

# Evaluation of Parallelization Frameworks

## Background

The roadmaps of major manufacturers show a soaring trend to parallel computing architectures. Especially the emerging variety of multi-core CPU and current research on many-core systems opens the way for totally new applications. Not only is this due to the increased processing power but also due to lower energy consumption and expected lower production cost (in relation to comparable traditional systems). Thus it is a logical step that after the appearance of multi-core desktop and portable computers, parallel systems continue to leave the area of high-performance systems and begin to reach the domain of embedded systems. For a successful transition from single-core to multi-core systems, scalable programming techniques are a challenging field of current research.

## Description

The subject of this student project is to evaluate frameworks that abstract the execution of tasks on multi-processor, multi-core systems and distributed systems.

The evaluation should especially focus on how these approaches can be directly used for embedded real-time systems or if/how they can be adopted accordingly. The analysis shall emphasize the fitness of the frameworks for use with automatic code generators such as for example found in the model-driven development tool EasyLab that has been created in the course of the EasyKit project.

## Tasks

This student project consists of the following tasks:

- Literature study on the frameworks suggested in this project proposal – further suggestions are welcome.
- Definition of at least two representative application / benchmark scenarios and three reference frameworks.
- Implementation of the benchmark applications using the selected reference frameworks.
- Comparison of the results and projection to the suitability of the respective frameworks for use with embedded systems.
- Adaption of the approach that has been rate best to an embedded platform.



Technische Universität München



Fakultät für Informatik  
Lehrstuhl für Echtzeitsysteme  
und Robotik

---

**Supervisor:**  
Prof. Dr.-Ing. Alois Knoll

**Advisor:**  
Dipl.-Inf. Simon Barner

**Research project:**  
EasyKit

**Type:**  
MA, DA

**Research area:**  
Embedded Systems,  
Parallelization

**Programming language:**  
C, C++

**Required skills:**  
Threads, processes,  
synchronization primitives

**Language:**  
English, German

**Date of submission:**  
13. November 2009

---

**For more information please  
contact us:**

Phone: +49.89.289.18111

E-Mail: [barner@in.tum.de](mailto:barner@in.tum.de)

Internet: [www6.in.tum.de](http://www6.in.tum.de)



## References

- [EasyLab](#): A model-based development tool for mechatronic systems.
- [OpenMPI](#): A High Performance Message Passing Library
- [OpenMP](#): The OpenMP API supports multi-platform shared-memory parallel programming in C/C++ and Fortran.
- [Grand Central Dispatch \(GCD\)](#): Kernel-based parallelization infrastructure in Mac OS-X and FreeBSD 9.
- [libdispatch](#): User-space support library for GCD.
- [Introduction to C blocks](#): An extension to the C programming language to express parallelism.



Technische Universität München



Fakultät für Informatik

Lehrstuhl für Echtzeitsysteme  
und Robotik