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Power over Ethernet (PoE) User Guide for EX Series Switches

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About This Guide

Use this guide to configure the Power over Ethernet (also known as PoE) feature in Junos OS. PoE permits electric power, along with data, to be passed over a copper Ethernet LAN cable. Powered devices that support PoE—such as voice over IP (VoIP) telephones, wireless access points, video cameras, and point-of-sale devices—can receive power safely from the same access ports that are used to connect personal computers to the network.

1
CHAPTER

Overview

Understanding PoE on EX Series Switches

IN THIS SECTION

Power over Ethernet (PoE) enables electric power, along with data, to be passed over a copper Ethernet LAN cable. Powered devices—such as *VoIP* telephones, wireless access points, video cameras, and point-of-sale devices—that support PoE can receive power safely from the same access ports that are used to connect personal computers to the network. This reduces the amount of wiring in a network, and also eliminates the need to position a powered device near an AC power outlet, making network design more flexible and efficient.

This topic describes PoE on Juniper Networks EX Series Ethernet Switches.

PoE Versions

PoE was first defined in the IEEE 802.3af standard, which supplied up to 15.4 W of power to a connected powered device. Subsequent versions increased the amount of power that can be supplied to a powered device, as follows:

Enhanced PoE	Supplies up to 18.6 W of power. This is a Juniper Networks extension to the IEEE 802.3af standard introduced in Junos OS Release 11.1.
IEEE 802.3at (PoE+)	Supplies up to 30 W of power. The PoE+ standard provides support for legacy PoE devices—an IEEE 802.3af powered device can operate normally when connected to IEEE 802.3at (PoE+) power sourcing equipment.
Four-pair PoE (PoE-4P)	Supplies up to 90 W of power.

This is a Juniper Networks extension to the IEEE 802.3at standard introduced in Junos OS Release 18.2. PoE-4P delivers more power by utilizing all four pairs of wire in a standard RJ-45 Ethernet cable. In addition to providing more power, PoE-4P improves energy efficiency by reducing the amount of power lost during cable transmission. PoE-4P can deliver up to 60 W (high power PoE) or 90 W (ultra-high power PoE).

IEEE 802.3bt (PoE-bt)

Supplies up to 90 W of power.

The IEEE 802.3bt standard for four-pair PoE, introduced in Junos OS Release 19.3. PoE-bt introduces two new power types: Type 3 and Type 4, which deliver up to 60_W and 90_W of power, respectively.

The EX4100 switch offers PoE that enables consistent power to be provided to the endpoints, even when the switch is rebooting. The switch also supports a fast PoE capability that delivers PoE power to connected endpoints during a switch power-up, even before the switch is fully operational.

The EX4400 switches can be configured to deliver fast PoE capability, which enables the switches to deliver PoE power to connected PoE devices within a few seconds of power being applied to the switches. In addition, the EX4400 switches support perpetual PoE, which provides uninterrupted power to connected PoE powered devices (PDs) even when the switch is rebooting.

See Perpetual PoE and Fast PoE to know more about PoE and how to configure it.

See Table 1 on page 3 to find the version of PoE supported on EX Series switches and line cards.

Table 1: PoE Version Support

Switch or Line Card	PoE Version
EX2200 switch (EX2200-C-12P-2G, EX2200-24P-4G, EX2200-48P-4G models)	PoE+ (IEEE 802.3at) **NOTE**: Starting with Junos OS Release 12.2R1, PoE commands are enabled on all non-PoE-capable EX2200 switch models. The PoE commands do not provide any meaningful configuration on standalone non-PoE-capable switch models. However, in an EX2200 *Virtual Chassis*, you can execute PoE commands from a non-PoE-capable primary switch to configure PoE on PoE-capable Virtual Chassis members.

Table 1: PoE Version Support *(Continued)*

Switch or Line Card	PoE Version
EX2300 switch (EX2300-C-12P, EX2300-24P, EX2300-48P, EX2300-24MP, EX2300-48MP models)	PoE+ (IEEE 802.3at) **NOTE**: Starting with Junos OS Release 18.1R2, PoE is supported on EX2300-24MP and EX2300-48MP switch models, including multigigabit interfaces.
EX3200 switch (EX3200-24P, EX3200-24T, EX3200-48P, EX3200-48T models)	Enhanced PoE
EX3300 switch (EX3300-24P, EX3300-48P models)	PoE+ (IEEE 802.3at)
EX3400 switch (EX3400-24T, EX3400-24P, EX3400-48T, EX3400-48T-AFI, EX3400-48P models)	PoE+ (IEEE 802.3at)
EX4100 switch • EX4100 gigabit switch models: EX4100-24P and EX4100-48P • EX4100-F (fixed-form) switch models: EX4100-F-12P, EX4100-F-24P, and EX4100-F-48P • EX4100 multigigabit switch models: EX4100-H-12MP, EX4100-24MP, and EX4100-48MP •	• PoE+ (IEEE 802.3at) • PoE+ (IEEE 802.3at) • PoE-bt (IEEE 802.3bt)
EX4200 switch—P models (EX4200-24P and EX4200-48P)	Enhanced PoE
EX4200 switch—PX models (EX4200-24PX and EX4200-48PX)	PoE+ (IEEE 802.3at)

Table 1: PoE Version Support *(Continued)*

Switch or Line Card	PoE Version
EX4300 switch—P models (EX4300-24P and EX4300-48P)	PoE+ (IEEE 802.3at)
EX4300 switch—MP model (EX4300-48MP)	PoE+ (IEEE 802.3at), PoE+ in four-pair mode (PoE-4P), and PoE-bt (IEEE 802.3bt).
EX4400 switch—P models (EX4400-24P and EX4400-48P)	• PoE+ (IEEE 802.3at) and PoE+ in four-pair mode (PoE-4P) • PoE-bt (IEEE 802.3bt)
EX4400 switch—MP models (EX4400-24MP, EX4400-48MP, EX4400-48XP, and EX4400-48MXP)	• PoE+ (IEEE 802.3at) and PoE+ in four-pair mode (PoE-4P) • PoE-bt (IEEE 802.3bt)
EX4600 switch (EX4600-40F-AFO and EX4600-40F-AFI)	PoE+ (IEEE 802.3at) **NOTE**: PoE is supported on EX4600 switches only when they are part of a mixed Virtual Chassis with EX4300 switches.
EX6200-48P (48-port PoE+) line card	PoE+ (IEEE 802.3at)
EX8200-2XS-40P (40-port PoE+ with 4-port SFP and 2-port SFP+) line card EX8200-48PL (2-port SFP+ and 48-port PoE+ 20 Gbps) line card	PoE+ (IEEE 802.3at)—Ports 0 through 11, and PoE (IEEE 802.3af)—remaining PoE ports.

Power Management Modes

A switch or line card that supports PoE has a PoE controller. The controller determines how much power to allocate to the PoE interfaces. If the power consumption of a connected PD exceeds the maximum power allocated to that interface, the controller turns off power to the interface.

The method used to allocate power depends on the power management mode:

Class mode Power is allocated dynamically using the classification process. This is the default mode.

Static mode Power is allocated based on the maximum power configuration.

These methods use the processes described below:

Classification

Classification is a process by which the power sourcing equipment (PSE) and powered device (PD) exchange information to dynamically determine the power allocation. The process begins when a PD is connected to a PoE interface and presents a class signature. The PoE IEEE standards define classes for devices based on the levels of power they require.

The PSE responds with a power allocation based on the class of the PD. If LLDP is enabled on the interface, the allocation can be adjusted using LLDP power negotiation. See "LLDP Power Negotiation" on page 7 for more information.

NOTE: Powered devices that are not IEEE-compliant might not present a class signature. These will be assigned a default class of 0.

Table 2 on page 6 lists the classes of powered devices and associated power levels. Because of line loss, the power range of the powered device is less than the maximum power delivered at the PoE port for each class. Line loss is influenced by cable length, cable quality, and other factors and is typically less than 16 percent of the maximum power.

Table 2: Class of Powered Device and Power Levels

Standard	Class	Maximum Power Delivered by PoE Port	Power Range of Powered Device
IEEE 802.3af (PoE) and IEEE 802.3at (PoE+)	0	15.4 W	0.44 through 12.95 W
	1	4.0 W	0.44 through 3.84 W

Table 2: Class of Powered Device and Power Levels *(Continued)*

Standard	Class	Maximum Power Delivered by PoE Port	Power Range of Powered Device
	2	7.0 W	3.84 through 6.49 W
	3	15.4 W	6.49 through 12.95 W
IEEE 802.3at (PoE+)	4	30.0 W	12.95 through 25.5 W
High power PoE (PoE+ in four-pair mode)	0	30.8 W	0.88 through 25.9 W
	1	8.0 W	0.88 through 7.86 W
	2	14.0 W	7.86 through 12.98 W
	3	30.8 W	12.98 through 25.9 W
	4	60.0 W	25.9 through 51 W
Ultra-high power PoE (PoE+ in four-pair mode)	0-4	90.0 W	71 W
IEEE 802.3bt (PoE-bt)	5	45.0 W	40 W
	6	60.0 W	51 W
	7	75.0 W	62 W
	8	90.0 W	71.3 W

LLDP Power Negotiation

In class management mode, LLDP power negotiation can be used to refine the power allocation to the PD though an exchange of LLDP messages. For example, if the actual power requirement of the PD is a

lower amount of power than it was allocated based on its class designation, the PSE can reduce the power allocation.

The negotiated power allocation will include some additional power guard to accommodate cable length. This additional allocated power is approximately 15 percent of the requested value and it can allocate the power in small increments. For devices that use LLDP power negotiation, the power reserved for the interface is always greater than the LLDP-requested power value by the external POE device.

LLDP power negotiation is enabled by default in class management mode for LLDP interfaces. On interfaces that are in class management mode but are not enabled for LLDP, the power allocation is determined solely by the class of the PD.

NOTE: Starting in Junos OS Release 18.1R1, on EX2300 and EX3400 switches, once power is allocated based on LLDP power negotiation, LLDP power negotiation remains in effect, even if the interface link status goes off and on, or if the LLDP configuration is changed.

NOTE: LLDP power negotiation is not supported on EX3200 and EX4200 (except EX4200 PX models) switches.

Maximum Power Configuration

In static management mode, you configure the maximum power allocation for each PoE interface. The PSE allocates this amount of power to the interface from the maximum PoE power budget for the switch or line card. For example, if you specify a maximum value of 8.0 W for ge-0/0/3, the PoE controller allocates 8.0 W for this interface out of the maximum power consumption. This amount is allocated to the interface irrespective of whether a powered device is connected to the interface or the connected powered device uses less power than 8.0 W.

NOTE: Static management mode is not supported in PoE-bt.

Because of line loss, the power received by the powered device can be less than the power available at the PoE port. Table 3 on page 9 shows the maximum power available at a PoE port and the resulting power guaranteed to the powered device.

Table 3: Maximum Power per Port in Static Mode

Switch or Line Card	Maximum Power Delivered by PoE Port	Guaranteed Power to Powered Devices
EX2200 switches, EX3300 switches, EX4200 PX model switches, EX4300 P model switches, and EX4600 switches operating in a mixed Virtual Chassis	30 W	25.5 W
EX4300-48MP	30 W in two-pair mode 60 W in four-pair mode (high power) 90 W in four-pair mode (ultra-high power)	25.5 W 51 W 71 W
EX3200 switches and EX4200 P and T model switches running Junos OS Release 10.4 or earlier	15.4 W	12.95 W
EX3200 switches and EX4200 P and T model switches running Junos OS Release 11.1 or later	18.6 W **NOTE**: Switches that are upgraded to Junos OS Release 11.1 from a previous release require an upgrade of the PoE controller software to obtain 18.6 W.	15.64 W
EX2300 and EX3400 switches	30 W	25.5 W
EX6200-48P line cards	30 W	25.5 W
EX8200-2XS-40P line cards and EX8200-48PL line cards	30 W (ports 0 through 11) 15.4 W (remaining PoE ports)	25.5 W 12.95 W

Table 3: Maximum Power per Port in Static Mode *(Continued)*

Switch or Line Card	Maximum Power Delivered by PoE Port	Guaranteed Power to Powered Devices
EX4100 switches • EX4100 gigabit switch models models and fixed-form (-F) switch models • EX4100 multigigabit switch models	• 30 W • 90W	• 25.5 W • 71 W
EX4400 gigabit switch models	30 W 60 W (high power); 90 W (ultra-high power)	25.5 W 51 W; 71W

Maximum PoE Power Budget

The maximum PoE power budget is the total amount of power available for the PoE controller to allocate to all of the PoE interfaces. In allocating power, the PoE controller cannot exceed the maximum PoE power budget.

The maximum PoE power budget depends on the switch model:

Maximum PoE Power Budget on EX2200, EX2300, EX3200, EX3300, EX3400, EX4100, EX4100-F, EX4200, EX4300, and EX4400 Switches

The maximum PoE power budget on EX2200, EX2300, EX3200, EX3300, EX3400, EX4100, EX4100-F, EX4200, EX4300, and EX4400 switches depends on the switch model and the capacities of the power supplies installed. To find the maximum PoE power budget for each switch model, see Table 4 on page 11 for EX2200 switch models, Table 5 on page 12 for EX2300 switch models, Table 6 on page 12 for EX3200 switch models, Table 7 on page 13 for EX3300 switch models, Table 8 on page 14 for EX3400 switch models, Table 9 on page 14 for EX4100 and EX4100-F switch models, Table 13 on page 18 for EX4200 switch models, Table 14 on page 19 for EX4300 switch models, Table 15 on page 20 for EX4400 switch models, and Table 16 on page 21 for EX4400 switch models if Junos OS Release 22.2R1 or earlier is installed in the switch.

The maximum PoE power budget for a switch is displayed in the `Maximum power` field in the output of the `show poe controller` CLI command. The exception to this would be when LLDP power negotiation is in use.

If your switch supports power supplies of different capacities, keep the following points in mind:

- If you change your existing power supply to a lower-capacity power supply, the maximum PoE power budget might no longer be sufficient to power all the PoE ports on the switch.
- If your switch supports redundant power supplies and you have installed power supplies of different capacities, the maximum PoE power budget is based on the wattage of the lowest-capacity power supply.
- You cannot increase the number of PoE-capable ports on a switch by installing a power supply that has a higher capacity.

Table 4 on page 11 lists the EX2200 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 4: Maximum PoE Power Budget for EX2200 Switches

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX2200-C-12T	–	30 W	–
EX2200-C-12P	12	180 W	100 W
EX2200-24T	–	75 W	
EX2200-24P	24	550 W	405 W
EX2200-24T-DC	–	100 W	–
EX2200-48T	–	75 W	–
EX2200-48P	48	550 W	405 W

Table 5 on page 12 lists the EX2300 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 5: Maximum PoE Power Budget for EX2300 Switches

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX2300-24P	24	450 W	370 W
EX2300-24T	–	65 W	–
EX2300-48P	48	850 W	750 W
EX2300-48T	–	90 W	–
EX2300-C-12P	12	170 W	124 W
EX2300-C-12T	-	40 W	-
EX2300-24MP	24	535 W	380 W
EX2300-48MP	48	1005 W	750 W

Table 6 on page 12 lists the EX3200 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 6: Maximum PoE Power Budget for EX3200 Switch Models

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX3200-24T	8	320 W	130 W
EX3200-48T	8	320 W	130 W
EX3200-24P	24	600 W	410 W

Table 6: Maximum PoE Power Budget for EX3200 Switch Models *(Continued)*

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX3200-48P	48	930 W	740 W
EX3200-24T-DC	-	190 W	-
EX3200-48T-DC	-	190 W	-

Table 7 on page 13 lists the EX3300 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 7: Maximum PoE Power Budget EX3300 Switch Models

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX3300-24T	–	100 W	–
EX3300-24P	24	550 W	405 W
EX3300-24T-DC	–	100 W	–
EX3300-48T	–	100 W	–
EX3300-48T-BF	–	100 W	–
EX3300-48P	48	900 W	740 W

Table 8 on page 14 lists the EX3400 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 8: Maximum PoE Power Budget for EX3400 Switches

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX3400-48P	48	920 W	• 1440 W with two 920 W power supplies installed • 740 W with one 920 W power supply installed
EX3400-48T	-	150 W	-
EX3400-48T-AFI	–	150 W	-
EX3400-24P	24	600 W	• 720 W with two 600 W power supplies installed • 370 W with one 600 W power supply installed
EX3400-24T	–	150 W	–
EX3400-24T-DC	–	150 W	–

"Table 9" on page 14 lists the EX4100 and EX4100-F switch models, number of PoE-enabled ports on them, power supply ratings, and maximum PoE power budget.

Table 9: Maximum PoE Power Budget for EX4100 and EX4100-F Switch Models

Switch Model Number	**Number of PoE-Enabled Ports**	**Power Supply Rating**	Maximum PoE Power Budget (1 PSU/2 PSU)
EX4100-24MP	24	920 W	740 W/1620 W

Table 9: Maximum PoE Power Budget for EX4100 and EX4100-F Switch Models *(Continued)*

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget (1 PSU/2 PSU)
EX4100-48MP	48	920 W	740 W/1620 W
EX4100-24P	24	920 W	740 W/1440 W
EX4100-24T	0	150 W	N/A
EX4100-48P	48	920 W	740 W/1440 W
EX4100-48T	0	150 W	N/A
EX4100-F-24P	24	450 W	370 W
EX4100-F-24T	0	65 W	N/A
EX4100-F-48P	48	850 W	740 W
EX4100-F-48T	0	90 W	N/A
EX4100-F-12P	12	280 W	300 W with external AC power adapter and two uplink ports connected to external 90W PSE. PoE power budget is 180 W with external AC power adapter. For more information, see Table 12 on page 16
EX4100-F-12T	0	75 W	N/A

Table 10 on page 16 lists the EX4100-H-12MP switch models, number of PoE-enabled ports on them, power supply ratings, and maximum PoE power budget.

NOTE: If you connect a Class-4 power device (PD) when the available power is 31W, the PDs connected on lower-priority ports may go down. This is because the default power required for the PoE controller is 31.2W.

Instead, if you connect a Class-3 PD, you can reach to maximum PD power budget without any PD going down.

Table 10: Maximum PoE Power Budget for EX4100-H-12MP Switch Model

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget (1 PSU/2 PSU)
EX4100-H-12MP with one PSU	12	340 W	240 W (one PSU)
EX4100-H-12MP with two PSU	12	680 W	360 W (two PSUs)

Table 11: EX4100-H-12MP PoE Budget Planning

Switch Model Number	System Budget	PoE Budget	Total Budget	PSU
EX4100-H-12MP with one PSU	67 W	240 W	307 W	340 W (one PSU)
EX4100-H-12MP with two PSU	67 W	360 W	427 W	680 W (two PSUs)

Table 12: EX4100-F12P PoE Budget Planning

Uplink PD1/PD2	Power Source	PoE Budget	Total PoE Budget
PD at 90W Usable power = 60W	Adapter only (External adapter 280W, switch consumption is 60W, 20W is loss incurred in the power devices internal to board)	180W	180W

Table 12: EX4100-F12P PoE Budget Planning *(Continued)*

Uplink PD1/PD2	Power Source	PoE Budget	Total PoE Budget
	Only PD1 connected to a PSE switch (60W is consumed by the board)	0	0
	Only PD2 connected to a PSE switch (60W is consumed by the board)	0	0
	PD1 and PD2 connected to a PSE switch (60W is consumed by the board and another 60W is available as PoE budget)	60W	60W
	Adapter + (PD1 or PD2)	180W + 60W	240W
	Adapter + PD1 + PD2	180W + 60W + 60W	300W
PD at 60W Usable power =45W	Adapter only	180W	180W
	PD1 + PD2 (60W consumed by the board)	45W+45W-60W	30W
	Adapter (PD1 or PD2)	180W+45W+45W	225W
	Adapter + PD1 + PD2	180W+45W+45W	270W
PD at 45W Usable power =20W	Adapter only	180W	180W
	Adapter (PD1 or PD2)	180W+20W	200W
	Adapter + PD1 + PD2	180W+20W+20W	220W
PD at 30W Usable power =20W	Adapter only	180W	180W
	Adapter (PD1 or PD2)	180W+20W	200W
	Adapter + PD1 + PD2	180W+20W+20W	220W

NOTE: EX4100-F-12P switches can be powered using an external Power Adapter or an external PSE of 90W.

When you are using both the external Power Adapter and two external PSE of 90W, the PoE budget of 300W is available on the EX4100-F-12P.

Table 13 on page 18 lists the EX4200 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 13: Maximum PoE Power Budget for EX4200 Switch Models

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX4200-24T	8	320 W	130 W
EX4200-48T	8	320 W	130 W
EX4200-24P	24	600 W	410 W
EX4200-48P	48	930 W	740 W
EX4200-24PX	24	930 W	740 W
EX4200-48PX	48	930 W	740 W
EX4200-24F	-	320 W	-
EX4200-24F-DC	-	190 W	-
EX4200-24T-DC	-	190 W	-
EX4200-48T-DC	-	190 W	-

Table 14 on page 19 lists the EX4300 switch models, number of PoE-enabled ports, power supply ratings, and maximum PoE power budget.

Table 14: Maximum PoE Power Budget for EX4300 Switch Models

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Maximum PoE Power Budget
EX4300-48P	48	1100 W	• 1440 W with two 1100 W power supplies installed • 925 W with one 1100 W power supply installed
EX4300-48T	0	350 W	-
EX4300-48T-AFI	0	350 W	-
EX4300-24P	24	715 W	• 720 W with two 715 W power supplies installed • 565 W with one 715 W power supply installed
EX4300-24T	0	350 W	-
EX4300-48T-DC	0	550 W	-
EX4300-48T-DC-AFI	0	550 W	-
EX4300-48MP	48	1400 W **NOTE**: 1400 W PSU behaves as a 1100 W PSU at low line input voltage (90-110V AC input).	• 1700 W with two 1400 W power supplies installed • 1030 W with one 1400 W power supply installed

Table 15: Maximum PoE Power Budget for EX4400 Switch Models

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Max. PoE Power Budget (1 PSU/2 PSU); (1) 110 V input (2) 230 V input
EX4400-48P	48	1600 W	(1) 773 W/1796 W (2) 1310 W/2200 W
EX4400-48T	0	550 W	–
EX4400-48T-AFI	0	550 W	–
EX4400-24P	24	1050 W; 1600 W	1050: (1) 783 W/1806 W (2) 783 W/1806 W 1600: (1) 783 W/1806 W (2) 1320 W/2160 W
EX4400-24T	0	550 W	–
EX4400-48T-DC	0	550 W	–
EX4400-48T-DC-AFI	0	550 W	–
EX4400-48MP	48	1600 W	(1) 723 W/1746 W (2) 1260 W/2200 W

Table 15: Maximum PoE Power Budget for EX4400 Switch Models *(Continued)*

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Max. PoE Power Budget (1 PSU/2 PSU); (1) 110 V input (2) 230 V input
EX4400-24MP	24	1050 W; 1600 W	1050: (1) 753 W/1776 W (2) 753 W/1776 W 1600: (1) 753 W/1776 W (2) 1290 W/2160 W
EX4400-48XP	48	2000 W	(1) 724 W/1650 W (2) 1748 W/3600 W
EX4400-48MXP	48	2000 W	(1) 724 W/1650 W (2) 1748 W/3600 W

Table 16: Maximum PoE Power Budget for EX4400 Switch Models If Junos OS Release 22.2R1 or Earlier Is Installed in the Switch

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Max. PoE Power Budget (1 PSU/2 PSU); (1) 110 V input (2) 230 V input
EX4400-48P	48	1600 W	(1) 768 W/1440 W (2) 1290 W/1800 W
EX4400-48T	0	550 W	–
EX4400-48T-AFI	0	550 W	–

Table 16: Maximum PoE Power Budget for EX4400 Switch Models If Junos OS Release 22.2R1 or Earlier Is Installed in the Switch *(Continued)*

Switch Model Number	Number of PoE-Enabled Ports	Power Supply Rating	Max. PoE Power Budget (1 PSU/2 PSU); (1) 110 V input (2) 230 V input
EX4400-24P	24	1050 W	(1) 788 W/1440 W (2) 788 W/1440 W
EX4400-24T	0	550 W	–
EX4400-48T-DC	0	550 W	–
EX4400-48T-DC-AFI	0	550 W	–
EX4400-48MP	48	1600 W	(1) 750 W/1800 W (2) 1300 W/2200 W
EX4400-24MP	24	1050 W	(1) 780 W/1800 W (2) 780 W/1800 W

NOTE: EX4300 switches support power supply redundancy. For information on PoE power availability in N+N configurations and different PSU combinations, see *AC Power Supply in EX4300 Switches*.

Maximum PoE Power Budget on EX6200 and EX8200 Switches

For EX6200 and EX8200 switches, each line card that supports PoE has its own PoE controller and maximum PoE power budget. The maximum PoE power budget is allocated to the line card by the switch's power management, while PoE power is allocated to the ports on the line card by the PoE controller. Because EX6200 and EX8200 switches can differ in the number and capacity of power supplies installed and in the number and types of line cards installed, the amount of power available for PoE power can vary for switches of the same model.

Power management allocates PoE power to line cards that support PoE only after it has allocated base power to and powered on all line cards. It then allocates the remaining power to the line cards for PoE in

order of line card power priority. (In a default configuration, power priority is determined by the line card slot number, with slot 0 having the highest priority.) If the remaining power is insufficient to provide PoE power to all PoE line cards, a low-priority line card might receive no PoE power or partial PoE power.

By default, power management allocates enough PoE power to a line card to power all PoE ports at their maximum supported power. If the powered devices connected to that line card require less power than that, you can configure a smaller maximum PoE power budget for the line card. For example, power management normally allocates 915 W of PoE power to a 48-port PoE+ 20 Gbps (EX8200-48PL) line card. If the powered devices connected to that line card consume no more than a total of 250 W, you can set the maximum PoE power budget for the line card to 250 W. Doing so frees 665 W, which then can be used to fulfill the PoE power needs of lower-priority line cards.

You can also configure the power priority of the PoE ports on a line card. If power management is unable to allocate enough power to a line card to meet its maximum PoE power budget, the line card's PoE controller turns off power to PoE ports in reverse priority order as required to meet the reduced power allocation.

Power management adjusts PoE power allocations as power availability and demand in a switch change. As a general rule, power management allocates power to power on line cards before it allocates PoE power. For example, if you add a line card and there is insufficient power available to power it on, power management reduces the PoE power it provides to line cards, starting with the lowest priority line card, until it frees enough power to power on the new line card. When power management reduces the maximum PoE power budget for a line card because of insufficient power, it logs a message in the system log.

Note that the actual power consumed by the powered devices does not affect power management's power allocation for a line card. If you have set the maximum PoE power budget for a line card to 500 W, power management allocates 500 W even if the powered devices are consuming less power than that. Similarly, the maximum PoE power budget is not increased if you add additional powered devices—if the powered devices require more than the 500 W maximum that you have configured, lower-priority devices do not receive power.

You can display the switch's power budget maintained by power management, including its PoE power allocations, by using the `show chassis power-budget-statistics` command. You can also display the maximum PoE power budget for each line card in a switch by using the `show poe controller` command.

For more information about how power management allocates power, including PoE power, see Understanding Power Management on EX Series Switches.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
18.1R2	Starting with Junos OS Release 18.1R2, PoE is supported on EX2300-24MP and EX2300-48MP switch models, including multigigabit interfaces.
18.1R1	Starting in Junos OS Release 18.1R1, on EX2300 and EX3400 switches, once power is allocated based on LLDP power negotiation, LLDP power negotiation remains in effect, even if the interface link status goes off and on, or if the LLDP configuration is changed.
12.2R1	Starting with Junos OS Release 12.2R1, PoE commands are enabled on all non-PoE-capable EX2200 switch models.

RELATED DOCUMENTATION

- Enabling PoE on EX Series Switches (CLI Procedure) | **26**
- Upgrading to IEEE 802.3bt PoE | **64**
- Configuring the PoE Controller on EX Series Switches | **33**
- Configuring PoE Interfaces on EX Series Switches | **36**

2

CHAPTER

Configuring PoE

Enabling PoE on EX Series Switches (CLI Procedure)

IN THIS SECTION

Enabling PoE

For EX Series switches that support PoE ports, the factory default configuration enables PoE on the PoE-capable ports, with default settings in effect. You might not have to do any additional configuration if the default settings work for you. See Table 17 on page 29 for the configurable options and their default settings.

NOTE: We recommend that you do not connect an enabled PoE port on one switch to an enabled PoE port on a second switch. If there is a large voltage difference between the power supplies of the two switches, the resulting negative current will trigger a fail-safe mechanism that prevents the power sourcing equipment (PSE) from delivering power to the other PoE ports on that switch.

NOTE: On EX8200 switches, the factory default configuration enables PoE on all interfaces starting at Junos OS Release 11.2. Switches that have been upgraded to Release 11.2 from an earlier release might not have PoE enabled by default. To enable PoE on all PoE-capable ports on a switch, use the `set poe interface all` configuration command.

NOTE: EX4600 switches support PoE only in a mixed Virtual Chassis with EX4300 switches. EX4600 switches do not have PoE ports; therefore, the factory default configuration does not enable PoE.

NOTE: When connecting any of the EX2300, EX3400, EX4100, EX4100-F, EX4300, EX4300-48MP, EX2300-48MP, or EX4400 switches using network ports to an upstream PoE switch, make sure that PoE is disabled on the upstream switch PoE port, as well as the downlink switch PoE port (if applicable).

Enabling Legacy Powered Device

Starting in Junos OS Release 24.4R1 Junos release, the detection of legacy PD (powered device) is disabled by default in EX4400-24MP, EX4400-48MP, EX4400-48MXP and EX4400-48XP models only.

To enable a legacy PD in a port for these models, apply the *legacy-pd* knob as shown in the following examples.

- `set poe interface mge-x/y/z legacy-pd` (for EX4400-24MP, EX4400-48MP and EX4400-48MXP models)
- `set poe interface ge-x/y/z legacy-pd` (for EX4400-48XP)

NOTE:

- On any PoE enabled port, PD detection is carried out in real-time. The IEEE standards recommend resistive measurements-based detection for PDs. However, PDs manufactured prior to the IEEE standardization require capacitive measurements-based detection to be performed for a successful detection.
- *legacy-pd* knob should not be applied to switch ports that are not connected to any powered device or non-PD capable devices. It is also strongly recommended NOT to use the *set poe interface all legacy-pd* knob.

Verification Steps:

After the legacy PD is detected and powered on, the device will be shown as non-IEEE against the *Operational status detail* row in the `show poe interface mge-0/0/0` command.

```
{master:0}
user@lab> show poe interface ge-2/0/0
PoE interface status:
PoE interface               :  ge-2/0/0
Administrative status       : Enabled
Operational status          :   ON
Operational status detail   : 4P Port that deliver only 2 Pair non IEEE
```

```
FourPair status              : Disabled
Power limit on the interface : 10.0W (L)
Priority                     : Low
Power consumed               : 10.2W*
Class of power device        :      0/-
PoE Mode                     :   802.3bt
```

Enabling High Power and Ultra-high Power PoE

Starting in Junos OS Release 18.2R1, on EX4300-48MP switches, you can configure four-pair PoE (PoE-4P) to increase the power delivered to a powered device to 60_W (high power) or 90_W (ultra-high power).

NOTE: High power and ultra-high power PoE can be configured for a specific interface, or can be configured globally for all interfaces. For a global configuration, use the `all` option in place of the interface name.

To configure high power PoE, use the following command:

- ```
  [edit]
  user@switch# set poe interface interface-name high-power
  ```

To configure ultra-high power PoE, use the following command:

- ```
  [edit]
  user@switch# set poe interface interface-name ultrahigh-power
  ```

Enabling IEEE 802.3-BT PoE

Starting in Junos OS Release 19.3R1, EX4300-48MP switches support IEEE 802.3-BT (PoE-bt). Upgrading to a Junos OS release that supports PoE-bt does not enable PoE-bt by default. To enable PoE-bt, you must upgrade the PoE controller software.

For information on upgrading to PoE-bt, see "Upgrading to IEEE 802.3bt PoE" on page 64.

PoE Configurable Options

Table 17 on page 29 shows the configurable PoE options and their default settings for the PoE controller and for the PoE interfaces.

Table 17: Configurable PoE Options and Default Settings

Option	Default	Description
PoE Controller Options		
guard-band	0 W	**NOTE**: Guard band is not supported in PoE-bt. Reserves a specified amount of power from the PoE power budget to be used in the case of a spike in PoE power consumption: • Up to 15 W on EX6200 and EX8200 switches • Up to 19 W on all other switches
lldp-priority	Not included in default configuration	When included in the configuration, assigns interfaces the power priority provided by the connected powered device by using Link Layer Discovery Protocol (LLDP) power negotiation rather than the power priority configured on the switch interface. Requires LLDP power negotiation to be enabled.

Table 17: Configurable PoE Options and Default Settings *(Continued)*

Option	Default	Description
`management`	class	Sets the PoE power management mode for the switch or line card. The power management mode determines how power to a PoE interface is allocated: • class—In this mode, the power allocated to a PoE interface is based on the class of the powered device, and can be further adjusted using LLDP power negotiation. LLDP power negotiation is enabled by default on supported switches when the `management` option is set to `class`. If LLDP power negotiation is disabled or not supported on the powered device or the switch, the maximum power delivered by an interface is determined by the class of the connected powered device. If there is no powered device connected, standard 15.4W power is allocated on the interface. • static—The maximum power delivered by an interface is statically configured and is independent of the class of the connected powered device. The maximum power is allocated to the interface even if a powered device is not connected. **NOTE**: Static mode is not supported in PoE-bt.
`maximum-power`	**792** W for the EX8200-2XS-40P (40-port PoE+ with 4-port SFP and 2-port SFP+) line card **915** W for the EX8200-48PL (48-port PoE+ 20 Gbps) line card **1440** W for the EX6200-48P (48-port PoE+) line card	**NOTE**: Not supported in PoE-bt. (EX6200 and EX8200 switches only) Sets the PoE power budget for the line card: • 37 W through 792 W for the EX8200-2XS-40P line card • 37 W through 915 W for the EX8200-48PL line card • 37 W through 1440 W for the EX6200-48P line card

Table 17: Configurable PoE Options and Default Settings *(Continued)*

Option	Default	Description
`notification-control`	Not included in default configuration	When included in the configuration, enables the PoE controller to send PoE SNMP traps.
Interface Options		
`af-mode`	Not included in default configuration	(EX6200 switches only) When included in the configuration, restricts a PoE interface to supporting IEEE 802.3af only. The maximum power that can be delivered by the PoE interface is 15.4 W.
`disable`	Not included in default configuration	When included in the configuration, disables PoE on the interface. The interface maintains network connectivity but no longer supplies power to a connected powered device. Power is not allocated to the interface.
`maximum-power`	**30.0** W for interfaces that support PoE+ (IEEE 802.3at) **15.4** W for interfaces that support PoE (IEEE 802.3af)	**NOTE**: Not supported in PoE-bt. Sets the maximum power that can be delivered by a PoE interface when the power management mode is **static**: • Up to 30 W for EX2200, EX2300, EX3300, EX3400, EX4200, EX4300, EX6200, and EX8200 switches • Up to 18.6 W for EX3200 switches This setting is ignored if the power management mode is **class**. **NOTE**: The **maximum-power** setting permitted by the CLI might be greater than the maximum power a given PoE port can deliver. For example, the CLI permits you to set any port on an EX8200 line card to 30 W; however, only ports 0 through 11 support 30 W. Similarly, the CLI permits you to set any port on an EX4200 switch to 30 W, but some EX4200 models support only 18.6 W per port. If you configure a **maximum-power** value that is greater than the maximum power supported by a port, the power allocated to the port will be the maximum supported.

Table 17: Configurable PoE Options and Default Settings *(Continued)*

Option	Default	Description
`priority`	**low**	Sets an interface's power priority to either **low** or **high**. If power is insufficient for all PoE interfaces, the PoE power to low-priority interfaces is shut down before power to high-priority interfaces is shut down. Among interfaces that have the same assigned priority, the power priority is determined by port number, with lower-numbered ports having higher priority. If LLDP power priority is enabled, the switch assigns each interface the power priority provided by the connected LLDP-enabled powered device rather than the interface's configured priority. On EX6200 and EX8200 switches, **priority** determines the interface's power priority relative to the other interfaces on the line card, not the interfaces on the switch as a whole. If power management cannot provide the line card with its full PoE power budget, PoE power to interfaces with low priority is shut down first.
`telemetries`	Not included in default configuration	When included in the configuration, enables the logging of power consumption records on an interface. Logging occurs every 5 minutes for 1 hour unless you specify a different value for **interval (Power over Ethernet)** or **duration.**

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
19.3R1	Starting in Junos OS Release 19.3R1, EX4300-48MP switches support IEEE 802.3-BT (PoE-bt).
18.2R1	Starting in Junos OS Release 18.2R1, on EX4300-48MP switches, you can configure four-pair PoE (PoE-4P) to increase the power delivered to a powered device to 60_W (high power) or 90_W (ultra-high power).

RELATED DOCUMENTATION

Understanding PoE on EX Series Switches | 2

Configuring the PoE Controller on EX Series Switches

IN THIS SECTION

Configuring the PoE Controller on EX2200, EX2300, EX3200, EX3300, EX3400, EX4200, EX4300 and EX4600 Switches

You can change the management mode or configure a guard band setting for a standalone switch or for all members of an EX3300 Virtual Chassis, an EX4200 Virtual Chassis, an EX4300 Virtual Chassis, or a mixed EX4200 and EX4500 Virtual Chassis that supports PoE, or a mixed EX4300 and EX4600 Virtual Chassis that supports PoE.

To change the management mode, or to configure a guard band setting, use the following command:

- ```
  [edit]
  user@switch# set poe management mode guard-band watts
  ```

  For example, to set the management mode to static and to configure a guard band of 15 W:

  ```
  [edit]
  user@switch# set poe management static guard-band 15
  ```
  ```

NOTE: If the PoE power budget for the switch is insufficient to provide maximum power to all the PoE ports, we recommend that you do not change the management mode from class to static. If you change the power management mode to static and do not change the other default settings, the PoE controller allocates maximum power to the PoE ports in the order of port number, which means PoE will be disabled on higher-numbered ports when the PoE power budget runs out.

In class mode, on the other hand, the PoE controller does not allocate power to a port until a powered device is connected. The class of the connected device determines the amount of power allocated. Thus in class mode, any PoE port can be used to power a device and all the PoE ports on the switch can be used as long as the combined power demand does not exceed the PoE power budget.

NOTE: On EX3200 and EX4200 switches that support enhanced PoE, you must change the management mode from class to static to take advantage of the higher per-port power limits of enhanced PoE.

To enable PoE SNMP traps on a standalone switch or on an specific member of a Virtual Chassis, use the following command:

- ```
  [edit]
  user@switch# set poe notification-control fpc number
  ```

  For example, to enable PoE SNMP traps on a standalone switch or on member 0 of a Virtual Chassis:

  ```
  [edit]
  user@switch# set poe notification-control fpc 0
  ```

Configuring the PoE Controllers on EX6200 and EX8200 Switches

On EX6200 and EX8200 switches, each line card that supports PoE has its own PoE controller, so PoE controller options are configured separately for each line card.

In addition, each line card has its own separate, configurable PoE power budget. The default power budget for a line card is the amount of power needed to supply all PoE ports on the line card with their maximum supported power. Because there might not be enough power available in a switch to supply
  ```

each PoE line card with the default PoE power budget, you can configure smaller power budgets for one or more line cards, freeing power for other line cards.

To configure a guard band setting, to change the management mode, or to configure the PoE power budget for a specific line card, use the following command:

- ```
  [edit]
  user@switch# set poe fpc number  guard-band watts management mode maximum-power watts
  ```

  For example, to configure a PoE budget of 350 W and a guard band of 15 W on line card 1:

  ```
  [edit]
  user@switch# set poe fpc 1 guard-band 15 maximum-power 350
  ```

  NOTE: If you configure a PoE power budget for a line card that is smaller than the default power budget, we recommend that you do not change the management mode from class to static. If you change the power management mode to static and do not change the interface default settings, the PoE controller allocates maximum power to the PoE ports in the order of port number. As a result, PoE will be disabled on higher-numbered ports when the PoE power budget runs out.

  In class mode, on the other hand, the PoE controller does not allocate power to a port until a powered device is connected. The class of the connected device determines the amount of power allocated. Thus in class mode, any PoE port can be used to power a device and all the PoE ports on the switch can be used as long as the combined power demand does not exceed the PoE power budget.

To configure the same guard band value, management mode, or PoE power budget for all line cards in a switch, use the following command:

- ```
  [edit]
  user@switch# set poe fpc all  guard-band watts management mode maximum-power watts
  ```

  For example, to configure a PoE budget of 1000 W and static management mode for all line cards in a switch:

  ```
  [edit]
  user@switch# set poe fpc all management static maximum-power 1000
  ```

If you configure different settings for a specific line card, those settings override the settings configured with the `fpc all` statement.

To enable PoE SNMP traps on a line card, use the following command:

- ```
  [edit]
  user@switch# set poe notification-control fpc number
  ```

  For example, to enable PoE SNMP traps on line card 7:

  ```
  [edit]
  user@switch# set poe notification-control fpc 7
  ```

RELATED DOCUMENTATION

Understanding PoE on EX Series Switches | 2

Configuring PoE Interfaces on EX Series Switches

IN THIS SECTION

Power over Ethernet (PoE) ports on EX Series switches supply electric power over the same ports that are used to connect network devices. These ports enable you to plug in devices that require both network connectivity and electric power, such as VoIP phones, wireless access points, and some IP cameras. This reduces the amount of wiring in a network, and also eliminates the need to position a powered device near an AC power outlet, making network design more flexible and efficient.
  ```

Configuring PoE Interfaces

To configure the PoE interfaces on a switch that supports PoE:

- To configure all PoE interfaces with the same setting or settings:

```
[edit]
user@switch# set poe interface all options
```

For example, to enable telemetry collection on all interfaces, using the default collection duration and interval:

```
[edit]
user@switch# set poe interface all telemetries
```

NOTE: For PoE to be enabled on all PoE-capable interfaces, the configuration must include the `interface all` statement in the `[edit poe]` hierarchy level. With the exception of EX8200 switches that were shipped from the factory with a Junos OS release earlier than Release 11.2, the factory default configurations of switches that support PoE include this statement.

- To configure individual PoE interfaces with different settings:

```
[edit]
user@switch# set poe interface interface-name options
```

For example:

```
[edit]
user@switch# set poe interface ge-0/0/0 priority high telemetries duration 24

[edit]
user@switch# set poe interface ge-0/0/1

[edit]
user@switch# set  poe interface ge-0/0/5 maximum-power 18.6
```

```
[edit]
user@switch# set poe interface ge-5/0/7 disable
```

When you configure an individual interface, its configuration overrides any settings you configure with the `set poe interface all` command. For example, ge-0/0/1 in the preceding example retains the default settings, regardless of any settings configured with the `set poe interface all` command.

Example: Configuring PoE Interfaces on an EX Series Switch

IN THIS SECTION

Power over Ethernet (PoE) ports supply electric power over the same ports that are used to connect network devices and enable you to plug in devices that require both network connectivity and electric power, such as VoIP phones, wireless access points, and some IP cameras. This reduces the amount of wiring in a network, and also eliminates the need to position a powered device near an AC power outlet, making network design more flexible and efficient.

You do not need to configure PoE unless you want to modify the default values or disable PoE on a specific interface.

This example describes a default configuration of PoE interfaces on an EX Series switch:

Requirements

This example uses the following hardware and software components:

- One EX Series switch that supports PoE

  NOTE: EX4600 switches support PoE configuration on virtual chassis members only when operating in a mixed Virtual Chassis with EX4300 switches.

- Avaya IP telephones

- Wireless access point
- Junos OS Release 9.0 or later for EX Series switches

Before you configure PoE, be sure you have:

- Performed the initial switch configuration. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* or *Connecting and Configuring an EX Series Switch (J-Web Procedure)* for details.

Overview and Topology

IN THIS SECTION

The topology used in this example consists of a switch that has 24 ports. Eight of the ports support PoE (IEEE 802.3af), which means they provide both network connectivity and electric power for powered devices such as VoIP telephones, wireless access points, and IP security cameras that require 12.95 W or less. The remaining 16 ports provide only network connectivity. You use the standard ports to connect devices that have their own power sources, such as desktop and laptop computers, printers, and servers. Table 18 on page 39 details the topology used in this configuration example.

Table 18: Components of the PoE Configuration Topology

Property	Settings
Switch hardware	EX Series switch with 24 Gigabit Ethernet ports: 8 PoE interfaces (ge-0/0/0 through ge-0/0/7) and 16 non-PoE interfaces (ge-0/0/8 through ge-0/0/23)
VLAN name	default
Connection to a wireless access point (requires PoE)	ge-0/0/0
Connections to Avaya IP telephones with integrated hubs that allow phone and desktop PC to connect to a single port (requires PoE)	ge-0/0/1 through ge-0/0/7

Table 18: Components of the PoE Configuration Topology *(Continued)*

Property	Settings
Direct connections to desktop PCs, file servers, integrated printer/fax/copier machines (no PoE required)	ge-0/0/8 through ge-0/0/20
Unused ports (for future expansion)	ge-0/0/21 through ge-0/0/23

Topology

Configuration

IN THIS SECTION

To enable the default PoE configuration on the switch:

Procedure

CLI Quick Configuration

To quickly enable the default configuration on the switch:

Simply connect the powered devices to the PoE ports.

Step-by-Step Procedure

To use the PoE interfaces with default values:

1. Make sure the switch is powered on.
2. Connect the wireless access point to interface ge-0/0/0.
3. Connect the Avaya phones to interfaces ge-0/0/1 through ge-0/0/7.

Verification

IN THIS SECTION

To verify that PoE interfaces have been created and are operational, perform this task:

Verifying That the PoE Interfaces Have Been Created

Purpose

Verify that the PoE interfaces have been created on the switch.

Action

List all the PoE interfaces configured on the switch:

```
user@switch> show poe interface
Interface Admin        Oper        Max       Priority Power             Class
          status       status      power               consumption
 ge-0/0/0 Enabled      ON          15.4W     Low      7.9W                0
 ge-0/0/1 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/2 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/3 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/4 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/5 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/6 Enabled      ON          15.4W     Low      3.2W                2
 ge-0/0/7 Enabled      ON          15.4W     Low      3.2W                2
```

Meaning

The `show poe interface` command lists PoE interfaces configured on the switch, with their status, priority, power consumption, and class. This output shows that eight interfaces have been created with default values and are consuming power at the expected rates.

SEE ALSO

Troubleshooting PoE Interfaces | 75

Configuring PoE Interface Power Priority

Power over Ethernet (PoE) ports supply electric power over the same ports that are used to connect network devices. These ports enable you to plug in devices that need both network connectivity and electric power, such as VoIP phones, wireless access points, and some IP cameras.

You can configure a PoE interface to have a power priority. The power priority determines which interfaces receive power if PoE power demands are greater than the maximum PoE power consumption. If the total power allocated for all interfaces exceeds the maximum PoE power consumption, PoE power to lower-priority interfaces is turned off and the power allocated to those interfaces drops to 0.

By default, PoE ports on EX Series switches are set to low power priority. You can configure a PoE port to have a high power priority setting. If a situation arises where there is not sufficient power for all the PoE ports, the available power is directed to the higher priority ports. Ports that connect to powered devices such as security cameras and emergency phones should be configured with a higher power priority.

Among PoE interfaces that have the same assigned priority, power priority is determined by the port number, with lower-numbered ports having higher priority.

For EX6200 and EX8200 switches, interface power priority determines the relative priority of the interfaces on a line card, not on the switch as a whole. The relative priority of interfaces residing on different line cards is determined by line card priority. For example, if line card 1 has a higher power priority than line card 2 and a power shortage occurs, power is removed from the PoE interfaces in this order:

- Low-priority interfaces on line card 2
- High-priority interfaces on line card 2
- Low-priority interfaces on line card 1
- High-priority interfaces on line card 1

You can manually configure PoE interface power priority, or you can enable LLDP power priority, which assigns each interface the power priority provided by the connected LLDP-enabled powered device. Table 19 on page 43 describes how the switch converts LLDP power priorities to switch power priorities.

Table 19: LLDP Power Priority Conversion to Switch Power Priority

LLDP Power Priority	Switch Power Priority
Critical, High	High
Low	Low

NOTE: LLDP power priority requires LLDP power negotiation to be enabled, which is enabled by default when the PoE `management` option is set to `class`.

Example: Configuring PoE Interfaces with Different Priorities on an EX Series Switch

IN THIS SECTION

You can configure the power priority for a PoE port. If a situation arises where there is not sufficient power for all the PoE ports, the available power is directed to the higher priority ports, while power to the lower priority ports is shut down as needed.

This example describes how to configure a few high-priority PoE interfaces.

Requirements

This example uses the following hardware and software components:

- One EX Series switch that supports PoE

> **NOTE:** EX4600 switches support PoE only when operating in a mixed Virtual Chassis with EX4300 switches.

- Powered devices—wireless access point, VoIP telephones, and IP security cameras—that require PoE
- Junos OS Release 9.0 or later for EX Series switches

Before you configure PoE, be sure you have:

- Performed the initial switch configuration. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* or *Connecting and Configuring an EX Series Switch (J-Web Procedure)* for details.

Overview and Topology

IN THIS SECTION

The topology used in this example consists of a switch that has 24 ports. Eight of the ports support PoE (IEEE 802.3af), which means they provide both network connectivity and electric power for powered devices such as VoIP telephones, wireless access points, and IP security cameras that require 12.95 W or less. The remaining 16 ports provide only network connectivity. You use the standard ports to connect devices that have their own power sources, such as desktop and laptop computers, printers, and servers. Table 20 on page 44 details the topology used in this configuration example.

Table 20: Components of the PoE Configuration Topology

Property	Settings
Switch hardware	Switch with 24 Gigabit Ethernet ports: 8 PoE interfaces (ge-0/0/0 through ge-0/0/7) and 16 non-PoE interfaces (ge-0/0/8 through ge-0/0/23)
VLAN name	default
Connection to a wireless access point (requires PoE)	ge-0/0/0

Table 20: Components of the PoE Configuration Topology *(Continued)*

Property	Settings
Security IP Cameras (require PoE)	ge-0/0/1 and ge-0/0/2 high
Emergency VoIP phone (requires PoE)	ge-0/0/3 high
VoIP phone in Executive Office (requires PoE)	ge-0/0/4 high
Other VoIP phones (require PoE)	ge-0/0/5 through ge-0/0/7
Direct connections to desktop PCs, file servers, integrated printer/fax/copier machines (no PoE required)	ge-0/0/8 through ge-0/0/20
Unused ports (for future expansion)	ge-0/0/21 through ge-0/0/23

Topology

Configuration

IN THIS SECTION

To configure PoE interfaces:

Procedure

CLI Quick Configuration

By default, PoE interfaces are created for all PoE ports and PoE is enabled. The default priority for PoE interfaces is **low**.

To quickly set some interfaces to high priority and to include descriptions of the interfaces, copy the following commands and paste them into the switch terminal window:

```
[edit]
                        set poe interface ge-0/0/1 priority high
telemetries
                        set poe interface ge-0/0/2 priority high
telemetries
                        set poe interface ge-0/0/3 priority high
telemetries
                        set poe interface ge-0/0/4 priority high
telemetries
                        set interfaces ge-0/0/0 description "wireless access
point"
                        set interfaces ge-0/0/1 description "security camera front
door"
                        set interfaces ge-0/0/2 description "security camera back
door"
                        set interfaces ge-0/0/3 description "emergency
phone"
                        set interfaces ge-0/0/4 description "Executive Office VoIP
phone"
                        set interfaces ge-0/0/5 description "staff VoIP
phone"
                        set interfaces  ge-0/0/6 description "staff VoIP
phone"
                        set interfaces  ge-0/0/7 description "staff VoIP
phone"
```

Step-by-Step Procedure

To configure PoE interfaces with different priorities:

1. Set the interfaces connected to high-priority powered devices to high priority. Include the `telemetries` statement for the high-priority interfaces, thus enabling the logging of power consumption on those interfaces:

```
[edit poe]
user@switch# set interface ge-0/0/1 priority high telemetries
user@switch# set interface ge-0/0/2 priority high telemetries
user@switch# set interface ge-0/0/3 priority high telemetries
```

```
user@switch# set interface ge-0/0/4 priority high telemetries
```

2. Provide descriptions for the PoE interfaces:

```
[edit interfaces]
user@switch# set ge-0/0/0 description "wireless access point"
user@switch# set ge-0/0/1 description "security camera front door"
user@switch# set ge-0/0/2 description "security camera back door"
user@switch# set ge-0/0/3 description "emergency phone"
user@switch# set ge-0/0/4 description "Executive Office VoIP phone"
user@switch# set ge-0/0/5 description "staff VoIP phone"
user@switch# set ge-0/0/6 description "staff VoIP phone"
user@switch# set ge-0/0/7 description "staff VoIP phone"
```

3. Connect the wireless access point to interface ge-0/0/0. This interface uses the default PoE settings.
4. Connect the two security cameras to interfaces ge-0/0/1 and ge-0/0/2. These interfaces are set to high priority with telemetries enabled.
5. Connect the emergency VoIP phone to interface ge-0/0/3. This interface is set to high priority with telemetries enabled.
6. Connect the Executive Office VoIP phone to interface ge-0/0/4. This interface is set to high priority with telemetries enabled.
7. Connect the staff VoIP phones to ge-0/0/5, ge-0/0/6, and ge-0/0/7. These interfaces use the default PoE settings.

Results

Check the results of the configuration:

```
[edit]
user@switch# show
interfaces {
    ge-0/0/0 {
        description "wireless access point";
        unit 0 {
            family ethernet-switching;
        }
```

```
    }
    ge-0/0/1 {
        description "security camera front door";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/2 {
        description "security camera back door";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/3 {
        description "emergency phone";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/4 {
        description "Executive Office VoIP phone";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/5 {
        description "staff VoIP phone";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/6 {
        description "staff VoIP phone";
        unit 0 {
            family ethernet-switching;
        }
    }
    ge-0/0/7 {
        description "staff VoIP phone";
        unit 0 {
            family ethernet-switching;
        }
    }
```

```
}
poe {
    interface all;
    interface ge-0/0/1 {
        priority high;
        telemetries;
    }
    interface ge-0/0/2 {
        priority high;
        telemetries;
    }
    interface ge-0/0/3 {
        priority high;
        telemetries;
    }
    interface ge-0/0/4 {
        priority high;
        telemetries;
    }
}
```

Verification

IN THIS SECTION

To verify that PoE interfaces have been created and are operational, perform the following tasks:

Verifying That the PoE Interfaces Have Been Created with the Correct Priorities

Purpose

Verify that the PoE interfaces on the switch are now set to the correct priority settings.

Action

List all the PoE interfaces configured on the switch:

```
user@switch> show poe interface
Interface Admin        Oper       Max       Priority Power            Class
          status       status     power               consumption
 ge-0/0/0 Enabled      ON         15.4W     Low      7.9W               0
 ge-0/0/1 Enabled      ON         15.4W     High     4.8W               0
 ge-0/0/2 Enabled      ON         15.4W     High     4.8W               0
 ge-0/0/3 Enabled      ON         15.4W     High     3.3W               2
 ge-0/0/4 Enabled      ON         15.4W     High     4.7W               2
 ge-0/0/5 Enabled      ON         15.4W     Low      3.2W               2
 ge-0/0/6 Enabled      ON         15.4W     Low      3.3W               2
 ge-0/0/7 Enabled      ON         15.4W     Low      3.3W               2
```

Meaning

The `show poe interface` command lists PoE interfaces configured on the switch, with their status, priority, power consumption, and class. This output shows that eight PoE interfaces are enabled. Interfaces ge-0/0/1 through ge-0/0/4 are configured as priority **high**. The remaining PoE interfaces are configured with the default priority value of **low**.

SEE ALSO

Troubleshooting PoE Interfaces | 75

Verifying PoE Configuration and Status (CLI Procedure)

IN THIS SECTION

You can verify the Power over Ethernet (PoE) configuration and status on an EX Series switch.

This topic describes how to verify:

PoE Controller Configuration and Status

IN THIS SECTION

Purpose

Verify the PoE controller configuration and status, such as the PoE power budget, total PoE power consumption, power management mode, and the supported PoE standard.

Action

Enter the following command:

```
user@switch> show poe controller
```

Example output for an EX2200 switch:

```
Controller  Maximum   Power         Guard    Management  Status   Lldp
index       power     consumption   band                          Priority
   0        405.00W   130.00W         19W    Class       AT_MODE  Disabled
```

Example output for an EX8200 switch:

```
Controller  Maximum   Power         Guard    Management  Status      Lldp
index       power     consumption   band                           Priority
   3        540.00W   435.25W         0W     Static      AT/AF COMBO  Disabled
   4        915.00W   627.01W        15W     Class       AT/AF COMBO  Disabled
```

Meaning

- For the EX2200 switch—The switch has a PoE power budget of 405 W, of which 130 W were being used by the PoE ports at the time the command was executed. The **Guard band** field shows that 19 W is reserved out of the PoE power budget to protect against spikes in power demand. The power management mode is class. The PoE ports on the switch support PoE+ (IEEE 802.3at).
- For the EX8200 switch—Line card 3 has a PoE power budget of 540 W, of which 435.25 W were being used by the PoE ports on the line card at the time the command was executed. The management mode for line card 3 is static and the line card has a mix of PoE (IEEE 802.3af) and PoE+ (IEEE 802.3at) ports.

  Line card 4 has a PoE power budget of 915 W, of which 627.01 W were being used by the PoE ports on the line card at the time the command was executed. The **Guard band** field shows that 15 W is reserved out of the PoE power budget to protect against spikes in power demand. The management mode for line card 4 is class and the line card has a mix of PoE (IEEE 802.3af) and PoE+ (IEEE 802.3at) ports.

PoE Interface Configuration and Status

IN THIS SECTION

Purpose

Verify that PoE interfaces are enabled and set to the correct maximum power and priority settings. Also verify current operational status and power consumption.

Action

To view configuration and status for all PoE interfaces, enter:

```
user@switch> show poe interface
Interface Admin        Oper       Max       Priority Power            Class
          status       status     power               consumption
 ge-0/0/0 Enabled      ON         15.4W     Low      7.9W               3
 ge-0/0/1 Enabled      ON         25.0W (L) High     4.8W               4
 ge-0/0/2 Enabled      ON         30.0W     High     4.8W               0
 ge-0/0/3 Enabled      ON         7.0W      High     3.3W               2
 ge-0/0/4 Enabled      ON         7.0W      Low      3.3W               2
 ge-0/0/5 Enabled      ON         7.0W      Low      3.2W               2
 ge-0/0/6 Enabled      ON         7.0W      Low      3.3W               2
 ge-0/0/7 Enabled      OFF        30.0W     Low      0.0W               not-
applicable
```

NOTE: The `Max power` value followed by `(L)` indicates that maximum power is allocated from LLDP power negotiation.

To view the configuration and status for the PoE interfaces on an EX6200 or EX8200 line card:

```
user@switch> show poe interface fpc-slot 3
Interface Admin        Oper       Max       Priority Power            Class
          status       status     power               consumption
 ge-3/0/0 Enabled       ON        30.0W     Low      20.3W              4
 ge-3/0/1 Enabled       ON        30.0W     Low      17.8W              4
 ge-3/0/2 Enabled       ON        30.0W     High     16.3W              4
```

```
 ge-3/0/3 Enabled       ON         30.0W     High     16.2W              4
 ge-3/0/4 Enabled       ON         30.0W     Low      25.9W              4
 ge-3/0/5 Enabled       ON         30.0W     Low      10.1W              4
 ge-3/0/6 Enabled       ON         30.0W     Low      16.2W              4
 ge-3/0/7 Enabled       ON         30.0W     Low      6.4W               4
 ge-3/0/8 Enabled       ON         30.0W     Low      5.2W               4
 ge-3/0/9 Enabled       ON         30.0W     Low      5.2W               4
ge-3/0/10 Enabled       ON         30.0W     Low      21.5W              4
ge-3/0/11 Enabled       ON         30.0W     Low      21.7W              4
ge-3/0/12 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/13 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/14 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/15 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/16 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/17 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/18 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/19 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/20 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/21 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/22 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/23 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/24 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/25 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/26 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/27 Enabled       ON         15.4W     Low      9.4W               0
ge-3/0/28 Enabled       ON         15.4W     Low      7.0W               0
ge-3/0/29 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/30 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/31 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/32 Enabled       ON         15.4W     Low      2.0W               1
ge-3/0/33 Enabled       ON         15.4W     Low      2.0W               1
ge-3/0/34 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/35 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/36 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/37 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/38 Enabled       ON         15.4W     Low      2.2W               1
ge-3/0/39 Enabled       ON         15.4W     Low      2.2W               1
```

To view configuration and status for a single PoE interface, enter:

```
user@switch> show poe interface ge-0/0/3
PoE interface status:
```

```
PoE interface                :  ge-0/0/3
Administrative status        : Enabled
Operational status           :  ON
Power limit on the interface : 7.0W
Priority                     : High
Power consumed               : 3.3W
Class of power device        :   2
PoE Mode                     :   802.3at
```

Meaning

The command output shows the status and configuration of interfaces. For example, the interface ge-0/0/3 is administratively enabled. Its operational status is **ON**; that is, the interface is currently delivering power to a connected powered device. The maximum power allocated to the interface is 7.0 W. The interface has a high power priority. At the time the command was executed, the powered device was consuming 3.3 W. The IEEE 802.3af class of the powered device is class 2. If the PoE power management mode is class, the class of the powered device determines the maximum power allocated to the interface, which is 7 W in the case of class 2 devices.

The PoE Mode field indicates that the interface supports IEEE 802.3at.

PoE SNMP Trap Generation Status

IN THIS SECTION

Purpose

Verify the status of the **notification-control** option, which determines whether or not PoE SNMP traps are enabled.

Action

Enter the following command:

```
user@switch> show poe notification-control
FPC slot             Notification-control-status
    0                    OFF
```

Meaning

PoE SNMP traps are not enabled.

PoE Line Card Configuration and Status

IN THIS SECTION

Purpose

Verify the PoE configuration and status for line cards on an EX6200 or EX8200 switch, such as the PoE power allocation and priority for each line card.

Action

Enter the following command:

```
user@switch> show chassis power-budget-statistics
```

Example output for an EX6200 switch:

```
      PSU  0     (EX6200-PWR-AC2500)                :    2500 W   Online
      PSU  1     (EX6200-PWR-AC2500)                :    2500 W   Online
      PSU  2     (EX6200-PWR-AC2500)                :    2500 W   Online
      PSU  3     (EX6200-PWR-AC2500)                :    2500 W   Online
      Total Power supplied by all Online PSUs  :   10000 W
      Power Redundancy Configuration           :     N+1
      Power Reserved for the Chassis           :     500 W
Fan Tray Statistics            Base power    Power Used
FTC  0                         :     300 W      43.04 W
FPC Statistics                  Base power   Power Used   PoE power   Priority
FPC  1   (EX6200-48P)          :     220 W      49.47 W      1440 W       1
FPC  2   (EX6200-48P)          :     220 W      47.20 W       800 W       2
FPC  3   (EX6200-48P)          :     220 W    1493.57 W      1440 W       0
FPC  4   (EX6200-SRE64-4XS)    :     100 W      51.38 W         0 W       0
FPC  5   (EX6200-SRE64-4XS)    :     100 W      50.28 W         0 W       0
FPC  6   (EX6200-48P)          :     220 W      49.38 W       800 W       6
FPC  8   (EX6200-48P)          :     220 W      61.41 W      1440 W       9
FPC  9   (EX6200-48T)          :     150 W      12.49 W         0 W       9

      Total (non-PoE) Power allocated          :    1750 W
      Total Power allocated for PoE            :    5920 W
      Power Available (Redundant case)         :    5750 W
      Total Power Available                    :    2515 W
```

Example output for an EX8200 switch:

```
  PSU  0     (EX8200-AC2K)                :    2000 W  Online
  PSU  1     (EX8200-AC2K)                :    2000 W  Online
  PSU  2     (EX8200-AC2K)                :    2000 W  Online
  PSU  3     (EX8200-AC2K)                :    2000 W  online
  PSU  4     (EX8200-AC2K)                :    2000 W  Online
  Total Power supplied by all Online PSUs  :   10000 W
  Power Redundancy Configuration           :     N+1
  Power Reserved for the Chassis           :    2400 W
  FPC Statistics                            Base power    PoE power   Priority
  FPC  1   (EX8200-48T)                    :     350 W          0 W     15
  FPC  5   (EX8200-2XS-40P)                :     387 W        792 W      0
  FPC  9   (EX8200-48PL)                   :     267 W        915 W     15
  FPC  10  (EX8200-2XS-40T)                :     350 W          0 W      1
```

```
    FPC  12  (EX8200-48T)                  :     350 W          0 W     15

    Total (non-PoE) Power allocated        :    4104 W
    Total Power allocated for PoE          :    1707 W
    Power Available (Redundant case)       :    3896 W
    Total Power Available                  :    4263 W
```

Meaning

- For the EX6200 switch—The total of the PoE power budgets allocated to the line cards in the switch is 5920 W. This figure includes the 37 W of PoE power always included in the base allocation for each line card that supports PoE. For line cards with PoE ports, the `PoE power` field shows the PoE power budget allocated to each line card, along with the line card priority.
- For the EX8200 switch—The total of the PoE power budgets allocated to the line cards in the switch is 1707 W. This figure includes the 37 W of PoE power always included in the base allocation for each line card that supports PoE. For line cards with PoE ports, the `PoE power` field shows the PoE power budget allocated to each line card, along with the line card priority.

Perpetual PoE and Fast PoE

Overview

Power over Ethernet (PoE) facilitates the flow of electric power over data cables. With PoE, powered devices can receive power from the same ports that are used to connect PCs to the network. Perpetual PoE and fast PoE deliver PoE more efficiently and predictably from the power sourcing equipment (PSE) device to the connected powered device (PD).

- Perpetual PoE provides uninterrupted power to connected PDs even when the PSE switch is rebooting.
- With fast PoE, the switch saves PoE power settings across a reboot. It powers on the PD once the PSE starts booting—within a few seconds of switching on power—without waiting for the boot process to complete.

Perpetual PoE and fast PoE are complementary features that work independently of each other. In cases where perpetual PoE cannot maintain uninterrupted power, such as a power cycle or failure, fast PoE helps to restore power to the PDs quickly.

Perpetual PoE does not maintain uninterrupted power in the following cases:

- Power failure or power cycle.
- PoE controller firmware update.
- If LLDP power negotiation is enabled on a PoE interface, power to the PD on that interface will be interrupted even if perpetual POE is configured on the PSE. This is because the the OS must come online before LLDP packet exchanges between the PSE and PD can take place.

NOTE:

- The system PoE LEDs may show as OFF when you reboot the system, even though the PoE power is uninterrupted. This is because the perpetual PoE is enabled in the system. This is a known limitation.
- PoE controller firmware upgrade is not supported when fast PoE is configured.

Perpetual PoE and fast PoE are disabled in the following cases:

- System zeroization.
- USB installation.
- Loading the factory default configuration.

Configuring Perpetual PoE and Fast PoE

To configure perpetual PoE and fast PoE, use the following commands:

- To configure perpetual PoE:

```
[edit]
user@switch# set poe perpetual-poe
```

- To configure fast PoE:

```
[edit]
user@switch# set poe fast-poe
```

CHAPTER 3

Upgrading PoE

Upgrading the PoE Controller Software

IN THIS SECTION

Each Junos OS image for an EX Series switch that supports PoE contains the most recent version of the PoE controller software at the time the Junos OS image was built. When you upgrade Junos OS on your switch, the new image might contain a more recent version of the PoE controller software than is currently running on the PoE controller. You can upgrade your PoE controller software by requesting that the more recent version of the software contained in the Junos OS image be downloaded to the controller.

NOTE: Powered devices are not guaranteed to receive power while the new software is being downloaded to the PoE controller, a process that can take up to 10 minutes. In addition, during the software download, some PoE operational commands, such as **show poe interface**, might not show correct output. We recommend that you upgrade your PoE controller software during a regularly scheduled maintenance window.

NOTE: On an EX8200 Virtual Chassis, you cannot execute PoE commands on the XRE200 External Routing Engine. You can execute PoE commands only on the member EX8200 switches. Use the `request session member` *`member-id`* command to open a CLI session on a member switch.

This topic covers:

Determining Whether the PoE Controller Software Needs Upgrading

To determine whether the version of the PoE controller software supplied with Junos OS is more recent than the version of the software currently running on the PoE controller, enter the following command:

```
user@switch> show poe controller
Controller  Maximum   Power         Guard    Management  Status   Lldp
index       power     consumption   band                          Priority
   0**      405.00W   0.00W          19W     Class       AT_MODE  Disabled
  **New PoE software upgrade available.
 Use 'request system firmware upgrade poe fpc-slot <slot>'
 This procedure will take around 10 minutes (recommended to be performed during maintenance)
```

The **New PoE software upgrade available** text in the output indicates that the PoE controller software is out-of-date and needs to be upgraded.

For Virtual Chassis or switches with PoE line cards, the output of the `show poe controller` command indicates which members of a Virtual Chassis or which PoE line cards have out-of-date PoE controller software:

```
user@switch> show poe controller
Controller  Maximum   Power         Guard    Management   Status      Lldp
index       power     consumption   band                             Priority
   2        130.00W   120.34W         0W     Class        AF_ENHANCE  Disabled
   4**      410.00W   182.80W         0W     Class        AF_MODE     Disabled
  **New PoE software upgrade available.
 Use 'request system firmware upgrade poe fpc-slot slot'
 This procedure will take around 10 minutes (recommended to be performed during maintenance)
```

In the preceding example, member 4 of the Virtual Chassis has an out-of-date PoE controller software.

NOTE: We recommend that all member switches of a Virtual Chassis or all line cards in a switch run the same version of the PoE controller software.

Upgrading the PoE Controller Software

To upgrade the PoE controller software for a standalone switch with built-in PoE interfaces, enter:

```
user@switch> request system firmware upgrade poe fpc-slot 0
Firmware upgrade initiated. Poe Upgrade takes about 10 minutes
Use 'show poe controller' to get the download status
```

To upgrade the PoE controller software on a specific Virtual Chassis member or line card on a switch, enter:

```
user@switch> request system firmware upgrade poe fpc-slot 8
Firmware upgrade initiated. Poe Upgrade takes about 10 minutes
Use 'show poe controller' to get the download status
```

To upgrade the PoE controller software on all members of a Virtual Chassis or all line cards on a switch, enter:

```
user@switch> request system firmware upgrade poe fpc-slot all-members
Firmware upgrade initiated. Poe Upgrade takes about 10 minutes
Use 'show poe controller' to get the download status
```

Monitoring the Upgrade Progress

Use the `show poe controller` command to monitor the progress of the controller software upgrade:

```
user@switch> show poe controller
Controller  Maximum   Power         Guard    Management  Status            Lldp
index       power     consumption   band                                   Priority
   0**      130.00W   0.00W           0W                SW_DOWNLOAD(14%)  Disabled
  **New PoE software upgrade available.
 Use 'request system firmware upgrade poe fpc-slot <slot>'
 This procedure will take around 10 minutes (recommended to be performed during maintenance)
```

The **Status** field is updated during the download process to show the following stages of the download:

- DOWNLOAD_INIT

- SW_DOWNLOAD (*n*%)

When the software upgrade is complete, the **New PoE software upgrade available** text is no longer displayed for the particular FPC.

> **NOTE**: If you are upgrading the PoE controller software to enable enhanced PoE, the Status field for the controller shows AF_ENHANCE after the upgrade completes, indicating that the controller now supports enhanced PoE. The default maximum power per port is not automatically increased as a result of the upgrade—it is still 15.4 W per port. You must explicitly set the maximum power for a port to 18.6 W. Enhanced PoE is supported in Junos OS Release 11.1 or later on EX3200 switches and on EX4200-P or EX4200-T model switches.

Upgrading to IEEE 802.3bt PoE

IN THIS SECTION

IEEE 802.3bt Overview

IN THIS SECTION

The IEEE 802.3bt standard (PoE-bt) increases the amount of power that can be delivered to powered devices over PoE ports. PoE-bt can supply a maximum of 90 W of power by utilizing all four pairs of wire in a standard RJ-45 Ethernet cable.

What's New in IEEE 802.3bt

The IEEE 802.3bt standard includes enhancements to existing PoE functionality such as power management, negotiation and classification. For more information on these features, see "Understanding PoE on EX Series Switches" on page 2.

Four Pair Standard

Previous IEEE PoE standards have used two pairs out of four pairs of twisted wire in an Ethernet cable to deliver power. The pairs used depend on the mode of PoE operation: mode A or mode B. In mode A, PoE delivers power on the same pairs used to deliver data (pair 1-2 and pair 3-6). Mode B separates the power delivery from data delivery by using the spare pairs for power (pair 4-5 and pair 7-8).

PoE-bt is the first IEEE standard to deliver power over all four pairs of wire. Pre-standard implementations that provided power over four pairs, such as PoE-4P, are replaced by this standard.

Power Class Levels

PoE standards define classes of powered devices based on the levels of power that they require. The IEEE 802.3bt standard introduces two new types of PoE powered devices, type 3 and type 4, which add an additional four power class levels (5 through 8). Type 3, which includes classes 5-6, can support up to 60 W of power, and type 4, which includes classes 7-8, can support up to 90 W.

Powered Device Signatures

Before the power sourcing equipment (PSE) can deliver power to a connected powered device (PD), it performs a series of checks on the PD. The first check is known as signature detection. The PSE uses a low voltage to measure the resistance of the PD. If the correct level of resistance is detected, the switch knows that the PD is capable of receiving power. In PoE-bt, signature detection is performed on each set of pairs: the data pair and the spare pair. The connected PD must present a valid signature for each pairset to show that it can accept 4-pair power.

The PSE then performs a connection check to determine if the PD is a single-signature or a dual-signature PD. Single-signature PDs have one signature that applies to both sets of pairs: the data pair and the spare pair. Dual-signature PDs support two signatures, one for each pairset. Dual-signature PDs can support two power channels on a single interface, and each channel can support a different power class.

LLDP Power Negotiation

IEEE 802.3bt supports enhanced power negotiation using Link Layer Discovery Protocol (LLDP). LLDP power negotiation enables the PSE to refine the power allocation to the PD. For example, a PD using LLDP can request a lower amount of power than it was allocated based on its class designation.

PoE-bt extends the set of fields in the LLDP protocol to allow the PSE and PD to exchange information about the maximum amount of power that the PSE has available. This is not an allocation, but can be used to inform the power request from the PD.

Auto-classification

The IEEE 802.3bt standard introduces automatic class functionality. The auto-class feature allows the PSE to determine the actual maximum power drawn by the PD. The PSE measures the power consumption of the PD over a defined time period. Based on that measurement, the PSE sets the maximum power output for the PD.

PoE-bt Feature Support

PoE-bt supports the same features as previous versions of PoE, with the exception of the following, which are not supported:

- Static power management mode
- Maximum power configuration
- Guard band

The configuration commands for unsupported features are available in PoE-bt. This is to support configuration of these features in a mixed Virtual Chassis that includes both PoE-at and PoE-bt members.

Table 21 on page 66 explains the PoE-bt behavior when the commands are configured. For a complete list of PoE configuration commands and default settings, see "PoE Configurable Options" on page 29.

Table 21: Behavior for unsupported commands in PoE-bt

Command	PoE-BT Behavior
`management static`	If static mode is configured, the firmware will be set to class mode.
`maximum-power`	If maximum power is configured, the configuration is ignored.

Table 21: Behavior for unsupported commands in PoE-bt *(Continued)*

Command	PoE-BT Behavior
guard-band	Value is fixed to 1 W. If another value is configured, the configuration is ignored.

Upgrading to PoE-BT

Upgrading to a Junos OS release that supports PoE-bt does not enable PoE-bt. You must explicitly enable PoE-bt by upgrading the PoE controller software.

To upgrade the PoE controller software to PoE-bt, use the following command:

```
user@switch> request system firmware upgrade poe fpc-slot slot-number poe-bt-firmware
```

Verifying the Upgrade

To verify that the upgrade was successful, check the PoE firmware version. The PoE firmware should be upgraded to 3.0 or higher for PoE-bt.

To check the firmware version, use the following command:

```
user@switch> show chassis firmware detail
```

Example output before the upgrade:

```
user@switch> show chassis firmware detail
FPC 0
   PoE firmware            2.1.1.19.3
   Boot Firmware
      uboot                ***
Boot Firmware
      loader               FreeBSD/i386 bootstrap loader 1.2
```

Example output after the upgrade:

```
user@switch> show chassis firmware detail
FPC 0
   PoE firmware            3.4.8.0.26
   Boot Firmware
      U-Boot                ***
   Boot Firmware
      loader                FreeBSD/i386 bootstrap loader 1.2
```

When you have verified the firmware version, you must reboot the switch to enable PoE-bt. After the reboot, verify that PoE-bt mode is in effect using the following command:

```
user@switch> show poe controller
Controller  Maximum   Power        Guard  Management   Status    Lldp
 index      power     consumption  band                         Priority
   0        1315W     135.00W      0W       Class     BT_MODE   Disabled
```

Rollback to PoE-AT

If you load a version of Junos OS that does not support PoE-bt, an alarm will be raised:

```
user@switch> show chassis alarms
1 alarms currently active
Alarm time                Class    Description
2019-07-31 08:47:18 UTC    Major    Junos Version does not support POE 802.3bt standard, POE
Firmware Downgrade Required !!
```

In this case, you must rollback the PoE firmware to PoE-at.

To rollback to PoE-at, use the following command:

```
user@switch> request system firmware upgrade poe fpc-slot slot-number poe-at-firmware
```

Verify the rollback using the same procedure described in "Verifying the Upgrade" on page 67.

CHAPTER 4

Monitoring and Troubleshooting PoE

Monitoring and Troubleshooting PoE

IN THIS SECTION

Monitoring PoE Power Consumption (CLI Procedure)

IN THIS SECTION

You can monitor Power over Ethernet (PoE) power consumption, both for the switch as a whole and for individual PoE interfaces.

This topic describes how to monitor:

PoE Power Consumption on a Switch

IN THIS SECTION

Purpose

Determine the current PoE power consumption on a switch.

Action

Enter the following command:

```
user@switch> show poe controller
Controller  Maximum   Power         Guard    Management  Status   Lldp
index       power     consumption   band                          Priority
   0        405.00W   130.00W         0W     Class       AT_MODE  Disabled
```

Meaning

At the time the command was executed, the PoE interfaces on the switch were consuming 130 W out of the PoE power budget of 405 W.

Current Power Consumption for PoE Interfaces

IN THIS SECTION

Purpose

Determine the current power consumption for individual PoE interfaces.

Action

To monitor the power consumption of all PoE interfaces on the switch, use the following command:

```
user@switch> show poe interface
Interface Admin        Oper        Max       Priority Power            Class
          status       status      power              consumption
```

```
 ge-0/0/0 Enabled       ON         15.4W     Low      7.4W               0
 ge-0/0/1 Enabled       ON         15.4W     High     12.0W              0
 ge-0/0/2 Enabled       ON         15.4W     Low      12.4W              0
 ge-0/0/3 Enabled       ON         7.0W      Low      5.3W               2
 ge-0/0/4 Enabled       ON         4.0W      Low      4.0W               1
 ge-0/0/5 Enabled       ON         7.0W      Low      6.1W               2
 ge-0/0/6 Enabled       ON         15.4W     Low      12.3W              3
 ge-0/0/7 Disabled      Disabled   0.0W      Low      0.0W               not-
applicable
```

To monitor the power consumption of the PoE interfaces on a specific EX6200 or EX8200 line card, use the following command:

```
user@switch> show poe interface fpc-slot 3
Interface Admin        Oper        Max       Priority Power             Class
          status       status      power               consumption
 ge-3/0/0 Enabled       ON         30.0W     Low      20.3W                4
 ge-3/0/1 Enabled       ON         30.0W     Low      17.8W                4
 ge-3/0/2 Enabled       ON         30.0W     High     16.3W                4
 ge-3/0/3 Enabled       ON         30.0W     High     16.2W                4
 ge-3/0/4 Enabled       ON         30.0W     Low      25.9W                4
 ge-3/0/5 Enabled       ON         30.0W     Low      10.1W                4
 ge-3/0/6 Enabled       ON         30.0W     Low      16.2W                4
 ge-3/0/7 Enabled       ON         30.0W     Low      6.4W                 4
 ge-3/0/8 Enabled       ON         30.0W     Low      5.2W                 4
 ge-3/0/9 Enabled       ON         30.0W     Low      5.2W                 4
ge-3/0/10 Enabled       ON         30.0W     Low      21.5W                4
ge-3/0/11 Enabled       ON         30.0W     Low      21.7W                4
ge-3/0/12 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/13 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/14 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/15 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/16 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/17 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/18 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/19 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/20 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/21 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/22 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/23 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/24 Enabled       ON         15.4W     Low      9.4W                 0
ge-3/0/25 Enabled       ON         15.4W     Low      9.4W                 0
```

```
ge-3/0/26 Enabled       ON         15.4W     Low      9.4W                0
ge-3/0/27 Enabled       ON         15.4W     Low      9.4W                0
ge-3/0/28 Enabled       ON         15.4W     Low      7.0W                0
ge-3/0/29 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/30 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/31 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/32 Enabled       ON         15.4W     Low      2.0W                1
ge-3/0/33 Enabled       ON         15.4W     Low      2.0W                1
ge-3/0/34 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/35 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/36 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/37 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/38 Enabled       ON         15.4W     Low      2.2W                1
ge-3/0/39 Enabled       ON         15.4W     Low      2.2W                1
```

To monitor the power consumption of an individual PoE interface (for example, ge-0/0/3), use the following command:

```
user@switch> show poe interface ge-0/0/3
PoE interface status:
PoE interface                :  ge-0/0/3
Administrative status        : Enabled
Operational status           :  ON
Power limit on the interface : 7.0W
Priority                     : Low
Power consumed               : 5.3W
Class of power device        :   2
PoE Mode                     : 802.3at
```

Meaning

At the time the command was executed, the individual PoE ports were consuming the amount of power shown. For example, interface ge-0/0/3 was consuming 5.3 W at the time the command was executed.

Power Consumption for PoE Interfaces over Time

IN THIS SECTION

Purpose

Monitor the power consumption of a PoE interface over a period of time. The records collected remain available for future viewing.

You can specify the intervals at which power consumption data is collected, from once every minute to once every 30 minutes. The default is once every 5 minutes. You can also specify the duration over which the records are collected, from 1 hour (default) to 24 hours.

Action

To collect historical records of PoE interface power consumption and display those records:

1. Add the `telemetries` statement to the PoE interface configuration:

```
[edit]
user@switch# set poe interface ge-0/0/5 telemetries interval 10
```

   When you commit the configuration, record collection begins.

2. Display the collected records:

```
user@switch> show poe telemetries interface ge-0/0/5 count all
Sl No    Timestamp                Power    Voltage
   1     03-19-2010 13:00:07 UTC  3.9W     50.9V
   2     03-19-2010 12:50:07 UTC  3.9W     50.9V
   3     03-19-2010 12:40:07 UTC  3.9W     50.9V
   4     03-19-2010 12:30:07 UTC  3.9W     50.9V
   5     03-19-2010 12:20:07 UTC  3.9W     50.9V
   6     03-19-2010 12:10:07 UTC  3.9W     50.9V
```

To start another session of record collection on the interface, you must delete the existing telemetries configuration on the interface and then reconfigure telemetries. Deleting the telemetries configuration also clears the power consumption history data.

To clear the history of PoE power consumption without deleting the telemetries configuration, use the command **clear poe telemetries interface**.

Meaning

Over the hour in which the PoE power consumption data on ge-0/0/5 was collected, the connected powered device consistently consumed 3.9 W.

Troubleshooting PoE Interfaces

IN THIS SECTION

Problem: No Power supply to powered device

Problem Description

A Power over Ethernet (PoE) interface is not supplying power to the powered device.

Solution

Check for the items shown in Table 22 on page 75.

Table 22: Troubleshooting a PoE Interface

Items to Check	Explanation
Is the switch a full PoE model or a partial PoE model?	If you are using a partial PoE model, only interfaces ge-0/0/0 through ge-0/0/7 can function as PoE ports.
Has PoE capability been disabled for that interface?	Use the `show poe interface` command to check PoE interface status.

Table 22: Troubleshooting a PoE Interface *(Continued)*

Items to Check	Explanation
Is the cable properly seated in the port socket?	Check the hardware.
Has the PoE power budget been exceeded for the switch?	Use the `show poe controller` command to check the PoE power budget and consumption for the switch.
Does the powered device require more power than is available on the interface?	Use the `show poe interface` command to check the maximum power provided by the interface.
If the **telemetries** option has been enabled for the interface, check the history of power consumption.	Use the `show poe telemetries` command to display the history of power consumption.

Problem: All powered devices going down after PSU hot swap

Problem Description

When you are hot swapping a PSU, all the powered devices are going down.

If you are hot swapping (inserting a PSU and removing redundant PSU) within a period less than 25 secs, then you will observe all the power devices going down.

Solution

It is recommended to insert the redundant PSU, wait for at least 35 secs, and then remove the desired PSU.

5

CHAPTER

Configuration Statements and Operational Commands

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Junos CLI Reference Overview

We've consolidated all Junos CLI commands and configuration statements in one place. Learn about the syntax and options that make up the statements and commands and understand the contexts in which you'll use these CLI elements in your network configurations and operations.

- Junos CLI Reference

Click the links to access Junos OS and Junos OS Evolved configuration statement and command summary topics.

- Configuration Statements
- Operational Commands