CHAPTER 28

Power Management

This chapter describes the power management feature in the Catalyst 4500 series and Catalyst 4000 series switches.

Note For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 4500 Series, Catalyst 2948G, and Catalyst 2980G Switches Command Reference*.

This chapter consists of these sections:

Understanding How Power Management Works on the Catalyst 4500 Series Switches

These sections describe how to manage power for the Catalyst 4500 series switches.

Note For information on power management for the Catalyst 4006 switch, see the "Understanding How Power Management Works on the Catalyst 4006 Switch" section on page 28-6.

Power Management Overview

Catalyst 4500 series switches support the following power supplies:

- Fixed wattage—These power supplies always deliver a fixed amount of inline and system power:
  - 1000 W AC
  - 2800 W AC
- Variable wattage—These power supplies automatically adjust the wattage to accommodate inline and system power requirements:
  - 1300 W AC
  - 1400 W DC

For more information on available wattage for the power supplies, see Table 28-1 on page 28-4.

Caution Do not use the 1400 W DC power supply with any other power supply, even for a hot swap or other short-term emergency, because you can seriously damage your switch.

Note If you use power supplies with different types or wattages in your switch, the switch uses the power supply in power supply bay 1 (PS1) and ignores the power supply in power supply bay (PS2). Your switch will not have power redundancy.

Understanding Power Management Modes

Catalyst 4500 series switches support these two power management modes:

- Redundant mode—Uses one power supply as a primary power supply and the second power supply as a backup. If the primary power supply fails, the second power supply supports the switch without disrupting the network. Both power supplies must have the same wattage. A single power supply must have enough power to support the switch configuration. By default, the power supplies in the Catalyst 4500 series switch are set to redundant mode.
- Combined mode—Uses the power from all installed power supplies to support the power requirements of the switch configuration. Combined mode has no power redundancy; if a power supply fails, one or more modules might shut down. Combined mode requires that your switch has two power supplies. The 1400 W DC power supply does not support combined mode.

Your switch hardware configuration dictates which power supply or supplies you should use. For example, if your switch configuration requires more power than a single power supply provides, use the combined mode. In combined mode, however, the switch has no power redundancy.

Note See Table 28-1 on page 28-4 for a list of the maximum available power that is provided by the power supplies in either combined or redundant mode for the Catalyst 4500 series switches. See Table 28-2 on page 28-9 for the power requirements of the Catalyst 4500 series switching modules.

Redundant Mode Guidelines

This section describes the guidelines for using redundant mode in the Catalyst 4500 series switches:

- By default, the power supplies in a Catalyst 4500 series switch are set to redundant mode.
- The two power supplies must be the same type.

Caution Do not use the 1400 W DC power supply with any other power supply, even for a hot swap or other short-term emergency, because you can seriously damage your switch.

- If you set your switch to redundant mode and only one power supply is installed, your switch accepts the configuration but operates without redundancy.

Note If you use power supplies with different types or wattages in your switch, the switch uses the power supply in power supply bay 1 (PS1) and ignores the power supply in power supply bay (PS2). Your switch will not have power redundancy.

- When using fixed power supplies, choose a power supply that can support the switch configuration.
- When using variable power supplies, choose a power supply that supplies enough power so that the chassis and inline power requirements are less than the maximum available power for the chassis and inline power for the power supply. Variable power supplies automatically adjust the power resources to accommodate the chassis and inline power requirements when a system boots. Modules are brought up first, followed by powered devices.
- See Table 28-1 on page 28-4 for a list of the maximum available power for chassis and inline power for each power supply.

Combined Mode Guidelines

This section describes the guidelines for using combined mode in the Catalyst 4500 series switches:

- The two power supplies must be the same type.
- If you use power supplies with different types or wattages, the switch uses only one power supply. Your switch will have no power redundancy.
- The 1400 W DC power supply does not support combined mode. If you set the power budget to 2, the switch ignores this setting. For more information about the 1400 W DC power supply, see the "1400 W DC Power Supply Guidelines and Restrictions" section on page 28-5.
- When you set your switch to combined mode and only one power supply is installed, your switch continues to operate in combined mode.
- When using variable power supplies, choose a power supply that supplies enough power so that the chassis and inline power requirements are less than the maximum available power for the chassis and inline power for the power supply. Variable power supplies automatically adjust the power resources to accommodate the chassis and inline power requirements.
- When your switch is set to combined mode, the total available power is not the mathematical sum of the individual power supplies. The power supplies have a predetermined current sharing ratio. The total power available is P + (P * ratio).
- See Table 28-1 on page 28-4 for a list of the maximum available power for chassis and inline power for each power supply.

Available Power for Power Supplies

Table 28-1 lists the power that is provided by the power supplies for the Catalyst 4500 series switches.

Table 28-1 Available Power

Power Supply	Redundant Mode (W)	Combined Mode (W)
1000 W AC	Chassis[1] = 1000 Inline = 0	Chassis = 1667 Inline = 0
1300 W AC[2]	Chassis (max) = 1000 Inline (max) = 800 Chassis + inline + backplane ≤ 1300	Chassis (min) = 767 Chassis (max) = 1667 Inline (min) = 433 Inline (max) = 1333 Chassis + inline + backplane ≤ 2166
1400 W DC[3]	Chassis (min) = 200 Chassis (max) = 1360 Inline (max)[4] = (DC input[5] − [Chassis (min) + backplane] / 0.75) * 0.96	N/A
2800 W AC	Chassis = 1360 In-line = 1400	Chassis = 2473 Inline = 2545

1. The chassis power includes power for the supervisor engine(s), all line cards, and the fan tray.
2. The backplane consumes 10 W in both redundant and combined mode.
3. The backplane consumes 10 W in redundant mode.
4. The 1400 W DC power supply has 0.75 efficiency. The inline power has 0.96 efficiency.
5. The DC input can vary for the 1400 W DC power supply and is configurable. For more information, see the "Power Management Limitations" section on page 28-4.

Power Management Limitations

This section describes the power-management limitations for the Catalyst 4500 series switches.

Note To compute the power requirements and verify that your system has enough power, add the power that is consumed by the supervisor engine(s), the fan trays, and the installed modules (including the inline power). For more information, see the "Power Consumption for Modules" section on page 28-9.

- You can set the power requirements for the installed modules to exceed the power that is provided by the power supplies.
- If you insert a single power supply into the switch and then set combined mode, the switch displays this message:

```
Insufficient power supplies present for specified configuration.
```

- Combined mode requires that you install two power supplies in your switch. If you have only one power supply, and you set the switch to combined mode, the switch places each module in reset mode.
- If the power requirements for the installed modules exceed the power that is provided by the power supplies, the switch displays this message:

  `Insufficient power available for the current chassis configuration.`
- If you try to insert additional modules that exceed the power of the power supplies into the switch, the switch places the newly inserted module into reset mode and displays this message:

  `Module has been inserted` and `Insufficient power supplies operating.`
- If you power down a switch, and you insert an additional module or change the module configuration so that the power requirements exceed the available power, when you power on the switch again, one or more modules are placed in reset mode.
- If too many powered devices are drawing power from the system, the power to the devices is cut and some devices may power down.

Note A module in the reset mode continues to draw power as long as it is installed in the chassis.

1400 W DC Power Supply Guidelines and Restrictions

This section describes the guidelines and restrictions for using a 1400 W DC power supply in the Catalyst 4500 series switches:

Caution Do not use the 1400 W DC power supply with any other power supply, even for a hot swap or other short-term emergency, because you can seriously damage your switch.

- The 1400 W DC power supply works with a variety of DC sources. The DC input can vary from 300 W to 7500 W. Refer to the power supply documentation that shipped with your power supply for additional information.
- Supervisor Engine II cannot detect the DC source that is plugged into the 1400 W DC power supply. If you use the 1400 W DC power supply with Supervisor Engine II, use the **set power dcinput** command to set the DC input power. For more information, refer to the *Catalyst 4500 Series, Catalyst 2948G, and Catalyst 2980G Switches Command Reference*.
- Software automatically adjusts between system power (for modules, backplane, and fans) and inline power. The inline power is 96 percent efficient, and system power has only 75 percent efficiency. For example, each 120 W of system power requires 160 W from the DC input.
- The 1400 W DC power supply does not support combined mode. If you set the power budget to 2 (combined mode), the switch ignores the setting and remains in redundant mode.
- The 1400 W DC power supply has a separate power on/off switch for inline power. The power supply fan status is tied to the power supply status so that the status of the inline power switch can be reported to software. If the power supply fan fails, the display shows the power as faulty, even if the main power is working properly.

Understanding How Power Management Works on the Catalyst 4006 Switch

These sections describe how to manage power for the Catalyst 4006 switch.

Note For information on power management for the Catalyst 4500 series switches, see the "Understanding How Power Management Works on the Catalyst 4500 Series Switches" section on page 28-1.

The power management feature for the Catalyst 4000 series switches support a limited module configuration on a reduced number of power supplies.

The Catalyst 4000 series switch chassis supports only the 400 W AC, 400 W DC, and 650 W DC power supplies and allows you to use AC-input and DC-input power supplies in the same chassis. In systems with redundant power supplies, both power supplies should have the same wattage. If you use a 400 W power supply and a 650 W power supply, the switch acts as if there were two 400 W power supplies. For more information, refer to the *Catalyst 4000 Series Switch Installation Guide*.

Understanding Power Redundancy

The Catalyst 4006 switch contains holding bays for up to three power supplies. You need two primary power supplies to operate a fully loaded Catalyst 4006 chassis. You can set the power redundancy to two primary plus one redundant power supply (2+1 redundancy mode) or to one primary plus one redundant power supply (1+1 redundancy mode). The 1+1 redundancy mode might not support a fully loaded chassis.

If your switch has only two power supplies and is in 2+1 redundancy mode (the default mode), there is no redundancy. You can create redundancy with only two power supplies by setting the power redundancy to operate in 1+1 redundancy mode (one primary plus one redundant power supply). However, 1+1 redundancy does not support all configurations.

The modules for the Catalyst 4006 switch have different power requirements; some switch configurations require more power than 1+1 redundancy mode (a single power supply) can provide. In those configurations, redundancy requires three power supplies.

You can use the 1+1 redundancy mode in these hardware configurations:

- One Catalyst 4006 chassis with a WS-X4013 supervisor engine with two 400 W power supplies (in 1+1 redundancy mode) and four WS-X4148-RJ or WS-X4148-RJ21 modules
- One Catalyst 4006 chassis with a WS-X4013 supervisor engine with two 650 W power supplies (in 1+1 redundancy mode) and five WS-X4148-RJ or WS-X4148-RJ21 modules

Although other configurations are possible, we do not recommend that you use them without carefully considering the power usage of the system. For example, other similar and possible configurations may consist of four modules that consume less power, and the total module power usage does not exceed the absolute maximum power usage for the system.

The supervisor engine uses 110 W and the fan tray uses 25 W. The total load for the modules, the supervisor engine, and the fan cannot total more than the power that is supplied by the power supply. The 1+1 redundancy mode might not support a fully loaded chassis. You may need to leave one slot of the chassis empty. An attempt to use five modules risks an oversubscription of available power.

If you choose to use the 1+1 redundancy mode, the type and number of modules that are supported are limited by the power that is available from a single power supply. To determine the power consumption for each module in your chassis, see the "Power Consumption for Modules" section on page 28-9.

To use a 1+1 redundancy configuration, you must change the system configuration from the default 2+1 redundancy mode to 1+1 redundancy mode by entering the **set power budget** command. Enter the **set power budget 1** command to set the power budget to accommodate a 1+1 redundancy mode. In the 1+1 redundancy mode, the nonredundant power that is available to the system is the power of a single power supply. The second power supply provides full redundancy.

1+1 Redundancy Mode Guidelines and Restrictions

This section describes the guidelines and restrictions for the 1+1 redundancy mode in the Catalyst 4006 switch:

- To compute the power requirements and verify that your system has enough power, add up the power that is consumed by the supervisor engine, the fan tray, and the installed modules. See the "Power Consumption for Modules" section on page 28-9 for more information on the power consumption for the various components of your switch.
- A module in reset mode continues to draw power as long as it is installed in the chassis; however, the module is not shown in the **show module** command output, because the system considers it removed.
- A single power supply provides 400 W or 650 W. Two 400 W power supplies provide 750 W. Two 650 W power supplies supply only 750 W; this power supply cooling capacity restriction applies to the Catalyst 4006 switch.
- When considering the 1+1 redundancy mode, you must carefully plan the configuration of the module power usage of your chassis. An incorrect configuration will disrupt your system during the evaluation cycle. To avoid a disruption, ensure that your configuration is within the power limits, or return to the default 2+1 redundancy configuration by installing a third power supply in your switch and setting the power budget to 2+1 redundancy mode.
- Enter the **set power budget 2** command to set the power budget to the 2+1 redundancy mode.

1+1 Redundancy Mode Limitations

This section describes the 1+1 redundancy mode limitations for the Catalyst 4006 switch.

If you try to configure the switch to operate in 1+1 redundancy mode, and you have more modules that are installed in the chassis than a single power supply can handle, the switch displays this message:

```
Insufficient power supplies for the specified configuration.
```

If you are already operating in 1+1 redundancy mode with a valid module configuration and you try to insert additional modules that require more power than the single power supply provides, the switch places the newly inserted module into reset mode and displays this message:

`Module has been inserted` and `Insufficient power supplies operating.`

If you power down a chassis that has been operating in 1+1 redundancy mode with a valid module configuration, and you insert a module or change the module configuration inappropriately and power on the switch again, the module(s) in the chassis (at boot up) that require more power than is available, are placed into reset mode.

These scenarios initiate the five-minute evaluation countdown timer. When this timer runs out, the switch tries to resolve this power limitation by evaluating the type and number of modules that are installed. The evaluation process may require several cycles to stabilize the chassis' power usage.

During the evaluation cycle, the modules are removed and reinserted, thus disrupting network connectivity. The switch reactivates only the modules that it is able to support with the limited power available and leaves the remaining modules in reset mode. The supervisor engine always remains enabled. Modules that are placed in reset mode still consume some power. If the chassis module combination and the modules in reset mode still require more power than is available, the timer starts again, and additional modules are placed into reset mode until the power usage is stable.

If the power requirement of the active modules and the modules in reset mode do not exceed the available power, the switch is stable and no more evaluation cycles are run, until something again causes insufficient power usage. One or two cycles are required to stabilize the switch. If you configure the chassis correctly, the switch does not enter the evaluation cycle.

Note If all three power supplies are installed in your Catalyst 4006 switch and you set 1+1 redundancy mode but later add additional modules that exceed the power available, the timer starts again. The switch may require several evaluation cycles to stabilize the system.You can either remove the extra modules or change the power budget to 2+1 redundancy mode. If you change to 2+1 redundancy mode, each module in reset mode is brought up one at a time to an operational state.

If you use a 400 W power supply and a 650 W power supply in your switch, the switch acts as if there were two 400 W power supplies.

If you have one 400 W power supply and one 650 W power supply in 1+1 redundancy mode, and a second 650 W power supply is set as the backup, the switch acts as if there were a total of 400 W. If the 400 W power supply fails, the backup 650 W power supply comes into service; however, the switch still has only 400 W available. You must remove the failed 400 W power supply so that the switch can use the available 650 W.

The following configuration requires a minimum of 395 W:

- WS-X4013 supervisor engine—110 W
- Four WS-X4148-RJ modules—65 W each (260 W total—the optimized module configuration)
- Fan tray—25 W

The following configuration requires more power than a single 400 W power supply can provide. It requires 445 W and cannot be used in 1+1 redundancy mode for a 400 W power supply. A single 650 W power supply provides enough power for 1+1 redundancy mode for this configuration.

- WS-X4013 supervisor engine—110 W
- Two WS-X4148-RJ modules in slots 2 and 3—65 W each (130 W total)
- Two WS-X4448-GB-LX modules in slots 4 and 5—90 W each (180 W total)
- Fan tray—25 W

The following configuration requires more power than either a single 400 W or 650 W power supply can provide. It requires 735 W and cannot be used in 1+1 redundancy mode for either a 400 W or 650 W power supply.

- WS-X4013 supervisor engine—110 W
- Five 48-port 100BASE-FX modules in slots 2 through 6—120 W each (600 W total)
- Fan tray—25 W

Power Consumption for Modules

Table 28-2 lists how much power is consumed by the components on the Catalyst 4500 series and the Catalyst 4006 switch. See Table 28-2.

Table 28-2 Power Consumption for Catalyst 4500 Series and 4000 Series Components

Module	Power Consumed During Operation (W)	Power Consumed in Reset Mode (W)
Supervisor Engine II	110	110
Catalyst 4003 and 4006 fan tray	25	25
Catalyst 4503 fan tray	30	30
Catalyst 4506 fan tray	50	50
Catalyst 4003 and 4006 switch backplane	0	0
Catalyst 4503 switch backplane	10	10
Catalyst 4506 switch backplane	10	10
6-port 1000BASE-X (GBIC) Gigabit Ethernet WS-X4306-GB	35	30
32-port 10/100 Fast Ethernet RJ-45 WS-X4232-RJ-XX	50	35
Catalyst 4000 Access Gateway Module with IP/FW IOS WS-X4604-GWY	120	60
24-port 100BASE-FX Fast Ethernet switching module WS-X4124-FX-MT	90	75
32-port 10/100 Fast Ethernet RJ-45, plus 2-port 1000BASE-X (GBIC) Gigabit Ethernet WS-4232-GB-RJ	55	35
48-port 100BASE-FX Fast Ethernet switching module WS-4148-FX-MT	120	10
18-port server switching 1000BASE-X (GBIC) Gigabit Ethernet WS-4418-GB	80	50
Catalyst 4006 Backplane Channel Module WS-X4019	10	10
48-port 10/100 Fast Ethernet RJ-45 WS-X4148-RJ	65	40
Catalyst 4003 and 4006 Layer 3 Services Module WS-X4232-L3	120	70
12-port 1000BASE-T Gigabit Ethernet, plus 2-port 1000BASE-X (GBIC) Gigabit Ethernet WS-X4416	110	70
24-port 1000BASE-X Gigabit Ethernet WS-X4424-GB-RJ45	90	50
48-port 1000BASE-X Gigabit Ethernet WS-X4448-GB-RJ45	120	72

Table 28-2 Power Consumption for Catalyst 4500 Series and 4000 Series Components (continued)

Module	Power Consumed During Operation (W)	Power Consumed in Reset Mode (W)
48-port 1000BASE-X Gigabit Ethernet WS-X4448-GB-LX	90	50
48-port Telco 10/100BASE-TX switching module WS-X4148-RJ21	65	40
48-port inline power 10/100BASE-TX switching module WS-X4148-RJ45V	60	50
4-port MT-RJ uplink module WS-U4504-FX-MT	10	10
48-port MT-RJ 100BASE-LX switching module WS-X4148-FE-LX-MT	88	10
48-port 10/100/1000BASE-T switching module WS-X4548-GB-RJ45	58	15
2-port 1000BASE-X (GBIC) Gigabit Ethernet WS-X4302-GB	35	30

Migrating a Supervisor Engine II from a Catalyst 4006 Switch to a Catalyst 4500 Series Switch

If you migrate a Supervisor Engine II from a Catalyst 4006 switch to a Catalyst 4503 or 4506 switch, save your configuration and reload the configuration file after you insert the supervisor engine into the Catalyst 4500 series chassis.

The Catalyst 4006 switch has 1024 MAC addresses that you can use as bridge identifiers; the Catalyst 4500 series switches have 64 MAC addresses. MAC address reduction is always enabled on the Catalyst 4500 series switches; however, MAC address reduction may or may not be enabled on a Catalyst 4006 switch. This might affect the selection of the root bridge after you migrate your supervisor engine. Here are two scenarios to consider:

- The Catalyst 4006 switch is not a root switch

  In this case, the spanning tree topology does not change. If you add a Catalyst 4500 series switch with MAC reduction enabled and a default spanning tree bridge ID priority set to 32,768 to the network, the bridge ID priority of the new switch becomes the bridge ID priority that is added to a system ID extension. The system ID extension, which is the VLAN number, can vary from 1 to 4094. If the switch is in VLAN 1, the new bridge ID priority will be 32,789. Because 32,769 is greater than 32,768, this switch cannot become the root switch.

- The Catalyst 4006 switch is a root switch

  In this case, the spanning tree topology may change. If the other switches in the network are not running MAC address reduction, the topology will change after you replace the chassis with a Catalyst 4500 series switch. The bridge ID priority of the new Catalyst 4500 series switch increments in the same manner as in the previous scenario (bridge ID priority + VLAN number). If the switch is in VLAN 1, the new bridge ID will be 32,789. Because 32,769 is greater than 32,768, this switch cannot become the root switch. The network designates a new root switch; the spanning tree topology also changes to reflect the new root switch.

If the bridge priority of the Catalyst 4006 switch has been lowered administratively and you use the same configuration in the new Catalyst 4500 series switch, then the switch remains the root switch and the spanning tree topology does not change.

Understanding How Inline Power Works

The Catalyst 4006 switch and the Catalyst 4500 series switches can sense if a powered device is connected to an inline power module. The Catalyst 4006 switch and the Catalyst 4500 series switches can supply inline power to the powered device if there is no power on the circuit. The powered device can also be connected to an AC power source and supply its own power to the voice circuit. If there is power on the circuit, the switch does not supply it.

Note A powered device is any device that is connected to the switch that requires external power or can utilize inline power. An access point or IP phone is an example of this device type.

Table 28-3 lists the switch components that support inline power.

Table 28-3 Switch Components Supporting Inline Power

Switch Chassis	Modules	Power Supplies
Catalyst 4006	WS-X4148-RJ45V	Catalyst 4000 Series Power Entry Module (PEM)
Catalyst 4503 Catalyst 4506	WS-X4148-RJ45V	1300 W AC 2800 W AC 1400 W DC

You can configure the switch to stop supplying power to the powered device and to disable the detection mechanism. If your switch has a module that can provide inline power to end stations, you can set each port on the module to detect and apply inline power automatically if the end station requires power.

Note For information on powering powered devices that are connected to other Catalyst switching modules, refer to the *Catalyst Family Inline-Power Patch Panel Installation Note*.

You can power only one device for each port; you must connect the phone directly to the switch port. If you daisy chain a second phone off the phone that is connected to the switch port, the switch cannot power the second phone.

The WS-X4148-RJ45V switching modules can supply a maximum of 6.3 W per port and is 100 percent efficient.

To determine the power requirements for your configuration, you need to estimate the following:

- Power requirements for all powered devices for the entire switch and for each module.
- Maximum power that is available per port for each module.
- Total available inline power that is available for the switch (see Table 28-1 on page 28-4 and the PEM documentation).
- When using variable power supplies, consider the required system power (see Table 28-2 on page 28-9).

Inline Power Management Modes

Each port is configured through the CLI, SNMP, or a configuration file in one of the following modes (configured through the **set port inlinepower** CLI command):

- Auto—The supervisor engine directs the switching module to power up the port *only* if the switching module discovers that the phone and the switch have enough power. You can specify the maximum wattage that is allowed on the port. If you do not specify a wattage, then the switch delivers no more than the hardware-supported maximum value.
- Static—The supervisor engine directs the switching module to power up the port to the wattage you specify *only* if the switching module discovers the phone. You can specify the maximum wattage that is allowed on the port. If you do not specify a wattage, then the switch allows the hardware-supported maximum value. The maximum wattage, whether determined by the switch or specified by you, is preallocated to the port. If the switch does not have enough power for the allocation, the command will fail.
- Off—The supervisor engine does not direct the switching module to power up the port even if an unpowered phone is connected.

Each port has a status that is defined as one of the following:

- on—Power is supplied by the port.
- off—The power is not supplied by the port.
- 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 that is required by the port. The power is not being supplied by the port.
- err-disable—The port cannot provide power to the connected device that is configured in Static mode.
- faulty—The port failed diagnostic tests.

Power Requirements

Each powered device has different power requirements. Table 28-4 lists the power requirements for the different classes of IP phones and several other powered devices. The supervisor engine initially calculates the power allocation for each port based on the per-port configuration and default power allocation. If the correct amount of power is determined from the CDP messaging with the Cisco-powered device, the supervisor engine reduces or increases the allocated power for any ports that are set to Auto mode. Allocated power is not adjusted for ports that are set to Static mode.

For example, the default allocated power is 7 W for a Cisco IP Phone requiring 6.3 W. The supervisor engine allocates 7 W for the Cisco IP Phone and powers it up. After the Cisco IP Phone is operational, it sends a CDP message with the actual power requirement to the supervisor engine. The supervisor engine then decreases the allocated power to the required amount if the port is set to Auto mode.

Table 28-4 Power Requirements for Some Powered Devices

Device	Required Power (W)
Cisco legacy IP phone	6.3
Cisco + IEEE IP phone	7
Cisco high-power powered device	15.4
Cisco Aironet 1200 Access Point with 802.11a and 802.11b radio installed	11

Wall-Powered Phones

When a wall-powered phone is present on a switching module port, the switching module cannot detect its presence. The supervisor engine discovers the phone through CDP messaging with the port. If the phone supports inline power (the supervisor engine determines this through CDP), and the mode is set to Auto, Static, or Off, the supervisor engine does not attempt to power on the port. If a power outage occurs, and the mode is set to Auto, the phone loses power, but the switching module discovers the phone and informs the supervisor engine, which then applies inline power to the phone. If a power outage occurs, and the mode is set to Static, the phone loses power, but the switching module discovers the phone and applies the preallocated inline power to the phone.

Powering Off the Phone

The supervisor engine can turn off power to a specific port by sending a message to the switching module. The power for a port in Auto mode is then added back to the available system power. Power for ports in Static mode is not added back to the available system power. This situation occurs only when you power off the phone through the CLI or SNMP.

Phone Removal

The switching module informs the supervisor engine if a *powered* phone is removed using a link-down message. The supervisor engine then adds the allocated power for that port back to the available inline power if the port is in Auto mode.

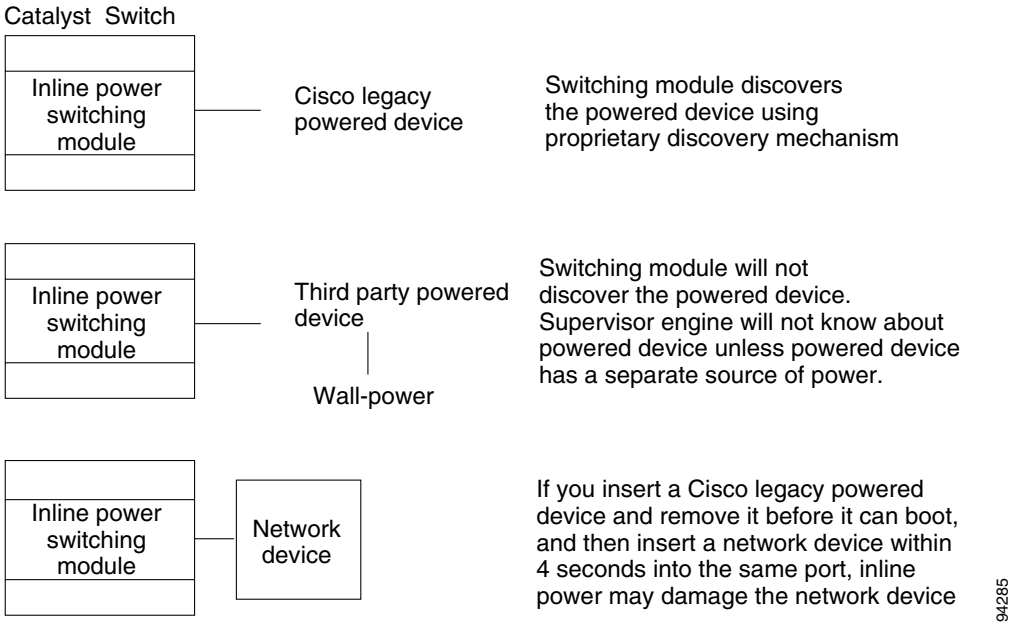
In addition, the switching module informs the supervisor engine if an *unpowered* phone is removed.

Caution When you plug a Cisco IP phone into a port and turn the power on, the supervisor engine waits 4 seconds for the link to go up on the line. During this time, if you unplug the phone cable and plug in a network device, you could damage the device. We recommend that you wait at least 10 seconds between unplugging a device and plugging in a new device.

Phone Detection Summary

Figure 28-1 shows how the system detects a phone that is connected to a Catalyst 4006 switch or a Catalyst 4500 series switch port.

Figure 28-1 Power Detection Summary



Configuring Power Management

These sections describe how to configure power management on the Catalyst 4500 series switches and the Catalyst 4006 switch.

Note The tasks in these sections apply only to the Catalyst 4500 series and Catalyst 4006 switches unless otherwise noted.

Setting Redundant Mode for the Catalyst 4500 Series Switches

To set redundant mode on the Catalyst 4500 series switch, perform this task in privileged mode:

	Task	Command
Step 1	Set the system power management mode to redundant mode.	**set power budget 1**
Step 2	Verify the system power management mode and the current power usage for the switch.	**show environment power**

This example shows how to set the power management mode to redundant:

```
Console>(enable) set power budget 1
Console> (enable) show environment power
Total Inline Power Available: 774.00 Watts (15.48 Amps @50V)
Total Inline Power Drawn From the System: 62.00 Watts ( 1.24 Amps @50V)
Remaining Inline Power in the System: 696.50 Watts (13.93 Amps @50V)
Configured Default Inline Power allocation per port: 15.400 Watts (0.30 Amps @50V)
Module Total Allocated Max H/W Supported Max H/W Supported
To Module (Watts) Per Module (Watts) Per Port (Watts)
------ ---------------- ------------------ -----------------
2 31.00 836.00 15.400
3 31.00 836.00 15.400
DC Power supplies are configured for 2500Watts DC input
Power Budget is : 1 supply
Power Available to the System (excluding voice power): 1000 Watts (83.33 Amps @12V)
Power Drawn from the System (excluding voice power): 516 Watts (43.00 Amps @12V)
Remaining Power (excluding voice power): 484 Watts (40.33 Amps @12V)
Console>(enable)
```

Setting Combined Mode on the Catalyst 4500 Series Switches

To set combined mode on the Catalyst 4500 series switch, perform this task in privileged mode:

	Task	Command
Step 1	Set the system power management mode to combined mode.	**set power budget 2**
Step 2	Verify the system power management mode and the current power usage for the switch.	**show environment power**

This example shows how to set the power management mode to combined mode:

```
Console>(enable) set power bedget 2
Console> (enable) show environment power
Total Inline Power Available: 1333.00 Watts (26.66 Amps @50V)
Total Inline Power Drawn From the System: 62.00 Watts ( 1.24 Amps @50V)
Remaining Inline Power in the System: 1255.50 Watts (25.11 Amps @50V)
Configured Default Inline Power allocation per port: 15.400 Watts (0.30 Amps @50V)
Module Total Allocated Max H/W Supported Max H/W Supported
To Module (Watts) Per Module (Watts) Per Port (Watts)
------ ---------------- ------------------ -----------------
2 31.00 836.00 15.400
3 31.00 836.00 15.400
DC Power supplies are configured for 2500Watts DC input
Power Budget is : 2 supplies
Power Available to the System (excluding voice power): 1666 Watts (138.83 Amps @12V)
Power Drawn from the System (excluding voice power): 516 Watts (43.00 Amps @12V)
Remaining Power (excluding voice power): 1150 Watts (95.83 Amps @12V)
Console>(enable)
```

Setting the DC Power Input

To set the DC power input for the 1400 W DC power supply, perform this task in privileged mode:

	Task	Command
Step 1	Set the input wattage for the 1400 W DC power supply.	**set power dcinput**
Step 2	Verify the configuration.	**show environment power**

This example shows how to set the DC power input to 5000 W and confirm the setting:

```
Console> (enable) set power dcinput 5000
Console> (enable) show enviroment power
Total Inline Power Available: 4166.00 Watts (83.32 Amps @50V)
Total Inline Power Drawn From the System: 0 Watt
Remaining Inline Power in the System: 4166.00 Watts (83.32 Amps @50V)
Configured Default Inline Power allocation per port: 6.00 Watts (0.12 Amps @50V)
Module Total Allocated Max H/W Supported Max H/W Supported
To Module (Watts) Per Module (Watts) Per Port (Watts)
------ ----------------- ----------------- -----------------
2 0.00 830.562 15.400
3 0.00 830.562 15.400
4 0.00 830.562 15.400
5 0.00 830.562 15.400
6 0.00 830.562 15.400
DC Power supplies are configured for 5000Watts DC input
Power Budget is : 1 supply
Power Available to the System (excluding voice power): 1360 Watts (113.33 Amps @
12V)
Power Drawn from the System (excluding voice power): 485 Watts (40.42 Amps @12V)
Remaining Power (excluding voice power): 875 Watts (72.92 Amps @12V)
Console> (enable)
```

Setting the Power Budget for the Catalyst 4006 Switch

To set the power budget for the Catalyst 4006 switch, perform this task in privileged mode:

	Task	Command
Step 1	Set the power budget for the Catalyst 4006 switch.	**set power budget** {**1** | **2**}
Step 2	Verify the power budget and the current power usage for the switch.	**show environment power**

This example shows how to set the power budget to 1 (1+1 redundancy mode) and display the power budget and current power usage for the switch:

```
Console> (enable) set power budget 1
Warning:
Your power supply budget will be constrained to
the power available from only one power supply.
Do you want to continue? [confirm (y/n)]:y
Console> (enable) show environment power
Total Inline Power Available:0 Watt
Total Inline Power Drawn From the System:0 Watt
Remaining Inline Power in the System:0 Watt
Default Inline Power allocation per port:6.00 Watts (0.11 Amps @51V)

 Module          Inline Power Allocated(mA)
 ------          --------------------------
  1                 0
  2                 0
  3                 0

➔ Power Budget is :2 supplies
Power Available to the System (excluding voice power):750 Watts (62.06 Amps
@12V)
Power Drawn from the System (excluding voice power):265 Watts (22.01 Amps
@12V)
Remaining Power (excluding voice power):485 Watts (40.05 Amps @12V)
Console> (enable)
```

Displaying System Information

To display information on the power supplies installed in the chassis and other chassis information, perform this task:

Task	Command
Display system information.	**show system**

This example shows how to display the output for the **show system** command with mixed power supplies:

```
Switch# show system
PS1-Status PS2-Status
---------- ----------
➔ ok         err-disable

Fan-Status Temp-Alarm Sys-Status Uptime d,h:m:s Logout
---------- ---------- ---------- -------------- ---------
ok         off        ok         74,23:42:50    20 min

PS1-Type           PS2-Type
------------------ ------------------
➔ PWR-C45-2800AC    PWR-C45-1000AC

Modem   Baud  Traffic Peak Peak-Time
------- ----- ------- ---- -------------------------
disable  9600   0%      0% Fri May 31 2002, 10:24:04

Power Capacity of the Chassis: 1 supply
```

```
System Name              System Location          System Contact           CC
------------------------ ------------------------ ------------------------ ---
Switch#
```

Migrating a Supervisor Engine II from a Catalyst 4006 Switch to a Catalyst 4500 Series Switch

To migrate your supervisor engine from a Catalyst 4006 switch to a Catalyst 4503 or 4506 switch, perform this task:

	Task	Command
Step 1	Change the nondefault configuration mode to text and specify the configuration file to use at boot up.	**set config mode text bootflash:switch.cfg**
Step 2	Save the current nondefault configuration to NVRAM.	**write memory**
Step 3	Save the configuration on the Catalyst 4006 switch.	**copy config flash**
Step 4	Remove the supervisor engine from the Catalyst 4006 switch and insert it into the Catalyst 4500 series switch.	
Step 5	Clear the current configuration.	**clear config all**
Step 6	Load the saved configuration.	**configure bootflash:switch.cfg**
Step 7	If you have only one power supply in your Catalyst 4506 switch, set the power budget to 1. If you have two power supplies, set the power budget to 2.	**set power budget 1**

Configuring Inline Power

These sections show how to configure inline power for the Catalyst 4500 series switches and the Catalyst 4006 switch.

Setting the Power Mode of a Port or Group of Ports

To set the power mode of a port or group of ports, perform this task in privileged mode:

Task	Command
Set the power mode of a port or group of ports.	**set port inlinepower** *mod/port* {[**auto** | **static**] [*max-wattage*] | **off**}

Note If you configure the *max-wattage* values that are multiples of 420 on a Catalyst 4500 series switch with the **set port inlinepower** *mod/port* **static** | **auto** *max-wattage* command, the power drawn from the global allocation is possibliy slightly smaller than the power reported in the **Total PWR Allocated to Module** field of the **show environment power** command. This discrepancy is due to the internal conversion of units from Watts to cAmps and back to Watts. The difference between the total allocated power and the total power that is drawn from the system is no more than +/- 0.5 Watts.

This example shows how to set the power mode of a port or group of ports:

```
Console> (enable) set port inlinepower 2/5 off
Inline power for port 2/5 set to off.
```

This example shows how to set the maximum wattage allowed for ports 2/3-9 to not exceed 800 mW:

```
Console> (enable) set port inlinepower 2/3-9 800
Inline power for ports 2/3-9 set to auto and max-wattage to 800 mWatt.
Console> (enable)
```

Setting the Default Power Allocation for a Port

By default, the switch allocates 7 W to a port when it discovers a powered device on the port. This number automatically adjusts downward to the amount the powered device actually requires when the switch receives a CDP packet from the powered device. Normally, this automatic method works very well, and no further configuration is required. However, if CDP is disabled, or if you are attempting to power up the maximum number of powered devices supported by your configuration (setting this may allow you to get one last powered device powered up), you can set the default power allocation for each port. To set the default power allocation for a port, perform this task in privileged mode:

Task	Command
Set the default power allocation for each port.	**set inlinepower defaultallocation** *value*

This example shows how to set the default power allocation for a port:

```
Console> (enable) set inlinepower defaultallocation 9500
Default inline power allocation set to 9500 mWatt per applicable port.
Console> (enable)
```

Displaying the Power Status for Modules and Individual Ports

To display the power status for modules and individual ports, perform this task in normal mode:

Task	Command
Display the power status for individual ports.	**show port inlinepower** [*mod*[*/port*]]

This example shows how to display the power status for modules and individual ports:

```
Console> show port inlinepower 6/1
Configured Default Inline Power allocation per port:15.400 Watts (0.36 Amps
@42V)
Total inline power drawn by module 6: 26.46 Watts ( 0.63 Amps @42V)

Port      InlinePowered      PowerAllocated Device     IEEE class DiscoverMode
Admin  Oper   Detected mWatt mA @42V
----- ------ ------ -------- ----- -------- ---------- ---------- ------------

6/1   static on     yes      5040  120      Cisco      None       cisco

Port  Maximum Power    Actual Consumption  absentCounter  OverCurrent
      mWatt   mA @42V   mWatt   mA @42V
----- -----   -------  ------   ---------  -------------  -----------
 6/1  5200    123      5000     119          0              0
Console> (enable)
```