CS-E4690 – Programming parallel supercomputers D

1 - Course management

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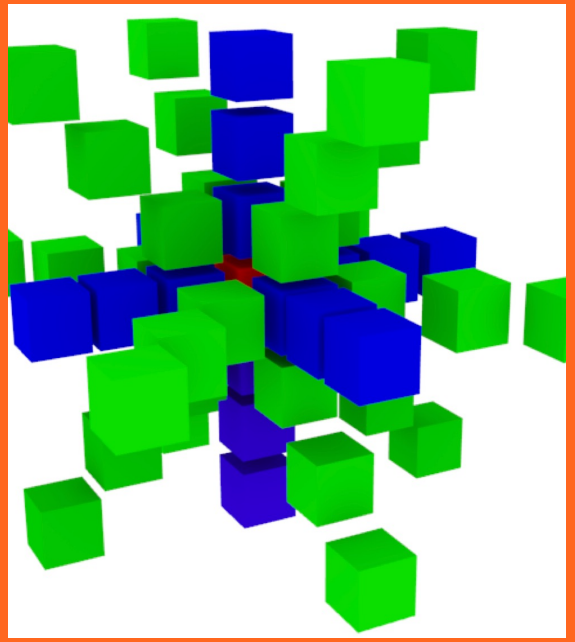
Aalto University
School of Science



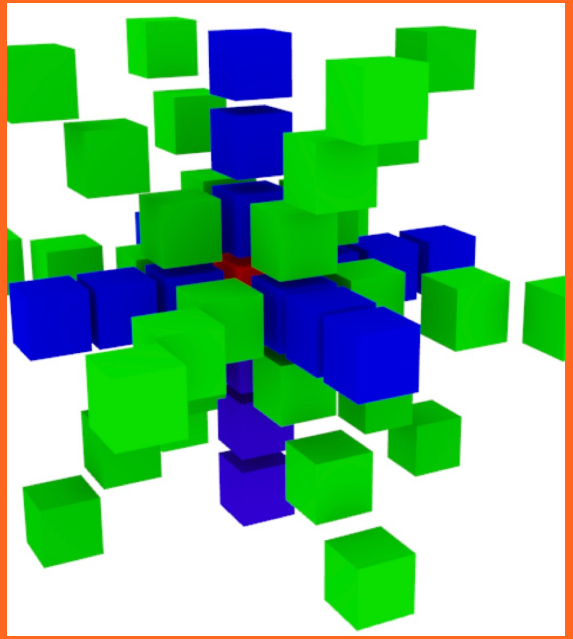
Other teaching staff

Touko Puro (TA): touko.puro@aalto.fi (coding exercises)

Matthias Rheinhardt: matthias.rheinhardt@aalto.fi (back-up lecturer & coding exercises)

Mira Salmensaari: mira.salmensaari@aalto.fi (Technical Triton support)

Learning outcomes



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Our learning objectives are

- **Get yourself familiarized with the current HPC landscape** to be able to choose the correct framework for your large-scale problem.
- **Learn basic concepts on how to build efficient applications** for clusters or supercomputers with thousand(s) to million(s) of cores
- **Master distributed memory and hybrid** (distributed + shared memory) programming models
- **Learn essentials of message-passing interface**
- **Learn essentials of HPC in hybrid architectures with graphics processing units (GPUs).**

Our learning objectives are not

- To become fluent in using Triton and CSC supercomputing environments; we get you started in Triton; SciComp and CSC trainings will support you further

- To solve any practical large-scale problem; the next course in the series, **CS-E4002 Large-scale computing and data analysis**, will deal with practical applications in the CSC environment.

The knowledge presented in this course, even quite theoretical, will be useful for your practical applications.

Break-down of learning objectives

Lecture1

Introduction to the current HPC landscape

Understanding how this course fits into that

Establishing understanding of the learning outcomes

Lecture2

Learning basic definitions and taxonomies

Understanding the importance of the "network"

Learning basic performance models

Lecture3

Becoming knowledgeable of the modern landscape of distributed memory programming

Understanding why in this course we will concentrate on low-level programming models

Getting acquainted with MPI: basics and synchronous and asynchronous point-to-point communication

Break-down of learning objectives

Lecture4

Learning more about MPI:

One-sided point-to-point communications

Collective communications

Lecture5

Programming MP hybrid architectures

Becoming knowledgeable of the spectrum of options

Understanding efficiency issues

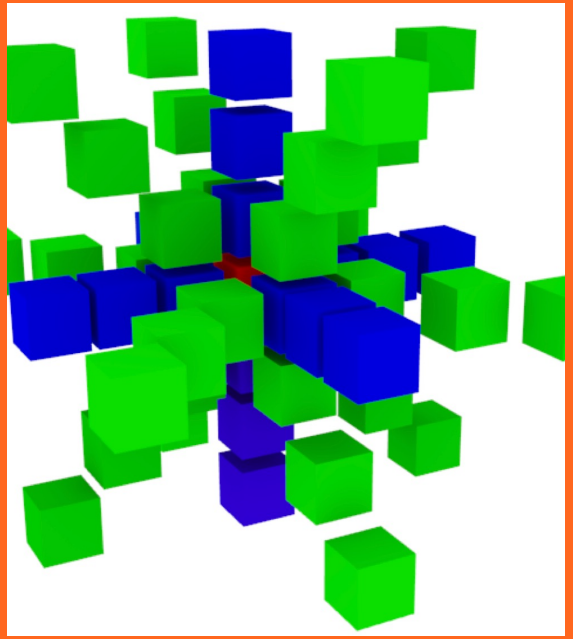
Lecture6

Programming hybrid architectures with accelerators

Acquiring knowledge of CUDA-MPI programming model

Some background from “Programming parallel computers” is essential

Practicalities



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Sessions

- Six 90 min ”lectures” on Tuesdays 14:15, in T5.
- Pre-recorded **videos & slides** + extra reading
  - Compilation of **materials in MyCo** belonging to each lecture
  - Minimally watch/read through the **core material** (indicated) before the Tuesday session; **extra reading** (indicated) is for the curious/passionate.
  - The lecture times are intended for: **synthesis!**
    - Q&A about the materials; discussion points
    - going through the example codes
    - completing some exercises
  - You can also post questions or comments about the **lectures/exercises** in the **Zulip chat**, and these will be discussed/answered on **Tuesdays/Fridays**.

Exercises

- Course grading is solely based on the exercise points. **All sheets must be returned.** One exercise sheet per lecture. Available from the course GitLab during the entire course.
- **2 first ones** involve no coding, and will **preferably undertaken as group work during the first 2 lectures**.
- **4 last ones are coding exercises**.
- Exercise session on **Fridays 12:15-13:45 (**Y342a**):** technical assistance on Triton environment and **help/hints on the coding exercises will be provided during this session. Be there!**
- DL for submissions is in the end of the evaluation week, **16:00 on Friday the 8th of Dec. The DL is strict.**

Basic exercises (2 first weeks)

- Reading, understanding + a little bit of maths
- You can get **full points** by participating in the lecture time group work.
- If you cannot attend the lecture, then you have to return the material in as a **learning diary** in MyCo, and **the contents will be graded**.
- **The completion of the first exercise is necessary to get a Triton account. DL is Tue 31st of Oct, 16:00.**

Triton

HPC environment to be used is Tier-2 semi-local **Triton cluster**; a temporary user account will be set up for those who do not already have one **and who have completed Ex. 1 in time.** Some relevant links for self-study:

https://scicomp.aalto.fi/triton/#tutorials

https://www.youtube.com/watch?v=13gikRotUVQ&list=PLZLVmS9rf3nPRb-QjrWsg_fTUfJ5Bbv07

Support available in Zulip and during exercises!

Coding exercises

- **HPC environment** to be used is Tier-2 semi-local **Triton cluster**; a temporary user account will be set up for those who do not already have one **and who have completed Ex. 1 in time.**
- Example codes, scripts, and the exercise sheets themselves are available through **GitLab**.
- **Everybody is encouraged to create repositories in Aalto GitLab**, as the user accounts are temporary (they will expire 31.12.2023; for those who did not have one before)
- Submission of all materials to a dedicated submission directory set up per each participant in Triton. Codes will be **evaluated in Triton directly; readable only to course personnel and the participant.** DL 8.12.2023 16:00.
- **Model solutions** will be made available in GitLab to those who submitted **all sheets** (link available **11.12.2023**).

Course feedback

- Standard feedback query; please return!
- **Continuous anonymised feedback** welcomed through MyCo at all times.
- Dedicated (voluntary) feedback session on **Tue 12th of Dec, lecture time, online&physical, see MyCo calendar.**

Help to improve the relatively new course for future years!

Communications

- Pre-recorded videos, slides, and reading materials are posted in MyCourses
- Example codes, scripts, exercise sheets available from GitLab repo.
- Zulip chat for the course

pps23.zulip.cs.aalto.fi

Invite link