

Master Thesis Project Proposal (30hp):

Performance and Power Predictions Based on Comparative Microbenchmarking

In a scenario where the execution of task-based parallel applications is delegated from a customer to a service provider, the latter may profit from runtime data collected on the customer's system prior to execution. Assuming that both systems undergo a series of microbenchmarks to gauge their relative power/performance characteristics for various workloads, it would be interesting whether the provider can infer the behavior of a given application on its own system based on a partial test execution on the customer's system. This information could then be exploited for resource management and scheduling purposes, enabling the provider to operate more efficiently in terms of both revenue and sustainability.

G. Da Costa (2025). Hardware and application aware performance, power and energy models for modern HPC servers with DVFS. *Sustain. Comput.* 46:101106. <https://doi.org/10.1016/j.suscom.2025.101106>
T. Rauber, G. Rünger, M. Stachowski (2018). Performance and energy metrics for multi-threaded applications on DVFS processors. *Sustain. Comput.* 17:55–68. <https://doi.org/10.1016/j.suscom.2017.10.015>
A. Herten, O. Pearce, F. S. M. Guimarães (2026). An HPC benchmark survey and taxonomy for characterization. *Int. J. High Perform. Comput. Appl.* 40(1):42–51 <https://doi.org/10.1177/10943420251351424>
Standard Performance Evaluation Corporation (SPEC) (2025). Power and Performance Benchmark Methodology V2.3. https://www.spec.org/power/docs/SPEC-Power_and_Performance_Methodology.pdf

Task A suitable set of microbenchmarks is to be developed, allowing to characterize a system with respect to performance and power consumption, at least relative to another given system. Furthermore, a set of test applications to examine the feasibility of the above approach needs to be assembled. Subsequently, experiments will be conducted and their results analysed on various (combinations of) test systems so that insights on the achievable prediction accuracy and the effort necessary to obtain these can be gained.

Prerequisites TDDD56 Multicore and GPU Programming (mandatory), C/C++ (mandatory), TDTS08 Advanced Computer Architecture (recommended), Linux programming skills.

Contact Sebastian Litzinger, Sajad Khosravi, Christoph Kessler (first.last@liu.se)