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TECHNISCHE UNIVERSITÄT DARMSTADT

Fachgebiet Scientific Computing

SCIENTIFIC COMPUTING

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Thesis-topic (BSc/MSc): Hybrid Performance Measurement Techniques

Hinweis: Dieses Thema kann sowohl in englischer als auch in deutscher Sprache bearbeitet werden.

Background:

All performance tools for HPC systems require sampling or instrumentation to gather data. In **sampling** approaches, usually the measurement tool stops the target application in fixed intervals or at specific events and samples the execution pointer along with the applications' stack-frames. At this point, additional information about hardware and program state can also be recorded. By analyzing the call stack, a sampling tool can pinpoint the corresponding context and provide feedback to the user.

In the **instrumentation** approach, the target program is augmented with measurement points, called probes, to gather the necessary information. These probes are typically implemented as calls to a tool specific measurement library. E.g. the most widely used form of instrumentation, the '-finstrument_function' option of the GNU compiler installs probes at all entries and exits of a given function.

Both methods have their individual strengths and weaknesses, especially in terms of overhead and data quality. Current research aims to leverage information from compiler analysis and aims to combine instrumentation and sampling into a combined approach.

The chair for Scientific Computing has recently developed an prototype for an extreme lightweight sampling approach capable of cutting existing sampling overheads in half and plans to combine sampling and instrumentation in the next step.

The goal of this cutting edge thesis (both bachelor and master level) is to combine existing **sampling** and **instrumentation** techniques into a combined prototypical measurement layer.

For this thesis you will use state of the art

a. call stack analysis and sampling tools (LibUnwind and CachES)
b. compiler based instrumentation technology (ROSE + InstRO)
c. state of the art measurement libraries, such as Score-P

to create

- a **hybrid measurement library** and
- case studies using the **Lichtenberg-Cluster** of the TU Darmstadt

Recommended background knowledge:

- good command of C/C++,
- basic understanding of compilers,
- fundamentals of program execution,
- and good understanding of English (due to Literature).

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