Power Over Ethernet

# Applications Driving the Adoption of Power over Ethernet (PoE)

White Paper


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## Introduction

Power over Ethernet (PoE) is a progressive technology that extends the capabilities of Ethernet by providing reliable DC power delivery to network devices over the same wires that currently carry data.

Since acceptance of the IEEE 802.3af Power over Ethernet standard in 2003, equipment vendors have been designing standards-based products that leverage the numerous advantages and benefits offered by PoE. The functionalities and benefits that PoE offers have helped it gain rapid interest for enterprise applications. This white paper explores key applications that are driving the deployment of PoE networks—Voice over Internet Protocol (VoIP) phones, IP security and surveillance cameras, and wireless access points (WAPs).

PoE offers two benefits that are consistent across applications: cost savings and flexibility of device placement. Because PoE runs data and power together over the same cable to each device attached to the local area network (LAN), devices can be installed without the concern for proximity to individual AC outlets. This saves money by eliminating the cost and time associated with AC outlet installations, while providing the flexibility to locate PoE devices where performance is optimum.

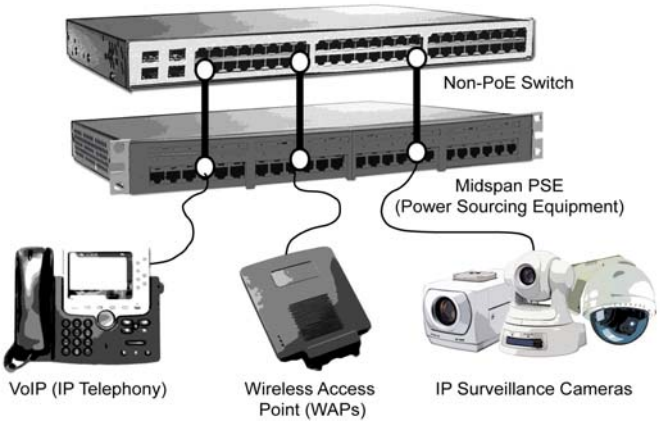


**Figure 1.** Applications currently driving the adoption of PoE include VoIP phones, wireless access points (WAPs), and IP security and surveillance cameras.

Additional benefits of PoE may include manageability of power sources and battery backups to protect against outages and power spikes. Using a centralized power source, PoE offers the ability to remotely power connected devices on or off in the event of service disruptions or reconfigurations.

PoE also helps protect network investments, as it is backward and forward compatible with other 802.3 Ethernet protocols. Under IEEE 802.3af, 15.4 W of power are available for each powered device, which is adequate for most current PoE applications. A new standard (IEEE 802.3at, commonly referred to as PoE Plus) is expected to be ratified in 2008 that would increase power delivery up to a minimum of 30 W for evolving applications such as motorized (i.e., point-tilt-zoom, or PTZ) network cameras and IP telephony video phones.

To implement PoE in a new or existing Ethernet network, organizations have a choice of varied solutions that include PoE-enabled network switches, midspan power sourcing equipment (PSE), powered patch panels, and single port injectors. The most appropriate solution, however, depends upon each organization's requirements for:

- Scalability (i.e., power capacity, port growth)
- Flexibility (i.e., moves, adds, and changes)
- Manageability (i.e., simple power injection versus endpoint control and power monitoring)

## VoIP (Voice over Internet Protocol)

**The Adoption of VoIP**

Voice over Internet Protocol phones are becoming incredibly popular because they offer a lower total cost of voice network ownership. VoIP technologies are enabling enterprises to unify voice, data, and video messaging; eliminate toll and long distance charges; and transform their network telephone system into a single infrastructure which helps reduce associated wiring and maintenance costs. As VoIP products have matured, their adoption rate has increased dramatically across enterprise and education sectors.

In 2004, early VoIP adopter Bank of America announced the rollout of 180,000 Cisco IP phones. In late 2006, a series of high-profile rollouts were announced that included Amazon.com (5,000 Pingtel IP phones), the New York Times (approximately 3,500 Nortel IP phones), and Chicago Public Schools (5,000 Mitel IP phones). Business Communications Review estimates that 13.4 million IP phone units were shipped in 2006. A recent Forrester Research report projects that in new installations, VoIP phones will outsell conventional phones in North America and Europe by a 2-1 margin in 2007.

Combining VoIP with an effective Power over Ethernet (PoE) connection maximizes an enterprise's ability to enhance business continuity through scalability, flexibility, and manageability. The diverse and wide array of product options enables PoE solutions that are individually matched to individual VoIP phone systems—allowing enterprises to grow a network as needed.

**VoIP with PoE: Reliability and Flexibility**

In January 2004, the *Network World* article "How to Quantify Downtime" conservatively estimated the hourly average cost of network downtime at $42,000, and companies that rely entirely on technology for business operations (such as online brokers and e-commerce sites) can face hourly downtime costs of $1 million or more. In a call center or emergency response center, continued operation and reliability of service is imperative. Even five minutes of downtime can result in hundreds of missed calls, the loss of hundreds of thousands of dollars, or (in the case of an emergency response center) loss of critical response time.

Public telephone providers typically claim an operational uptime of 99.999% (i.e., "five nines"). To approach or match that level of performance, PoE-enabled IP phones must receive uninterrupted data and power over the IP network to ensure voice network reliability. DC power is injected onto the Ethernet cable by the POE hardware and, in times of emergency or interruption, backed up by uninterruptible power supply (UPS) systems.

Because PoE technology allows for the delivery of both data and power over a single line, VoIP phones can be placed and powered over any existing Category 5e and above Ethernet network. This flexibility frees enterprises to organize their business units (i.e., departments, call centers, conference rooms) as they see fit, and enables the quick relocation of those same areas as necessary.

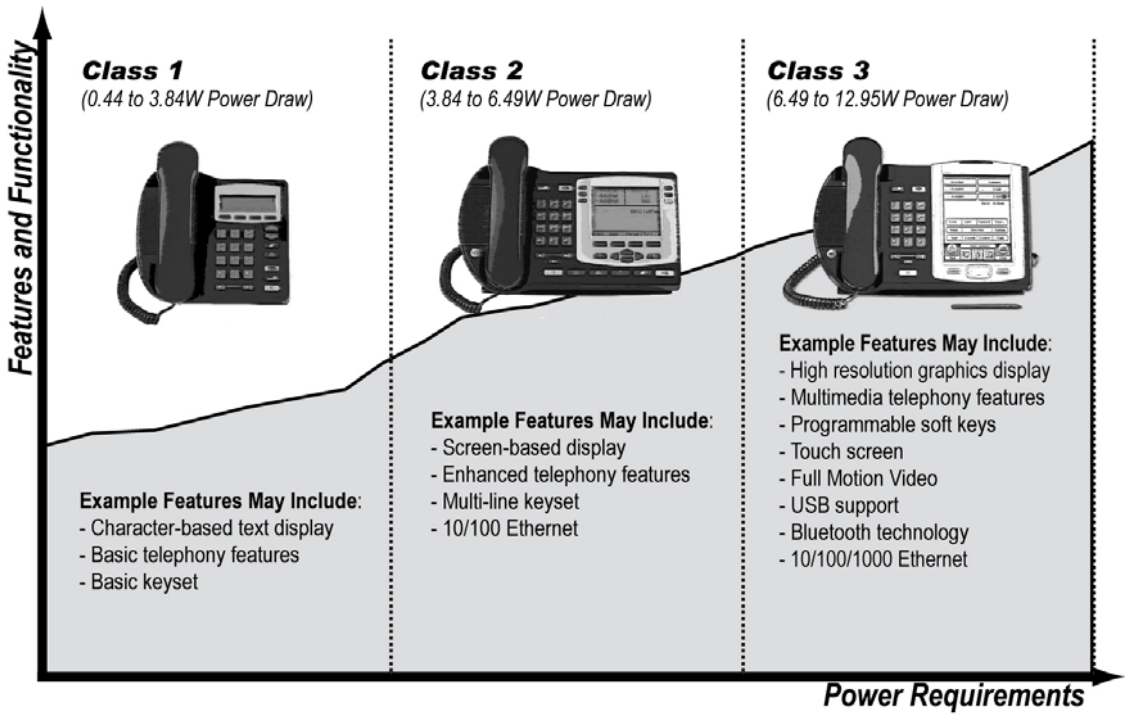


**Figure 2**. As the features and functionalities of VoIP phones grow, so do the power requirements. Power Class 1 phones offer basic features such as single-line displays and anywhere from 8 to 24 programmable feature keys, and typically use little power. However, as IP phones add advanced features, such as multimedia, video conferencing, or web access capabilities, the need for power grows—and so does the power class of the phone. PoE will continue to meet these power needs by progressively expanding its own power delivery capabilities (as evidenced by the IEEE 802.3at "PoE Plus" draft standard).

**Efficient Power Management**

UPS systems are typically placed throughout an enterprise to deliver emergency power to mission-critical network devices, including customer call center telephones. If a power disruption occurs, each emergency power system activates to deliver uniform power across all connected devices. In this scenario, the cost and management of multiple UPS systems can be a drawback. The need for systems to be monitored and maintained individually consumes time and resources that could be better utilized elsewhere.

In contrast, a managed PoE system allows backup power to be intelligently distributed to those VoIP devices deemed critical to the operation of the enterprise. VoIP phones remain available and reliable for business success despite the occurrence of natural or technology disruptions. Meanwhile, non-critical applications or services can be left un-powered to extend the life of a UPS system and maximize power on a per-port basis. This type of intelligence is a direct benefit of a managed PoE system.

## IP Surveillance

**Growth of IP Surveillance in Enterprise Settings**

IP security cameras and surveillance devices are rapidly gaining acceptance among cost-conscious organizations. According to a January 2006 iSuppli research report, "Video Surveillance: Migrating to IP Cameras and Networked Systems," IP video surveillance cameras achieved a 100% growth rate in 2005 and sales are expected to climb as high as $1.3 billion by 2010. In fact, it is anticipated that IP security cameras will outsell CCTV systems as soon as 2009, driven by new and smarter products with better resolutions, image tracking, and response and alert systems. Combined with expanded system-level integration for new and diverse surveillance markets such as public safety, traffic control, educational, and other applications, the IP security market is well positioned for impressive growth opportunities.

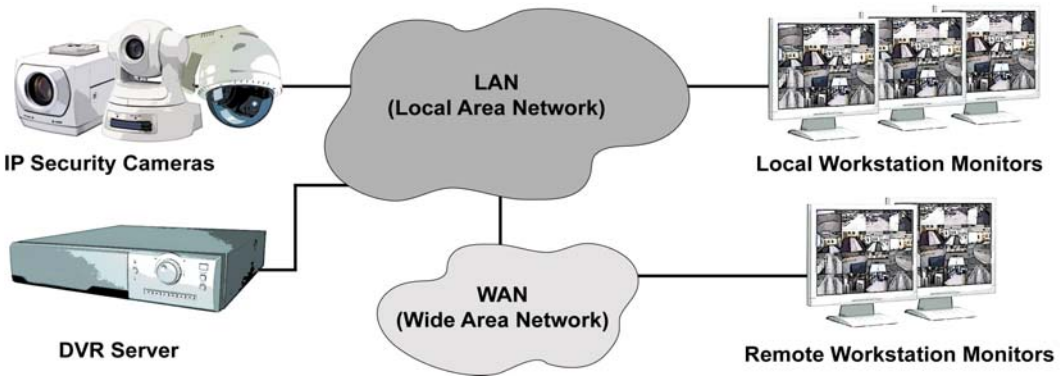


**Figure 3.** With the ongoing digitalization of security and surveillance systems organizations today can take advantage of Ethernet, Internet, or wireless technologies as the backbone of their security infrastructure to gain the advantages of greater device capabilities, network convergence, interoperability, and remote or local accessibility.

**Benefits of Combining IP Surveillance with PoE**

When combined with Power over Ethernet (PoE) systems, IP security cameras and surveillance devices offer unique opportunities to lower an organization's total cost of network ownership through scalability, flexibility of device placement, and cost-effective deployment. As with VoIP technologies, by transmitting power and data over a single Ethernet connection, the need for installed AC outlets to power IP security devices is eliminated, reducing costs and allowing more flexible placement options.

Remote manageability of PoE devices gives organizations the ability to access, manage, and control power to devices that are placed in inaccessible or hard-to-reach areas. Functions such as camera resets and calibration of connected PoE-capable devices can be performed at an internal management workstation, or from an external web access point, without the need to physically touch a device that is placed out of reach.

Reduction of equipment expense is another driving factor towards IP security. The use of IP security devices can broaden enterprise security initiatives without the expense of proprietary hardware and software, or traditional CCTV equipment purchases such as multiplexers, repeaters, and signal splitters. With a digital signal, camera views can be monitored over a virtually unlimited number of screens by utilizing almost any workstation with a common web-browser. In addition, digitizing the camera signal enables the use of IP multicast solutions and enhanced hard-disk based recording devices and storage options not available with traditional CCTV systems.

**IP Surveillance and PoE: Increased Reliability**

The need to prevent theft, safeguard employees and students, and guard against vandalism and terrorism is on the minds of all corporate security officials. Surveillance cameras are essential to the security of many organizations, and keeping these devices reliably operational is critical. Any downtime in the security network, whether data connectivity or power, can leave an organization vulnerable. With traditional AC-powered cameras, a power outage can compromise visibility and monitoring until emergency power is restored.

PoE systems increase the reliability of security networks by providing cost-effective centralized backup power to all connected IP surveillance devices. During local power interruptions, a single UPS unit attached to the powered patch panel or PSE activates to provide seamless, reliable power for all surveillance cameras connected to it. Centralized backup power through PoE offers the additional benefit of increased reliability, lower total cost of ownership through simpler maintenance procedures, easier monitoring, and higher efficiency than a traditional system would offer.

## Wireless Access Points

**Mobility Services in Enterprise Settings**

Applications-based mobility has been a prime driver of the IT marketplace for several years, and the appetite for wireless technologies continues in both enterprise and consumer environments. In 2006, laptop shipments exceeded desktop computer shipments for the first time, and nearly all of those laptops came equipped with wireless cards. In its report “The Total Economic Impact of Mobility Services”, Forrester Research reported that WLAN adoption in North American enterprise environments increased from 9% in 2003 to 24% in 2005, and that 75% of enterprises were predicted to be using or evaluating WLANs by the end of 2006.

Enterprises are taking advantage of the mobility offered by wireless technologies to help workers get results from anywhere in the building. A specific enterprise setting that demands high worker mobility is health care, which in 2006 led all market segments with a 62% wireless adoption rate. In a hospital setting, health care professionals increasingly rely on mobile technologies to access and collect patients’ medical data and to transfer high-resolution medical images. With enough WAPs in place to cover a medical campus, doctors can now use devices such as pocket PCs, tablet computers, and smart phones to instantly enter or retrieve data from anywhere in the hospital campus. The wireless network ensures high availability, high-speed roaming, and session persistence in order to enable uninterrupted service and improved patient care.

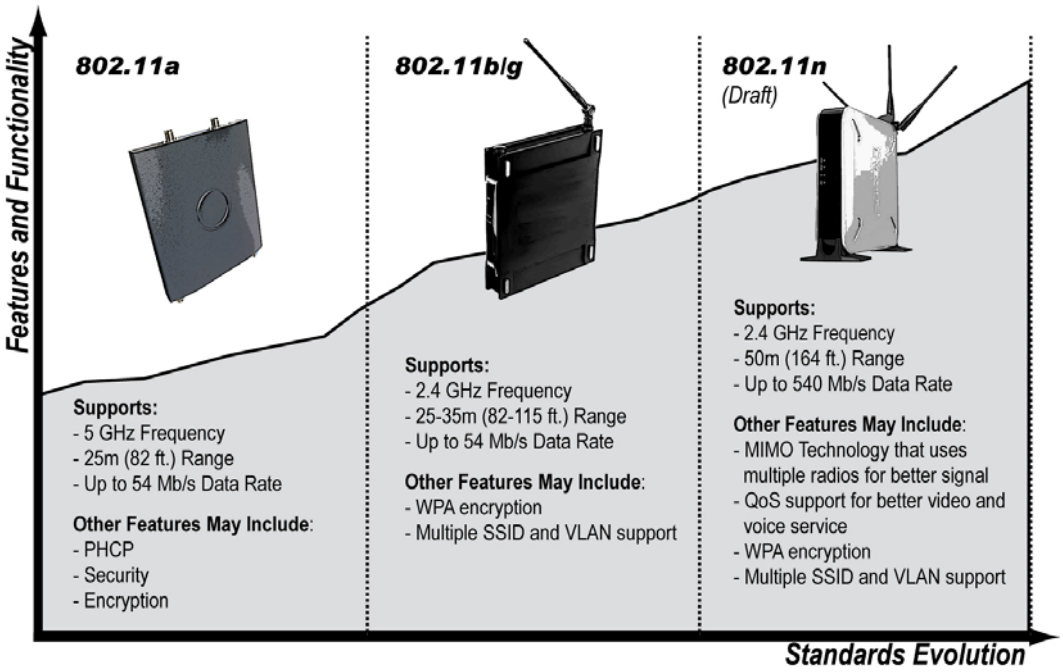


**Figure 4.** Wireless networks operate by sharing maximum bandwidth among all users and reducing data throughput per user accordingly. Average operating ranges, frequencies, and speeds are shown above for wireless access point devices in typical enterprise environments. Most 802.11a/b/g WAPs are Class 2 powered devices, each drawing about 5-8 W, with an operating range of about 100 ft before performance is affected significantly. Devices designed for outdoor deployment and longer-range transmission can draw 13 W (Class 3) to 28 W (high power).

Wireless networks also have found strong implementation in manufacturing and warehousing sectors, in the form of Radio Frequency Identification (RFID) systems technologies. RFID tags are small memory devices equipped with antennas that enable them to receive and respond to signals from wireless transmitters. Information can be added to and read from RFID tags along any stage of the inventory and deployment process, which makes RFID technology a good fit for all types of asset tracking including work-in-progress (i.e., assembly line) and reusable container tracking. RFID offers companies considerable savings in time and cost by reducing the amount of labor required to label and track inventory, and boosting inventory transparency.

**Wireless Security Challenges and Solutions**

The benefits of mobility applications are balanced by security and performance challenges. Security is often cited as the main obstacle to wireless adoption. The remote management capabilities of PoE enhance WLAN security both during and outside of core business hours. During the workday, the WAPs associated with populated areas of the building can be enabled for connectivity and use. Then overnight, as users leave the building, remote management of the wireless system permits selective shutdown of WAPs in order to discourage unauthorized users from attempting to log on to the WLAN. Enough WAPs can be kept powered during off-hours to provide coverage for the limited number of authorized users and to keep mission-critical security applications functional.

Common wireless performance challenges include interference and competition for bandwidth over shared channels. Many other wireless devices use the 2.4 GHz band (including *Bluetooth* technologies, medical telemetry devices, cordless phones, and microwave ovens) and can interfere with signals sent to and from a WAP. Also, the performance of a wireless connection depends on distance and bandwidth: the more users sharing the same channel and the greater the distance from an access point, the slower the connection. In general, network designers overcome these issues by performing site-specific surveys to implement effective levels of redundant WAP coverage. Of course, greater WAP deployment requires more powered endpoints.

**Benefits of Combining PoE and the WLAN**

PoE technologies enable WLAN managers to power WAPs over the network and realize the benefits of ease and speed of deployment, ease of management, and enhanced security. With data and power run over the same wire, WAPs can be installed and re-located on an as-needed basis for optimum coverage. This enhanced design flexibility is especially important for devices like WAPs, which may require installations in awkward or hard to reach locations, such as the ceiling of a warehouse or manufacturing plant. Flexible design placement also enables scalability and ensures saturation coverage to optimize user mobility and customer service, which is crucial in markets such as health care.

PoE also greatly reduces the overall cost of a wireless installation through speed of deployment. Rather than take on the expense of contracting an electrician to run electrical lines to specific locations, a powered patch panel and connector wires can be dropped in a ceiling enclosure and WAPs attached as needed. This represents a significant area of cost savings, especially given that many WAPs are installed after a site survey is completed, long after the building is finished.

Also, PoE devices that are Simple Network Management Protocol (SNMP) manageable can be remotely controlled to simplify maintenance and efficiently manage or troubleshoot power consumption and/or failures. For example, remote resets of WAPs can be performed to facilitate upgrades of endpoint devices.

## *PANDUIT® DPoE™* Solutions

With *PANDUIT® DPoE™* Power over Ethernet Systems, customers buy only the ports and power they need to deploy reliable, cost-effective PoE solutions.

**Scalability: Grow a Network as Needed**

For smaller deployments of PoE-enabled devices, the modular 8-port *DPoE™* Compact 8 Midspan is an ideal solution. Each unit offers 2X power (up to 32 watts per port), and up to three units can fit horizontally across a 1 RU rack space. Enterprises can take advantage of this scalability to power initial or smaller rollouts, such as a single-room WAP deployment or small VoIP network, which then can be scaled to larger installations. *DPoE™* 12- and 24-port Power Patch Panels support 15.4 W to every port and are available in a space-saving 1 RU design. These Power Patch Panels offer an equally scalable but more permanent punch down solution for PoE-capable devices not expected to be moved frequently or relocated.

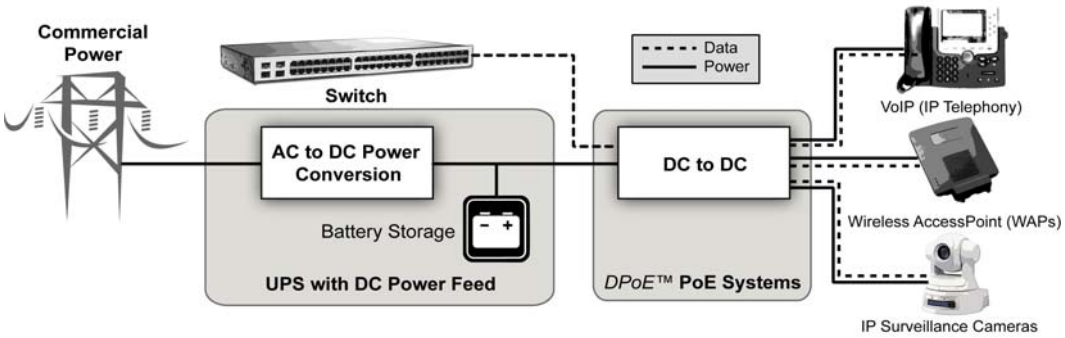


**Figure 5.** *PANDUIT*® *DPoE*™ Power over Ethernet Systems work together with UPS units to provide seamless and reliable power over Ethernet cabling. Network managers can use *DPoE*™ Element Manager software to assign power usage, define on/off times, and prioritize delivery on a per-port basis to maximize the reliability and flexibility of the powered network.

**Flexibility: Tough Placement? No Problem!**

The modular *DPoE*™ Compact 8 Midspan fits in space-constrained areas and offers gigabit data pass-through. These features make this power midspan an ideal choice for powering IP surveillance cameras that need higher bandwidth to transmit high-resolution images, and help IT managers avoid the time and expense required to install new outlets in hard to reach areas such as ceilings. All *DPoE*™ devices can be deployed with the network live, and the plug-and-play features of *DPoE*™ devices allow installers to integrate them quickly into new or existing Ethernet networks, to maximize network uptime and worker productivity.

**Manageability: Efficient, Effective Power Use**

*DPoE*™ Element Manager software enables network managers to intelligently monitor and control power to all connected devices, both from a local or remote management station using integrated SNMP technology. Shipped with all *DPoE*™ Power Patch Panels and Compact 8 Midspans, this intelligent power management software enables network managers to set individual power delivery priority tags across all ports. In the event of a power failure, network systems may then signal the *DPoE*™ Power over Ethernet Systems to begin shutting down non-critical devices, according those priority settings.

*DPoE*™ systems also offer the unique advantage of optimizing power by automatically sensing and providing proper powering for connected devices. This eliminates the need to install separate power modules per port, thereby saving space, providing greater design flexibility, and lowering overall cost of installation for peripheral components.

## About *PANDUIT*

*PANDUIT* is a leading, world-class developer and provider of innovative networking and electrical solutions. For more than 50 years, *PANDUIT* has engineered and manufactured end-to-end solutions that assist our customers in the deployment of the latest technologies. Our global expertise and strong industry relationships make *PANDUIT* a valuable and trusted partner dedicated to delivering technology-driven solutions and unmatched service. Through our commitment to innovation, quality and service, *PANDUIT* creates competitive advantages to earn customer preference.

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