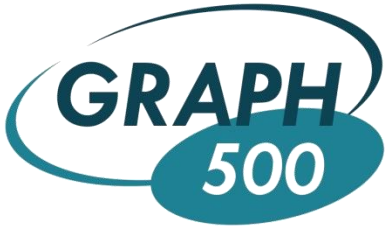
GREEN GRAPH500



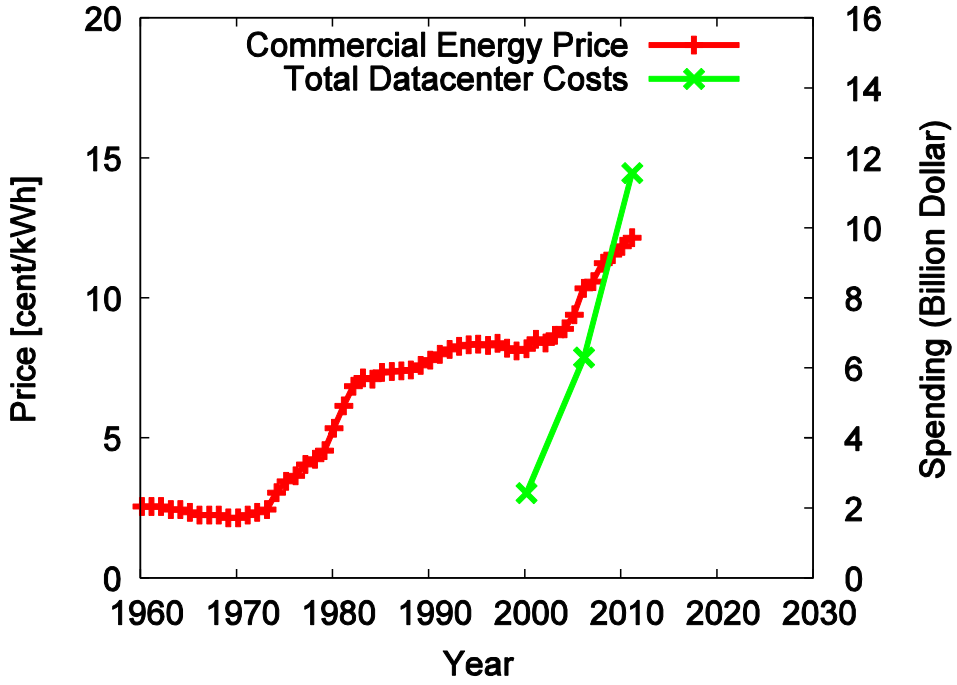
Torsten Hoefler

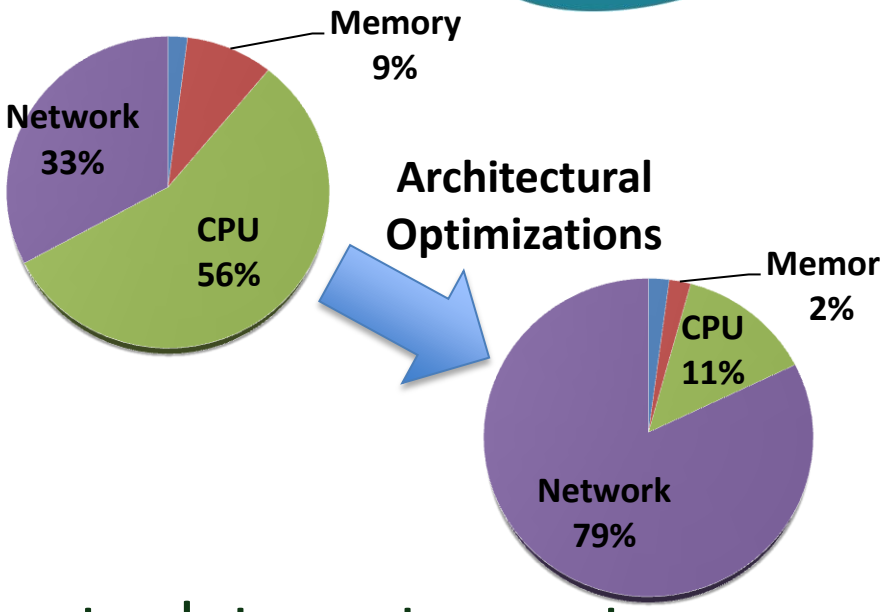
University of Illinois at Urbana-Champaign
and ETH Zürich

Talk at ISC'12, Hamburg, Germany

With support of David Bader, Andrew Lumsdaine, Richard Murphy, and Marc Snir

Motivation



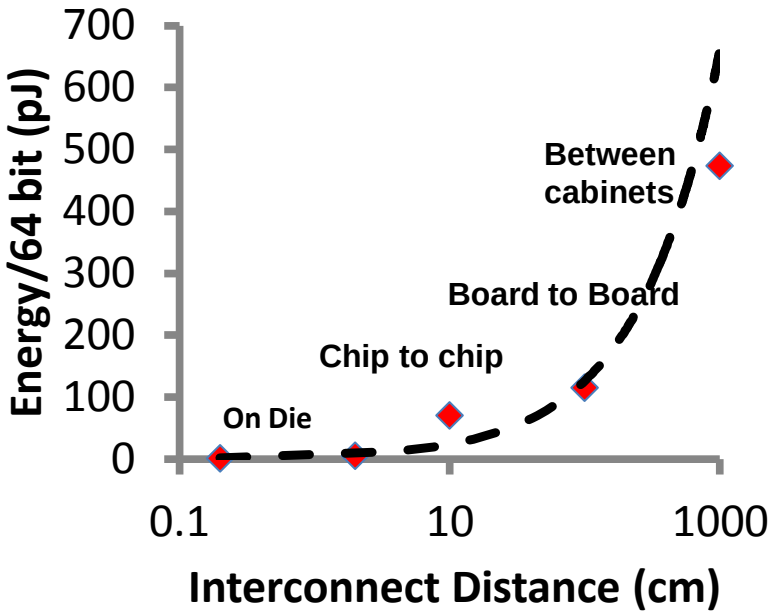


- Big Data analysis may dominate datacenter cost
  - Encourage vendors to provide "greener" hardware

Hoefler: "Energy-aware Software Development for Massive-Scale Systems", EnA-HPC Keynote 2011

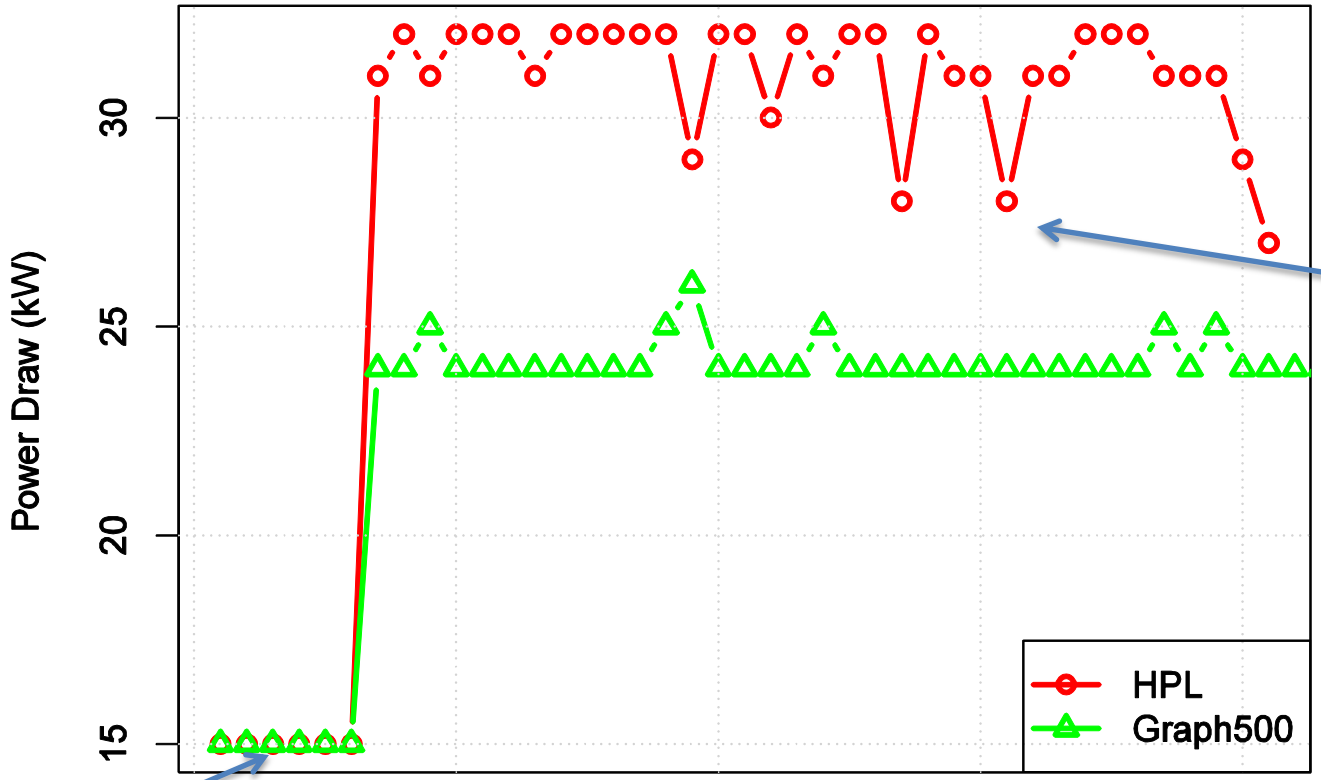
WHY NOT JUST GREEN500?

- Green500 is centered around HPL
  - HPL: extremely structured, FP/Cache intensive
  - Graph500: unstructured, no good separators, (main) memory and network intensive
- Completely different optimization goals!
  - Need to be addressed by vendors!
  - Maybe specialized machines?

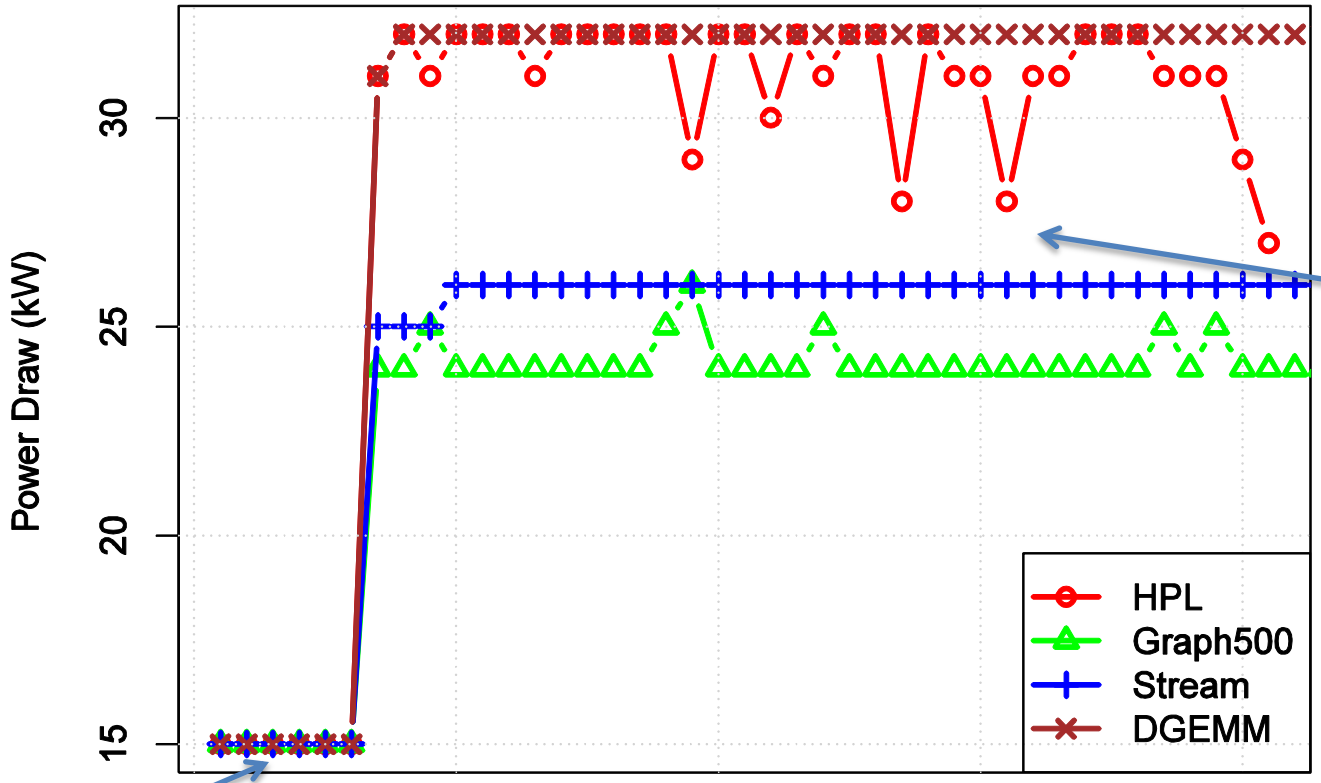


Source: S. Borkar, Hot Interconnects 2011, Keynote

Real Comparative Measurements



Real Comparative Measurements



Panel Bcast

Scale=32

Idle (calibrate wait)

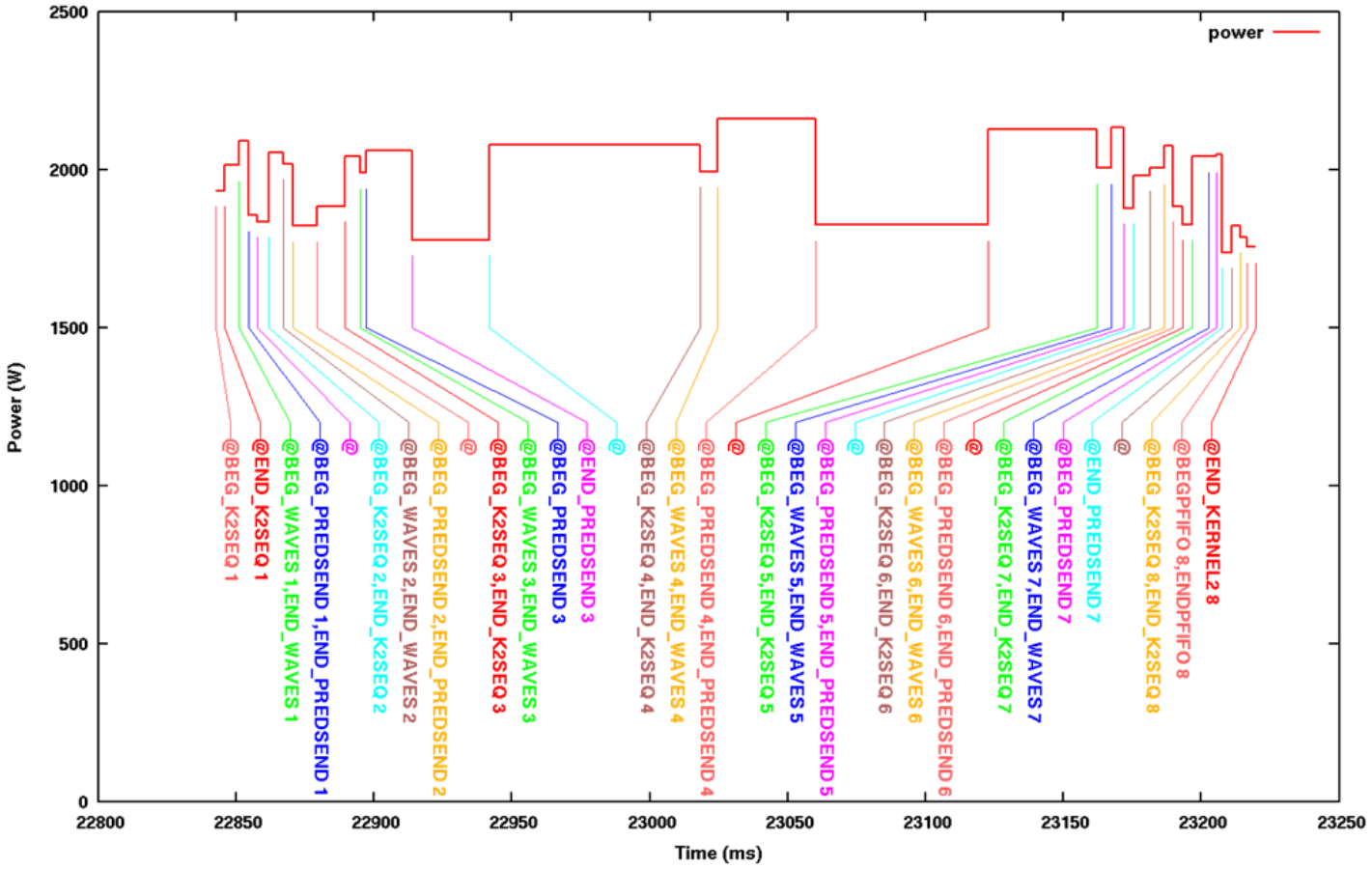
~75 kTEPS/W

452 MFLOPS/W

A Second Detailed Power Trace

>3 MTEPS/W measured on BG/Q

Scale=34



Thanks to (IBM): Fabrizio Petrini, Yutaka Sugawara, George Chiu, Paul Coteus, Fabio Checconi, James Sexton, Michael Rosenfield, Gerard V Kopcsay

The Green Graph500 List

- In close collaboration with Graph500 (same rules)
  - Will have a separate list and separate awards
  - http://green.graph500.org/
- Measurement techniques compatible with established practice and Green500
  - Allows comparisons and cross-analyses
  - Only real measurements, no TDP etc.

Procedures & Technicalities

- Report used energy for full solution
  - Metric: TEPS/Average Power [TEPS/W] or [TEPJ]
  - Test system: ~75 kTEPS/W vs. 452 MFLOPS/W
- Count power for compute nodes and network
  - Either measure single node and switch and sum
  - Or measure cumulative power (at inlet)
  - Or any combination of those (rack …)
- PUE is irrelevant for the benchmark

The Future of the List

- First List: Supercomputing 2012
  - Submission deadline: aligned with Graph500
- Submission details:
  - Through Graph500, provide output data and energy information, or power trace
  - May run different (smaller?) problem sizes
- Watch http://green.graph500.org/
- Support:
  - Thanks to David Bader, Andrew Lumsdaine, Richard Murphy, and Marc Snir