SvPablo: A multi-language Architecture-Independent Performance Analysis System

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Goal of their work.

- Development of a GUI tool kit which can…
  - Correlate sequential/ parallel source code with dynamic performance data from both software and hardware measurements
  - Provide a portable, intuitive and easily used interface.

Their achievements.

- SvPablo(source view pablo):
  - Is a graphical environment for instrumenting application source code and browsing dynamic performance data.
  - Is portable, language independent, and performance metric independent(enabled by using the SDDF-self describing data format).
  - Supports for applications executing on both sequential and parallel systems and exploits hardware support of performance counters.

Details: How did they achieve that?

- Performance Instrumentation
- Hardware performance integration
- Performance Visualization
- Language and Architecture Transparency

Performance instrumentation

- Supports both interactive and automatic instrumentation.
- Automatic instrumentation
  - Support analysis of HPF code.
  - Why not allow interactive instrumentation?
    - HPF compiler does high-level optimizations and allowing users to instrument data parallel source code can potentially inhibit any of these optimizations, reducing performance.
  - Let HPF compiler emit instrumented code, which calls the svPablo library. It captures data for each executable line and every procedure call.

Performance instrumentation

- Interactive Instrumentation
  - Most compilers for sequential languages primarily focus on local optimizations.
  - Support interactive instrumentation of C and Fortran.
  - Restrict instrumentable constructs to outer loops and procedure calls.

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Hardware performance integration

- Software instrumentaion is simply not enough! We need to consider also…
  - Superscalar instruction execution effect
  - Cache effect in hardware-managed distributed shared memory hierarchy
- New microprocessors commonly provide a set of performance registers. (cycles, cache misses, floating point instructions, branch misprediction, etc.)

Hardware performance integration

- During program execution, the SvPablo library queries the user-selected counters and records them.
- After program execution, the SvPablo records its statistical analyses in a set of summary files, one for each executing process and merges them computing new global statistics, which is input to the analysis graphical interface.

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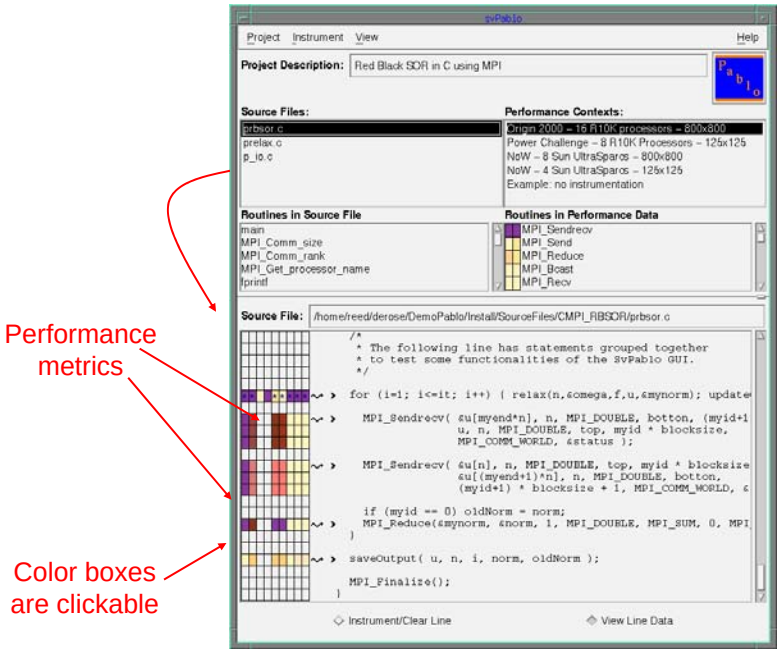

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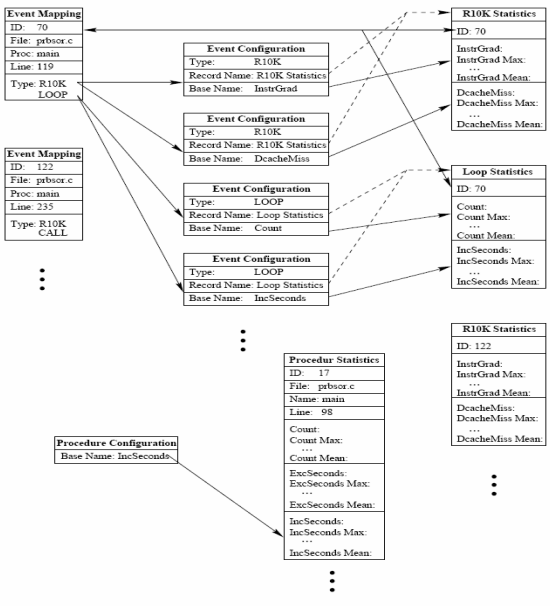
Language and Architecture Transparency

- Requires a flexible specification mechanism for instrumentation points and performance metrics.
- SDDF (self-describing data format) separates performance data presentation from language and architecture
  - A group of record descriptors and record instances.
  - Three groups of record descriptors: mapping, configuration, and statistics.



SvPablo SDDF Record Hierarchy

Language and Architecture Transparency

- SDDF main features.
  - Portability: portable directly across systems, in binary or ASCII format
  - Generality: a variety of events or data types can be supported
  - Extensibility: tool developers can easily add new metrics

Language and Architecture Transparency

- Event Statistics
  - Performance data is represented by a Event Mapping record and a set of Statistics records
- Procedure Statistics
  - Procedure statistics records define the performance metrics associated with all procedures: # of calls to the procedure and the exclusive duration of the procedure. etc.

Related Works

- Paradyn (U of Wisconsin)
  - a tool for measuring the performance of large scale parallel programs
  - Instrumentation and visualization are performed during run-time.
- Pablo (U of Illinois)
  - Consists of several components for instrumenting and tracing parallel programs and for analyzing the trace file.
- AIMS (NASA Ames Research)
  - A tool kit for parallel applications.
  - Support MPI and PVM.

SvPablo Summary.

- A graphical environment for instrumenting application source code and browsing dynamic performance data.
- Support for not only software performance measurement but also access to hardware performance counters.
- Language and architecture transparency by representing performance data via XML-like format.