Power over Ethernet (PoE) Power Requirements FAQ

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Questions

Introduction

Power over Ethernet (PoE) is the ability for the LAN switching infrastructure to provide power over a copper Ethernet cable to an endpoint or powered device.

This capability was developed and first delivered by Cisco in 2000 in order to support the emerging IP Telephony deployments. IP telephones, such as desktop PBX phones, need power for their operation, and PoE enables scalable and manageable power delivery and simplifies deployments of IP Telephony.

While IP telephones and wireless access points (APs) are the most intuitive uses for PoE, the advent of the 802.3af standardization of PoE opens the door to a new generation of network−attached devices, such as video cameras, point−of−sale devices, security access control devices (card scanners), building automation and industrial automation.

PoE promises to create a new world of networked appliances as it provides power and data connectivity over existing Ethernet cables.

This document answers some of the most frequently asked questions about Cisco IP phone power requirements.

Q. What is Power over Ethernet?

A. Power over Ethernet (PoE) is the ability to deliver 48 VDC of power over the same copper cable as Ethernet. Two primary elements are required in order to implement PoE. They are:

- power sourcing equipment (PSE) the LAN switch or source power delivered over Ethernet

- the powered device (PD) the end device that accepts and uses power from the Ethernet cable for its operation

Q. What is the difference between inline power and PoE?

A. They are the same. When Cisco Systems® first introduced powered Ethernet ports, the technology was called inline power. In order to allow for universal terminology, Cisco now uses "Power over Ethernet" or "PoE" for all deployments, standard or pre−standard.

Q. What is the difference between the Cisco original PoE products and the IEEE 802.3af standard?

A. The differences include:

- the amount of power that is available to the connected device
- the method used for device discovery
- the way that power is removed from the wire when a powered device is removed

Q. What IP phone models support the Cisco pre−standard method of powered device detection?

A. These Cisco IP phones can accept Cisco pre−standard PoE from a card integrated with a Cisco Catalyst switch or a Catalyst in−line power patch panel:

- 7985G
- 7960G
- 7940G
- 7910G
- 7910G + SW
- 7912G
- 7905G
- 7902G
- 7962G
- 7975G
- 802.3af

These phones can draw local power from a power cube (CP−PWR−CUBE−2=) in addition to a country or regionally specific power cord (CP−PWR−CORD−xx=).

Q. What IP phone models support the IEEE standard method of powered device detection?

A. These Cisco IP phones support IEEE 802.3af PoE:

- 7961G−GE
- 7971G−GE
- 7931G
- 7941G−GE
- 7945G
- 7965G
- 7975G

Note: These Cisco IP phones support both the Cisco pre−standard PoE and IEEE 802.3af PoE:

- 7970G
- 7961G
- 7906G
- 7941G
- 7911G
- 7962G

Q. Can a Cisco switch be forced to provide pre−standard PoE to an 802.3af−compliant IP phone?

A. There is no way to force the switch to provide pre−standard PoE, because the power allocation is done automatically through negotiation.

Cisco switches with PoE capability automatically supply power to connected pre−standard powered devices, such as Cisco IP phones and Cisco Aironet access points, and to IEEE 802.3af−compliant powered devices if the switch senses that there is no power on the circuit. This means the switch supplies power to any non−Cisco device that does not have Cisco Discovery Protocol (CDP), as long as it is an IEEE 802.3af−compliant powered device.

In conclusion, Cisco pre−standard PoE devices and 802.3af−compliant devices work accordingly, and the switch cannot provide either pre−standard PoE to an 802.3af device or 802.3af power to a Cisco pre−standard device.

Q. Does the Catalyst 3750 switch support Cisco pre−standard compliant IP phones?

A. The Catalyst 3750 switch supports both the Cisco pre−standard PoE method and the IEEE 802.3af PoE standard. The switches automatically supply power to connected pre−standard powered devices, such as Cisco IP phones and Cisco Aironet access points, and to IEEE 802.3af−compliant powered devices if the switch senses that there is no power on the circuit.

However, there can be issues when you connect some third party pre−standard compliant devices to the Catalyst 3750, because the third party devices can potentially use different pins in order to detect power. When you deal with third party pre−standard compliant devices, check with the manufacturer about the alignment of the pins for power detection.

Q. How do I determine if the IP phones that receive inline power use the Cisco pre−standard PoE version or the IEEE 802.3af standard?

A. Cisco Standards based Power over Ethernet supplies power to Cisco IP phones, Cisco Wireless access points and any third party IEEE 802.3af standard compliance powered devices (PDs) with the same Ethernet cable that carries the data. Cisco Catalyst 3750 and 3560 Power over Ethernet supports both the Cisco pre−standard Power over Ethernet implementation as well as the IEEE 802.3af Power over Ethernet implementation. This ensures backward and forward compatibility and investment protection.

The Catalyst 3750/3560 PoE switches support both the Cisco pre−standard Power over Ethernet, and the Standards based Power over Ethernet methods of PD detection. Both detection methods are active at the same time, and either one can be used in order to detect a valid PD. The Catalyst 3750/3560 PoE switches periodically check all ports, powered and non−powered, in order to check their status and the power status of connected devices.

Cisco Catalyst 3750/3560 PoE switches support Cisco pre−standard PD detection mechanisms, and any Standards based compliant PDs. Most Cisco made PDs, pre−standard or standard, support Cisco Discovery Protocol (CDP). Once power is applied to a port that contains a pre−standard or standard Cisco PD, CDP is used in order to determine the actual power requirement, and the system power budget is adjusted accordingly.

For Cisco pre−standard PDs, if CDP is enabled on the switch, 15.4W is initially allocated, and then further refined when the CDP message is received from the PD. If CDP is disabled on the switch, or if the PD does not support the Power requirements field of the CDP message, the initial allocation value of 15.4W is used throughout the duration of the connection.

For Standards based compliant PDs, the Catalyst 3750/3560 Power over Ethernet controller classifies the PD at the detection stage and allocates a required power budget based on the IEEE class. If a PD supports both IEEE 802.3af and Cisco pre−standard, the PD is detected as an IEEE device. The Catalyst 3750/3560 PoE switches classify the PD at the detection stage and allocate a required power budget based on the IEEE class. Then, a CDP message determines the actual power usage for the PD, provided that CDP is enabled on the switch. If the requested power through CDP is higher than the PoE controller classified power, the requested power is adjusted to the PoE controller IEEE class.

Since all of this happens automatically, it is not possible to determine whether the IEEE standard or the pre−standard runs.

Q. A Catalyst 3560 switch with 48 ports supports 370W. Because C7941G−GE is a Class 3 device, it requires up to 15.4W. Can this be reduced to 7W so that the switch can power all 48 phones?

A. If Cisco Discovery Protocol (CDP) is enabled, there is no need to reduce the power requirement to 7W. The phone is classified as a Class 3 device when it first powers up, but after it powers up, CDP sets the desired power level on the 3560 to 7W. This allows the switch to support 48 ports of phones.

Note: If you use C7941G−GE, it is not possible to power all 48 phones. C7941G−GE usually draws 12.9W. The total power available is 370W, and for 48 ports, this evenly divides up to ~7.71W per port. In this case, the 3560 switch can only support 28 phones that draw 12.9W each.

Q. When the pre−standard PoE is used, why does the 7970G IP phone negotiate 15.4W with the 802.3af protocol?

A. A Cisco IEEE+CDP powered device, such as a Cisco IP phone 7970G, comes up in low power mode (6.3W) and transmits a Cisco Discovery Protocol (CDP) message with an inline power (ILP) type length value (TLV) that informs the Power Source Equipment (PSE) of the actual power required by the device. If the power is less than the default 15.4W, the PSE acknowledges the request with its available power and modifies the PSEs power budget. If the requesting powered device exceeds the power budget for the line card or switch, the port is either powered down, or the port remains in low power mode (7W).

This management scheme is implemented in order to provide backward compatibility and investment protection to the installed base of Cisco Catalyst pre−standard Power over Ethernet capable line cards and switches. Cisco IP phones are power efficient and require 6.3W maximum power as reflected within the pre−standard Power over Ethernet

implementation. However, the development of new high−power powered devices, such as wireless access points and IP phones with color LCD screens, requires additional power that cannot be delivered with the pre−standard implementations. Because Cisco powered devices are brought up in low power mode, Cisco high−power powered devices can operate, albeit with reduced functionality, on two pre−standard line cards. Additionally, as Cisco powered devices explicitly signal their exact power requirements to the PSE, the PSE can accurately budget power consumption because only the power actually required by the powered device is allocated.

This management intelligence allows better power resource allocation, because powered devices can return unused power to the PSE power budget. For example, if an IEEE 802.3af Class 3 powered device requires 9W, the PSE must budget for the full 15.4W even though the device only ever draws 9W. This wastes 6.4W on the powered device. If multiple 9W devices are present, it wastes enough power budget to deny power to other lower−power powered devices. Since Cisco Discovery Protocol explicitly signals the actual power required, the wasted power is returned to the PSE power budget.

Periodically, the PSE checks to see whether the powered device is still present and requires power and also implements checks in order to detect conditions, such as where a short circuit occured between transmit and receive pairs. Cisco implements two mechanisms in order to detect these conditions. The first is an extension of the pre−standard discovery protocol, whereby a discovery signal is transmitted periodically. If the received discovery signal has the same amplitude as the transmitted signal, the PSE removes power, because there is a short circuit. If the PSE receives a discovery signal that is attenuated by the low pass filter, the PSE maintains power to the powered device. IEEE 802.3af−2003 is the second mechanism supported by Cisco. With this mechanism, the power draw is monitored, and if it exceeds a specific value for a specific time period, power delivery is shut down to the port.

Q. What are the power requirements for the various models of the IP phone models?

- CP−7902G (6.3W)
- CP−7905G (6.3W)
- CP−7910−SW (6.3W)
- CP−7910G (6.3W)
- CP−7912G (6.3W)
- CP−7940G (6.3W)
- CP−7960G (6.3W)
- CP−7906G (5W) (Class 2)
- CP−7911G (5W) (Class 2)
- CP−7941G (6.3W) (Class 2)
- CP−7941G−GE (12.9W) (Class 3)
- CP−7961G (6.3W) (Class 2)
- CP−7961G−GE (12.9W) (Class 3)
- CP−7970G (10.25W) (Class 3)
- CP−7971−G−GE (15.4W) (Class 3)
- CP−7985G (12.55W) (Class 0, Not full brightness)
- IEEE 802.3af Device − Class 0 (15.4W)
- IEEE 802.3af Device − Class 1 (4W)
- IEEE 802.3af Device − Class 2 (7W)
- IEEE 802.3af Device − Class 3 (15.4W)

Related Information

- **Cisco Technical Support IP Phone FAQ**
- **IEEE 802.3 Inline Power**
- **Voice Technology Support**
- **Voice and Unified Communications Product Support**
- **Recommended Reading: Troubleshooting Cisco IP Telephony**
- **Technical Support & Documentation − Cisco Systems**

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