Information Society Technologies

ARTIST2 – Year 1 Review

Grenoble, October 3rd-4th, 2005

Activity *Cluster Integration*

Timing-Analysis Platform

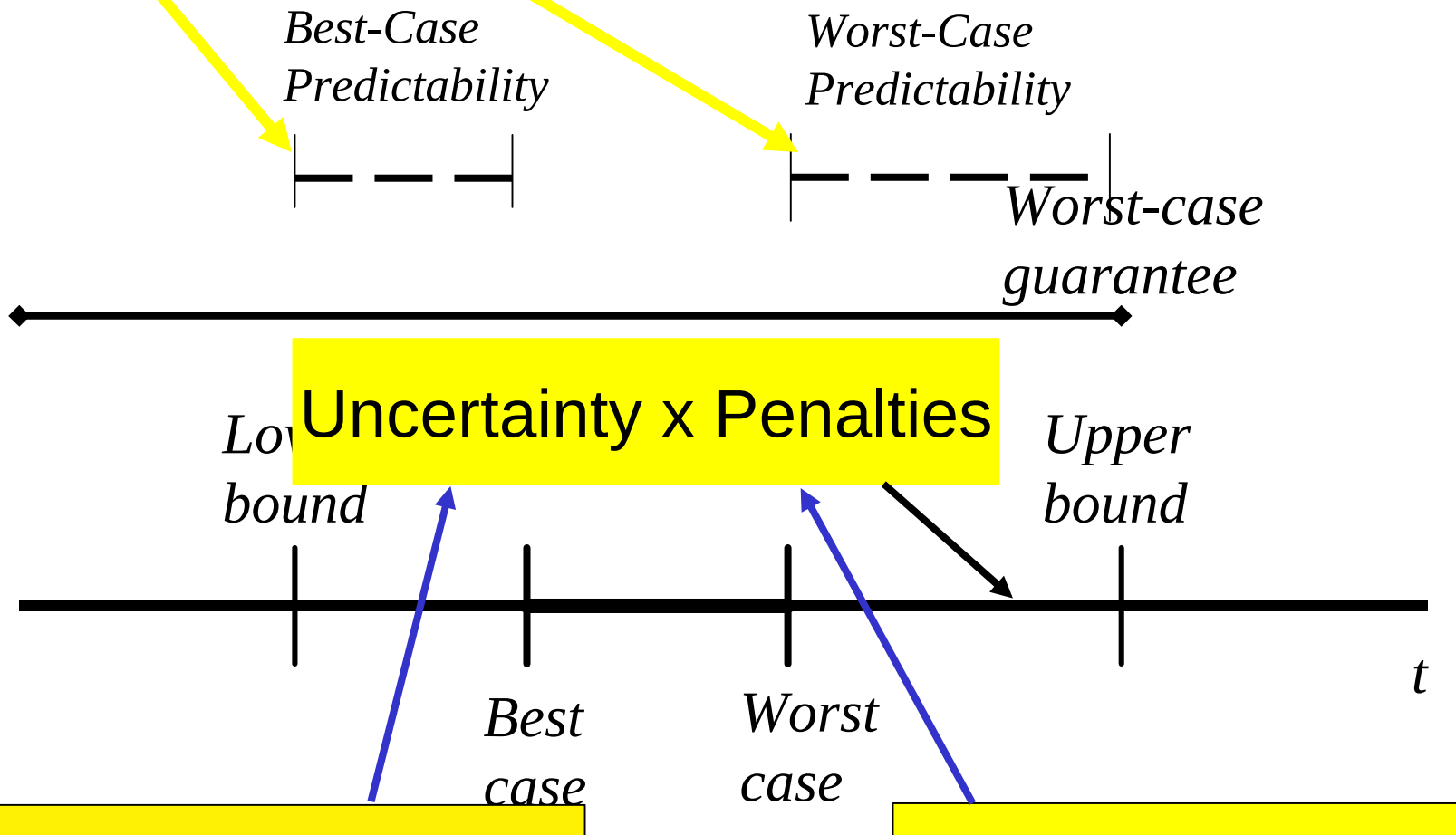
Activity leader : Reinhard Wilhelm (Saarland)

Industrial Needs and Experience

- Artist2 Interaction with Industry
  - Cooperation, meetings, visits with automotive, avionics, multi-media, telecommunications, defense industries
- Industrial Needs
  - *avionics industry in Old Europe is using Timing-Analysis tools routinely, has integrated the technology into development process, is aware of the problem of Timing Predictability.*
  - *(some) automotive industries are expecting push-button solutions doing miracles,*
  - *telecommunications would be happy with solid measurement-based approaches.*
- Possible Global Impacts of Research Results
  - *improved usability, precision, and efficiency,*
  - *awareness of the problem of designing systems with timing-predictable behavior.*

Basic Notions

Determined by
- Hardware architecture
- Software design
- Analysis methods



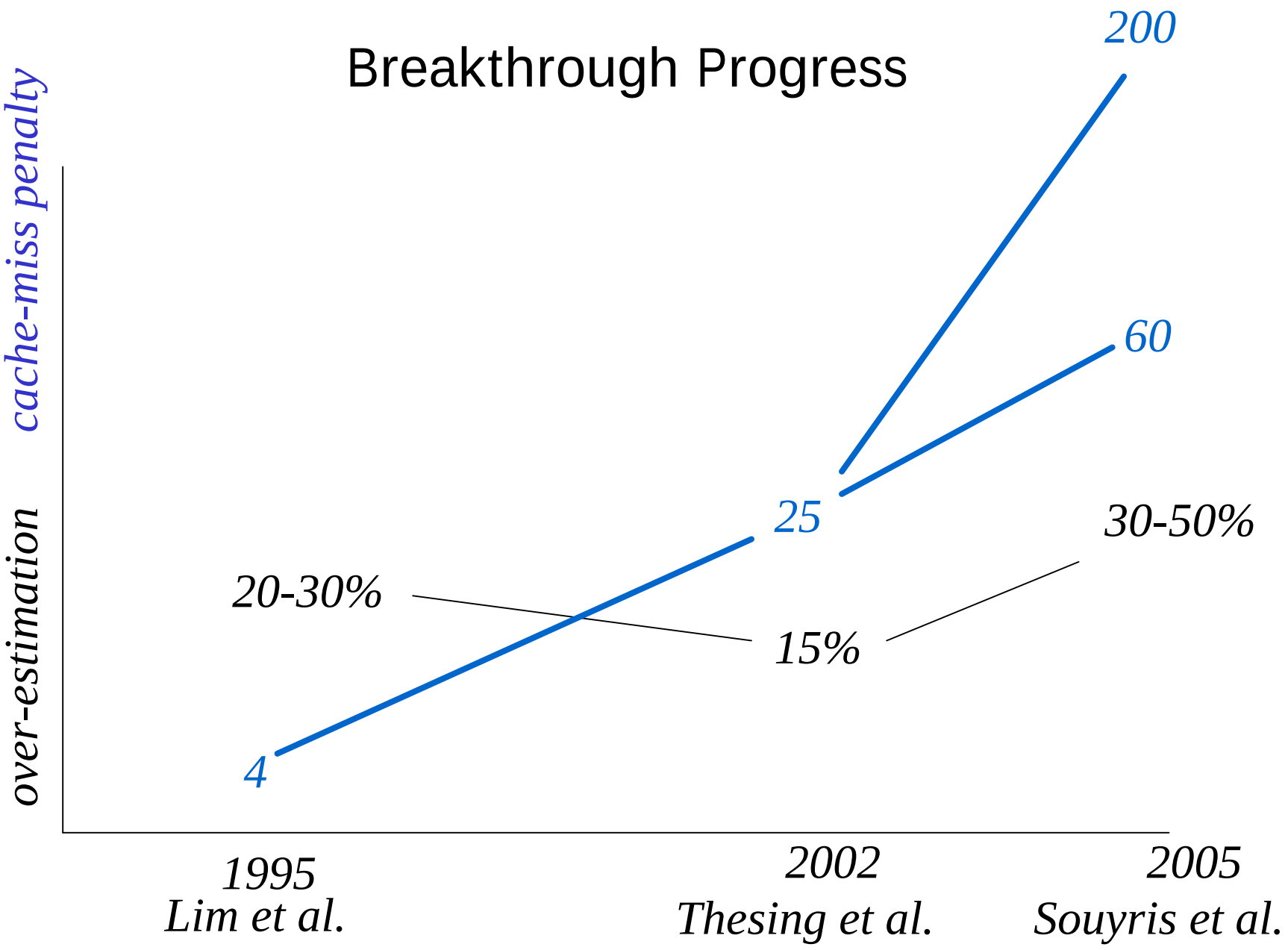
Timing-Analysis Platform

Resource-aware Design

Year 1 activities

Achievements & Ongoing Work

- State of the Art
  - Timing-Analysis technology is mature enough for industrial use.
  - Several tools are commercially available, all by partners of ARTIST2
  - Technology needs integration into the development process, developers need to be aware of Design for Predictability


Breakthrough Progress
cache-miss penalty
over-estimation
200
60
25
4
30-50%
20-30%
15%
1995
Lim et al.
2002
Thesing et al.
2005
Souyris et al.

Achievements & Ongoing Work

- *Achievements in Year 1*
- Choosing and extending the interchange format:
  CRL2 - Generic and processor-independent format usable for static analysis, optimisation of machine code and assembly language used in AbsInt and Universität des Saarlandes frameworks,
  - Integrated representation of control flow graph and intermediate analysis results,
  - Inter-procedural analyses implemented easily with CRL2,
  - parts of analysis tool chain communicate via CRL2.
  - CRL2 was found suitable for integration of various work groups' analyses,
  - An efficient C/C++ library reads/writes CRL2 and provides an API to data structures,
  - Several cooperation partners of the WCET groups started to interface with CRL2,
  - CRL2 is also used as a compiler-analyser interface (WCET-aware compilation).
- Transformation of Flow Facts in parallel to Code Optimization (TU Wien)
- Measurement-based approach (U York)
- *Collaboration with other world-class teams?*
  Seoul National University, Florida State University, Singapore National University
- *Ongoing Work*
  Definition of a complex interface has required and will require a lot of work

Year 1 activities

Interaction & Building Excellence

- Interaction Between Partners
  Platform activity would not have happened without ARTIST2

- Building (better, Keeping) Excellence
  Europe's groups were leading when ARTIST2 started – and they still are,
  all commercially available tools come from Europe.

  Conference organization:
  ARTIST2 sponsored the WCET 2005 workshop (chair R. Wilhelm)

  Tutorial on Timing Analysis at DATE 2005
  Tutorial on Timing Analysis and Timing Predictability at the ARTIST2 Summerschool
  Chapter on Timing Analysis in the Embedded Systems Handbook, CRC Press

Year 1 activities

Management Perspectives

- What worked well

  Networking is a strength of ARTIST2, stronger into the Execution-Platform cluster, the Timing-Analysis network in fact pre-existed.

- Difficulties encountered

  NoEs are a mess! Kostas Glinos, EMSOFT 2004

  Too much bureaucratic overhead (reporting/financials) for the funding provided!

  Changing interests of participants, e.g. for the Predictability issue and for the Integration-with-Compiler issue (activity cancelled during contract negotiations).
  Outside funding determines interests and orientation!
  The normative power of facts, i.e. existing implementation of an interface language; some other partners would have liked to switch to an XML-based format, but had not enough support for it.

- Structural changes in the activity

  Affiliated partner Tidorum should become a core partner.
  Activity Integration-with-Compiler became actual because of interest in a Compiler company.

18 Month Perspective

Work Planned for the next 18 months

- CRL2 - Cooperation and Integration Work
  - extending the definition and improve the documentation of the text format of CRL2 to suite the needs of partners
  - better supporting Peter Marwedel's group's use of CRL2 to interface their compiler with aiT tools.
  - formalisation of control flow graph structure and some format extensions for Rennes, Mälardalen and Tidorum
- Component integration
  - Integration of SWEET and Bound-T for teaching purposes,
  - Transfer NEC V850E binary reader of aiT to Mälardalen and Basic-Block Timing-Analysis from Mälardalen to aiT
  - Transfer annotated CRL2 between Bound-T and aiT or Transfer path lengths between Mälardalen longest-path search tool and aiT
  - Integrating Mälardalen's Flow Analysis with aiT's processor-behavior analysis (long term)
- Definition of benchmarks and support of tool and method comparisons
- Licensing scheme for integrated components

18 Month Perspective

Significant Events or Achievements Expected

- Exchange of analysis results between different tools based on CRL2
- Integration of components into partner's tool
- Integration of Compiler and Timing Analysis