

# Design Space Exploration for the Acceleration of Heterogeneous Systems

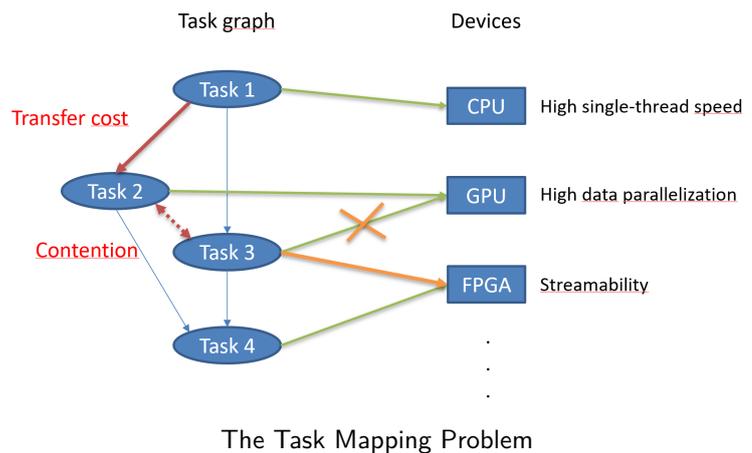
Research Project or Bachelor/Master Thesis

## Research Field

Today, most elaborate applications are embedded in a heterogeneous computing system, that is, the subtasks of the application are distributed along multiple different compute units, such as CPUs, GPUs, FPGAs, AI units and other specialized hardware. These complex heterogeneous systems can be found everywhere, ranging from high-performance computing clusters to energy-efficient edge devices such as smartphones.

The goal of a design space exploration is to identify profitable system configurations (design points), which lead to the best possible system performance, mainly in terms of execution time, but also in terms of energy efficiency or quality of the result. For this, we analyze systems and develop algorithms and architectures that find near-optimal solutions for large and complex heterogeneous systems. Exemplary problems would be:

- **Task Mapping:** How to assign (sub)tasks of an application to processing devices in order to maximize the efficiency of the overall system?
- **Scheduling:** In which order should tasks be executed to minimize the most expensive (critical) path of the application?
- **Data Streaming & Parallelization:** What is the best configuration of a given task to profit from data streaming on an FPGA / AI Unit or from parallelization on a GPU?



## Research Topic

This research field offers a wide range of potential research topics for students interested in algorithmics, computer architecture, programming or heterogeneous system design. Topics range from algorithm design and implementation to the exploration of software frameworks, system characterization and the design of AI hardware architecture. If you are interested in these topics, feel free to write me a mail.

## Skills

Required:

- Analytical thinking
- Programming knowledge

Desired:

- Knowledge of C++
- Affinity to algorithms and/or math



## Contact

Martin Wilhelm  
martin.wilhelm@ovgu.de  
G03-303

