

# 3Com Solutions: POWER OVER ETHERNET

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## OVERVIEW

Organizations gain the convenience and cost-savings of reduced power cabling when they take advantage of Power over Ethernet (PoE). This centralized, reliable source of power enables network devices such as IP phones, wireless access points, and network jacks to operate without additional power adapters, cords, or AC outlets. Using PoE-compliant devices, they can take advantage of low-voltage power distributed across a network on existing Ethernet data cabling.

Though PoE isn't a new concept, until recently it lacked a standard implementation scheme. To meet the increasing number of deployments of Voice over IP (VoIP) and wireless local area networks (WLANs), a number of different, and often incompatible, inline power solutions were brought to market by technology vendors.

### IEEE 802.3AF: THE POE STANDARD

To address this issue, the Institute of Electrical and Electronic Engineers (IEEE) standardized a PoE specification, known by its reference number 802.3af. Now even companies with only proprietary PoE solutions are publicly stating that they will offer standard-based versions of their products. And given the reality of a PoE standard, businesses are realizing the advisability of using only compliant PoE solutions.

An early proponent of a standards-based 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.

### POE APPLICATIONS

PoE can be a very cost-effective and convenient solution at the network edge for powering devices needing no more than 15 watts of power, such as IP phones, wireless access points, or switching devices such as 3Com® IntelliJack® switches. Its low output (about one-third of an ampere), however, is not designed to support larger systems and peripherals such as workstations, PCs, hospital/lab equipment, or printers.

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## THE BENEFITS OF POE IMPLEMENTATIONS

### EASY DEPLOYMENT

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

### CENTRALIZED RELIABILITY

- › Direct injection of power into data connections, resulting in only one wire per drop
- › Device discovery and testing to ensure that only compatible devices receive power
- › Single source of power eliminates the need to manage power cables or jacks individually
- › Reduced vulnerability to disconnection, damage, or hardware theft since power is centrally distributed

### ENHANCED AVAILABILITY

- › Increased availability of business-critical systems with the addition of a redundant or uninterruptible power supply (UPS)
- › Protection (provided by power management) against draw overloads and network shutdowns
- › Increased protection of equipment against power surges or spikes enabled by the use of low-voltage DC power mobility

### INVESTMENT PROTECTION

- › Vendor-independent interoperability and forward/backward compatibility enabled by standards-based solution
- › Geographic and network flexibility resulting from global standards that make IEEE 802.3af PoE compatible with IEEE 802.3 10BASE-T, 802.3u 100BASE-TX, and 802.3af 1000BASE-T

## HOW POE WORKS

### CABLING

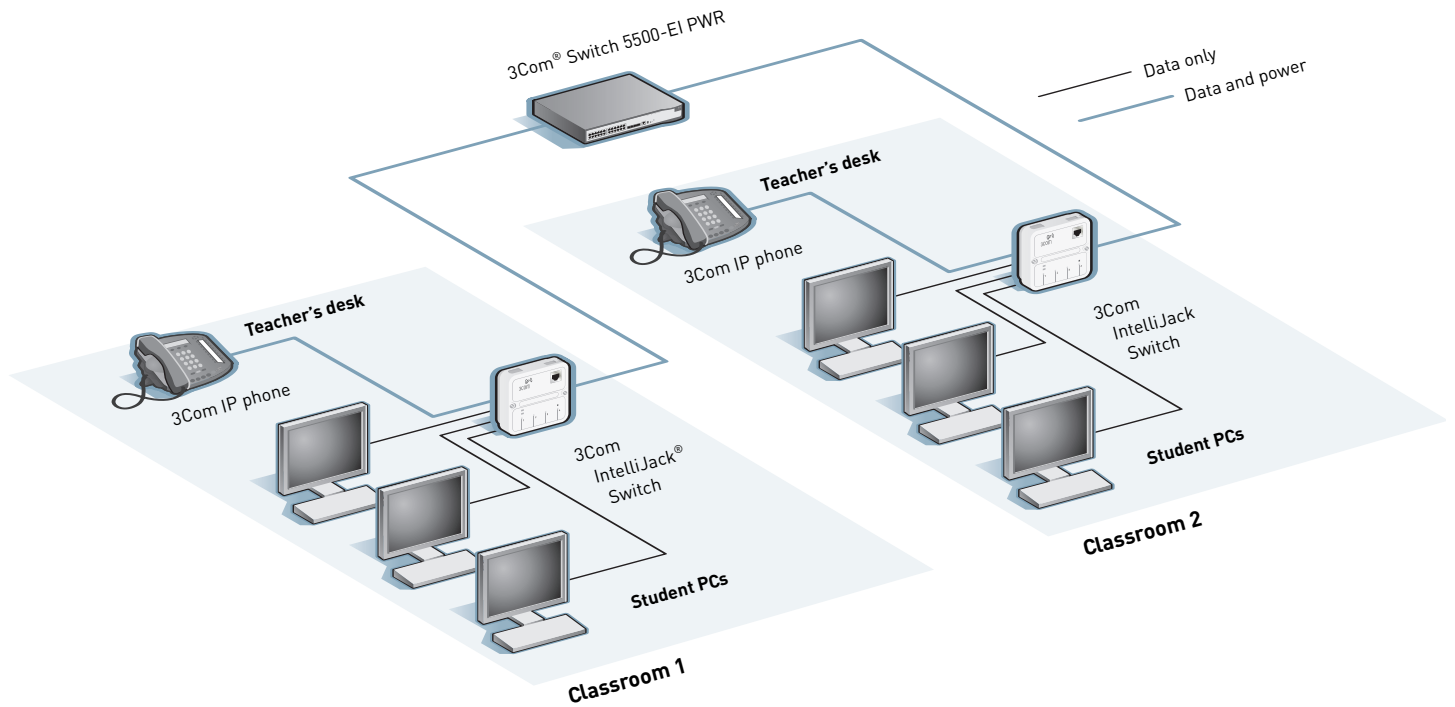
IEEE 802.3af PoE networks require standard Category 5/5e shielded or unshielded twisted-pair (STP or UTP) LAN cable, which is capable of carrying one to two amperes of DC current. Since power-limiting components in the network infrastructure typically will be patch panels and their various connectors, a maximum current of 350 mA per device connection is set by the IEEE standard.

### NETWORK CORE INFRASTRUCTURE

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) into the network. The PSE injects power into the network cabling, sending it to devices at the edge of the network.

### POWER SOURCE EQUIPMENT

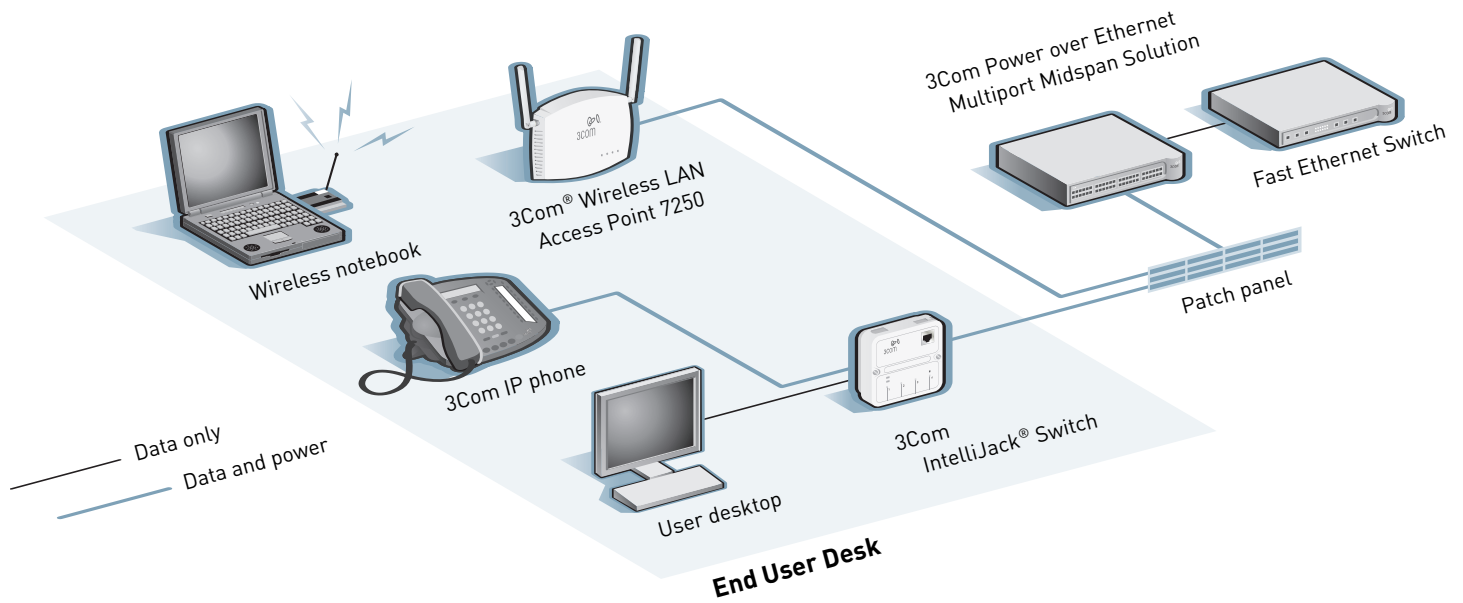
There are two basic types of PSE: endspan and midspan. **Endspan PSE** integrates PoE technology with a network switch appliance (Figure 1). **Midspan PSE** provides power only, and is used in combination with an existing network switch. (Figure 2)



**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.

As shown in Figure 1, the 3Com Switch 5500-EI 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 to help ensure reliability because device power is connected through the same pins as data traffic (pins 1, 2, 3, 6). This rack-mountable Layer 3 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 certified Powerware DC solution together with an uninterruptible power supply (UPS) helps ensure the continuous operation of business-critical devices, such as VoIP phones and WLAN access points, during power failures.



**FIGURE 2:** 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 IntelliJack switch can forward power and data to another device from its #1 port.

## POWER MANAGEMENT

Another way to maximize network availability is through power monitoring and management. The 3Com Switch 5500-EI PWR, for instance, can be configured to monitor the cumulative current draw. If the draw exceeds 300 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 3).

The power management system can also designate higher priority for certain ports to essentially guarantee that noncritical devices get shut down before critical ones. For example, critical phone locations can be prioritized to guarantee their receipt of power.

Port	Power State	Profile	Limited To	Current	Peak
<input type="checkbox"/> 1:1	Active	Not Guaranteed	-	13.1	13.4
<input type="checkbox"/> 1:2	Active	NBX 2102 - 3C10226A	0.4	4.0	4.0
<input type="checkbox"/> 1:3	Active	Not Guaranteed	-	4.0	4.0
<input type="checkbox"/> 1:4	Active	NJ200 - 3CNU200	15.4	12.7	12.7

**Figure 3:** The power management system can be configured to limit output on a per-port basis to enhance control and security.

## 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.

PoE's flexibility and reliability is particularly well suited for WLAN deployments. In Figure 2, the 3Com Wireless LAN Access Point 8760 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 network connectivity into difficult-to-wire or hard-to-reach locations—one of the primary reasons for installing wireless access in the first place.

There are some cases in which nonstandard devices may be modified to support IEEE 802.3af power. For instance, though older-generation 3Com IP phones normally operate on 24 VDC, they can accept IEEE 802.3af PoE from a 3Com IntelliJack switch 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 Switch 5500-EI PWR or 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 lets standard, nonstandard, and unpowered devices be connected on the same 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 the need to add hardware or reconfigure devices (Figures 1 and 2).

## 3COM POWER OVER ETHERNET PRODUCTS

	Product Description	3Com SKU
<b>Power over Ethernet Sources</b>		
<b>ENDSPAN SWITCH</b>	3Com Switch 8800 48-Port 10/100/1000BASE-T Module*	3C17528
	3Com Switch 8800 48-Port 10/100/1000BASE-T Access Module*	3C17532
	3Com Switch 7750 48-port 10/100/1000BASE-T PoE Module*	3C16890
	3Com Switch 7750 48-port 10/100BASE-TX PoE Module*	3C16891
	3Com Switch 5500G-EI PWR 24-Port	3CR17252-91
	3Com Switch 5500G-EI PWR 48-Port	3CR17253-91
	3Com Switch 5500-EI PWR 28-Port	3CR17171-91
	3Com Switch 5500-EI PWR 52-Port	3CR17172-91
	3Com Switch 4500G PWR 24-Port	3CR17771-91
	3Com Switch 4500G PWR 48-Port	3CR17772-91
	3Com Switch 4500 PWR 26-Port	3CR17571-91
	3Com Switch 4500 PWR 50-Port	3CR17572-91
	3Com Switch 4400 PWR	3C17205-US
	3Com Baseline Switch 2426-PWR Plus	3C16491
	3Com OfficeConnect® Managed Switch 9	3CR16708-91
	3Com OfficeConnect Managed Switch 9 FX	3CR16709-91
	3Com Unified Gigabit Wireless PoE Switch 24	3CRUS2475
	3Com Wireless LAN Switch WX1200	3CRWX120695A
	3Com WXR100 Remote Office Wireless LAN Switch	3CRWXR10095A
	<b>MIDSPAN SUPPLY</b>	3Com Power over Ethernet Multiport Midspan Solution
3Com Power over Ethernet Single-Port Midspan Solution†		3CNJPSE
<b>Devices That Both Receive and Forward Power over Ethernet</b>		
<b>INTELLIJACK SWITCHES</b>	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

\*Requires purchase of optional components to enable PoE.

† 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.

**3COM POWER OVER ETHERNET PRODUCTS** (CONTINUED)

	<b>Product Description</b>	<b>3Com SKU</b>	
<b>Devices That Receive Power over Ethernet</b>			
<b>WI-FI WIRELESS</b>	3Com Wireless 8760 Dual-Radio 11a/b/g PoE Access Point	3CRWE876075	
	3Com Wireless 7760 11a/b/g PoE Access Point	3CRWE776075	
	3Com Wireless LAN Managed Access Point 3750	3CRWX375075A	
	3Com Wireless LAN Managed Access Point 2750	3CRWX275075A	
	3Com 11a 54 Mbps Wireless LAN Outdoor Building-to-Building Bridge and 11b/g Access Point	3CRWEASYA73	
	3Com 11g 54 Mbps Wireless LAN Outdoor Building-to-Building Bridge	3CRWEASYG73-US	
	3Com 11g 54 Mbps Wireless LAN Indoor Building-to-Building Bridge	3CRWE920G73-US	
	<b>IP TELEPHONY</b>	3Com 3100 Entry Phone	3C10399A
		3Com 3101 Basic Phone	3C10401A
3Com 3101 Basic Phone with Speaker		3C10401SPKRA	
3Com 3102 Business Phone		3C10402A	
3Com 3103 Manager Phone		3C10403A	
3Com 3105 Attendant Console		3C10405A	

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## 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. In addition to delivering PoE advantages, 3Com IEEE 802.3af-compliant solutions offer simplified device installation and deployment that can extend the 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 the company has furthered its leadership role by developing and delivering a range of standards-compliant end-to-end PoE solutions. With world-class networking expertise, 3Com can provide the right answers to PoE questions such as how to leverage legacy and nonstandard products.



**Visit [www.3com.com](http://www.3com.com) for more information about 3Com secure converged network solutions.**

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