Energy Efficient Ethernet: Outstanding Questions

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March 12, 2007

This document is intended to track what is known and what is not (yet) known by the IEEE EEE study group. This is intended to reflect the general consensus of the EEE Study Group but does NOT do so in any official capacity.

What we knew at start of study group

- Energy consumption of IT equipment an increasing concern.
- EEE is good for network industry, IT mfrs, IT users (esp. data centers), economy, and planet.
- Goal is to eventually have all new NICs EEE-capable.
- Energy efficiency community (e.g. Energy Star) ready to help.
- Typical link utilization very low on average (not a problem — an opportunity)
- Aim is for EEE to be suitable for great majority of links (e.g. >99%) but able to be turned off if necessary.
- Time needed to switch data rates should be low (e.g. 1 ms).

Outstanding questions

Control Policies (CP)

Know

- CP is outside scope of 802 / EEE.
- Existence proof of ≥ 1 good CP needed to move EEE forward.
- Helpful to document good CPs somewhere.

Questions

- Do both NICs on a link need to use same CP?
- Can CP elegance be something manufacturers compete on?
- Should EEE NICs exchange information about policies and perhaps parameters? (e.g. delay times, buffer sizes)
- Where should CP examples be documented? (e.g. Informative annex to EEE standard, Ethernet Alliance, Academic literature, Other standards organization)

Traces / Use patterns

Know

- Burst pattern time scales of possible interest
  - Sub-second
  - Seconds to 100s of seconds
  - 1000s of seconds (hours) to days

Questions

- Do we need more sample traces (beyond Ken's) as references for designing EEE?
- Do we need other information about current link use patterns?
- How about 10 G link use information?

Data Rates

Know

- (New) Asymetric data rates raise questions about signaling, and in most applications would have only slight affect on energy savings, so not a priority for consideration at this time.
- (New) Power difference in PHY between 100 Mb/s and 10 Mb/s is too small to be concerned with for energy savings and of uncertain direction.
- (New) Zero Mb/s deserves consideration as a new data rate for EEE PHYs.
- (New) We should not consider PHY data rates other than multiples of 10.

Questions

- Are there non-energy reasons to choose 10 Mb/s or 100 Mb/s as the low data rate for 1 G? Should both be facilitated?
- Is there any reason to consider a rate other than 1 G as the low rate for 10 Gb/s links?
- Any reason to consider data rates other than multiples of 10 for non-PHY components?
- Might there be non-PHY reasons to facilitate both 100 Mb/s and 10 Mb/s for 1G links?

Transitions

Know

- (New) Candidate signaling mechanisms include: LLDP, OAM, MAC, LLDP (see Frazier/January slides).
- (New) Some parameters could usefully be stored to minimize transition time.

Questions

- Is switch time fixed or potentially negotiated (potentially influencing control policies)?
- What are the details / timing for resynchronization at new rate?
- Other than parameter storage, how can we minimize transition time?
- How do we know if the time needed is “quick enough”? (for great majority of applications)

Other Protocols / Layers

Know

- (NEW) We should confer with the PoE group on signaling.

Questions

- What interaction could there be with higher-layer protocols?
- Should link rate switching ever be advertised? (e.g. so that links in series can all shift up at same time)?
- Do upper layers ever need to know that link rates are changeable / changing?
- (NEW) Could / should EEE affect how the spanning tree algorithm uses link speed?
- (NEW) Should EEE be limited to edge connections?
- (NEW) Does link aggregation pose a problem for EEE?

(NEW) PHY types

- Does EEE apply to backplane Ethernet?
- Does EEE apply to fiber PHYs? (or other parts of fiber NICs)
- For 10G, is it OK if the EEE 1G PHY is not identical with today's 1G PHY since this state will only occur with 10G EEE PHYs?

Outreach

Know

- (NEW) We got a flurry of Internet coverage right after January meeting
- (NEW) Web resources: IEEE/EEE: grouper.ieee.org/groups/802/3/eee_study/
  LBNL: efficientnetworks.lbl.gov
  USF: www.csee.usf.edu/~christen/energy/main.html

Questions

- Do we want more information about other link technologies that change link rates? (ADSL2+, 1394, …)
- Any other outreach (companies, countries) of importance to inform or engage?

(NEW) **Getting to PAR submittal**

- Assume not necessary to have hardware experimentation