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Leaders in parallel software development tools

Allinea Unified Environment

Modern Tools for Debugging, Profiling and Optimizing HPC Codes

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Three Challenges for Tools

Scalability

- Speed and Simplification

Heterogeneity

- Accelerators and Coprocessors

Adoption

- Ease of Use and Education

Allinea Unified Environment

- **A modern integrated environment for HPC developers**
- **Supporting the lifecycle of application development and improvement**
  - **Allinea DDT :** Productively debug code
  - **Allinea MAP :** Enhance application performance
  - **Allinea Performance Reports**: Characterize Application performance
- **Designed for productivity**
  - Consistent easy to use tools
  - Enables effective HPC development
  - Responsive at all scales
- **Improve system usage**
  - Fewer failed jobs
  - Higher application performance

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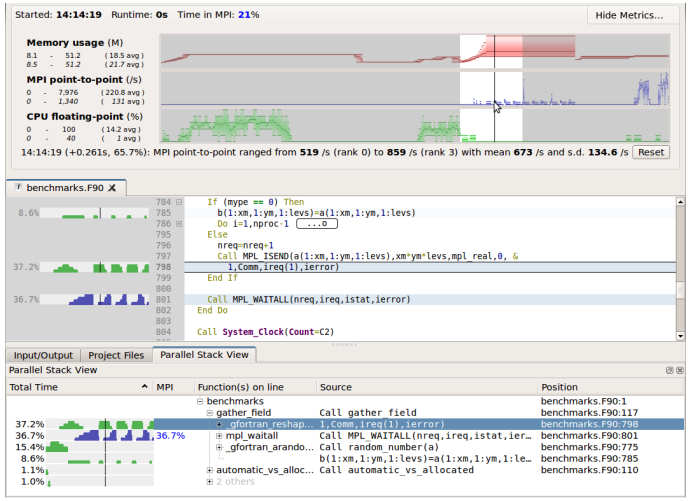
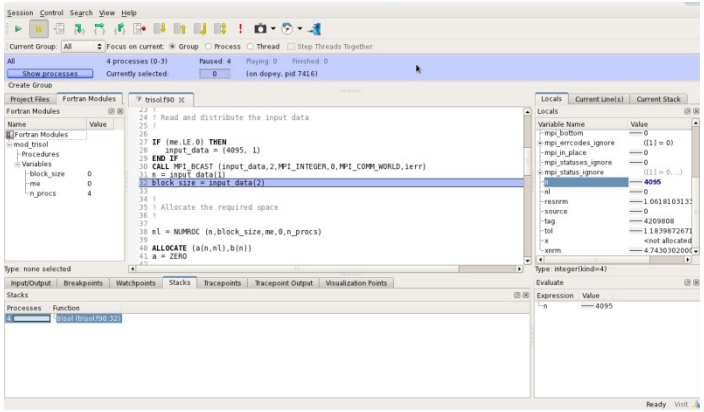
Unified Building Blocks

Shared Graphical Interface

Shared Configuration Files





Shared Scalable Architecture

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Allinea DDT
Fix software problems - fast

- **Graphical debugger designed for:**
  - C/C++, Fortran, UPC, CUDA
  - Multithreaded code
    - Single address space
  - Multiprocess code
    - Interdependent or independent processes
  - Accelerated codes
    - GPUs, Intel Xeon Phi
  - Any mix of the above

- **Slash your time to debug :**
  - Reproduces and triggers your bugs instantly
  - Helps you easily understand where issues come from quickly
  - Helps you to fix them as swiftly as possible

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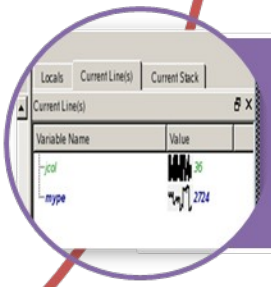
Allinea DDT: Debugging that scales

Where?

- Leaps to source automatically
- Powerful instantaneous memory debugging

How?

- Real-time data comparison and consolidation
- Identify outliers and unusual threads

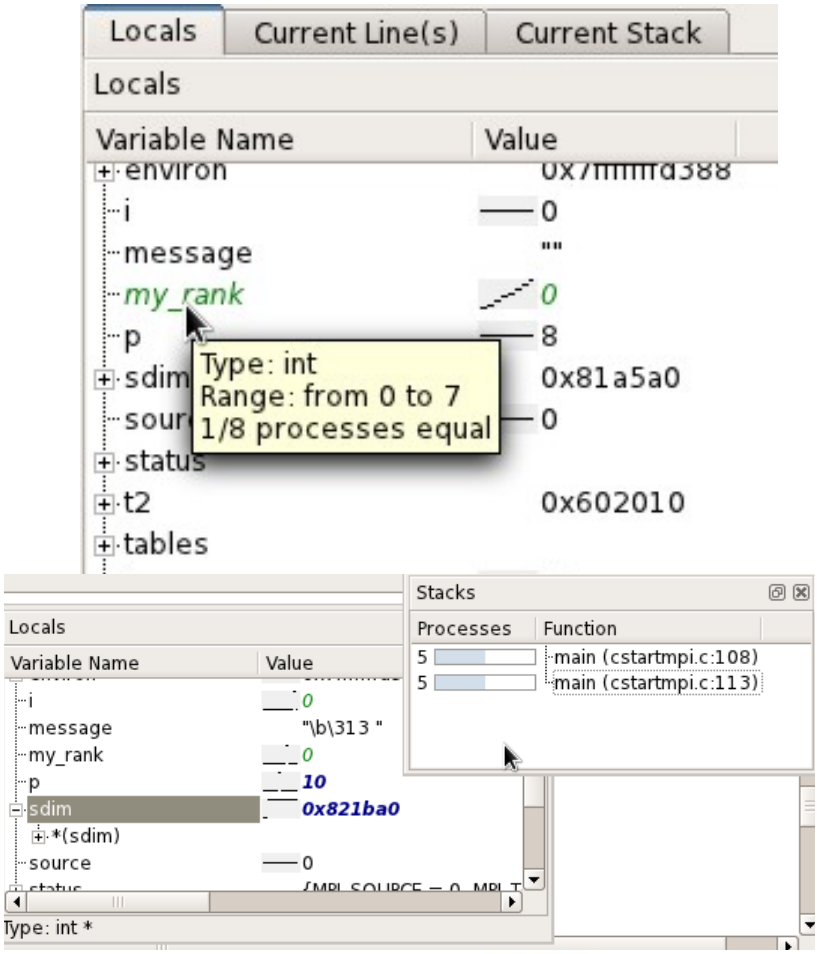


Why?

- “Smart Highlighting” of differences and changes
- Sparklines comparing data across processes

Simplifying Data Analysis

- **Need to understand the data**
  - Too many variables to trawl manually
  - Automatic data comparison and consolidation
  - No bottleneck on the GUI
- **Variable “Smart Highlighting”**
  - Subtle hints for differences and changes
  - With sparklines!
- **“Parallel Stack View”**



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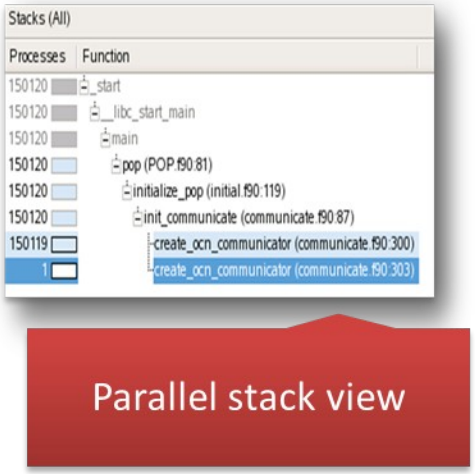
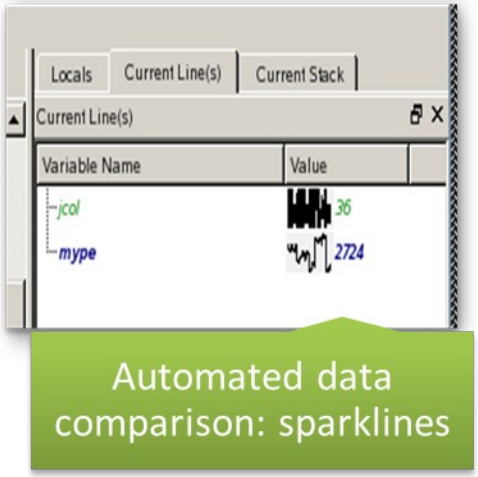
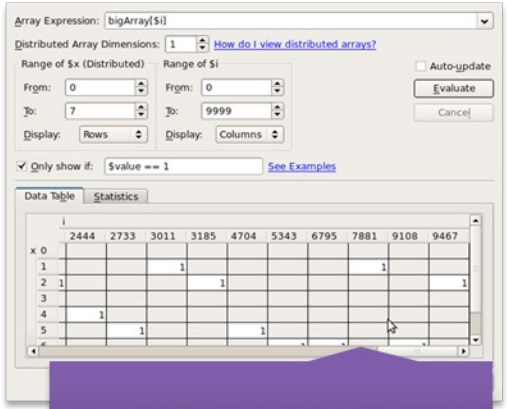
Top Features for HPC Debugging



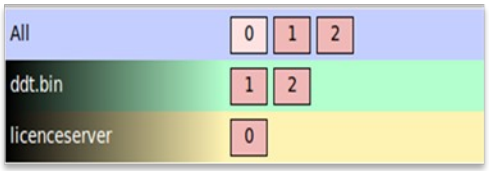
Parallel stack view

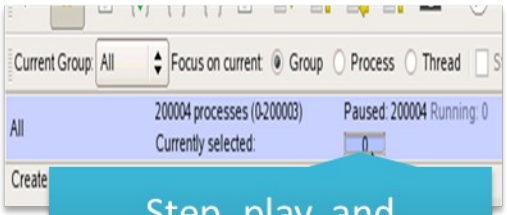


Automated data comparison: sparklines

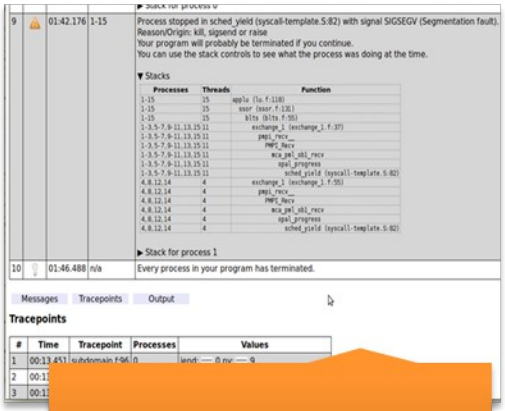


Parallel array searching





Step, play, and breakpoints



Offline debugging

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Allinea MAP
Increase application performance

- **Parallel profiler designed for:**
  - C/C++, Fortran
  - Multi-process code
    - Interdependent or independent processes
  - Multithreaded code
    - Monitor the main threads for each process
  - **Accelerated codes**
    - GPUs, **Intel Xeon Phi**

- **Improve productivity :**
  - Helps you detect performance issues quickly and easily
  - Tells you immediately where your time is spent in your source code
  - Helps you to optimize your application efficiently

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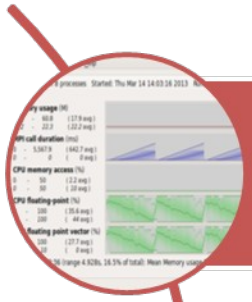
Allinea MAP: Performance made easy

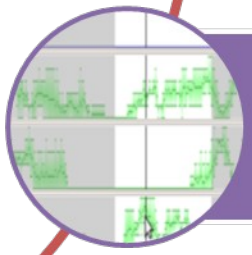


Low overhead measurement

- Accurate, non-intrusive application performance profiling
- Seamless – no recompilation or relinking required

Easy to use

- Source code viewer pinpoints bottleneck locations
- Zoom in to explore iterations, functions and loops

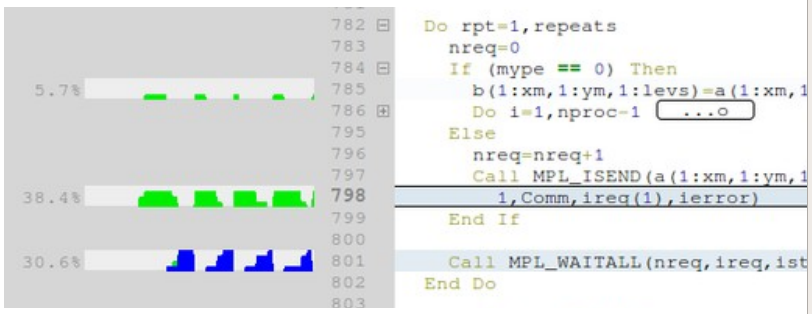


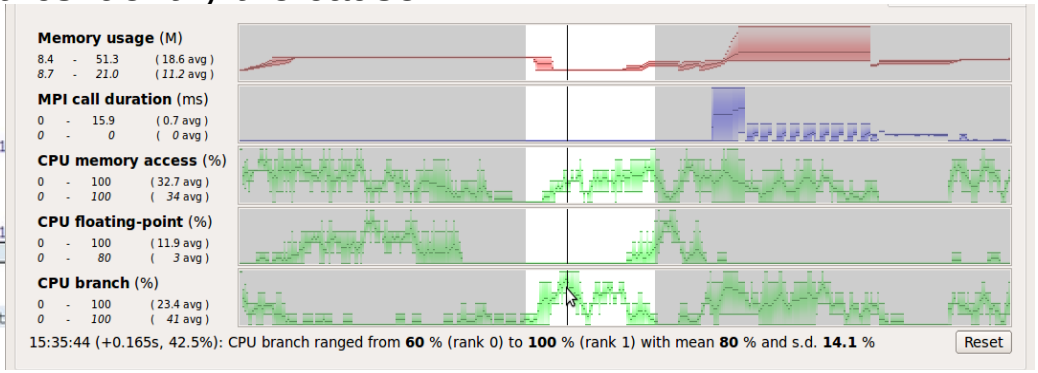
Deep

- Measures CPU, communication, I/O and memory to identify problem causes
- Identifies vectorization and cache performance

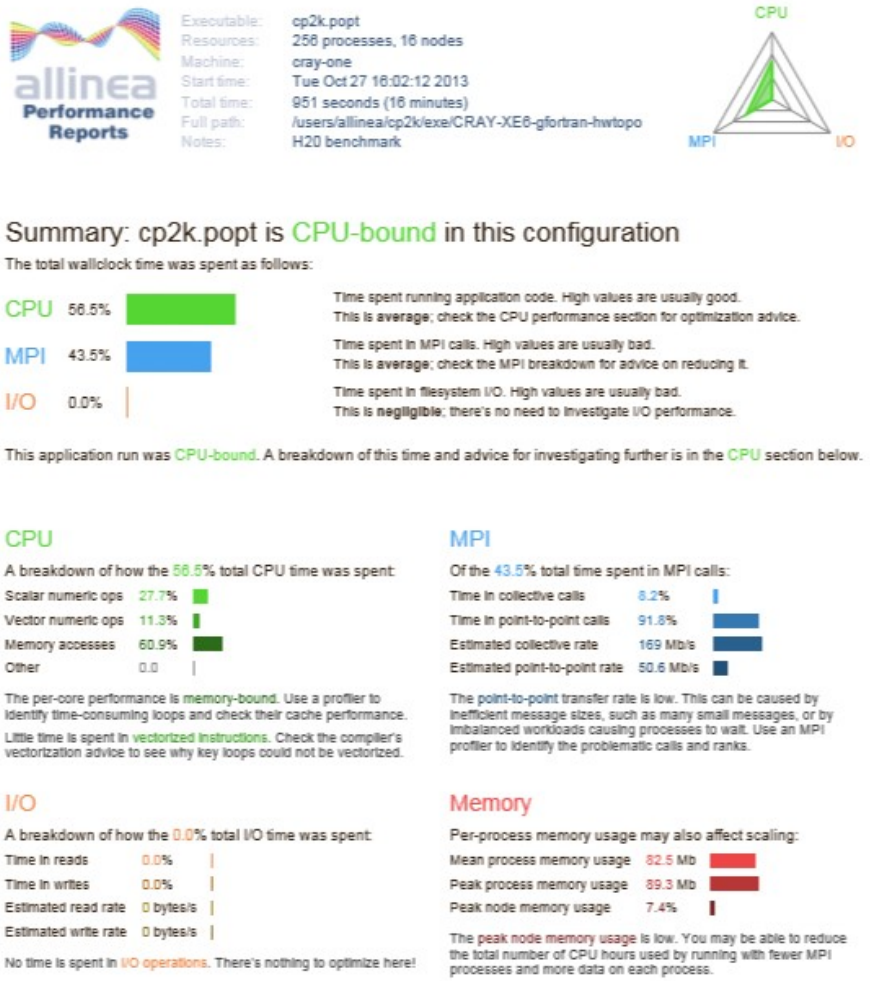
Allinea MAP
Find performance issues quickly

- **Look at the entire application on real data sets**
  - Visualize the entire run at full scale, not just reduced sets
  - Zoom in to explore iterations, functions and loops
- **Non-Destructive Profiling**
  - Less than 5% overhead
  - No need to instrument your code
  - Small output files (10-20Mb is typical)
- **Understand the nature of bottlenecks**
  - Source code viewer pinpoints bottleneck locations
  - CPU, MPI, I/Os and memory metrics identify the cause





Allinea Performance Reports



Effortless one-touch reports

- Add **one command** to your run script
- Generate a **one-page report** automatically

Characterize and understand application performance

- With **< 5%** application slowdown

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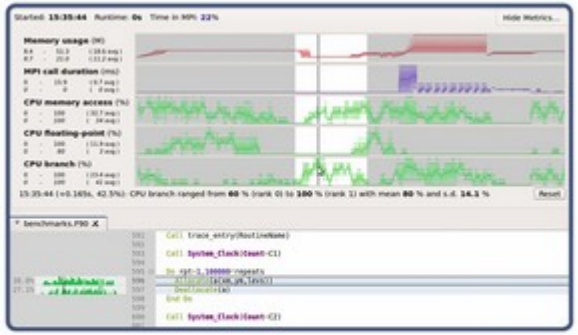
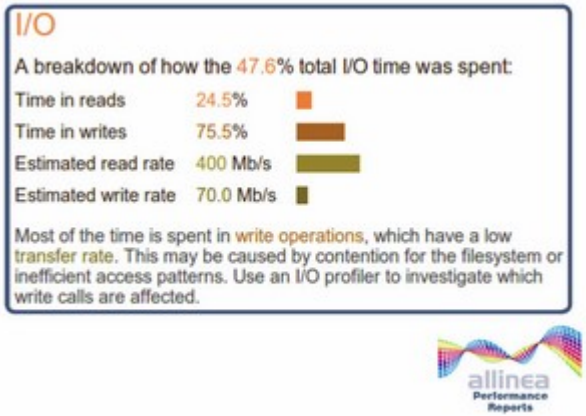
Top Features for HPC Code Optimization

- Allinea's tools provide extensive performance metrics, with low overhead
- Allinea's tools provide a graphical, easy-to-use presentation that is easily understood by scientists, engineers, and software developers
- Allinea MAP shows exactly which lines of source code are slow and why without modifications or instrumentation
- Allinea Performance Reports offers application level performance characterization and advice





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Why HPC Sites Choose Allinea

- ✓ **Scalable software:**
  - As responsive on several hundred thousand processes as on a dozen
  - Funding grants dependent on ability of application to scale
- ✓ **Easy to use, short learning curve:**
  - Modern GUI, designed from ground up for HPC
  - Quickly guides users to results (cost of developer $2,500/week)
- ✓ **Parallel programming is complex & getting harder**
  - Allinea known for automation, fast root cause discovery
  - Only company with integrated tool suite: debugging, profiling, reporting
- ✓ **Follow-me market:**
  - Major US Government labs: DoE, DoD, MPO, standardize on Allinea
  - Most major universities have standardized on DDT & MAP
    - NCSA Blue Waters: 700,000 cores
- ✓ **Simultaneous support:**
  - Support available when Intel, Nvidia announce new versions

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What Our Users are Saying

"My group routinely debugs code at over 100,000 processes using Allinea DDT. No other debugger comes close – obviously it's a hit with users," Oak Ridge National Laboratory

"Allinea's experience and tools will make a big impact in the speed at which scientists can complete their research," NCSA Blue Waters

"Previous experiences with other profilers had left us more confused than informed. Allinea MAP is the opposite."

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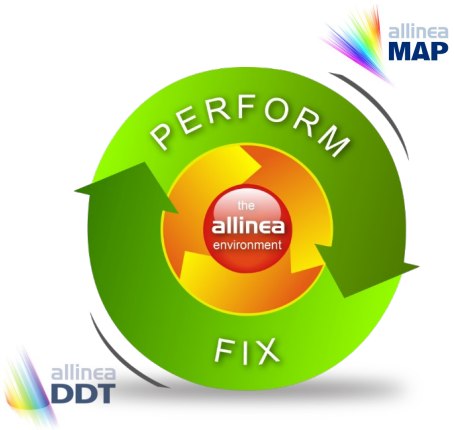

Thank You!

Try it out at:

http://www.allinea.com/products/trials/

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