

# Advanced OpenMP

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## Overview





- UK National Supercomputer Service, managed by EPSRC
  - housed, operated and supported by EPCC
  - hardware Supplied by Cray
- Training provided by the ARCHER Computational Science and Engineering (CSE) support team
  - 72 days per year at various locations round the UK
  - free to all academics

# Who am I?

Mark Bull [markb@epcc.ed.ac.uk](mailto:markb@epcc.ed.ac.uk)

- Senior researcher at EPCC
  - Interests in parallel algorithms, parallel programming models, benchmarking, novel uses of HPC
- Lecture on EPCC's MSc in HPC
- EPCC's representative on the OpenMP ARB

# Timetable – Day 1

- 09:00 - 11:00 Lectures: OpenMP basics: Parallel regions, Worksharing, Synchronisation
- 11:00 - 11:30 Coffee
- 11:30 - 13:00 Practical: Parallel regions
- 13:00 - 14:00 Lunch
- 14:00 - 15:30 Lectures: Tasks, Nested parallelism, Memory model coherency, NUMA
- 15:30 - 16:00 Tea
- 16:00 - 17:00 Practicals: Mandelbrot with nested loops, collapse, and tasks

# Timetable – Day 2

- 09:00 - 11:00 Lectures: Multicore and multithreaded CPUs, Caches, Cache coherency, NUMA
- 11:00 - 11:30 Coffee
- 11:30 - 13:00 Practicals: Streams, Coherency
- 13:00 - 14:00 Lunch
- 14:00 - 15:30 Lectures: OpenMP tips, tricks and pitfalls, Performance issues
- 15:30 - 16:00 Tea
- 16:00 - 17:00 Practicals: MD tuning

# Timetable – Day 3

- 09:00 - 11:00 Lectures: OpenMP + MPI
- 11:00 - 11:30 Coffee
- 11:30 - 13:00 Practicals: OpenMP + MPI
- 13:00 - 14:00 Lunch
- 14:00 - 15:30 OpenMP 4.0/4.5 features, target offload
- 15:30 - 16:00 Tea
- 16:00 - 17:00 Practicals: target offload

# Lecture notes etc.

Go to

`http://www.archer.ac.uk/training`

and follow the links!

# Access to Cirrus for practicals

- Cirrus is EPCC's Tier-2 cluster -  
`http://www.cirrus.ac.uk/`
- Guest accounts for the course
  - Will be closed soon after the end of today's session
- Full instructions for the exercises are in the exercise sheet



# Logging on to Cirrus

You will have been given a guest account ID – referred to generically here as username - and a password.

Linux/Mac users can use:

```
ssh -Y username@login.cirrus.ac.uk
```

Windows users should install PuTTY <https://www.putty.org/>  
or MobaXterm – <https://mobaxterm.mobatek.net/>

# Practical exercises source code

To get the source code for the practical exercises, use the following commands :

```
cp /home/shared/advomp.tar .  
tar xvf advomp.tar  
cd AdvOMP
```

# Reusing this material



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