Closing Session

Introduction to High Performance Computing

Dr. Tim Cramer

Introduction to HPC
Dr. Tim Cramer | IT Center, Chair for High Performance Computing, RWTH Aachen University

Our Support Offerings

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IT Center & JARA-CSD Support

General & Effective Usage of HPC Systems at RWTH

- Service for Tier-2 system, Tier-3 system, and hosted clusters
- Account creation, login, usage, batch system, installation of software, …
- Performance analysis and optimization
- Extensive training (e.g., PPCES & aiXcelerate events) and documentation
- Guidance and advice regarding the project-based access

Collaboration with FZ Jülich within JARA Center for Simulation and Data Science (JARA-CSD)

- Cross-sectional group "Parallel Efficiency"
- Performance and correctness analysis of parallel programs
- Development of performance and correctness tools
  - MUST (correctness), Score-P (measurement), Scalasca (analysis)

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HPC Consultation Hour

- **Open HPC consultation hour**
- **Online 4-weekly**
- **Q&A session for any HPC related question, e.g. about:**

  → Cluster usage

  → Parallel Programming

  → Performance analysis and optimization of self-written codes

  → Workflow optimization (e.g. job management and data processing)

  → Efficient usage of systems and software

  → Software installation and usage

  → Application for compute time on larger systems (tier 2 and 1)

- **Details:**

  → https://blog.rwth-aachen.de/itc-events/hpc-consultation-hour

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3rd-party Funded Projects cont.

HPC.NRW

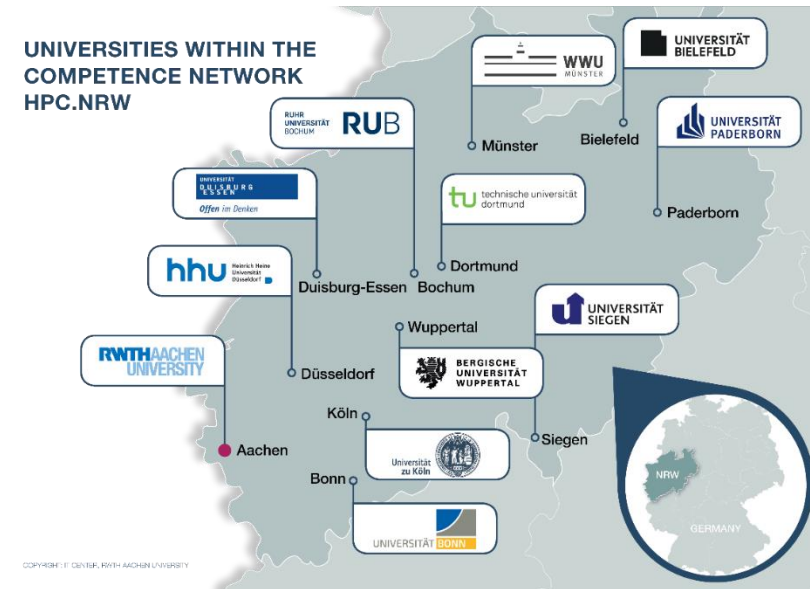**Competence Network**

https://hpc.nrw

Project Goals

- Establishing HPC consulting services
  - Consulting
  - Training
  - Tutorials
  - Workshops
- Provision of similar software environment in NRW
- Structured provision of HPC resources for Tier-2 and Tier-3 centers in NRW
- Online tutorials for OpenMP, Linux, Gprof (incl. Youtube videos) available:
  https://hpc-wiki.info/hpc/Category:Tutorials

UNIVERSITIES WITHIN THE COMPETENCE NETWORK HPC.NRW

In cooperation with:

DIGITALE HOCHSCHULE NRW

Founded by:

Ministry of Culture and Science of the German State of North Rhine-Westphalia

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Worksharing (OpenMP)

OpenMP in Small Bites/Worksharing

Contents [hide]
1 Video
2 Quiz

This video shows the concept of OpenMP worksharing, loop scheduling and synchronization mechanisms. After this tutorial session the programmer already has knowledge about the most common used OpenMP constructs and API functions. How the scoping of data is controlled is introduced in the part on Data Scoping.

Video

Influencing the For Loop Scheduling   ⊞ HPC.NRW

– *for*-construct: OpenMP allows to influence how the iterations are scheduled among the threads of the team, via the *schedule* clause:
  – `schedule(static [, chunk])`: Iteration space divided into blocks of chunk size, blocks are assigned to threads in a round-robin fashion. If chunk is not specified: #threads blocks.
  – `schedule(dynamic [, chunk])`: Iteration space divided into blocks of chunk (not specified: 1) size, blocks are scheduled to threads in the order in which threads finish previous blocks.
  – `schedule(guided [, chunk])`: Similar to dynamic, but block size starts with implementation-defined value, then is decreased exponentially down to chunk.

– Default on most implementations is `schedule(static)`.

Introduction to OpenMP   INNOVATION THROUGH COOPERATION.

(Slides as pdf)

Quiz

1. What is most commonly used worksharing construct in OpenMP to distribute work among loop interations?   [Collapse]

○ Click and submit to see the answer

Tutorial		
Title:		OpenMP in Small Bites
Provider:		HPC.NRW
Contact:		tutorials@hpc.nrw
Type:		Multi-part video
Topic Area:		Programming Paradigms
License:		CC-BY-SA

Syllabus		
1. Overview		
2. Worksharing		
3. Data Scoping		
4. False Sharing		
5. Tasking		
6. Tasking and Data Scoping		
7. Tasking and Synchronization		
8. Loops and Tasks		
9. Task Scheduling		
10. Non-Uniform Memory Access		

Follow Up Event

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PPCES 2023

March 13th to 17th 2023

Parallel Programming in Computational Engineering and Science
- Week-long event with in-depth parallel programming
    - OpenMP
    - Message Passing Interface (MPI)
    - Machine Learning
- Still seats available

→ Register here until March 7th (TODAY!):

https://www.itc.rwth-aachen.de/ppces

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