ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Institut für Technische Informatik
und Kommunikationsnetze
Computer Engineering and
Networks Laboratory

Prof. L. Thiele

Semester / Master Thesis:

Efficient calculations: Exploiting all PC components

CPUs, graphics cards, accelerators — lots of different processing devices are found in a modern PC. Program them all using OpenCL and make each one do what it is best at.

For a few years now, the CPU has no longer been the only processing unit in a PC. With the increasingly powerful graphics cards built into these systems, people started looking for ways of exploiting that calculation potential also for graphics-unrelated tasks. Today, general-purpose computing on GPUs (GPGPU) is well-established and increasingly popular. Intel has taken account of this trend by introducing their Xeon Phi co-processor, an accelerator that features 60 full-fletched processor cores together with 8 GB of GDDR5 SD-RAM on a single PCIe extension card.

Naturally, each of these types of devices — CPU, GPU and co-processor — has its own characteristics and preferred fields of application. Also, there are fundamental differences in how they can be programmed. To unify the programming of all devices, the OpenCL programming framework has been proposed. It uses a programming language called "OpenCL C", which is largely identical to C and only differs in technical details.

Task: We already have an OpenCL version of our high-level multi-core programming framework "DAL", which is based on process networks. So far, it works on CPUs and GPUs. The goal of this thesis is twofold. First, DAL should be extended to work on the Xeon Phi. Second, we want to develop clever techniques to efficiently distribute the individual tasks to the best-suited devices. The following steps will be part of this process:

1. Understand the concepts of OpenCL and DAL.
2. Extend DAL to also support the Xeon Phi.
3. Analyse selected example applications and find out which part of them runs best on which device.
4. Try to give general recommendations for this decision and build tools to automate it.

Requirements: You should be familiar with C and C++. Knowledge about OpenCL would be an asset, but is not required.

Interested? Please have a look at http://www.tec.ethz.ch/research.html and contact us for more details!

Contacts

- Andreas Tretter: andreas.tretter@tik.ee.ethz.ch, ETZ G81
- Lars Schor: lars.schor@tik.ee.ethz.ch, ETZ G78.1
- Lothar Thiele: thiele@ethz.ch, ETZ G87

Further Reading

- DAL: http://www.tik.ee.ethz.ch/~euretile/dal.php
- OpenCL: http://www.khronos.org/opencl/
- Xeon Phi: http://www.intel.com/content/www/us/en/processors/xeon/xeon-phi-detail.html