Microsemi

Using Power over Ethernet to Reduce Network Energy Consumption

White Paper
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Overview

Power over Ethernet (PoE) technology has become an increasingly important tool for simplifying network deployment while improving overall energy efficiency. The latest advances have presented new opportunities to further reduce power consumption and associated energy costs.

PoE enables data and power to be carried over a single Ethernet cable. The technology delivers up to 60 watts (W) of safe, uninterrupted power over the existing LAN infrastructure to powered devices (PDs), at voltages from 50 to 57 volt (V) levels, in support of the latest high-power IEEE802.3at-2009 standard (see Fig. 1). The IEEE802.3at-2009 standard is backwards compatible with and supersedes the earlier IEEE802.3af-2003 specifications.

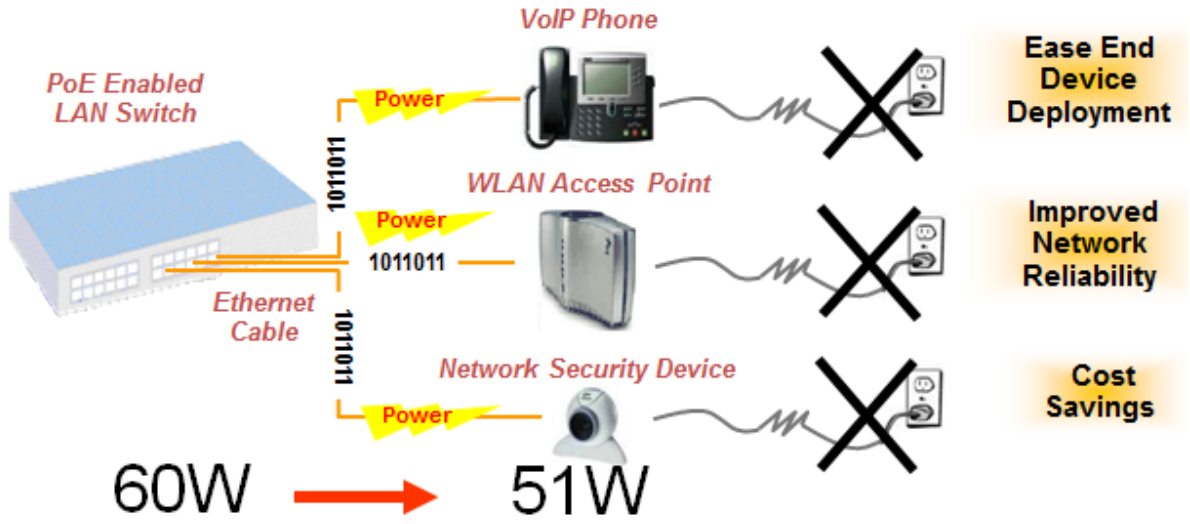

Fig. 1: PoE-enabled network power infrastructure

PoE enables network administrators to deploy VoIP phones, WLAN access points (APs), IP security cameras, access control system and other PDs anywhere throughout the facility without having to install AC outlets or send electricians to pull cables, modify building plans or get safety approvals. By eliminating the need for separate electrical wiring and power outlets, PoE technology can deliver savings of up to 50 percent as compared to traditional network powering infrastructures.

Choosing the Right PSE: The Midspan Advantage

PoE can be implemented with one of two different types of power sourcing equipment (PSE): either via a PoE-enabled switch, or by installing PoE midspans between an existing switch and the network PDs. Midspans offer the easiest approach for quickly deploying high-power PoE (see Fig. 2).

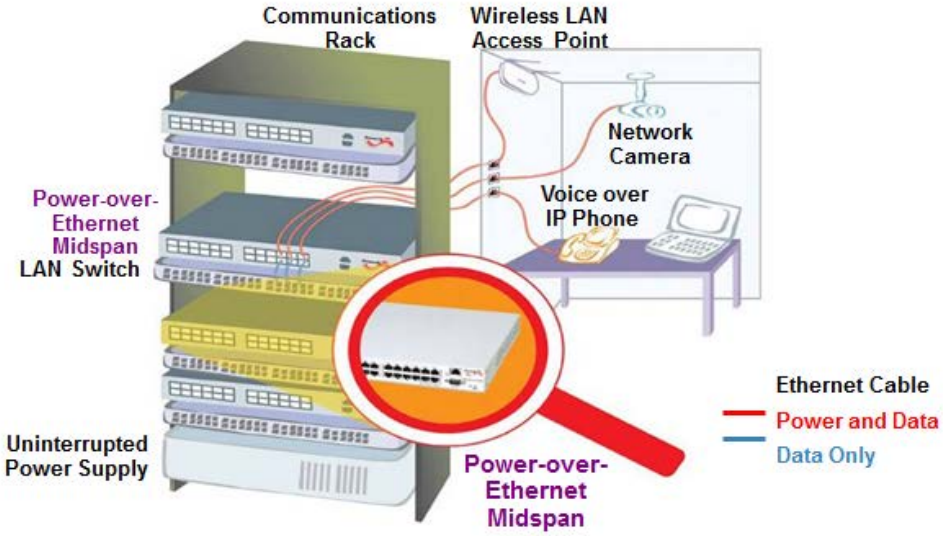

Fig. 2: PoE deployment using midspan technology

Unlike PoE-enabled switches, midspans enable PoE ports to be added incrementally over time, rather than all at once during initial installation. They also typically improve mean time between failure (MTBF) rates as compared to PoE-enabled switches, which concentrate high-power dissipation from the PoE section and the highly sensitive data section into a single box.

Midspans also are a more cost-effective and scalable solution than PoE-enabled switches, and make it easier for network administrators to upgrade their power infrastructure independent of their data infrastructure. Often, network administrators cannot justify the expense of upgrading to a new PoE-enabled switch when their existing switch might only be a few years old, and/or they may only need a few ports with PoE capability. Additionally, midspans enable administrators to upgrade their switch, as required, without having to simultaneously modify the power infrastructure. Finally, midspans enable network administrators to remotely manage PDs while centralizing all power management and backup, which further improves energy efficiency and ongoing infrastructure reliability, reduces operational

expenses, and enhances safety since the midspans also can detect and automatically disconnect non-PoE-compliant PDs in the event of overload, short circuit or under-load conditions.

Additional Energy-Saving Opportunities

There are three key ways that midspans can be used to squeeze the most power efficiency possible out of the network. The first is to leverage midspans' ability to deliver power over all four pairs of structured cable wires. Today's midspans feature two interfaces, each of which takes 25.5W into the same box (one over the two pairs using lines 1, 2, 3 and 6, and the other over the two pairs using lines 4, 5, 7 and 8). Connecting the two interfaces doubles standard power delivery to 51W while still fully complying with the 802.3at-2009 standard (see Fig. 3).

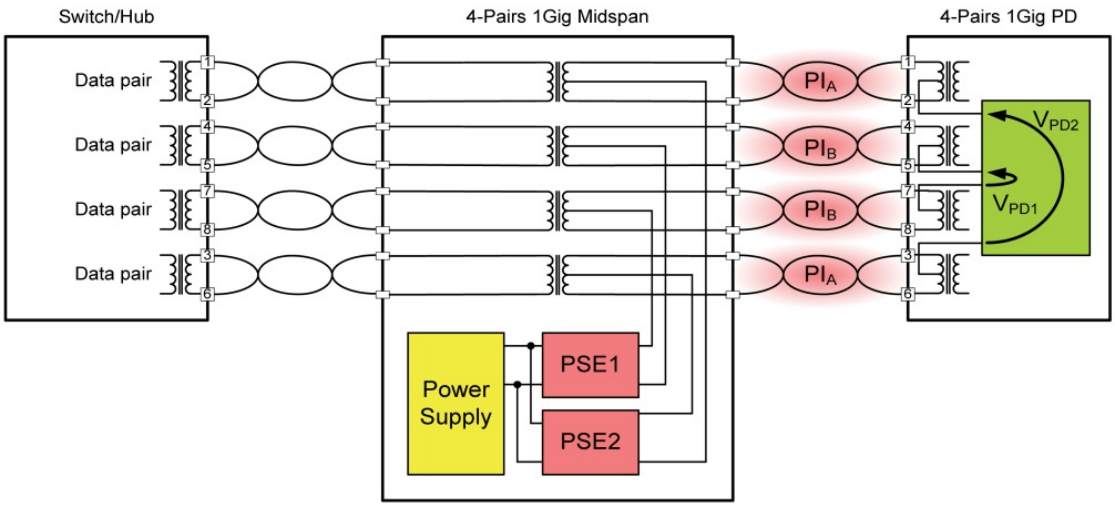

Fig. 3: Four-pair powering

Alternatively, four-pair powering can be used to cut power dissipation—instead of delivering 51W over CAT5 cable, this same four-pair configuration can be used to power two-pair devices with 30W of power, which dissipates up to half the power while consuming almost 15 percent less energy as compared to conventional two-pair solutions, for savings of more than 2.5W per port. Using this approach with a 12-port midspan, power dissipation is reduced by approximately 30W, which yields annual savings of 263kWh (30W x 24 hours x 365 days). At $0.10/kWh, this is $26 in annual savings per 12 WLAN APs.

The next tactic for improving power efficiency is to use midspans' remote PD monitoring and configuration capabilities. Network administrators can monitor per-port and total power consumption, and configure PDs for instant and scheduled port ON/OFF functions, as well as UPS status port ON/OFF functions. An organization with 12 WLAN APs could cut its round-the-clock operation down to, say, 10 hours per week

(8 a.m. to 6 p.m., Monday through Friday), which would reduce usage from 2,933KWh (12 APs x 27.9W x 24 hours x 365 days) to 837KWh (12 APs x 27.9W x 10 hours x 250 days), for a savings of 2,096KWh per year at $0.10/KWh, or $210 annually.

The third way to improve power efficiency is to minimize the effects of idle power consumption. Many PoE midspans and switches use switching power supplies (SPSs) that are 90 percent efficient at full load, which means as much as 220W of AC power is consumed for 200W of PoE power, or up to 440W for 400W of PoE power. The problem is that SPS units have high switching power losses when idle—as much as 20W to 40W with 0W load for 200W-rated units, and 40W to 80W with 0W load for 400W-rated units. The solution is to exploit a midspan's distributed power architecture, in which the PSE uses an internal or default power supply and can then be augmented with additional power supplies, as needed, depending on customer requirements. Using this approach, midspans are deployed with built-in power supplies that are capable of powering real needs, and are only upgraded to full power per port when and where needed via an external power. With this improved efficiency, it is possible to use a small (450W) internal power supply to handle all real-time requirements, and then augment it with an external 450W to 1kW power supply when required. This yields annual savings of 394kWh/year (45W x 24 hours x 365 days), which at $0.10/kWh equates to $39 annually for every 12 WLAN APs.

By aggregating the savings opportunities possible with each of these approaches, it is clear that organizations can reduce costs significantly using the latest energy-efficient PoE midspan technology. The savings opportunities include:

- Four-pair powering: saves 2W per port or $53/year;
- Power management: saves $210/year by enabling ports to be turned off when not needed; and
- Smaller internal supplies (augmented with external supplies as required): saves $39/year by reducing idle power consumption.

PoE technology makes it significantly easier to deploy and expand networks. Organizations can use PoE technology to further enhance network availability and energy efficiency while reducing capital and operating expenditures by choosing the latest high-power PoE midspans. These systems implement four-pair powering and built-in power-management capabilities while minimizing idle power consumption through the use of smaller internal power supplies.

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