



3Com® Power over Ethernet Solutions

WHITE PAPER

CONTENTS

What is Power over Ethernet?1
IEEE 802.3af: The PoE Standard.....1
Is Power over Ethernet Right For You?1
The Benefits of Implementing
Power over Ethernet.....2
How Power over Ethernet Works.....2
3Com Power over Ethernet Products5
Summary6

Power over Ethernet Overview

Simply stated, Power over Ethernet (PoE) provides a way to distribute low-voltage power across the network using existing Ethernet data cabling. This centralized, reliable source of power enables network devices such as IP telephones, wireless access points, and network jacks to operate without additional power adapters, cords, or AC outlets.

PoE isn't a new concept. Until now, the only real issue has been the lack of a standard implementation scheme. The demand for voice over IP (VoIP) telephony and wireless LAN (WLAN) has resulted in a number of different, and often incompatible, inline power solutions currently being offered on the market.

IEEE 802.3af: The PoE Standard

To address this issue, the IEEE standardized a PoE specification, known by its reference number 802.3af. Even companies that currently offer only proprietary PoE solutions are publicly stating that they will offer standard-based versions of their products. Now that there is a standard for PoE, it makes sense to only use compliant PoE in transmitting power across the network infrastructure.

3Com has been a long-term vendor-proponent for standard PoE. Since the year 2000, 3Com has helped drive the IEEE specification and has placed significant emphasis on offering 802.3af-compatible solutions that extend the value of IT investments.

Applications of Power over Ethernet

PoE can be a very cost-effective and convenient solution for smaller networked devices having power requirements of 15 watts or less—such as IP phones, wireless access points, or new switching devices such as the 3Com® IntelliJack® Switch.

PoE is ideal for powering multiple small devices at the edge of the wired infrastructure. PoE's low output (about one-third of an ampere) isn't designed to support larger end systems and peripherals—workstations, PCs, hospital/lab equipment, or printers.

The Benefits of Implementing Power over Ethernet

Easy Installation

- Seamless integration with standard Ethernet and Fast Ethernet infrastructures
- Easily installed in the same wiring closet as network switches and patch panels
- Ideal for hard-to-wire locations, such as warehouse ceilings, asbestos-insulated walls, and hospital wings
- Central power source eliminates the need for local AC outlets and power cords, or distributed power backups

Centralized Reliability

- Injects power directly into data connections—resulting in only one wire per drop
- Device discovery and testing helps ensure that only compatible devices receive power
- Single source of power eliminates the need to manage power cables or jacks individually
- Centrally distributed power is less vulnerable to disconnection, damage, or hardware theft

Enhanced Availability

- Adding a redundant or uninterruptible power supply (UPS) helps ensure availability of business-critical systems
- Power management protects against draw overloads and network shutdowns
- Low-voltage, DC power helps protect equipment against power surges or spikes

Investment Protection

- Standard solutions offer vendor-independent interoperability and forward/backward compatibility
- IEEE 802.3af PoE is compatible with IEEE 802.3 10BASE-T and 802.3u 100BASE-TX global networking standards
- IEEE 802.3af is compatible with IEEE 802.3ab Gigabit Ethernet over copper

How Power over Ethernet Works

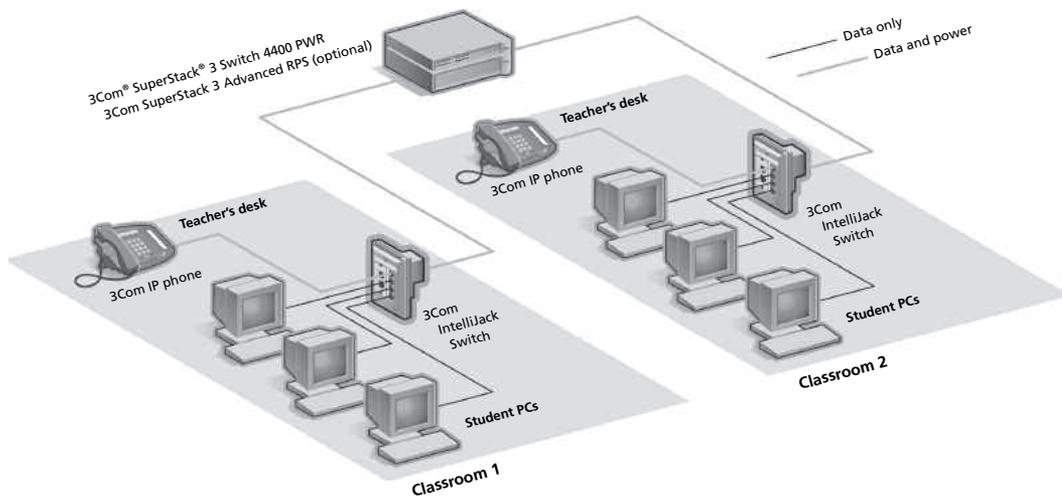
Cabling

An IEEE 802.3af PoE network requires standard Category 5/5e shielded or unshielded twisted-pair (STP or UTP) LAN cable, which is capable of carrying one to two amperes of DC current. Typically, power-limiting components in the network infrastructure will be patch panels and their various connectors. Because of this, the IEEE standard sets the maximum current at 350 mA per device connection.

Network Core

There's no real difference in basic infrastructure between a standard IEEE 802.3 Category 5/5e-cabled network and one that's 802.3af PoE-ready. Migrating an Ethernet network to standard PoE simply requires the addition of power source equipment (PSE) at the core of the network. The PSE injects power into the network cabling, sending it to devices at the edge of the network.

FIGURE 1: An endspan solution integrates a network switch and power source in a single appliance. Optional backup power enables 24/7 availability of IntelliJack switches and IP phones.



Power Source Equipment

There are two basic types of PSE: midspan and endspan. Endspan PSE integrates PoE technology with a network switch appliance (Figure 1). Midspan PSE provides power only, and is used in combination with an existing network switch. (Figure 4)

In Figure 1, the 3Com SuperStack® 3 Switch 4400 PWR delivers 10/100 Mbps switching and IEEE 802.3af-compliant power for up to 24 network devices and 150 W total output. PoE is injected into data pairs of the LAN cabling—which helps ensure reliability because device power is connected through the same pins as data traffic (pins 1, 2, 3, 6). This rack-mountable Layer 2 switch with multilayer traffic management features is SNMP manageable, making it compatible with most network management platforms, including 3Com network management software.

In addition to being more cost-effective, centrally deployed PoE that uses existing LAN cabling is more reliable than distributed power sources. PoE keeps devices from getting disconnected from the network while someone hunts for a local power outlet. For added fault tolerance, installing a 3Com SuperStack 3 Advanced RPS together with a UPS helps ensure the continuous operation of business-critical devices, such as VoIP phones and WLAN access points, during power failures.

Power Management

Another way to maximize network availability is through power monitoring and management. Most 3Com PSE products come with power files that offer several useful features. The 3Com SuperStack 3 Switch 4400 PWR, for instance, can be configured to monitor the cumulative current draw. If the draw exceeds 150 W, the switch automatically and incrementally shuts off power to device ports until the cumulative output falls back within the power budget. This helps ensure that the whole network doesn't go down as the result of connecting too many devices (Figure 2).

The power management system can also designate higher priority for certain ports to essentially guarantee that noncritical devices get shut down before critical ones (Figure 3).

Power Delivery

In an IEEE 802.3af network, PoE is transmitted over data-or spare-wiring pairs in the LAN cabling. The maximum power delivered over 100 meters of Category 5 cable is approximately 12.95 W. This may not sound like much, but a surprising number of network devices are designed to run at this power level—including IP phones, network jacks, and WLAN access points.

Port	Power State	Profile	Limited To	Current	Peak
1.1	Active	Not Guaranteed	-	13.1	15.4
1.2	Active	NB02102 - 3C10226A	9.4	4.0	4.0
1.3	Active	Not Guaranteed	-	4.0	4.0
1.4	Active	N2000 - 3CNU800	15.4	12.7	12.7

FIGURE 2: The power management system can be configured to limit output on a per-port basis to enhance control and security.

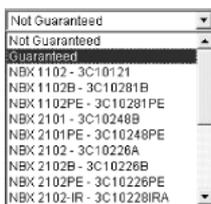


FIGURE 3: Critical phone locations can be prioritized to receive guaranteed power.

PoE's flexibility and reliability is particularly well suited for WLAN deployments. In Figure 4, the 3Com Wireless LAN Access Point 8750 can be mounted virtually anywhere it's needed, without being limited by the availability of local AC power. PoE makes it easier than ever to use WLANs to extend your network connectivity into difficult-to-wire or hard-to-reach locations—which is one of the primary reasons for installing wireless access in the first place.

In some cases, nonstandard devices may be modified to support IEEE 802.3af power. For instance, older-generation 3Com IP phones normally operate on 24 VDC. However, they can accept IEEE 802.3af PoE from a 3Com Network Jack or standard PSE if they are retrofitted with a simple, add-on power module—a compact adapter that fits neatly under the desktop phone base.

Device Discovery

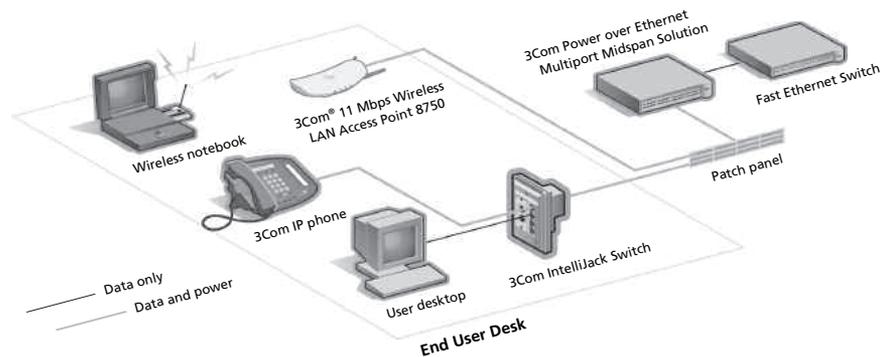
A standard-compliant PSE—such as the 3Com SuperStack 3 Switch 4400 PWR or 3Com Power over Ethernet Multiport Midspan Solution—uses a signal detection scheme to ensure that network devices won't be damaged by the addition of power. This powered-device discovery enables standard, nonstandard, and unpowered devices to be connected on the same Fast Ethernet infrastructure without special wiring or device configurations.

The IEEE 802.3af discovery scheme is known as Resistive Power Discovery, and relies on 25 K (nominal) resistors integrated into PoE network devices. Before sending full power onto the network, the PSE tests the resistance of connected devices with a series of two very low-voltage “discovery” signals. The second signal uses a slightly higher voltage than the first, but neither is powerful enough to damage an incompatible device. After the PSE has determined which ports are connected to IEEE 802.3af-compliant devices, it injects the full 48 VDC power to those devices only. It will not send power to devices that failed either of the two resistance tests.

Power Forwarding

3Com IntelliJack Switches are unique among PoE-compatible devices because of their ability to both operate on and forward inline power to another IEEE 802.3af device. These “in the wall” switches add a whole new dimension to the PoE network by expanding traffic prioritization and power availability at the edge of the network—without adding hardware or reconfiguring devices (Figures 1 and 4).

FIGURE 4: The midspan solution distributes power to network devices over existing switch connections. The Wi-Fi access point seamlessly extends network connectivity into hard-to-wire locations. The network jack can forward power and data to another device from its #1 port.



3Com Power over Ethernet Products

POWER OVER ETHERNET SOURCES			
Endspan Switch	3Com SuperStack 3 Switch 4400 PWR	3C17205	
	3Com Baseline Switch 2226-PWR Plus	3C16490	
	3Com Wireless LAN Switch WX1200	3CRWX120695A	
Midspan Supply	3Com Power over Ethernet Multiport Midspan Solution	3CNJPSE24	
	3Com Power over Ethernet Single-Port Midspan Solution†	3CNJPSE	
DEVICES THAT BOTH RECEIVE AND FORWARD POWER OVER ETHERNET			
IntelliJack Switches	3Com IntelliJack Switch NJ 225‡	3CNJ225	
	3Com IntelliJack Switch NJ 220	3CNJ220	
	3Com IntelliJack Switch NJ 205	3CNJ205	
	3Com IntelliJack Switch NJ 200	3CNJ200	
	3Com IntelliJack Switch NJ 105	3CNJ105	
	3Com IntelliJack Switch NJ 100	3CNJ100	
	3Com Network Jack NJ 100	3CNJ100	
DEVICES THAT RECEIVE POWER OVER ETHERNET			
Network Jacks	3Com Network Jack NJ 90	3CNJ90	
Wi-Fi Wireless	3Com Wireless LAN Access Point 8750	3CRWE875075A	
	3Com Wireless LAN Access Point 8250	3CRWE825075A	
	3Com Wireless LAN Access Point 7250	3CRWE725075A	
	3Com Wireless LAN Managed Access Point 2750	3CRWX275075A	
	3Com OfficeConnect® Wireless 108Mbps 11g PoE Access Point	3CRGPOE10075	
	3Com 11g 54Mbps Wireless LAN Outdoor Building-to-Building Bridge	3CRWEASYG73-US	
	3Com 11 Mbps Wireless LAN Access Point 8000	3CRWE80096A	
	3Com 11g 54Mbps Wireless LAN Indoor Building-to-Building Bridge	3CRWE920G73-US	
	3Com Wireless LAN Building-to-Building Bridge	3CRWE91096A	
	3Com 11 Mbps Wireless LAN Outdoor Bridge Solution	3CRWEASY96A	
IP Telephony	3Com 3101 Basic Phone	3C10401A	
	3Com 3101 Basic Speaker Phone	3C10401SPKRA	
	3Com 3102 Business Phone	3C10402A	
	3Com 3105 Attendant Console	3C10405A	
	3Com NBX 2101PE Basic Phone	3C10248PE	
	3Com NBX 1102PE Business Phone	3C10281PE	
	3Com NBX 2102PE Business Phone	3C10226PE	
	3Com NBX 2102PE-IR Business Phone with IR	3C10228IRPE	
	3Com NBX Analog Terminal Adapter	3C10400	
	3Com NBX Phone Power Module	3CNJVOIPMOD-NBX	
	<i>The following products can support IEEE 802.3af-compliant PoE when modified with the 3CNJVOIPMOD-NBX module.</i>		
		3Com NBX 1102 Business Phone, Black	3C10121
		3Com NBX 1102 Business Phone, White	3C10122
	3Com NBX 1105 Attendant Console, Black	3C10123/A	
	3Com NBX 1105 Attendant Console, White	3C10124	
	3Com NBX 2102 Business Phone	3C10226A	
	3Com NBX 2102B Business Phone	3C10226B	
	3Com NBX 2102-IR Business Phone with IR	3C10228IRA	
	3Com NBX 2102B-IR Business Phone	3C10228IRB	
	3Com NBX 2101B Basic Phone	3C10248B	
	3Com NBX 1102B Business Phone	3C10281B	

† This PoE product is not fully compliant with the IEEE 802.3af standard.
 ‡ The NJ 225 FX, a variant of the NJ 225, does not receive PoE because of its fiber uplink.

Summary

PoE is ideal for powering a vast array of computing devices. In fact, it can benefit virtually any enterprise Ethernet LAN with cost-savings, high availability, and configuration flexibility. 3Com IEEE 802.3af-compliant solutions deliver simplified device installation and deployment—as well as outstanding opportunities for consolidating data and power networks over a standards-based infrastructure.

In 2001, 3Com was the first vendor to offer a PoE-compatible, Wi-Fi certified access point (the 3Com 11 Mbps Wireless LAN Access Point 6000). And we've furthered this

leadership role by developing and delivering standards-compliant end-to-end PoE solutions. It's this world-class networking expertise that lets us provide the right answers to your PoE questions, including how to leverage legacy and nonstandard products.

For additional information on 3Com products—including technical tips, product data sheets, technology white papers, frequently asked questions, user guides, and more—please visit us at www.3com.com.

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To learn more about 3Com solutions, visit www.3com.com. 3Com is publicly traded on NASDAQ under the symbol COMS.

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