

Power Saving Objective for EPoC

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The Need for Energy Management in Cable Industry

U.S. Cable Industry Launches New Energy Efficiency Initiative

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CableLabs® - Energy Lab Facility Dedicated to Improving Energy Conservation

WASHINGTON, D.C. / LOUISVILLE, CO – The U.S. cable industry today announced a new initiative dedicated to improving the energy efficiency of consumer set-top boxes and other devices and developing advanced cable-enabled services designed to promote innovative consumer energy conservation measures. A key element of the initiative is the “CableLabs® - Energy Lab,” a new facility within the cable industry’s R&D consortium that will concentrate exclusively on improving energy efficiency, the National Cable & Telecommunications Association (NCTA) and CableLabs® announced today.

- Details at:
<http://www.ncta.com/ReleaseType/MediaRelease/US-Cable-Industry-Launches-New-Energy-Efficiency-Initiative.aspx>

Energy Management for Set-top Boxes

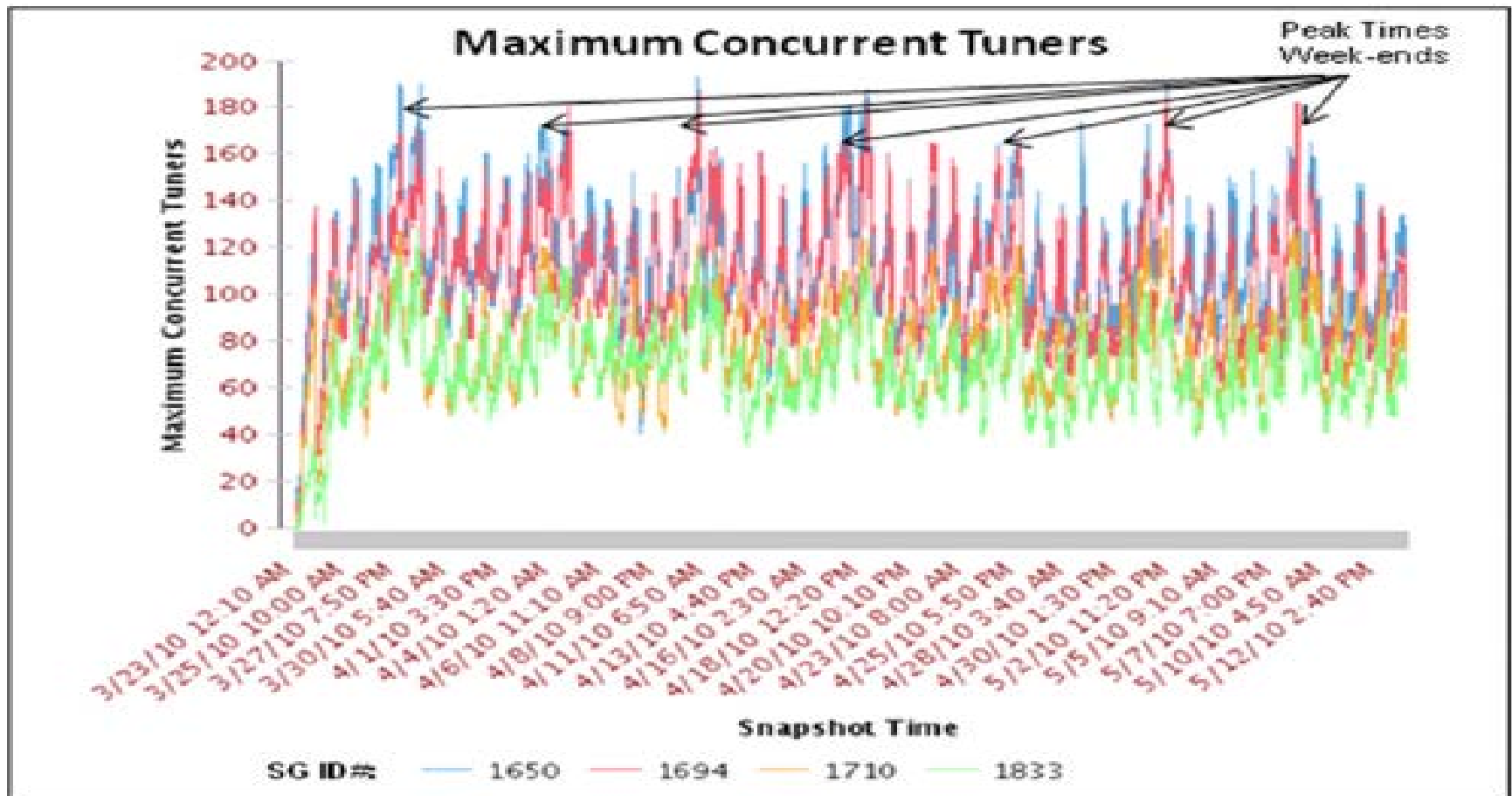
- The first HD DVRs (10 years ago) used around 45 Watts
- The ENERGY STAR® program has been active for the last several years defining set-top efficiency goals and encouraging participation by Service Providers
 - http://www.energystar.gov/index.cfm?c=revisions.settop_box_spec
- In 2011 Q1, 95 percent of shipped Comcast's and 100 percent of Time Warner Cable's STBs were ENERGY STAR compliant
- Digital set-top boxes being deployed by the U.S. cable industry this year are projected to offer energy savings of 20 percent or more when the devices shift into a "light sleep" mode
 - http://www.cablelabs.com/news/pr/2012/12_pr_SetTop_Light_Sleep_031912.html
 - Deep Sleep mode being investigated for additional power savings

Energy Management in DOCSIS®

- CableLabs has worked with suppliers of DOCSIS equipment to innovate around a “Deep Sleep” mode for DOCSIS cable modems.
 - Under this “Deep Sleep” mode, CMTS instructs the CM to enter the sleep mode for a defined period of time (could be on order of minutes) or until a local process wakes the CM up. The said sleep instruction is sent using a DOCSIS MAC Management Message.
 - The CMTS maintains the registration state of the CM while it is in the sleep, but does not queue packets for it (any multicast / broadcast data may be lost)
- Details at: <http://www.cablelabs.com/about/inventions/downloads/60341-published.pdf>

Periodicity of TV Viewing

TV viewing has a clearly periodic character, with abundant opportunities to save energy in the access network equipment outside of peak hours



- SWITCHED INFINITY: SUPPORTING AN INFINITE HD LINEUP WITH SDV, Civileto, J. and Milin, L., Proceedings of 2010 SCTE Cable-Tec Expo

Potential for power saving in EPoC

- Even in high transaction-rate networks, utilization is not 100% 24 hours/day 365 days/year = opportunity to save energy¹

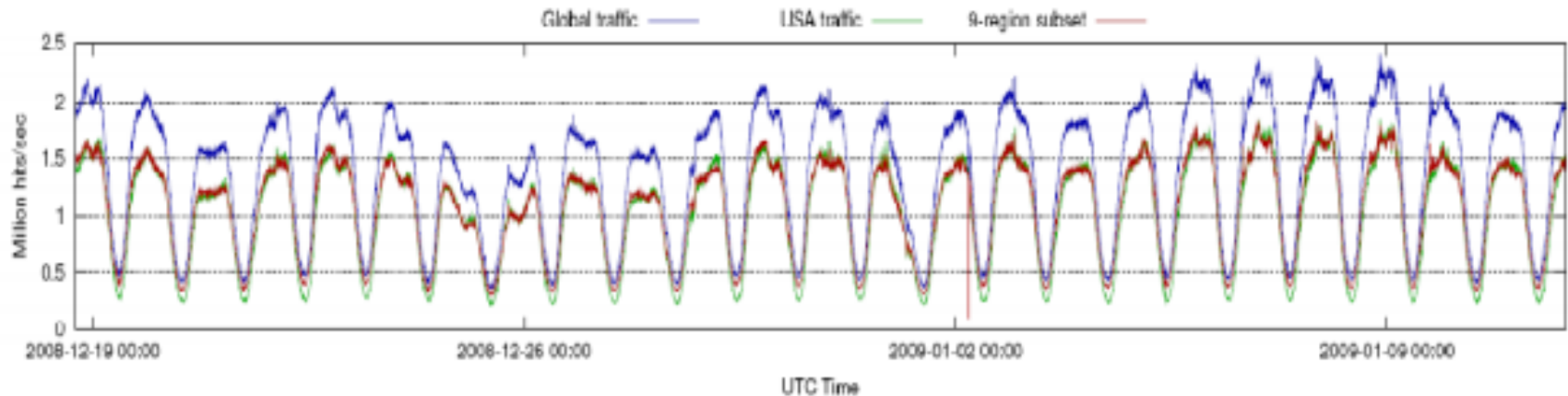


Figure 14: Traffic in the Akamai data set. We see a peak hit rate of over 2 million hits per second. Of this, about 1.25 million hits come from the US. The traffic in this data set comes from roughly half of the servers Akamai runs. In comparison, in total, Akamai sees around 275 billion hits/day.

- 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

Incentives for power saving in EPoC

- There are both regulatory, environmental and financial incentives for implementing and using power saving mechanisms in access networks.
 - Green companies providing green products and services have positive social image
 - Financial savings for CAPEX for CO and outdoor equipment
- Power saving mechanism are already supported in EPON (see IEEE 802.3az™-2010 and IEEE P1904.1) and used in commercial products:
 - adaptation of these mechanisms to EPoC does not represent substantial technical challenges

Lessons Learned (from the past)

- Adding power saving mechanisms to already existing products results in sub-optimum solutions and may be service-affecting
 - Much more can be achieved when equipment is designed for power saving operation from day 1
 - Needs to be supported by multiple elements in devices, including (among the others) SOC, memory, UNI ports, software ...
- Power saving support must be added on both sides of the link (CO and customer site)
 - Targeting only one side of the link is sub-optimum
 - Close cooperation between both link ends under power saving mechanism helps drive power consumption down
- Power saving must be service-aware, with simple rules to follow:
 - Don't go to sleep when calls are ongoing
 - Don't affect time critical services (video, voice) when session is on
 - Adaptive cycle lengths and combination with QoS usually help

Existing Power Saving Solutions

Technical Feasibility

- IEEE Std 802.3az-2011, supported as optional capability by a number of copper PHYs specified in 802.3-2008
 - mechanism referred to as Energy Efficient Ethernet (EEE)
- EEE is included in the following ongoing projects: P802.3bj (approved by TF/WG) and RTPGE (soon to be P802.3bp). It is being considered in Next Gen Optics (P802.3bm).
- IEEE Std 1904.1 adds support for protocol level power saving mechanisms for EPON
 - Adopting this mechanism to EPoC (derivative of EPON protocol running on different CNU) is expected to be straightforward
 - Spec already cover multiple requirements, including support for multicast and broadcast services, packet buffering ...

Regarding Objectives

- Objectives represent an agreement between Task Force and 802.3 Working Group
 - it can be modified at any time subject to 802.3 WG consensus
- Does not require approval by 802 EC or IEEE at large
 - approval and voting done during 802.3 plenary meeting
- It was done before by other Task Forces
 - Objectives are remodeled and updated as Task Force learns more about the PHY design, requirement etc. to better address the end market
 - P802.3bj Objectives (an example) were revised already 3 times (as posted at [objectives_0712.pdf](#))
- Revision of objectives does not imply any shortcomings in the original SG work
 - In TF, technical discussions help crystalize other goals that need addressing by the project

Proposal for P802.3bn TF

- Add a new objective to the P802.3bn EPoC TF:
Define optional Energy Efficient Ethernet operation for the PHY specified in P802.3bn
- “optional” means optional to implement. It also means optional to use, i.e., configurable by the operator
- Requires approval at the next 802.3 WG plenary and reposting of resulting “Objectives” document on the Task Force website
- No changes to PAR, 5 Criteria, and project timelines

THANK YOU