KnightShift: Scaling the Energy Proportionality Wall Through Server-Level Heterogeneity

Daniel Wong *Murali Annavaram*

University of Southern California

How do you accurately quantify energy proportionality?

How do you accurately quantify energy proportionality?

$$DR = \frac{Power_{peak} - Power_{idle}}{Power_{peak}}$$

Dynamic Range

How do you accurately quantify energy proportionality?

$$EP = 1 - \frac{Area_{actual} - Area_{ideal}}{Area_{ideal}}$$

Energy Proportionality =

$$DR = \frac{Power_{peak} - Power_{idle}}{Power_{peak}}$$

Dynamic Range

How do you accurately quantify energy proportionality?

$$EP = 1 - \frac{Area_{actual} - Area_{ideal}}{Area_{ideal}}$$

$$DR = \frac{Power_{peak} - Power_{idle}}{Power_{peak}}$$

Energy Proportionality =

Dynamic Range

+ Linear Deviation

$$LD = \frac{Area_{actual}}{Area_{linear}} - 1$$

What can historical Energy Proportionality trends tell us?

What can historical Energy Proportionality trends tell us?

Lessons from the past:

1. Dynamic range improvements has stalled
2. Energy Proportionality has also stalled

What can historical Energy Proportionality trends tell us?

Lessons from the past:

1. Dynamic range improvements has stalled
2. Energy Proportionality has also stalled

Opportunities for future EP growth

1. To improve EP, we must improve LD
2. Large disproportionality at low utilization

KnightShift Server Architecture

KnightShift improves EP by:

- Improving Dynamic Range
- Closing disproportionality at low utilization
- Improving Linear Deviation

Come see our talk!

Session IIB – Energy I

British Ballroom

Starting @ 3:30pm