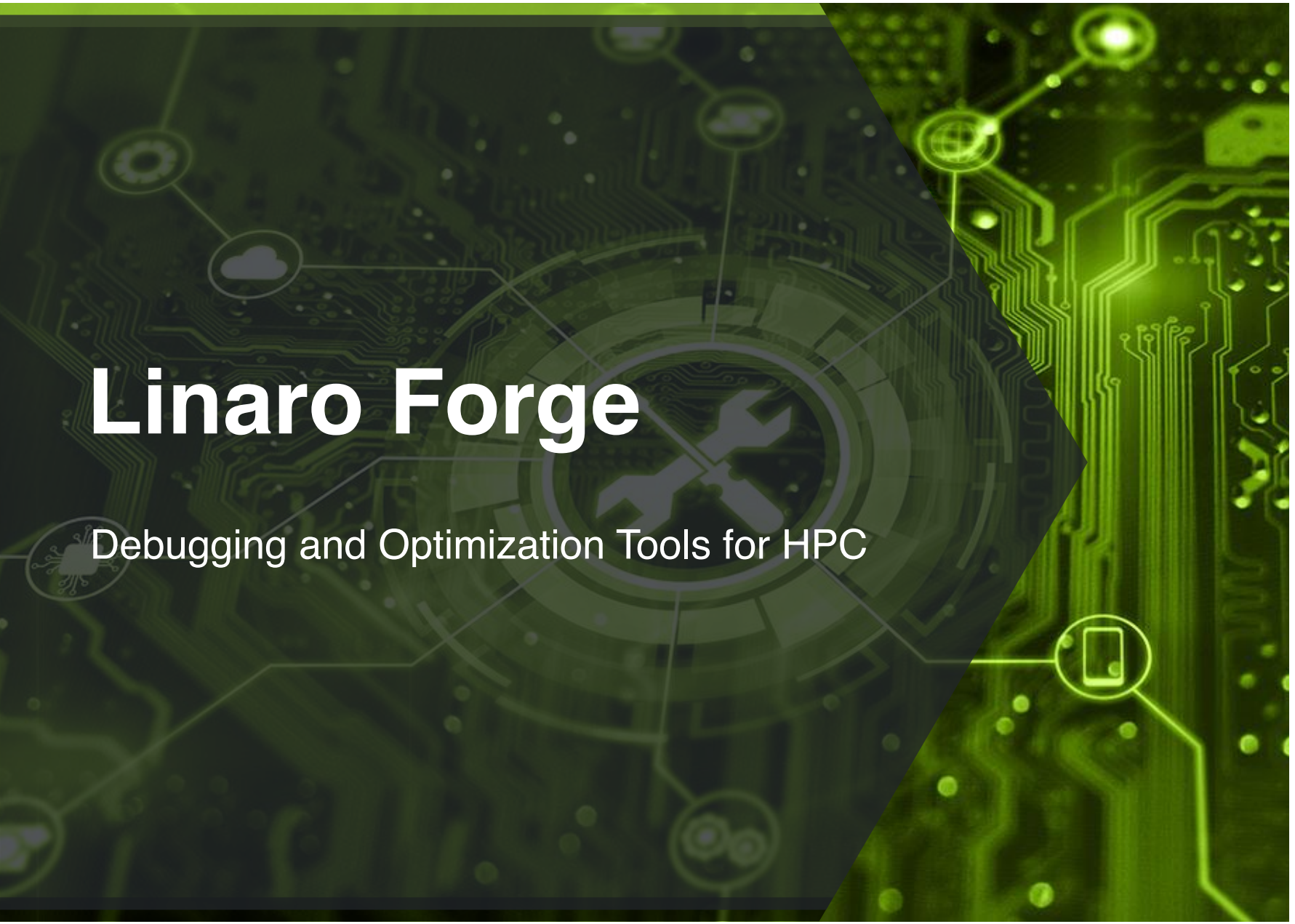
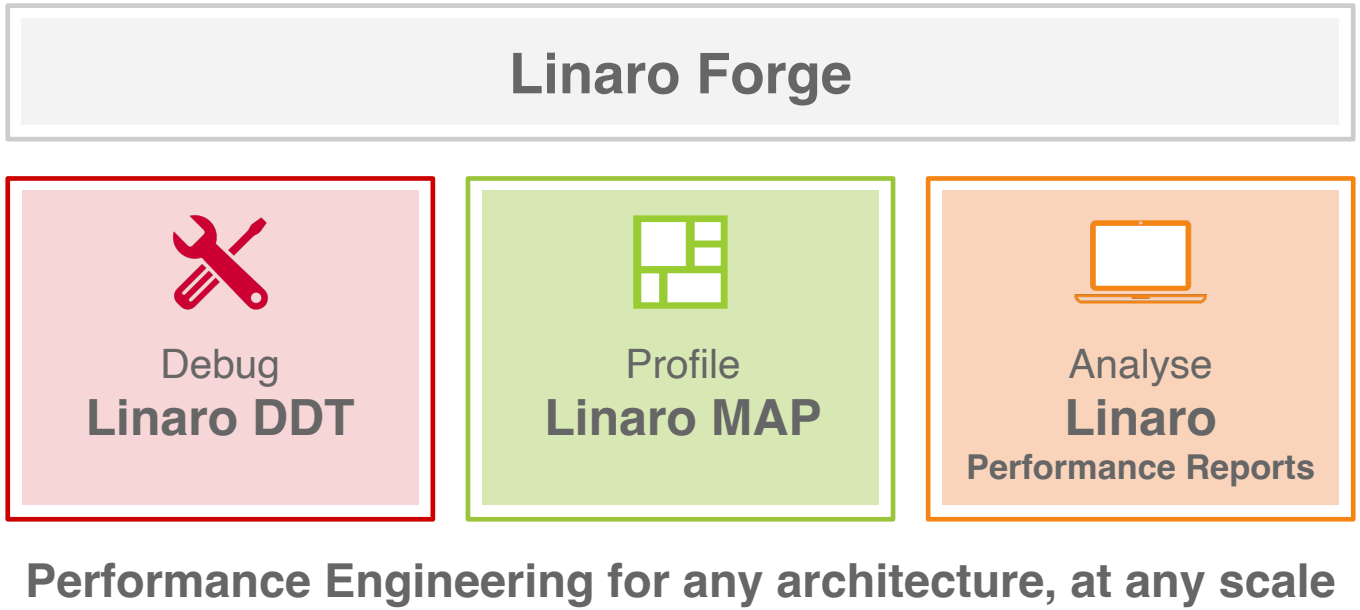


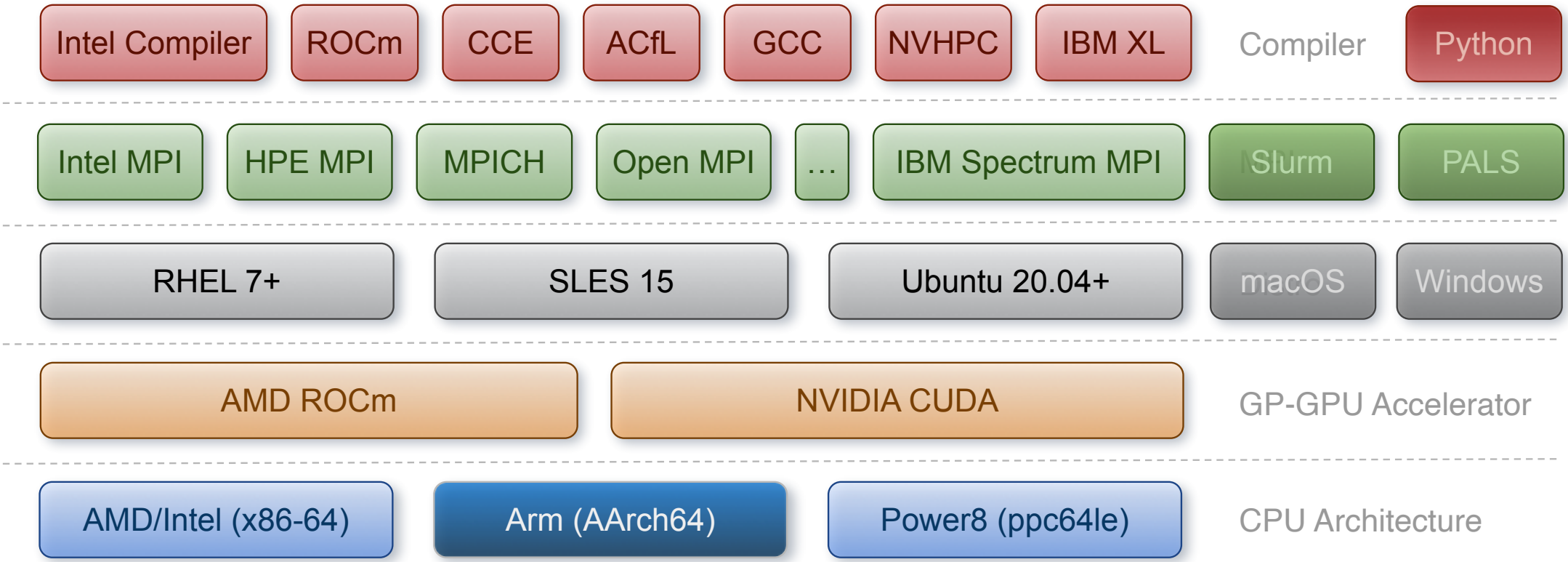
Linaro Forge

HPC Development Solutions from Linaro

Best in class commercially supported tools for HPC



Supported Platforms



Debugging with DDT

An interoperable toolkit for debugging

The de-facto standard for HPC development

- Most widely-used debugger in HPC
- Fully supported by Linaro on Intel, AMD, Arm, Nvidia, AMD GPUs, etc.

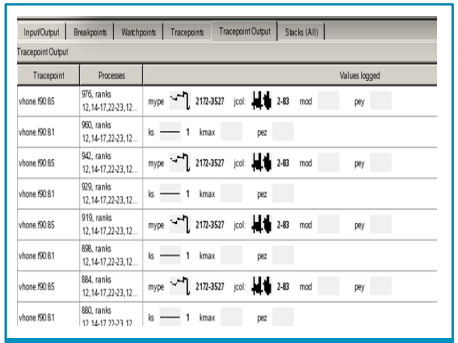
State-of-the art debugging capabilities

- Powerful and in-depth error detection mechanisms (including memory debugging)
- Available at any scale (from serial to exascale applications)

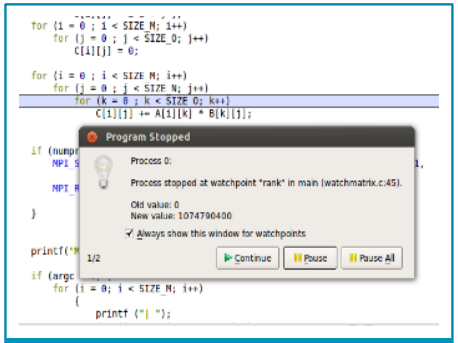
Easy to use by everyone

- Unique capabilities to simplify remote interactive sessions
- Innovative approach to present quintessential information to users

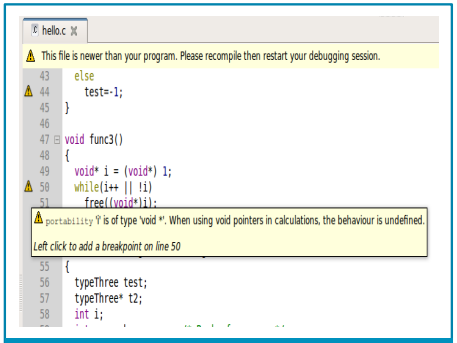
Linaro DDT Debugger Highlights



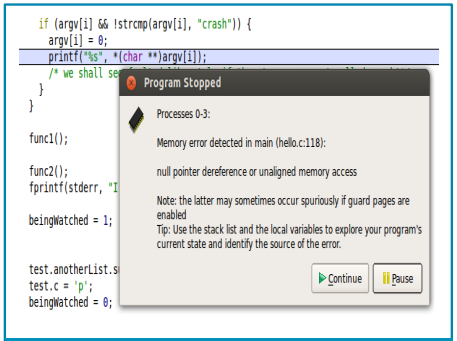
The scalable print alternative



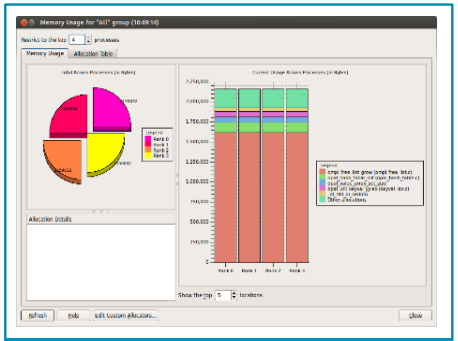
Stop on variable change



Static analysis warnings on code errors



Detect read/write beyond array bounds



Detect stale memory allocations

Multi-dimensional Array Viewer

What does your data look like at runtime?

View arrays

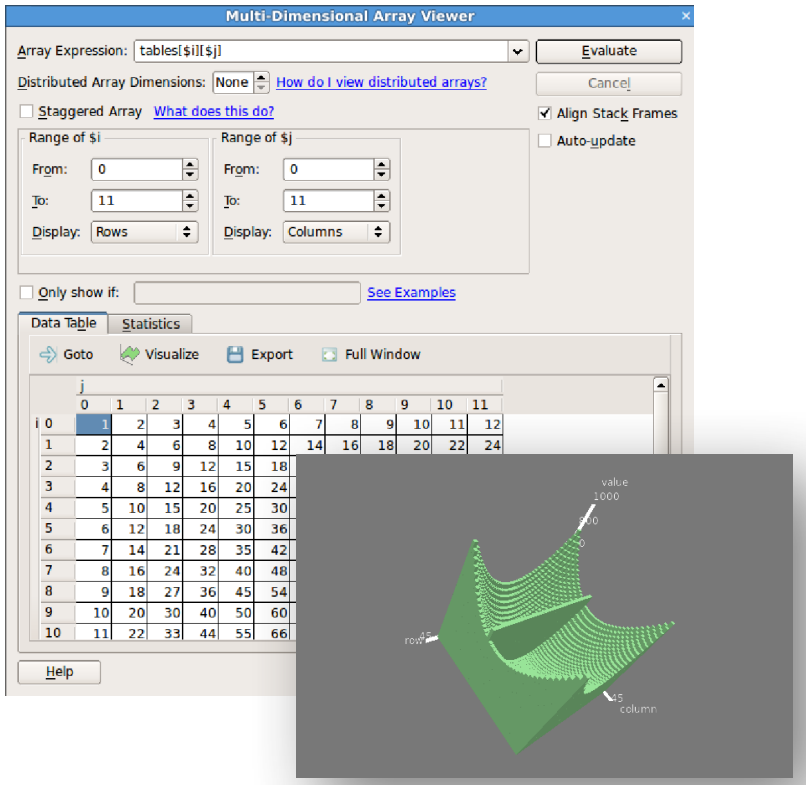
- On a single process
- Or distributed on many ranks

Use metavariables to browse the array

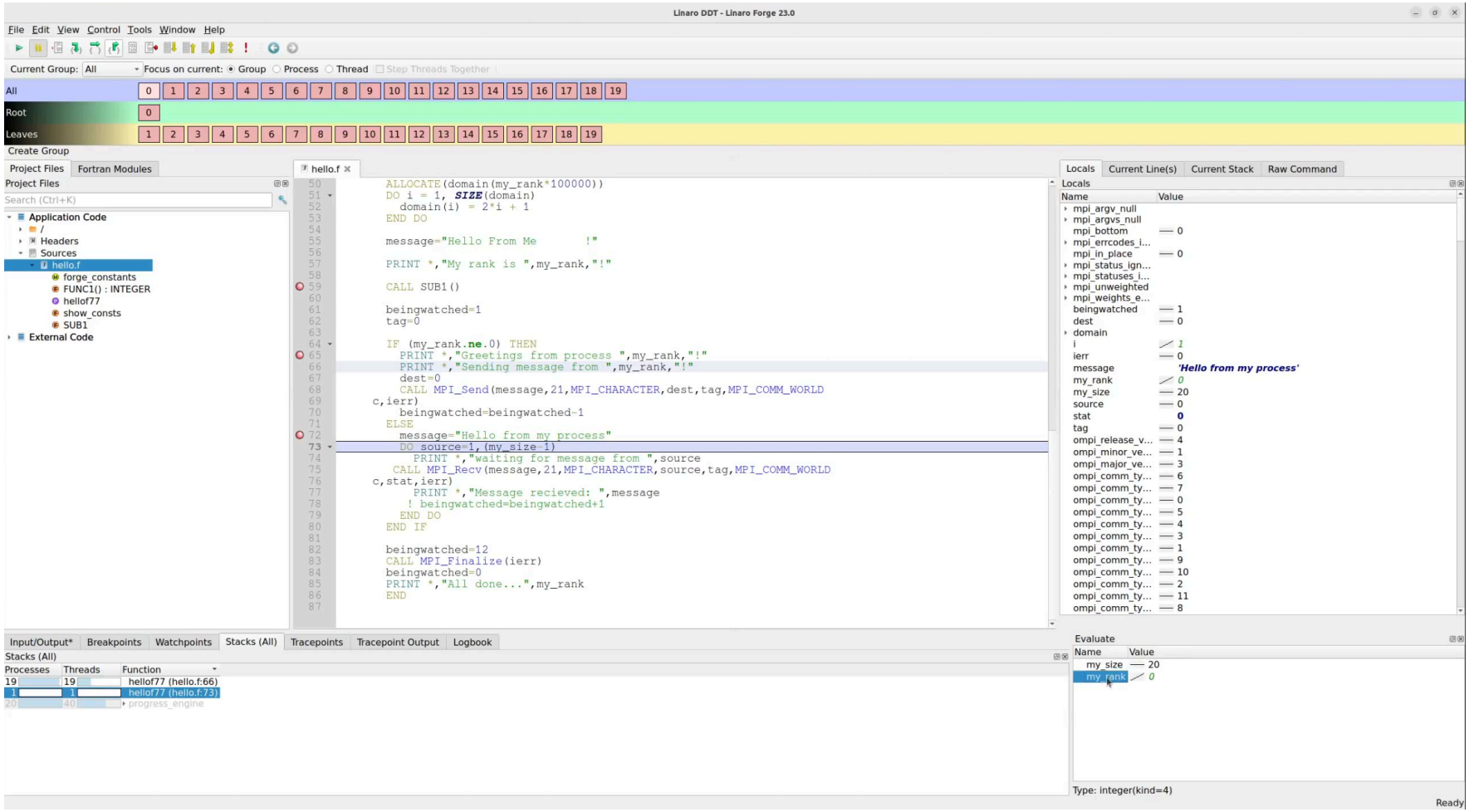
- Example: $i and $j
- Metavariables are unrelated to the variables in your program
- The bounds to view can be specified
- Visualise draws a 3D representation of the array

Data can also be filtered

- “Only show if”: $value>0 for example $value being a specific element of the array



Debug Example - Fortran code



Linaro Performance tools

Characterize and understand the performance of HPC application runs

Commercially supported by Linaro

Gather a rich set of data

- Analyses metric around CPU, memory, IO, hardware counters, etc.
- Possibility for users to add their own metrics

Accurate and Astute insight

Build a culture of application performance & efficiency awareness

- Analyses data and reports the information that matters to users
- Provides simple guidance to help improve workloads' efficiency

Relevant advice to avoid pitfalls

Adds value to typical users' workflows

- Define application behaviour and performance expectations
- Integrate outputs to various systems for validation (eg. continuous integration)
- Can be automated completely (no user intervention)

MAP Capabilities

MAP is a sampling based scalable profiler

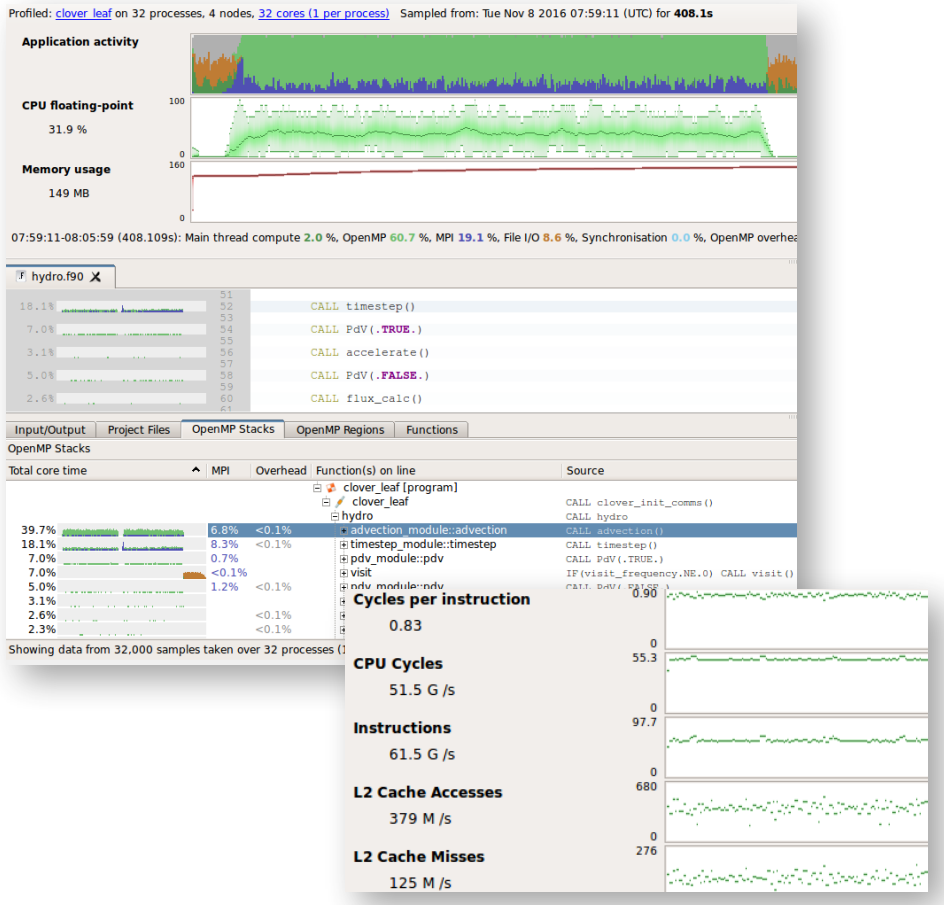
- Built on same framework as DDT
- Parallel support for MPI, OpenMP, CUDA
- Designed for C/C++/Fortran

Designed for ‘hot-spot’ analysis

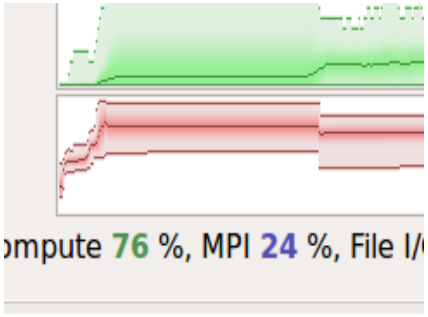
- Stack traces
- Augmented with performance metrics

Adaptive sampling rate

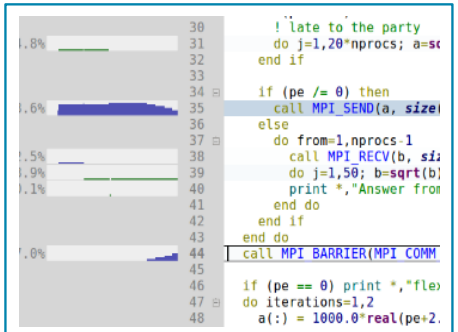
- Throws data away - 1,000 samples per process
- Low overhead, scalable and small file size



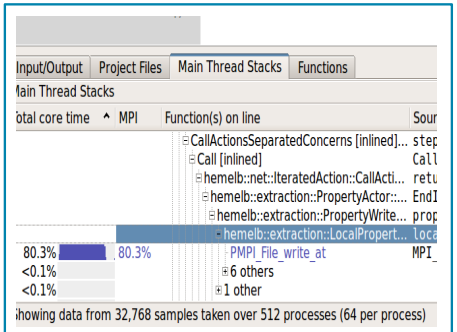
Linaro MAP Source Code Profiler Highlights



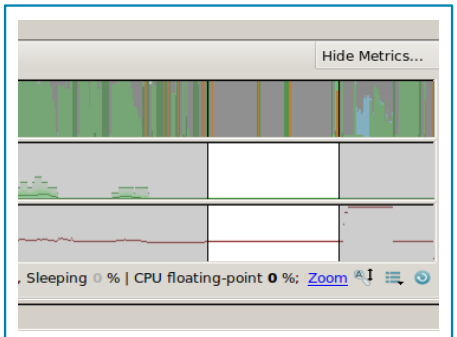
Find the peak memory use



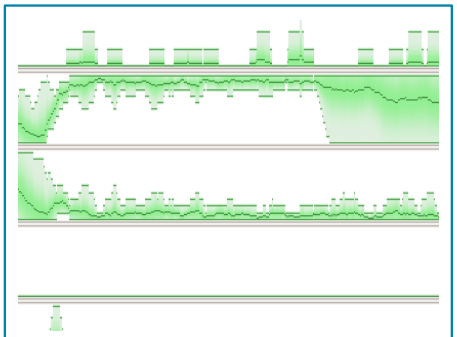
Fix an MPI imbalance



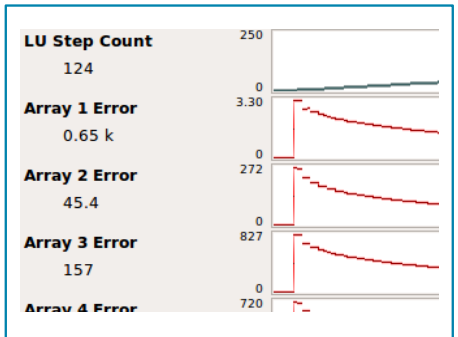
Remove I?O bottleneck



Make sure OpenMP regions make sense

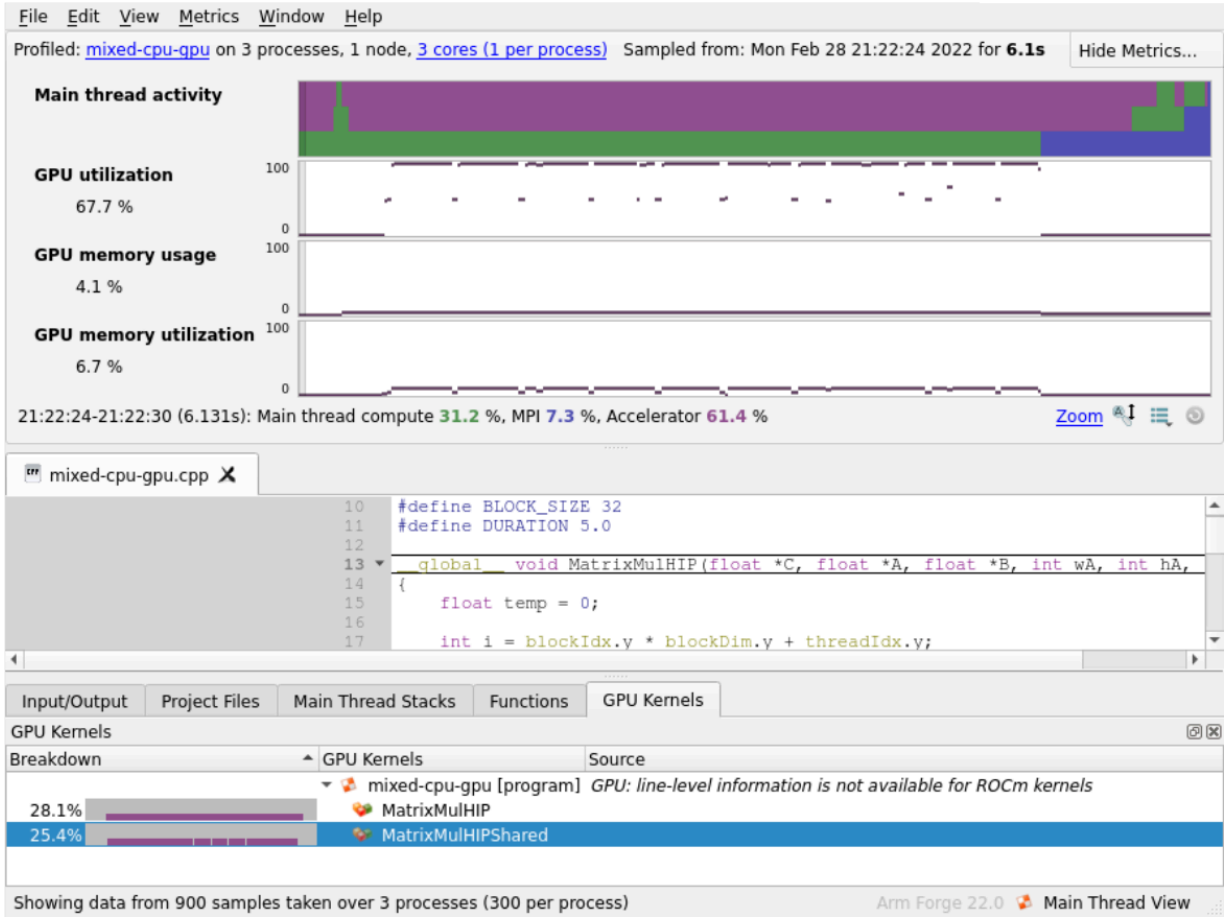


Improve memory access



Custom Metrics

MAP Example - ROCm AMD GPU



Profile

- Ran for 6s, taking 300 samples per process
- Able to bring up metadata of the profile
- Mixed CPU [green] / GPU [purple] application
- CPU time waiting for GPU Kernels [purple]
- GPU Kernels graph indicating Kernel activity

GUI information

- GUI is consistent across platforms
- Zoom into main thread activity
- Ranked by highest contributors to app time

Performance Reports Example - Python

Report information

- Summary of application performance
- Actionable insight
- Could integrate into CI/CD

Generating a report

- Able to generate from a MAP file
- Generated through the command-line
- Text output or HTML report

Running on Frontier

Forge is already on Frontier

```
module load forge
```

DDT offline debugging

```
ddt --offline srun -A <project_id> -t 00:05:00 -p <partition> -N 2 -n 4 --ntasks-per-node=2 ./app
```

MAP offline profile

```
map --profile srun -A <project_id> -t 00:05:00 -p <partition> -N 2 -n 4 --ntasks-per-node=2 ./app
```

Performance report

```
perf-report srun -A <project_id> -t 00:05:00 -p <partition> -N 2 -n 4 --ntasks-per-node=2 ./app
```

For remote connection

https://docs.linaroforge.com/latest/html/forge/forge/connecting_to_a_remote_system/connecting_remotely.html

Thank you

~

Go to www.linaroforge.com

rudy.shand@linaro.org

Linaro Forge