

# Compiler and memory optimizations for low-power and -energy

Olivier Zendra

HiPEAC Adaptive Compilation Cluster  
HiPEAC Computing System Week  
Cluster meetings 03/06/2008



# Outline

- 1: Context
- 2: Research interests
- 3: Ongoing work
- Conclusion

# 1: Context

- INRIA researcher
- INRIA Nancy – Grand Est Research Center
  - In Nancy, North-Eastern France
    - hence not in Paris/Saclay nor Alchemy ;)
  - In TRIO (team focusing on Real-Time and Embedded Systems issues)

## 2: Research interests

- Compilation (& languages)
  - Historically for OO languages
    - Did GNU Eiffel compiler
- Memory (-management)
  - In software
  - Did GC automatically adapted (“customized”) to compiled application
- Embedded systems (more recently)
- Low-power issues (more recently)

## 2.1: A word on memory

- More advanced memory management
  - Policies
  - Automated
  - Adaptive (including at runtime)
- Higher-level approach
  - Increased system adaptability
  - Ease of design and development
  - Likely future requirement in industry (Java)

## 2.2: A word on architectures

- Characterize (model) the impact of HW architecture on optimisations
- Better adapt the compiled program to its HW environment
- Bring HW level to SW level
  - Without the gory HW details software engineers are not at ease with
  - Better architectural choices and optimizations
  - Requires better HW-SW cooperation

# 3.1: HiPEAC work

- (small) cluster “Architecture-aware Compiler Solutions for Energy issues in Embedded Systems” (ACSEES) (late H1)
  - with UEDIN, Thales and Technion/Intel Haifa
- New H2 cluster “Adaptive compilation”
- New H2 cluster “Compilation platform”
- New H2 cluster “Simulation platform”
- New H2 “Task Force on Low-Power” ?

## 3.2: Some non-HiPEAC work

- ANR MORE: Multicriteria Optimization for Real-time Embedded systems
  - Iterative, adaptive compilation
  - Criteria: WCET (constraint), size, energy
    - I do energy (& memory)
      - With PhD: Maha IDRISSE AOUAD
  - With IRIT and LIP6
  - 2007-2010

## 3.2: Some non-HiPEAC work

- Pending: ANR Open-PEOPLE: Open Power and Energy Optimization Platform and Estimator
  - HW platform: characterize HW and model it
  - SW platform: simulate from these models
  - Partners: 5 from academy, 2 from industry
  - Am in charge of SW platform
  - Could be integrated into HiPEAC simulation platform (thus need for standard API)
  - 2008-2011

# Conclusion

- Long term (ideal) goal
  - Compilation techniques, related to memory, for low-power and -energy (in embedded systems or not), applicable with “high-level” languages (i.e. commonly used C++, Java...)
- Wanted to give you a feeling of what I do / would like to do
  - Open to partnerships
  - Keywords: program analyses, compilation, memory, energy