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SC' 14, New Orleans, LA, USA

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

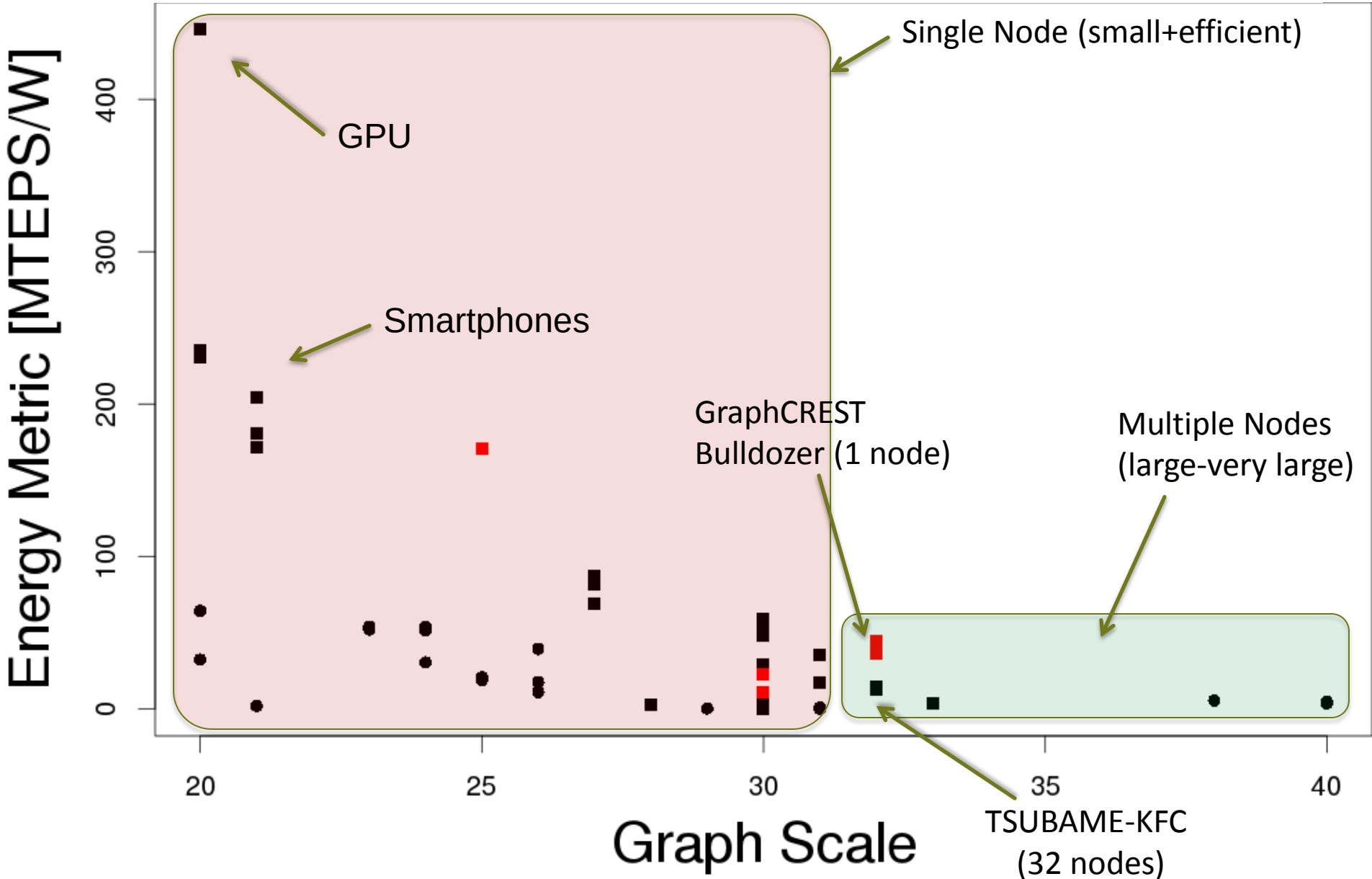
Green Graph 500

GRAPH 500

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.

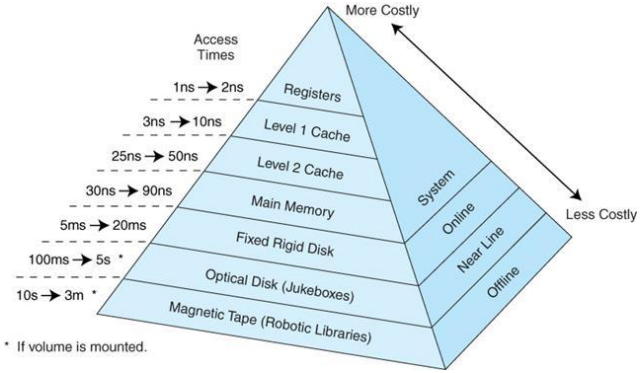
Received Submissions

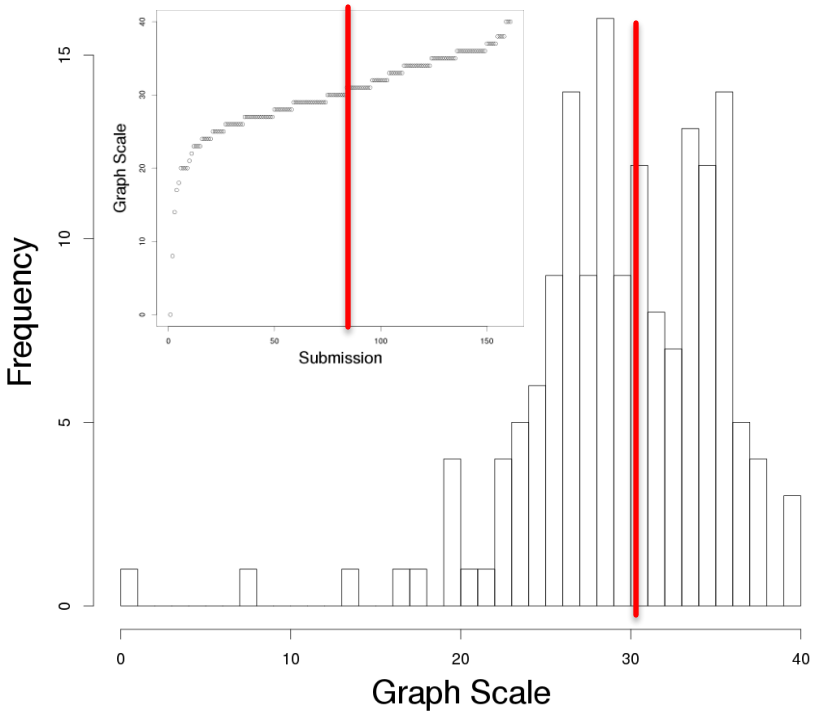


A Natural Split

- **Small Data vs. Big Data**
  - Fundamentally different categories
  - Often: single node vs. multiple nodes
    - *Or: in cache vs. in memory?*
    - *Or: in registers???*

- **Graph500 doesn't limit the "minimal submission" (yet)**
  - Median of Graph500 scales
  - Nov. 2014 list: Scale 30 (unchanged)





The Small Data List

Rank	MTEPS/W	Site	Machine	G500 rank	Scale	GTEPS	Nodes
1	**445.92**	George Washington University	Colonial		20	122.18	1
2	**235.15**	Kyushu University	GraphCREST-Xperia-Z1-SO-01F		20	1.03	1
3	**230.40**	Kyushu University	GraphCREST-Xperia-A-SO-04E		20	0.74	1
4	**204.38**	Tokyo Tech	EBD-GoldenBox-Prototype		21	1.64	1
5	**180.76**	Kyushu University	GraphCREST-Xperia-A-SO-04E		21	0.59	1
6	**171.77**	Kyushu University	GraphCREST-Xperia-Z1-SO-01F		21	0.91	1
7	**170.64**	University of Tsukuba	kitty6		25	35.18	1

The Big Data List

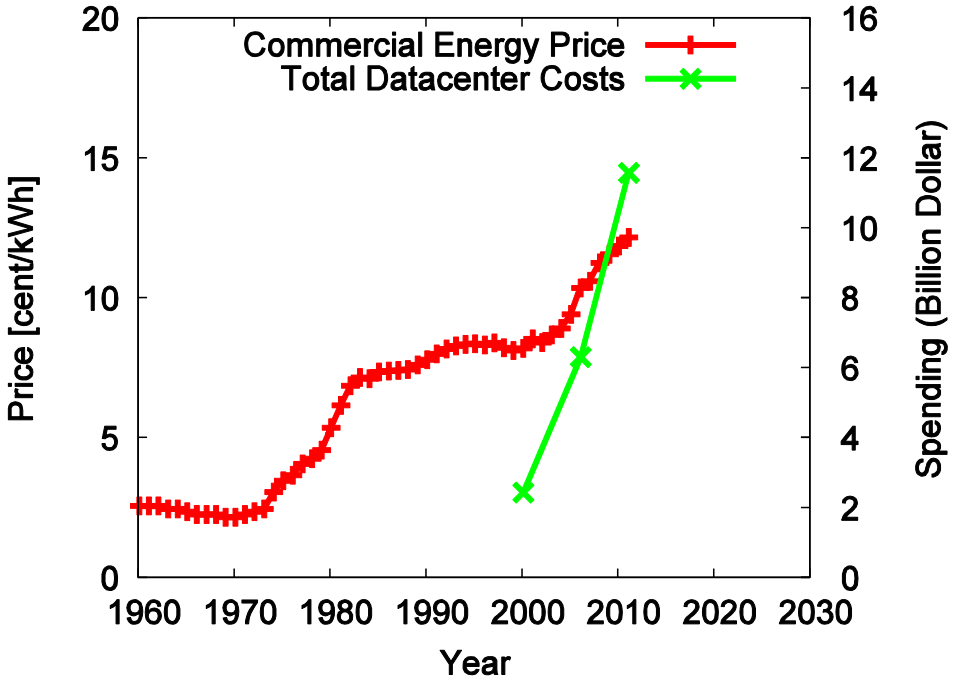
Rank	MTEPS/W	Site	Machine	G500 rank	Scale	GTEPS	Nodes
1	**59.12**	Kyushu University	GraphCREST-SandybridgeEP-2.4GHz		30	28.48	1
2	**48.28**	Kyushu University	GraphCREST-Sandybridge-EP-2.7GHz		30	31.95	1
3	**44.42**	Kyushu University	GraphCREST-Huawei		32	55.74	1
4	**35.87**	Tokyo Tech	GraphCREST-Custom #1		32	10.64	1
5	**28.88**	Tokyo Tech	MEM-CREST Node #2		30	7.98	1
6	**22.36**	University of British Columbia	Alkindi26-hybrid		30	10.31	1
7	**17.24**	Kyushu University	GraphCREST-Bulldozer		31	13.63	1

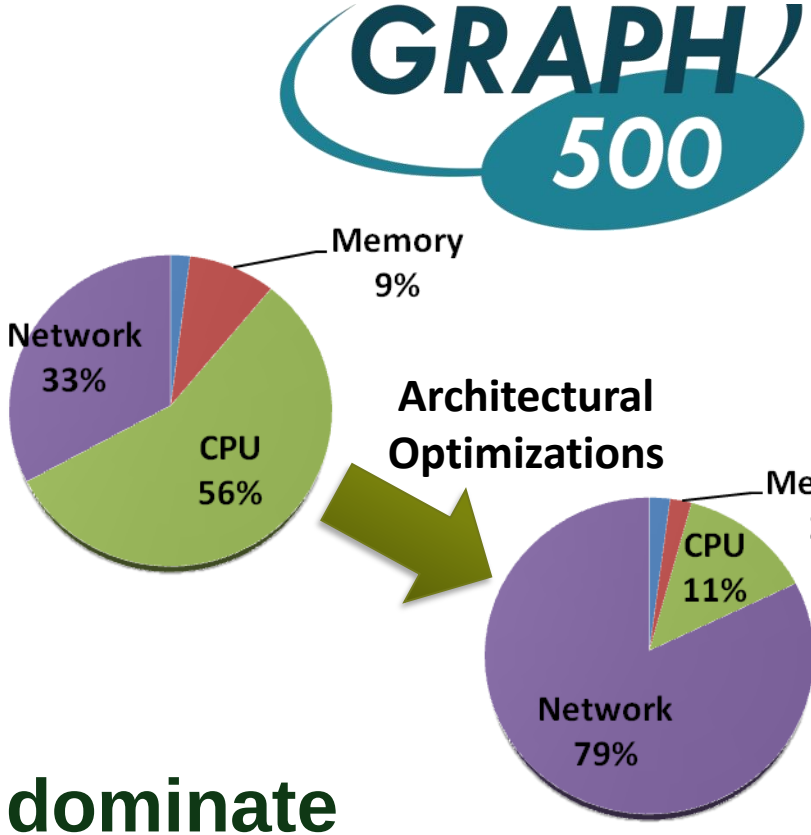
The Future of the List

- **Next list: Jun. 2015**
  - Submission deadline: aligned with Graph500
- **Submission details:**
  - Through Graph500, provide output data and energy information, or power trace
- **Watch** http://green.graph500.org/
- **Thanks for Support:**
  - Thanks to David Bader, Andrew Lumsdaine, Richard Murphy, and Marc Snir

Backup

Motivation



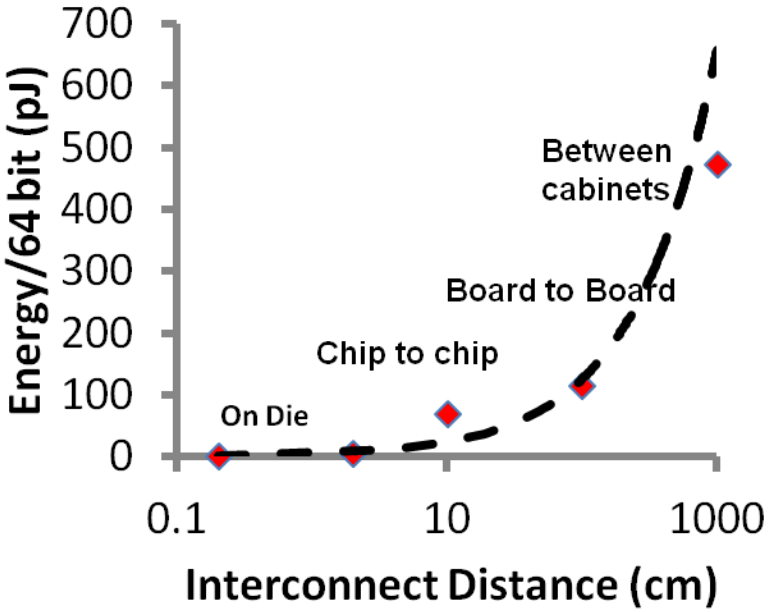


- **Big Data analysis may dominate datacenter cost**
  - Encourage vendors to provide “greener” hardware

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

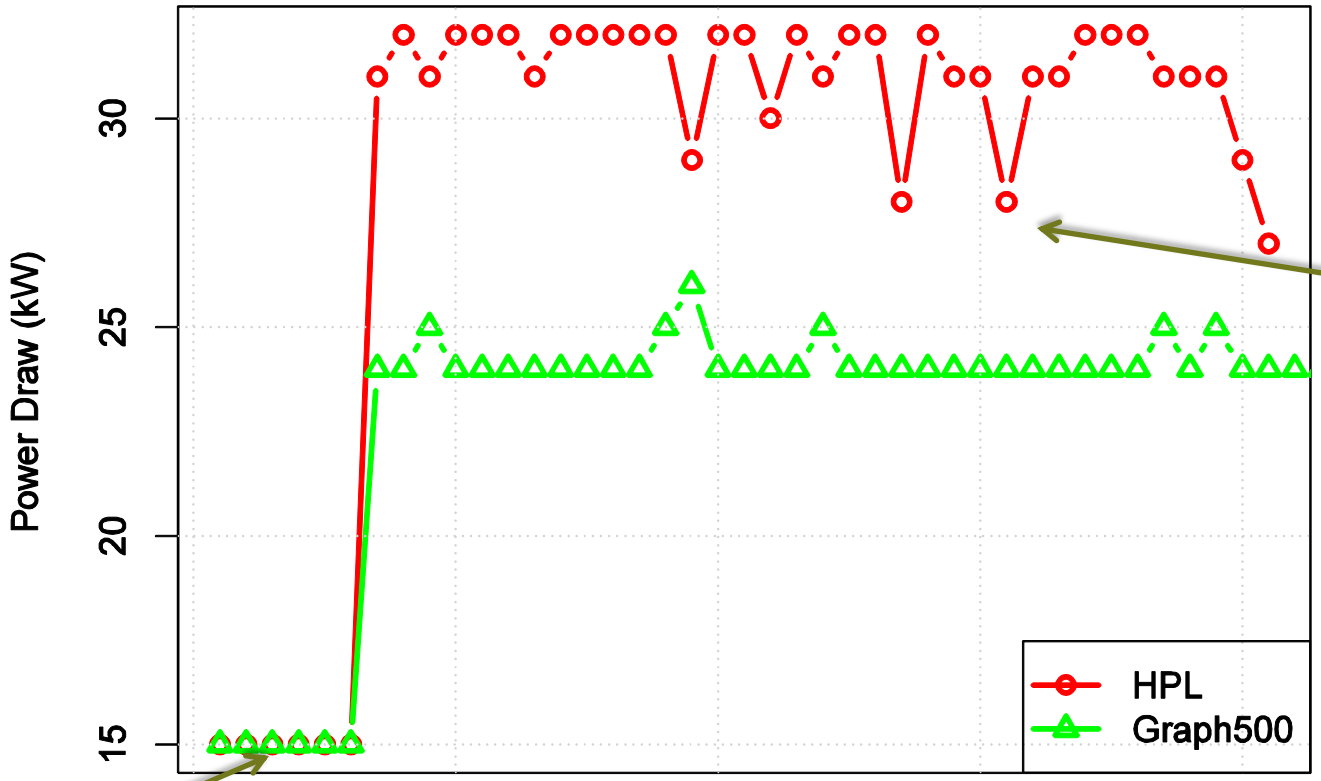
Why not just Green500?

- **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



Panel Bcast

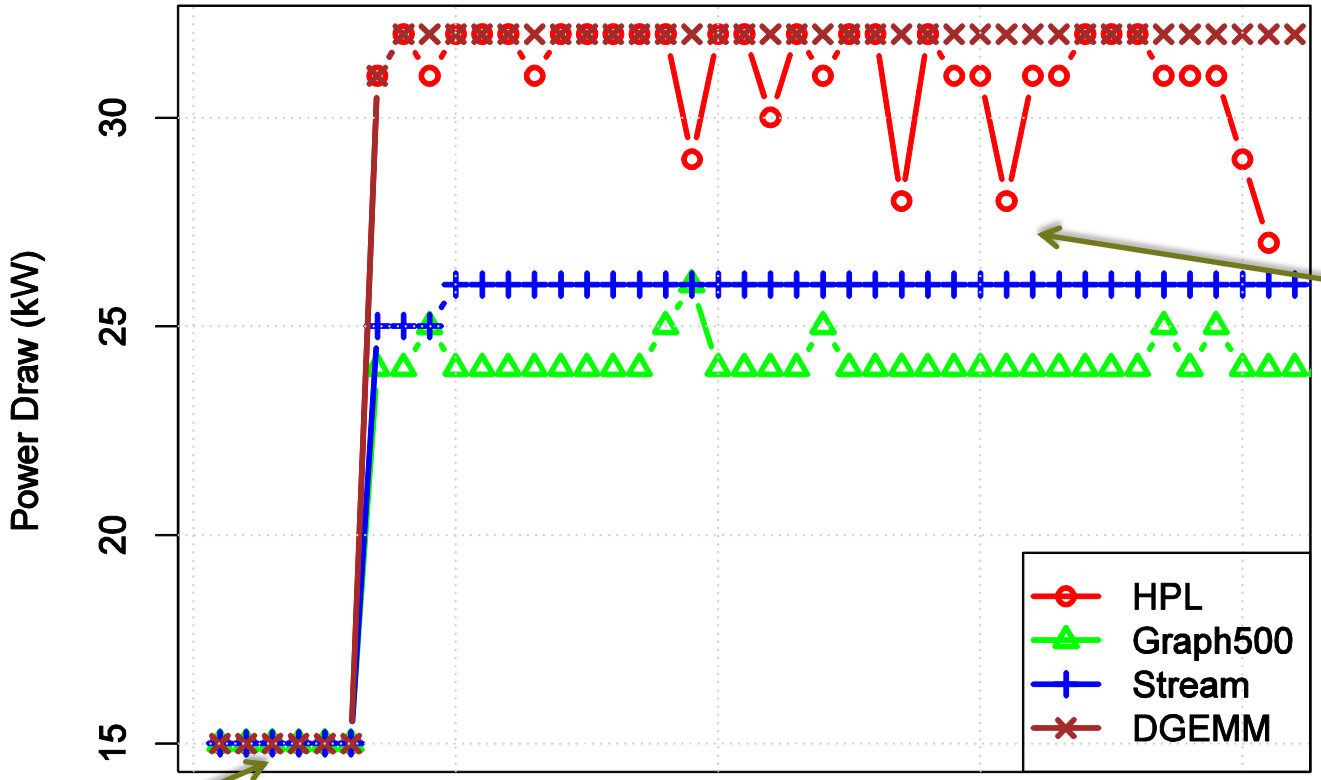
Scale=32

Idle (calibrate wait)

~75 kTEPS/W

452 MFLOPS/W

Real Comparative Measurements



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