

Semester / Master Thesis:

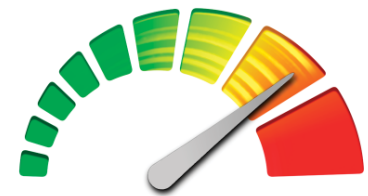
## Taking advantage of a GPU's memory hierarchy

**Graphics cards typically feature multiple different memories. Smart utilisation of these is crucial for attaining good performance. Find out how this works in OpenCL.**

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.

Programming such graphics devices has become distinctively easier with OpenCL. OpenCL is a programming framework that makes it possible to run the same program on CPUs and GPUs. It uses a programming language called “OpenCL C”, which is largely identical to C and only differs in technical details.

Still, CPU and GPU programming differ in a lot of ways. In particular, GPUs are made for SIMD computations and feature a complex memory configuration. In addition to the global memory provided by dedicated RAM chips on the graphics card board, a GPU may contain on-chip cache as well as small and fast on-chip memories controlled by the programmer. The way in which the memory is accessed can make up for huge performance gains or losses.



# OpenCL

**Task:** We already have an OpenCL version of our high-level multi-core programming framework “DAL”, which is based on process networks. Currently, it only uses global memory. The goal of this thesis is to extend it such that it can deal with all memories on a graphics card. This includes the following steps:

1. Understand the concepts of OpenCL and of DAL.
2. Analyse selected example applications and find out how to optimally exploit all memory types.
3. Try to give general recommendations on memory optimisation and build tools to automate it.

**Requirements:** You should be familiar with C and C++. Knowledge about GPUs or 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!**

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### Further Reading

- DAL: <http://www.tik.ee.ethz.ch/~euretile/dal.php>
- OpenCL: <http://www.khronos.org/opencl/>