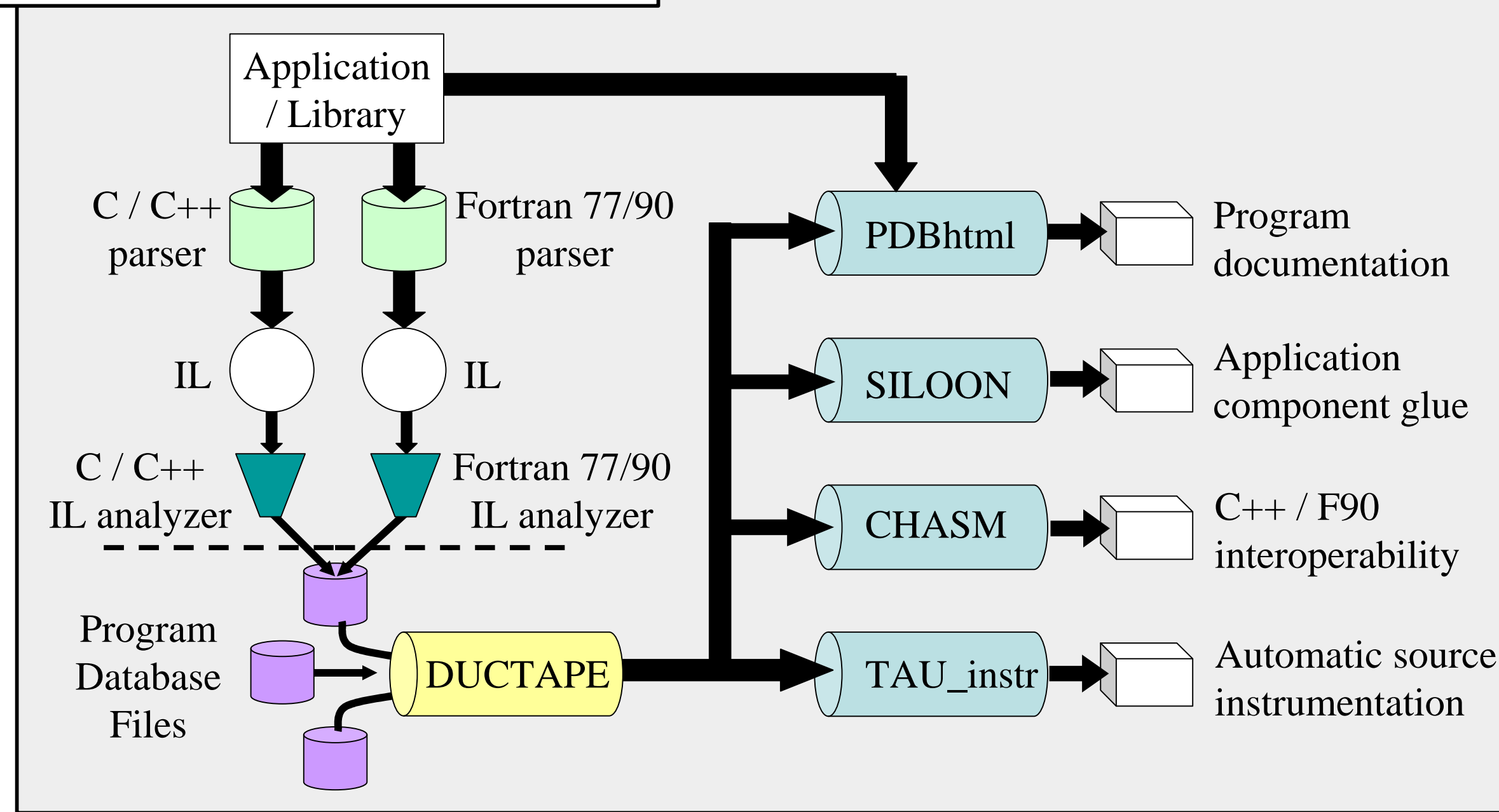
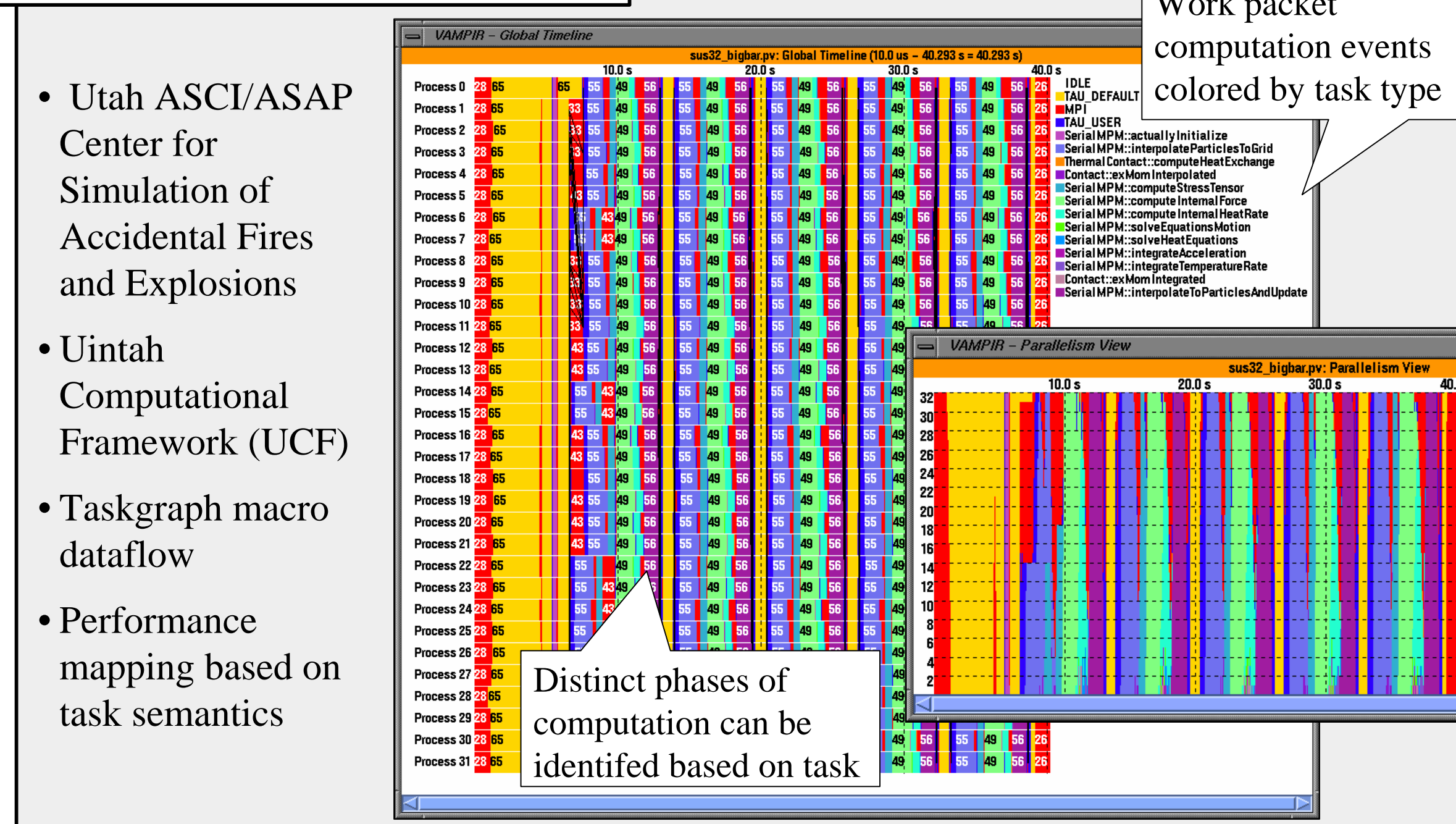


Performance Technology for Tera-Class Parallel Computers: Evolution of the TAU Performance System

Program Database Toolkit (PDT)

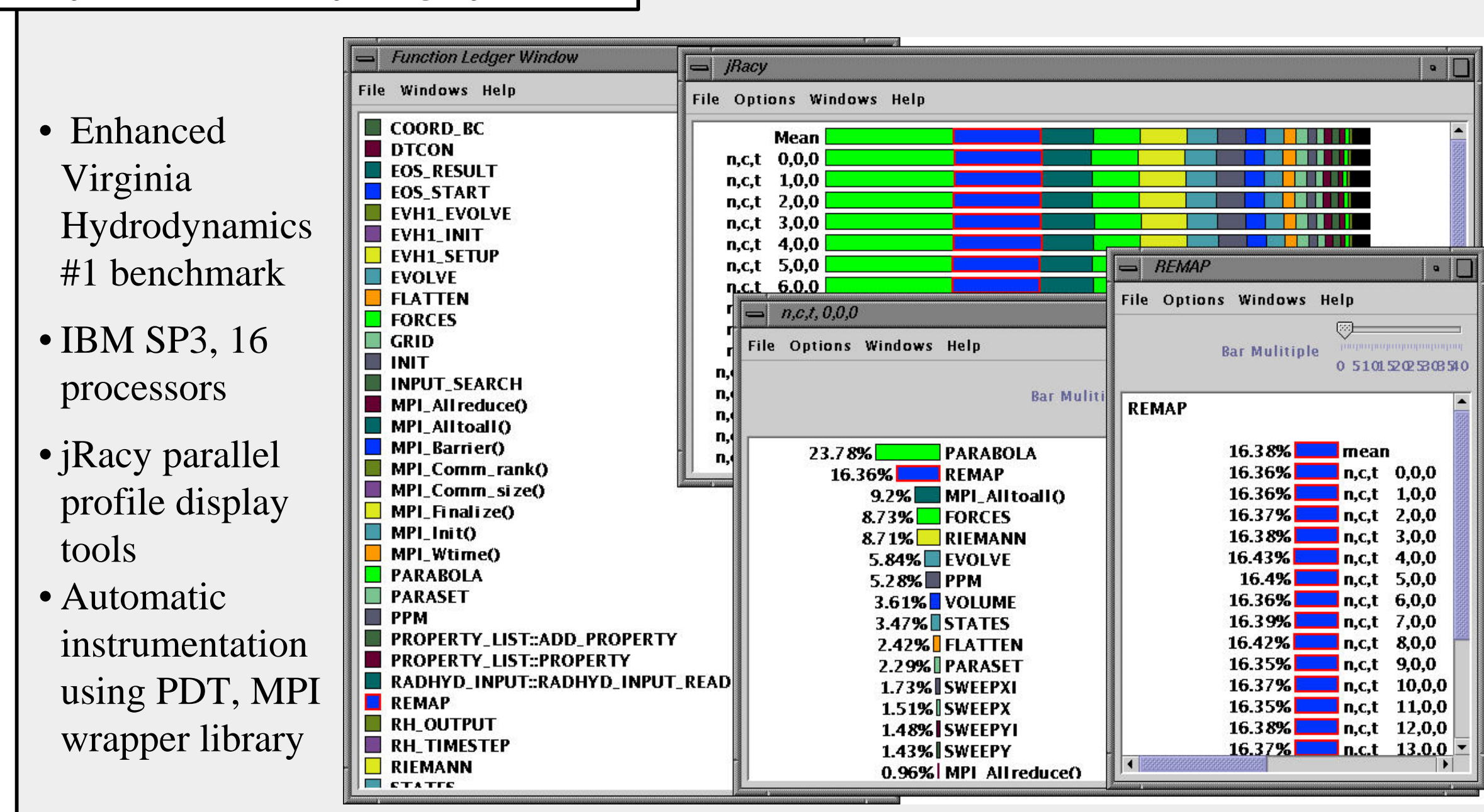


Performance Mapping in Uintah



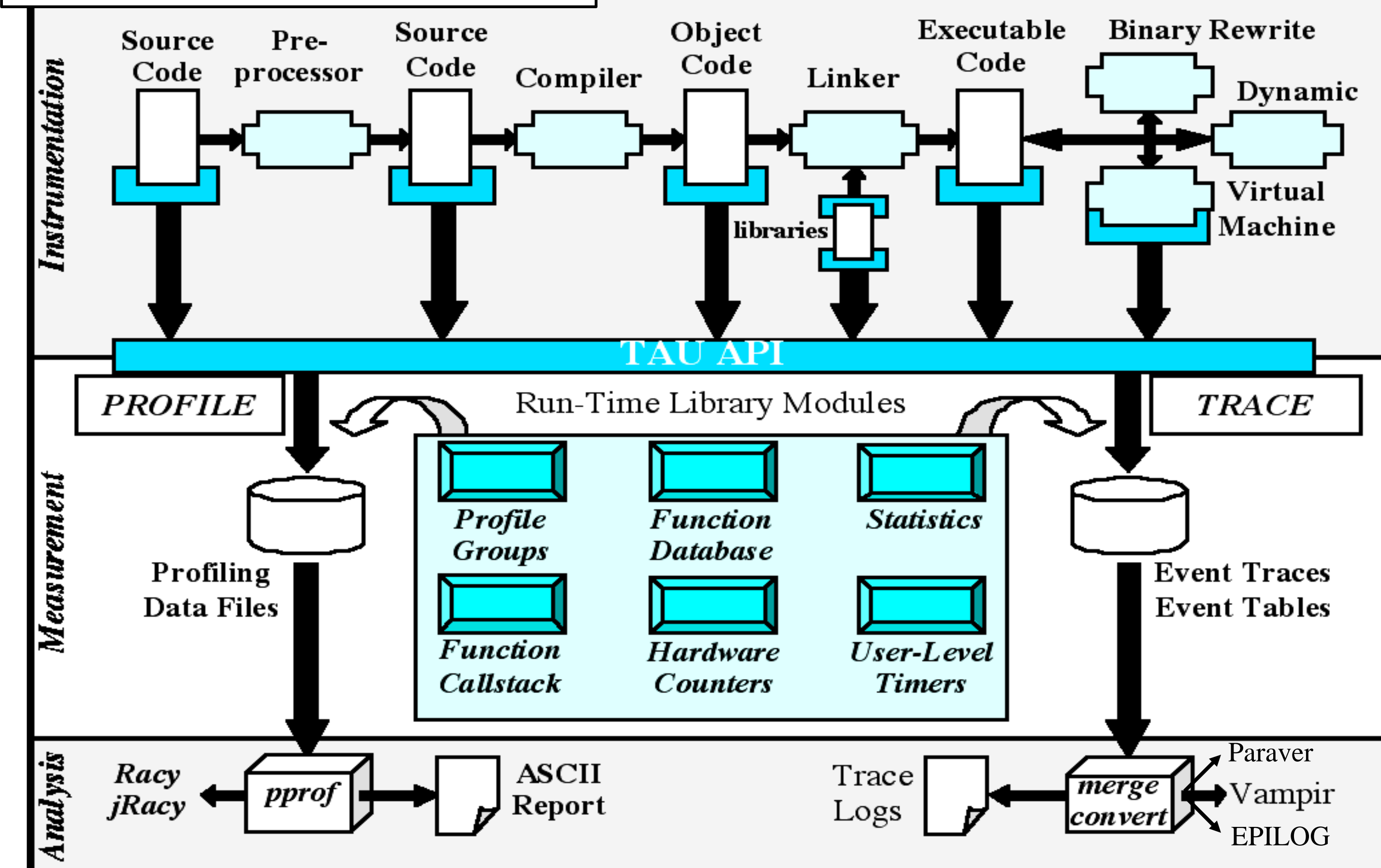
- Utah ASCI/ASAP Center for Simulation of Accidental Fires and Explosions
- Uintah Computational Framework (UCF)
- Taskgraph macro dataflow
- Performance mapping based on task semantics

Performance Profiling of EVH1

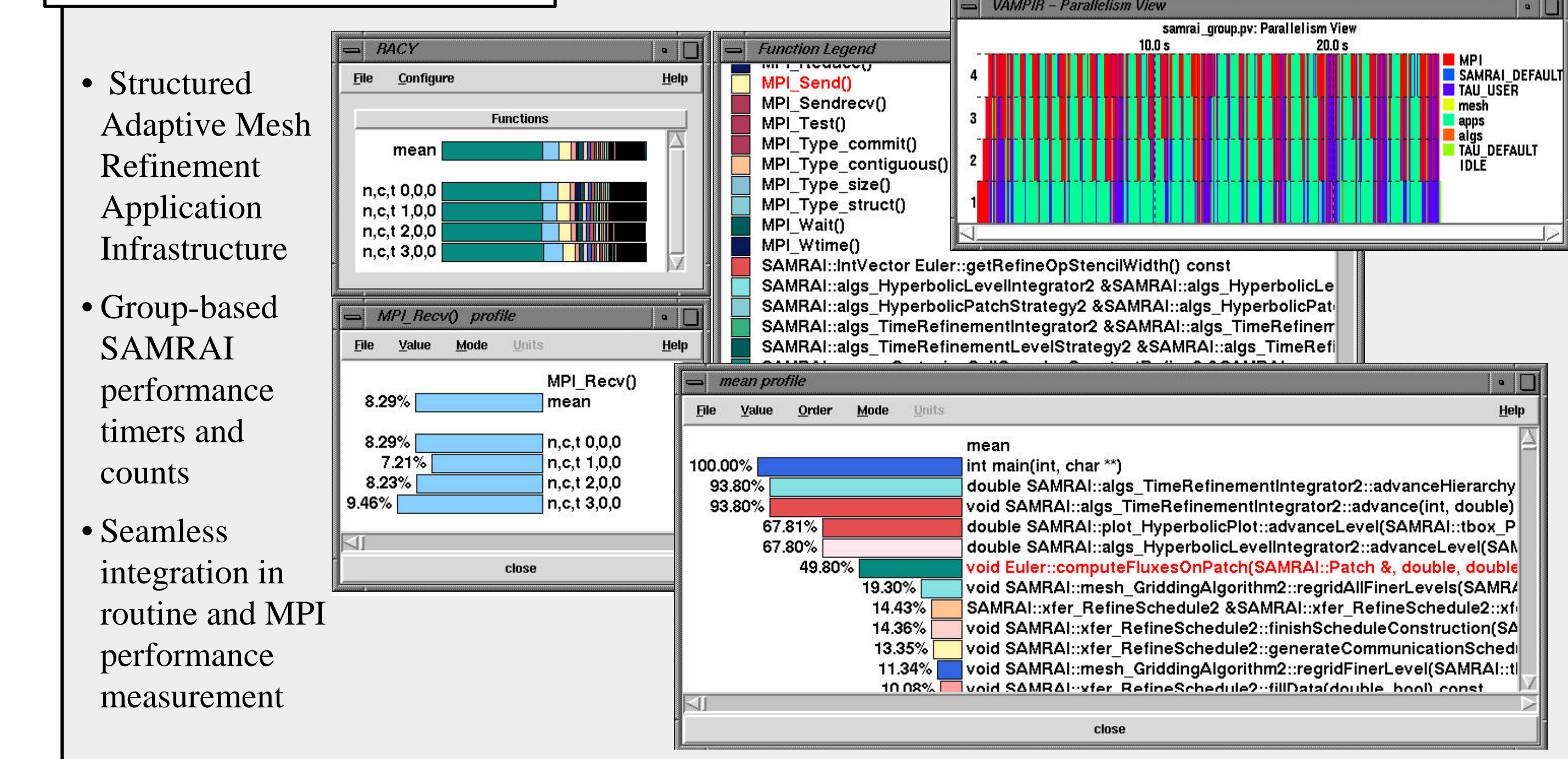


- Enhanced Virginia Hydrodynamics #1 benchmark
- IBM SP3, 16 processors
- jRacy parallel profile display tools
- Automatic instrumentation using PDT, MPI wrapper library

TAU Performance System Architecture



TAU Integration in SAMRAI



- Structured Adaptive Mesh Refinement Application Infrastructure
- Group-based SAMRAI performance timers and counts
- Seamless integration in routine and MPI performance measurement

TAU Performance System Status

Platforms: IBM SP3, SGI Origin 2K/3K, Compaq Alpha Tru64/Linux Cluster, Cray T3E, Linux x86 / IA-64 clusters, Hewlett-Packard Superdome/V-class, Hitachi SR8000, NEC SX-5

Languages: C, C++, Fortran 77, F90, OpenMP, Java, Python

Thread libraries: pthreads, SGI sproc, OpenMP, Java, Windows

Communications libraries: MPI, PVM, SHMEM

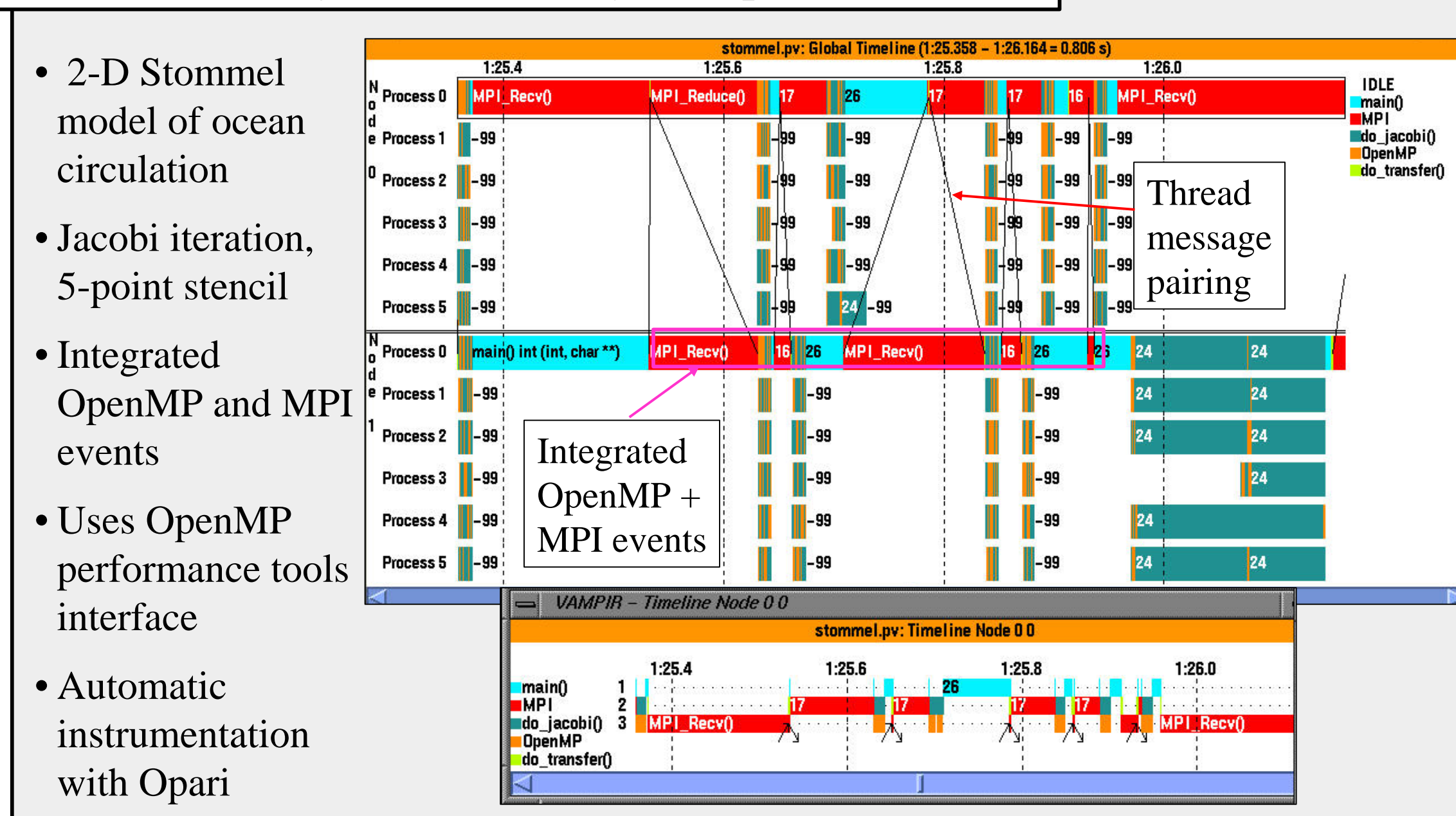
Parallelism paradigms: shared memory multi-threading, distributed memory message passing, mixed-mode

Performance technologies: Dyninst dynamic instrumentation, PAPI and PCL hardware counter libraries, Opari automatic OpenMP instrumentation, EPILOG tracing library, EXPERT trace analyzer, Vampir trace visualization, Paraver trace visualization

TAU Applications

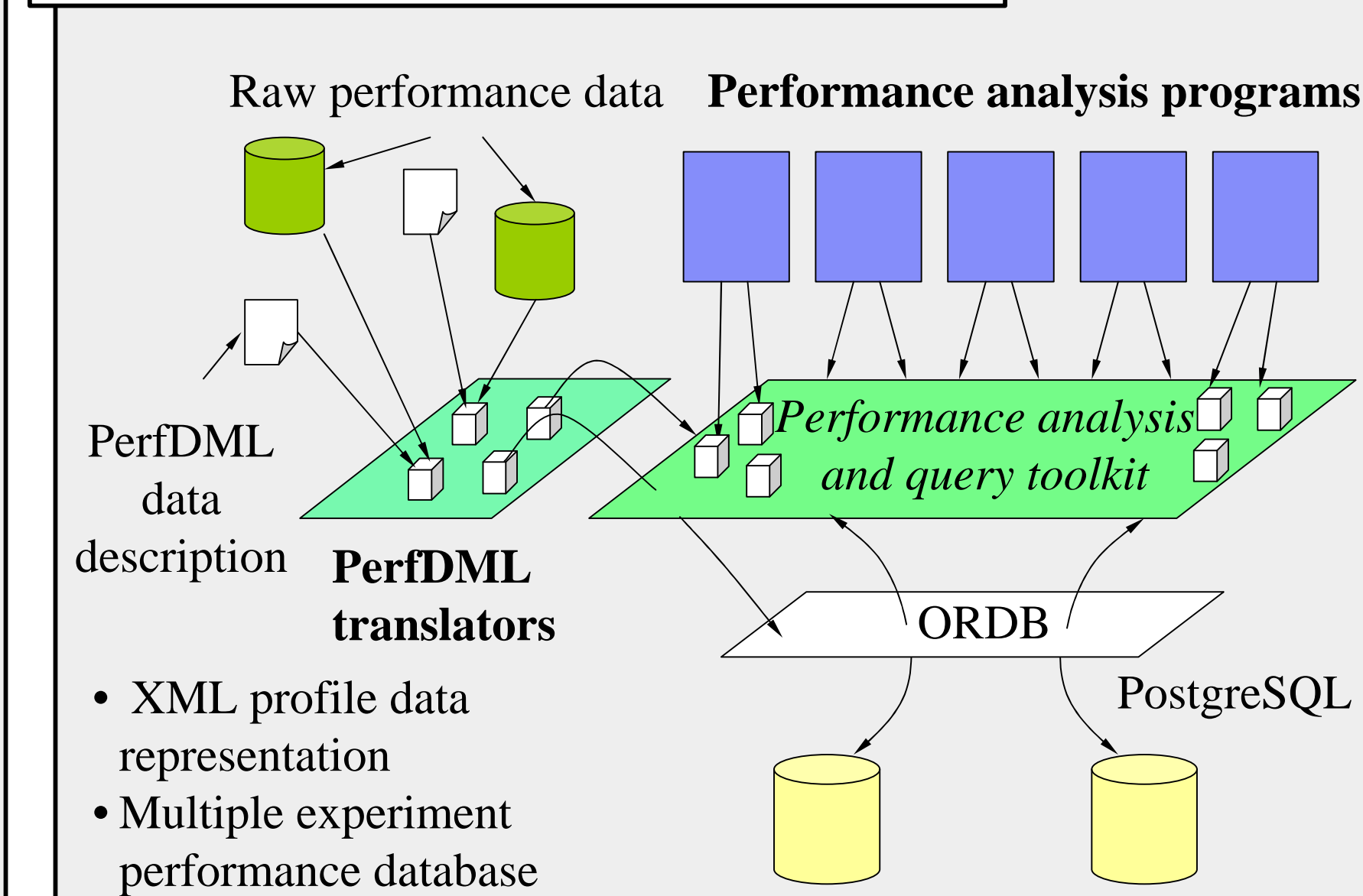
- SAMRAI** (LLNL, Andy Wissink). TAU is being integrated in SAMRAI framework as the main performance measurement facility, replacing hand-instrumented counters and timers. TAU is included as part of the SAMRAI distribution.
- OVERTURE** (LLNL, Brian Miller). TAU is being used in the Overture framework for object-oriented performance measurement. Miller has also integrated TAU in the adaptive-mesh refinement simulator, AMRsim, and is using TAU for another (undisclosed) software development project.
- ALPS** (LLNL, James Schek). The Adaptive Laser Plasma Simulator uses SAMRAI as a software component. It gains access to TAU's measurement support in SAMRAI as well as uses TAU directly in other ALPS code.
- C-SAFE** (ASCI/ASAP; Utah, Chris Johnson and Steve Parker). TAU is being integrated in the Uintah Computation Framework (UCF) for use in performance measurement and analysis of C-SAFE applications. This work also includes new performance regression analysis and results reporting tools for cross-version and cross-experiment performance evaluation.
- PERC** (DOE SciDAC; PERC consortium). TAU has been installed at PERC sites and is being applied in performance analysis studies of SciDAC applications, including the EVH11 astrophysics code. Oregon is an affiliate member of PERC.
- VTF** (ASCI/ASAP; Caltech, Julian Cummings and Michael Aivazis). TAU is being integrated in the Virtual Test Facility (VTF) infrastructure because of its sole ability to portably measure performance across HPC systems with dynamically-loaded libraries and Python-controlled execution.
- OpenMP** (ASCI Path Forward; Intel/KAI, Bob Kuhn; Pallas, Hans-Christian Hoppe). A performance monitoring interface for OpenMP is being defined and will be submitted to the OpenMP Architecture Review Board for standardization. A prototype has been developed and demonstrated with the TAU performance system and the EXPERT analysis tool.
- SAGE** (LANL, Jack Horner). TAU has been applied to performance scalability analysis of the SAGE application. TAU is the only performance system that reliably provided a portable parallel profiling capability across all ASCII platforms.
- POOMA II** (LANL / Code Sourcery LLC, Jeffrey Oldham and Mark Mitchel). TAU has been used as the primary tool for performance analysis throughout the POOMA project, most recently in the POOMA 2 development. TAU is the only tool able to instrument and measure the complex use of C++ templates and expression template parallelization in the POOMA framework.

Mixed-Mode Performance Analysis (OpenMP + MPI)



- 2-D Stommel model of ocean circulation
- Jacobi iteration, 5-point stencil
- Integrated OpenMP and MPI events
- Uses OpenMP performance tools interface
- Automatic instrumentation with Opari

TAU Performance Database Framework



- XML profile data representation
- Multiple experiment performance database

Project Goals and Recent Accomplishments

- Dynamic performance measurement control**
 - Dynamic event grouping
 - Multiple configurable counters
 - Selective instrumentation
- Application-Level Performance Access**
 - Incremental profile dumping
 - Runtime profile access
- Multi-Level Performance Instrumentation and Mapping**
 - Optimized instrumentation
 - Tracing library enhancement
 - Performance mapping profile display
- System and Hardware Performance Integration**
 - Callback registration for system and hardware counters
 - Trace recording of counts