EEE

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Recap: Motivation for EEE in this project

- EEE could help make the datacenter more energy proportional to load[1].
- End users are asking developers to “make better energy proportionality a primary design objective” for future systems[1].
- Savings for the IEEE 802.3az PHY alone should be around 90% and energy reduced by up to 70% for the NIC when in LPI mode[2].
  - much greater savings possible in systems using LLDP
    - See dove_02_05_08.pdf (slide 5)

1. L. Barroso and U. Hölzle, The Case for Energy-Proportional Computing. Computer, 40(12):33-37, December 2007
2. P. Reviriego, K. Christensen, J. Rabanillo, and J. A. Maestro, 'An Initial Evaluation of Energy Efficient Ethernet' in IEEE communications letters, VOL. 15, NO. 5, May 2011

Recap: Motivation for EEE in this project

- EEE should be included *at the beginning of projects*
  - Very difficult and time consuming task to retrofit EEE into completed specifications
  - Run the risk of breaking things
  - Much more efficient to consider EEE in the initial design
- Inclusion of EEE should be considered similar to auto-negotiation
  - You need it, just do it

Contributors to 9/11 material

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Straw Polls from September Meeting

- Straw Poll #1: Do you support doing the work to specify EEE for 100G Cu and Backplane IEEE P802.3bj interfaces?
- Results: Yes: 43; No: 0; Unsure: 12

- Straw Poll #2: I would work on the specification of EEE 100G Cu and Backplane IEEE P802.3bj interfaces.
- Results: Yes: 20; No: 8; Unsure: 29

EEE and the 5 critters (11/11)

- We have received contributions from one of the largest data center operators in the world.
- EEE will be compatible with 802.3 standard
- There currently is no specification for EEE for 100G
- Technical feasibility has been demonstrated in proposals for EEE
- Implementing EEE will not add any significant cost to the devices specified in this project

Straw Poll

I would support adding an objective to Define optional Energy-Efficient Ethernet operation for 100G Backplane and Twinaxial cable PHYs specified in P802.3bj

Yes: 58 No: 1 Abstain: 19

802.3 voters only

Yes: 39 No: 1 Abstain: 11

Extras

Motivation for EEE in this project

- Energy cost is still a significant operational expense in data centers [1]

Company	Servers	Electricity	Cost
eBay	16K	$\sim 0.6 \times 10^5$ MWh	~$3.7M
Akamai	40K	$\sim 1.7 \times 10^5$ MWh	~$10M
Rackspace	50K	$\sim 2 \times 10^5$ MWh	~$12M
Microsoft	>200K	$> 6 \times 10^5$ MWh	>$36M
Google	>500K	$> 6.3 \times 10^5$ MWh	>$38M
USA (2006)	10.9M	610×10^5 MWh	$4.5B
MIT campus		2.7×10^5 MWh	$62M

1. Cutting the Electric Bill for Internet-Scale Systems, Qureshi et. al, SIGCOMM '09 Proceedings of the ACM SIGCOMM 2009 conference on Data communication, ISBN: 978-1-60558-594-9. Estimated annual electricity costs for large companies (servers and infrastructure) @ $60/MWh (6 cents / KWh)

Motivation for EEE in this project

- Even in high transaction-rate networks, utilization is not 100% 24 hours/day, 365 days/year = opportunity to save energy[1]

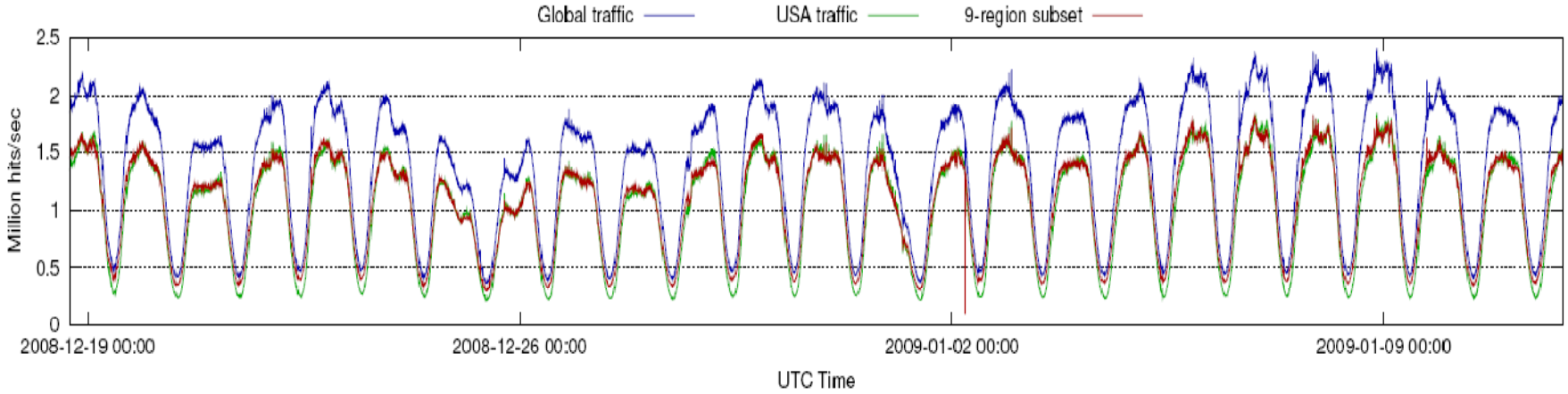

Figure 14: Traffic in the Akamai data set. We see a peak hit rate of over 2 million hits per second. Of this, about 1.25 million hits come from the US. The traffic in this data set comes from roughly half of the servers Akamai runs. In comparison, in total, Akamai sees around 275 billion hits/day.

1. Cutting the Electric Bill for Internet-Scale Systems, Qureshi et. al, SIGCOMM '09 Proceedings of the ACM SIGCOMM 2009 conference on Data communication, ISBN: 978-1-60558-594-9

Motivation for EEE in this project

- Another example of an energy saving opportunity

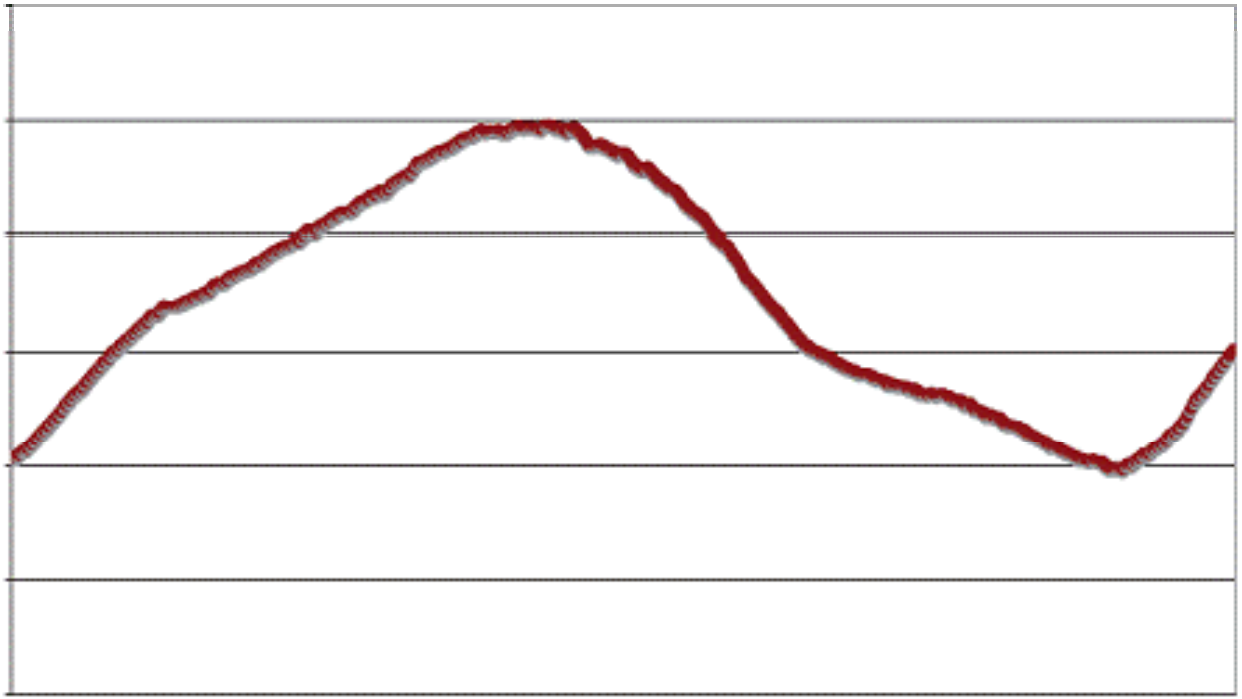

FIGURE 2.2: Example of daily traffic fluctuation for a search service in one datacenter; *x*-axis is a 24-h period and the *y*-axis is traffic measured in queries per second.

1. http://research.google.com/pubs/pub35290.html