Power Over Ethernet Applications

Executive Summary

With everything from phones to men's razors now able to receive power from data cabling, what is the best method to deliver that power? As the IEEE 802.3af standard is currently written, there are two methods of providing power to a PoE device. The PSE or power sourcing equipment (the equipment providing power) can be either mid-span or end-span. Based on the standard, there are some clear and distinct differences between the two. Highlights of the IEEE 802.3af PoE standard are as follows:

Power is provided over a data cabling channel

- Powering devices can be mid-span (injected power within channel) or end-span (power source is in the switch)
- Power delivered from end-span devices can be injected onto pairs transmitting data
- Power delivered from current standards-based mid-span devices typically inject power onto unused pairs.
- Power delivery capability:
- 500mA absolute limit, peak allowable current 450mA with a 50mA safety margin (guardbands)
- Port voltage of 44V – Maximum 48V
- Most resistive allowable cable (20 ohms round trip)
    - Cable drops an additional 7V when maximum current is flowing and arrives at powered equipment as 37V
    - 37V*350mA = 12.95W (maximum power to a powered device (PD)
    - PSE (Power Source Equipment) must detect if attached device is standard or powered and drop power if not needed

In mid-span power, there will be a device between the switch and the end device. Typically, these mid-span devices introduce (inject) power to the end device on the 2 cable pairs that are not used for data, therefore requiring four pairs for operation. The advantage of mid-span devices is that network equipment does not have to be upgraded in order to utilize PoE.

The disadvantage of current standards based mid-span devices is that they require 2 unused pairs to deliver power. This means that these mid-span devices will not work in a legacy split pair configuration as all four pairs are required. In addition, these mid-span devices can only support data applications that operate over 2-pairs such as 10BASE-T and 100BASE-T. This bounds maximum data speed to 100 Mbps, which is a significantly limiting factor in today's networks, where gigabit to the desktop and gigabit VoIP phones is becoming common. Most mid-span devices also require additional rack space and additional connections to a UPS as well as additional connections to the network for management capabilities. This introduces another location for troubleshooting in the event of a failure.

Powered patch panels are mid-span devices that operate within the patch panel. The advantage is lower rack space utilization. However should a device fail, re-termination would be required to move the cable to another powered port, adding the most costly portion of an installation - labor. Powered patch panels also require an additional connection to a UPS, a network connection if management is used, and re-termination of all ports should a higher power level be required at a future date resulting in higher upgrade costs due to

added labor. As devices that require power are added to the network, their connections would need to be re-terminated in the telecommunications room. This may not be suitable for end users that do not have staff with this expertise, as a cabling technician would need to be dispatched each time that power is needed. At present, powered patch panels would also require replacement or replacement of the power modules for gigabit operations if the standard is changed to allow for gigabit mid-span operations.

The other option for providing power to PoE end devices is an end-span device. In an end-span configuration, the switch provides the power with no intermediate device. Because end-span devices do not break into the channel, they are able to provide standards based power to gigabit and 10-gigabit devices as the power is delivered on data pairs. With the costs of chips steadily decreasing, the incremental costs for providing power in a switch is following suit. In addition, providing UPS backup power to the switch only, represents a cost savings compared to providing back-up power to both the switch and the mid-span device.

There are some distinct advantages to end-span power application. In addition to providing power to gigabit devices over the data pairs, newer devices are field upgradeable to increase delivered power. Power can also be managed and backed off if a device is consuming less power than the standard 12.95W delivery. This can provide savings in power consumption resulting in lower operating costs than devices that provide full power at all times. This option requires no additional rack space and no additional connections to the UPS, although the UPS and power back up systems need to be properly sized to handle the loads. There are no additional points of failure, and a simple patch cord change can move a device to either a powered or non-powered port.

Power over Ethernet Plus (IEEE 802.3at) is a new study group within IEEE. The goals are to determine if gigabit in a mid-span configuration will be recognized, as well as to increase the level of delivered power to allow devices that require up to 30W to be energized over the data cabling. This standard is 2-3 years from being finalized. At this point, there are several interested vendors and the standard will likely change several times before the publication date. This would, however, allow laptops, higher gain wireless access points, heavier pan-tilt-zoom IP cameras and other devices to utilize data cabling power.

Siemon recommends power delivery via end-span devices to ensure maximum system return-on-investment, compatibility with network application upgrades, and fewest points of failure. For users that want to provide power to some equipment, such as VoIP phones, and do not have field upgradeable switches or the budget to upgrade their switches, mid-span may provide an acceptable interim solution.

All of Siemon's cabling systems are compatible with Power over Ethernet (PoE) in the published 802.3af standard. We are also working within IEEE to assure ensure that our cabling is compatible with the new Power over Ethernet Plus standard when it is finalized.

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