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Power over Ethernet (PoE) Support

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**Note**

- For information about switching modules that support PoE, see the *Release Notes for Cisco IOS Release 15.2SY* publication at this URL:
http://www.cisco.com/en/US/docs/switches/lan/catalyst6500/ios/15.1SY/release_notes.html
- For complete syntax and usage information for the commands used in this chapter, see these publications:
http://www.cisco.com/en/US/products/ps11846/prod_command_reference_list.html

**Tip**

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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Prerequisites for PoE

None.

Restrictions for PoE

PoE is supported only on Layer 2 switchports.

Information About PoE

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Device Roles

- Power sourcing equipment (PSE)—A device that provides power through a twisted-pair Ethernet connection. The switch, through switching modules equipped with Power over Ethernet (PoE) daughtercards, functions in the PSE role.
- Powered device (PD)—A device powered by a PSE (for example, IP phones, IP cameras, and wireless access points).



Note

Not all PoE-capable devices are powered from the switch. There are two sources of local power for PoE-capable devices:

- A power supply connected to the device.
- A power supply through a patch panel over the Ethernet connection to the device.

When a locally powered PoE-capable device is present on a switching module port, the switching module itself cannot detect its presence. If the device supports CDP, the supervisor engine can discover a locally powered PoE-capable device through CDP messaging with the device. If a locally powered PoE-capable device loses local power, the switching module can discover and supply power to the IP phone if the inline power mode is set to **auto**.

PoE Overview

Cisco PoE daughtercards support one or more PoE implementation:

- IEEE 802.3at standard, shown in Cisco Feature Navigator as “PoE Plus (PoE+, PoEP) support”.
 - Supported only with the PoE daughtercard on the WS-X6148E-GE-45AT switching module.
 - These features are supported for IEEE 802.3at-compliant class 4 PDs:
 - Class 4: 30.00 W at the PSE (12.95 W to 25.50 W at the PD).
 - Optionally, [LLDP Inline Power Negotiation for PoE+](#).
 - With releases earlier than Release 15.1(1)SY, maximum 16.8 W at the PSE (ePoE for 45 ports maximum).
- IEEE 802.3af standard.
 - Supported with the WS-F6K-48-AF PoE daughtercard and the PoE daughtercard on the WS-X6148E-GE-45AT switching module.
 - Maximum 16.80 W at the PSE.
 - The IEEE 802.3af PoE standard defines a method to sense a PD and to immediately classify the power requirement of the PD into these per port power ranges at the PSE:
 - Class 0: Up to 15.4 W (0.44–12.95 W at the PD; default classification)
 - Class 1: Up to 4 W (0.44–3.84 W at the PD)

- Class 2: Up to 7 W (3.84–6.49 W at the PD)
- Class 3: Up to 15.4 W (6.49–12.95 W at the PD)
- Cisco prestandard inline power—10 W at the PSE.

With a PoE daughtercard installed, a switching module can automatically detect and provision a PoE-capable device that adheres to a PoE implementation supported by the PoE daughtercard. The switching module can supply power to devices supporting other PoE implementations only through manual configuration.

Only a PD connected directly to the switch port can be powered from the switch. If a second PD is daisy-chained from the PD that is connected to the switch port, the second PD cannot be powered by the switch.

Each PD requires power to be allocated from the chassis power budget. Because each PD can have unique power requirements, more devices can be supported if the system's power management software can intelligently allocate the necessary power on a per-port basis.

You can configure ports to allocate power at a level based on the following:

- If a PD is detected, with auto mode configured:
 - Information sensed from the device
 - A default level
 - A configured maximum level
- Whether or not a PD is present on the port, with static mode configured:
 - A default level
 - A configured level

CPD-Based PoE Management

When a switching module port detects an unpowered PD, the default-allocated power is provided to the port. When the correct amount of power is determined through CDP messaging with the PD, the supervisor engine reduces or increases the allocated power, up to the hardware limit of the installed PoE daughtercard.



Caution

When a PD cable is plugged into a port and the power is turned on, the supervisor engine has a 4-second timeout waiting for the link to go up on the line. During those 4 seconds, if the IP phone cable is unplugged and a network device is plugged in, the network device could be damaged. We recommend that you wait at least 10 seconds between unplugging a network device and plugging in another network device.

Inline Power IEEE Power Classification Override

The IEEE 802.3af standard contains no provision for adjustment of the power allocation. 802.3af-compliant PDs that support CDP can use CDP to override the IEEE 802.3af power classification.

The WS-F6K-48-AF PoE daughtercard or the PoE daughtercard on the WS-X6148E-GE-45AT switching module support these inline power IEEE 802.3af power classification override features:

- Power use measurement—The ability to accurately measure the power provided by the port to the powered device.
- Power policing—The ability to monitor power usage on a port.

With power measurement and policing, you can safely override the IEEE 802.3af power classification of a device that requires a power level at the lower end of its IEEE power classification range.

PoE monitoring and policing compares the power consumption on ports with the administrative maximum value (either a configured maximum value or the port's default value). If the power consumption on a monitored port exceeds the administrative maximum value, the following actions occur:

- A syslog message is issued.
- The monitored port is shut down and error-disabled.
- The allocated power is freed.

LLDP Inline Power Negotiation for PoE+ (IEEE 802.3at)

The PoE daughtercard on the WS-X6148E-GE-45AT switching module supports [IEEE 802.3at](#)-compliant LLDP PoE power negotiation, which supports additional negotiation that can reduce power usage.

**Note**

- Enabled by default.
- The LLDP TLV used is DTE Power-via-MDI TLV.
- When a PD that performs power negotiation using multiple protocols (CDP and LLDP 802.3at) is connected to a switch, the switch locks to the first protocol packet (CDP or LLDP) that contains the power negotiation TLV. If you need to use any single protocol for power negotiation each time, you must administratively disable the other power negotiation protocols on the switch interface.
- See this publication for other the Link Layer Discovery Protocol (LLDP) configuration procedures: http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_lldp-med.html

How to Configure PoE Support

- [Displaying PoE Status, page 20-5](#)
- [Configuring Per-Port PoE Support, page 20-5](#)
- [Configuring PoE Power Priority, page 20-6](#)
- [Configuring PoE Monitoring and Policing, page 20-8](#)
- [Disabling LLDP Power Negotiation \(IEEE 802.3at\), page 20-8](#)

Displaying PoE Status

This example shows how to display the PoE status on switch:

```
Router# show power auxiliary
system auxiliary power mode = on
system auxiliary power redundancy operationally = redundant
system primary connector power limit = 7266.00 Watts (173.00 Amps @ 42V)
system auxiliary connector power limit = 10500.00 Watts (250.00 Amps @ 42V)
system primary power used = 1407.00 Watts (33.50 Amps @ 42V)
system auxiliary power used = 22.68 Watts ( 0.54 Amps @ 42V)
```

Slot	Card-Type	Inline Pwr-Limit Watts	A @42V	Inline-Pwr Used-Thru-Pri Watts	A @42V	Inline-Pwr Used-Thru-Aux Watts	A @42V	VDB Aux-Pwr Capable
2	WS-F6K-48-AT	1600.20	38.10	23.10	0.55	11.34	0.27	Yes
4	WS-F6K-48-AT	1600.20	38.10	23.10	0.55	11.34	0.27	Yes
Totals:				46.20	1.10	22.68	0.54	

Configuring Per-Port PoE Support

To configure per-port PoE support, perform this task:

	Command	Purpose
Step 1	Router(config-if)# power inline { auto static never } [max milliwatts]	Configures per-port PoE support and optionally specifies a maximum inline power level in milliwatts for the port.
Step 2	Router# show power inline { <i>type slot/port</i> <i>module slot</i> } [detail]	Verifies the configuration.

When configuring inline power support with the **power inline** command, note the following information:

- To configure auto-detection of a PD and PoE auto-allocation, enter the **auto** keyword.
- To configure auto-detection of a PD but reserve a fixed PoE allocation, enter the **static** keyword.
- To specify the maximum power to allocate to a port, enter either the **auto** or **static** keyword followed by the **max** keyword and the power level in milliwatts.
- When the **auto** keyword is entered and CDP is enabled on the port, a PD that supports CDP can negotiate a different power level.
- To disable auto-detection of a PD, enter the **never** keyword.

- With a WS-F6K-GE48-AF, WS-F6K-48-AF, or the PoE daughtercard on the WS-X6148E-GE-45AT switching module:
 - The configurable range of maximum power using the **max** keyword is 4000 to 16800 milliwatts. If no maximum power level is configured, the default maximum power is 15400 milliwatts.

**Note**

To support a large number of inline-powered ports using power levels above 15400 milliwatts on an inline power card, we recommend using the **static** keyword so that the power budget is deterministic.

- When the **auto** keyword is entered and CDP is enabled on the port, an inline-powered device that supports CDP can negotiate a power level up to 16800 milliwatts unless a lower maximum power level is configured.

This example shows how to disable inline power on GigabitEthernet port 2/10:

```
Router# configure terminal
Router(config)# interface gigabitethernet 2/10
Router(config-if)# power inline never
```

This example shows how to enable inline power on GigabitEthernet port 2/10:

```
Router# configure terminal
Router(config)# interface gigabitethernet 2/10
Router(config-if)# power inline auto
```

This example shows how to verify the inline power configuration on GigabitEthernet port 2/10:

```
Router# show power inline gigabitethernet 2/10
```

Interface	Admin	Priority (enabled)	Oper	Power(Watts) From PS To PD		Device	Class
Gi2/10	auto	low	on	14.5	13.1	Cisco IP Phone 9971	4


```
Interface AdminPowerMax Police ActConsumption  
(Watts)
```

Interface	AdminPowerMax (Watts)	Police	ActConsumption
Gi2/10	30.0	on	6.7

Configuring PoE Power Priority

You can configure how the switch responds if a power shortage occurs by setting the priority of ports providing PoE. The priority determines the order in which PoE is removed from ports if a power shortage occurs: low-priority, then high-priority, with power maintained for critical-priority ports as long as possible. These sections describe how to configure PoE power priority:

- [Setting the PoE Power Priority Global Enable State, page 20-7](#)
- [Configuring PoE Port Power Priority, page 20-7](#)

Setting the PoE Power Priority Global Enable State

To disable PoE power priority globally, perform this task:

	Command	Purpose
Step 1	Router(config)# no power inline priority enable	Disables PoE power priority globally (default: enabled).
Step 2	Router# show power inline	Verifies the configuration.

This example shows how to disable PoE power priority globally:

```
Router(config)# no power inline priority enable
```

The column heading of any **show power inline** command displays the PoE power priority global state (“disabled” in this example):

```
Router# show power inline
Interface Admin  Priority      Oper      Power(Watts)  Device      Class
              (disabled)    From PS To PD
-----
...
```

Configuring PoE Port Power Priority

To configure PoE port power priority, perform this task:

	Command	Purpose
Step 1	Router(config-if)# power inline auto priority {critical high low}	Enables PoE port power priority (default: low priority when power priority is enabled globally). If a power shortage occurs, PoE is removed from ports in the following order: <ul style="list-style-type: none"> Low priority ports High priority ports PoE is maintained for critical priority ports as long as possible.
Step 2	Router# show power inline type slot/port [detail]	Verifies the configuration.

This example shows how to configure the PoE port power priority of GigabitEthernet port 2/10 as high:

```
Router# configure terminal
Router(config)# interface gigabitethernet 2/10
Router(config-if)# power inline auto priority high
```

This example shows how to verify the PoE port power priority configuration of GigabitEthernet port 2/10:

```
Router# show power inline gigabitethernet 2/10 detail | include Priority
Priority: high
```

Configuring PoE Monitoring and Policing

With the WS-F6K-48-AF PoE daughtercard or the PoE daughtercard on the WS-X6148E-GE-45AT switching module, to configure PoE monitoring and policing, perform this task:

	Command	Purpose
Step 1	Router(config-if)# power inline police	Enables PoE monitoring and policing.
Step 2	Router# show power inline {type slot/port module slot}[detail]	Verifies the configuration.

This example shows how to enable monitoring and policing on GigabitEthernet port 1/9:

```
Router# configure terminal
Router(config)# interface gigabitethernet 2/10
Router(config-if)# power inline police
```

These examples shows how to verify the power monitoring and policing configuration on GigabitEthernet port 2/10:

```
Router# show power inline gigabitethernet 2/10 detail | include Police
```

```
Police: on
```

```
Router#
```

```
Router# show power inline gigabitethernet 2/10
```

```
Interface  Admin  Oper  Power (Watts)  Device  Class
          -----
          From PS To Device
-----
Gi2/10      auto   on    17.3    15.4      Ieee PD   3

Interface  AdminPowerMax (Watts)  Police  ActualConsumption
-----
Gi2/10      15.4                on      5.7
Router#
```

Disabling LLDP Power Negotiation (IEEE 802.3at)

With the WS-X6148E-GE-45AT switching module, LLDP power negotiation is enabled by default. To disable LLDP power negotiation, perform this task:

Command	Purpose
Router(config-if)# no lldp tlv-select power-management	Disables LLDP power negotiation (default: enabled).

This example shows how to display the LLDP power negotiation configuration on interface GigabitEthernet 3/1 when LLDP power negotiation is enabled:

```
Router# show power inline gigabitethernet 2/10 detail | begin LLDP
LLDP Power Classification    -- Sent to PD --  -- Rcvd from PD --
Power Type :                 type 2 PSE                type 2 PD
Power Source :                primary                  PSE
Power Priority :              low                       high
Requested Power (watts):     11.2                      11.2
Allocated Power (watts):     11.2                      11.2
Power class :                 4                         4
```



```
LLDP Legacy MDI TLV          -- Rcvd from PD --
MDI power support :          0
pse power pair :             0
MDI power class :            0
```

This example shows how to disable LLDP power negotiation on interface GigabitEthernet 2/10:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# interface gigabitethernet 2/10
Router(config-if)# no lldp tlv-select power-management
```

**Tip**

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http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html

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