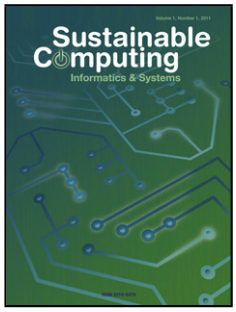

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PII: S2210-5379(14)00017-1
DOI: http://dx.doi.org/doi:10.1016/j.suscom.2014.03.006
Reference: SUSCOM 85

To appear in:

Received date: 15-9-2013
Revised date: 28-2-2014
Accepted date: 21-3-2014

Please cite this article as: Mohammed El Mehdi Diouri, Manuel F. Dolz, Olivier Glück, Laurent Lefèvre, Pedro Alonso, Sandra Catalán, Rafael Mayo, Enrique S. Quintana-Ortí, Assessing Power Monitoring Approaches for Energy and Power Analysis of Computers, *Sustainable Computing: Informatics and Systems* (2014), http://dx.doi.org/10.1016/j.suscom.2014.03.006

Assessing Power Monitoring Approaches for Energy and Power Analysis of Computers

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Abstract

Large-scale distributed systems (e.g., datacenters, HPC systems, clouds, large-scale networks, etc.) consume and will consume enormous amounts of energy. Therefore, accurately monitoring the power dissipation and energy consumption of these systems is more unavoidable. The main novelty of this contribution is the analysis and evaluation of different external and internal power monitoring devices tested using two different computing systems, a server and a desktop machine. Furthermore, we provide experimental results for a variety of benchmarks which intensively exercise the main components (CPU, Memory, HDDs, and NICs) of the target platforms to validate the accuracy of the equipment in terms of power dissipation and energy consumption. On the other hand, we also evaluate three different power measurement interfaces available on current architecture generations. Thanks to the high sampling rate and to the different measured lines, the internal wattmeters allow an improved visualization of some power fluctuations. However, a high sampling rate is not always necessary to understand the evolution of the power consumption during the execution of a benchmark.

Keywords: Wattmeters, power measurement interfaces, energy and power analysis, power profiling

1. Introduction

For decades, the computer science research community exclusively focused on performance, which resulted in highly powerful, but in turn, low energy-efficient systems with a very high total cost of ownership (TCO) [1]. Yet, in recent years, the HPC community has acknowledged that the energy efficiency of HPC systems is a major concern in designing future Exascale systems [2, 3].

Nowadays there exist intensive efforts that pursue the design of energy-efficient supercomputers. Hardware provides part of the solution by unceasingly exposing more energy-efficient devices which also provide abilities that current operating systems can successfully leverage to save energy [4]. Mechanisms such as Dynamic Voltage Scaling (DVFS) or P-state management have also been used to develop power-aware user-level software [4, 5, 6].

The Green500 list seeks to raise the awareness of power and energy consumption in supercomputing by reporting the power dissipation and energy efficiency of large-scale HPC facilities. Even the Top500 list is currently tracking the power draw by today's most powerful HPC systems, ranking their efficiency

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