OpenMP for Computational Scientists
Preliminaries

Dr Tom Deakin
University of Bristol

Tuesday 1 December, 2020

University of
BRISTOL

University of BRISTOL

- ▶ Today: Learn OpenMP 4.5 (and maybe some 5.0).
- ▶ We will cover a lot of material!
- ▶ This is a hands-on tutorial!
- ▶ Mixture of lectures and exercises.
- ▶ Experiment and have fun with them!
- ▶ Solutions provided, but only look as last resort.
- ▶ Assume knowledge of basic Fortran; parallel programming with MPI useful.

Materials

Download code (and slides) from: `https://github.com/UoB-HPC/openmp-for-cs`

GW4 Isambard

- UK Tier-2 Supercomputer.
- Collaboration between GW4 Alliance, UK Met Office, Cray, Arm and EPSRC.
- 21,000+ Armv8 cores.
- Collection of CPUs/GPUs from different vendors.
- **Today:** using the Intel Xeon 2x18-core Broadwell and NVIDIA P100 nodes.

Thanks to Simon McIntosh-Smith and Bristol for supporting today's tutorial with time on Isambard.

Part One: CPUs

09:30–09:40 Introduction.

09:40–10:10 Parallel worksharing.

10:10–10:35 Exercise 1: Parallel stencil (two-ways).

10:35–11:00 Data sharing.

11:00–11:15 Coffee Break.

11:15–11:35 Exercise 2: Parallel convergence.

11:35–12:10 Vectorisation and NUMA.

12:10–12:30 Exercise 3: Optimising stencil.

Lunch break (12:30–13:30)

Agenda

Part Two: GPUs

13:30–13:35 Welcome back.

13:35–14:10 Transferring execution and data movement.

14:10–14:35 Exercise 3: Stencil on a GPU.

14:35–15:00 Target Parallelism.

15:00–15:15 Coffee Break.

15:15–15:40 Optimising data movement.

15:40–16:25 Exercise 4: Optimising stencil on a GPU.

16:25–16:30 Wrap up.

Thanks

Thanks go to the following authors, whose own OpenMP tutorials have inspired this one:

- ▶ Tim Mattson (Intel)
- ▶ Alice Koniges (Berkeley Lab/NERSC)
- ▶ Simon McIntosh-Smith and the HPC team (UoBristol)
- ▶ Gethin Williams (UoBristol)
- ▶ and many others