Environmental Monitoring and Power Management

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About Environmental Monitoring

Environmental monitoring of chassis components provides early warning indications of possible component failure. This warning helps you to ensure the safe and reliable operation of your system and avoid network interruptions.

This section describes how to monitor critical system components so that you can identify and rapidly correct hardware-related problems.

Using CLI Commands to Monitor your Environment

Enter the **show environment** [**all** | **counters** | **history** | **location** | **sensor** | **status** | **summary** | **table**] command to display system status information. Keyword descriptions are listed in the following table.

Table 1: Keyword Descriptions

Keyword	Purpose
all	Displays a detailed listing of all the environmental monitor parameters (for example, the power supplies, temperature readings, voltage readings, and so on). This is the default.
counters	Displays operational counters.
history	Displays the sensor state change history.
location	Displays sensors by location.
sensor	Displays the sensor summary.

Keyword	Purpose
status	Displays field-replaceable unit (FRU) operational status and power and power supply fan sensor information.
summary	Displays the summary of all the environment monitoring sensors.
table	Displays a sensor state table.

Displaying Environment Conditions

Supervisor modules and their associated line cards support multiple temperature sensors per card. The environment condition output includes the temperature reading from each sensor and the temperature thresholds for each sensor. These line cards support three thresholds: warning, critical, and shutdown.

The following example illustrates how to display the environment condition on a supervisor module. The thresholds appear within parentheses.

```
Device# show environment

Number of Critical alarms:  0
Number of Major alarms:     0
Number of Minor alarms:     0

 Slot        Sensor          Current State   Reading
Threshold(Minor,Major,Critical,Shutdown)
 ----------  --------------  --------------- ------------
-------------------------------------
 R0          Temp: InltFrnt  Normal          27   Celsius (45 ,50 ,55 ,60 )(Celsius)
 R0          Temp: InltRear  Normal          28   Celsius (45 ,50 ,55 ,60 )(Celsius)
 R0          Temp: OtltFrnt  Normal          35   Celsius (75 ,80 ,85 ,90 )(Celsius)
 R0          Temp: OtltRear  Normal          43   Celsius (75 ,80 ,85 ,90 )(Celsius)
 R0          Temp: UADP_0_0  Normal          54   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_1  Normal          53   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_2  Normal          53   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_3  Normal          55   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_4  Normal          54   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_5  Normal          55   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_6  Normal          64   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_7  Normal          59   Celsius (105,110,120,124)(Celsius)
 R0          Temp: UADP_0_8  Normal          55   Celsius (105,110,120,124)(Celsius)
 <output truncated>
```

The following example illustrates how to display the LED status on a supervisor module.

```
Device# show hardware led

SWITCH: 1
SYSTEM: GREEN

Line Card : 1
PORT STATUS: (48) Fo1/0/1:BLACK Fo1/0/2:BLACK Fo1/0/3:BLACK Fo1/0/4:BLACK Fo1/0/5:BLACK
Fo1/0/6:BLACK Fo1/0/7:BLACK Fo1/0/8:BLACK Fo1/0/9:BLACK Fo1/0/10:BLACK Fo1/0/11:BLACK
Fo1/0/12:BLACK Fo1/0/13:BLACK Fo1/0/14:BLACK Fo1/0/15:BLACK Fo1/0/16:BLACK Fo1/0/17:BLACK
Fo1/0/18:BLACK Fo1/0/19:BLACK Fo1/0/20:BLACK Fo1/0/21:GREEN Fo1/0/22:BLACK Fo1/0/23:BLACK
Fo1/0/24:BLACK Hu1/0/25:GREEN Hu1/0/26:BLACK Hu1/0/27:BLACK Hu1/0/28:BLACK Hu1/0/29:BLACK
Hu1/0/30:BLACK Hu1/0/31:BLACK Hu1/0/32:BLACK Hu1/0/33:BLACK Hu1/0/34:BLACK Hu1/0/35:BLACK
Hu1/0/36:BLACK Hu1/0/37:BLACK Hu1/0/38:BLACK Hu1/0/39:BLACK Hu1/0/40:BLACK Hu1/0/41:BLACK
```

```
Hu1/0/42:BLACK Hu1/0/43:BLACK Hu1/0/44:BLACK Hu1/0/45:BLACK Hu1/0/46:BLACK Hu1/0/47:BLACK
Hu1/0/48:BLACK
BEACON: BLACK
STATUS: GREEN

Line Card : 2
PORT STATUS: (48) Fo2/0/1:BLACK Fo2/0/2:GREEN Fo2/0/3:GREEN Fo2/0/4:GREEN Fo2/0/5:GREEN
Fo2/0/6:GREEN Fo2/0/7:GREEN Fo2/0/8:GREEN Fo2/0/9:GREEN Fo2/0/10:GREEN Fo2/0/11:GREEN
Fo2/0/12:GREEN Fo2/0/13:GREEN Fo2/0/14:GREEN Fo2/0/15:GREEN Fo2/0/16:GREEN Fo2/0/17:GREEN
Fo2/0/18:GREEN Fo2/0/19:GREEN Fo2/0/20:GREEN Fo2/0/21:GREEN Fo2/0/22:GREEN Fo2/0/23:GREEN
Fo2/0/24:BLACK Hu2/0/25:BLACK Hu2/0/26:BLACK Hu2/0/27:BLACK Hu2/0/28:BLACK Hu2/0/29:BLACK
Hu2/0/30:BLACK Hu2/0/31:BLACK Hu2/0/32:BLACK Hu2/0/33:BLACK Hu2/0/34:BLACK Hu2/0/35:BLACK
Hu2/0/36:BLACK Hu2/0/37:BLACK Hu2/0/38:BLACK Hu2/0/39:BLACK Hu2/0/40:BLACK Hu2/0/41:BLACK
Hu2/0/42:BLACK Hu2/0/43:BLACK Hu2/0/44:BLACK Hu2/0/45:BLACK Hu2/0/46:BLACK Hu2/0/47:BLACK
Hu2/0/48:BLACK
BEACON: BLACK
STATUS: GREEN

MODULE: slot 3
SUPERVISOR: ACTIVE
PORT STATUS: (0)
BEACON: BLACK
STATUS: GREEN
SYSTEM: GREEN
ACTIVE: GREEN

MODULE: slot 4
SUPERVISOR: STANDBY
PORT STATUS: (0)
BEACON: BLACK
STATUS: GREEN
SYSTEM: GREEN
ACTIVE: AMBER

Line Card : 5
PORT STATUS: (48) Twe5/0/1:BLACK Twe5/0/2:GREEN Twe5/0/3:GREEN Twe5/0/4:GREEN Twe5/0/5:GREEN
 Twe5/0/6:GREEN Twe5/0/7:GREEN Twe5/0/8:GREEN Twe5/0/9:GREEN Twe5/0/10:GREEN Twe5/0/11:GREEN
 Twe5/0/12:GREEN Twe5/0/13:GREEN Twe5/0/14:GREEN Twe5/0/15:GREEN Twe5/0/16:GREEN
Twe5/0/17:GREEN Twe5/0/18:GREEN Twe5/0/19:GREEN Twe5/0/20:GREEN Twe5/0/21:GREEN
Twe5/0/22:GREEN Twe5/0/23:GREEN Twe5/0/24:GREEN Twe5/0/25:GREEN Twe5/0/26:GREEN
Twe5/0/27:GREEN Twe5/0/28:GREEN Twe5/0/29:GREEN Twe5/0/30:GREEN Twe5/0/31:GREEN
Twe5/0/32:GREEN Twe5/0/33:GREEN Twe5/0/34:GREEN Twe5/0/35:GREEN Twe5/0/36:GREEN
Twe5/0/37:GREEN Twe5/0/38:GREEN Twe5/0/39:GREEN Twe5/0/40:GREEN Twe5/0/41:GREEN
Twe5/0/42:GREEN Twe5/0/43:GREEN Twe5/0/44:GREEN Twe5/0/45:GREEN Twe5/0/46:GREEN
Twe5/0/47:BLACK Twe5/0/48:BLACK
BEACON: BLACK
STATUS: GREEN

Line Card : 6
PORT STATUS: (48) Twe6/0/1:BLACK Twe6/0/2:GREEN Twe6/0/3:GREEN Twe6/0/4:GREEN Twe6/0/5:GREEN
 Twe6/0/6:GREEN Twe6/0/7:GREEN Twe6/0/8:GREEN Twe6/0/9:GREEN Twe6/0/10:GREEN Twe6/0/11:GREEN
 Twe6/0/12:GREEN Twe6/0/13:GREEN Twe6/0/14:GREEN Twe6/0/15:GREEN Twe6/0/16:GREEN
Twe6/0/17:GREEN Twe6/0/18:GREEN Twe6/0/19:GREEN Twe6/0/20:GREEN Twe6/0/21:GREEN
Twe6/0/22:GREEN Twe6/0/23:GREEN Twe6/0/24:GREEN Twe6/0/25:GREEN Twe6/0/26:GREEN
Twe6/0/27:GREEN Twe6/0/28:GREEN Twe6/0/29:GREEN Twe6/0/30:GREEN Twe6/0/31:GREEN
Twe6/0/32:GREEN Twe6/0/33:GREEN Twe6/0/34:GREEN Twe6/0/35:GREEN Twe6/0/36:BLACK
Twe6/0/37:BLACK Twe6/0/38:BLACK Twe6/0/39:BLACK Twe6/0/40:GREEN Twe6/0/41:GREEN
Twe6/0/42:GREEN Twe6/0/43:GREEN Twe6/0/44:GREEN Twe6/0/45:GREEN Twe6/0/46:BLACK
Twe6/0/47:BLACK Twe6/0/48:BLACK
BEACON: BLACK
STATUS: GREEN

RJ45 CONSOLE: GREEN
```

```
GigabitEthernet0/0 (MGMT): GREEN

TenGigabitEthernet0/1 (SFP MGMT): BLACK
FANTRAY STATUS: GREEN
FANTRAY BEACON: BLACK
```

Displaying On Board Failure Logging (OBFL) information

The OBFL feature records operating temperatures, hardware uptime, interrupts, and other important events and messages that can assist with diagnosing problems with line cards and supervisor modules installed in a switch. Data is logged to files stored in nonvolatile memory. When the onboard hardware is started up, a first record is made for each area monitored and becomes a base value for subsequent records. The OBFL feature provides a circular updating scheme for collecting continuous records and archiving older (historical) records, ensuring accurate data about the system. Data is recorded in one of two formats: continuous information that displays a snapshot of measurements and samples in a continuous file, and summary information that provides details about the data being collected. The data is displayed using the **show logging onboard** command. The message "No historical data to display" is seen when historical data is not available.

```
Device# show logging onboard RP active voltage detail

--------------------------------------------------------------------------------
VOLTAGE SUMMARY INFORMATION
--------------------------------------------------------------------------------
Number of sensors          : 33
--------------------------------------------------------------------------------
Sensor                     ID         Normal Range          Maximum Sensor Value
--------------------------------------------------------------------------------
CPU_P5V                    0          0 - 5                 5
CPU_P3V3                   1          0 - 5                 3
CPU_P2V5_VPP               2          0 - 5                 2
CPU_PVCCSCFUSESUS          3          0 - 5                 1
CPU_PVCCIN                 4          0 - 5                 1
CPU_P1V5_PCH               5          0 - 5                 1
CPU_PVCCKRHV               6          0 - 5                 1
CPU_P1V2_VDDQ              7          0 - 5                 1
CPU_P1V05_COMBINED         8          0 - 5                 1
CPU_P0V6_VTT               9          0 - 5                 1
BB_P1V0_BCM82752           10         0 - 5                 3
BB_P3V3_A                  11         0 - 5                 12
BB_P12V0                   12         0 - 12                12
BB_P7V0                    13         0 - 7                 7
BB_P5V0                    14         0 - 5                 5
BB_P1V5                    15         0 - 5                 3
BB_P3V3                    16         0 - 5                 3
BB_P2V5                    17         0 - 5                 2
BB_P1V8                    18         0 - 5                 1
BB_P0V9_DP0_PLL            19         0 - 5                 0
BB_P0V9_DP1_PLL            20         0 - 5                 0
BB_P0V9_DP2_PLL            21         0 - 5                 0
BB_P0V8_DP0_VDD            22         0 - 5                 0
BB_P0V8_DP1_VDD            23         0 - 5                 0
BB_P0V8_DP2_VDD            24         0 - 5                 0
BB_P0V9_DP0_AVDD           25         0 - 5                 0
BB_P0V9_DP1_AVDD           26         0 - 5                 0
BB_P0V9_DP2_AVDD           27         0 - 5                 1
BB_P1V1_HATH               28         0 - 5                 1
BB_P1V1_DP0_AVDDH          29         0 - 5                 1
BB_P1V2_HATH               30         0 - 5                 3
BB_3V3_IRC                 31         0 - 5                 3
```

```
BB_P3V3_EUSB              32         0 - 5                0

-------------------------------------------------------------------------------
Sensor Value
Total Time of each Sensor
-------------------------------------------------------------------------------

value: 0
0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 94d, 577h, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 112d, 112d,
 112d, 112d, 112d, 112d, 112d, 112d, 50d, 0s, 0s, 0s, 0s, 112d,
value: 1
0s, 0s, 0s, 112d, 112d, 112d, 112d, 112d, 50d, 426h, 645h, 0s, 0s, 0s, 61d, 50d, 0s, 61d,
50d, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 112d, 112d, 50d, 0s, 0s,
value: 2
0s, 0s, 112d, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 50d, 0s, 0s, 0s, 0s,
 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s,
value: 3
0s, 112d, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 50d, 0s, 0s, 0s, 61d, 50d, 0s, 0s, 0s, 0s,
0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 61d, 112d, 0s,
value: 4
900h, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 160d, 43d, 0s, 0s, 0s, 0s, 0s, 0s,
0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s, 0s,
value: 5
<output truncated>
```

Emergency Actions

The chassis can power down a single card, providing a detailed response to over-temperature conditions on line cards. However, the chassis cannot safely operate when the temperature of the supervisor module itself exceeds the critical threshold. The supervisor module turns off the chassis' power supplies to protect itself from overheating. When this happens, you can recover the switch only by cycling the power on and off switches on the power supplies or by cycling the AC or DC inputs to the power supplies.

Shutdown temperature emergencies on a supervisor will trigger chassis shutdown. Shutdown temperature emergencies on a linecard will shut down the linecard but not the chassis. Critical temperature emergencies will trigger a warning message and the fan will be at its highest speed, but the chassis will not shut down. This applies to all slots.

The following table lists temperature emergencies but does not distinguish between critical and shutdown emergencies.

Table 2: Emergency and Action

Case 1. Complete fan failure emergency.	SYSLOG message displays and the chassis shuts down.
Case 2. Temperature emergency on a line card.	Power down the line card.
Case 3. Temperature emergency on a power supply. When the shutdown alarm threshold is exceeded, all the power supplies will shut down.	Power cycle the device to recover from power supply shut down.
Case 4. Temperature emergency on the active supervisor module.	Power down the chassis.

System Alarms

Any system has two types of alarms: major and minor. A major alarm indicates a critical problem that could lead to system shutdown. A minor alarm is informational—it alerts you to a problem that could become critical if corrective action is not taken.

The following table lists the possible environment alarms.

Table 3: Possible Environmental Alarms

A temperature sensor over its warning threshold	minor
A temperature sensor over its critical threshold	major
A temperature sensor over its shutdown threshold	major
A partial fan failure	minor
A complete fan failure **Note** A complete fan failure alarm does not result in system shutdown.	major

Fan failure alarms are issued as soon as the fan failure condition is detected and are canceled when the fan failure condition clears. Temperature alarms are issued as soon as the temperature reaches the threshold temperature. An LED on the supervisor module indicates whether an alarm has been issued.

When the system issues a major alarm, it starts a timer whose duration depends on the alarm. If the alarm is not canceled before the timer expires, the system takes emergency action to protect itself from the effects of overheating. The timer values and the emergency actions depend on the type of supervisor module.

Note Refer to the *Hardware Installation Guide* for information on LEDs, including the startup behavior of the supervisor module system LED.

Table 4: Alarms on Supervisor Module

Event	Alarm Type	Supervisor LED Color	Description and Action
Card temperature exceeds the critical threshold.	Major	Red	Syslog message displays when the alarm is issued.
Card temperature exceeds the shutdown threshold.	Major	Red	Syslog message displays when the alarm is issued.
Chassis temperature exceeds the warning threshold.	Minor	Orange	Syslog message displays when the alarm is issued.
Chassis fan tray experiences partial failure.	Minor	Orange	Syslog message displays when the alarm is issued.

Event	Alarm Type	Supervisor LED Color	Description and Action
Chassis fan tray experiences complete failure.	Major	Red	Syslog message displays when the alarm is issued.

Power Management

This section describes the power management feature in the Cisco Catalyst 9600 Series Switchesand the aspects of power management that you can control and configure. For information about the hardware, including installation, removal and power supply specifications, see the *Cisco Catalyst 9600 Series Switches Hardware Installation Guide*.

Restrictions for Power Management

- When using an AC power source for the power supply modules, you cannot mix 110V and 220V inputs.
- When using a combination of AC and DC power sources for the power supply modules, the input voltage for all the power supply modules needs to be the same. The input voltage can either be 110V or 220V for all the power supply modules. This applies to both the combined mode and n+1 redundant power supply mode.

Power Supply Modes

Cisco Catalyst 9600 Series Switches offer combined and redundant configuration modes for power supplies.

Combined Mode

This is the default power supply mode.

The system operates on one to four power supplies. All available power supplies are active and sharing power and can operate at up to 100 percent capacity.

Available power in the combined mode is the sum of the individual power supplies.

Redundant Mode

In a redundant configuration, a given power supply module can be either active, or in standby mode, and switch to active when required.

You can configure an n+1 redundant mode.

- n+1 redundant Mode—n number of power supply modules are active (n can be one to seven power supply modules). +1 is the power supply module reserved for redundancy.

  The default power supply slot is PS4.

  Specify a standby slot, by entering the **power redundancy-mode redundant n+1** *standby-PSslot* command.

Enter the **show power detail** command in priviledged EXEC mode, to display detailed information about the currently configured power supply mode.

Operating States

The operating state refers to the system's capacity to respond to a situation where all active power supply modules fail. The system deems the chassis operating state as full protected, normal protected, or combined depending on these factors:

- Total active output power, which is the total output power that is available from all the active power supply modules in the chassis.
- Required budgeted power, which is the power the system requires only for the supervisor modules, switching modules (line cards), and fan tray to operate in the chassis.

  In the **show** command outputs (**show power**, **show power detail**), this is displayed as `System Power`.
- Total standby output power, which is the total output power that is available from all the power supply modules in the chassis that are configured as standby.

Whether in the n+1, the system considers the chassis in a full protected state, when ALL of these conditions are met:

- Total active output power is greater than the required budgeted power
- Total standby output power is greater than or equal to total active output power

Whether in the n+1, the system considers the chassis in a normal protected state, when ALL of these conditions are met:

- Total active output power is greater than the required budgeted power
- Total standby output power is lesser than the total active output power

The system operates in a combined state, when it encounters these conditions (any redundancy configuration is rejected):

- Total active output power is lesser than the required budgeted power
- A standby power supply module is not configured or installed.

Information about the operating state is also displayed in the **show power** and **show power detail** command output.

Power Management Considerations

It is possible to configure a switch that requires more power than the power supplies provide.

The following list the conditions where the power requirements for the installed modules exceed the power provided by the power supplies.

- If the switch has a single power supply module that is unable to meet power requirements, the following error message is displayed:

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

  The **show power** command output will also indicate this state of insufficient input power.

- If the switch has more than one power supply module, and requirements for the installed modules still exceed the power provided by the power supplies, the following error message is displayed:

  ```
  Insufficient number of power supplies (2) are installed for power redundancy mode
  ```

  The **show power** command output will also indicate this state of insufficient input power.

If you attempt to insert additional modules into your switch and exceed the power supply, the switch immediately places the newly inserted module into reset mode, and the following error message is displayed:

```
Power doesn't meet minimum system power requirement.
```

Additionally, if you power down a functioning chassis and insert an additional linecard or change the module configuration so that the power requirements exceed the available power, one or more linecards enter reset mode when you power on the switch again.

Selecting a Power Supply 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 Cisco power calculator on cisco.com to help determine the number of power supplies that is required for either combined or redundant mode.

Configuring the Redundant Mode

By default, the power supplies in the switch are set to operate in combined mode. To effectively use redundant mode, note the following:

- If you have the power supply mode set to redundant mode and only one power supply installed, your switch accepts the configuration but operates without redundancy.
- Choose a power supply module that is powerful enough to support the switch configuration.
- Use the Cisco Power Calculator to help assess the number of power supplies required by the system. Ensure that you install a sufficient number of power supply modules, so that the chassis and PoE requirements are less than the maximum available power. Power supplies automatically adjust the power resources at startup to accommodate the chassis and PoE requirements. Modules are brought up first, followed by IP phones.
- For optimal use of system power, choose power supply modules of the same capacity when configuring a redundant mode on the switch.

To configure redundant mode, perform this task:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.
Step 2	**power redundancy-mode redundant** [**n+1** *standby-PSslot* | **n+1** *standby-PSslot*]	**power redundancy-mode redundant n+1** *standby-PSslot*—Configures the n+1 redundant

	Command or Action	Purpose
	Example: `Device(config)# power redundancy-mode redundant n+1 4`	mode. Enter the standby power supply module slot number. In the n+1 example here, the power supply module in slot PS4 is the designated standby module and has been configured accordingly. Operational power supply modules installed in all other slots, are active. If you are using power supply modules of different capacities, you must configure the power supply module with the highest wattage or capacity as the standby for the n+1 redundant mode.
Step 3	**end** **Example:** `Device(config)# end`	Exits global configuration mode.
Step 4	**show power** **Example:** `Device# show power`	Displays the power redundancy mode information.

Configuring the Combined Mode

To use the combined mode effectively, follow these guidelines:

- If you have the power supply mode set to combined mode and only one power supply installed, your switch accepts the configuration, but power is available from only one power supply.
- When your switch is configured to combined mode, available power is the sum of the individual power supplies

To configure combined mode on your switch, perform this task:

Before you begin

Note that this mode utilizes the available power from all the power supplies; however, your switch has no power redundancy.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	**power redundancy-mode combined** **Example:** `Device(config)# power redundancy-mode combined`	Sets the power supply mode to combined mode.
Step 3	**end** **Example:** `Device(config)# end`	Exits global configuration mode.
Step 4	**show power** **Example:** `Device# show power`	Displays the power redundancy mode information.

Power Budgeting for Supervisor Modules

The power budget, or required budgeted power, is the power the system ***requires*** and ***reserves*** for supervisor modules, switching modules (line cards), and the fan tray to operate in the chassis. In the **show power**, and **show power detail** command outputs, this is displayed as `System Power`. The system does not allow any part of this required budgeted power to be automatically redirected for use by other components in the system.

This section describes how power budgeting works with respect to supervisor modules and the configuration options that are available.

By default, the system reserves power for a redundant setup, to ensure high availability. This means that the system reserves the power required by both the supervisor modules in the chassis, as part of the required budgeted power (`System Power`).

You can also configure the system to reserve power for a single supervisor. This configuration option is suited to situations where a single supervisor is installed and the total available power is not sufficent to enable all line cards and PoE ports. In such a scenario, configuring the switch to reserve power for a single supervisor enables you to free-up power and use it for other components, such as PoE ports, or line cards instead.

Note the following restrictions and guidelines:

- If you have installed both supervisor modules, you cannot configure the power budget mode for a single supervisor. The system rejects the configuration and following message is displayed: `cannot enable single sup mode when remote supervisor is present.`
- If you have installed both supervisor modules and the default setting is effective, you must install the necessary number of power supply modules to meet overall system requirements (including line cards and fan tray). Do not remove the second supervisor to remedy a situation where there is an insufficient number of power supply modules.
- If you have installed a single supervisor module and configured the power budget mode for a single supervisor, and you install a second supervisor:
  - The system will reject the configuration, and allow the first supervisor to come up.
  - If this action is accompanied by a low power condition where the system does not have sufficient power, linecards maybe denied power.

For information about how to safely move from a single to a dual supervisor setup, see task *Moving from a Single to a Dual Supervisor Setup* below.

The following tasks describe the available configuration options:

Configuring the Power Budget Mode for a Single Supervisor

Beginning in the privileged EXEC mode, perform these steps to configure the power budget mode for a single supervisor setup:

Before you begin

Ensure that these prerequisites are met:

- You have installed only one supervisor module in the chassis.
- You have installed a blank in the second supervisor slot.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.
Step 2	**power budget mode** {**single-sup**} **Example:** `Device(config)# power budget mode single-sup`	Reserves power for one supervisor module in the chassis.
Step 3	**end** **Example:** `Device(config)# end`	Exits the global configuration mode.

Moving from a Single to a Dual Supervisor Setup

Beginning in the privileged EXEC mode, perform these steps to move from single to a dual supervisor setup:

Before you begin

Calculate the required power for a dual supervisor setup. Cisco Power Calculator (CPC) enables you to calculate the power supply requirements for a specified configuration:

1. Go to https://cpc.cloudapps.cisco.com/cpc → **Launch Cisco Power Calculator**.
2. Select applicable values for the `Product Family`, `Chassis`, `Supervisor Engine` (both supervisor slots), `Input Voltage`, and `Line Card` fields. Click **Next** to display results.

3. In the results that are displayed, locate the `Configuration Details` section and note the `Output Power` for the supervisor module. This is the amount of spare power that must be available in the system to safely install the second supervisor.
4. Enter the **show power** command in privileged EXEC mode.

   This command displays power supply configuration information.

   In the output, check the difference between the `Total Maximum Available` and `Total Used`, this must be greater that what the CPC says in the `Output Power` column for the supervisor module. If this is the case, proceed with the task, if not, first install the required number of additional power supply modules.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.
Step 2	**no power budget mode** {**single-sup**} **Example:** `Device(config)# no power budget mode single-sup`	Reverts to the default setting where the system reserves power for both the supervisor modules in the chassis.
Step 3	**end** **Example:** `Device(config)# end`	Exits configuration mode.
Step 4	Insert the second supervisor module in the supervisor slot.	For detailed steps, see the Supervisor Module Installation Note → Removal and Replacement Procedures, on cisco.com.

Powering Down a Line Card

If your system does not have enough power for all modules installed in the switch, you can power down one or more line cards and place them in power-off mode.

To power down a line card, perform this task:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	**hw-module slot** *card slot/slot number* **shutdown unpowered** **Example:** `Device(config)# hw-module slot 1/0 shutdown unpowered`	Powers down the specified module by placing it in low power mode.
Step 3	**end** **Example:** `Device(config)# end`	Exits the global configuration mode

Configuration Examples for Operating States

The examples in this section show how to view the operating states of the system.

show power

The following is sample output of the **show power** command.

```
Device# show power
Power                                                          Fan States
Supply       Model No              Type Capacity  Status         1     2
------       --------------------  ---- --------  ------------  -----------
PS1          C9600-PWR-2KWAC       ac   2000 W    active        good good
PS2          C9600-PWR-2KWAC       ac   2000 W    active        good good
PS3          C9600-PWR-2KWAC       ac   2000 W    active        good good
PS4          C9600-PWR-2KWAC       ac   2000 W    active        good good

PS Current Configuration Mode : Combined
PS Current Operating State : none

Power supplies currently active : 4
Power supplies currently available : 4

Power Summary Maximum
(in Watts) Used Available
------------ ------ ---------
System Power 2860 7820
------------ ------ ---------
Total 2860 7820
```

show power detail

The **show power detail** command inlcudes the output of **show power** and **show power module** commmand in privileged EXEC mode.

```
Device# show power detail
Power                                                    Fan States
Supply  Model No              Type  Capacity  Status       1     2     3     4
------  --------------------  ----  --------  ------------ ------------------------

PS1     C9600-PWR-2KWAC      AC    2000 W    active       good  good  good  good
PS2     C9600-PWR-2KWAC      AC    2000 W    active       good  good  good  good
```

```
PS3     C9600-PWR-2KWAC      AC    2000 W    active        good  good  good  good
PS4     C9600-PWR-2KWAC      AC    2100 W    active        good  good  good  good

PS Current Configuration Mode : Combined
PS Current Operating State    : none

Power supplies currently active    : 4
Power supplies currently available : 4

Power Summary          Maximum
(in Watts)    Used    Available
-------------  ------  ---------
System Power   2860    7820
-------------  ------  ---------
Total          2860    7820


Power Budget Mode           : Dual Sup

                                        Power                                  Out of  In
Mod     Model No             Priority  State     Budget  Instantaneous  Peak  Reset   Reset
---     --------------------  --------  --------  ------  -------------  ----  ------  -----
1       C9600-LC-24C           0        accepted  200     0              0     200     10
2       C9600-LC-48YL          1        accepted  230     0              0     230     10
3       C9600-SUP-1            0        accepted  775     0              0     775     202
4       C9600-SUP-1            0        accepted  775     0              0     775     202
5       C9600-LC-48YL          2        accepted  230     0              0     230     10
6       C9600-LC-24C           3        accepted  200     0              0     200     10
FM1     C9606-FAN                       accepted  450     --             --    450     --
---  --------------------  --------  --------  ------  -------------  ----  ------  -----
Total allocated power: 2860
Total required power: 2860
```

Feature History for Environmental Monitoring and Power Management

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Gibraltar 16.11.1	Environmental Monitoring and Power Management	Environmental monitoring of chassis components provides early warning indications of possible component failure. This warning helps you to ensure the safe and reliable operation of your system and avoid network interruptions.
Cisco IOS XE Cupertino 17.7.1	Environmental Monitoring and Power Management	Support for this feature was introduced on the Cisco Catalyst 9600 Series Supervisor 2 Module (C9600X-SUP-2.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.