

WCET Tool Challenge 2006

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WCET Tool Challenge - the Mission

- **Compare WCET tools** under the aspects:
 - precision, tightness of estimated WCET value,
 - efficiency, run time of the tool,
 - flow analysis (e.g., number of automatically found loop bounds)
 - required user interaction, (e.g., number of program-specific manual annotations)
- Comparability is difficult
 - architecture and compiler dependence
 - measurement-based and static approaches
 - emphasis on different subtasks

Purpose

The purpose of the WCET Tool Challenge is

- to be able to study, compare the properties of different WCET tools and approaches,
- to define common metrics,
- to enhance the existing WCET benchmarks.

See <http://www.idt.mdh.se/personal/jgn/challenge/>

The Benchmarks

Mälardalen WCET Benchmarks

- A collection of 30+ benchmark programs from diverse sources (15 selected)
- Different codes (loops, nested loops, arrays, matrixes, bit operations, recursion, unstructured code, floating point etc.)
- Single path and multi path modes
- Varying sizes (\approx 100 to 1300 LOC)

PapaBench

- Based on a real and complete real-time embedded application
- Consists of two tasks, total size \approx 2000 LOC
- Software developed in the Paparazzi project, to be used on Unmanned Aerial Vehicles (UAV).
- Quite complex code that makes extensive use of floating point computation and mathematical library routines

The Tools

- **aiT** - a commercial tool from AbsInt, Saarbrücken, Germany
- **Bound-T** - a commercial tool from Tidorum, Espoo, Finland
- **MTime** - a research prototype from TU Vienna, Austria
- **SWEET** - a research prototype from Mälardalen Univ., Västerås, Sweden
- **Chronos** - a research prototype from National University of Singapore

Evaluation

- Carried out by Lili Tan, University of Duisburg-Essen.
⇒ independent feedback on tool usability
- Lili Tan has visited all WCET developers but Singapore
- The tests have also been performed by the development teams themselves
- The working group:
 - Jan Gustafsson, Mälardalen University,
 - Klaus Echte, University of Duisburg-Essen,
 - Steffen Goerzig, DaimlerChrysler Research, Ulm,
 - Reinhard v. Hanxleden, Kiel University,
 - Paul Levi, Stuttgart University,
 - Reinhard Wilhelm, Saarland University.

Experiences and Preliminary Results

- Some tools failed on some benchmarks, i.e, the benchmarks are not too simple
- Bugs in benchmark files and in tools have been found and corrected
- WCET results hard to compare this time
 - no common architecture-compiler basis
- Detailed results will be presented at ISoLA, Nov. 17, and in a report

The Future

- Make this a continuing process
- Update benchmarks and the setup of the Challenge, try to identify at least one common processor (ARM7?)
- Include more complex processors and industrial code
- Try to extend the number of participants: Measurement-based tools (Rapita, SYMTA/P) and Heptane will be invited again
- Include industrial code, e.g. automotive and avionics
- Include automatically generated code
- Define hardware setup to enable comparison of different processor-behavior prediction methods (e.g., cache, pipeline, and branch prediction)