PEPPHER

Performance Portability and Programmability for Heterogeneous Many-core Architectures

KEYWORDS: programmability, performance portability, heterogeneity, many-core

Introduction

The emergence of highly parallel, heterogeneous, many-core processors poses major challenges to the European software industry. It is imperative that future many-core architectures can be fully exploited without starting from scratch with each new design. In particular, there is an urgent need for techniques for efficient, productive and portable programming of heterogeneous many-core systems.

PEPPHER will devise a unified framework for programming and optimizing applications for architecturally diverse, heterogeneous many-core processors to ensure performance portability.

Objectives

PEPPHER will advance state-of-the-art in its five technical work areas:

1) methods and tools for component-based software;
2) portable compilation techniques;
3) adaptive, auto-tuned algorithms and data structures;
4) efficient, flexible run-time systems;
5) hardware support mechanisms for auto-tuning, synchronization and scheduling.

PEPPHER is unique in proposing direct compilation to the target architectures. Portability is supported by powerful composition methods and a toolbox of adaptive algorithms. Heterogeneity is further managed by advanced auto-tuning mechanisms and efficient run-time schedulers. The PEPPHER framework will thus ensure that applications execute with maximum efficiency on each supported platform.

Expected Results

Concrete project outcome will be the fully specified methodology, the definitions of the (meta)-languages and APIs involved. Project results will also include a set of prototype tools that demonstrate the proposed methodology. The tools will facilitate the construction of new applications as well as the stepwise parallelization of existing codes.

Efficiency will be ensured by providing a comprehensive library of autotuned algorithms and data structures as well as advanced runtime scheduling mechanisms across a wide range of heterogeneous multi-cores architectures. The applicability of the developed methodologies will be tracked by implementation of prototype applications from various application domains. Performance reports will be generated from both system simulations and prototype hardware platforms using real applications and kernels.

PEPPHER is driven by challenging benchmarks from the industrial partners. Results will be widely disseminated through high-quality publications, workshops and summer-schools, and an edited volume of major results. Techniques and software prototypes will be exploited by the industrial partners.

This project is part of the portfolio of the

G.3 - Embedded Systems and Control Unit
Information Society and Media DG

For more information please check:

http://cordis.europa.eu/fp7/ict/programme/challenge3_en.html

European Commission
Information Society and Media

SEVENTH FRAMEWORK PROGRAMME

January 2010

Partners and Their Roles

The PEPPHER consortium unites Europe's leading experts and consists of world-class research centres and universities (INRIA, Chalmers, LIU, KIT and UNIVIE), a major company (Intel) and European multi-core SMEs (Codeplay and Movidius).

UNIVIE provides expertise in parallel programming languages, compilers, parallel algorithms and data structures, high-level parallel building block design, software construction tools, and performance evaluation tools.

Chalmers is well known for their exceptional contributions in lock- and wait-free data structures for shared memory systems, run-time systems, and parallel algorithms and data structures.

Codeplay has over a decade of experience in designing portable, optimizing compilers for SIMD, VLIW and multi-core architectures, with recent experience in parallelization technology for heterogeneous multi-core processors.

INRIA contributes extensive experience in design and analysis of efficient run-time systems for heterogeneous, parallel systems, parallel algorithms, languages and libraries.

Intel GmbH contributes its competency in parallelizing and optimizing applications for desktop and server platforms, and its insights in the future of multi- and many-core platforms.

LIU has expertise in compiler technology, the design of parallel programming languages, software composition and auto-tuning.

Movidius, an award-winning fabless semiconductor SME, contributes its experience in designing semiconductor integrated circuits.

KIT is a leading expert in (parallel) algorithms and data structures, and experimental algorithmics, and has extensive knowledge of parallel interfaces for both traditional HPC and emerging multi-core systems.

PEPPHER at a Glance

CONTRACT NUMBER
248481

FULL NAME
Performance Portability and Programmability for Heterogeneous Many-core Architectures

TYPE OF PROJECT
Collaborative Project, STREP

PROJECT PARTICIPANTS
1) Universität Wien (Coordinator), (UNIVIE) AUSTRIA
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BUDGET
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TIMETABLE
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