Overview
PRACE CUDA Course 2021

26-30 April 2021 | Andreas Herten | Forschungszentrum Jülich, Jülich Supercomputing Centre

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SUPERCOMPUTING
CENTRE

Jülich Supercomputing Centre

- Forschungszentrum Jülich
- Part of Institute for Advanced Simulation (IAS), Gauss Centre for Supercomputing (GCS), PRACE, …
- Operates supercomputers and connected infrastructure
- Researches in next-gen supercomputers
- Supports applications leveraging machines
- Supercomputers
  - JUWELS Cluster, JUWELS Booster
  - JURECA DC, JURECA Booster
  - DEEP
  - JUSUF

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JSC CUDA Course

About

- Since 2010
- Second time: online course
- First time on Europe's fastest supercomputer

- Interactive course – many hands-ons 🤲
- There are other *many-core* courses in JSC training program

Tutors

Kaveh Haghighi-Mood
Application-Oriented Technology Development, JSC

Markus Hrywniak
NVIDIA Application Lab at Jülich, NVIDIA

Jan Meinke
Computational Science, SimLab Biology, JSC

Andreas Herten
NVIDIA Application Lab at Jülich, JSC

Jiri Kraus
NVIDIA Application Lab at Jülich, NVIDIA

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Timetable

- Every day from 9:00 until 13:00
- 30 minute break around 10:45

Day 1 Basics
- GPU Introduction
- CUDA Introduction

Day 2 Tools, Matrix Multi
- GPU Tools: Debug, Profile
- Matrix Multiplication *Part 1*

Day 3 Multi-GPU
- Q&A
- Multi-Node GPU Programming

Day 4 Performance, Matrix Multi
- Performance Optimization
- Matrix Multiplication *Part 2*

Day 5 Advanced CUDA
- Cooperative Groups
- CUDA C++, pSTL, CUB
- CUDA Fortran

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More Technicalities

- Supercomputer for this course: **JUWELS Booster**
- Infrastructure for tasks
  - Already done for *Profound Proverb Challenge*
  - Jupyter-JSC: `https://jupyter-jsc.fz-juelich.de`
  - Project: `training2110`; Partition: `LoginBooster`
  - Remember to **bootstrap** – or manually `source` environment (tasks rely on environment variables)
- Tasks
  - Sorted by session
  - Solutions are always given, you decide how long you tinker before peeking into solutions (Hint: The longer, the more benefit you will get from this course!)
  - Re-sync once might be needed now, call `jsc-material-sync`
    More commands: jsc-material-sync-force, jsc-material-reset-01, ...

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Let's Get Started!

Questions?

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My favorite programming language is:

C	C++	Fortran	Python
Java	JavaScript	Julia	Haskell
Go	Rust	Bash	Assembly

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What's a lambda?

λ	Λ
[ ]( ){ }	

I've used a debugger before

Yes	No

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I've used MPI before

Yes	No

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I've used a GPU before

Yes	No

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I programmed a GPU before

Yes	No

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Last week, I moved a total distance of...

< 10 km	10 km to 40 km
40 km to 100 km	> 100 km

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I dial in from

The current COVID-19 incidence (cases per 100 000 population) here is…

< 100	100 to 150
150 to 200	> 200

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