Power over Ethernet Solutions for Campus Environments

White Paper

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Campus Networks

Today's campus environments experience constant growth and improvements in technology to provide students with leading edge learning experiences and uncompromised safety. Internet Protocol (IP) based security devices, cameras and access control devices are expanding in scope and in reach, as campus security remains a growing concern for today's campuses. Further, wireless access points and Voice over IP (VoIP) devices improve student-to-student, student-to-teacher and administration-to-administration communications for increased information sharing opportunities.

The number of powered devices (PDs) in the campus environment is astounding—includingWLAN access points, IP phones, IP cameras, access control and many others. These require secure, reliable power sources with remote management capabilities. Energy costs, however, were up nearly 20 percent during 2010 and many schools face budget cuts. The demand for network solutions minimizing the total cost of ownership for campus IT solutions is growing.
But one question that cannot be ignored is, "How will you power that?"

Power-over-Ethernet (PoE) technology enables IP devices to be powered over the existing network-cabling infrastructure, thus avoiding the need for separate power and data cable installations and costly AC outlets or power bricks in hard to reach places. Furthermore, it allows the removal of the electricians from the installation process.

By connecting IP based end-terminals to a remote SNMP management system, institutions can experience additional cost savings through remote device management and scheduling.

The Challenges

Increasing Demand among Students and Professors for Access

Connectivity has become an integral part of the education experience. Wireless access points (APs) are scattered throughout the campus—the library, classrooms, dorms, even outdoors. Installation and management of WAPs must be simple and cost effective. Full WLAN coverage is not required 24/7 for all APs everywhere because students move between classrooms and dorm rooms. IP phones in the students' rooms and teachers' offices also require safe and reliable power. In many cases, many legacy devices will also be maintained on the network.

Expanding Surveillance Capabilities and Limiting Physical Access; IP Cameras and Access Control Systems

Campus residents are at risk for a number of security threats—violence, terrorism, theft—all requiring top notch campus security. IP cameras are installed in remote and hard to reach locations throughout the campus to provide adequate visibility and coverage. As campus demographics change and traffic flow shifts, cameras often need to be relocated.

Professors have access to sensitive information such as grades and tests. Universities use access control systems to limit the access to private areas.

What is Power over Ethernet?

Power over Ethernet (PoE) is the technology that integrates data, voice and power over standard Ethernet infrastructure using Cat 5 or better cables. It is the means to supply reliable, uninterrupted power to Internet Protocol (IP) network cameras, IP phones, WLAN access points, access control devices, thin clients and other Ethernet devices.

Field proven PoE technology saves the time and cost of installing separate power cabling, AC outlets and wall warts, as well as eliminating the need for a dedicated UPS for individual devices. The power delivered over the Ethernet infrastructure is automatically activated when a compatible terminal is attached to the network and identified, and blocked to legacy devices that are not compatible. This feature allows users to freely and safely mix legacy and PoE-compatible devices on their network. PoE

technology is designed in a way that does not degrade the network data communication performance or decrease network reach.

There are two ways to implement PoE:

- **Endspan:** PoE enabled Ethernet switch. Power is supplied directly from the data ports, in a layer 2 device.
- **Midspan:** A standalone, plug and play device, residing between an ordinary Ethernet switch and the end terminals, often referred to as a Power injector or midspan. Power is supplied through a layer 1 pass-through (Figure 1).

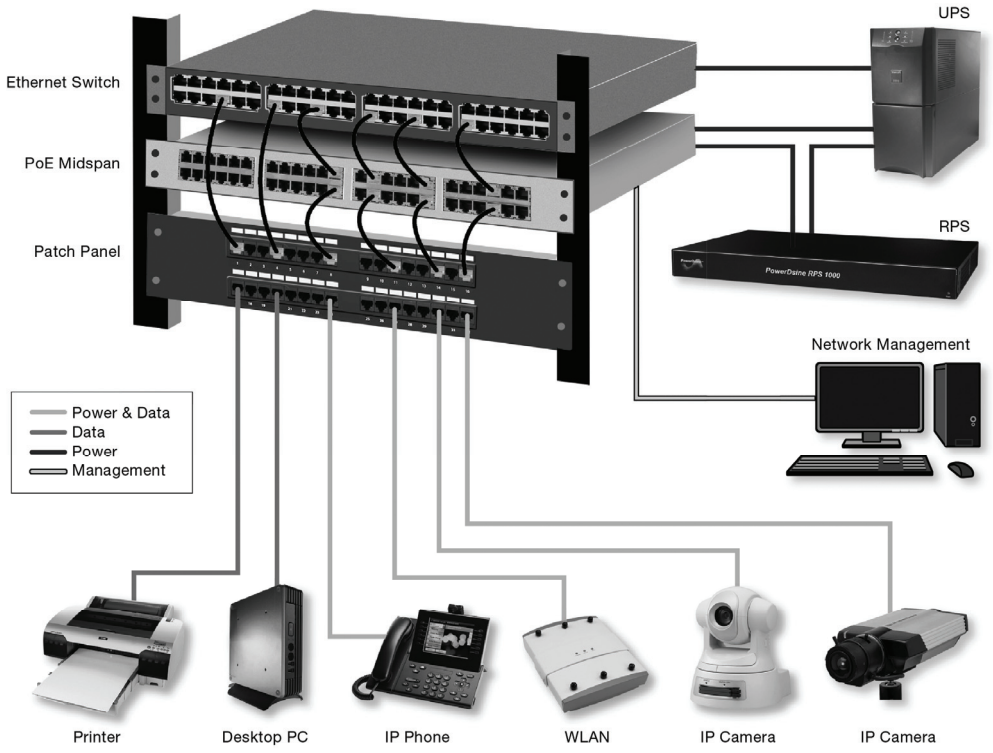

Figure 1: Architecture of Power-over-Ethernet in a campus network

Key Benefits of PoE in Campus Environments

Lower Installation Costs

Electrical wiring costs are greatly reduced by using PoE. Those costs consist of AC wiring, electricians' fees and AC outlet costs. Alternatively, safe power is supplied to the IP phone or other device over existing standard Ethernet wires.

Cost Savings through Remote Scheduling

SNMP Remote Power Management tools allow scheduled up and down-time for powered devices. As students migrate from dorm to classroom, and elsewhere on the campus, the demand for powered devices changes, and devices such as WLAN APs can be powered down in periods of non-use. Such scheduling can result in reductions in power consumption and therefore cost savings in excess of $300 per year.

Increased Reliability
Devices are connected automatically to an uninterruptible power supply (UPS) through the Ethernet cables, increasing reliability and reducing data loss. Further, a redundant power supply (RPS) offers complete reliability of an IP telephony system for reductions in data loss and increased network security.

Assured Safety with Advanced Line Terminal Detection
Line detection enables safe installation without worry of high voltage damage to laptops, desktops and other non-power ready devices, due to a misplaced connection. A faulty camera or an access control terminal can be detected and shut down, preventing damage to expensive switches and patch panels in the Ethernet network. Line detection is one of the reasons why a Power over Ethernet Midspan is much more than an intelligent power source.

Midspans for Outdoor Installations
Midspans for outdoor installations allow PDs installed outside to receive power and data while offering protection from elements like wind, rain and dust, as well as providing necessary surge protection to ensure a safe operation of these devices. Installation of outdoor PoE midspans support installation of IP cameras and allow creation of mesh networks, which are critical for wide surveillance.

Installing PoE
This paper focuses on the approach to optimize PoE technology for the unique needs and demands of a typical campus environment as most installations share very similar infrastructure.

The Ethernet lines run from the network switch, sometimes through a patch panel, out of the communication room and connect to the VoIP phones and other IP devices (see Figure 1). Adding PoE enables devices to be powered over the same Cat 5 cabling infrastructure, providing the most cost-effective solution.

When a non-PoE switch is already installed, the simplest means to add PoE is by adding a dedicated PoE midspan.

Installation Tips
The following are some installation tips for installing IP based and PoE PDs:
Ensure power devices are using PoE wherever possible.

- Midspans provide a simple convenient (plug and play) means to remotely power-down devices during periods of non-use and power-up again when needed.
- Maintaining UPS capability creates reliable power access to the devices and eliminates data loss.

Install all PoE midspans in communication rooms and data centers. To minimize tampering with the units and enable central management, 6-port, 12-port and 24-port units should preferably be rack mounted. Single port and four-port devices can be placed on top of equipment or wall mounted.

Use color code cables. This will assist in management and indicate that these cables are not to be touched by maintenance personnel.
Concentrate UC devices. This will optimize installation costs and effectiveness. Rather than attempting to install the shortest cabling, try to pull network cabling to a single communication room rather than distributing small numbers of device ports in network closets. For devices that are located more than 100 meters (M) from the network room, use a PoE extender to extend the reach of your power and data. This will enable selection and flexibility in choosing a midspan, and a higher port density midspan will save rack space and installation costs.

Further, through mutual midspan backup using two 24-port devices, 48 devices may be combined into a single midspan system to utilize and take advantage of a single power budget, thereby saving costs further.

Use an external power supply, where available. An external power supply, such as a PD-RPS, will lower initial deployment costs by allowing for flexibility as a network grows.

Install Surge Protected and Outdoor Rated devices as specified for outdoor camera's and access points. Install either an indoor midspan for outdoor PDs or an appropriately IP rated outdoor midspan for outdoor PDs.

Non-Standard Devices Using a Splitter

There are IP end terminals that were not originally designed to accept power from the Ethernet. These devices either only accept power through their DC jack while their RJ45 input only accepts data or they only accept voltage levels lower than the standard's 48 volts DC.
By using a passive or active splitter the device immediately becomes PoE ready without any modification required on either side.

How to Select the Appropriate PoE Midspan

Once installed, the Ethernet cabling from end-devices is pulled to the communication rooms, where the switches and midspans are installed.

When choosing a PoE solution, the following aspects should be considered:

- The number of devices to be connected to the midspan—referred to as port density
- Power consumption of each device
- Future expansion plans
- Whether full-time power is required or whether scheduling would allow for additional savings in power consumption
- Whether the PD will be impacted by environmental factors such as wind, dust, rain or sunshine.

The port density of devices that reach a specific communication room depends on the following parameters:

- Ethernet cable maximum length, which is 100 meters (330 feet) without a PoE extender
- Number of devices needed, per total site
- The geographic stretch of the facility.

Non-IEEE802.3 compatible devices: Determine the number of non-standard devices that will need active splitters to reduce voltage or increase amperage.

Number of ports: Once the number of UC devices per communication room has been estimated, select the appropriate PoE midspan.

Ports Density	Appropriate PoE Midspan
1-2	1-port
3-4	4-port
5-6	6-port
9	12-port
16	24-Port

Room for Expansion: In a similar fashion to Ethernet ports, 1 to 2 spare ports should be available for future growth.

Remote Management and Gigabit support: Determine whether you want to control the power supplied to the phones. Identify the required communication transfer rate (10/100/1000BaseT).

Conclusion

This paper serves as a guide for implementing Power-over-Ethernet in campus networks as a means to easily expand or upgrade the network through the installation of PoE based power sources and PoE

enabled Ethernet devices. Using the information provided here will assure the installer, user or IT manager a network that is easier to set up and maintain while also lowering power consumption and reducing costs.

PowerDsine PoE solutions by Microsemi provide IT managers the simplest, safest, most cost-effective solution for upgrading their network with higher powered, more robust end devices resulting in more reliable, cost-effective communications, increased student safety and theft reduction. The advanced features of the PoE midspans also vastly simplify ongoing maintenance of the network, enabling reliable continuous operation with minimum downtime. The paper discusses the means to optimize features of PoE Midspan.

Advanced detection guarantees safety and interoperability with many Powered Devices.
For more information on Microsemi's PowerDsine PoE systems, visit www.microsemi.com/powerdsine.

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