Tutorial

PPoPP 2013: ACM SIGPLAN Annual Symposium on Principles and Practice of Parallel Programming

Title

Challenges and Opportunities of Heterogeneous Computing

Presenter

Ph.D. **Biagio Cosenza** is a Post-Doctoral Researcher in Thomas Fahringer's group at the University of Innsbruck, Austria. He received an MSc/diploma degree in Computer Science from University of Salerno, Italy, in 2007 and a PhD in Computer Science in 2011. He has been the recipient of two HPC-Europa grants in 2008 and 2009, a DAAD Scholarship in 2010, and a Cineca ISCRA in 2010. His research includes Compilers, High Performance Computing, Parallel Computing and applications to Computer Graphics and Visualization.

The tutorial will include contributions from Klaus Kofler and Ivan Grasso (University of Innsbruck), and resources and materials from the Insieme Compiler Framework.

Contact

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The Insieme Compiler Framework
www.insieme-compiler.org
Project leader: Prof. Ph.D. Thomas Fahringer

Target audience

Everyone who wants to write efficient parallel software in a heterogeneous environment.

Content level

50% Basic, 30% Intermediate, 20% Advanced.

Planned Length

Half day tutorial, 3 to 4 hours

Summary

This tutorial focuses on the challenge to unleash the full potential of heterogeneous systems.

We start by giving an overview of today's heterogeneous computing hardware, existing programming models and software support to program such systems. In particular, we will introduce OpenCL as mean to program heterogeneous systems. Thus we introduce the main challenges of heterogeneous computing, as portability, ease of programming, and support of device optimizations.

Finally, we introduce in detail the problem of task partitioning among heterogeneous nodes, presenting the state-of-the-art in this topic and current solutions to the problem.

Outline of the contents

Topics to be covered:

1. Introduction to heterogeneous computing
   a. Overview of heterogeneous hardware
   b. Overview of programming models, existing software, and language support for programming heterogeneous hardware
2. An brief introduction to OpenCL concepts
   a. OpenCL platform and execution model
   b. OpenCL programming and memory model
   c. The OpenCL framework
   d. Programming heterogeneous hardware in OpenCL
3. Challenges of heterogeneous computing
   a. Portability versus device optimizations
   b. Easy-to-program interface versus advanced optimizations
   c. Task partitioning
4. Partitioning approaches for heterogeneous computing.
   a. Static approaches versus dynamic approaches
   b. Overview of dynamic, library based approaches
   c. Overview of static, compiler based approaches
   d. Insieme OpenCL compiler approach for automatic partitioning