High-Level GPU Programming

Programming GPUs with SYCL and Kokkos, 14.-16.2., every day 09:00-17:00 (EET), CSC, Life Science Center, Keilaranta 14, Espoo, Finland and in Zoom

Zoom: https://cscfi.zoom.us/j/67534098583
Events page (slides and exercises): https://github.com/csc-training/high-level-gpu-programming
Chat Channel: https://chat.csc.fi/group/HLGP/
Chat Invite Link: https://chat.csc.fi/invite/QR2CYh

Useful links & further resources

- CSC docs
- Data Parallel C++
- sycl.tech

Schedule

Day 1, Wednesday 14.2.

Time	Topic
09:00-09:15	Welcome
09:15-10:00	Introduction to GPUs
10:00-10:40	GPU execution model
10:40-11:20	GPU memory hierarchy
11:20-12:00	Refresher of C++ concepts
12:00-13:00	Lunch break
13:00-13:30	Mahti and LUMI Computing Platforms
13:30-15:00	SYCL I
15:00-15:30	Coffee break
15:30-16:45	SYCL I (continued)
16:45-17:00	Day 1 wrap-up

Day 2, Thursday 15.2.

Time	Topic
09:00-12:00	SYCL II
12:00-13:00	Lunch break
13:00-15:00	SYCL III
15:00-15:30	Coffee Break
15:30-16:45	Exercises (on Mahti & LUMI)
16:45-17:00	Day 2 wrap-up

Day 3, Friday 16.2.

Time	Topic
09:00-09:30	Kokkos
09:30-11:00	Kokkos exercises
11:00-12:00	Interoperability with third-party libraries and MPI
12:00-13:00	Lunch break
13:00-14:00	Heat equation, CUDA to SYCL demo
14:00-15:00	Exercises & Bring your own code
15:00-15:30	Coffee Break
15:30-16:45	Exercises & Bring your own code
16:45-17:00	Day 3 wrap-up & Course closing

General Exercise Instructions

Exercises
Computing Platforms Issues

Icebreaker questions:

What is your favourite programming language?

- **C**: x, x, x, x, x
- **C++**: x, x, x, x, x
- **Fortran**: x, x, x
- **Python**: x, x, x, x, x, x, x, x, x
- **Rust**: x, x
- **Ruby**:
- **Other**:
- **Julia**: x, x, x
- **HTML**:
- **Assembly**: x
- **R**: x

What is your previous experience programming accelerators?

- **CUDA/HIP**: x, x, x, x, x, x, x, x, x, x
- **DPCPP/SYCL**: x, x, x
- **FPGA**:
- **ASIC**: x
- **Kokkos**:
- **RAJA**:,x
- **OpenMP/etc**: x, x, x, x
- **None**: x, x, x, x, x
- **Others**: x, x

What is your previous experience using scheduler?

- **Master of Slurm**: x, x 😱
- **Advanced** x, x, x, x, x, x, x
- **Low** x, x, x, x, x
- **Never Used** x, x, x, x, x

Please let us know why you join the training and what are your expectations.

- I join this course because it has some contents related to GPU programming that possibly relieves us the burden of complex CUDA programming
- I am planning to do research with heavy (well, reasonably heavy) computations, therefore use this course as an introduction to the topic
- I want to be smarter
- I want to be cool (me too!) - you are
- For scientific machine learning in geoscience.
- For TurboGAP <3

Tabs or spaces?

- **Tabs**: x,\t,\t
- **Spaces**: x, x, x