Energy-Efficient High Performance Computing: Measurement and Tuning (SpringerBriefs in Computer Science)

James H. Laros III, Kevin Pedretti, Suzanne M. Kelly, Wei Shu, Kurt Ferreira, John Van Dyke, Courtenay Vaughan

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In this work, the unique power measurement capabilities of the Cray XT architecture were exploited to gain an understanding of power and energy use, and the effects of tuning both CPU and network bandwidth. Modifications were made to deterministically halt cores when idle. Additionally, capabilities were added to alter operating P-state. At the application level, an understanding of the power requirements of a range of important DOE/NNSA production scientific computing applications running at large scale is gained by simultaneously collecting current and voltage measurements on the hosting nodes. The effects of both CPU and network bandwidth tuning are examined, and energy savings opportunities without impact on run-time performance are demonstrated. This research suggests that next-generation large-scale platforms should not only approach CPU frequency scaling differently, but could also benefit from the capability to tune other platform components to achieve more energy-efficient performance.

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