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Thermal Benchmarking and Modeling for HPC using Big Data Applications

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Abstract

Characterizing thermal profiles of cluster nodes is an integral part of any approach that addresses thermal emergencies in a data center. Most existing thermal models make use of CPU utilization to estimate power consumption, which in turn facilitates outlet-temperature predictions. Such utilization-based thermal models may introduce errors due to inaccurate mappings from system utilization to outlet temperatures. To address this concern in the existing models, we eliminate utilization models as a middleman from the thermal model. In this paper, we propose a thermal model, *tModel*, that projects outlet temperatures from inlet temperatures as well as directly measured multicore temperatures rather than deploying a utilization model. In the first phase of this work, we perform extensive experimentation by varying applications types, their input data sizes, and cluster sizes. Simultaneously, we collect inlet, outlet, and multicore temperatures of cluster nodes running these diverse bigdata applications. The proposed thermal model estimates the outlet air temperature of the nodes to predict cooling costs. We validate the accuracy of our model against data gathered by thermal sensors in our cluster. Our results demonstrate that

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