exam period, mid/end of January)

Books

- *Introduction to High Performance Computing for Scientists and Engineers*

  by G. Wellein and G. Hager

Books

- *Introduction to High-Performance Scientific Computing* and
- *Parallel Computing Book*

  by Victor Eijkout
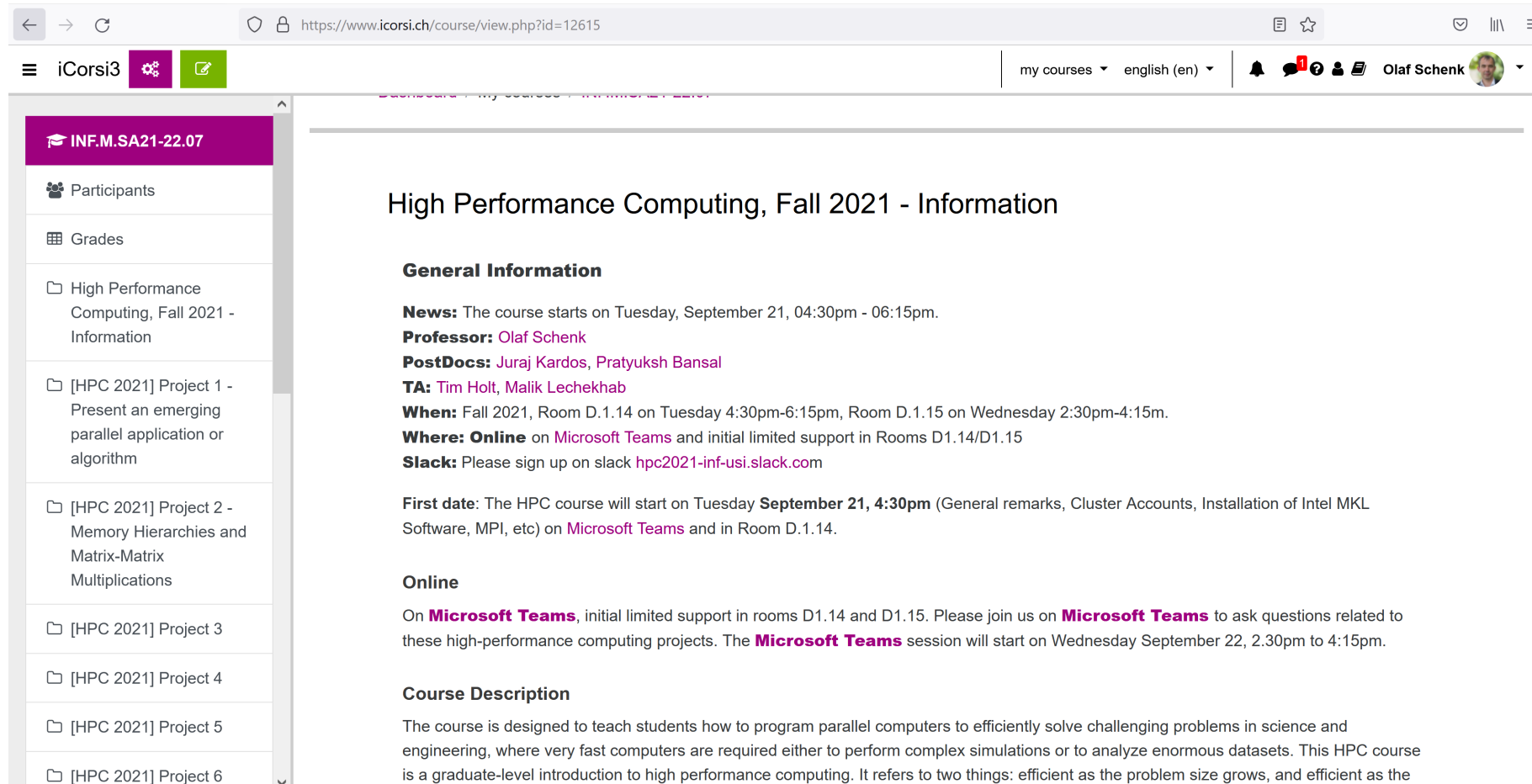
- Both books are available on https://bitbucket.org/VictorEijkhout/

Applications of Parallel Computers

- Applications of Parallel Computers
  - U.C. Berkeley CS267 Home Page, **Applications of Parallel Computers,** Spring 2018
  - https://sites.google.com/lbl.gov/cs267-spr2018/

Repositories: iCorsi (for Upload & Download)

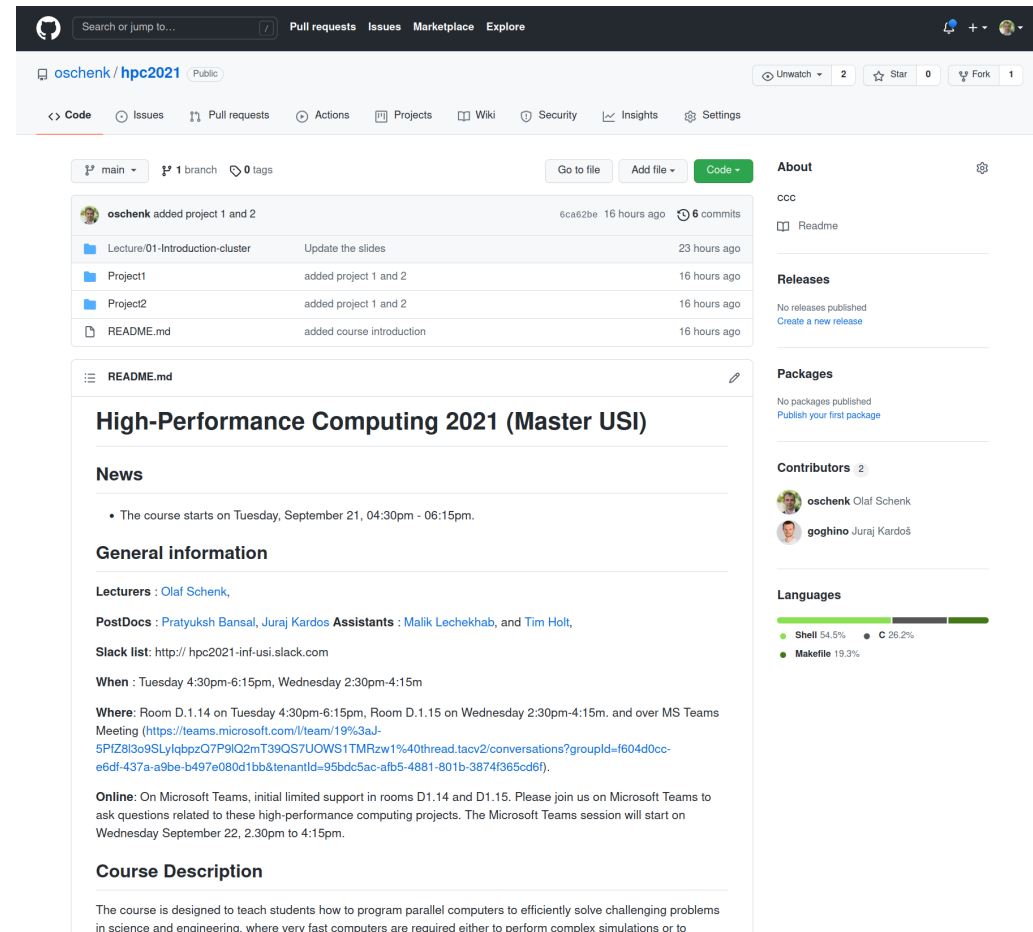We will use iCorsi for this course https://www.icorsi.ch/course/view.php?id=12615

Projects & Icorsi

Icorsi

- The mini-projects sheets will be uploaded on the iCorsi webpage
- The exercise should be solved until the deadline with is given on the project summary
- Please upload your code and a clear summary solution in electronic form on the iCorsi page
- We only accept submissions using our Latex template including Matlab and C/C++ code.

Repositories: Github (for Download)

We will use Github for this course https://github.com/oschenk/hpc2021

Slack (for General Support and Discussion)

SLACK - https://hpc2021-inf-usi.slack.com/
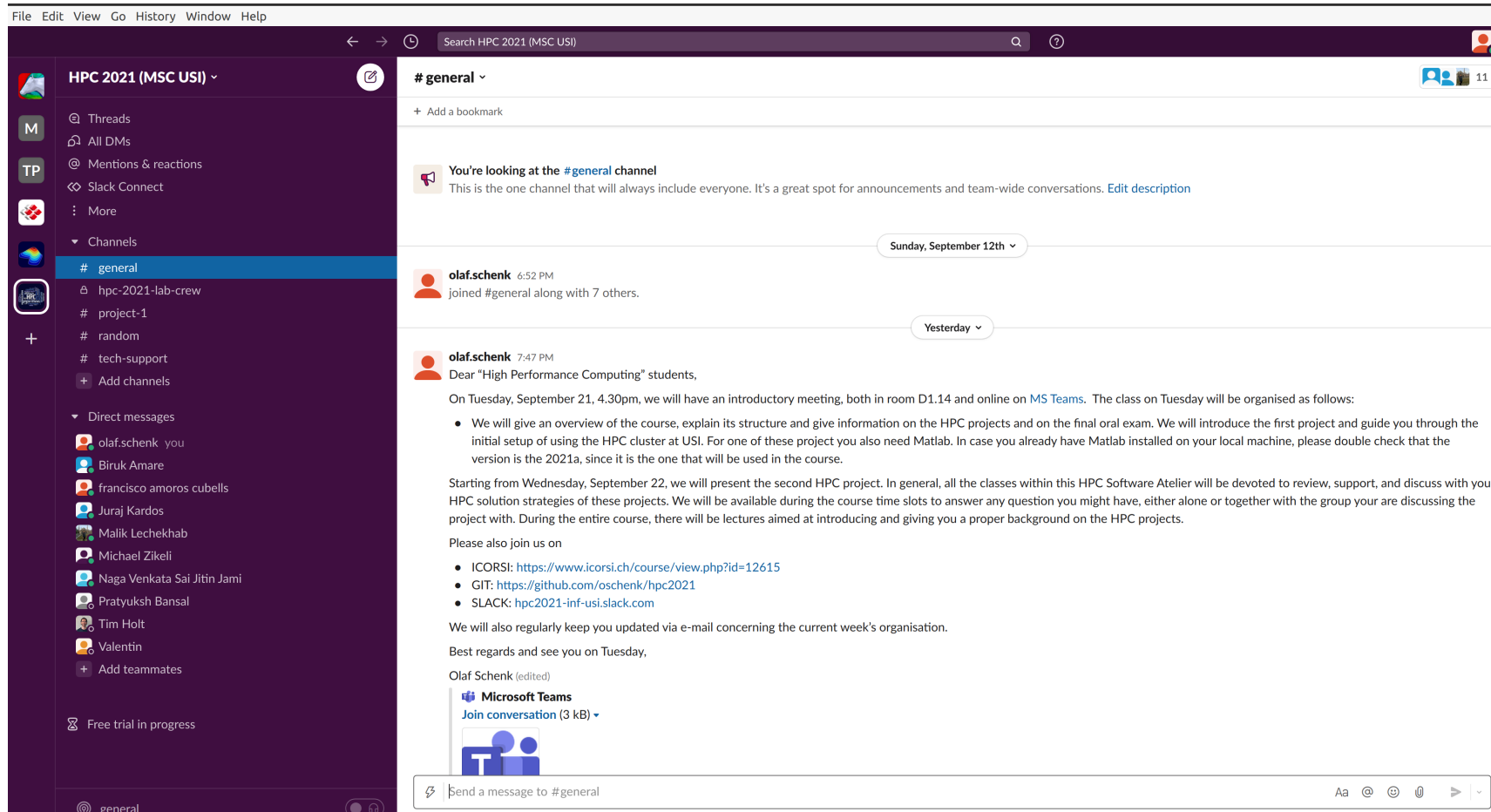
Assignments collaboration policy

- You are allowed to discuss such questions with anyone you like; however:

- Your submission **must list anyone** you discussed problems with.

- You must write up your submission **independently**.

- Late day policy: All assignments are due in class on the assigned due date, but you/we have ONE free mini-project that we will not count for the final grade.

- We only accept submissions using our Latex template and C/C++ code. Each project will have 100 points (out of 15 point will be given to the general written quality of the report).

Where do we meet in this Software Atelier (Lab) on High Performance Computing?

[MS Teams](#)

and

Rooms D1.14/D1.15

CSCS - Swiss National Supercomputing Centre

- CSCS
  Swiss National Supercomputing Centre
  Via Trevano 131
  6900 Lugano

- CSCS Visit: Tuesday/Wednesday in November (Virtual or in person)

- The agenda will be

  Overview CSCS (20 min)
  Research Talk (20 min)
  Guided Tour CSCS Server Room (50 min)

CSCS-USI Course: Effective HPC & Data Analytics with GPUs (July 2022, 10 days)

This summer school will focus on the effective exploitation of state-of-the-art hybrid High-Performance Computing (HPC) systems with a special focus on Data Analytics.

First week

- GPU architectures
- GPU programming (CUDA and OpenACC)
- Message passing programming model (MPI
- Performance optimization and scientific libraries
- Interactive Supercomputing with JupyterLab

Second week

- Interactive supercomputing Python HPC libraries
- Introduction to Machine Learning frameworks (Rapids)
- Deep Learning on HPC platforms (TensorFlow)

6 ECTS for MSC students in AI, CS, FINTECH

Next Schedule

- Questions?

- Release of mini-project 1: September 21.
- Release of mini-project 2: September 22.

- Deadline for mini-project 1: TBA – please fill in https://doodle.com/poll/cfuubkey5yznsu62
- Deadline for mini-project 2: Monday, 11 October 2021, 12:00 AM

Today
- And support with Cluster installation/accounts – Juraj Kardos
- Presentation of project P1 - Tim Holt