



## CHAPTER 9

# Configuring Catalyst 3750-X StackPower

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The Catalyst 3750-X and 3560-X switches have two power supplies per system, allowing the power load to be split between them. This accommodates the increased maximum power of 30 watts per port provided to a powered device to meet the PoE+ standard (802.3at). With PoE+, a 48-port system would need 1440 Watts to provide 30 Watts per powered device for the PoE ports. Systems with fewer powered devices might require only one power supply. In this case, the additional power supply can provide one-to-one redundancy for the active supply.

In addition, the Catalyst 3750-X stackable switch supports Cisco StackPower, which allows the power supplies to share the load across multiple systems in a stack. By connecting the switches with power stack cables, you can manage the power supplies of up to four stack members as a one large power supply that provides power to all switches and to the powered devices connected to switch ports. Since power supplies are most effective when running at 30 to 90% of their maximum load, taking some of the power supplies offline provides maximum power efficiency. Switches in a power stack must be members of the same switch (data) stack.

The Cisco eXpandable Power System (XPS) 2200 is a standalone power system that you can connect to Catalyst 3560-X and Catalyst 3750-X switches that are running Cisco IOS Release 12.2(55)SE1 and later. The XPS 2200 can provide backup power to connected devices that experience a power supply failure or, in a Catalyst 3750-X power stack, it can supply additional power to the power stack budget. For more information about the XPS 2000, see the configuration notes on Cisco.com: [http://www.cisco.com/en/US/docs/switches/power\\_supplies/xps2200/software/configuration/note/ol24241.html](http://www.cisco.com/en/US/docs/switches/power_supplies/xps2200/software/configuration/note/ol24241.html)

The XPS 2200 power ports and internal power supplies can operate in redundant power supply (RPS) mode or stack power (SP) mode. Stack-power mode is used only on Catalyst 3750-X switches in a power stack. With no XPS, a power stack operates in ring topology with a maximum of four switches in the stack. If you merge two stacks, the total number of switches cannot exceed four. When an XPS is in the power stack, you can connect up to nine switches in the stack plus the XPS, providing power budgets to power stack members similar to stack-power ring topology operation.

All Catalyst 3750-X switches connected to an XPS on SP ports are part of the same power stack, and all power from the XPS and the switches is shared across all switches in the stack. Power sharing is the default mode, but the XPS supports the same stack power modes that are supported in a ring topology (strict and nonstrict power-sharing or redundant modes).

See the hardware installation guide for information on designing and connecting the power stack. For more information about PoE ports, see the “[Power over Ethernet Ports](#)” section on page 15-7 in the chapter on *Configuring Interfaces*. For more information about the commands in this chapter, see the command reference for this release.

This chapter includes these sections:

- [Understanding Cisco StackPower, page 9-2](#)

- [Configuring Cisco StackPower, page 9-6](#)

## Understanding Cisco StackPower

Some reasons for connecting individual switches in a power stack are:

- In case of power supply failure, if there is enough spare power budget in the rest of the power stack, switches can continue to function.
- You can replace a defective power supply without having to shut down all powered devices in the systems.
- System operation can become more green by maximizing power supply efficiency and working with the most efficient load (30 to 90% of their maximum load).

Cisco StackPower uses these terms:

- *Available power* is the total power available for PoE from all power supplies in the power stack. To see the available power in a stack, enter the **show power inline** privileged EXEC command.
- *Budgeted power* is the power allocated to all powered devices connected to PoE ports in the stack. Budgeted power is referred to as *Used (Watts)* in the output of the **show power inline** command.
- *Consumed power* is the actual power consumed by the powered devices. Consumed power is typically less than the budgeted power. To see the consumed power in a stack, enter the **show power inline police** privileged EXEC command.

These sections describe Cisco StackPower:

- [StackPower Modes, page 9-2](#)
- [Power Priority, page 9-3](#)
- [Load Shedding, page 9-4](#)

## StackPower Modes

A power stack can run in one of two modes, configured by using the command-line interface:

- In power-sharing mode (the default), all input power is available to be used for power loads. The total available power in all switches in the power stack (up to four) is treated as a single large power supply, with power available to all switches and to all powered devices connected to PoE ports. In this mode, the total available power is used for power budgeting decisions and no power is reserved to accommodate power-supply failures. If a power supply fails, powered devices and switches could be shut down (load shedding).
- In redundant mode, the power from the largest power supply in the system is subtracted from the power budget, which reduces the total available power, but provides backup power in case of a power-supply failure. Although there is less available power in the pool for switches and powered devices to draw from, the possibility of having to shut down switches or powered devices in case of a power failure or extreme power load is reduced.

In addition, you can configure the mode to run a strict power budget or a non-strict (relaxed) power budget. In both modes, power is denied when there is no more power available in the power budget.

- In strict mode, when a power supply fails and the available power drops below the budgeted power, the system balances the budget through load shedding of powered devices, even if the actual power being consumed is less than the available power.

- In non-strict mode, the power stack is allowed to run in an over-allocated state and is stable as long as the actual power does not exceed the available power. In this mode, a powered device drawing more than normal power could cause the power stack to start shedding loads. This is normally not a problem because most devices do not run at full power and the chances of multiple powered devices in the stack requiring maximum power at the same time is small.

You configure power modes at a power-stack level (that is, the mode is the same for all switches in the power stack). To configure power-stack parameters, enter the `stack-power stack` global configuration command followed by the name of the power stack to enter stack-power configuration mode.

You can also configure a switch connected in a power stack to not participate in the power stack by setting the switch to standalone power mode. This mode shuts down both stack power ports. This is a switch parameter and is configurable by entering the `stack-power switch` global configuration command followed by a switch number to enter switch stack power configuration mode.

## Power Priority

You can configure the priority of a switch or powered device to receive power. This priority determines the order in which devices are shut down in case of a power shortage. You can configure three priorities per system: the system (or switch) priority, the priority of the high-priority PoE ports on a switch, and the priority of the low-priority PoE ports on a switch.

You set port priority at the interface level for powered devices connected to a PoE port by entering the `power inline port priority {high | low}` interface configuration command. By default, all ports are low priority. This command is visible *only* on PoE ports.



### Note

Although the `power inline port priority {high | low}` command is visible on the Catalyst 3560-X switch PoE ports, it has no effect because Catalyst 3560-X switches do not participate in StackPower.

You configure the priority values of each switch in the power stack and of all high and low priority ports on that switch by using the `power priority` commands in power-stack configuration mode. These commands set the order in which switches and ports are shut down when power is lost and load shedding must occur. Priority values are from 1 to 27; switches and ports with highest values are shut down first.



### Note

The 27 priorities are used to accommodate power stacks connected in a star configuration with the expandable power supply. In that case there would be nine members (switches) per system with three priorities per switch. See the hardware installation guide for more information on stack power star and ring configuration.

On any switch, the switch priority must be lower than port priorities, and the high priority value must be set lower than the low priority value. We recommend that you configure different priority values for each switch and for its high priority ports and low priority ports. This limits the number of devices shut down at one time during a loss of power. If you try to configure the same priority value on different switches in a power stack, the configuration is allowed, but you receive a warning message.

The default priority ranges, if none are configured, are 1-9 for switches, 10-18 for high-priority ports, and 19-27 for low-priority ports.

## Load Shedding

Load shedding is the process of shutting down devices in case of power supply, cable, or system failures. In general, Cisco StackPower supports only single faults; for example, a single power supply failing, a single cable breaking, or a single system halting operation.

For power stacks in power-sharing mode, there are two types of load-shedding: immediate and graceful.

- Immediate load shed occurs when a failure could cause the power stack to fail very quickly. For example, if the largest power supply in the power stack fails, this could cause the stack to immediately start shutting down powered devices.
- Graceful load-shedding can occur when a smaller power supply fails. Switches and powered devices are shut down in order of their configured priority, starting with devices with priority 27, until the power budget matches the input power.

Graceful load shedding is always enabled and immediate load shedding occurs only when necessary, so both can occur at the same time.



### Note

Load shedding does not occur in redundant mode unless two or more power supplies fail, because the largest power supply is used as a backup power source.

Notes on load shedding:

- The method (immediate or graceful) is not user-configurable, but is based on the power budget.
- Immediate load shedding also occurs in the order of configured priority, but occurs very quickly to prevent hardware damage caused by loss of power.
- If a switch is shut down because of load shedding, the output of the **show stack-power** privileged EXEC command still includes the MAC address of the shut down switch as a neighbor switch, even though the switch is down. This command output shows the StackPower topology, even if there is not enough power to power up a switch.

## Immediate Load Shedding Example

For power stacks in power-sharing mode, if a large power supply in the power stack fails, the stack immediately starts shutting down powered devices until the power budget matches the input power. Cisco StackPower can support multiple power supply failures if the total amount of power lost is less than or equal to one-half the total input power. For example, in a power stack with four 1100 W power supplies, the power stack can lose two 1100 W power supplies and continue to operate. In addition, Cisco StackPower can support a loss of more than one-half of the total input power when the power supply failures are more than five minutes apart.

This example has a power stack of four switches (*Powerstack1*) in power sharing mode and shows which devices would be shut down in the immediate load shedding process caused by loss of either of two power supplies.

The output of the **show env all** command shows that power supplies included in power sharing are a 715 W power supply in switch 1, and one 350 W and one 1100 W power supply in switch 4. Other power supplies are inactive (disabled or not present).

```
Switch# show env all
FAN 1 is OK
FAN 2 is OK
FAN PS-1 is OK
FAN PS-2 is OK
TEMPERATURE is OK
Temperature Value: 30 Degree Celsius
```

```

Temperature State: GREEN
Yellow Threshold : 49 Degree Celsius
Red Threshold    : 59 Degree Celsius
SW  PID                Serial#      Status      Sys Pwr  PoE Pwr  Watts
--  -
1A  NG3K-PWR-715WAC    LIT133705FH  OK          Good     Good     715/0
1B  C3KX-PWR-715WAC    DTN1341K018  Disabled   Good     Good     715/0
2A  Not Present
2B  C3KX-PWR-325WAC    LIT13330FNM  Disabled   Good     Good     325/0
3A  C3KX-PWR-325WAC    LIT13330FN3  Disabled   Good     Good     325/0
3B  Not Present
4A  C3KX-PWR-350WAC    DTN1342L00T  OK          Good     Good     350/0
4B  NG3K-PWR-110WAC    LIT13370577  OK          Good     Good     1100/0

```

<output truncated>

The output of the **show stack-power** privileged EXEC command shows the priorities of the powered devices and switches in the power stack.

```

Switch# show stack-power
Power stack name: Powerstack1
Stack mode: Power sharing
Switch 1:
Power budget: 206
Low port priority value: 17
High port priority value: 16
Switch priority value: 2
Port A status: Not shut
Port B status: Not shut
Neighbor on port A: 0022.bdcf.ab00
Neighbor on port B: 0022.bdd0.4380

Switch 2:
Power budget: 206
Low port priority value: 12
High port priority value: 11
Switch priority value: 1
Port A status: Not shut
Port B status: Not shut
Neighbor on port A: 0022.bdd0.6d00
Neighbor on port B: 0022.bdcf.af80

Switch 3:
Power budget: 656
Low port priority value: 22
High port priority value: 21
Switch priority value: 3
Port A status: Not shut
Port B status: Not shut
Neighbor on port A: 0022.bdcf.af80
Neighbor on port B: 0022.bdd0.6d00

Switch 4:
Power budget: 682
Low port priority value: 27
High port priority value: 26
Switch priority value: 4
Port A status: Not shut
Port B status: Not shut
Neighbor on port A: 0022.bdd0.4380
Neighbor on port B: 0022.bdcf.ab00

```

If the 715 W or 1100 W power supply fails, devices (powered devices connected to PoE ports and the switches themselves) would be shut down in the this order until power consumption drops below 105% of the rated power of the remaining power supplies:

- Devices connected to Switch 4 low priority ports (priority 27)
- Devices connected to Switch 4 high priority ports (priority 26)
- Devices connected to Switch 3 low priority ports (priority 22)
- Devices connected to Switch 3 high priority ports (priority 21)
- Devices connected to Switch 1 low priority ports (priority 17)
- Devices connected to Switch 1 high priority ports (priority 16)
- Devices connected to Switch 2 low priority ports (priority 12)
- Devices connected to Switch 2 high priority ports (priority 11)
- Switch 4 (priority 4)
- Switch 3 (priority 3)
- Switch 1 (priority 2)

Switch 2 would never have to be shut down because all power would have been lost by the time priority 1 devices were reached.

The output from the **show stack-power load-shedding order** command shows the order in which devices would shut down in the event of load-shedding:

```
Switch# show stack-power load-shedding order powerstack-1
Power Stack          Stack   Stack   Total   Rsvd   Alloc   Unused   Num   Num
Name                 Mode    Topolgy Pwr (W) Pwr (W) Pwr (W) Pwr (W)  SW   PS
-----
Powerstack-1         SP-PS   Ring    2880    34     473     2373    2    4

Priority   Load   Switch or PoE
Shed Order Type   Devices Shed
-----
22        Lo     Gi2/0/16,
21        Lo     Gi1/0/13, Gi1/0/20,
12        Hi     Gi1/0/7,
4         Sw     Switch: 2
3         Sw     Switch: 1
```

## Configuring Cisco StackPower

Configuring Cisco StackPower includes these tasks:

- Identifying a stack ID and setting the power stack mode for the power stack to power sharing or redundant with a strict or non-strict (loose) adherence to the power budget. See the [“Configuring Power Stack Parameters”](#) section on page 9-7.
- Configuring switches in the power stack with the power stack ID and setting the priority on PoE ports to high or low. See the [“Configuring Power Stack Switch Power Parameters”](#) section on page 9-8.
- Setting priority values for switches in the power stack and for the high and low priority ports on the switch to determine load-shedding order. See the [“Configuring PoE Port Priority”](#) section on page 9-9.

For information about configuring the XPS 2000, see the configuration notes on Cisco.com:  
[http://www.cisco.com/en/US/docs/switches/power\\_supplies/xps2200/software/configuration/note/ol24241.html](http://www.cisco.com/en/US/docs/switches/power_supplies/xps2200/software/configuration/note/ol24241.html)

**Note**

A stack power member switch that does not have a PSU connected in Slot A or Slot B might fail during a Cisco IOS upgrade.

The workaround is to ensure that each stack member has at least one PSU connected. Alternatively, you can download and install the Cisco IOS image using the **archive download-sw /force-ucode-reload** privileged EXEC command.

## Configuring Power Stack Parameters

Beginning in privileged EXEC mode, follow these steps to configure a power stack:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>stack-power stack</b> <i>power stack name</i>	Enter the stack power stack name and enter power stack configuration mode. The name can be up to 31 characters.
Step 3	<b>mode</b> { <b>power-sharing</b>   <b>redundant</b> } [ <b>strict</b> ]	Set the operating mode for the power stack: <ul style="list-style-type: none"> <li>• <b>power-sharing</b>—The input power from all switches in the power stack can be used for loads, and the total available power appears as one huge power supply. This is the default.</li> <li>• <b>redundant</b>—The largest power supply is removed from the power pool to be used as backup power in case one of the other power supplies fails. This is the recommended mode if enough power is available in the system.</li> <li>• <b>strict</b>—(<b>Optional</b>) Configures the power stack mode to run a strict power budget. The stack power needs cannot exceed the available power. The default is non-strict.</li> </ul>
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>show stack-power</b>	Verify your entries.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

This is an example of setting the stack power mode for the stack named *power1* to redundant power mode. The largest power supply in the stack is removed from the power budget and used as a backup in case of power supply failure.

```
Switch(config)# stack-power stack power1
Switch(config-stackpower)# mode redundant
Switch(config-stackpower)# exit
```

## Configuring Power Stack Switch Power Parameters

Beginning in privileged EXEC mode, follow these steps to configure a switch in a power stack:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>stack-power switch</b> <i>switch-number</i>	Enter the stack member number of the switch in the power stack and enter switch stack power configuration mode. The range is from 1 to 9.  <b>Note</b> Only four switches can belong to the same power stack.
Step 3	<b>stack</b> [ <i>power-stack-name</i> ]	Enter the name of the power stack to which the switch belongs. The name can be up to 31 characters. If you do not enter a name and no other switches in the power stack have a name configured, a power-stack name is automatically generated.
Step 4	<b>power-priority switch</b> <i>value</i>	Set the power priority of the switch. The range is from 1 to 27. This value must be lower than the value set for the low and high-priority ports.
Step 5	<b>power-priority high</b> <i>value</i>	Set the power priority of the PoE ports on the switch that are configured as high-priority ports. The range is from 1 to 27, with 1 as the highest priority. The <b>high</b> value must be lower than the value set for the low-priority ports and higher than the value set for the switch.
Step 6	<b>power-priority low</b> <i>value</i>	Set the power priority of the PoE ports on the switch that are configured as low-priority ports. The range is from 1 to 27. This value must be higher than the value set for the low-priority ports and the value set for the switch.
Step 7	<b>end</b>	Return to privileged EXEC mode.
Step 8	<b>show stack-power</b>	Verify your entries.
Step 9	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

This is an example of setting the switch stack power parameters for switch 3 in the stack that is connected to the power stack with the stack ID *power2*. If load-shedding becomes necessary, switches and powered devices in the power stack with the higher numbers are shut down first, with shutdown proceeding in order.

```
Switch(config)# stack-power switch 3
Switch(config-switch-stackpower)# stack power2
Switch(config-switch-stackpower)# power-priority switch 5
Switch(config-switch-stackpower)# power-priority high 12
Switch(config-switch-stackpower)# power-priority low 20
Switch(config-switch-stackpower)# exit
Switch(config-stackpower)# exit
```



### Note

Entering the **write erase** and **reload** privileged EXEC commands does not change the power priority or power mode non-default configuration saved in the switch flash memory.

## Configuring PoE Port Priority

Beginning in privileged EXEC mode, follow these steps to configure the priority of a PoE port on a switch:

	Command	Purpose
Step 1	<b>configure terminal</b>	Enter global configuration mode.
Step 2	<b>interface</b> <i>interface-id</i>	Enter the interface ID of the port in the stack and enter interface configuration mode. The interface must be a PoE port.
Step 3	<b>power inline port priority</b> { <b>high</b>   <b>low</b> }	Set the power priority of the port to <b>high</b> or <b>low</b> . Powered devices connected to low priority ports are shut down first in case of a power reduction. The default is low priority.
Step 4	<b>end</b>	Return to privileged EXEC mode.
Step 5	<b>show power inline priority</b>	Verify your entries.
Step 6	<b>copy running-config startup-config</b>	(Optional) Save your entries in the configuration file.

This is an example of setting the power priority of a port to high so that it is one of the last ports to shut down in case of a power failure.

```
Switch(config)# interface gigabitetherent1/0/1
Switch(config-if)# power inline port priority high
Switch(config-if)# exit
```

