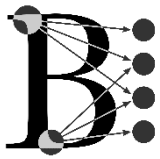
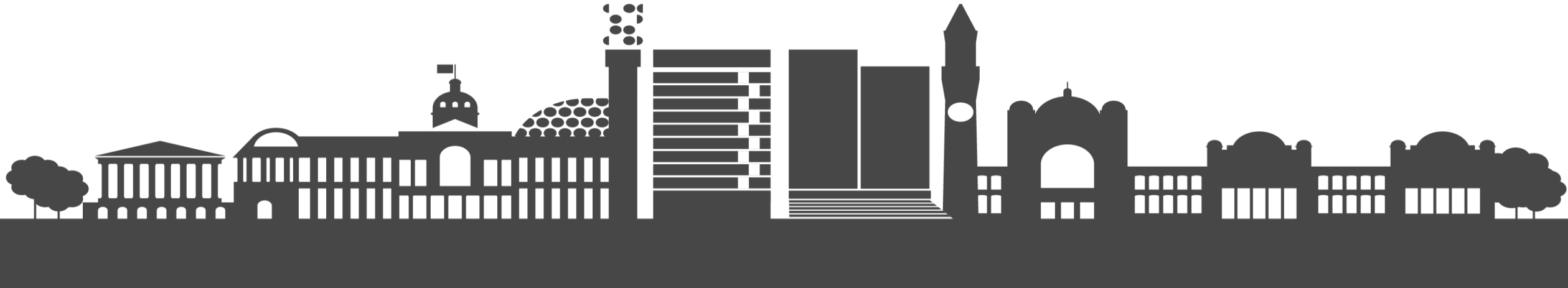
UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



Baskerville

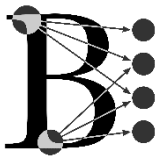
Linaro-Forge



Session Objectives

- To understand how, why and when to use Linaro-Forge
  - DDT -
  - MAP -
- Using Linaro-Forge on BlueBEAR
  - Command Line
  - GUI
    - Single GPU
    - Multi-GPU / MPI with remote launch

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



DDT

- DDT is the debugger
- Used for static analysis that analyses potential problems in the source code.
- Integrated memory debugging that can catch reads and writes out of array bounds
- scalable beyond the petascale

DDT

- Programs must be compiled with the addition of the debug flag
- Static analysis
  - Buffer overflows
  - Memory leaks
  - Unused variables
- Version control
  - Can see line by line information from Git
  - Option found in the view member
  - Can view commit messages

MAP

- Parallel profiler
  - Run code and looks at what sections took the longest and why
- Source level profiler
- Works like DDT with compiled code with the debug flag
- Creates a .map file

MAP Colour scheme

- Dark green - Single threaded computational
- Blue - MPI communication and wait time
- Dark purple – Accelerator
- Different colours for OpenMP

Linaro-Forge Command Line

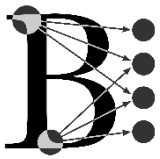
- Forge examples present in: /bask/projects/v/vjgo8416-training24/forge_examples
- We will look at examples creating DDT reports:
  - wave_c
  - matrixMul (cuda)
- Will see how to create MAP file

Wave_c

- Implements the concurrent wave equation
- A vibrating string is decomposed into points. Each task is responsible for updating the amplitude of a number of points over time.
- `ddt --mpi=openmpi-compat --offline -o wave.html --np 10 forge_examples/wave_c`
- `ddt --mpi=openmpi-compat --offline -o wave_trace.html --trace-at=forge_examples/wave.c:121,x --np 10 forge_examples/wave_c`
- `map --mpi=openmpi-compat --profile --np ${SLURM_NTASKS} wave_c`

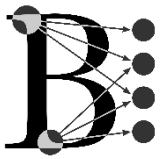
```
Shell
  Linaro Forge 23.0.1 - Linaro DDT

Debugging               : $PATH/wave_c
MPI enabled             : Yes
* MPI implementation    : Open MPI (Compatibility)
* number of processes   : 10
* number of nodes       : 1
Memory debugging enabled : No

Wave solution with 10 processes
points = 1000000, running for 30 seconds

                    min      mean    max
All time (ms): 30008    30008   30010
CPU time (ms): 23530    25891   29498
MPI time (ms): 510      4117    6479

CPU time (%) : 78       86      98
MPI time (%) : 2        13      22

Iterations   : 38320    38320   38320
points/second: 1277.0M (127.7M per process)
wave finished

Offline log written to: '$PATH/wave.html'
```

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



Command line Profiling

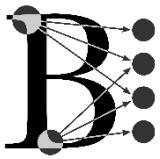
UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



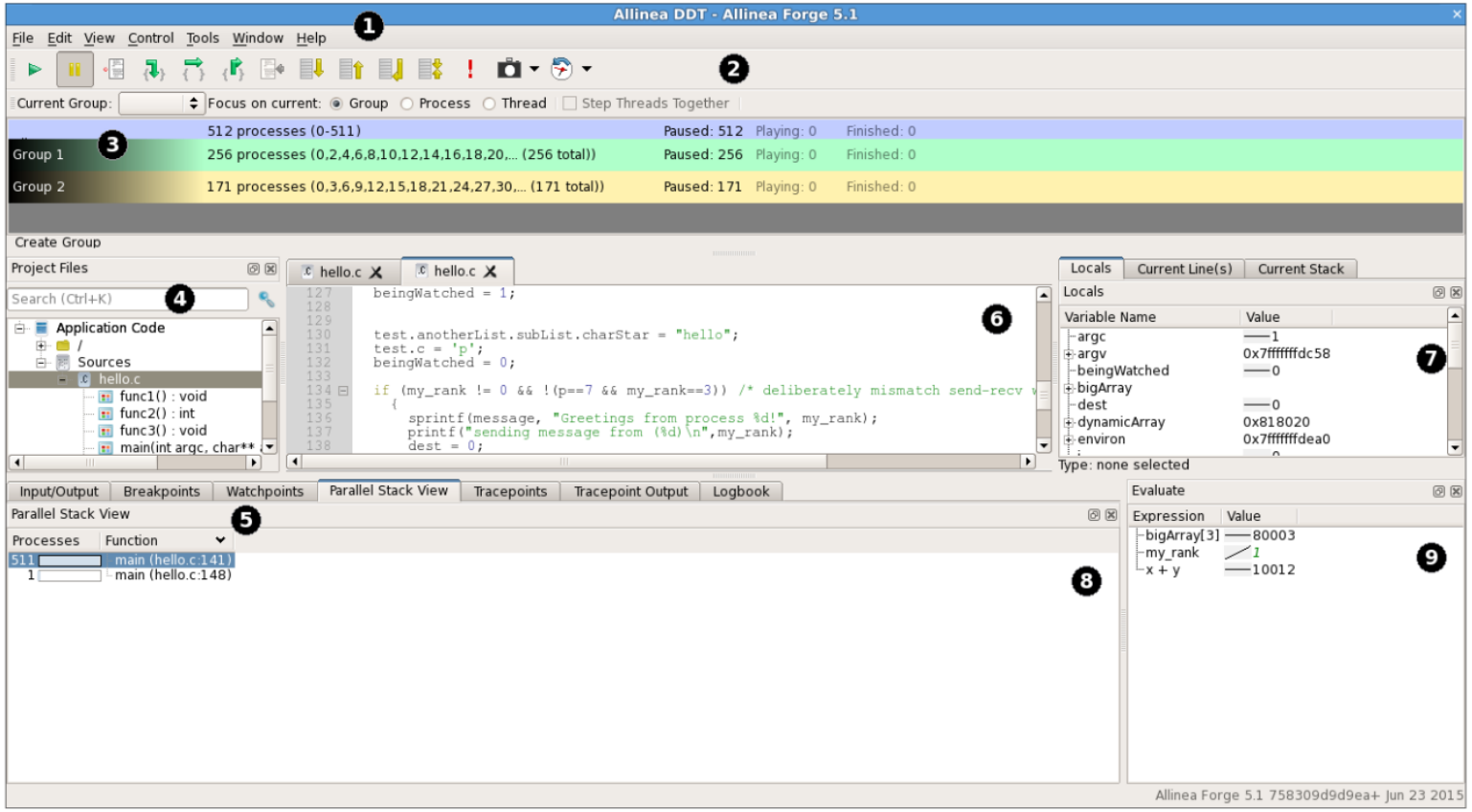
Linaro-Forge GUI

- We will look at the GUI to examine the .map files
  - CUDA Matrix Multiplication example
  - CUDA MPI example
- Running an example job for DDT
- Learning the steps to do remote launch - https://www.stonybrook.edu/commcms/ookami/support/faq/_docs/Linaro-Ookami.pdf

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



Linaro-Forge DDT GUI



Key

(1) Menu Bar

(2) Process Controls

(3) Process Groups

(4) Find File or Function

(5) Project Files

(6) Source Code

(7) Variable and Stack of Current Process/Thread

(8) Parallel Stack, IO and Breakpoints

(9) Evaluate Window

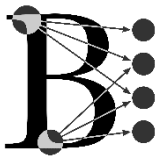
(10) Status Bar

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |

Remote Launch / Remote Client

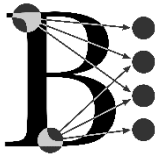
- Configuration directory is in ~/.allinea
  - Allinea originally created Forge
  - Must place remote-script in this location
- Have to signify remote launch in the GUI
- Identify compute node for hostname
- Can test remote launch to make sure it connects
- Once connected can submit jobs to the queue

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



Linaro Forge GUI

UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |



UNIVERSITY OF BIRMINGHAM | BEAR BIRMINGHAM ENVIRONMENT FOR ACADEMIC RESEARCH |

Thank You

Any Questions