



**PEPPHER**  
Programmability &  
Portability



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# PEPPHER: Performance Portability and Programmability for Heterogeneous Many-core Architectures

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This project is part of the portfolio of the  
G.3 - Embedded Systems and Control Unit  
Information Society and Media Directorate-General  
European Commission

[www.peppher.eu](http://www.peppher.eu)

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Contract Number: 248481  
Total Cost [€]: 3.44 million  
Starting Date: 2010-01-01  
Duration: 36 months



# Project Consortium



- **University of Vienna (Coordinator), Austria**
  - Siegfried Benkner, Sabri Pllana and Jesper Larsson Träff
- **Chalmers University, Sweden**
  - Philippas Tsigas
- **Codeplay Software Ltd., UK**
  - Andrew Richards
- **INRIA, France**
  - Raymond Namyst
- **Intel GmbH, Germany**
  - Herbert Cornelius
- **Linköping University, Sweden**
  - Christoph Kessler
- **Movidius Ltd. Ireland**
  - David Moloney
- **Karlsruhe Institute of Technology, Germany**
  - Peter Sanders



**CHALMERS**



Linköpings universitet



# Project Aim and Objectives



- **Aim:** Enable **productive**, performance-**portable**, and **efficient** programming of heterogeneous multi-core systems
- **Objectives:** advance state-of-the-art in five technical work areas
  - methods and tools for component-based software
  - portable compilation techniques
  - adaptive, auto-tuned algorithms and data structures
  - efficient, flexible run-time systems
  - hardware support mechanisms for auto-tuning, synchronization and scheduling

# The Key Result of PEPPER



- **Key result:** a unified framework for programming and optimizing applications for architecturally-diverse many-core processors
- It will make it easier to program heterogeneous multi-core systems for a mainstream programmer

# PEPPHER Long Term Impact



- Strengthen the European excellence in heterogeneous multi-core systems
  - high-level software development, compilation technologies, algorithms and data structures, run-time systems, hardware support for software development
- Affect also embedded and HPC domains
  - accelerated systems (GPU, CellBE)
  - HPC systems rely increasingly on multi-core systems as building blocks
- Industrial use of results
  - commercialization of OpenCL code generation tools by Codeplay
  - use of PEPPHER PCB demonstrator for the next 40nm SoC design by Movidius
  - potential take-up of interesting PEPPHER technology by Intel
- Academic use of results for research-driven teaching
  - deliver state-of-the-art knowledge from this domain to students

# Beyond PEPPER



- Intelligent software development environments
  - programming environment **supports proactively the programmer**
  - automation & autonomy
  - (Pllana et al. LNCS 5415, pp. 137–147, Springer 2009)
- Investigate resource-aware parallel programming techniques
  - **energy-awareness**
  - architectural support for resource-efficient parallel programming
- Holistic-approach to research in computing systems is important
  - in future should **address the needs of the mainstream programmer**
  - **emphasize research at higher layers**