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Maintaining HPC debugging and performance engineering leadership

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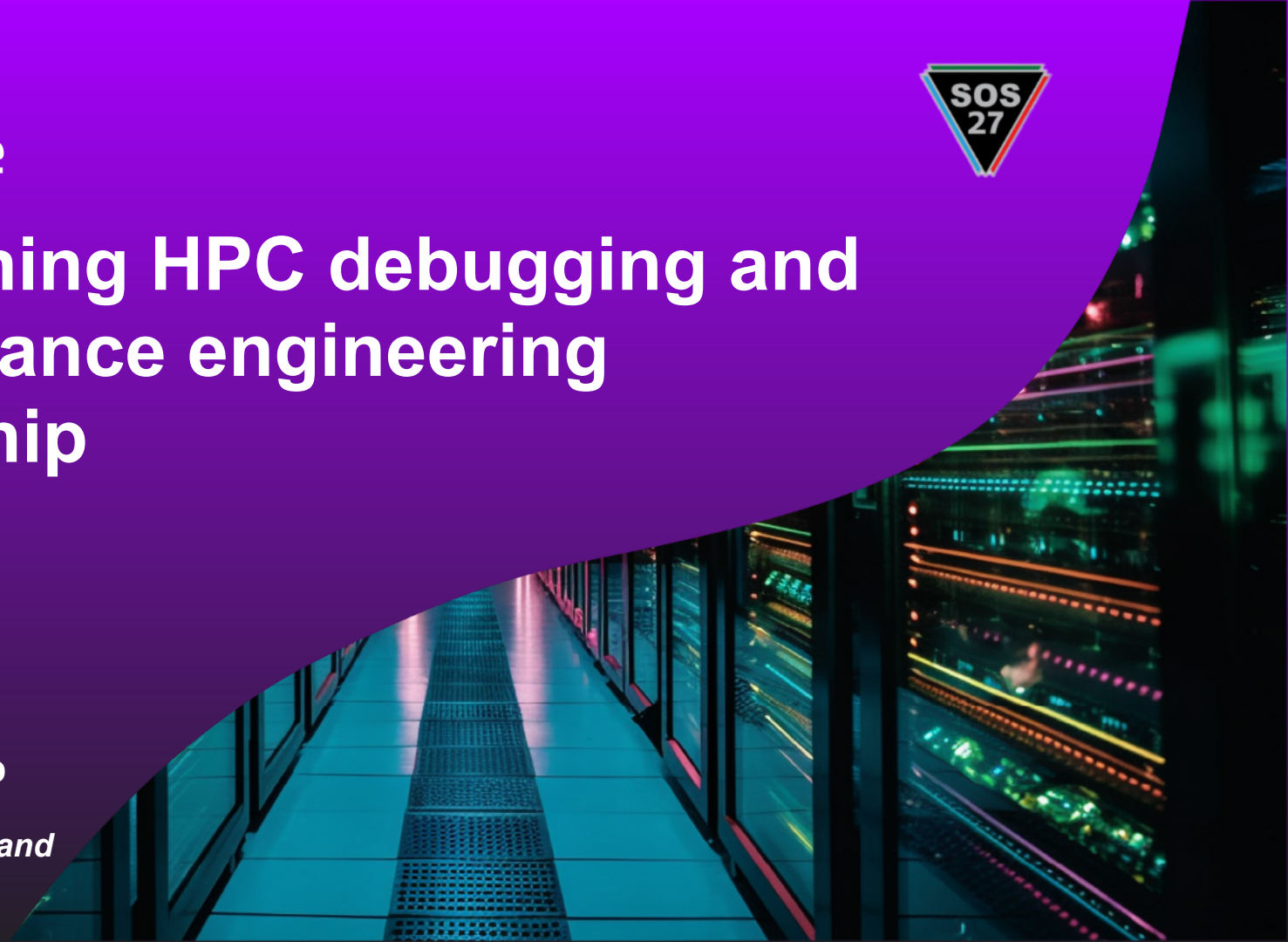
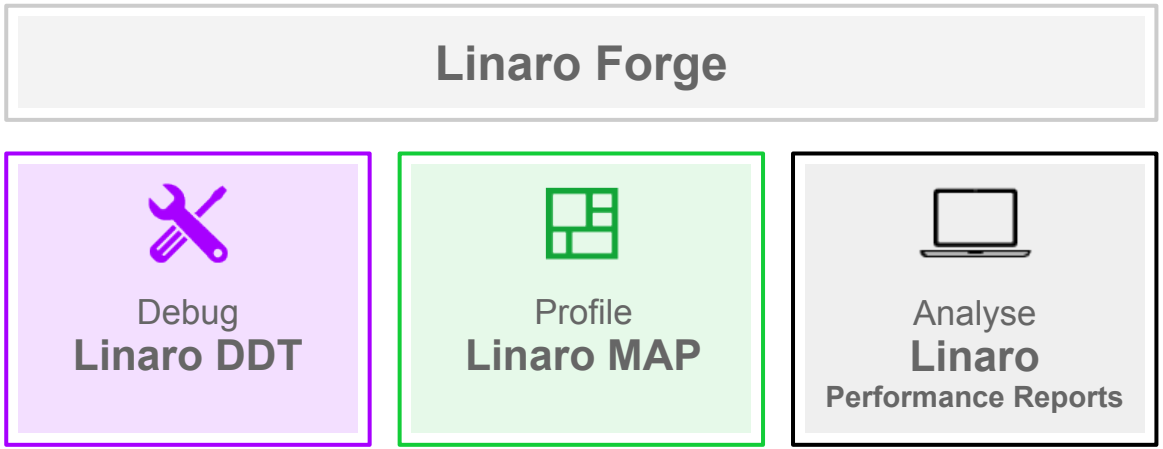


HPC Development Solutions from Linaro

Best in class commercially supported tools for Linux and high-performance computing (HPC)



Performance Engineering for any architecture, at any scale

Collaboration

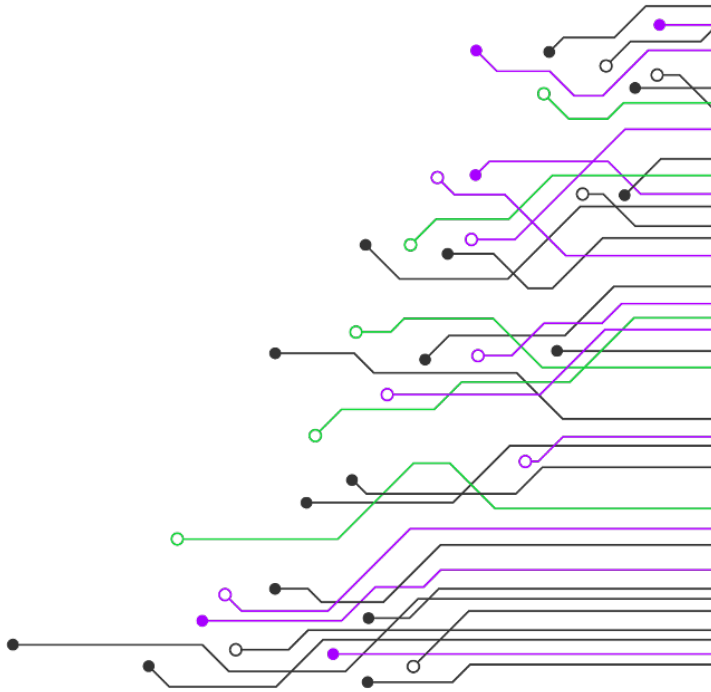
Leveraging the power of community

GDB is the underlying DDT debugger

- Linaro upstreams patches to the GDB community
- Forge team raises and fixes GDB bugs

Nimble at supporting new technologies

- Rely on Hardware vendors to add GDB support
- Rely on Software consortiums to add GDB support
- Helps us to stay current, state of the art debugger



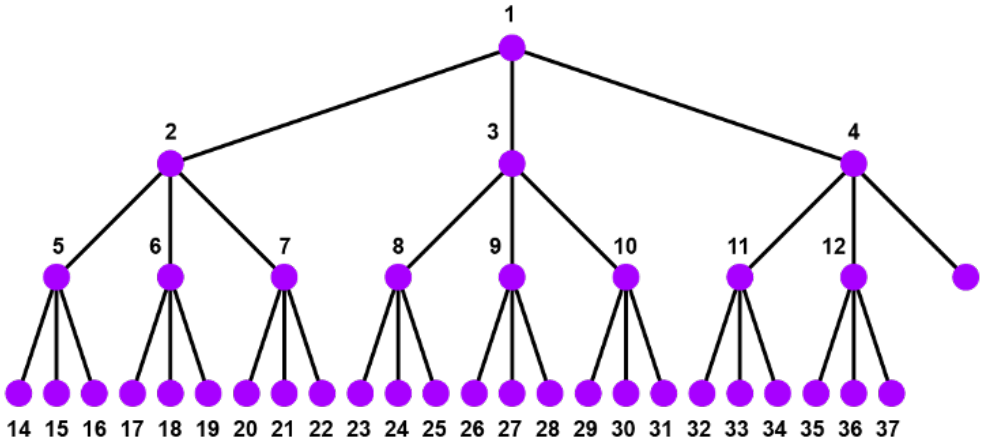
Innovation

Finding effective solutions to difficult problems

Scalable Tree Network

- Treeserver design is how is how Forge is able to scale across processes
- Send bulk commands and merge responses
- Aggregate the data instead of broadcasting hundreds / thousands responses

Tree network topology



Effort

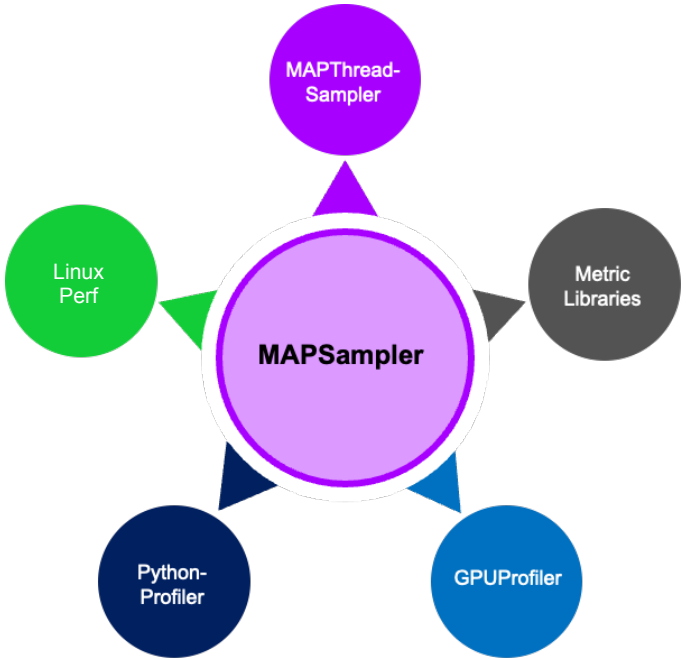
Investing time and energy into what matters

Collect samples

- ***MAP Thread Sampler***: Samples across threads
- ***Python Profiler***: Profiles the Python interpreter
- ***GPU profiler***: Obtain data on CUDA kernels
- ***Metric libraries***: Core set of performance metrics
- ***Linux Perf***: Collects Linux perf metrics

Adaptive sampling

- The sampling frequency of MAP automatically decreases over time to ensure a manageable amount of data is collected
- Keeps overhead and file sizes low



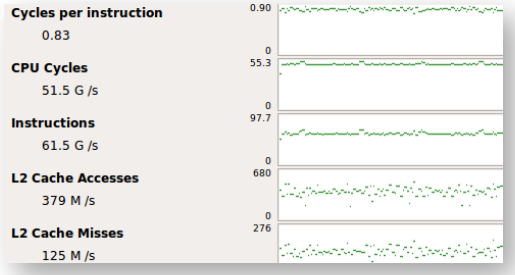
MAP Capabilities

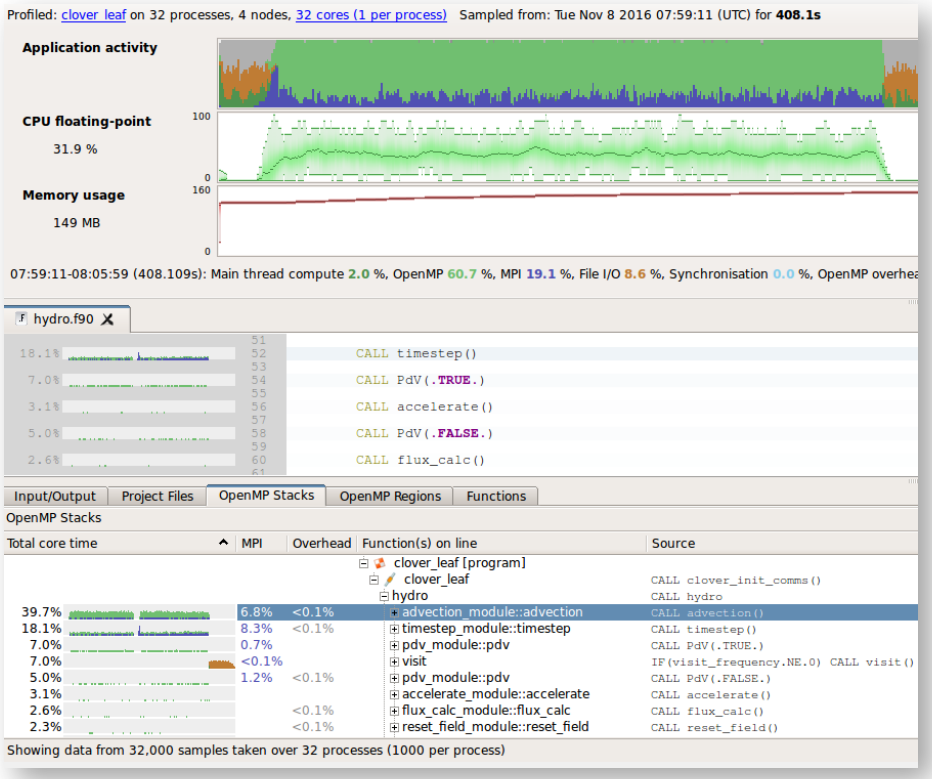
MAP is a sampling based scalable profiler

- 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





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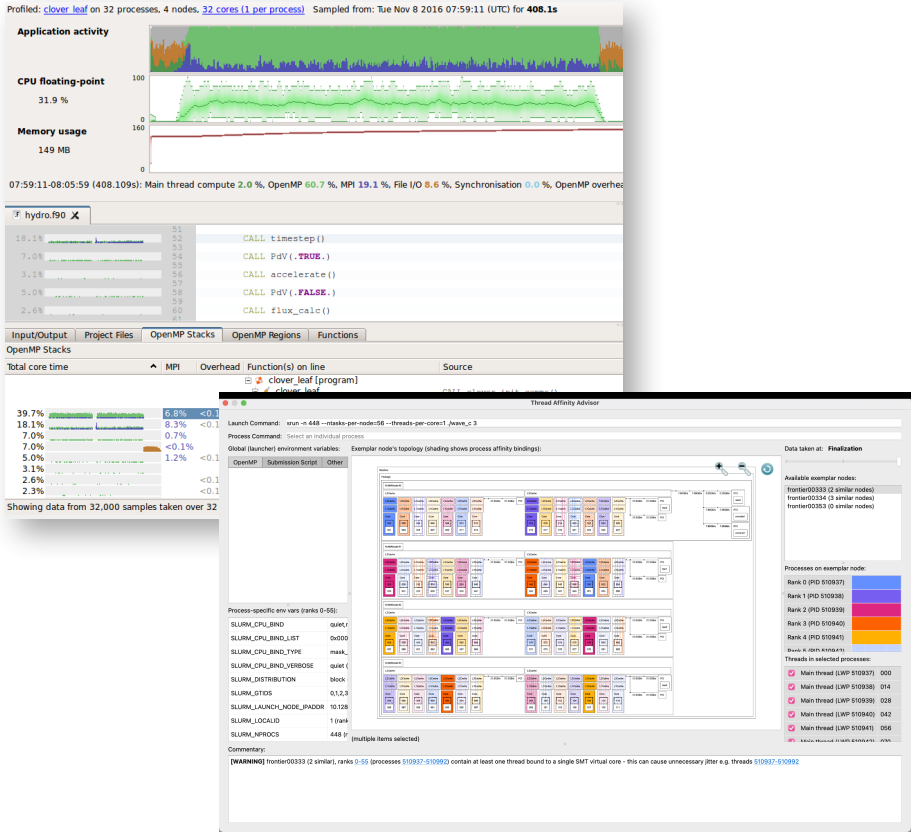
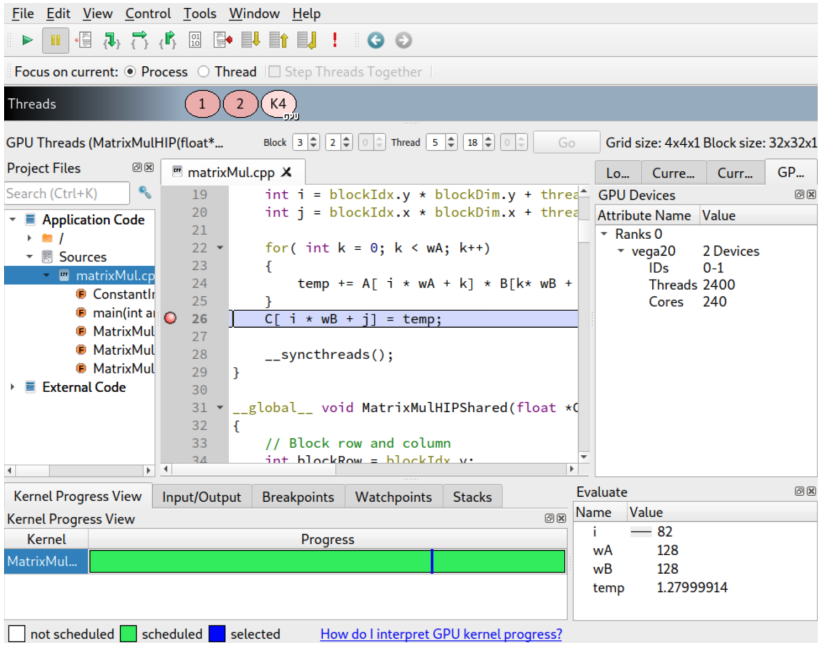
Debugging and Profiling to exascale and beyond!



- Highly scalable architecture
- Rich set of features
- Cross platform



Notable achievements over the years

AMD GPU Debugging and Profiling
- In partnership with ORNL, AMD, and HPE, delivered for the Frontier system

Intel GPU debugging
- In partnership with ANL and Intel, delivered for the Aurora system

Caliper support
- Introduction of Caliper instrumentation in MAP, in partnership with LLNL

Arm Compiler for Linux
- Collaboration with SNL to ensure debugger compatibility with the Vanguard Astra system, including adding support for ACfL

Thread Affinity Advisor feature
- Collaboration with SNL and CSCS on the new Thread Affinity Advisor feature

Machine Learning
- Collaborating with CSCS and ANL on ML Performance Reports

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Thank you

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