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Maximize Benefits of Gigabit WLAN APs with PoE Midspans

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Overview

Wireless device proliferation in the enterprise sector has accelerated thanks to key trends including the Bring Your Own Device (BYOD) mobility deployment phenomenon. This, coupled with migration to new gigabit and multi-gigabit Wi-Fi standards such as IEEE 802.11n and IEEE 802.11ac, is increasing the challenges associated with powering a rapidly growing array of WLAN access points with various reach and performance capabilities. The solution is to take advantage of higher power delivery of the IEEE 802.3at Power over Ethernet (PoE) standard where needed, and use midspan technology to enable more flexible WLAN AP positioning while enhancing infrastructure scalability and delivering important network-wide power management capabilities.

New and Emerging Wi-Fi Technologies

The IEEE 802.11n WLAN standard has become the industry's predominant Wi-Fi technology thanks to its improved reach and bandwidth, along with key features that significantly enhance the quality of video delivery as compared to earlier solutions. According to a June 2012 report from Infonetics Research, WLAN AP shipments have more than doubled over the last five years, and more than three-quarters of all units are based on 802.11n technology. Now, a new IEEE 802.11ac multi-gigabit wireless standard due for completion in 2012 and ratification in 2013 promises to overtake 802.11n, offering up to three times the speed. At the same time, the IEEE 802.11ad Working Group, in conjunction with the Wireless Gigabit Alliance (WiGig), is developing 60GHz wireless technologies that deliver even higher data rates, over relatively short distances.

Clearly, there have never been more WLAN AP technology options, which can create challenges for network administrators trying to deploy and manage the associated PoE powering infrastructure. Power consumption for these various Wi-Fi technologies can vary dramatically in terms of performance per watt, and it is hard to know the extent to which their power efficiency will improve over time. For instance, the power consumption of the earliest IEEE 802.11n solutions exceeded IEEE 802.3af limits, but has since declined in the latest products even as performance has increased. At the same time, however, IEEE 802.11n solutions that boost reach and performance by using more than one radio—or multiple transmitting antennas per radio—consume more power, sending these requirements in the opposite direction.

As an example, IEEE 802.3af power sourcing equipment (PSE) may be adequate for 802.11n 2x2 multiple input multiple output (MIMO) dual-frequency APs with two transmit and two receive radio chains,

but its 12.5 watts (W) of power delivery capability might not be enough for 4x4 MIMO APs that have four transmit radios and four receive radios. Some multi-radio APs might need as much as 20 W of power, pushing them to the 30 W delivery capabilities of IEEE 802.11at. Power consumption varies from vendor to vendor, and there can even be variations between models made by the same vendor.

802.11ac APs are likely to require 802.3at power due to the increased power draw of the faster technology and associated radios. 802.11ac APs go beyond the 20 MHz and 40 MHz channels of 802.11n to add 80 MHz channels, with the goal of providing the same data rate with fewer RF chains. However, a single antenna generally will not suffice for services such as video delivery that require stable and reliable data transmission. It is expected that 802.11ac will use up to 8x8 MIMO antenna configurations, and these additional radios will certainly increase power requirements.

Some vendors seek to increase power delivery for applications in an IEEE 802.3af infrastructure by using dual IEEE 802.3af-capable Ethernet ports, but this also means dual cable runs must be used. Alternatively, one can disable one or more 802.11n transmitters to conserve power, but this simultaneously reduces WLAN AP system performance and capabilities..

The best solution is to upgrade the powering infrastructure to the higher-power IEEE 802.3at standard, and the best way to do this is not through a switch upgrade, but by installing PoE midspans with gigabit interfaces and other features to support next-generation WLAN APs. Easy to deploy, midspans are simply installed between an existing switch and the network's powered devices (PDs), and require no changes to either the switch or the Category 5 (CAT5) and above cabling infrastructure. They support a mixture of both IEEE 802.3af and IEEE 802.3at APs, can be used to power APs up to 100 meters (m) away (and beyond by cascading PoE-extender devices), and feature cloud-based remote management capabilities that make it significantly easier to monitor and control APs, to reboot them remotely, and to leverage time-based PoE to power them down during periods of planned non-use for optimal energy efficiency.

Midspans Put WLAN APs Where They Need to Be

Unlike PoE-enabled switches, which require that long-term decisions about port density be made at the time of installation, midspans enable PoE ports to be added one at a time, as needed. This is particularly important for organizations installing next-generation Wi-Fi APs—administrators may not know precisely

how many they will eventually need, whether these APs can be powered with 802.11af or will need 802.11at technology and where they will need these APs to be positioned. Conversely, administrators may want to upgrade their switch after the powering infrastructure has been deployed. Because midspans decouple the power and data infrastructures, data infrastructures can be upgraded without incurring the cost of PoE—again.

The original, low-power IEEE 802.3af PoE standard used two pairs of wires in the CAT5 cable to deliver up to 15.4 W over distances up to 100 m. The more recent IEEE 802.3at standard doubled power delivery to 30 W over two pairs, and required 2-event classification support to enable communication between the PSE and high-power gigabit APs and other PDs. The IEEE 802.3at standard also made it possible to deploy fully compliant, industry-standard PoE functionality over all four pairs of Ethernet cable, which opened the door for safely delivering 60 W of DC power over a single Ethernet cable to today's high-power gigabit WLAN APs and other PDs.

Four-pair powering also improves efficiency by using lower current, which reduces losses on the cable and translates into extended powering reach using standard cable. Reach can be further extended—up to an additional 100 m, or more—by using PoE extender technology. Table 1 shows the resulting baseline distance extensions. Extenders can also be cascaded to reach even longer powering distances. This gives network administrators significantly more flexibility to deploy WLAN APs both where they are needed, and where they will be the least vulnerable to the inevitable signal impairments and dead zones throughout the typical enterprise environment.

PSE Source	PD Available Power @ 200m
four-pairs IEEE802.3at PSE (60 W)	25.5W (802.3at PD)
IEEE802.3at PSE (30 W)	12.95W (802.3af PD)
IEEE802.3af PSE (15.4 W)	12.3W (802.3af Class 2 PD)

Table 1

It is important to understand that Ethernet standards limit data delivery to 100 m from the switch (typically located in the communication room) and any device connected to it, such as an 802.11n AP. Data integrity cannot be guaranteed beyond this distance. There are several techniques for increasing reach, including using extender technology. Microsemi's extender technology, with four-pair powering, transmits 60 W across 200 m, and 25.5 W beyond this distance—a key requirement for the latest Wi-Fi APs. Another alternative—the implementation of xDSL or fiber cabling between the PSE and PD—extends

reach for data transmission, only, and not power. And while deploying a combination of fiber and copper between the PSE and PD can achieve the desired goal of transmitting both power and data over longer distances, it is significantly more expensive than using PoE extender technology.

The combination of PoE extenders with four-pair powering ensures that power can be transmitted at the higher, 60 W IEEE802.3at levels across these same 200 m distances—and 25.5 W beyond—while supporting the full, gigabit speeds that are necessary for 802.11n WLAN APs and other PDs. PoE extension technology increases the distance that gigabit WLAN APs can be placed from the data and power source, while still maintaining high levels of power efficiency and data integrity. In other words, WLAN APs can be deployed in the best place for their usage, not the closest place to a power outlet.

Not only do midspans expand options for placing APs where they are needed, they also cut deployment costs for high-power gigabit and multi-gigabit APs. This is because generally only high-end switches will support high-power IEEE 802.3at. Investing in a high-end switch just to get high-power PoE capabilities generally doesn't make economic sense. Additionally, midspans offer a variety of remote management capabilities that are not available with PoE switches, enabling users to realize significantly improved power efficiency and associated cost savings.

Improving WLAN AP Management and Power Efficiency

As more and more gigabit WLAN APs and other high-power PDs are deployed, it becomes increasingly important to manage their use, maintenance and power consumption, both individually and holistically. Midspans make this possible, through the combination of a distributed power architecture with dynamic power allocation, and the ability to monitor and manage WLAN APs and other PDs remotely.

Most high-power IEEE 802.3at applications don't require full power on any single port; plus, many IEEE 802.3at PSEs must power lower-power PDs as well as high-power ones such as IEEE 802.11a/b/g and IEEE 802.11n APs, further complicating the power management and allocations picture. In addition to providing more powering flexibility at lower cost, PoE midspans also improve overall energy efficiency by minimizing the effects of idle power consumption. For instance, many PoE midspans and switches use switching power supplies (SPSs) that are only 90 percent efficient at full load. This means that up to 220 W of AC power is consumed for 200 W of PoE power, or as much as 440 W for 400 W of PoE power.

The solution is to exploit PoE's distributed power architecture, enabling midspans to replace a large power supply with a smaller, more economical internal default power supply that is augmented by external power supplies for incremental additional power when needed. By measuring power consumption and managing power dynamically, midspans deliver only the necessary power to each port, and can tap into external power supplies when additional power is needed. As an example, network administrators can start with a 450 W internal power supply to handle all real-time requirements, and only upgrade to full power per port with an external 450 W to 900 W power supply such as Microsemi's PowerDsine RPS1000 when needed.

Another benefit of this distributed architecture is that, when midspans are interconnected, they can be used to back each other up. Prioritized per-port backup power is an important feature for network administrators supporting gigabit WLAN APs. All devices are supported using a centralized power architecture, and all are backed up. If a managed PoE midspan is used concurrently with a managed UPS, devices can communicate and users can predefine the highest priority devices that should continue to operate when power fails. For example, a user can define that if the UPS battery level drops below 50 percent, the PoE midspan will turn off power to selected APs and other PDs while continuing to deliver power to others.

Midspans' remote power-management capabilities also enable network administrators to optimize network-wide energy efficiency by turning APs on or off at pre-determined times during low traffic periods. This can reduce power consumption by 70 percent. Each device's power consumption can be measured and its average power consumption can be actively reduced. An organization with, say, 12 WLAN APs running around the clock could cut these APs' use to 10 hours per week and realize associated savings in annual energy costs.

Finally, remote power management also enables web-based monitoring for maintenance purposes. Malfunctioning field-based WLAN APs can be reset remotely, eliminating an expensive service call. When the midspan is integrated with a UPS system, the remote power-off/power-on capability also enables low-priority APs to be disconnected during power failures.

Conclusion

Given the evolving features and requirements of next-generation Wi-Fi technologies, the most prudent course is to establish a powering infrastructure that can easily scale to higher power delivery, more WLAN APs, and different types of WLAN AP technology, with as much flexibility as possible to position APs where they are needed most and where there are the fewest signal impairments. At the same time,

the denser the proliferation of APs, the more important it is to have network-wide power management capabilities, including the option to power APs up or down as needed, and perform remote maintenance operations. Midspans provide all of these benefits while enhancing scalability and future-proofing network infrastructure investments.

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