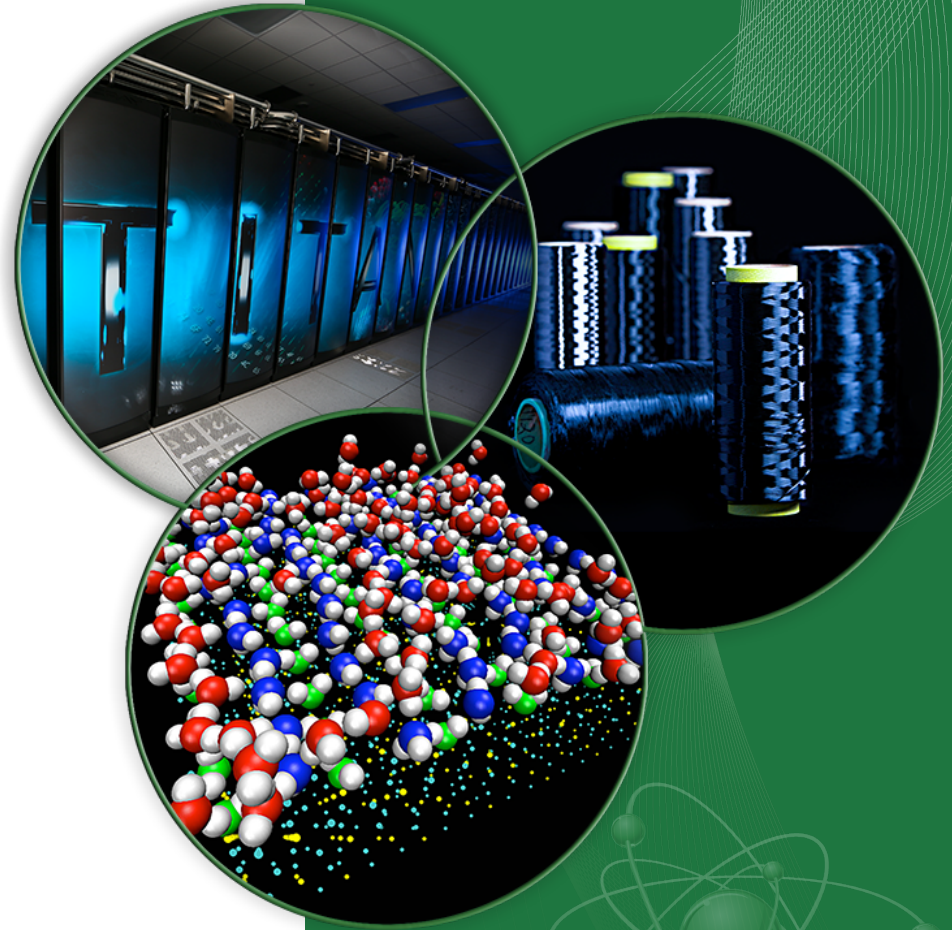


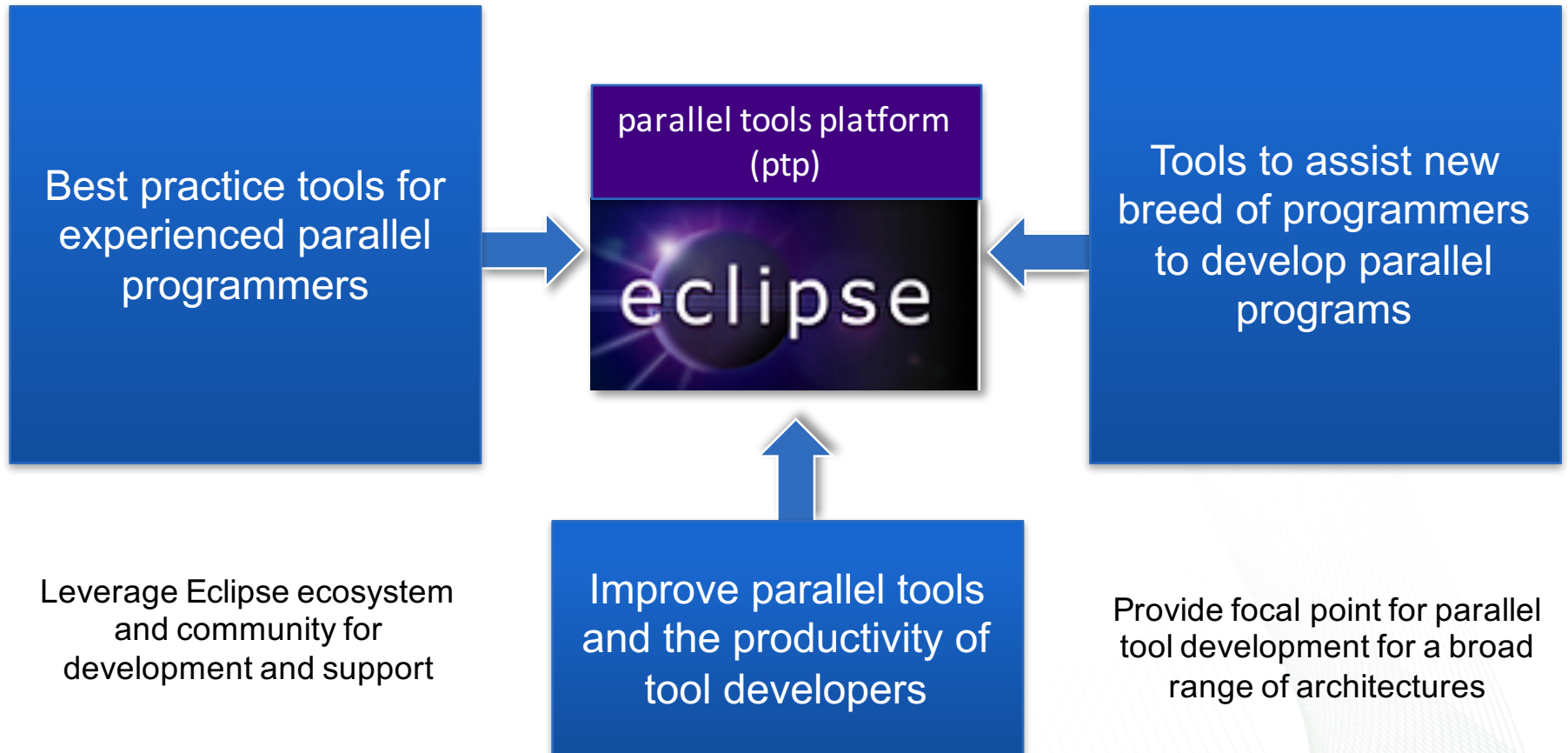
Eclipse for Science

How the Parallel Tools Platform can enhance the development of scientific applications



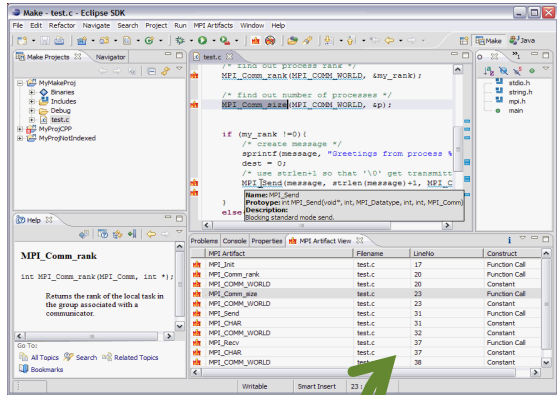
Parallel Tools Platform

Enabling Parallel Application Development

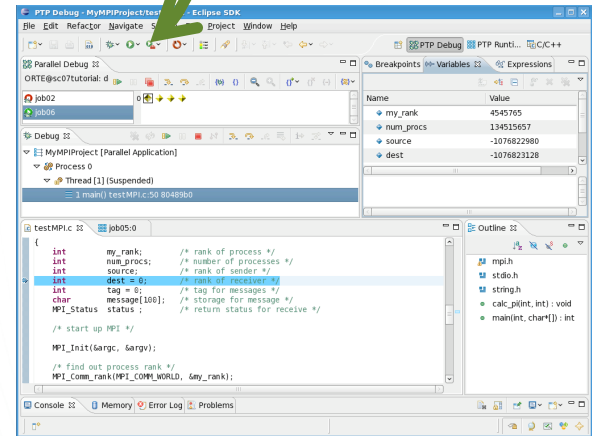
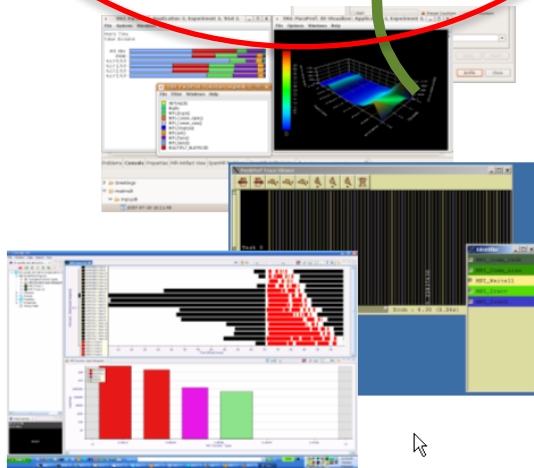
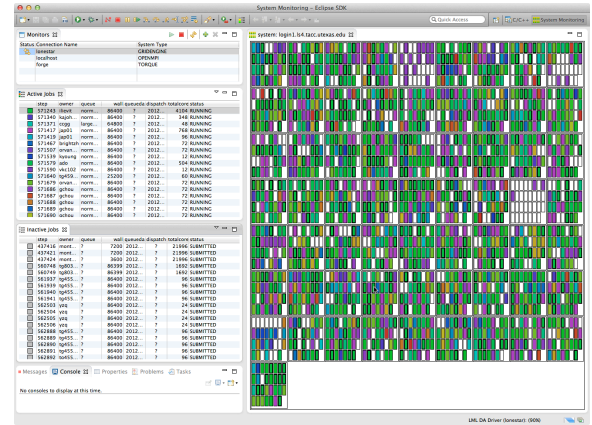


PTP Application Development Cycle

Coding & Static Analysis



Application Execution



Dynamic & Performance Analysis

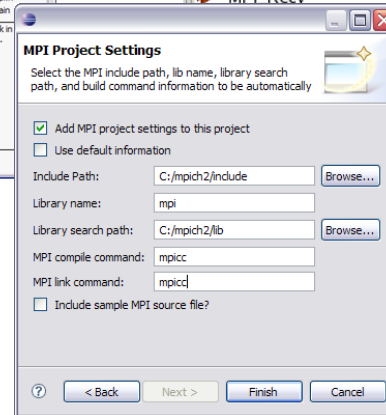
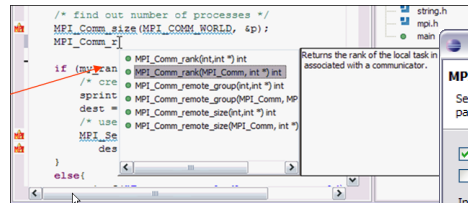
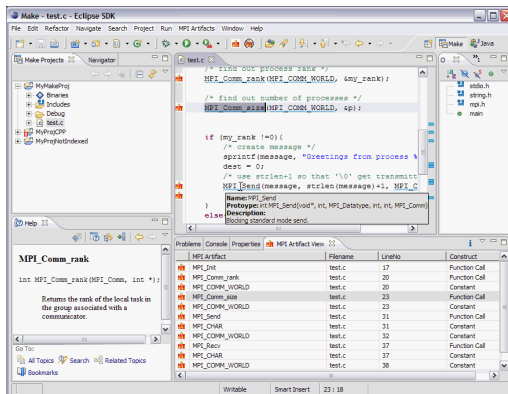
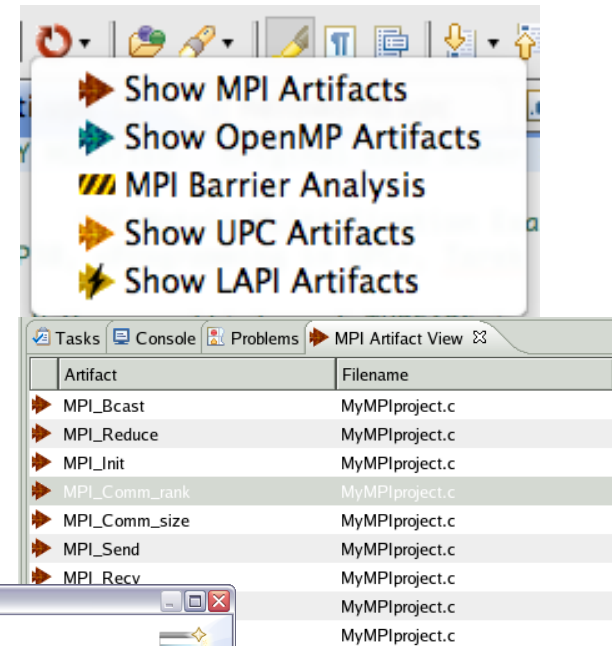
Application Debugging

Coding & Static Analysis

- Eclipse provides a wide variety of coding assistance tools
 - Project management, Editing and formatting, Navigation, Advanced searching, Refactoring, Version control
- C/C++ Development Tools (CDT)
 - Standard (Makefile) and managed builders, Support for arbitrary toolchains, Visual debugging using GDB, High level views (outline view, call hierarchy, type hierarchy, include browser), Refactorings
- Parallel Tools Platform (PTP)
 - Fortran, New project wizards (MPI, OpenMP) Content Assist, Hover help, Built-in API descriptions (MPI, OpenMP, LAPI, UPC), Location of parallel “artifacts” in code (MPI, OpenMP, PAMI, and UPC), Barrier analysis, Deadlock detection
- Python Development (PyDev)
 - Code completion, type hinting, refactoring, debugging, interactive console, unittest, code coverage, Django integration

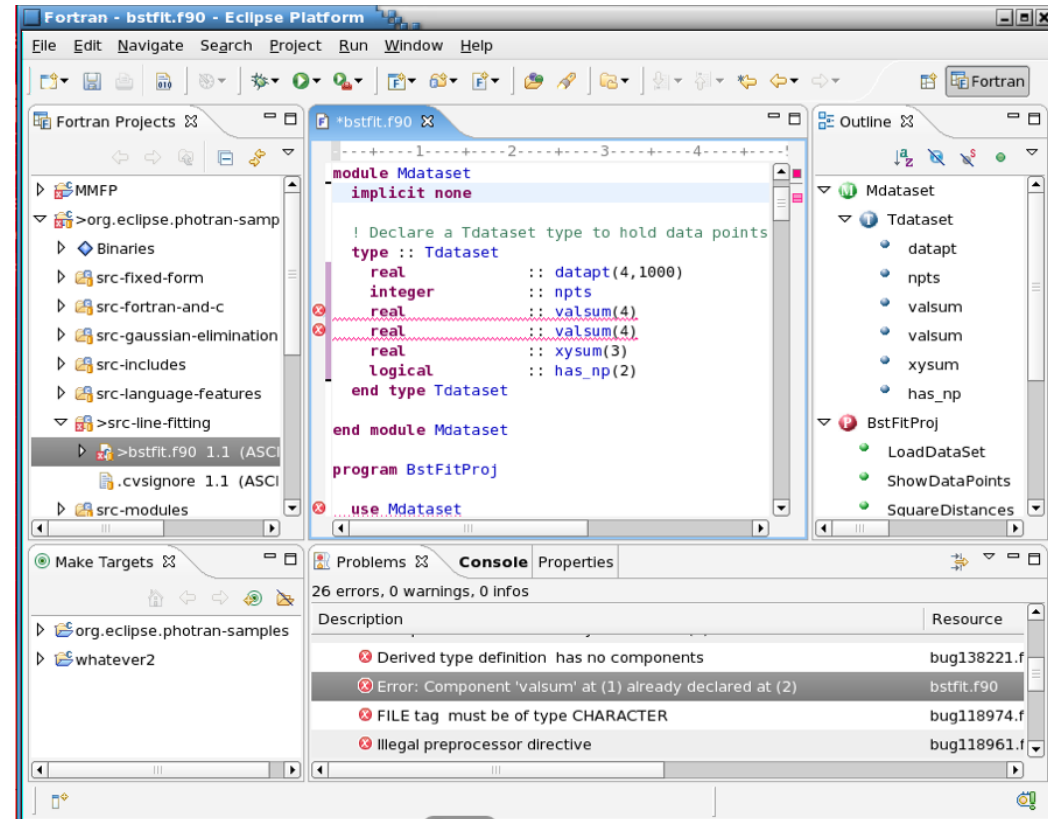
Coding & Static Analysis

- Assistance tools to increase productivity of parallel programmers
 - New project wizards (MPI, OpenMP)
 - Content Assist (command/API completion), hover help, built-in API help descriptions in an html help “view” (MPI, OpenMP, LAPI, UPC)
 - Location of parallel “artifacts” in code: MPI, OpenMP, and UPC

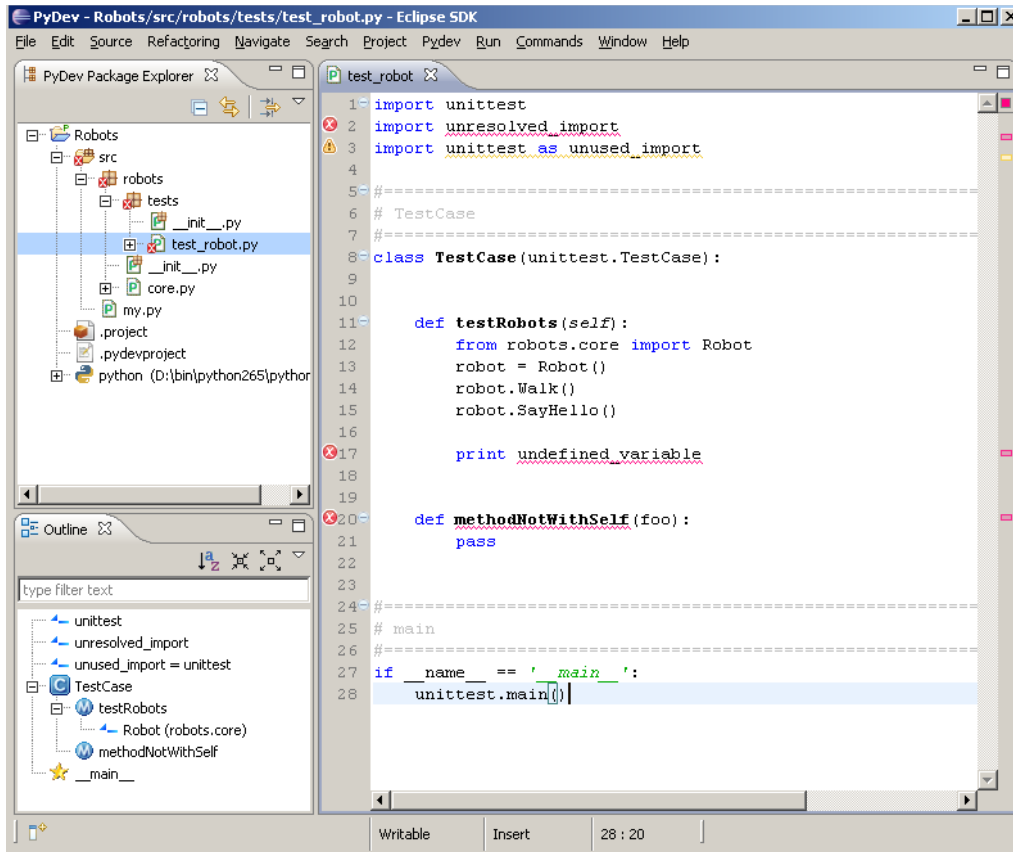


Fortran Development Tools

- Photran features:
 - Supports Fortran 77-2008
 - Syntax-highlighting editor
 - GUI interface to *gdb*
 - Makefile-based compilation
 - Compiler error extraction
 - Outline view
 - Open declaration
 - Fortran refactorings
 - C preprocessor support



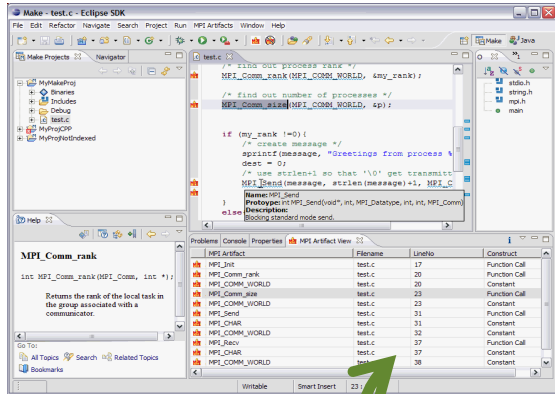
Python Development



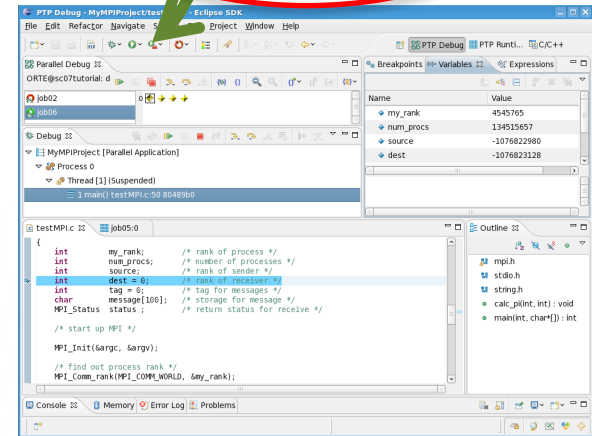
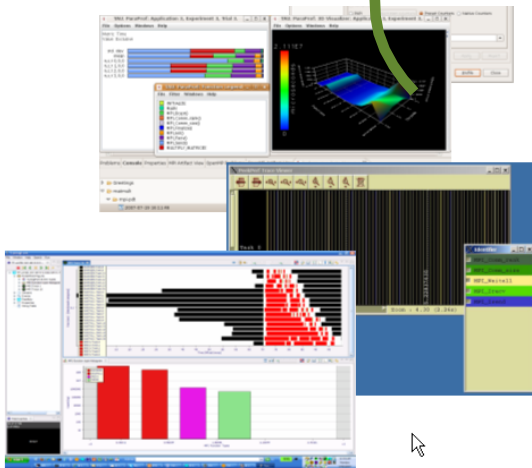
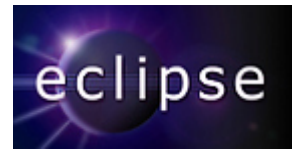
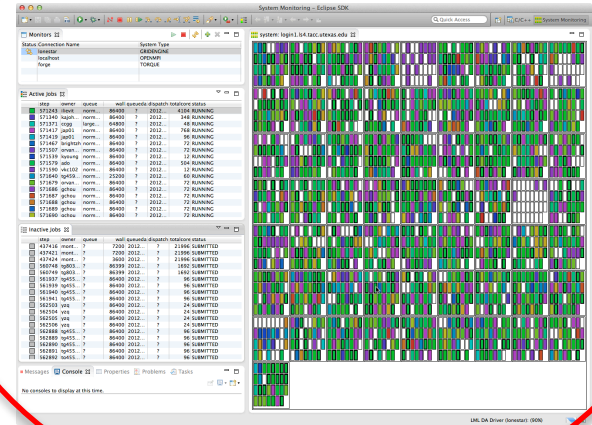
- PyDev is a Python IDE for Eclipse
- Create/manage Python modules
- Full array of Eclipse editing features for Python
- Python debugger
- Interactive console with Python interpreter
- Integration with Python unittest and code coverage modules

PTP Application Development Cycle

Coding & Static Analysis



Application Execution

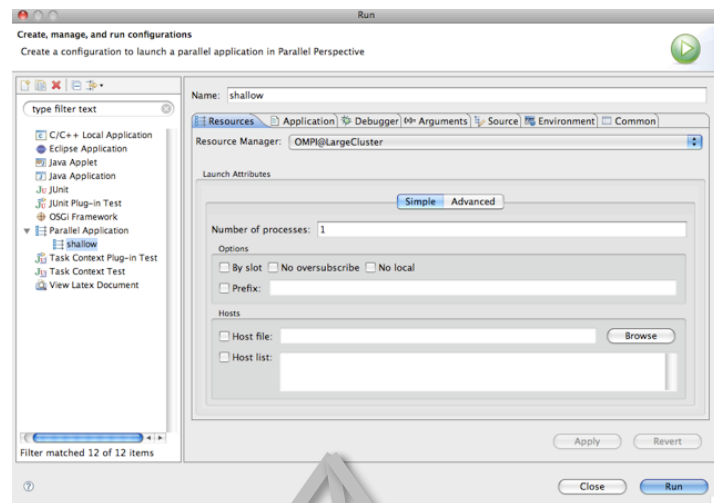
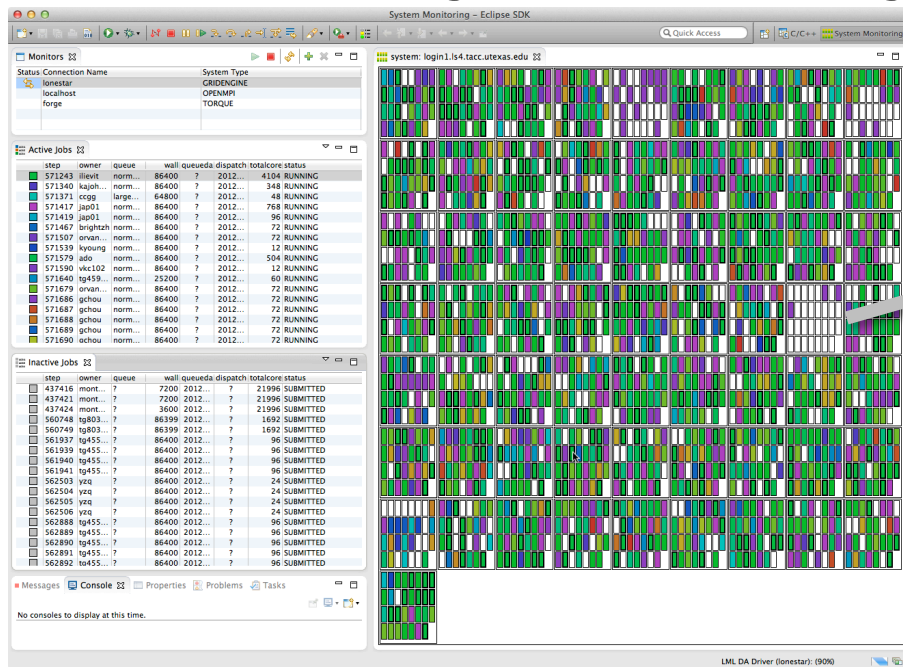


Dynamic & Performance Analysis

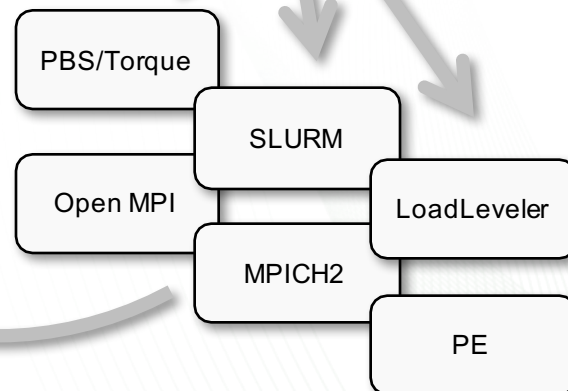
Application Debugging

Application Execution

• Launching & Monitoring



- Improves visibility into target system
- Single point of interface for launching and control
- Manages interaction with different runtime systems and job schedulers

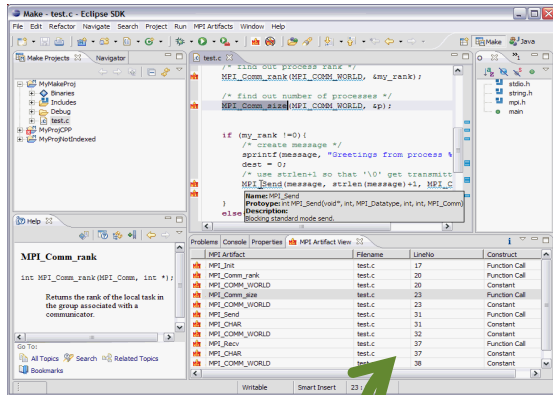


Application Execution

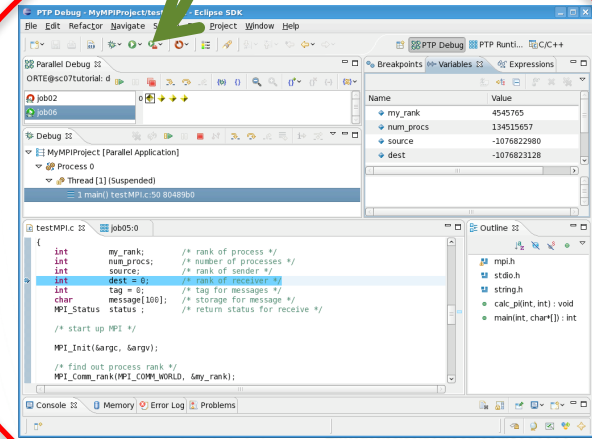
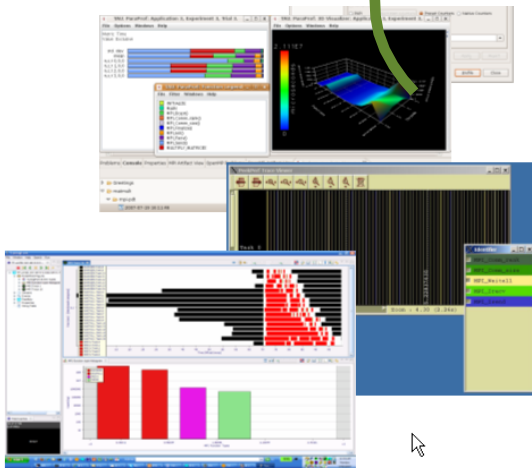
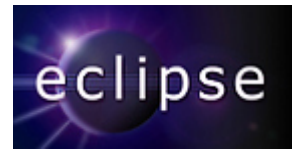
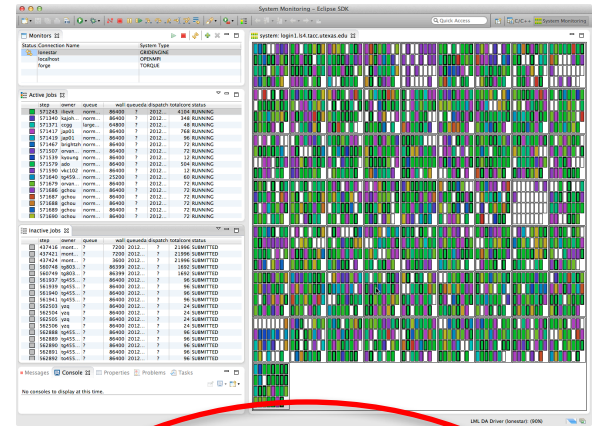
- Target Configuration Framework
 - Extensible framework for launching & monitoring
 - System and node status information
 - Job status (e.g. position in queue) & application status
 - Job submission & control
 - Debugger launch
 - Configuration files to support different resource managers
 - Job schedulers (LoadLeveler, PBS, Torque, SLURM, GridEngine)
 - Interactive runtimes (e.g. PE, Open MPI, MPICH2, MVAPICH)
 - Systems (AIX, Linux, Power, x86, BG/Q, Cray)
 - Local or remote system support
 - Command-line tools executed locally or via ssh connection

PTP Application Development Cycle

Coding & Static Analysis



Application Execution

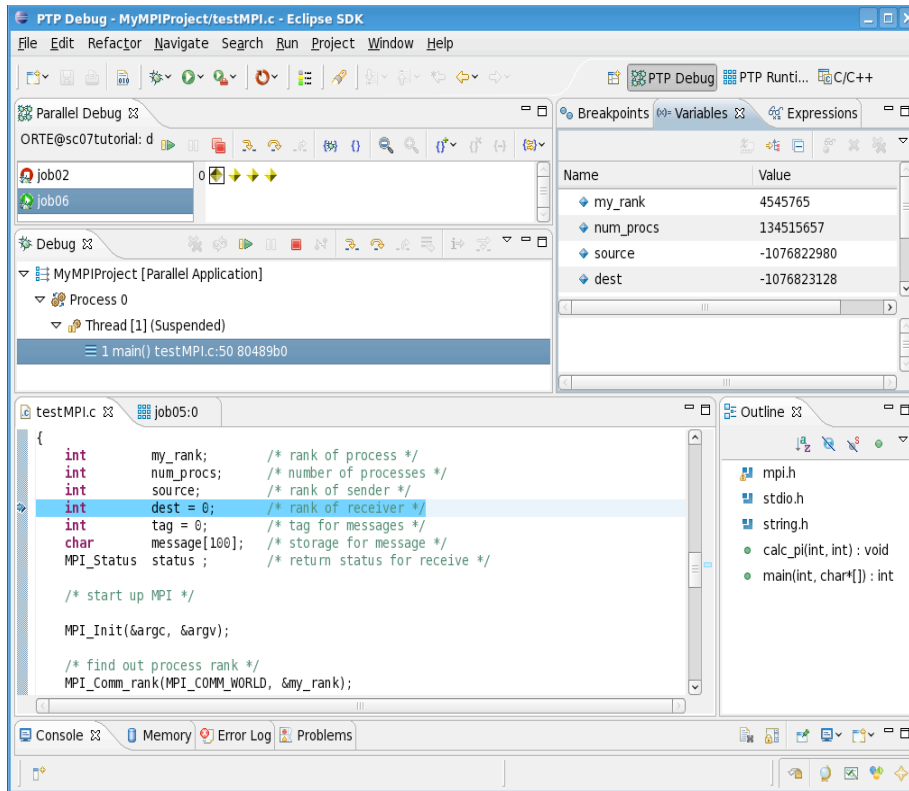


Dynamic & Performance Analysis

Application Debugging

Application Debugging

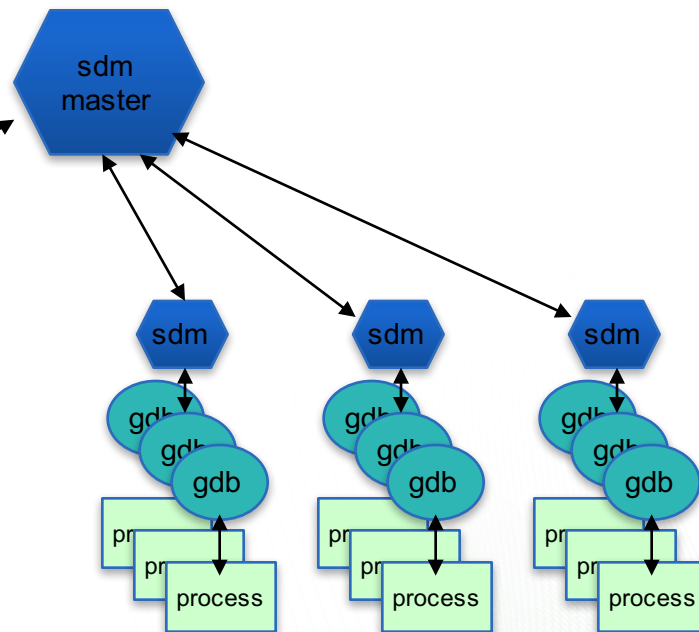
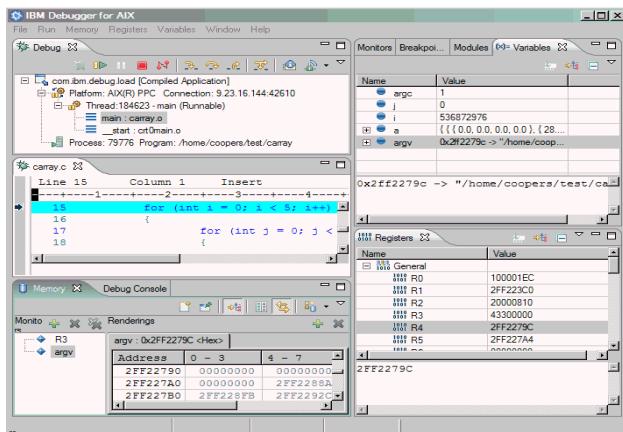
- PTP Parallel Debugger



- Mid-scale integrated debugger
- Tightly integrated with Eclipse
- Supports debugging multiple jobs simultaneously
- Utilizes backend debugger (e.g. gdb) for low level operations
- Targeted at SPMD programming models
- Supports mixed MPI & thread debugging
- Single process and group operations
- Platform for building new debugging paradigms

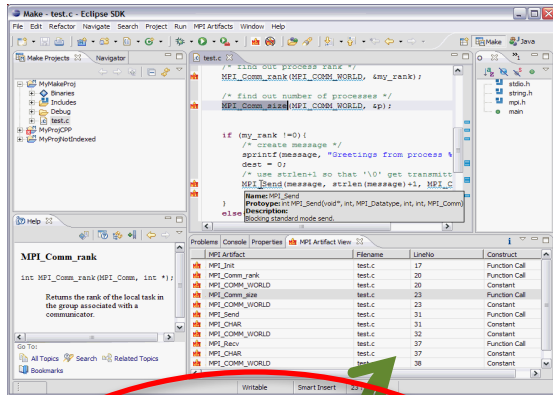
Application Debugging

- Scalable debugger using multicast reduction network
- Integrated with PTP and launched using target configurations
- Supports basic debug commands
- Uses gdb on backend

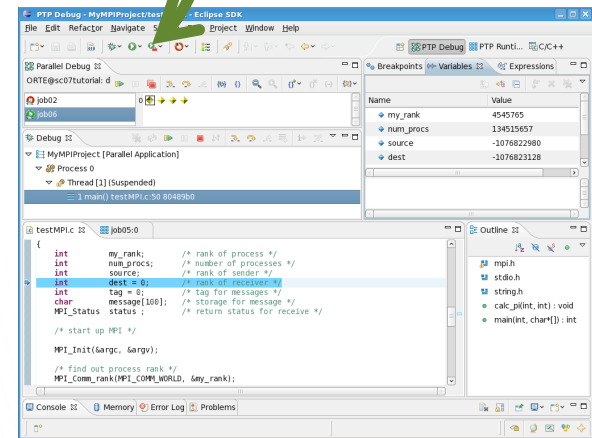
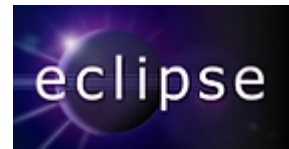
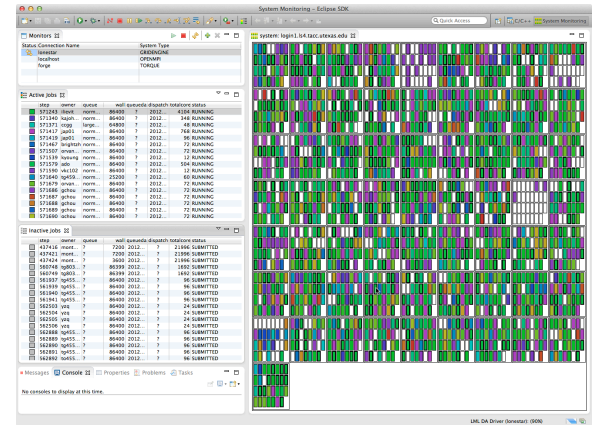


PTP Application Development Cycle=

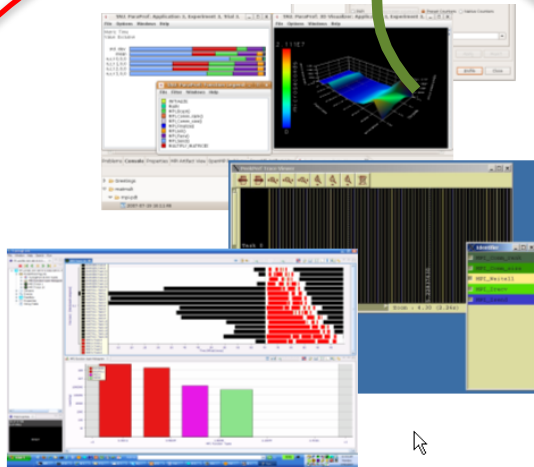
Coding & Static Analysis



Application Execution



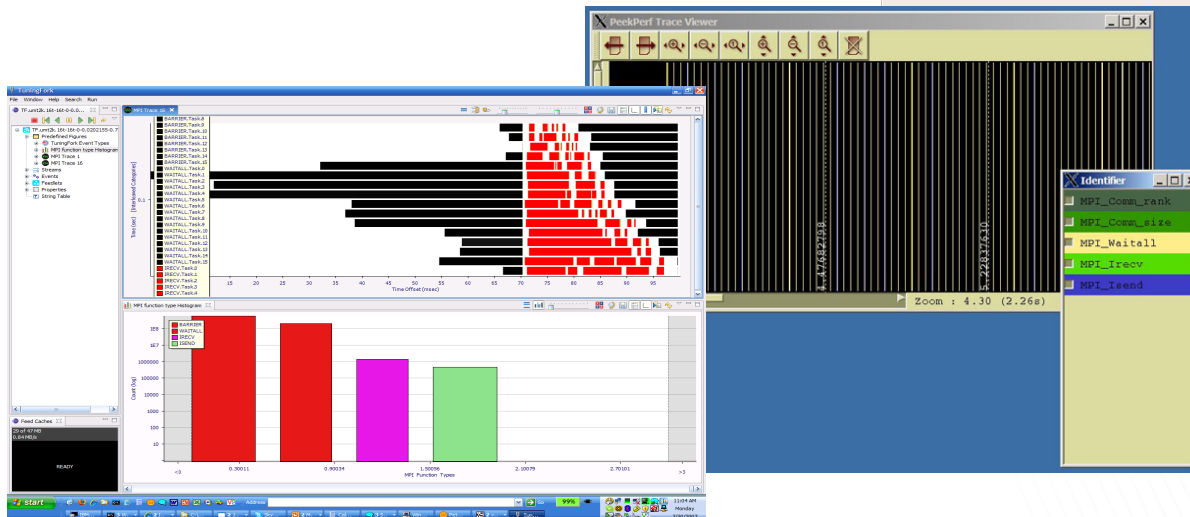
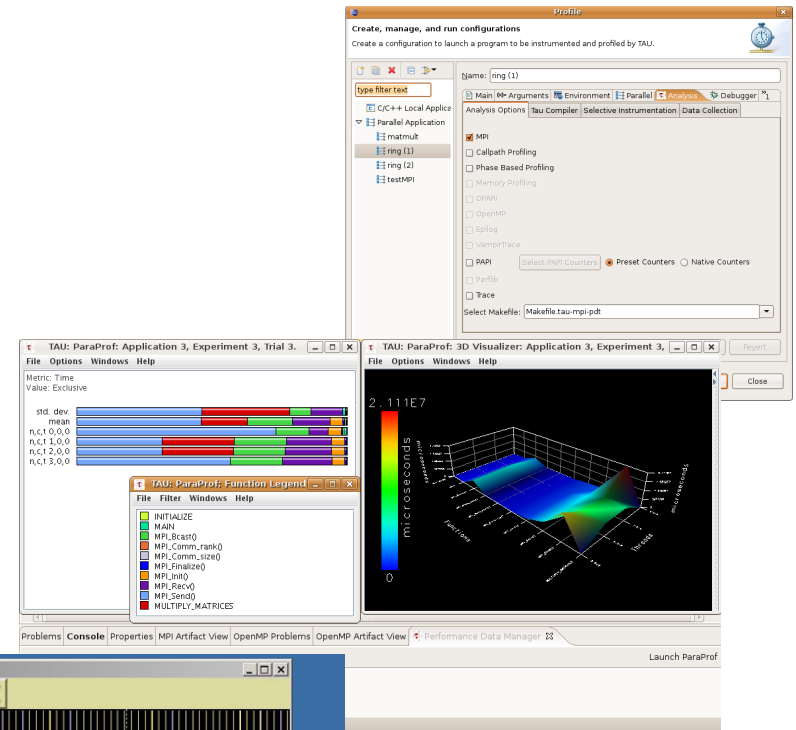
Dynamic & Performance Analysis



Application Debugging

Dynamic & Performance Analysis

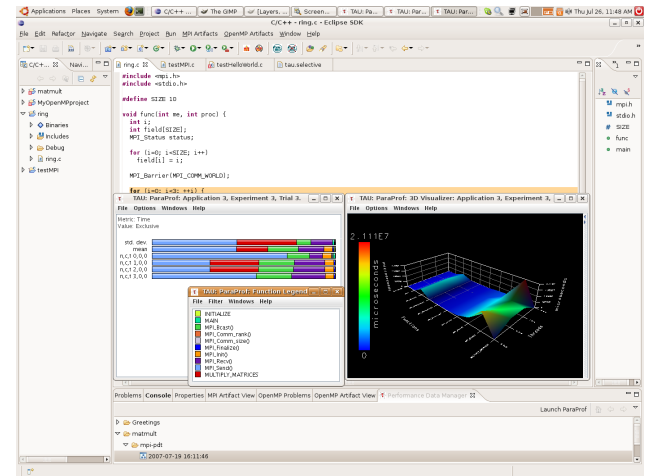
- Dynamic Analysis Tools
 - Perform analysis on the running application using external tools
 - Generate results that must be brought back into Eclipse as part of the development workflow
 - May require external tool for visualization or other purposes



Dynamic & Performance Analysis

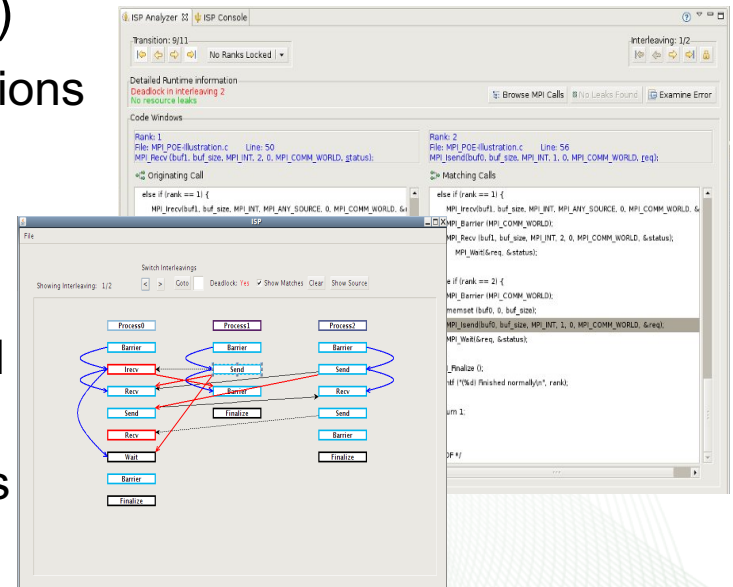
- Tuning and Analysis Utilities (TAU)

- Instrumentation and transparent re-build of application executable
- Execution of profiled application and collect performance data
- Performance data visible in UI
- Launches paraprot visualization client from Eclipse



- Graphical Explorer of MPI Programs (GEM)

- Formal Dynamic Verification of MPI Applications
- Detects all deadlocks, assert violations, MPI object leaks, and default safety properties
- Matches sends and receives
- Allows post-verification review of highlighted bugs
- Works with a variety of MPI implementations



Online Information

- **Information about PTP**

- Main web site for downloads, documentation, etc.

- <http://eclipse.org/ptp>

- Developers' wiki for designs, planning, meetings, etc.

- <http://wiki.eclipse.org/PTP>

- Articles and other documents

- <http://wiki.eclipse.org/PTP/articles>

Community

- **PTP Mailing lists**

- Major announcements (new releases, etc.) - low volume
 - <http://dev.eclipse.org/mailman/listinfo/ptp-announce>
- User discussion and queries - medium volume
 - <http://dev.eclipse.org/mailman/listinfo/ptp-user>
- Developer discussions - higher volume
 - <http://dev.eclipse.org/mailman/listinfo/ptp-dev>