Configuring PTP

This chapter describes how to configure the Precision Time Protocol (PTP) on Cisco NX-OS devices.

This chapter includes the following sections:

About PTP

PTP is a time synchronization protocol defined in IEEE 1588 for nodes distributed across a network. With PTP, it is possible to synchronize distributed clocks with an accuracy of less than 1 microsecond via Ethernet networks. In addition, PTP's hardware timestamping feature provides timestamp information in the ERSPAN Type III header that can be used to calculate packet latency among edge, aggregate, and core switches.

A PTP system can consist of a combination of PTP and non-PTP devices. PTP devices include ordinary clocks, boundary clocks, and transparent clocks. Non-PTP devices include ordinary network switches, routers, and other infrastructure devices.

PTP is a distributed protocol that specifies how real-time PTP clocks in the system synchronize with each other. These clocks are organized into a master-slave synchronization hierarchy with the grandmaster clock, which is the clock at the top of the hierarchy, determining the reference time for the entire system. Synchronization is achieved by exchanging PTP timing messages, with the members using the timing information to adjust their clocks to the time of their master in the hierarchy. PTP operates within a logical scope called a PTP domain.

PTP supports the following functionality:

- Multicast and unicast PTP transport—In the multicast transport mode, PTP uses multicast destination IP address 224.0.1.129 as per IEEE 1588 standards for communication between devices. For the source

IP address, it uses the user configurable global IP address under the PTP domain. In the unicast transport mode, PTP uses configurable unicast source and destination IP addresses that can be configured under an interface. In both, the unicast and the multicast modes, PTP uses UDP ports, 319 for event messages and 320 for general messages communication between devices.

- Clock mode (two step and one step)—In the Two-step mode, PTP master sends follow-up messages to pass on the precise transmit timestamp for sync messages. Where as in the One-step mode, no follow up message is used because the sync message itself contains the transmit timestamp as well as the correction filed to obtain the precise transmit timestamp.
- PTP interfaces types—PTP is supported on L3 and L2 SVI interface types. PTP multicast mode is supported on both, the L3 and L2 SVI interface types. However, unicast PTP is supported only on the L3 interface type. For L3/L2 SVI Port-channel interface types, PTP must be configured under the member interfaces.
- PTP encapsulation over UDP over IP—PTP uses UDP as the transport protocol over IP. In both, the unicast and multicast modes, PTP uses UDP ports 319 for event messages and 320 for general messages communication between devices. L2 encapsulation mode is not supported.
- PTP profiles—PTP supports default (1588) , AES67, and SMPTE 2059-2 profiles. They all have different ranges of sync and delay request intervals. For information on the default profile, refer to IEEE 1588. For more information on AES67 and SMPTE 2059-2, refer to the respective specifications.
- Path delay measurement—We support delay request and response mechanism to measure the delay between the master and slave devices. Peer delay request and response mechanism is not supported.
- Message intervals—You can configure the interval at which the announce, syn,c and delay request messages needs to be sent between devices.
- Best master clock (BMC) selection—BMC algorithm is used to select master, slave, and passive states of the PTP enabled interfaces based on the Announce message received as per 1588 specification.

PTP Device Types

Clocks

The following clocks are common PTP devices:

Ordinary clock

Communicates with the network based on a single physical port, similar to an end host. An ordinary clock can function as a grandmaster clock.

Boundary clock

Typically has several physical ports, with each port behaving like a port of an ordinary clock. However, each port shares the local clock, and the clock data sets are common to all ports. Each port decides its individual state, either master (synchronizing other ports connected to it) or slave (synchronizing to a downstream port), based on the best clock available to it through all of the other ports on the boundary clock. Messages related to synchronization and establishing the master-slave hierarchy terminate in the protocol engine of a boundary clock and are not forwarded.

Transparent clock

Forwards all PTP messages like an ordinary switch or router but measures the residence time of a packet in the switch (the time that the packet takes to traverse the transparent clock) and in some cases the link delay of the ingress port for the packet. The ports have no state because the transparent clock does not need to synchronize to the grandmaster clock.

There are two kinds of transparent clocks:

End-to-end transparent clock

Measures the residence time of a PTP message and accumulates the times in the correction field of the PTP message or an associated follow-up message.

Peer-to-peer transparent clock

Measures the residence time of a PTP message and computes the link delay between each port and a similarly equipped port on another node that shares the link. For a packet, this incoming link delay is added to the residence time in the correction field of the PTP message or an associated follow-up message.

Note PTP operates only in boundary clock mode. Cisco recommends deployment of a Grand Master Clock (10 MHz) upstream, with servers containing clocks requiring synchronization connected to the switch.

End-to-end transparent clock and peer-to-peer transparent clock modes are not supported.

PTP Process

The PTP process consists of two phases: establishing the master-slave hierarchy and synchronizing the clocks.

Within a PTP domain, each port of an ordinary or boundary clock follows this process to determine its state:

- Examines the contents of all received announce messages (issued by ports in the master state)
- Compares the data sets of the foreign master (in the announce message) and the local clock for priority, clock class, accuracy, and so on
- Determines its own state as either master or slave

After the master-slave hierarchy has been established, the clocks are synchronized as follows:

- The master sends a synchronization message to the slave and notes the time it was sent.
- The slave receives the synchronization message and notes the time that it was received. For every synchronization message, there is a follow-up message. Hence, the number of sync messages should be equal to the number of follow-up messages.
- The slave sends a delay-request message to the master and notes the time it was sent.
- The master receives the delay-request message and notes the time it was received.
- The master sends a delay-response message to the slave. The number of delay request messages should be equal to the number of delay response messages.
- The slave uses these timestamps to adjust its clock to the time of its master.

High Availability for PTP

Stateful restarts are supported for PTP. After a reboot or a supervisor switchover, the running configuration is applied. For more information on high availability, see the Cisco Nexus 9000 Series NX-OS High Availability and Redundancy Guide.

Licensing Requirements for PTP

Product	**License Requirement**
Cisco NX-OS	PTP requires no license. Any feature not included in a license package is bundled with the nx-os image and is provided at no extra charge to you. For a complete explanation of the Cisco NX-OS licensing scheme, see the Cisco NX-OS Licensing Guide.

Guidelines and Limitations for PTP

- To match PTP control packets using RACL, enable PIM on the L3 interface.
- When PTP is configured on a Cisco Nexus 9000 series switch, set the clock protocol to use PTP through the**clock protocol ptp vdc 1** command. NTP cannot coexist with PTP on a Cisco Nexus 9000 series switch.
- PTP is supported for all Cisco Nexus 9000 Series and 3164Q hardware except for the 100G 9408PC line card and the 100G M4PC generic expansion module (GEM).
- Beginning with Cisco NX-OS Release 9.2(3), PTP is supported on the N9K-C9504-FM-R.
- The **ptp correction-range**, **ptp correction-range logging**, and **ptp mean-path-delay** commands are not supported on the Cisco Nexus 9508-R line cards.
- For Cisco Nexus 31108PC-V and 31108TC-V switches, PTP is not supported on ports running at 100G speed.
- For Cisco Nexus 9300 and 9500 Series switches, PTP clock correction is expected to be in the 3-digit range, from 100 to 999 nanoseconds. For Cisco Nexus 9200 and 9300-EX Series switches, PTP clock correction is expected to be in the 1- to 2-digit range, from 1 to 99 nanoseconds.
- PTP operates only in boundary clock mode. End-to-end transparent clock and peer-to-peer transparent clock modes are not supported.
- PTP supports transport over User Datagram Protocol (UDP). Transport over Ethernet is not supported.
- PTP supports multicast communication. PTP also supports unicast communication and the unicast mode is optional.
- Cisco Nexus 9000 Series switches support mixed non-negotiated mode of operation on master PTP ports. Meaning that when a slave client sends unicast delay request PTP packet, the Cisco Nexus 9000 responds with an unicast delay response packet. And, if the slave client sends multicast delay request PTP packet, the Cisco Nexus 9000 responds with a multicast delay response packet. For mixed non-negotiated mode

to work, the source IP address used in the `ptp source <IP address>` configuration on the BC device must also be configured on any physical or logical interface of the BC device. The recommended best practice is to use the loopback interface of the device.

- Cisco Nexus 9000 Series switches support mixed non-negotiated mode of operation on master PTP ports. Meaning that when a slave client sends unicast delay request PTP packet, the Cisco Nexus 9000 responds with an unicast delay response packet. And, if the slave client sends multicast delay request PTP packet, the Cisco Nexus 9000 responds with a multicast delay response packet.
- Beginning with Cisco NX-OS Release 9.2(1), Cisco N9K-X9732C-EX, N9K-X9736C-EX, and N9K-X97160YC-EX line cards support PTP offloading.
- PTP Offloading is not supported on the Cisco Nexus 9508 switch with an -R series line card.
- PTP offloading is not supported on the Cisco N3K-C36180YC-R and N3K-C3636C-R line cards.
- Beginning with Cisco NX-OS Release 9.2(1), Cisco N9K-X9636C-RX, N9K-X9636C-R, and N9K-X9636Q-R line cards support IEEE 802.1AS. IEEE 802.1AS is not supported on the Cisco N9K-X96136YC-R line card or the Cisco Nexus 9504.
- Cisco Nexus 93108TC-EX and 93180YC-EX switches support PTP mixed mode and unicast mode. The Cisco Nexus 9396 switch supports PTP mixed mode.
- PTP is not supported on the Cisco N9K-X96136YC-R line card.
- PTP is not supported on the Cisco Nexus 9504 switch with an -R series line card.
- PTP is supported with sync interval “-3” only Cisco Nexus 9508-R family Line Cards, higher sync intervals are not supported.
- PTP is supported with sync interval “-2” only on Cisco Nexus N3K-C36180YC-R and N3K-C3636C-R series line card, higher sync intervals are not supported.
- PTP unicast is supported only on the default vrf.
- PTP supports unicast communication on Cisco Nexus 9508 switches with N9K-X9636C-R, N9K-X9636C-RX, and N9K-X9636Q-R line cards.
- For PTP to work, you must use the latest SUP and LC FPGA versions.
- PTP unicast mode on the Layer2 SVI interfaces is not supported on Cisco Nexus 9508 switches with N9K-X9636C-R, N9K-X9636C-RX, and N9K-X9636Q-R line cards.
- PTP configuration with UC and MC on either sides is not supported on Cisco Nexus 9508 switches with N9K-X9636C-R and N9K-X9636Q-R line cards.
- Forwarding PTP management packets is supported on Cisco Nexus 9508 switches with N9K-X9636C-R, N9K-X9636C-RX, and N9K-X9636Q-R line cards.
- PTP One Step is not supported on the Cisco Nexus 9508 switch with an -R series line card.
- PTP is limited to a single domain per network.
- All management messages are forwarded on ports on which PTP is enabled. Handling management messages is not supported.
- PTP is not supported on FEX interfaces.

- PTP-capable ports do not identify PTP packets and do not time-stamp or redirect those packets unless you enable PTP on those ports.
- PTP can be enabled on port-channel member ports.
- Cisco N9K-X9732C-EX, N9K-X9736C-EX, and N9K-X97160YC-EX line cards support timestamp tagging.
- We recommend that the PTP device can either have multicast or unicast PTP mode configured, but not both multicast and unicast mode together.
- We recommend that you have the one-step or two-step PTP in the PTP device and the associated downstream switches.

Default Settings for PTP

The following table lists the default settings for PTP parameters.

Table 1: Default PTP Parameters

Parameters	Default
PTP	Disabled
PTP version	2
PTP domain	0
PTP priority 1 value when advertising the clock	255
PTP priority 2 value when advertising the clock	255
PTP announce interval	1 log second
PTP announce timeout	3 announce intervals
PTP delay-request interval	• 0 log seconds • -1 log seconds for Cisco Nexus 3232C, 3264Q, and 9500 platform switches
PTP sync interval	• -2 log seconds • -3 log seconds for Cisco Nexus 3232C, 3264Q, and 9500 platform switches
PTP VLAN	gPTP supports only default vlan 1, and no other user configured VLANs.

Configuring PTP

Configuring PTP Globally

You can enable or disable PTP globally on a device. You can also configure various PTP clock parameters to help determine which clock in the network has the highest priority to be selected as the grandmaster.

Note You must always set the clock protocol ptp vdc1 for the local clock to be updated by the PTP protocol, irrespective of the one-step or the two-step mode. You can verify the configuration using the **show running-config clock_manager** command.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **feature ptp** **Example:** `switch(config)# feature ptp`	Enables or disables PTP on the device. **Note** Enabling PTP on the switch does not enable PTP on each interface.
Step 3	[**no**] **ptp device-type** [**generalized-ptp** | **boundary-clock**] **Example:** `switch(config)# ptp device-type generalized-ptp`	Configures the device type as gPTP or boundary clock. The **generalized-ptp** option is available only for Cisco Nexus 9508 switches with an -R series line card.
Step 4	[**no**] **ptp source** *ip-address* **Example:** `switch(config)# ptp source 10.10.10.1`	Configures the source IPv4 address for all the PTP packets in the multicast PTP mode.
Step 5	(Optional) [**no**] **ptp domain** *number* **Example:** `switch(config)# ptp domain 1`	Configures the domain number to use for this clock. PTP domains allow you to use multiple independent PTP clocking subdomains on a single network. The range for the *number* is from 0 to 128.
Step 6	(Optional) [**no**] **ptp priority1** *value* **Example:** `switch(config)# ptp priority1 1`	Configures the priority1 value to use when advertising this clock. This value overrides the default criteria (clock quality, clock class, etc.) for best master clock selection. Lower values take precedence.

	Command or Action	Purpose
		The range for the *value* is from 0 to 255.
Step 7	(Optional) [**no**] **ptp priority2** *value* **Example:** `switch(config)# ptp priority2 1`	Configures the priority2 value to use when advertising this clock. This value is used to decide between two devices that are otherwise equally matched in the default criteria. For example, you can use the priority2 value to give a specific switch priority over other identical switches. The range for the *value* is from 0 to 255.
Step 8	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring PTP on an Interface

After you globally enable PTP, it is not enabled on all supported interfaces by default. You must enable PTP interfaces individually.

Before you begin

Make sure that you have globally enabled PTP on the switch and configured the source IP address for PTP communication.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Specifies the interface on which you are enabling PTP and enters the interface configuration mode.

Step 3	[**no**] **ptp** **Example:** `switch(config-if)# ptp`	Enables or disables PTP on an interface in a multicast mode.
Step 4	(Optional) [**no**] **ptp announce** {**interval** *log-seconds* | **timeout** *count*} **Example:**	Configures the interval between PTP announce messages on an interface or the number of PTP intervals before a timeout occurs on an interface.

<table>
<tr><th></th><th>Command or Action</th><th>Purpose</th></tr>
<tr><td></td><td><code>switch(config-if)# ptp announce interval 3</code></td><td>The range for the PTP announcement interval is from 0 to 4 log seconds, and the range for the interval timeout is from 2 to 4 intervals.</td></tr>
<tr><td>Step 5</td><td>(Optional) [no] ptp delay-request minimum interval <i>log-seconds</i>
Example:
<code>switch(config-if)# ptp delay-request minimum interval -1</code></td><td>Configures the minimum interval allowed between PTP delay messages when the port is in the master state.
The range is from log(–1) to log(6) seconds, where log(–1) = 1 frame every 2 seconds.</td></tr>
<tr><td>Step 6</td><td>(Optional) [no] ptp delay-request minimum interval [aes67-2015 | smpte-2059-2] <i>log-seconds</i>
Example:
<code>switch(config-if)# ptp delay-request minimum interval aes67-2015-1</code></td><td>Configures the minimum interval allowed between PTP delay messages when the port is in the master state.
<i>Table 2: PTP Delay-Request Minimum Interval Range and Default Values</i>
<table>
<tr><th>Option</th><th>Range</th><th>Default Value</th></tr>
<tr><td>aes67-2015</td><td>–4 to 5 log seconds</td><td>0 log seconds</td></tr>
<tr><td>smpte-2059-2</td><td>–4 to 5 log seconds</td><td>0 log seconds</td></tr>
<tr><td>Without the aes67-2015 or smpte-2059-2 option</td><td>–1 to 6 log seconds (where –1 = 1 frame every 2seconds)</td><td>0 log seconds</td></tr>
</table></td></tr>
<tr><td>Step 7</td><td>(Optional) [no] ptp sync interval <i>log-seconds</i>
Example:
<code>switch(config-if)# ptp sync interval 1</code></td><td>Configures the interval between PTP synchronization messages on an interface.
The range is from log(–3) to log(1) seconds. For the media-related profile information, see the Cisco NX-OS IP Fabric for Medial Solution Guide when configuring PTP for media.</td></tr>
<tr><td>Step 8</td><td>(Optional) [no] ptp sync interval [aes67-2015 | smpte-2059-2] <i>log-seconds</i>
Example:
<code>switch(config-if)# ptp sync interval aes67 1</code></td><td>Configures the interval between PTP synchronization messages on an interface.
<i>Table 3: PTP Synchronization Interval Range and Default Values</i>
<table>
<tr><th>Option</th><th>Range</th><th>Default Value</th></tr>
<tr><td>aes67-2015</td><td>–4 to 1 log seconds</td><td>–2 log seconds</td></tr>
</table></td></tr>
</table>

	Command or Action	Purpose
		<table><tr><th>Option</th><th>Range</th><th>Default Value</th></tr><tr><td>smpte-2059-2</td><td>–4 to –1 log seconds</td><td>–2 log seconds</td></tr><tr><td>Without the aes67-2015 or smpte-2059-2 option</td><td>–3 to 1 log seconds</td><td>–2 log seconds</td></tr></table>
Step 9	(Optional) [**no**] **ptp vlan** *vlan-id* **Example:** `switch(config-if)# ptp vlan 1`	Specifies the VLAN for the interface where PTP is being enabled. You can only enable PTP on one VLAN on an interface. The range is from 1 to 4094.
Step 10	(Optional) **show ptp brief** **Example:** `switch(config-if)# show ptp brief`	Displays the PTP status.
Step 11	(Optional) **show ptp port interface** *interface slot/port* **Example:** `switch(config-if)# show ptp port interface ethernet 2/1`	Displays the status of the PTP port.
Step 12	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring PTP in Unicast Mode

Configuring Unicast Mode

Traditional PTP messages are delivered to the nodes that are capable of receiving PTP multicast messages. (For example, announce, sync, delay_req, delay_resp and follow_up). In Unicast mode, all PTP messages are delivered only to a particular PTP node. Multicast address is not used. In unicast mode, you can configure master/slave role and assign corresponding peer slave/master IP addresses.

Up to 8 master IPs can be configured for a slave unicast port and 64 slave IPs can be configured for a master port with a maximum 256 slave IP total for all ports. The following commands are used to configure the unicast slave IPs and unicast master IPs. Unicast packets are only sent to and received from these IPs. Packets received from other IPs are ignored.

```
switch(config-if)# ptp transport ipv4 ucast master
switch(config-if-ptp-master)# slave ipv4 10.10.10.2
```

```
switch(config-if)# ptp transport ipv4 ucast slave
switch(config-if-ptp-slave)# master ipv4 10.10.10.1
```

Assigning Master Role

Complete the following steps to assign a master role:

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Specifies the interface on which you are enabling PTP and enters the interface configuration mode.

Step 3	[**no**] **ptp transport ipv4 ucast master**
	Example:
	`switch(config-if)# ptp transport ipv4 ucast master`
	`switch(config-if-ptp-master)#`
		Enables PTP master on a particular port (Layer 3 interface). In the master sub-mode, you can enter the slave IPv4 addresses.

Step 4	**slave ipv4** *<IP_address>*
	Example:
	`switch-1(config)# interface ethernet 1/1`
	`switch-1(config-if)# ptp transport ipv4 ucast master`
	`switch-1(config-if-ptp-master)# slave ipv4 1.2.3.1`
	`switch-1(config-if-ptp-master)# slave ipv4 1.2.3.2`
	`switch-1(config-if-ptp-master)# slave ipv4 1.2.3.3`
	`switch-1(config-if-ptp-master)# slave ipv4 1.2.3.4`
	`switch-1(config-if-ptp-master)#`
		Enters the slave IPv4 addresses. Maximum of 64 IP addresses are allowed per master, but this number varies and it depends on the sync interval configuration. The master sends announce, sync, follow-up, and delay_resp only to these slave addresses. You have to make sure that the slave IP is reachable.

Assigning Slave Role

Complete the following steps to assign a slave role:

Procedure

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

	Command or Action	Purpose
	`switch# configure terminal` `switch(config)#`	

Step 2	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Specifies the interface on which you are enabling PTP and enters the interface configuration mode.

Step 3	[**no**] **ptp transport ipv4 ucast slave**
	Example:
	`switch(config-if)# ptp transport ipv4 ucast slave`
	`switch(config-if-ptp-slave)#`
		Enables PTP slave on a particular port (Layer 3 interface). In the slave sub-mode, you can enter the master IPv4 addresses.

Step 4	**master ipv4** *<IP_address>*
	Example:
	`switch-1(config)# interface ethernet 1/1`
	`switch-1(config-if)# ptp transport ipv4 ucast slave`
	`switch-1(config-if-ptp-slave)# master ipv4 4.4.4.1`
	`switch-1(config-if-ptp-slave)# master ipv4 4.4.4.2`
	`switch-1(config-if-ptp-slave)# master ipv4 4.4.4.3`
		Enters the master IPv4 addresses. Maximum of 64 IP addresses are allowed per master, but this number varies and it depends on the sync interval configuration. The master sends announce, sync, follow-up, and delay_resp only to these slave addresses. You have to make sure that the slave IP is reachable. Maximum of 8 IP addresses are allowed per slave. The announce, sync, and follow-up messages are received only from the configured master and all other are rejected. This slave sends a delay request to the best master among the configured masters. You have to make sure that the master IP is reachable.

Configuring Unicast Source Address

Complete the following steps to configure unicast source address:

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Specifies the interface on which you are enabling PTP and enters the interface configuration mode.

Step 3	**ptp transport ipv4 ucast slave | master**	Configures PTP in slave or master mode.

	Command or Action	Purpose

Step 4	[**no**]**ptp ucast-source**
	Example:
	`switch(config-if)# ptp ucast-source`
	`A.B.C.D  IPv4 address (A.B.C.D) of source`
		You can configure PTP source address per interface level. This IP address is used only for unicast PTP messages. You have to make sure that the PTP unicast source IP address is reachable.

Timestamp Tagging

The timestamp tagging feature provides precision time information to track in real time when packets arrive at remote devices. Packets are truncated and timestamped using PTP with nanosecond accuracy. Using the TAP aggregation functionality on the switch, along with the Cisco Nexus Data Broker, you can copy the network traffic using SPAN, filter and timestamp the traffic, and send it for recording and analysis.

Configuring Timestamp Tagging

You can configure timestamp tagging for Cisco Nexus 9200 and 9300-EX Series switches

Note Configuring timestamp tagging is not supported on Cisco Nexus 9508 switches with N9K-X9636C-R, N9K-X9636C-RX, and N9K-X9636Q-R line cards.

Before you begin

Make sure that you have globally enabled PTP offloading.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface** *type slot/port*
	Example:
	`switch(config)# interface ethernet 2/2`
	`switch(config-if)#`
		Enters interface configuration mode for the specified interface.

Step 3	[**no**] **ttag** **Example:** `switch(config-if)# ttag`	Configures timestamp tagging on the Layer 2 or Layer 3 egress interface.

Configuring the TTAG Marker Packets and Time Interval

You can configure timestamp tagging for Cisco Nexus 9200 and 9300-EX Series switches

The ttag timestamp field attaches a 48-bit timestamp on the marker packet. This 48-bit timestamp is not a human familiar ASCII based timestamp. To make thsi 48-bit timestamp human readable, the ttag market packet can be used to provide additional information to decode the 48-bit timestamp information.

Field	**Position (byte:bit)**	**Length**	**Definition**
Magic		64	By default, this field displays A6A6A6A6A6A6A6A6. This enables to identify ttag-marker packets on the packet stream.
Version		8	Version number. The default version is 1.
Granularity		8	This field is 32-bit based hardware timestamp value of the switch. By default, the value is 00, which is 100 picoseconds or 0.1 nanoseconds.
UTc_offset		8	The utc_offset between the ASIC and the UTC clocks. The default value is 0.
Timestamp_hi		32	The high 16-bit of 48- bit ASIC hardware timestamp.
Timestamp_lo		32	The low 32-bit of 48- bit ASIC hardware timestamp.
UTC sec		32	The seconds part of UTC timestamp from the CPU clock of the Cisco Nexus 9000 Series switch.
UTC usec		32	The microseconds part of UTC timestamp from the CPU clock of the Cisco Nexus 9000 Series switch.
Reserved		32	Reserved for future use.
Signature		32	The default value is 0xA5A5A5A5. This allows a forward search of marker packet and provide references to the UTC timestamp, so the client software can use that reference UTC to recover the 32-bit hardware timestamp in each packet header.

Pad		8	This is align byte to convert the ttag-marker align to 4 byte boundary.

Before you begin

Make sure that you have globally enabled PTP offloading.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface** *type slot/port*
	Example:
	`switch(config)# interface ethernet 2/2`
	`switch(config-if)#`
		Enters interface configuration mode for the specified interface.

Step 3	[**no**] **ttag-marker enable** **Example:** `switch(config-if)# ttag-marker enable`	Sends the ttag-marker packets to the outgoing port.
Step 4	**ttag-marker-interval 90** **Example:** `switch(config-if)# ttag-marker enable`	Configures the seconds that a switch will take to send a ttag-marker packet to the outgoing ports. This is a global to the switch. By default, it sends a ttag-marker packet every 60 seconds.

Verifying the PTP Configuration

Use one of the following commands to verify the configuration:

Table 4: PTP Show Commands

Command	Purpose
show ptp brief	Displays the PTP status.
show ptp clock	Displays the properties of the local clock, including clock identity.
show ptp clock foreign-masters-record	Displays the state of foreign masters known to the PTP process. For each foreign master, the output displays the clock identity, basic clock properties, and whether the clock is being used as a grandmaster.
show ptp corrections	Displays the last few PTP corrections.

Command	Purpose
show ptp counters [**all** | **interface ethernet** *slot/port*]	Displays the PTP packet counters for all interfaces or for a specified interface.
show ptp parent	Displays the properties of the PTP parent.
show ptp port interface ethernet *slot/port*	Displays the status of the PTP port on the switch.
show ptp time-property	Displays the PTP clock properties.
show running-config ptp [**all**]	Displays the running configuration for PTP.
clear ptp counters [**all** | **interface ethernet** *slot/port*]	Clears all PTP messages that are received and transmitted on a specific interface or on all interfaces that has PTP enabled.

Configuration Examples for PTP

This example shows how to configure PTP globally on the device, specify the source IP address for PTP communications, and configure a preference level for the clock:

```
switch# configure terminal
switch(config)# feature ptp
switch(config)# ptp source 10.10.10.1
switch(config)# ptp priority1 1
switch(config)# ptp priority2 1
switch(config)# show ptp brief
PTP port status
-----------------------
Port State
------- --------------
switch(config)# show ptp clock
PTP Device Type: Boundary clock
Clock Identity : 0:22:55:ff:ff:79:a4:c1
Clock Domain: 0
Number of PTP ports: 0
Priority1 : 1
Priority2 : 1
Clock Quality:
  Class : 248
  Accuracy : 254
  Offset (log variance) : 65535
Offset From Master : 0
Mean Path Delay : 0
Steps removed : 0
Local clock time:Mon Dec 22 14:13:24 2014
```

This example shows how to configure PTP on an interface and configure the intervals for the announce, delay-request, and synchronization messages:

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# ptp
switch(config-if)# ptp announce interval 3
```

```
switch(config-if)# ptp announce timeout 2
switch(config-if)# ptp delay-request minimum interval -1
switch(config-if)# ptp sync interval 1
switch(config-if)# show ptp brief
PTP port status
-----------------------
Port State
------- --------------
Eth2/1 Master
switch(config-if)# show ptp port interface ethernet 2/1
PTP Port Dataset: Eth2/1
Port identity: clock identity: 0:22:55:ff:ff:79:a4:c1
Port identity: port number: 1028
PTP version: 2
Port state: Master
Delay request interval(log mean): 4
Announce receipt time out: 2
Peer mean path delay: 0
Announce interval(log mean): 3
Sync interval(log mean): 1
Delay Mechanism: End to End
Peer delay request interval(log mean): 0
```

This example shows how to configure master/slave role and assign corresponding peer slave/master IP addresses.

```
switch-1(config)# interface ethernet 1/1
switch-1(config-if)# ptp transport ipv4 ucast master
switch-1(config-if-ptp-master)# slave ipv4 1.2.3.1
switch-1(config-if-ptp-master)# slave ipv4 1.2.3.2
switch-1(config-if-ptp-master)# slave ipv4 1.2.3.3
switch-1(config-if-ptp-master)# slave ipv4 1.2.3.4
switch-1(config-if-ptp-master)#

switch-1(config-if)# ptp transport ipv4 ucast slave
switch-1(config-if-ptp-slave)# master ipv4 4.4.4.1
switch-1(config-if-ptp-slave)# master ipv4 4.4.4.2
switch-1(config-if-ptp-slave)# master ipv4 4.4.4.3


switch-1(config-if-ptp-slave)# ptp ucast-source 9.9.9.9


switch-1(config-if)# sh running-config ptp

!Command: show running-config ptp
!Time: Tue Feb  7 17:37:09 2017

version 7.0(3)I4(6)
feature ptp

ptp source 1.1.1.1


interface Ethernet1/1
  ptp transport ipv4 ucast master
    slave ipv4 1.2.3.1
    slave ipv4 1.2.3.2
    slave ipv4 1.2.3.3
    slave ipv4 1.2.3.4

interface Ethernet1/2
```

```
  ptp transport ipv4 ucast slave
    master ipv4 4.4.4.1
    master ipv4 4.4.4.2
    master ipv4 4.4.4.3
  ptp ucast-source 9.9.9.9

switch-1(config-if)#
```

Additional References

Related Documents

Related Topic	**Document Title**
ERSPAN	Configuring ERSPAN
1588 IEEE	1588 IEEE standards and https: www.smpte.org www.aes.org