The Performance Analysis Infrastructure for the Cray XT3

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The Cray Tools Strategy

- Must be easy to use
- Integrated performance tools solution
- Strategy based on the three main steps normally used for application optimization and tuning:
  - Debug application
    - Nobody really cares how fast the program can compute the wrong answer
  - Single processor optimization
    - Make the common case fast
      - **Profile** based on runtime summarization
  - Parallel processing and I/O optimization
    - Communication / barriers / etc.
      - **Profile and trace** based visualization tools
- Close interaction with application developers for feedback, targeting functionality enhancements

Cray Performance Analysis Infrastructure

- CrayPat
  - **pat_hwpc**
    - Utility for whole program performance measurement
  - **pat_build**
    - Utility that instruments the application
      - Based on binary rewrite
      - No source code modification required
  - **CrayPat run-time library** (transparent to the user)
    - API for performance collection at finer granularity
    - Collects performance data during execution
    - Writes performance file
  - **pat_report**
    - Utility to create a text report or a performance visualization file
  - **pat_help**
- Cray Apprentice^2
  - Graphical performance analysis and visualization tool

Single Processor Optimization

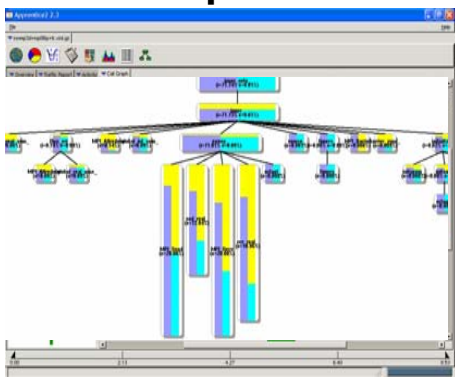
- Answer the following questions:
  - Do I have a performance problem at all?
    - Time / Resource / Hardware Counters measurement
    - Provides overall view of the program execution
      - **pat_hwpc** a.out
  - Where are the main bottlenecks?
    - Profilers (Flat, Call graph, Function)
      - **CrayPat profile** with runtime summarization
  - Why is it there?
    - HW counters based Instrumentation library
      - **CrayPat profile** with runtime summarization
      - Automatic or hand instrumentation for fine grain measurements

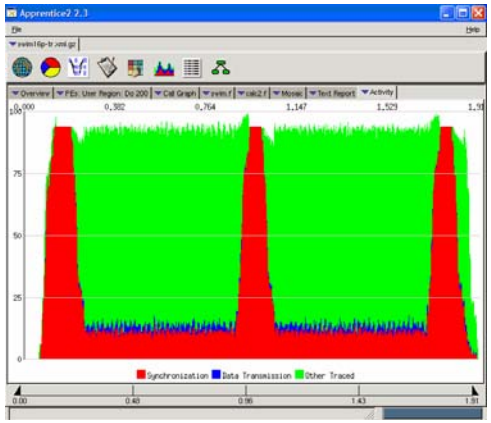
Parallel Processing Optimization

- Answer the following questions:
  - Do I have communication/synchronization problems?
    - Communication profiler
    - Load balance profile
      - CrayPat
  - Why?
    - Tracing
      - CrayPat tracing library
    - Cray PAT Visualization GUI
      - Cray Apprentice^2

Cray Apprentice2

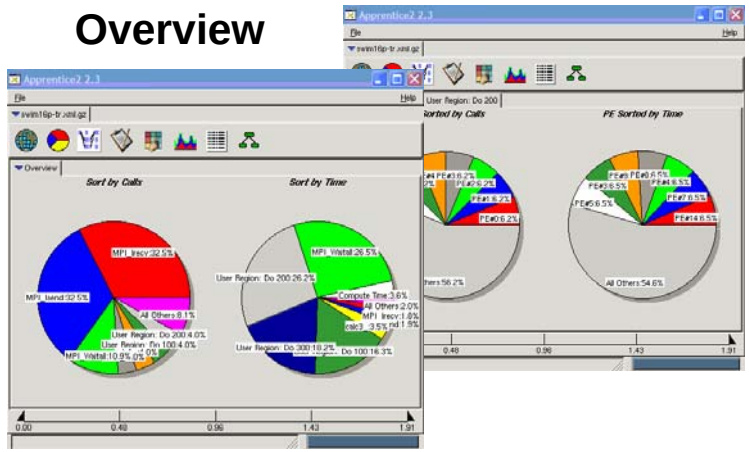
Call Graph Profile

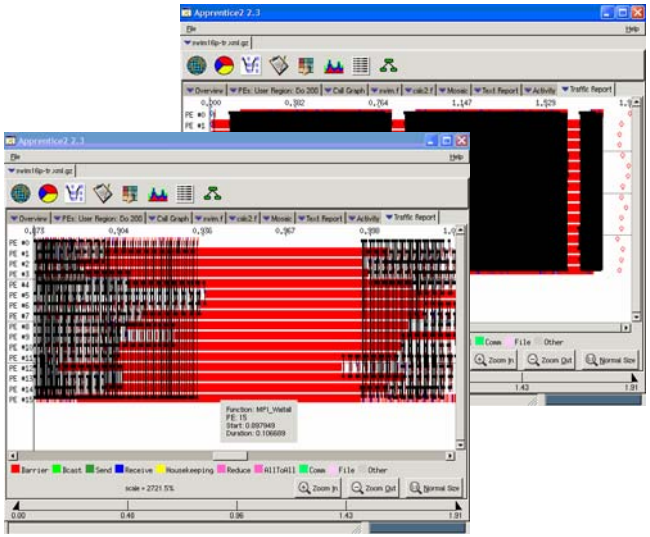




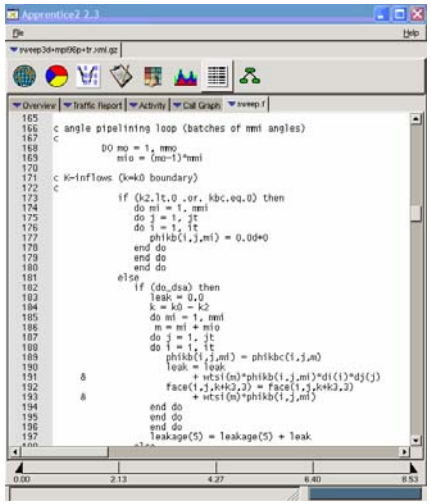
Communication Activity View

Communication Overview

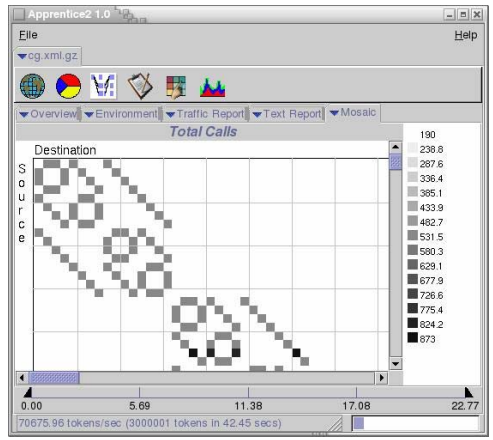




Time Line View



Source code mapping



Pair-wise Communication View

Conclusions

- Cray performance tools infrastructure was designed to address all steps of the performance tuning process

- Close user interaction provides essential feedback for development of a practical performance tools infrastructure and for functionality enhancements

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Cray Apprentice^2 - Load Balance