

# 4-Day-Course – NHR South-West / CSC Frankfurt – 1<sup>st</sup> day

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## Content

**Login on desktop + Goethe-NHR & setup**

**MPI on beginners' level**

1. MPI Overview
2. Process model and language bindings
3. Messages and point-to-point communication
4. Nonblocking communication

## Schedule

08:30 Local registration  
09:00 Welcome & Login  
09:20 Lectures and exercises on MPI  
(including some breaks)  
**13:00 Lunch break**  
14:00 Lectures and exercises on MPI  
(including some breaks)  
**18:00 Final end**  
**Social event**

# 4-Day-Course – NHR South-West / CSC Frankfurt – 2<sup>nd</sup> day

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## Content

**MPI on beginners' level – continued**

6.(1) Collective communication

**Shared memory parallelization with OpenMP**

Overview

Execution model

Worksharing directives

Worksharing – continued (Tasks ...)

Data environment

Heat example (homework)

Summary

Pitfalls

**Shared memory parallelization with OpenMP**

Verifying an OpenMP Parallelization  
with the Intel Inspector XE

## Schedule

08:45 Local registration  
09:00 Lectures and exercises on MPI  
(including some breaks)  
10:45 Lectures and exercises on OpenMP  
(including some breaks)  
**13:00 Lunch break**  
14:00 Lectures and exercises on OpenMP  
(including some breaks)  
17:30 Verifying an OpenMP Parallelization  
with the Intel Inspector XE  
18:00 **Optional:**  
Exercises with the Intel Inspector XE  
**18:00/18:30**  
**Final end without/with the exercise**

# 4-Day-Course – NHR South-West / CSC Frankfurt – 3<sup>rd</sup> day

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## Content

### **MPI on intermediate level**

- 7. Error handling
- 8. Groups & Communicators, Environment Management
  - (1) MPI\_Comm\_split, intra- & inter-communicators
  - (2) Advanced topics (short talk)
- 9. Virtual topologies
  - (1) A multi-dimensional process naming scheme
  - (2) Neighborhood-communication + MPI\_BOTTOM (no practical)
  - (3) Optimized re-numbering (short talk)

### 12. Derived datatypes

- (1) transfer any combination of typed data

### 19. Heat example

### **MPI on beginners' level – continued (Fortran users only)**

- 5. The New Fortran Module mpi\_f08

## Schedule

- 08:45 Local registration
- 09:00 Lectures & exercises on interm. MPI (including some breaks)
- 13:00 Lunch break
- 14:00 Lectures & exercises on interm. MPI (including some breaks)
- 17:30 **For Fortran participants only:** Additional lecture + exercises on the mpi\_f08 module/interface
- 18:00 Final end

# 4-Day-Course – NHR South-West / CSC Frankfurt – 4<sup>th</sup> day

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## Content

### **Advanced MPI**

- 10. One-sided Communication
- 11. Shared Memory One-sided Communication
  - (1) MPI\_Comm\_split\_type & MPI\_Win\_allocate\_shared
  - (2) MPI memory models and synchronization rules (no pract.)

### Short tour through

- 6.(2) Advanced topics on collective communication
- 12.(2) Advanced topics on derived datatypes (title slide)
- 13. Parallel File I/O (title + 5 slides)
- 14. MPI and Threads (title +1 slide)
- 15. Probe, Persistent Requests, Cancel (title + 3 slides)
- 16. Process Creation and Management (title + 3 slides)
- 17. Other MPI features (regular 4 slides)

### 18. Best practice

### MPI Summary

### **Shared memory parallelization with OpenMP**

### OpenMP-4.0 / 4.5 / 5.0 Extensions

## Schedule

- 08:45 Local registration
- 09:00 Lectures & exercises on advanced MPI (including some breaks)
- 13:00 Lunch break
- 14:00 Lectures on advanced MPI (including some breaks)
- 16:45 Lectures on advanced OpenMP
- 18:00 Final end