

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
olaf.schenk@usi.ch
- 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)

Introduction to High Performance Computing for Scientists and Engineers



Georg Hager
Gerhard Wellein



A CHAPMAN & HALL BOOK

www.crcpress.com

Books

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

by G. Wellein and G. Hager



Introduction to High Performance Scientific Computing

Books

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

by Victor Eijkhout

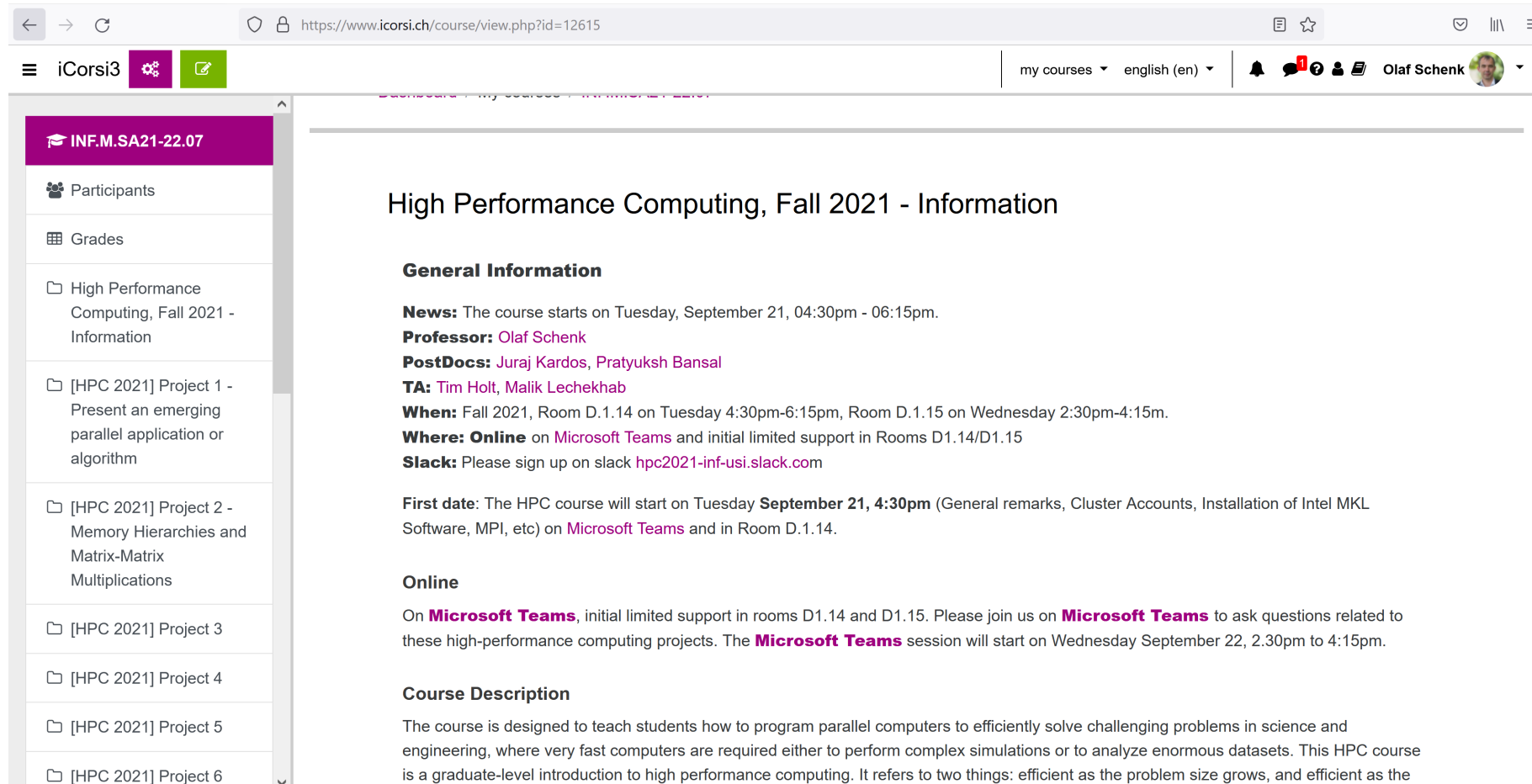
- Both books are available on <https://bitbucket.org/VictorEijkhout/>

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>



The screenshot shows the iCorsi web interface. The browser address bar displays the URL <https://www.icorsi.ch/course/view.php?id=12615>. The page header includes the iCorsi3 logo, navigation links for 'my courses' and 'english (en)', and a user profile for 'Olaf Schenk'. The main content area is titled 'High Performance Computing, Fall 2021 - Information'. Under the 'General Information' section, it lists course details: News (starts Tuesday, September 21, 04:30pm - 06:15pm), Professor (Olaf Schenk), PostDocs (Juraj Kardos, Pratyuksh Bansal), TA (Tim Holt, Malik Lechekhab), When (Fall 2021, Room D.1.14 on Tuesday 4:30pm-6:15pm, Room D.1.15 on Wednesday 2:30pm-4:15m), Where (Online on Microsoft Teams and initial limited support in Rooms D1.14/D1.15), and Slack (sign up on slack hpc2021-inf-usi.slack.com). The 'First date' section states the HPC course will start on Tuesday September 21, 4:30pm. The 'Online' section mentions initial limited support in rooms D1.14 and D1.15, with a Microsoft Teams session starting on Wednesday September 22, 2:30pm to 4:15pm. The 'Course Description' states the course is designed to teach students how to program parallel computers to efficiently solve challenging problems in science and engineering, where very fast computers are required either to perform complex simulations or to analyze enormous datasets. This HPC course is a graduate-level introduction to high performance computing. It refers to two things: efficient as the problem size grows, and efficient as the

INF.M.SA21-22.07

- Participants
- Grades
- High Performance Computing, Fall 2021 - Information
- [HPC 2021] Project 1 - Present an emerging parallel application or algorithm
- [HPC 2021] Project 2 - Memory Hierarchies and Matrix-Matrix Multiplications
- [HPC 2021] Project 3
- [HPC 2021] Project 4
- [HPC 2021] Project 5
- [HPC 2021] Project 6

High Performance Computing, Fall 2021 - Information

General Information

News: The course starts on Tuesday, September 21, 04:30pm - 06:15pm.
Professor: Olaf Schenk
PostDocs: Juraj Kardos, Pratyuksh Bansal
TA: Tim Holt, Malik Lechekhab
When: Fall 2021, Room D.1.14 on Tuesday 4:30pm-6:15pm, Room D.1.15 on Wednesday 2:30pm-4:15m.
Where: Online on Microsoft Teams and initial limited support in Rooms D1.14/D1.15
Slack: Please sign up on slack hpc2021-inf-usi.slack.com

First date: The HPC course will start on Tuesday **September 21, 4:30pm** (General remarks, Cluster Accounts, Installation of Intel MKL Software, MPI, etc) on Microsoft Teams and in Room D.1.14.

Online

On Microsoft Teams, initial limited support in rooms D1.14 and D1.15. Please join us on Microsoft Teams to ask questions related to these high-performance computing projects. The Microsoft Teams session will start on Wednesday September 22, 2.30pm to 4:15pm.

Course Description

The course is designed to teach students how to program parallel computers to efficiently solve challenging problems in science and engineering, where very fast computers are required either to perform complex simulations or to analyze enormous datasets. This HPC course is a graduate-level introduction to high performance computing. It refers to two things: efficient as the problem size grows, and efficient as the

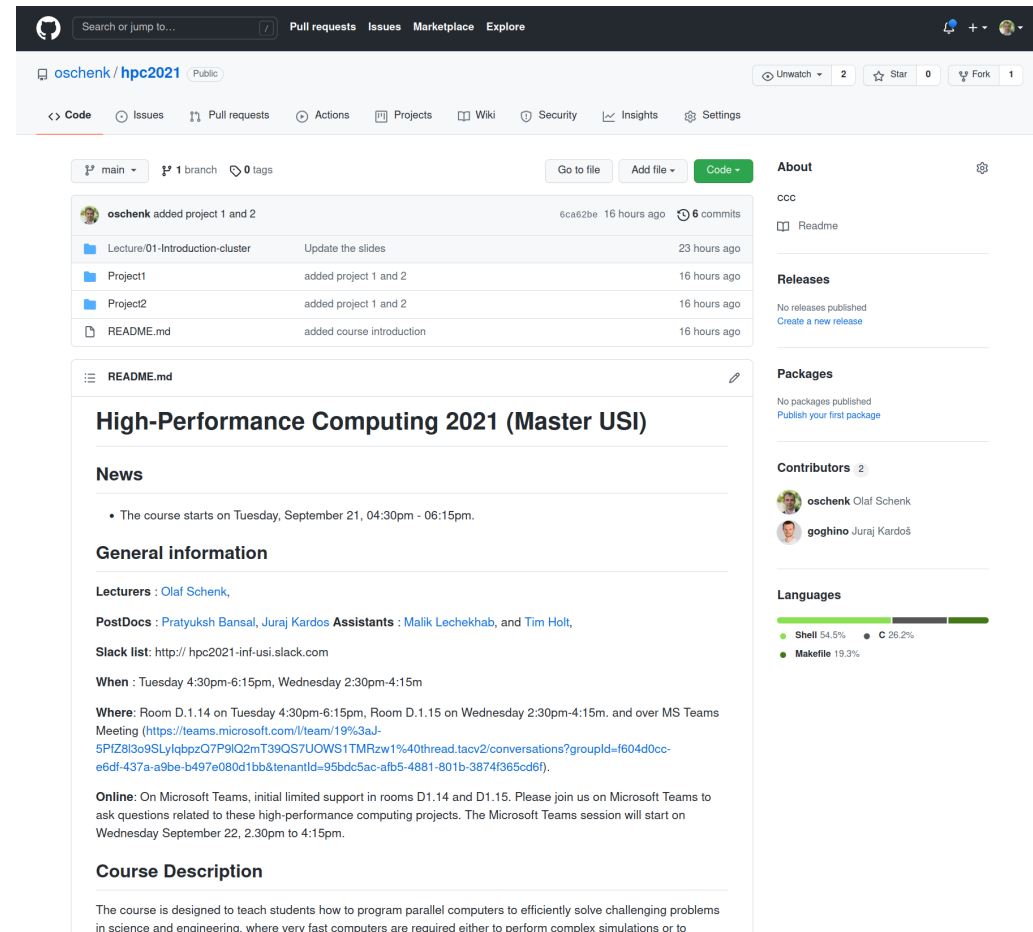
Projects & Icorsi

Icorsi

- The mini-projects sheets will be uploaded on the iCorsi webpage
- The exercise should be solved until the deadline which 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>



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Commit	Message	Time
oschenk	added project 1 and 2	6ca62be 16 hours ago 6 commits
	Lecture/01-Introduction-cluster Update the slides	23 hours ago
	Project1 added project 1 and 2	16 hours ago
	Project2 added project 1 and 2	16 hours ago
	README.md added course introduction	16 hours ago

README.md

High-Performance Computing 2021 (Master USI)

News

- The course starts on Tuesday, September 21, 04:30pm - 06:15pm.

General information

Lecturers : [Olaf Schenk](#),

PostDocs : [Pratyuksh Bansal](#), [Juraj Kardos](#) **Assistants :** [Malik Lechekhab](#), and [Tim Holt](#),

Slack list: [http:// hpc2021-inf-usi.slack.com](http://hpc2021-inf-usi.slack.com)

When : Tuesday 4:30pm-6:15pm, Wednesday 2:30pm-4:15m

Where: Room D.1.14 on Tuesday 4:30pm-6:15pm, Room D.1.15 on Wednesday 2:30pm-4:15m, and over MS Teams Meeting (<https://teams.microsoft.com/l/team/19%3aJ-5PIZ8l3o9SLylqbpzQ7P9lQ2mT39QS7UOWS1TMRzw1%40thread.tacv2/conversations?groupId=f604d0cc-e6df-437a-a9be-b497e080d1bb&tenantId=95bdc5ac-afb5-4881-801b-3874f365cd6f>).

Online: On Microsoft Teams, initial limited support in rooms D1.14 and D1.15. Please join us on Microsoft Teams to ask questions related to these high-performance computing projects. The Microsoft Teams session will start on Wednesday September 22, 2.30pm to 4.15pm.

Course Description

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About

ccc

Readme

Releases

No releases published
[Create a new release](#)

Packages

No packages published
[Publish your first package](#)

Contributors 2

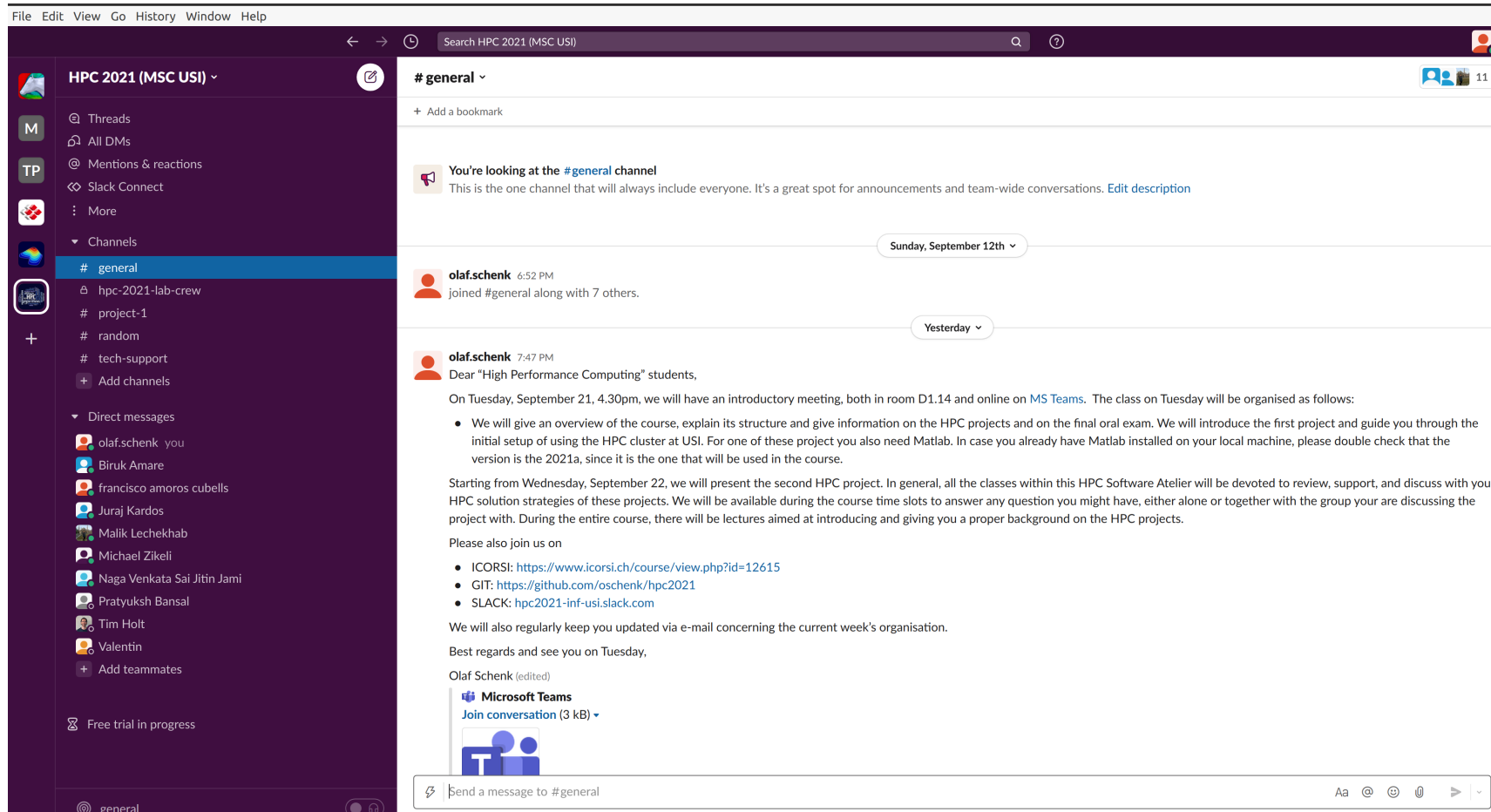
- oschenk Olaf Schenk
- goghino Juraj Kardos

Languages

Shell 54.5% C 26.2% Makefile 19.3%

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