

Energy Efficient Ethernet: Tap Energy Savings in Your Network

Executive Summary

Spiraling energy costs and increasing demand for a greener environment have made energy efficiency a hot subject in data networking. Governments and businesses around the world are looking for and promoting a new generation of energy efficient networking equipment, supplementing programs like ENERGY STAR.

To attract interested IT managers, networking vendors are starting to label their offerings as “green” and “environmentally-friendly.” But what really makes an IT product “green?” How does IT embrace “green” concepts in a climate of tight budgets and “do more with less”?

“Energy efficiency is at the heart of the EU’s Europe 2020 Strategy for smart, sustainable and inclusive growth and of the transition to a resource efficient economy.”—Europe 2020 initiative ¹

This paper outlines an easy way for IT to reduce power consumption using a new industry standard, IEEE Energy Efficient Ethernet (802.3az). We discuss the nature of network traffic in relation to power consumption, the technology and approaches behind achieving energy efficiency, and some practical ways to implement energy efficient products in your network now.

Opportunities for Energy Efficient Devices

Think about utilization of PCs and the networks that support them. Office workers, warehouse workers, and hotel users often connect sporadically, with irregular, brief spikes in traffic interspersed with long periods of system and network inactivity. This idle time leaves business assets such as desktops, servers, and Voice over IP phones under-utilized, often at just 5 percent activity levels.

Like the desktops and servers they support, most network devices at the edge of the network—switches, routers, and gateways—lie idle most of the time. Because they are sized and powered to allow for peak capacity (the highest spike in usage requirements), energy cost is a function of capacity, rather than actual processing activity. These devices draw just as much power when they are under peak load as when there’s no one in the office.

Lessons from ENERGY STAR

When efficiency initiatives like the ENERGY STAR program gain traction, they can make a big difference in energy consumption. According to the EPA, the average energy savings of ENERGY STAR electronics devices ranges from 20 to 55 percent.² ENERGY STAR has promoted development of systems that sleep or hibernate when not in use (among other efficiencies). That idea is at the center of the IEEE’s new Energy Efficient Ethernet (EEE) standard as well. As much as 90 percent of the time, an Ethernet connection is idle but still drawing power.³ If we put the network device to sleep when it isn’t needed, we can save that energy. To serve its network role in real-time transmissions and communications, however, it has to wake up fast. Unlike an ENERGY STAR desktop, there’s no human to shake the mouse and revive the system.

The EEE standard provides an industry-approved way for the devices in the network technology chain to communicate efficiently. This new standard—ratified in 2010 with products commercially available in 2011—defines a new Ethernet protocol. Network components only communicate when they need to, when there are packets to transmit.

The model for ENERGY STAR has individual device manufacturers optimizing their individual devices independently. In contrast, EEE systems from different manufacturers can coordinate to optimize energy use as a system. The EEE protocol includes signaling and alerts so the devices can spend as much time in the idle state—saving energy—as possible, but wake up when needed. With the EEE standard, when the network layer goes idle and the switch lies dormant, it can also notify other devices—like printers and wireless access points—to move to a low power state. This will allow power savings in all of these networked devices, without disrupting the user experience with a noticeable delay.

“The protocol eliminates the overhead of typical administrative messages, allowing systems to stay in a sleep mode as much as 80 percent of the time.”—Bill Snyder, InfoWorld ⁴

¹ http://ec.europa.eu/energy/efficiency/action_plan/action_plan_en.htm

² <http://www.greenbiz.com/computing/research/report/2011/01/04/ceas-2010-sustainability-report#ixzz1G82uOnek>

³ Read more: <http://www.greenbiz.com/news/2010/10/12/broadcom-autogreen-taps-new-energy-efficient-ethernet-standard#ixzz1G81MBwym>

⁴ <http://www.infoworld.com/t/routers-and-switches/what-you-missed-energy-efficient-ethernet-has-arrived-real-savings-897>

Technologies Behind EEE

The EEE standard builds on previous power optimizations, such as power reduction in all port active mode, scaling power based on the length of the cable, and idling power when links are inactive.

For example, Broadcom, an EEE-compliant chip manufacturer, has created an "Automatic Green Mode" that includes an automatic power reduction when the device is connected to a cable with distances up to 30 meters. This technique saves 10 percent of energy consumption over longer cable connections. When you add in EEE support, which will also work for devices on longer cables, you can see power savings of up to 70 percent compared to active mode. For devices that are powered down or not connected by a cable (such as laptops), Broadcom's link power management offers savings of up to 95 percent compared to active mode. Another innovation uses on-chip counters to monitor energy consumption. With this monitoring, a system might send out alerts when energy consumption reaches thresholds and report power outages right away. With this range of options, device designers can take advantage of the strategies that make sense for their specific use cases.

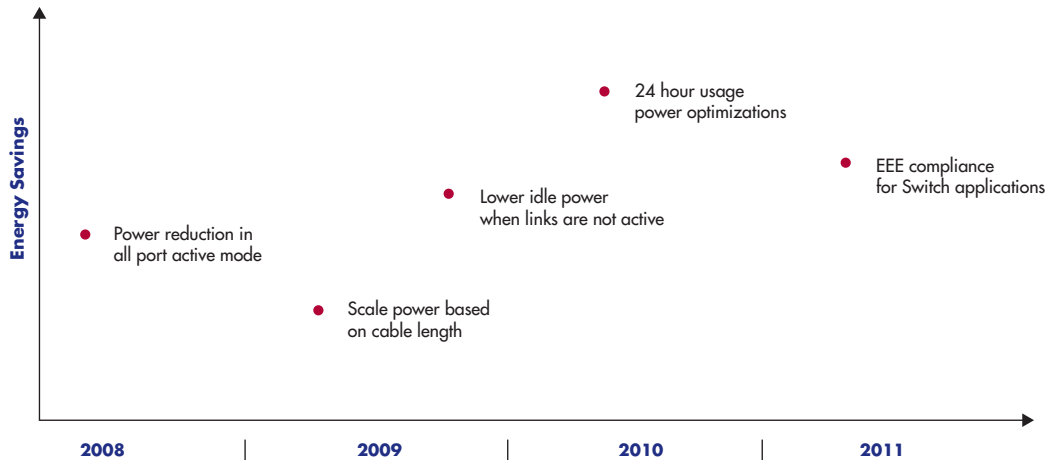


Figure 1: History of energy saving methods in the Ethernet industry. Source: Broadcom

Making Green IT Practical in the Real World

As chips from providers like Broadcom are built into network devices from equipment manufacturers like NETGEAR, IT managers who want to go green will have more and more options. Over time, as we saw with other Ethernet standards, almost all networking gear will support this standard. Since it is a backward-compatible standard, any EEE equipped device should work alongside other current 802.3-compliant Ethernet equipment.

One distinct advantage of EEE is that supporting it requires minimal changes to the hardware, which can be as simple as a different chip in the device, or a new network interface card. For equipment manufacturers, there can be a pin-compatible swap where the old chip is exchanged for a new EEE-compliant chip. These simple chip and card swaps minimize the retooling and testing required and alleviate concerns about interoperability. Manufacturers can make it part of standard product upgrade cycles without significant extra expense.

While EEE provides a standard protocol baseline, vendors are able to add value and differentiation with software, integrations, and other product enhancements, delivering a selection of options for environmentally-sensitive IT buyers.

Rolling Out End-To-End Efficiencies

The sooner you start adopting equipment that supports EEE, the sooner you will start to save on your power bill. For example, a small to medium business might cut its network switch's energy consumption by more than half. Depending on the price of your switch, the savings could allow a new device to pay for itself in just a few years.

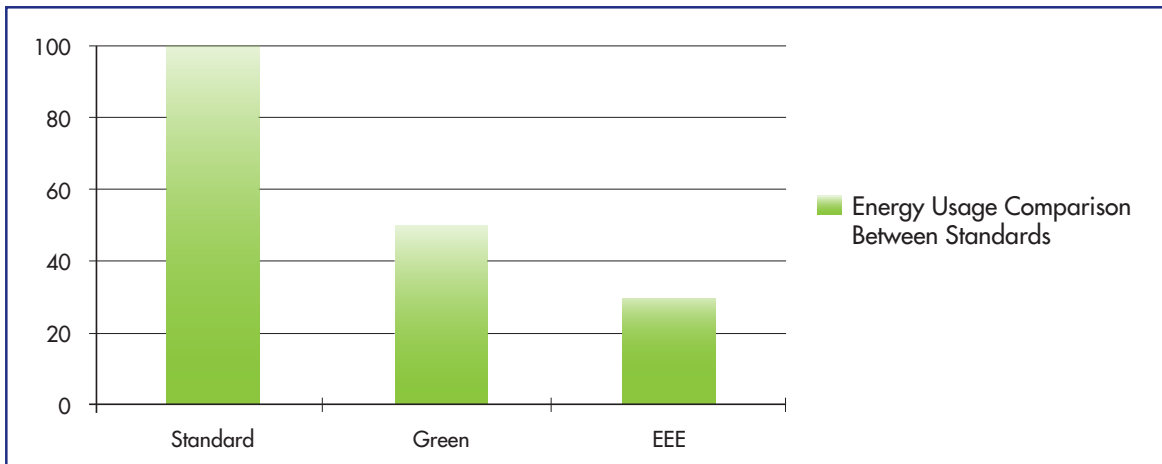


Figure 2: Energy usage comparison between standards⁵

With its interoperability with existing equipment, EEE adoption can start at the network edge, with switches, or new adapter cards. As your efforts mature, monitor and measure the devices with the greatest consumption and direct your energy saving activities to these areas. Look for sites where utilization is low or Internet use sporadic. As you replace networked PCs, printers, wireless access points, and storage, insist on the EEE standard (and ENERGY STAR) with every purchase.

When the EEE protocol can connect end-to-end across the network, the pieces work as a system to deliver the most energy savings. Not only will your network be more "green," you may even see people turn a little green—with envy.

SPOTLIGHT: NETGEAR ProSafe Switches Help Business Migrate to Green IT

Thousands of small and medium businesses rely on NETGEAR to connect their businesses to the Internet safely, reliably, and in an environmentally friendly way. NETGEAR has moved quickly to incorporate EEE technologies in its Green Ethernet switches. These NETGEAR ProSafe Switches include Unmanaged, Plus, and Smart Switches. In addition to using EEE chips and cable-length detection for energy savings, NETGEAR uses automatic power down software in its Smart Switches to further optimize power usage.

For example, software controls can turn devices like IP phones and wireless access points off and on automatically to match the hours of business operations. For retail sites and branch offices with regular hours, this control will save power. It may also reduce the chance of outsiders and hackers using your network inappropriately, for instance using your network to send spam or gain access to internal resources.

In addition, NETGEAR has eliminated the need for a fan, reducing power consumption as well as noise pollution. Through efficiencies like these, NETGEAR Green Ethernet switches deliver up to 60 percent lower power consumption than older non-Green models. And with green manufacturing, NETGEAR product packaging uses at least 80 percent recycled materials.

To encourage the move to green IT, NETGEAR's pricing strategy delivers Green Ethernet devices that are EEE compliant and Energy Star approved, at no extra charge. You can mix and match switches to upgrade on your schedule. Start enjoying the energy savings as soon as you drop in your new switch.

⁵ Estimates based on four 24 port Gigabit switches that consume an estimated \$61 in energy per year (assuming eight hours of daily operation and \$0.15/Kw-hr). A switch to Energy Efficient Ethernet would cut the annual electricity bill by more than half, to \$27.