



CHAPTER 8

Configuring PTP

This chapter describes how to configure the Precision Time Protocol (PTP) on the Cisco IE 3000 switch.

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Understanding PTP

The Precision Time Protocol (PTP), as defined in the IEEE 1588 standard, synchronizes with nanosecond accuracy the real-time clocks of the devices in a network. The clocks are organized into a master-member hierarchy. PTP identifies the switch port that is connected to a device with the most precise clock. This clock is referred to as the master clock. All the other devices on the network synchronize their clocks with the master and are referred to as members. Constantly exchanged timing messages ensure continued synchronization.

PTP is particularly useful for industrial automation systems and process control networks, where motion and precision control of instrumentation and test equipment are important.

You can globally configure the switch to pass PTP packets through the switch as normal multicast traffic (forward mode), to synchronize all switch ports with the grand master clock (end-to-end transparent mode), or you can configure boundary clock mode, where the switch participates in selecting the best master clock and can act as the master clock if no better clocks are detected.

When the switch is in PTP forward or end-to-end transparent mode, no PTP configuration is available except configuring PTP mode to another mode. You can only configure per-port PTP when the switch is in boundary mode.

Configuring PTP

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Default Configuration

By default, PTP is enabled on all the Fast Ethernet and Gigabit Ethernet ports on the base switch module. Only the ports on the base switch module are PTP-capable. The switch expansion modules do not support PTP. The default PTP mode on all ports is end-to-end transparent.

Table 8-1 *Default PTP Configuration*

Feature	Default Setting
PTP boundary mode	Disabled
PTP forward mode	Disabled
PTP transparent mode	Enabled
PTP priority1 and PTP priority2	Default priority number is 128
PTP announce interval	2 seconds
PTP announce timeout	8 seconds
PTP delay request interval	32 seconds
PTP sync interval	1 second
PTP sync limit	500000000 nanoseconds

Setting Up PTP

Beginning in privileged EXEC mode, follow these steps to set up PTP:

	Command	Purpose
Step 1	configure terminal	Enter global configuration mode.
Step 2	ptp {mode {boundary e2transparent forward} priority1 <i>value</i> priority2 <i>value</i>}	<p>Set the synchronization clock.</p> <ul style="list-style-type: none"> • Select boundary mode to enable the switch to participate in selecting the best master clock. If no better clocks are detected, the switch becomes the grandmaster clock on the network and the parent clock to all connected devices. If the best master is determined to be a clock connected to the switch, the switch synchronizes to that clock as a child to the clock, then acts as a parent clock to devices connected to other ports. After initial synchronization, the switch and the connected devices exchange timing messages to correct time skew caused by clock offsets and network delays. <p>Use this mode when overload or heavy load conditions produce significant delay jitter.</p> <ul style="list-style-type: none"> • Select e2transparent (end-to-end transparent) mode for the switch to synchronize all switch ports with the grand master clock connected to the switch,. This is the default clock mode. The switch corrects for the delay incurred by every packet passing through it (referred to <i>residence time</i>). <p>This mode causes less jitter and error accumulation than boundary mode.</p> <ul style="list-style-type: none"> • Select forward mode for incoming PTP packets to pass through the switch as normal multicast traffic. This disables both boundary and end-to-end transparent mode. <p>When the switch port is in boundary mode, set the clock priority properties.</p> <ul style="list-style-type: none"> • Specify the priority1 value to override the default criteria (clock quality, clock class, etc.) for best master clock selection. Lower values take precedence. The range for both is from 0 to 255. The default is 128. • Specify a priority2 value to be used as a tie-breaker between two devices that are otherwise equally matched in the default criteria. For example, you can use priority2 value to give a specific switch priority over other identical switches. The range for both is from 0 to 255. The default is 128. <p>These values set the clock priority on the PTP network for the purpose of best master selection.</p>
Step 3	interface <i>interface-id</i>	<p>Specify an interface to configure, and enter interface configuration mode.</p> <p>Enter the number of the switch port, including port type (such as <i>Fa</i> for Fast Ethernet and <i>Gi</i> for Gigabit Ethernet), the base switch number (1), and the specific port number. For example: <i>Fa1/1</i> is Fast Ethernet port 1 on the base switch.</p>

	Command	Purpose
Step 4	ptp { announce { <i>interval value</i> timeout <i>value</i> } delay-req { <i>interval value</i> enable sync { <i>interval value</i> limit <i>value</i> } }	Specify the settings for the timing messages. These options are only available when the switch is in boundary mode. <ul style="list-style-type: none"> For <i>announce interval</i>, specify the time for sending announce messages. The range is 0 to 4 seconds. The default is 1 (2 seconds). For <i>timeout value</i>, specify the time for announcing timeout messages. The range is 2 to 10 seconds. The default is 3 (8 seconds). For <i>delay request interval</i>, specify the time recommended to the member devices to send delay request messages when the port is in the master state. The range is -1 second to 6 seconds. The default is 5 (32 seconds). For <i>sync interval</i>, enter the time for sending synchronization messages. The range is -1 second to 1 second. The default is 1 second. For <i>sync limit</i>, specify the maximum clock offset value before PTP attempts to resynchronize. The range is 50 to 500000000 nanoseconds. The default is 500000000 nanoseconds.
Step 5	end	Return to privileged EXEC mode.
Step 6	show running-config	Verify your entries.
Step 7	copy running-config startup-config	(Optional) Save your entries in the configuration file.

Displaying the PTP Configuration

To display the PTP configuration, use one or more of these privileged EXEC commands in [Table 8-2](#).

Table 8-2 Commands for Displaying the PTP Configuration

Command	Purpose
show ptp clock	Display the PTP clock properties.
show ptp foreign-master-record	Display the PTP foreign-master dataset.
show ptp parent	Display the parent and grand-master properties.
show ptp port	Display all the PTP port properties.
show ptp FastEthernet <i>interface</i>	Display the PTP FastEthernet properties on the specified port.
show ptp GigabitEthernet <i>interface</i>	Display the PTP GigabitEthernet properties on the specified port.
show ptp time-property	Display the PTP time properties.