CHAPTER 10

Configuring Power over Ethernet

Note Before reading this chapter, read the "Preparing for Installation" section of the *Catalyst 4500 Series Installation Guide*. You must ensure that your installation site has enough power and cooling to accommodate the additional electrical load and heat introduced by PoE.

This chapter describes how to configure Power over Ethernet (PoE) on the Catalyst 4500 series switch.

This chapter contains the following sections:

Note For complete syntax and usage information for the switch commands used in this chapter, look at the *Cisco Catalyst 4500 Series Switch Command Reference* and related publications at this location:

http://www.cisco.com/en/US/products/hw/switches/ps4324/index.html

If the command is not found in the Catalyst 4500 Command Reference, it is located in the larger Cisco IOS library. Refer to the *Catalyst 4500 Series Switch Cisco IOS Command Reference* and related publications at this location:

http://www.cisco.com/en/US/products/ps6350/index.html

About Power over Ethernet

The Catalyst 4500 series switch provides support for Power over Ethernet (PoE) for both Cisco Prestandard PoE and the IEEE 802.3af standard. Certain linecards also support the higher 802.3at standard. PoE is supported by all Catalyst 4500+E series chassis and requires a PoE module and power

supply. The amount of PoE power available depends on the PoE capabilities of individual power supplies. Support for PoE enables the system to power inline devices, such as IP phones, IP video phones, and wireless access points over standard copper cabling (Category 5, 5e, or 6 cabling).

In addition, with PoE, you do not need to provide wall power for each PoE enabled device. This action eliminates the cost for additional electrical cabling that would otherwise be necessary for connected devices. Moreover, PoE enables you to isolate critical devices on a single power system, enabling the entire system to be supported by UPS backup.

You typically deploy a Catalyst 4500 series switch in one of two deployment scenarios. The first scenario is data-only, which requires power to operate the switch and the associated modules. The second scenario supports data and PoE (also termed "inline power") for deployments where the attached device derives power from the Ethernet port.

Catalyst 4500 series switches can sense if a powered device is connected to a PoE module. They can supply PoE to the powered device if there is no power on the circuit. (If there is power on the circuit, the switch does not supply it.) The powered device can also be connected to an AC power source and supply its own power to the voice circuit.

Note You should select the amount of PoE desired using the Cisco Power Calculator:

http://tools.cisco.com/cpc/

Hardware Requirements

To power a device using PoE, your chassis must use at least one of the power supplies listed in Table 10-1, and connect the device to at least one of the switching modules listed in Table 10-1.

Table 10-1 Hardware Requirements

Switching Modules	Power Supplies
WS-X4148-RJ45V	PWR-C45-1300ACV=
WS-X4224-RJ45V	PWR-C45-1400DCV=
WS-X4248-RJ21V	PWR-C45-2800ACV=
WS-X4248-RJ45V	PWR-C45-4200ACV=
WS-X4506-GB-T	PWR-C45-6000ACV=
WS-X4524-GB-RJ45V	
WS-X4548-RJ45V+	
WS-X4548-GB-RJ45V	
WS-X4648-RJ45V-E	
WS-X4648-RJ45V+E WS-X4748-RJ45V+E	
WS-X4748-UPOE+E	

Power Management Modes

If your switch has a module capable of providing PoE to end stations, you can set each interface on the module to automatically detect and apply PoE if the end station requires power.

The Catalyst 4500 series switch has three PoE modes:

- **auto**—PoE interface. The supervisor engine directs the switching module to power up the interface *only* if the switching module discovers the phone and the switch has enough power. You can specify the maximum wattage that is allowed on the interface. If you do not specify a wattage, then the switch delivers no more than the hardware-supported maximum value. This mode has no effect if the interface is not capable of providing PoE.
- **static**—High priority PoE interface. The supervisor engine preallocates power to the interface, even when nothing is connected, guaranteeing that power exists for the interface. You can specify the maximum wattage that is allowed on the interface. If you do not specify a wattage, then the switch preallocates the hardware-supported maximum value. If the switch does not have enough power for the allocation, the command fails. The supervisor engine directs the switching module to power up the interface *only* if the switching module discovers the powered device.
- **never**—Data interface only The supervisor engine never powers up the interface, even if an unpowered phone is connected. This mode is only needed when you want to make sure power is never applied to a PoE-capable interface.

The switch can measure the actual PoE consumption for an 802.3af-compliant PoE module, and displays this consumption in the **show power module** command.

PoE consumption cannot be measured on the WS-X4148-RJ45V PoE module. Therefore, for all PoE calculations, the PoE consumption on this module is presumed to be equal to its administrative PoE.

For more information, see the "Displaying the PoE Consumed by a Module" section on page 10-8.

For most users, the default configuration of "auto" works well, providing plug and play capability. No further configuration is required. However, to make an interface higher priority or data only, or to specify a maximum wattage, perform this task:

	Command	Purpose
Step 1	`Switch(config)# interface {fastethernet | gigabitethernet} slot/port`	Selects the interface to configure.
Step 2	`Switch(config-if)# power inline {auto [max milli-watts] | never | static [max milli-watts]}`	The **auto** keyword sets the interface to automatically detect and supply power to the powered device. This is the default configuration. The **static** keyword sets the interface to higher priority than auto. If necessary, use the **max** keyword to specify the maximum wattage allowed on the interface (4000 to 15400 mW for most switching modules. As of Cisco IOS release 12.2(44)SG the WS-X4648-RJ45V+E can support up to 30 W available per port and the WS-X4648-RJ45V-E supports up to 20 W. For more information, see "Enhanced Power PoE Support on the E-Series Chassis" on page 15). Use the **never** keyword to disable detection and power for the PoE capable interface.

	Command	Purpose
Step 3	`Switch(config-if)# end`	Exits configuration mode.
Step 4	`Switch# show power inline {fastethernet | gigabitethernet} slot/port`	Displays the PoE state for the switch.

Note If you set a non-PoE-capable interface to automatically detect and apply power, an error message indicates that the configuration is not valid.

The following example shows how to set the Fast Ethernet interface 4/1 to automatically detect PoE and send power through that interface, and to verify the PoE configuration:

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface fastethernet 4/1
Switch(config-if)# power inline auto
Switch(config-if)# end
Switch# show power inline fastethernet 4/1
Available:677(w)  Used:11(w)  Remaining:666(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----
Fa4/1     auto   on         11.2       10.0       Ieee PD             0

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------
Fa4/1                15.4                 10.0
Switch#
```

The following example shows how to configure an interface so that it never supplies power through the interface:

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface fastethernet 5/2
Switch(config-if)# power inline never
Switch(config-if)# end
Switch#
```

Intelligent Power Management

All Catalyst 4500 PoE-capable modules use Intelligent Power Management to provide power on each interface. When a powered device (PD) is attached to a PoE-capable port, the port detects the PD and provision power accordingly. If a Cisco PD is used, the switch and PD negotiate power using CDP packets to determine the precise amount of power needed by the PD. If the PD is 802.3af or 802.3at compatible, the switch and the PD negotiate using LLDP-MED or LLDP Power-Management TLVs if the TLV is enabled and present. The difference of power in the class-based power allocation and power negotiation is returned back to the switch power budget for use by other attached devices. So, power negotiation enables customers to stretch their power budget and use it more effectively.

Power negotiation also enables the interoperability of newer Cisco powered devices with older legacy PoE-capable ports from Cisco. Newer Cisco PDs do not consume more than what the switch port can provide.

Configuring Power Consumption for Powered Devices on an Interface

By default, when the switch detects a powered device on an interface, it assumes the powered device consumes the maximum the port can provide (7 W on a legacy Power over Ethernet (PoE) module and 15.4W on the IEEE PoE modules introduced in Cisco IOS Release 12.2(18)EW). Then, when the switch receives a CDP/LLDP packet from the powered device, the wattage automatically adjusts downward to the specific amount required by that device.Normally, this automatic adjustment works well, and no further configuration is required or recommended. However, you can specify the powered device's consumption for a particular interface to provide extra functionality from your switch. This behavior is useful when CDP/LLDP is disabled or not available.

Note When manually configuring the consumption for powered devices, you need to account for the power loss over the cable between the switch and the powered device.

To change the power consumption of a single powered device, perform this task:

	Command	Purpose
Step 1	`Switch(config)# interface {fastethernet | gigabitethernet} slot/port`	Selects the interface to configure.
Step 2	`Switch(config-if)# [no] power inline consumption milli-watts`	Sets the PoE consumption (in milliwatts) of the powered device connected to a specific interface. The power consumption can range from 4000 to 15,400. To re-enable the automatic adjustment of consumption, either use the **no** keyword or specify 15,400 milliwatts.
Step 3	`Switch(config-if)# end`	Exits configuration mode.
Step 4	`Switch# show power inline consumption {fastethernet | gigabitethernet} slot/port`	Displays the PoE consumption for the interface.

This example shows how to set the PoE consumption to 5000 milliwatts for interface gi 7/1 regardless what is mandated by the 802.3af class of the discovered device, or by any CDP packet received from the powered device. This example also verifies the PoE consumption on interface gi 7/1.

The following output displays the initial power consumption of the interface.

```
Switch# show power inline gi 7/1
Available:627(w)  Used:267(w)  Remaining:360(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi7/1     auto   on         7.9        7.0        IP Phone 7941       3

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------

Gi7/1                15.4                15.4

Switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
```

```
Switch(config)# interface gi 7/1
Switch(config-if)# power inline consumption 5000
Switch(config-if)# exit
Switch(config)# exit
```

The following output displays the power consumption after issuing the **power inline consumption** command against the interface:

```
Switch# show power inline gi 7/1
Available:627(w)  Used:265(w)  Remaining:362(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----
Gi7/1     auto   on         5.6        5.0        Ieee PD             3

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------

Gi7/1                15.4                  5.0
```

Displaying the Operational Status for an Interface

Each interface has an operational status which reflects the PoE status for an interface. The operational status for an interface is defined as one of the following:

- on—Power is supplied by the port.
- off—Power is not supplied by the port. If a powered device is connected to an interface with external power, the switch does not recognize the powered device. The “Device” column in the **show power inline** command displays as n/a.
- Power-deny—The supervisor engine does not have enough power to allocate to the port, or the power that is configured for the port is less than the power required by the port; power is not being supplied by the port.
- err-disable—The port is unable to provide power to the connected device that is configured in static mode.
- faulty—The port failed diagnostics tests.

Use the **show power inline** command to view the operational status for an interface.

This example shows how to display the operational status for all interfaces on module 3.

```
Switch# show power inline module 3
Available:677(w)  Used:117(w)  Remaining:560(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Fa3/1     auto   on         17.3       15.4       Ieee PD             0
Fa3/2     auto   on         4.5        4.0        Ieee PD             1
Fa3/3     auto   on         7.1        6.3        Cisco IP Phone 7960 0
Fa3/4     auto   on         7.1        6.3        Cisco IP Phone 7960 n/a
Fa3/5     auto   on         17.3       15.4       Ieee PD             0
Fa3/6     auto   on         17.3       15.4       Ieee PD             0
```

```
Fa3/7     auto   on         4.5        4.0        Ieee PD            1
Fa3/8     auto   on         7.9        7.0        Ieee PD            2
Fa3/9     auto   on         17.3       15.4       Ieee PD            3
Fa3/10    auto   on         17.3       15.4       Ieee PD            4
Fa3/11    auto   off        0          0          n/a                n/a
Fa3/12    auto   off        0          0          n/a                n/a
Fa3/13    auto   off        0          0          n/a                n/a
Fa3/14    auto   off        0          0          n/a                n/a
Fa3/15    auto   off        0          0          n/a                n/a
Fa3/16    auto   off        0          0          n/a                n/a
Fa3/17    auto   off        0          0          n/a                n/a
Fa3/18    auto   off        0          0          n/a                n/a

--------- ------ ---------- ---------- ---------- ------------------ -----

Totals:          10   on    117.5      104.6
Switch#
```

This example shows how to display the operational status for Fast Ethernet interface 4/1:

```
Switch# show power inline fa4/1
Available:677(w)  Used:11(w)  Remaining:666(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                                 From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------ -----

Fa4/1     auto   on         11.2       10.0       Ieee PD            0

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------

Fa4/1                15.4                 10.0
Switch#
```

Displaying all PoE Detection and Removal Events

Starting with Cisco IOS Release XE 3.2.2SG, a Catalyst 4500 series switch can display all PoE detection and removal events.

To enable PoE event logging, you use the **power inline logging global** command:

```
Switch# conf terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# power inline logging global
Switch(config)# int gigabitEthernet 5/5
Switch(config-if)# shut
Switch(config-if)#
*Oct 17 12:02:48.407: %ILPOWER-5-IEEE_DISCONNECT: Interface Gi5/5: PD removed
Switch(config-if)# no shut
Switch(config-if)#
*Oct 17 12:02:54.915: %ILPOWER-7-DETECT: Interface Gi5/5: Power Device detected: IEEE PD
```

Displaying the PoE Consumed by a Module

A Catalyst 4500 series switch can measure the actual PoE consumption for an 802.3af-compliant PoE module. You can observe this consumption with the **show power module** and **show power detail** commands. For all PoE calculations, presume that the PoE consumption on the WS-X4148-RJ45V module equals its administrative PoE.

The 802.3af-compliant PoE modules can consume up to 20 W of PoE to power FPGAs and other hardware components on the module. To ensure that the system has sufficient power for the PDs connected to the switch, add at least 20 W to your PoE requirements for each 802.3af-compliant PoE module.

The following example uses the **show power module** command to display the PoE consumption for an 802.3af-compliant module:

```
Switch# show power module

Watts Used of System Power (12V)
Mod   Model               currently  out of reset  in reset
----  -----------------   ---------  ------------  --------
 1    WS-X4013+TS             330         330         330
 2    WS-X4548-GB-RJ45V       60          60          20
 3    WS-X4548-GB-RJ45V       60          60          20
 --   Fan Tray                30          --          --
-----------------------   ---------  ------------   -------
       Total                 480         450         370

                        Watts used of Chassis Inline Power (-50V)
                        Inline Power Admin  Inline Power Oper
Mod   Model                PS     Device       PS     Device     Efficiency
----  -----------------  ----------------    ----------------    ----------
 2    WS-X4548-GB-RJ45V    138      123         73        65          89
 3    WS-X4548-GB-RJ45V      0        0         22        20          89
-----------------------  ----------------    ----------------    ----------
       Total                138      123         95        85

                        Watts used of Module Inline Power (12V -> -50V)
                        Inline Power Admin  Inline Power Oper
Mod   Model                PS     Device       PS     Device     Efficiency
----  -----------------  ----------------    ----------------    ----------
 1    WS-X4013+TS          128      128         63        63          100
-----------------------  ----------------    ----------------    ----------
Switch#
```

The Inline Power Oper column displays the amount of PoE consumed by the powered devices that are attached to the module, in addition to the PoE consumed by the FPGAs and other hardware components on the module.

The Inline Power Admin column displays only the amount of PoE allocated by the powered devices attached to the module.

Note The operating PoE consumption for an 802.3af-compliant module can be non-zero, even when there are no powered devices attached to the module, because of the PoE consumed by FPGAs and other hardware components on the module. In addition, the operating PoE can vary because of fluctuations in the PoE consumed by the hardware components.

The following example uses the **show power detail** and **show power inline** commands to display the PoE consumption for an 802.3af-compliant module:

```
Switch# show power detail

Power                                              Fan      Inline
Supply  Model No          Type       Status        Sensor   Status
------  ----------------  ---------  ------------  -------  -------
PS1     PWR-C45-1300ACV   AC 1300W   good          good     good
PS2     none              --         --            --       --

Power supplies needed by system    : 1
Power supplies currently available : 1

Power Summary                      Maximum
 (in Watts)               Used     Available
----------------------   ----     ---------
System Power (12V)        480        1000
Inline Power (-50V)       138         800
Backplane Power (3.3V)      0           0
----------------------   ----     ---------
Total                     618 (not to exceed Total Maximum Available = 1300)

Module Inline Power Summary (Watts)
(12V -> -48V on board conversion)
---------------------------------
                    Maximum
Mod      Used      Available
---      ----      ---------
1         128            158
---      ----      ---------

                          Watts Used of System Power (12V)
Mod   Model               currently  out of reset  in reset
----  ------------------  ---------  ------------  --------
 1    WS-X4013+TS            330         330         330
 2    WS-X4548-GB-RJ45V       60          60          20
 3    WS-X4548-GB-RJ45V       60          60          20
 --   Fan Tray                30          --          --
----------------------   ---------  ------------   -------
       Total                 480         450         370

                        Watts used of Chassis Inline Power (-50V)
                        Inline Power Admin  Inline Power Oper
Mod   Model                PS     Device       PS     Device     Efficiency
----  ------------------  ----------------    ----------------    ----------
 2    WS-X4548-GB-RJ45V    138      123         73       65          89
 3    WS-X4548-GB-RJ45V      0        0         22       20          89
----------------------  ----------------    ----------------    ----------
       Total                138      123         95       85

                        Watts used of Module Inline Power (12V -> -50V)
                        Inline Power Admin  Inline Power Oper
Mod   Model                PS     Device       PS     Device     Efficiency
----  ------------------  ----------------    ----------------    ----------
 1    WS-X4013+TS          128      128         64       64         100
----------------------  ----------------    ----------------    ----------
```

```
Switch# show power inline g1/1
Module 1 Inline Power Supply: Available:158(w)  Used:128(w)  Remaining:30(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi1/1     auto   on         10.3       10.3       CNU Platform        3

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------

Gi1/1                15.4                15.4

switch# show power inline g2/1
Chassis Inline Power Supply: Available:800(w)  Used:138(w)  Remaining:662(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi2/1     auto   on         11.5       10.2       CNU Platform        n/a

Interface  AdminPowerMax   AdminConsumption
             (Watts)           (Watts)
---------- --------------- --------------------

Gi2/1                15.4                15.4

Switch# show power inline module 1
Module 1 Inline Power Supply: Available:158(w)  Used:128(w)  Remaining:30(w)

Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi1/1     auto   on         10.3       10.3       CNU Platform        3
Gi1/2     auto   on         10.3       10.3       CNU Platform        3
Gi1/3     auto   on         10.3       10.3       CNU Platform        3
Gi1/4     auto   on         10.3       10.3       CNU Platform        3
Gi1/5     auto   on         10.3       10.3       CNU Platform        3
Gi1/6     auto   on         10.3       10.3       CNU Platform        3
Gi1/7     auto   on         10.3       10.3       CNU Platform        3
Gi1/8     auto   on         10.3       10.3       CNU Platform        3
Gi1/9     auto   on         10.3       10.3       CNU Platform        3
Gi1/10    auto   on         15.4       15.4       Cisco/Ieee PD       3
Gi1/11    auto   on         10.3       10.3       CNU Platform        3
Gi1/12    auto   on         10.3       10.3       CNU Platform        3
--------- ------ ---------- ---------- ---------- ------------------- -----

Totals:          12   on    128.2      128.2
switch#

switch# show power inline module 2
Chassis Inline Power Supply: Available:800(w)  Used:138(w)  Remaining:662(w)
Interface Admin  Oper            Power(Watts)     Device              Class
                              From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi2/1     auto   on         11.5       10.2       CNU Platform        n/a
Gi2/2     auto   on         11.5       10.2       CNU Platform        n/a
```

```
Gi2/3     auto   on         11.5       10.2       CNU Platform        n/a
Gi2/4     auto   on         11.5       10.2       CNU Platform        n/a
Gi2/5     auto   off        0.0        0.0        n/a                 n/a
Gi2/6     auto   off        0.0        0.0        n/a                 n/a
Gi2/7     auto   off        0.0        0.0        n/a                 n/a
Gi2/8     auto   off        0.0        0.0        n/a                 n/a
Gi2/9     auto   on         11.5       10.2       CNU Platform        3
Gi2/10    auto   on         11.5       10.2       CNU Platform        n/a
Gi2/11    auto   on         11.5       10.2       CNU Platform        n/a
Gi2/12    auto   on         11.5       10.2       CNU Platform        n/a
Gi2/13    auto   on         11.5       10.2       CNU Platform        3
Gi2/14    auto   on         11.5       10.2       CNU Platform        3
Gi2/15    auto   on         11.5       10.2       CNU Platform        3
Gi2/16    auto   on         11.5       10.2       CNU Platform        3
Gi2/17    auto   off        0.0        0.0        n/a                 n/a
Gi2/18    auto   off        0.0        0.0        n/a                 n/a
Interface Admin  Oper            Power(Watts)     Device              Class
                                 From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi2/19    auto   off        0.0        0.0        n/a                 n/a
Gi2/20    auto   off        0.0        0.0        n/a                 n/a
Gi2/21    auto   off        0.0        0.0        n/a                 n/a
Gi2/22    auto   off        0.0        0.0        n/a                 n/a
Gi2/23    auto   off        0.0        0.0        n/a                 n/a
Gi2/24    auto   off        0.0        0.0        n/a                 n/a
Gi2/25    auto   off        0.0        0.0        n/a                 n/a
Gi2/26    auto   off        0.0        0.0        n/a                 n/a
Gi2/27    auto   off        0.0        0.0        n/a                 n/a
Gi2/28    auto   off        0.0        0.0        n/a                 n/a
Gi2/29    auto   off        0.0        0.0        n/a                 n/a
Gi2/30    auto   off        0.0        0.0        n/a                 n/a
Gi2/31    auto   off        0.0        0.0        n/a                 n/a
Gi2/32    auto   off        0.0        0.0        n/a                 n/a
Gi2/33    auto   off        0.0        0.0        n/a                 n/a
Gi2/34    auto   off        0.0        0.0        n/a                 n/a
Gi2/35    auto   off        0.0        0.0        n/a                 n/a
Gi2/36    auto   off        0.0        0.0        n/a                 n/a
Gi2/37    auto   off        0.0        0.0        n/a                 n/a
Gi2/38    auto   off        0.0        0.0        n/a                 n/a
Gi2/39    auto   off        0.0        0.0        n/a                 n/a
Gi2/40    auto   off        0.0        0.0        n/a                 n/a
Interface Admin  Oper            Power(Watts)     Device              Class
                                 From PS    To Device
--------- ------ ---------- ---------- ---------- ------------------- -----

Gi2/41    auto   off        0.0        0.0        n/a                 n/a
Gi2/42    auto   off        0.0        0.0        n/a                 n/a
Gi2/43    auto   off        0.0        0.0        n/a                 n/a
Gi2/44    auto   off        0.0        0.0        n/a                 n/a
Gi2/45    auto   off        0.0        0.0        n/a                 n/a
Gi2/46    auto   off        0.0        0.0        n/a                 n/a
Gi2/47    auto   off        0.0        0.0        n/a                 n/a
Gi2/48    auto   off        0.0        0.0        n/a                 n/a
--------- ------ ---------- ---------- ---------- ------------------- -----

Totals:          12   on    138.2      123.0
Switch#
```

PoE Policing and Monitoring

Note This functionality is supported on the WS-X4548-RJ45V+, WS-X4648-RJ45V-E, WS-X4648-RJ45V+E, and WS-X4748-UPOE+E line cards.

PoE policing protects a switch from faulty inline powered devices that may draw more current than they were designed for. When a device is connected to a port, a linecard detects the type of device connected and allocates the appropriate amount of power. It sets a PoE policing threshold to a value 5 per cent greater than the allocated power. If the device consumes more power than specified by the policing threshold for a more than 1 second, the port shuts down. Depending on the policing action configured, the port may then be error-disabled, or a message might be logged to the console and the port restarted.

PoE monitoring lets you display the true power consumption of inline powered devices attached to the switch, allowing you determine your actual power consumption.

Topics include:

PoE Policing Modes

PoE policing comprises two modes, which determine the action to take on the interface after a port shuts down because of an inline-power policing violation:

Logging - An error message is logged to the console and the interface restarts; the device powers up.

Errdisable (Default) - In addition to logging an error message to the console, the interface is placed in an errdisable state so that the device attached to the port does not receive inline-power until you restart the port or configure an errdisable autorecovery mechanism.

Note After an inline-power policing violation occurs and the port shuts down, PoE policing automatically turns on again when the port restarts. So, if the connected device exceeds its allocated power again, the port once again shuts down.

Configuring Power Policing on an Interface

The default policing levels are determined by the discovery and power allocation methods (listed in order of priority):

- Configured consumption values, in case any exist
- ?oCDP/LLDP allocated values (for Cisco devices using CDP, or IEEE devices using LLDP)
- Allocated power from IEEE discovery (for devices using this mechanism)

To activate default PoE policing, enter the following:

```
Switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# int g2/1
Switch(config-if)# power inline police
Switch(config-if)# end
Switch# show power inline police g2/1
Available:800(w)  Used:32(w)  Remaining:768(w)

Interface Admin  Oper       Admin      Oper       Cutoff Oper
          State  State      Police     Police     Power  Power
--------- ------ ---------- ---------- ---------- ------ -----
Gi2/1     auto   on         errdisable ok         17.2   16.7
```

The default action for power policing is to set the port to errdisable; the **power inline police** command is equivalent to the **power inline police action errdisable** command, as the above example illustrates. The following example illustrates how to configure the logging policing action:

```
Switch# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# int g2/1
Switch(config-if)# power inline police action log
Switch(config-if)# end
Switch# show power inline police g2/1
Available:800(w)  Used:32(w)  Remaining:768(w)

Interface Admin  Oper       Admin      Oper       Cutoff Oper
          State  State      Police     Police     Power  Power
--------- ------ ---------- ---------- ---------- ------ -----
Gi2/1     auto   on         log        ok         17.2   16.7
```

When a PD consumes more than its allocated power, the port shuts down and a warning message similar to the following appears on the console.

For the WS-X4648-GB-RJ45V, WS-X4648-GB-RJ45V+, and WS-X4748-UPOE+E:

```
*Sep 12 09:15:28.583: %C4K_ETHPORTMAN-3-INLINEPOWEROVERDRAWN: Inline powered device
connected on port Gi3/25 exceeded its policed threshold.
```

For the WS-X4548-RJ45V+:

```
*Sep 26 09:23:21.355: %C4K_SWITCHMANAGER-3-INLINEPOWEROVERDRAWN: Inline powered device
connected on port Gi2/1 exceeded its policed threshold.
```

For actions of Log type, the port restarts itself and the device reboots. In contrast, when the action is to set the port in an errdisable state, a log message like the following appears:

```
*Sep 26 09:30:20.463: %PM-4-ERR_DISABLE: inline-power error detected on Gi2/1, putting
Gi2/1 in err-disable state

Switch# show power inline police g2/1
Available:800(w)  Used:16(w)  Remaining:784(w)

Interface Admin  Oper       Admin      Oper       Cutoff Oper
          State  State      Police     Police     Power  Power
--------- ------ ---------- ---------- ---------- ------ -----
Gi2/1     auto   errdisable errdisable overdrawn  0.0    0.0
```

Displaying Power Policing on an Interface

You can display power policing on an interface, on a module, or for all the PoE-capable linecards in a chassis.

The following example shows output for the **show power inline police** command:

```
Switch# show power inline police
Available:623(w)  Used:6(w)  Remaining:617(w)

Interface Admin  Oper       Admin       Oper         Cutoff Oper
          State  State      Police      Police       Power  Power
--------- ------ ---------- ----------  ----------   ------ -----
Gi2/1     auto   off        none        n/a          n/a    0.0
Gi2/2     auto   on         none        n/a          n/a    16.7
Gi2/3     auto   off        errdisable  n/a          0.0    0.0
Gi2/4     auto   on         errdisable  ok           16.6   11.4
Gi2/5     auto   on         log         ok           16.6   11.2
Gi2/6     auto   on         errdisable  overdrawn    0.0    0.0
```

The following table lists the interface and the status.

Interface Configuration	State
Gi2/1	No PD connected, no policing configured.
Gi2/2	PD connected, no policing configured.
Gi2/3	No PD connected, policing configured (gets enabled when PD is connected). Policing action is errdisable.
Gi2/4	PD connected, policing configured. Configured policing action is errdisable. Port is currently operating within policing limits.
Gi2/5	PD connected, policing configured. Configured policing action is log. Port is currently operating within policing limits.
Gi2/6	PD connected, policing configured. Configured policing action is errdisable. Port is currently in errdisable state as it has overdrawn its policed power level.

If you enter the **show power inline** command at the global level (**show power inline police**), the last line of the output under the Oper Power field displays the total of true inline power consumption of all devices connected to the switch.

Configuring Errdisable Recovery

By default, errdisable auto recovery for inline-power is disabled; when an interface is placed in an errdisable state because of an inline-power policing violation, it remains in that state. You must enter **shut** and **no shut** on the affected interface to revive it.

The errdisable autorecovery mechanism allows you to configure a timer for errdisable recovery so that when an interface enters errdisable state (after the timer expires), the interface returns from the errdisable state.

errdisable detection

By default, errdisable detection for inline-power is enabled, as the following example illustrates:

```
Switch# show errdisable detect
ErrDisable Reason    Detection    Mode
-----------------    ---------    ----
inline-power         Enabled      port
```

Note If detection is disabled (through the **errdisable detect cause inline-power** command), the port is not placed in errdisable state when it exceeds its power policing threshold.

errdisable recovery

By default, errdisable recovery for inline-power is disabled. To enable errdisable recovery, enter the **errdisable detect cause line-power** command:

```
Switch# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# errdisable detect cause inline-power
Switch(config)# end
Switch# show errdisable recovery
ErrDisable Reason            Timer Status
-----------------            --------------
-----------                  ----------
inline-power                 Enabled
```

Enhanced Power PoE Support on the E-Series Chassis

The WS-X4648-RJ45V-E, WS-X4648-RJ45V+E, and WS-X4548-RJ45V+ switching modules support IEEE 802.3af PoE as well as the Cisco proprietary Inline Power standard. With Cisco IOS Release 12.2(44)SG, the WS-X4648-RJ45V+E linecard can also support the IEEE 802.3at standard with up to 30 W available per port. Furthermore, the WS-X4648-RJ45V-E linecard supports up to 20 W. The WS-X4548-RJ45V+ switching module is supported with Cisco IOS Release 12.2(50)SG and can provide up to 30 W of inline power per port. The WS-X4747-RJ45V+ linecard introduced in Cisco IOS Release 15.0(1)XO provides up to 30 watts per port.

For these switching modules, the valid milliwatt ranges for the **power inline** command have been increased appropriately for the module, as the following table illustrates:

Linecard	Standard	Max Power/Port	Cisco IOS Release
WS-X4248-RJ45V	IEEE 802.3af	15.4 W	12.2(18)EW
WS-X4548-RJ45V	IEEE 802.3af	15.4 W	12.2(18)EW
WS-X4648-RJ45V-E	IEEE 802.3af IEEE 802.3at	20 W	12.2(44)SG
WS-X4648-RJ45V+E	IEEE 802.3af IEEE 802.3at	30 W	12.2(44)SG
WS-X4548-RJ45V+	IEEE 802.3af IEEE 802.3at	30 W	12.2(50)SG

Linecard	Standard	Max Power/Port	Cisco IOS Release
WS-X4748-RJ45V+E	IEEE 802.3af IEEE 802.3at	30 W	3.1.0SG
WS-X4748-UPOE+E	IEEE 802.3af IEEE 802.3at UPOE	60 W	3.2.0SG

Ordinarily, the default power inline configurations suffice; no additional configuration is required even for high power consumption Cisco powered devices (for example, a Cisco AP1250 Wireless Access Point). When a high power consumption device is attached to a port on a WS-X4648-RJ45V-E or WS-X4648-RJ45V+E linecard, the switch and device negotiate power using CDP/LLDP packets to automatically determine the extended amount of power needed by the device.

Depending on the deployment requirements and design, you specify a specific configuration with the **power inline** command.

The following example shows how to pre-allocate PoE allocation to 16500 mW for Gi 2/1, regardless of what is mandated either by the 802.3af class of the discovered device or by any CDP packet that is received from the powered device:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet 2/1
Switch(config-if)# power inline static max 16500
Switch(config-if)# end
Switch#
```

Configuring Universal PoE

Note This feature is only available on Supervisor Engine 7-E and Supervisor Engine 7L-E.

Although IEEE 802.at only provides for power up to 30W per port, the WS-X4748-UPOE+E module can provide up to 60W using the spare pair of an RJ45 cable (wires 4,5,7,8) with the signal pair (wires 1,2,3,6). Power on the spare pair is enabled when the switch port and end-device mutually identify themselves as Universal PoE (UPOE) capable using CDP or LLDP and the end-device requests for power on the spare pair to be enabled. When the spare pair is powered, the end-device can negotiate up to 60W power from the switch using CDP or LLDP.

If the end-device is PoE capable on both signal and spare pairs but does not support the CDP or LLDP extensions required for UPOE, then the following configuration automatically enables power on both signal and spare pairs from the switch port:

	Command	Purpose
Step 1	`Switch # interface terminal`	Changes mode to global configuration.
Step 2	`Switch(config)# interface {fastethernet | gigabitethernet} slot/port`	Selects the interface to configure.
Step 3	`Switch(config-if)# power inline four-pair forced`	To automatically enables power on both signal and spare pairs from a switch port.

	Command	Purpose
Step 4	`Switch(config-if)# shutdown`	Shuts down the port.
Step 5	`Switch(config-if)# no`	Boots the port.
Step 6	`Switch(config-if)# end`	Exits configuration mode.
Step 7	`Switch# show platform software interface {fastethernet | gigabitethernet} slot/port status`	Displays EEE status.

The following example shows how to automatically enable power on both signal and spare pairs from switch port gigabit ethernet 2/1:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet 2/1
Switch(config-if)# power inline four-pair forced
Switch(config-if)# shutdown
Switch(config-if)# no shutdown
Switch(config-if)# end
Switch#
```

Do not enter this command if the end-device is incapable of sourcing inline power on the spare pair or if the end-device supports the CDP or LLDP extensions for UPOE.