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Institute of Informatics
System and Network Engineering Lab

Performance Engineering

Assignment 4: performance counters and performance patterns

Assignment 4.1: Performance counters: SpMV on CPU (3p)

Use two CPU SpMV versions (at least one parallel) from assignment 3 and analyze their behavior using performance counters. Take a set of three matrices and illustrate (empirically) the differences (if any) observed through performance counters analysis for these two versions. Are the counters correlated to any performance difference you have observed?

Assignment 4.2: Performance counters: parallel reduction on GPU (3p)

CUDA SDK contains an implementation of the Reduction kernel (on DAS this can be found in `/cm/shared/apps/cuda10.0/sdk/10.0.130/6_Advanced/reduction/`) with 6 different versions. Pick 3 of these versions and analyze their performance using performance counters. Can the counters explain the performance difference? Do you observe any patterns?

Assignment 4.3: Performance anti-patterns: mini-apps (3p)

Propose 3 simple "mini-apps" (a "mini-app" is a trendy term that indicates a simple application, something in-between a micro-benchmarking kernel and a real-life kernel - e.g., a couple of loops) to illustrate the use of performance counters for detecting 3 performance "anti-patterns". For example, consider load imbalance, false sharing, and bad NUMA locality. Check for inspiration Chapters 7,8 from "Introduction to High Performance Computing for Scientists and Engineers" (pdf online).

Assignment 4.4: Improving performance: mini-apps (3p)

Solve the performance problems you have identified/introduced at 4.3, and demonstrate, using performance counters data, that the problem has gone. Do your solutions introduce new performance problems?

Submission due date: May 29, 2022