SC15 Birds of Feather "Identifying a Few, High-Leverage Energy Efficiency Metrics" November 19, 2015

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Energy Efficiency Metrics for the DOE Better Buildings Data Center Partnership
https://www4.eere.energy.gov/challenge/sites/default/files/uploaded-files/Better_Buildings_Data_Center_Overview-FAQ.pdf

As Natalie mentioned in her talk, the dashboard work focused on key metrics for various target users to provide tools to better manage energy in data centers.
http://doi.ieeecomputersociety.org/10.1109/IPDPSW.2013.272

While IT energy efficiency metrics were identified as desirable dashboard elements, most are weak or difficult to measure. Energy efficiency metrics have focused on the infrastructure side of data centers (e.g. PUE). Some IT metrics considered to be important are less measurable than originally thought, and are often not continuously measured and tracked.

In establishing the DOE Better Buildings Data Center partnership program it was desired to have a measure of overall data center efficiency/productivity for which data centers would establish targets and track performance. However the measurement and aggregation of computational output has been elusive. An industry focus group recommended starting with infrastructure (PUE) and called for a 20-25% decrease in PUE -1. (The program focusses on individual improvement rather than ranking as in the case of Energy Star). The focus group considered the lack of progress in defining and aggregating computational output and suggested utilization/proportionality (the ability for power to scale or track with utilization) as the first IT side energy metric.

DOE joined forces with the Green Grid to develop utilization metrics. A working group is meeting every two weeks and the problem gets more complex as we go. How to aggregate utilization data from different types of equipment (e.g. storage and compute) with different characteristics and uses across an entire diverse data center over time is a challenge. And we thought utilization would be the easy IT metric to measure! Work continues.

While PUE is conceptually simple, many data centers have insufficient metering to measure it, so compromises are required. The point is, if PUE is difficult and expensive to measure, other metrics, like those for IT efficiency need to be easy(ier).

So what is the answer? Assuming we agree on utilization/proportionality as a good IT efficiency metric, should we ignore storage and network energy and just focus on CPU utilization? Should we just give up and know that computational efficiency is always getting better (new machines are more energy efficient than the one they replace). Or do we rely on IT efficiency ratings based on standard loads that may not represent actual use, and not worry about real life.

These issues all may be simpler in a homogeneous super computer environment where the utilization is near 100%. But the vision of measuring the overall computer center's energy performance especially in a multi-machine environment "solving" different computational problems, remains elusive.