Preliminary Discussion

Multi-Core Architectures and Programming

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Hardware/Software Co-Design, Friedrich-Alexander University Erlangen-Nürnberg (FAU)
April 21, 2015
Administrative Trivia

Tutors

- Oliver Reiche
- Christian Schmitt
- Michael Witterauf
- Frank Hannig

Place

Room 02.133-128
Department of Computer Science
Cauerstr. 11
91058 Erlangen

Date/Time for seminar meetings: by arrangement
Administrative Trivia

Project up to 2 students form a group

Paper Discussion

• Duration: (20+5) min
• Individual presentation

Project Presentation

• Duration: (20+5) min
• Group presentation

Language: English or German, as you like
Administrative Trivia

Embedded

• 2 × Jetson Board (Tegra K1): NVIDIA Kepler GPU + ARM Cortex A15 quad-core
• 2 × Arndaleboard: ARM Mali T604 GPU + ARM Cortex A15 dual-core

Server-grade Accelerators

• 1 × Intel Xeon Phi
• 1 × NVIDIA Tesla K20
• 2 × NVIDIA Tesla C2050

Desktop GPUs

• 2 × NVIDIA GeForce GTX 285
• 1 × ATI Radeon HD 6970
• 1 × ATI Radeon HD 5870

Many-core

• 1 × 256-core Kalray
• 1 × Tilera TILEPro64

Network

• OpenMP and MPI enabled PCs
Purpose of Seminar

Learn how to . . .

- Do research in a certain topic (find information and evaluate it critically)
- Give a presentation, so that others can benefit from your findings/results
- Discuss complex topics in a constructive manner
- Tackle difficult problems in a team
Purpose of Seminar

Learn about…

- The architecture of bleeding-edge multi-core systems
- Methods for efficiently mapping algorithms to these architectures
- New programming paradigms and best practices
- High performance computing applications
Previous Topics
Previous Topics

Panorama photo stitching

Accelerate compute intensive parts on graphics card

- Image calibration
- Image registration
- Image blending
MAP Superresolution

(a) Input ($128 \times 128$)

(b) Bicubic ($256 \times 256$)

(c) Super-resolved ($128 \times 128$)

(d) Original ($256 \times 256$)
Previous Topics

Ant simulation with CUDA
Previous Topics

Optical flow with WebGL

On  Off  CPU  GPU
Frames per second: 0 (avg: 0)

Projekt aus dem Vorjahr von Marvin Kampf und Michael Moese

https://www12.informatik.uni-erlangen.de/edu/map/ss14/
Available Topics
Projects

Each group selects and implements one application:

- mathematical problems
  - N-Queens
- image processing
  - Harris corner detection
  - optical flow calculation
  - Viola Jones object detection
  - bilateral grid filter
  - local Laplacian
- image compression
  - JPEG, JPEG 2000 (complex)
- partial differential equation (PDE) solver

Free choice of target architecture and programming environment:

- discrete GPU vs. embedded GPU vs. Tilera vs. . . .
- CUDA vs. OpenCL vs. Renderscript vs. TBB vs. pthreads vs. OMP vs. . . .
Tentative Schedule

Paper presentations
- CW 21: 18.05.2015 – 22.05.2015

Project presentations

• P.S. Please discuss your presentation slides with the tutors!
• P.P.S. Use only PDFs for presentations
Login

Each group gets one account: SSH + (Mercurial | Git | Subversion)

SSH

- one user account per group: mappraktX
- external login via gateway codesigns14:
  
  ssh mappraktX@codesigns14.informatik.uni-erlangen.de

- from there all codesignsXX servers are reachable

Repositories

Mail us your public SSH key and choose a repository type:

  **Mercurial**  
  hg clone
  ssh://mapsvn@codesigns14.informatik.uni-erlangen.de/seminar/map15/mappraktX

  **Git**  
  git clone
  ssh://mapsvn@codesigns14.informatik.uni-erlangen.de/seminar/map15/mappraktX.git

  **Subversion**  
  svn co
  svn+ssh://mapsvn@codesigns14.informatik.uni-erlangen.de/seminar/map15/mappraktX
Paper Presentation

- OpenCL/CUDA Architectures
- MPSoC Architectures for Smartphones and Tablets
- Intel Many Integrated Core Architecture (MIC)
- Tiled Architectures
- Lock-free Data Structures
- Mapping Strategies for Multi-core Systems
- Approximate Computing
- ARM Cluster
- PGAS GPI
- Processing of Big Data