



Tier 2 Network-related Requirements

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Background



Network connectivity affects energy consumption in several ways

- **Direct** consumption of network interfaces
- **Induced** consumption of entire product
- **Induced** consumption in *other* products

ENERGY STAR concerned with all three

Current network-related requirement



“Computers shall reduce the speed of any active 1 Gb/s Ethernet network links when transitioning to Sleep or Standby.”

(under (3) Power Management Requirements)

- Already a feature on many notebook (*and other?*) PCs when spec finalized
- Requires auto-negotiation to renegotiate link speed
 - Slow, but time to wake up or turn on generally takes similar or more time anyways
 - Autonegotiation latency an impediment to use when idle and may have unacceptable effects on higher layers

Tier 2 Requirements



Two new requirements

- Adaptive Link Rate
- Proxying

Forward-looking so addresses technology not currently available in market

Meets ENERGY STAR goals of market transformation and causing new energy savings

Adaptive Link Rate



Tier 2 text:

“All computers shall reduce their network link speeds during times of low data traffic levels in accordance with any industry standards that provide for quick transitions among link rates.”

Key points

- Fast transitions make suitable for use anytime
- Mechanism will ensure transparency to higher layers
- Power savings modest but occur at **both** ends of link
 - Both ends need to support ALR for it to engage
 - Addresses direct energy use and that induced in other products
 - Supportive of proxying
- Likely no increase in cost to buy ALR interfaces
- Goal to transform entire (copper) Ethernet market to EEE
 - Including 10G for data centers (and workstations?)

Adaptive Link Rate “Energy Efficient Ethernet”



aka RPS “Rapid PHY Switching

Status / Timeline

- July 2005 — Tutorial to IEEE 802 Plenary
- November 2006 — Overwhelmingly successful “Call For Interest” yields 802.3 Study Group
- January - May 2007 — Four intensive 2-day working sessions
- May 2007 — Prep. complete for July advancement to Task Force

Next Steps

- Task force will write draft standard for final vote
- Availability of product for beginning of Tier 2 will be challenging

Energy Efficient Ethernet



Who is involved?

Meetings (partial list)

- 3COM
- AMCC
- Aquantia
- Broadcom
- Cisco
- HP
- Intel
- Keyeye
- LBNL
- Micrel
- Nortel
- Realcomtec
- Solarflare
- Sun
- UNH Interoperability Lab
- Univ. Of S. Florida
- Vitesse

Email Reflector

- Agere
- Alliedtelesis
- Altera
- Avagotech
- Cefriel (Italy)
- DENA (Germany)
- Force10 Networks
- Hitachi
- Hspdesign
- Huawei (China)
- ICIR
- Infineon
- Fujitsu (Japan)
- JPL/NASA
- KETI (Korea)
- Marvell
- Microsemi
- Midascomm
- Neteffect
- Nexans
- NSC
- Nvidia
- Orcaflow
- Panasonic
- Platonetworks
- Powerdsine
- Realtek (Taiwan)
- Seed (Taiwan)
- Serverengines
- Siemens
- Teknovus
- Teranetics
- TI
- Trendchip (Taiwan)
- Wovensystems
- Zyxel (Taiwan)

“Proxying”



Background

- Most energy used by desktop PCs in U.S. when no one is present
 - Enabling power management could save > 50% of desktop PC energy use
- Network connectivity the major impediment to enabling sleep moving forward
- Topic dates back to beginning of Energy Star PC process in 2004
- Intent is to enable sleep without requiring any changes to existing protocols and applications used on great majority of PCs
- Wake On LAN inadequate for general solution for many reasons

Goal

- Drive proxying functionality into all networked electronic products that have significant On / Sleep power difference (printers, consumer electronics)

Proxying



Tier 2 Text:

“ENERGY STAR qualified computers must maintain full network connectivity while in Sleep mode, according to a platform-independent industry standard”

What does a proxy do?

- Ignore all packets that can be ignored
- Respond to routine network chatter (e.g. ARP)
- Auto-generate packets as needed (e.g. DHCP)
- Wakeup machine when wakeup truly required

Where could proxy reside?

- Network Interface (NIC)
- Local network switch
- 3rd party device

Proxying



Status

- Initial “sketch” of proxying functionality in Gunaratne et al[‡]
- Ongoing discussions with several relevant companies
 - Drafting standard
 - Creating prototype hardware

Key Questions

- How to finalize list of standard functions of proxy
- What standards organization to deposit result with
- What interface is needed with OS
- What timeframe is achievable to have hardware available on market
- What issues do wireless connections pose

[‡]Gunaratne, Chamara, Ken Christensen, and Bruce Nordman, "Managing Energy Consumption Costs in Desktop PCs and LAN Switches with Proxying, Split TCP Connections, and Scaling of Link Speed," *International Journal of Network Management*, Vol. 15, No. 5, pp. 297-310, September/October 2005.

Conclusions



- Network issues of increasing importance to energy consumption, savings, and ENERGY STAR
- See **<http://efficientnetworks.lbl.gov>** for further details
- Ecma standard, BAPCo implementation, and ENERGY STAR spec need to properly account for network connectivity
 - Report capabilities (Ecma/BAPCo)
 - Account for in calculations (EPA)