Power over Ethernet (PoE)

Technology Primer and Deployment Considerations

White Paper

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What is Power over Ethernet ?

Power over Ethernet (PoE) is an evolving technology that extends the already ultra-broad functionality of Ethernet by supplying reliable DC power over the same cables that currently carry Ethernet data. PoE, modeled after the technology used by the telecommunications industry to supply reliable power to telephones, enables lifeline quality power for IP telephones (VoIP) as well as many other low power Ethernet network devices like wireless access points (WAP) and IP security cameras.

In 1999, the IEEE (Institute of Electrical and Electronics Engineers) began developing the 802.3af standard, which defined the transmission of Power over Ethernet to address the need to ensure interoperability among a growing number of proprietary methods of distributing DC power to network devices.

Since acceptance of IEEE 802.3af standard in 2003, PoE equipment vendors have been designing standards-based products that leverage the numerous advantages offered by PoE, such as:

- IP Telephony Sets
- Wireless Access Points (WAPs)
- IP Surveillance Cameras
- Network Clocks
- Video Kiosks

Constantly emerging applications using PoE are limited only by the ingenuity of the product designers.

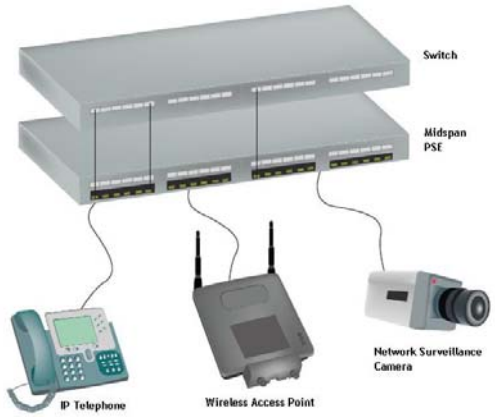

Figure 1. Typical PoE installation utilizing a powered patch panel midspan Power Source Equipment (PSE) to support common low power Ethernet devices.

Benefits of PoE

Network equipment investments are expected to provide functionality that supports current and future productivity enhancements. Deploying a PoE network today offers the following advantages that will also support tomorrow's innovations.

Lower Cost

PoE eliminates the need for running both data and power wires to each network device. WAPs and security cameras can be installed without the additional expense of contracting an electrician to install AC outlets where deployed. PoE also helps protect IT investments as it is forward and backward compatible with other Ethernet protocols. Furthermore, PoE devices that are Simple Network Management Protocol (SNMP) manageable can be remotely monitored and controlled to efficiently manage or troubleshoot power consumption and/or failures.

More Flexible

Network devices can be installed and re-located where performance is optimum, without concern of an existing AC outlet. This is especially important for devices like WAPs, which may require installations in hard to reach locations, such as the ceiling, in order to achieve the broadest coverage.

More Reliable

Centralized power sources that are SNMP manageable protect against power overloads, outages, surges and spikes. When PoE is implemented with uninterruptible power supplies (UPS) or battery backups, it allows enterprises to distribute power, even when the AC electrical power is down. This enables replacement of conventional telephones with feature-rich VoIP phones that will continue to retain lifeline reliability benefits.

Due to all of these advantages, PoE continues to generate a lot of interest and excitement among IT vendors and consumers.

How Does Power over Ethernet Work?

There are two basic components in an IEEE 802.3af compliant PoE network:

1. **Power Sourcing Equipment (PSE)**
   A device that supplies power
2. **Powered Device (PD)**
   A device that receives and utilizes the power

When the PSE connects to a network device, the PSE determines or “discovers” if the device is a PD or not. This prevents non-PoE enabled Ethernet equipment from receiving power, which could cause damage. The PSE applies two small current-limited voltage signals across the cable as it checks for the presence of a characteristic resistance. If resistance is detected, power is provided. A PD may also classify how much power it will require from the PSE. This feature supports the PSE by helping it supply power in an efficient way.

After the PSE has discovered a PD, it supplies 48 V and a maximum current of 350 mA. Voltage may be lost along the cable, depending on distance. However, a minimum of about 13 W is available to each PD, which is adequate power for numerous applications including VoIP telephones, WAPs, security cameras and building access systems.

Once the PSE begins to provide power, it continuously monitors the PD current draw. Once the PD current consumption drops below a minimum value, for example when the device is unplugged, the PSE discontinues supplying power and the discovery process begins again.

IEEE 802.3at

In September of 2005, the IEEE agreed to begin reviewing new PoE specifications in order to enhance current PoE guidelines into a next-generation standard (IEEE 802.3at), commonly referred to as PoE Plus.

The goal for the new standard (expected to be ratified in 2008) is to increase maximum power rating to the 30 to 60 watt range to provide greater power for evolving application applications such as motorized network cameras, IP telephony video phones, RFID readers and access-control systems, point-of-sale and information kiosks, and laptops.

Midspans Vs. Endspans

The IEEE 802.3af standard defines two different types of PSEs: endspan and midspan.

An endspan PSE - Integrates the power sourcing functionality with a network switch. Endspans available today look and function exactly the same as any other Ethernet switch, except they can provide PoE in addition to routing data. Since Ethernet data pairs use transformers coupled at each end of the link, DC power can easily be added to the center tap of the transformer without disrupting the data. In this mode of operation, an endspan injects both power and data on pin-pairs 3 and 6 and pin-pairs 1 and 2.

A midspan PSE - Fits in between the switch and the PD. It supplies power over the unused cable pin-pairs 4 and 5 and pin-pairs 7 and 8. Data is routed through the midspan device without modification, as shown in Figure 2. These devices are usually mounted adjacent to the Ethernet switch in an equipment rack. It is important to note that although the PSE can only use pin-pairs assigned from an endspan or a midspan, the PD must have the capability to accept power from both.

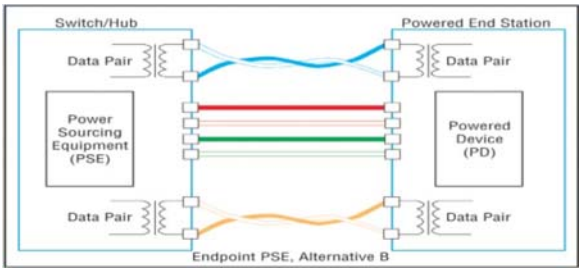

Figure 2. A midspan PSE supplies power on the unused wire pairs and is typically a stand-alone device.

The Midspan Advantage

Midspan devices offer the advantage of retaining the current investment in a switch that does not support PoE. Furthermore, midspans are typically a more cost-effective way of adding PoE to an existing network without disrupting existing switch configuration parameters. A single midspan may be used to support multiple switches with connections to PDs that require PoE.

Currently, there are two different types of midspan devices: power midspan and powered patch panels.

Power Midspan - has two RJ-45 outlets for each PoE port, an input and output, both of which are located on the front. A patch cord connects the switch port to the input of the midspan device and an additional patch cord connects the matching midspan output to a standard patch panel and subsequently the PD. This approach allows for the highest modularity and flexibility to grow PoE ports as needed.

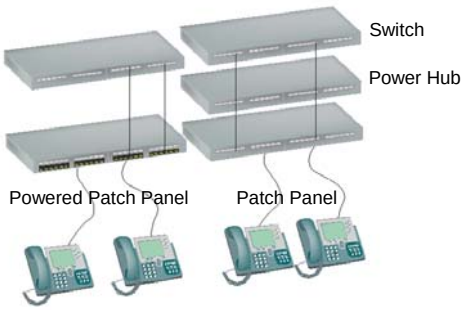

Figure 3. Comparison of implementation configurations for the two types of midspan PSEs: powered patch panel (left) verses power midspan.

Powered Patch Panels - combines the functionality of a midspan device with a conventional patch panel. By using a powered patch panel midspan, such a ***PANDUIT® DPoE™* Power Patch Panel**, the switch connects directly to the PD through the panel. An RJ-45 patch cord connects the switch to the front of the patch panel while the PD is connected to the back of the panel on the matching punch down terminal. Power is added to the unused data pin-pairs within the patch panel. Using this simplified approach requires fewer ports, fewer patch cords and less rack space compared to power midspans as shown in Figure 3.

Conclusion

PoE is an emerging technology that is enabling the efficient deployment of reliable VoIP and wireless networking tools to:

- Increase the efficiency of communication across the enterprise
- Provide network design flexibility
- Enable network modularity and scalability to grow as needed
- Lower the overall cost of installation and peripheral components
- Reduce the overall cost of network ownership

Although both endspan and midspan devices deliver PoE, *PANDUIT*® *DPoE*™ Power Patch Panels and the *PANDUIT*® *DPoE*™ Compact 8 Midspan offer the most efficient solution to upgrade the network with PoE enabled applications.

The *PANDUIT*® *DPoE*™ Power Patch Panel and the *PANDUIT*® *DPoE*™ Compact 8 Midspan offer:

- **Compact designs** that save valuable rack space and offer scalability
- **Optimized performance** that supports IEEE 802.3af-2003 and Cisco power schemes which automatically sense and provide proper powering for connected devices
- **Power** that eliminates power budget load balancing and provides greater design flexibility by sharing power across all utilized ports
- **Low heat dissipation** for lower BTU output than comparable network equipment

About *PANDUIT*

PANDUIT is a global leader in wiring and communication products, delivering end-to-end solutions in support of demanding electrical and networking requirements. The *PANDUIT* solution is built on a foundation of quality and durability to ensure maximum reliability and performance. Continually focused on market needs, research and development enables *PANDUIT* to provide innovative products that meet today's applications and environments. This provides leading-edge solutions that allow businesses to move forward with their strategic objectives.