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Techniques and tools for measuring energy efficiency of scientific software applications

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As both High Performance Computing (HPC) and High Throughput Computing (HTC) are sensitive to the rise of energy costs, energy-efficiency has become a primary concern in scientific fields such as High Energy Physics (HEP). There has been a growing interest in utilizing low power architectures, such as ARM processors, to replace traditional Intel x86 architectures. Nevertheless, even though such solutions have been successfully used in mobile applications with low I/O and memory demands, it is still unclear if they are suitable and more energy-efficient in the scientific computing environment. Furthermore, there is still lack of tools to derive and compare power consumption for these types of workloads, and eventually to support software optimizations for energy efficiency.

To that end, we have performed several physical and software-based measurements of workloads from CERN running on ARM and Intel architectures, to compare their power consumption and performance. We leverage several profiling tools to extract different aspects of the experiments, including hardware usage and software characteristics. We report the results of these measurements and the experience gained in developing a set of measurement techniques and profiling tools to accurately assess the power consumption for scientific workloads.

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