

Closing Session

Introduction to High Performance Computing

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Our Support Offerings



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)

- **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>





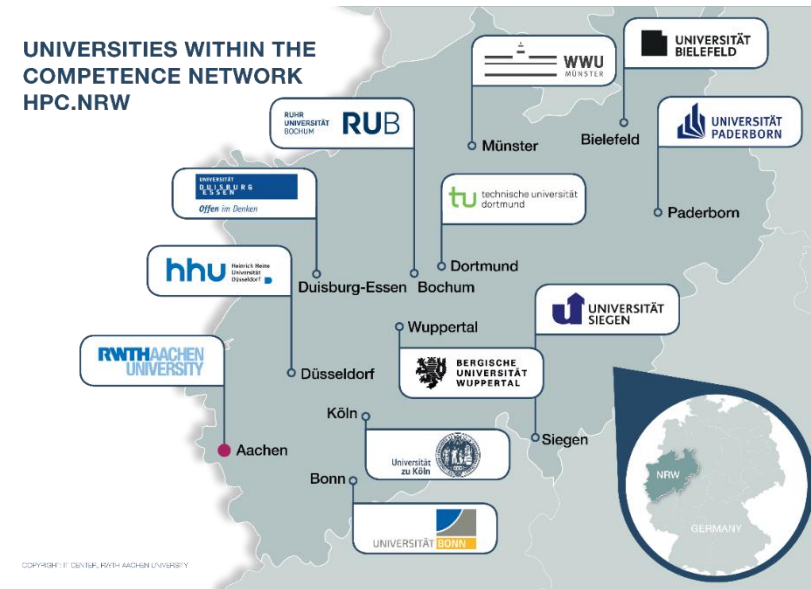
Competence Network



<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>



In cooperation with:



Founded by:

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



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



- *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 iterations? [Collapse]

Click and submit to see the answer

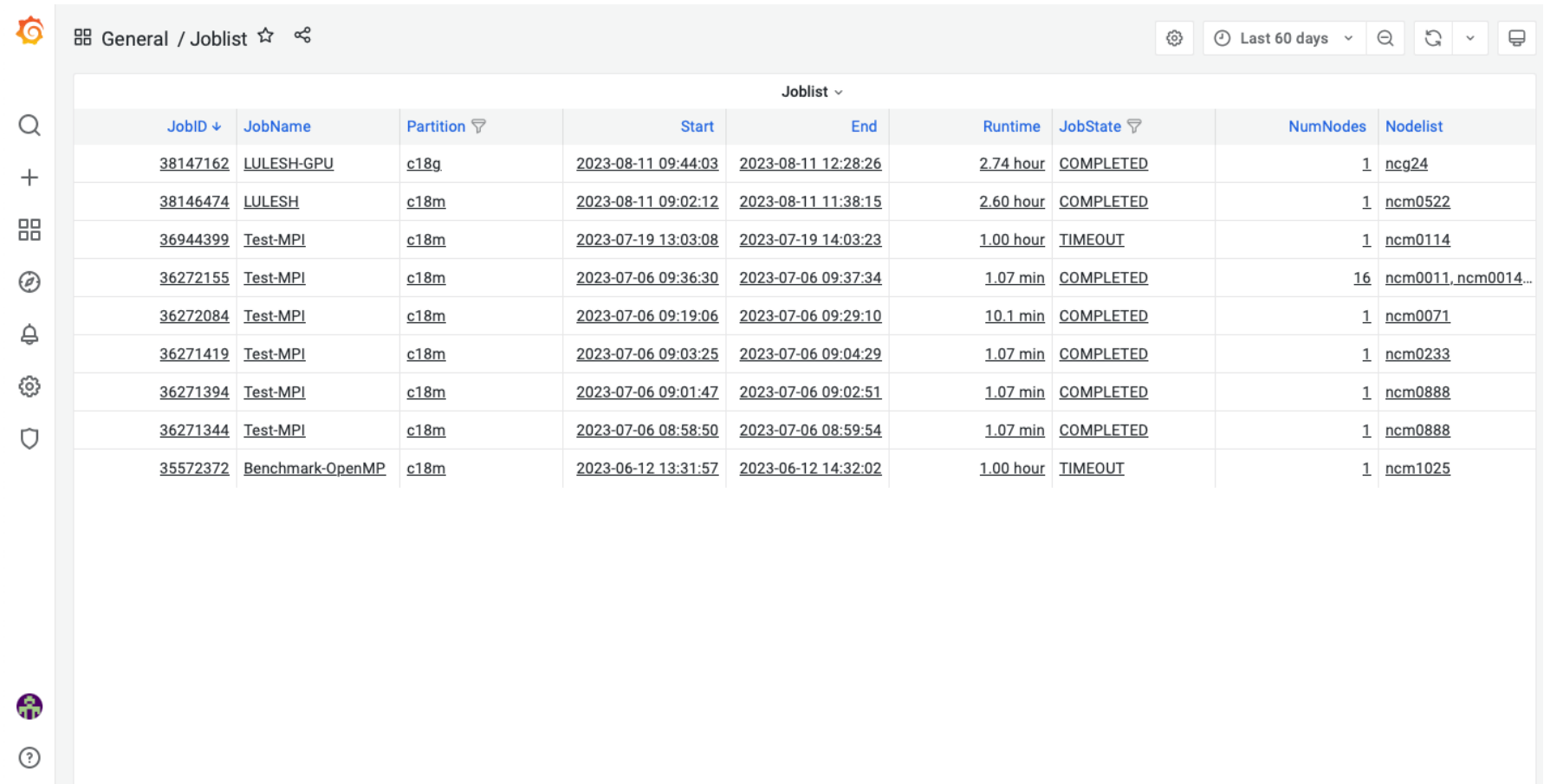
Tutorial

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
10. Task Scheduling
11. Non-Uniform Memory Access

■ <https://perfmon.hpc.itc.rwth-aachen.de>



The screenshot shows the 'Joblist' interface of the perfmon.hpc.itc.rwth-aachen.de monitoring system. The interface includes a navigation bar with 'General / Joblist', a search bar, and a filter for 'Last 60 days'. The main content is a table with the following columns: JobID, JobName, Partition, Start, End, Runtime, JobState, NumNodes, and Nodelist. The table contains 10 rows of job data.

JobID ↓	JobName	Partition ↕	Start	End	Runtime	JobState ↕	NumNodes	Nodelist
38147162	LULESH-GPU	c18g	2023-08-11 09:44:03	2023-08-11 12:28:26	2.74 hour	COMPLETED	1	ncg24
38146474	LULESH	c18m	2023-08-11 09:02:12	2023-08-11 11:38:15	2.60 hour	COMPLETED	1	ncm0522
36944399	Test-MPI	c18m	2023-07-19 13:03:08	2023-07-19 14:03:23	1.00 hour	TIMEOUT	1	ncm0114
36272155	Test-MPI	c18m	2023-07-06 09:36:30	2023-07-06 09:37:34	1.07 min	COMPLETED	16	ncm0011, ncm0014...
36272084	Test-MPI	c18m	2023-07-06 09:19:06	2023-07-06 09:29:10	10.1 min	COMPLETED	1	ncm0071
36271419	Test-MPI	c18m	2023-07-06 09:03:25	2023-07-06 09:04:29	1.07 min	COMPLETED	1	ncm0233
36271394	Test-MPI	c18m	2023-07-06 09:01:47	2023-07-06 09:02:51	1.07 min	COMPLETED	1	ncm0888
36271344	Test-MPI	c18m	2023-07-06 08:58:50	2023-07-06 08:59:54	1.07 min	COMPLETED	1	ncm0888
35572372	Benchmark-OpenMP	c18m	2023-06-12 13:31:57	2023-06-12 14:32:02	1.00 hour	TIMEOUT	1	ncm1025

■ <https://perfmon.hpc.itc.rwth-aachen.de>





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Follow Up Event



March 10th – 14th, 2025

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 TODAY**

→ Register here:

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