

## Preliminary Agenda 2022/ZIH

### Day 1: 8:30 - 18:00

08:30 Login to ZOOM (and establishing the break-out rooms)

09:00 Welcome

09:15 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

### Day 2: 8:45 - 18:00

08:45 Login to ZOOM (and establishing the break-out rooms)

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)

18:00 Final end

### Day 3: 8:45 - 18:00

08:45 Login to ZOOM (and establishing the break-out rooms)

09:00 Lectures and exercises on intermediate MPI (including some breaks)

13:00 Lunch break

14:00 Lectures and exercises on intermediate MPI (including some breaks)

17:15 For Fortran participants only:

Additional lecture + exercises on the mpi\_f08 module/interface

18:00 Final end

### Days 4: 8:45 - 18:00

08:45 Login to ZOOM (and establishing the break-out rooms)

09:00 Lectures and exercises on advanced MPI (including some breaks)

13:00 Lunch break

14:00 Lectures and exercises on advanced MPI (including some breaks)

18:00 Final end

### Days 5: 8:45 - 17:30

08:45 Login to ZOOM (and establishing the break-out rooms)

09:00 Lectures and exercises on Debugging Tools (including some breaks)

12:00 Lunch break

13:00 Lectures and exercises on Performance Tools (including some breaks)

16:00 Final end

## **Content** (preliminary, the numbers refer to MPI course chapters)

### **Day 1: MPI on beginners' level**

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

### **Day 2: MPI & Shared memory parallelization with OpenMP**

Message Passing Interface (MPI) - continued:

- 6.(1) Collective communication

Shared Memory Parallelization with OpenMP

- Overview
- Execution model
- Worksharing directives
- Data environment
- Heat example (homework)
- Summary
- Pitfalls

### **Day 3: MPI on intermediate level**

7. Error handling
8. Groups & Communicators, Environment Management
  - (1) MPI\_Comm\_split, intra- & inter-communicators, (2) Short talk on Advanced topics
9. Virtual topologies
  - (1) A multi-dimensional process naming scheme, Short talks on (2) Neighborhood-communication and (3) Optimized re-numbering
12. Derived datatypes
  - (1) transfer any combination of typed data
6. (2) Advanced topics on collective communications
5. The New Fortran Module mpi\_f08 (Fortran users only)

### **Day 4: Advanced MPI & OpenMP**

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
- Short tour through
- |   |                                     |
|---|-------------------------------------|
| 12.(2) Advanced topics on derived datatypes | 16. Process Creation and Management |
| 13. Parallel File I/O                       | 17. Other MPI features              |
| 14. MPI and Threads                         | 18. Best practice                   |
| 15. Probe, Persistent Requests, Cancel      |                                     |

Summary

Shared Memory Parallelization with OpenMP, continued / advanced  
OpenMP-4.0, 4.5 and 5.0 Extensions

### **Day 5: Debugging [D...] and Performance Tools [P...] for Parallel Programming**

- Introduction to Parallel Debugging [D1]
- Verifying an OpenMP Parallelization with the Intel Inspector XE [D2]
- MPI Correctness Checking with MUST [D3]
- Parallel Debugging with Allinea DDT [D4]
- Introduction to Performance Engineering [P1]
- Score-P: A Joint Performance Measurement Run-Time Infrastructure [P2]
- Profile examination with CUBE [P3]
- Automatic Trace Analysis with Scalasca [P4]
- Interactive Trace Analysis with Vampir [P5]