

IEEE 1588v2 PTP Support

IEEE 1588v2 Precision Time Protocol (PTP) is a packet-based two-way message exchange protocol for synchronizing clocks between nodes in a network, thereby enabling an accurate time distribution over a network.This document explains how to configure IEEE 1588v2 PTP on the Cisco ASR 1002-X Routers.

- Restrictions for IEEE 1588v2 PTP, on page 1
- Information About IEEE 1588v2 PTP , on page 1
- Configuring IEEE 1588v2 PTP, on page 9
- Additional References, on page 20
- Feature Information for IEEE 1588v2 PTP Support, on page 21

Restrictions for IEEE 1588v2 PTP

These are the restrictions for configuring IEEE 1588v2 PTP:

- Supports IPv4 unicast mode, but not multicast mode.
- Does not support Dot1q, Q-in-Q, and port-channel interfaces.
- Primary PTP supports only a maximum of 32 secondary PTP.
- PTP boundary clock is supported only in unicast negotiation mode.
- IPv6 and Multiprotocol Label Switching (MPLS) encapsulation are not supported for PTP packet transfer over Cisco ASR 1002-X Routers.
- The time-of-day recovered from a 1588v2 session does not synchronize with the system clock.
- GPS interfaces can be used only for clock recovery. You cannot transmit the system clock on the GPS interface.

Information About IEEE 1588v2 PTP

IEEE 1588v2 PTP is a packet-based two-way message exchange protocol for synchronizing a local clock with a primary reference clock in a hierarchical primary-secondary architecture. This synchronization is achieved through packets that are transmitted and received in a session between a primary reference clock and a secondary clock. IEEE 1588v2 PTP supports system-wide synchronization accuracy in the sub-microsecond range with little use of network and local clock-computing resources.

The following sections describe the terminologies used for better understanding of the IEEE 1588v2 PTP.

PTP Clocks

PTP employs a hierarchy of clock types to ensure that precise timing and synchronization is maintained between the source and the numerous PTP clients that are distributed throughout the network. A logical grouping of PTP clocks that synchronize with each other using the PTP protocol, but are not necessarily synchronized to the PTP clocks in another domain, is called a PTP domain.

The three PTP clock types are Ordinary clock, Boundary clock, and Transparent clock.

- **Ordinary clock**—This clock type has a single PTP port in a domain, and maintains the timescale used in the domain. It may serve as a source of time, that is, be a primary, or may synchronize to another clock by being a subordinate. It provides time to an application or to an end device.
- **Boundary clock**—This clock type has multiple PTP ports in a domain, and maintains the timescale used in the domain. It may serve as a source of time, that is, be a primary, or may synchronize to another clock by being a subordinate. A boundary clock, that is secondary, has a single slave port, and transfers timing from that port to the primary ports.
- **Transparent clock**—This clock type is a device that measures the time taken for a PTP event message to pass through the device, and provides this information to the clocks receiving this PTP event message.

{start cross reference}Table 13-1{end cross reference} shows the 1588v2 PTP support matrix on a Cisco ASR1000 platform.

Table 1: 1588v2 PTP Support Matrix on a Cisco ASR1000 platform

Platform/PTP Clock mode	Ordinary Clock	Boundary Clock	Transparent Clock	Hybrid Clock
ASR1002X	Yes	Yes	No	No

Components of a PTP-enabled Network

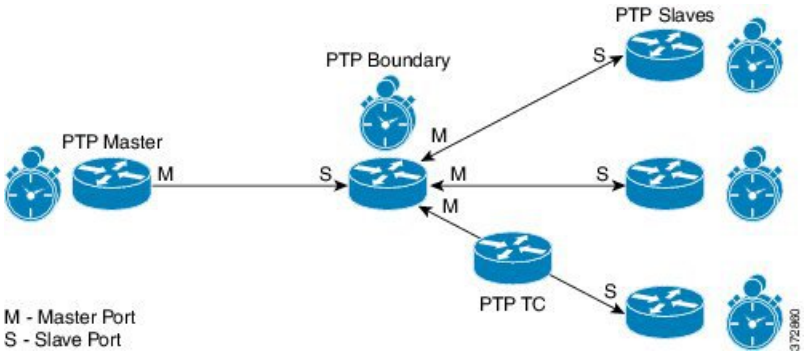
The three key components of a PTP-enabled data network are primary reference, PTP client, and PTP-enabled router acting as a Boundary clock.

- **Primary Reference**—An IEEE1588v2 PTP network needs a primary reference to provide a precise time source. The most economical way of obtaining the precise time source for the primary reference is through a Global Positioning System (GPS) because it provides +/- 100 nanosecond (ns) accuracy. First, the PTP primary reference's built-in GPS receiver converts the GPS timing information to PTP time information, which is typically Coordinated Universal Time (UTC), and then delivers the UTC time to all the PTP clients.
- **PTP client**—A PTP client has to be installed on servers, network-monitoring and performance-analysis devices, or other devices that want to use the precise timing information provided by PTP, and it's mostly an ordinary clock. The two kinds of PTP clients are pure software PTP clients and hardware-assistant PTP clients.
- **PTP boundary clock**—Any router that is between a PTP primary and PTP secondary can act as a PTP boundary clock router. It has two interfaces, one facing the PTP primary and another facing the PTP secondary. The boundary clock router acts as a *secondary* on the interface facing the *PTP primary router* , and acts as a *primary* on the interface facing the *PTP secondary router* . The PTP boundary clock router is deployed to minimize timing delay in cases where the distance between PTP primary router and the PTP secondary router is more.

Note Intermediary nodes between PTP primary and secondary should be a PTP-enabled or transparent clock node.

The following figure shows the functions of a PTP Enabled device.

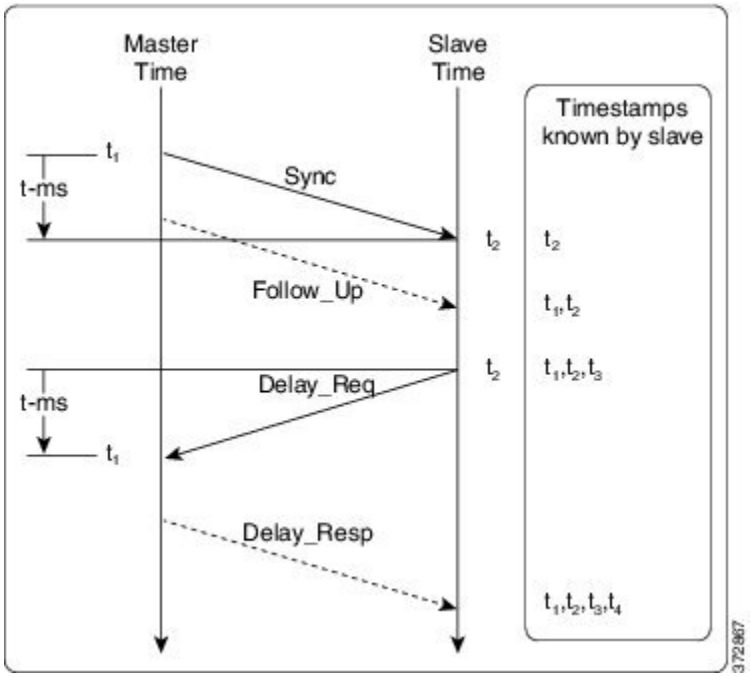
Figure 1: 372860.eps Functions of a PTP-Enabled Device



Clock-Synchronization Process

Clock synchronization is achieved through a series of messages exchanged between the primary clock and the secondary clock as shown in the figure.

Figure 2: Clock-Synchronization Process



After the primary-secondary clock hierarchy is established, the clock synchronization process starts. The message exchange occurs in this sequence:

1. The primary clock sends a Sync message. The time at which the Sync message leaves the primary is time-stamped as t{start subscript}1{end subscript}.
2. The secondary clock receives the Sync message and is time-stamped as t{start subscript}2{end subscript}.
3. The secondary sends the Delay_Req message, which is time-stamped as t{start subscript}3{end subscript} when it leaves the secondary, and as t{start subscript}4{end subscript} when the primary receives it.
4. The primary responds with a Delay_Resp message that contains the time stamp t{start subscript}4{end subscript}.

The clock offset is the difference between the primary clock and the secondary clock, and is calculated as follows:

Offset = t{start subscript}2{end subscript} - t{start subscript}1{end subscript} - meanPathDelay

IEEE1588 assumes that the path delay between the primary clock and the secondary clock is symmetrical, and hence, the mean path delay is calculated as follows:

meanPathDelay = ((t{start subscript}2{end subscript} - t{start subscript}1{end subscript}) + (t{start subscript}4{end subscript} - t{start subscript}3{end subscript}))/2

PTP Messages

All PTP communication is performed through message exchange. The two sets of messages defined by IEEE1588v2 are General messages and Event messages.

- **General messages**—These messages do not require accurate time stamps, and are classified as Announce, Follow_Up, Delay_Resp, Pdelay_Resp_Follow_Up, Management, and Signaling.
- **Event messages**—These messages require accurate time stamping, and are classified as Sync, Delay_Req, Pdelay_Req, and Pdelay_Resp.

PTP Clocking Modes

The following are the PTP clocking modes supported on a Cisco ASR 1002-X Router:

- **Unicast Mode**—In unicast mode, the primary sends the Sync or Delay_Resp messages to the secondary on the unicast IP address of the secondary, and the secondary in turn sends the Delay_Req message to the primary on the unicast IP address of the primary.
- **Unicast Negotiation Mode**—In unicast negotiation mode, the primary does not know of any secondary until the secondary sends a negotiation message to the primary. The unicast negotiation mode is good for scalability purpose because one primary can have multiple secondary.

PTP Accuracy

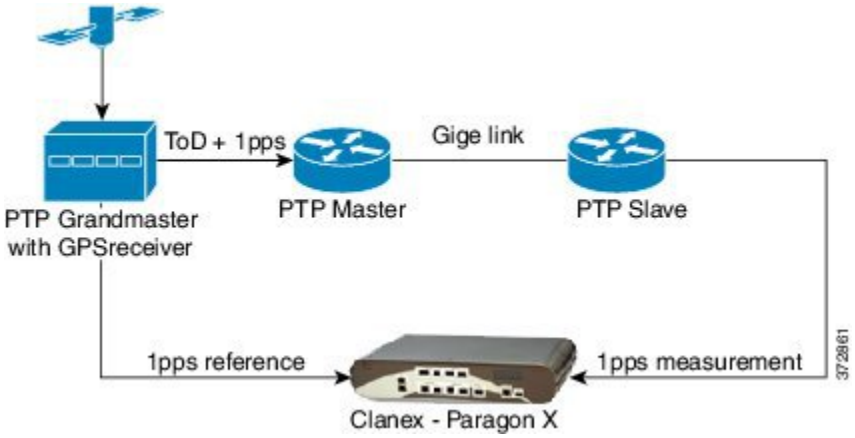
Accuracy is an important aspect of PTP implementation on an Ethernet port. For a packet network, Packet Delay Variation (PDV) is one of the key factors that impacts the accuracy of a PTP clock. The Cisco ASR 1002-X Router can handle the PDV of the network with its advanced hardware and software capabilities, such as hardware stamping and special high-priority queue for PTP packets. It can provide around 300 ns accuracy in a scalable deployment scenario.

The two methods used on the same topology to cross-check and verify the results are:

- One-pulse-per-second (1PPS) to verify the secondary PTP.
- Maximum Time Interval Error (MTIE) and Time Deviation (TDEV) to verify the PDV.

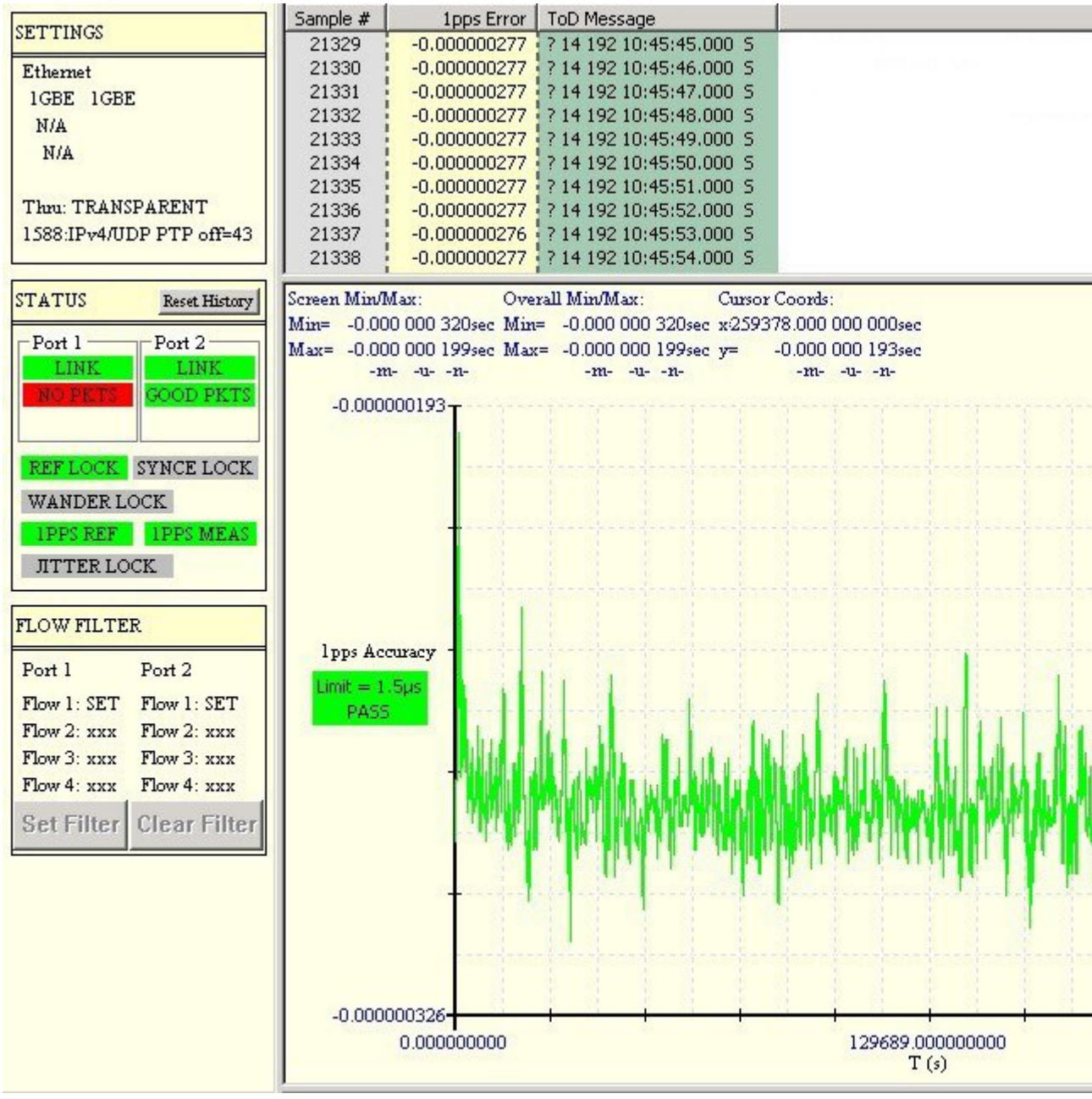
The verification topology includes a primary reference with a GPS receiver, a Cisco ASR 1002-X Router, PTP hardware secondary reference clocks with 1PPS output, and a test equipment for the measurement.

Figure 3: 1PPS Accuracy Measurement



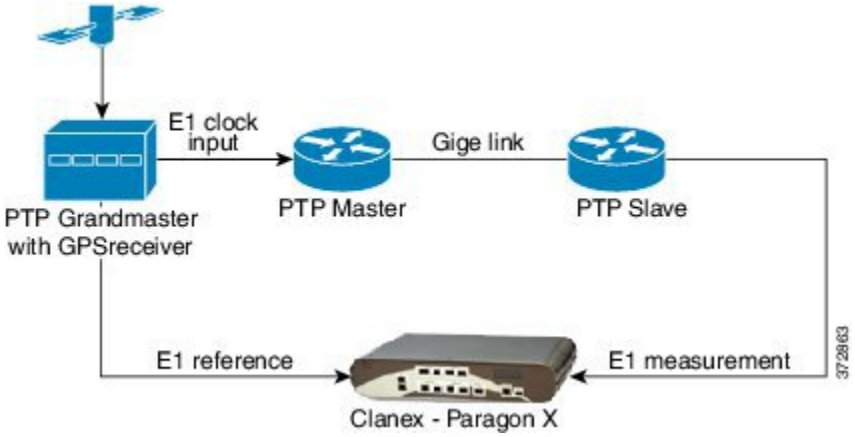
The following figure shows the PPS accuracy, with time of day measured using the test equipment as per the topology shown in the following figure. The average PPS accuracy value found is 250 ns.

Figure 4: Graph Showing PPS Accuracy



{start cross reference}Figure 13-5{end cross reference} shows a topology that includes a primary reference with a GPS receiver, a Cisco ASR 1002-X Router, PTP hardware secondary reference clocks, and a test equipment for the MTIE and TDEV measurement.

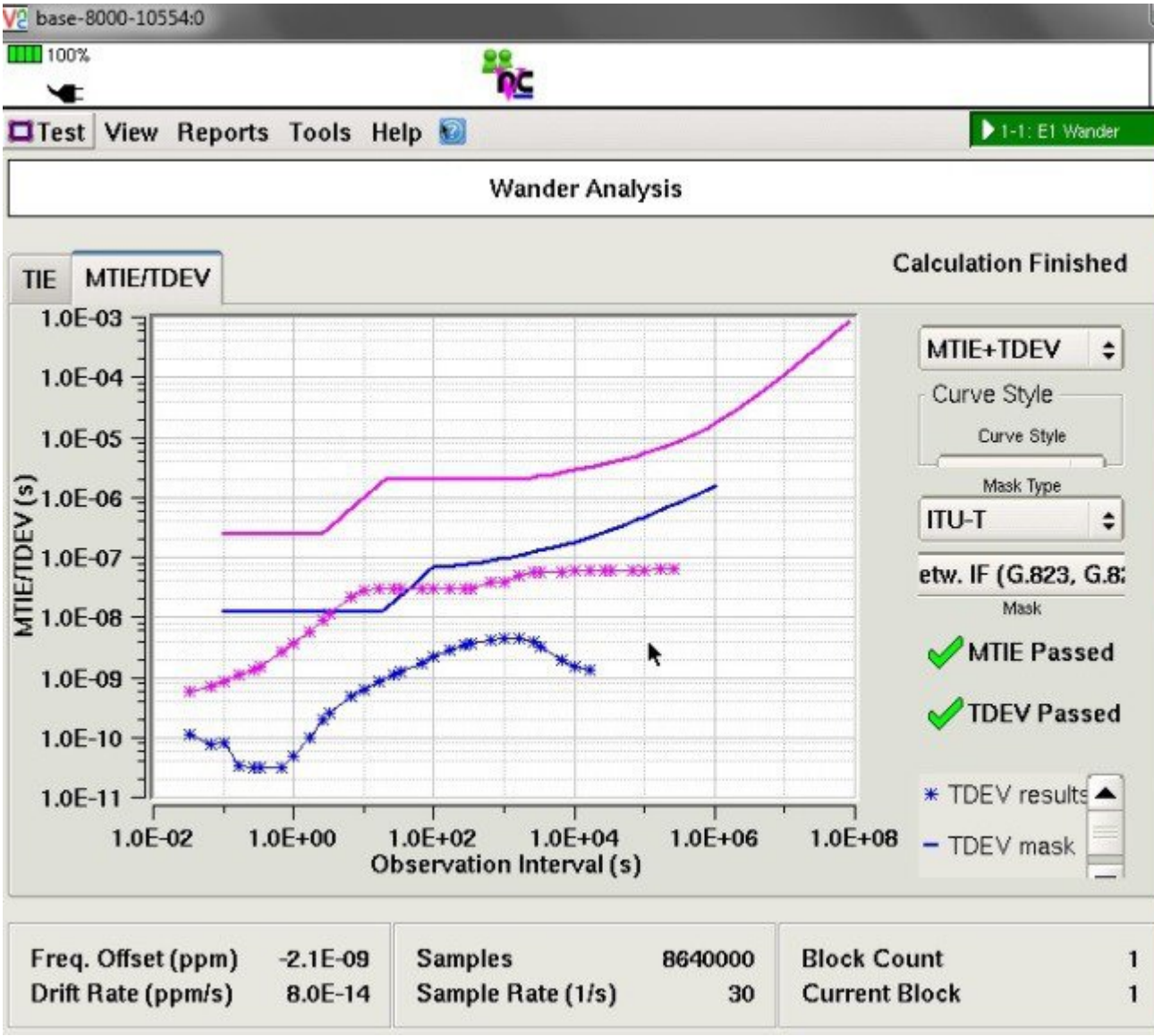
Figure 5: MTIE and TDEV measurement



{start cross reference}Figure 13-6{end cross reference} shows a graph with the MTIE and TDEV measurements to verify the PDV.

IEEE 1588v2 PTP Support

Figure 6: Graph to show MTIE and TDEV Measurement



IEEE 1588v2 PTP Support

IEEE 1588v2 PTP supports these features on a Cisco ASR1002-X Router:

- Two-step Ordinary clock and Boundary clock.
- Hardware-assistant PTP implementation to provide sub-300 ns accuracy.
- PTP operation on all physical onboard Gigabit Ethernet interfaces.
- Supports built-in Gigabit Ethernet links in two-step clock mode.

Configuring IEEE 1588v2 PTP

You can configure IEEE 1588v2 PTP features on the Cisco ASR 1002-X Router by performing the following procedures:

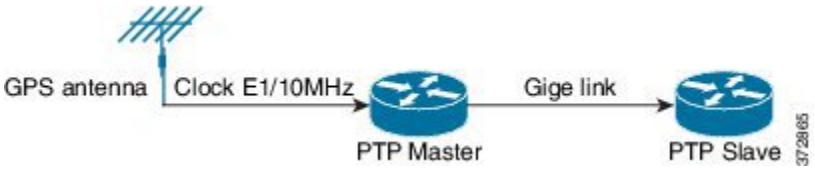
Configuring Input or Output Network Clocking

We recommend that you configure a stable input clock source from a GPS device before configuring primary PTP. The GPS device acts as a PTP primary reference, and the BITS or 10-MHz port of a Cisco ASR 1002-X Router can be used to input or output the network clock. Perform these tasks to configure network clocking on a Cisco ASR 1002-X Router:

Configuring an Ordinary Clock

You can configure a Cisco ASR 1002-X Router in Ordinary clock mode as either primary or secondary.

Figure 7: Ordinary Clock Scenario with a GPS Device as Primary Reference



Perform these tasks to configure an ordinary clock as either primary or secondary:

Configuring an Ordinary Clock as Primary PTP

This section describes how to configure an ordinary clock as primary PTP.

SUMMARY STEPS

1. **configure terminal**
2. **ptp clock ordinary domain** *domain_number*
3. **clock-port** *name* **master**
4. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**
5. **clock destination** *ip-address*
6. **sync interval** *interval*
7. **end**

DETAILED STEPS

Procedure

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

	Command or Action	Purpose
	`Router# configure terminal`	
Step 2	**ptp clock ordinary domain** *domain_number* **Example:** `Router(config)# ptp clock ordinary domain 0`	Creates a PTP clock and specifies the clock mode.
Step 3	**clock-port** *name* **master** **Example:** `Router(config-ptp-clk)# clock-port MASTER master`	Specifies the clocking mode of a PTP port and enters the clock port configuration mode.
Step 4	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:** `Router(config-ptp-port)# transport ipv4 unicast interface Loopback11 negotiation`	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets. The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchange negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.
Step 5	**clock destination** *ip-address* **Example:** `Router(config-ptp-port)# clock destination 20.20.20.20`	Specifies the IP address of a PTP clock destination. If the clock port is set to primary mode with unicast negotiation, you need not use this command because the device uses negotiation to determine the IP address of PTP slave devices.
Step 6	**sync interval** *interval* **Example:** `Router(config-ptp-port)# sync interval -4`	(Optional) Specifies the interval used to send PTP synchronization messages. The default value is -5.
Step 7	**end** **Example:** **Example:** `Router(config-ptp-port)# end`	Exits global configuration mode.

Examples

The following example shows how to configure an ordinary clock as primary PTP:

```
Router# configure terminal
Router(config)# ptp clock ordinary domain 0
Router(config-ptp-clk)# clock-port MASTER master
Router(config-ptp-port)# transport ipv4 unicast interface
```

```
Loopback11
 negotiation
Router(config-ptp-port)# clock destination
20.20.20.20
Router(config-ptp-port)# Sync interval

-4
Router(config-ptp-port)# end
```

Configuring an Ordinary Clock as Secondary PTP

This section describes how to configure Ordinary Clock as secondary PTP.

SUMMARY STEPS

1. **configure terminal**
2. ptp clock ordinary domain domain_number
3. clock-port *name* slave
4. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**
5. **clock source** *ip-address*
6. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	ptp clock ordinary domain domain_number **Example:** `Router(config)# ptp clock ordinary domain 0`	Creates a PTP clock and specifies the clock mode.
Step 3	clock-port *name* slave **Example:** `Router(config-ptp-clk)# clock-port SLAVE slave`	Specifies the clocking mode of a PTP port and enters the clock port configuration mode.
Step 4	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:** `Router(config-ptp-port)# transport ipv4 unicast interface Loopback22 negotiation`	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets. The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchanges negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.

	Command or Action	Purpose
Step 5	**clock source** *ip-address* **Example:** `Router(config-ptp-port)# clock source 10.10.10.10`	Specifies the source IP address of a primary PTP clock. **Note** You can specify only 1 primary clock IP address. Priority-based clock source selection is not supported.
Step 6	**end** **Example:** `Router(config-ptp-port)# end`	Exits global configuration mode.

Examples

The following example shows how to configure an ordinary clock as secondary PTP:

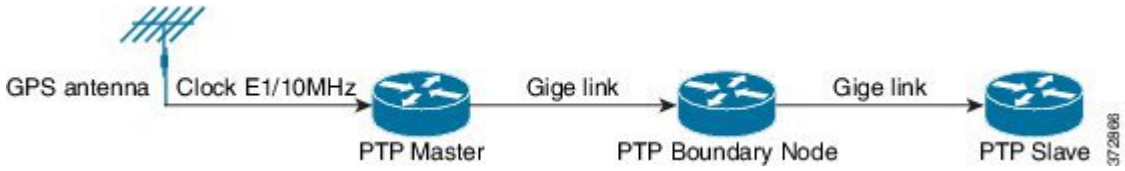
```
Router# configure terminal
Router(config)# ptp clock ordinary domain 0
Router(config-ptp-clk)# clock-port SLAVE master
Router(config-ptp-port)# transport ipv4 unicast interface
Loopback22
 negotiation
Router(config-ptp-port)# clock source
10.10.10.10
Router(config-ptp-port)# end
```

Configuring a Boundary Clock

You can configure the primary PTP and secondary PTP in a boundary clock topology as shown in the figure in the same way that you configure a primary and secondary in ordinary clock mode. This section describes how to configure a Cisco ASR 1002-X Router in boundary clock mode.

Note Currently, boundary clock supports only unicast negotiation mode.

Figure 8: PTP Boundary Clock Scenario



SUMMARY STEPS

1. **configure terminal**
2. ptp clock boundary domain domain_number
3. clock-port *name* slave
4. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**

5. **clock source** *ip-address*
6. **exit**
7. clock-port *name* master
8. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**
9. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	ptp clock boundary domain domain_number **Example:** `Router(config)# ptp clock boundary domain 0`	Creates a PTP clock and specifies the clock mode.
Step 3	clock-port *name* slave **Example:** `Router(config-ptp-clk)# clock-port SLAVE slave`	Specifies the clocking mode of a PTP port and enters the clock port configuration mode.
Step 4	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:** `Router(config-ptp-port)# transport ipv4 unicast interface Loopback11 negotiation`	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets. The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchange negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.
Step 5	**clock source** *ip-address* **Example:** `Router(config-ptp-port)# clock source 10.10.10.10`	Specifies the source IP address of a PTP master clock. **Note** You can specify only one primary clock IP address. Priority-based clock source selection is not supported.
Step 6	**exit** **Example:** `Router(config-ptp-port)# exit`	Exits clock port configuration mode.

	Command or Action	Purpose
Step 7	clock-port *name* master **Example:** `Router(config-ptp-clk)# clock-port MASTER master`	Specifies the clocking mode of a PTP port and enters clock port configuration mode.
Step 8	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:** `Router(config-ptp-port)# transport ipv4 unicast interface Loopback10 negotiation`	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets. The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchange negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.
Step 9	**end** **Example:** **Example:** `Router(config-ptp-port)# end`	Exits global configuration mode.

Examples

The following example shows how to configure a boundary clock:

```
Router# configure terminal
Router(config)# ptp clock ordinary domain 0
Router(config-ptp-clk)# clock-port SLAVE slave
Router(config-ptp-port)# transport ipv4 unicast interface
Loopback11
 negotiation
Router(config-ptp-port)# clock source
10.10.10.10
Router(config-ptp-port)# exit
Router(config-ptp-clk)# clock-port MASTER master
Router(config-ptp-port)# transport ipv4 unicast interface
Loopback10
 negotiation
Router(config-ptp-port)# end
```

Configuring Time of Day

A Cisco ASR 1002-X Router can exchange time of day and 1PPS input with an external device, such as a GPS receiver, using the time of day and 1PPS input and output interfaces on the router.

Perform these tasks to configure Time of Day (ToD) messages on the Cisco ASR 1002-X Router:

Configuring Input Time-of-Day Messages

This section describes how to configure input time-of-day messages.

Note You can configure time-of-day input only in a primary PTP clock port.

SUMMARY STEPS

1. **configure terminal**
2. ptp clock ordinary domain domain_number
3. **tod {R0 | R1} {cisco | ntp}**
4. **input [1pps] { R0 | R1 }**
5. clock-port *name* master
6. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**
7. **clock destination** *ip-address*
8. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	ptp clock ordinary domain domain_number **Example:** `Router(config)# ptp clock ordinary domain 0`	Creates a PTP clock and specifies the clock mode.
Step 3	**tod {R0 | R1} {cisco | ntp}** **Example:** **Example:** `Router(config-ptp-clk)# tod R0 ntp`	Configures the time-of-day message format used by the 1PPS or BITS interface. **Note** Currently, only R0 1PPS port is supported; R1 is not valid. Also, only ntp mode is supported, not cisco mode.
Step 4	**input [1pps] { R0 | R1 }** **Example:** `Router(config-ptp-clk)# input 1pps R0`	Enables PTP input clocking using a 1.544-Mhz, 2.048-Mhz, or 10-Mhz timing interface, or phase using the 1PPS or RS-422 interface. **Note** Currently, only R0 1PPS port is supported; R1 is not valid.
Step 5	clock-port *name* master **Example:**	Specifies the clocking mode of a PTP port and enters the clock port configuration mode.

	Command or Action	Purpose
	`Router(config-ptp-clk)# clock-port MASTER master`	
Step 6	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:** `Router(config-ptp-port)# transport ipv4 unicast interface Loopback11 negotiation`	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets. The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchange negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.
Step 7	**clock destination** *ip-address* **Example:** `Router(config-ptp-port)# clock destination 20.20.20.20`	Specifies the IP address of a PTP clock destination. If the clock port is set to primary mode with unicast negotiation, you need not use this command because the device uses negotiation to determine the IP address of secondary PTP devices.
Step 8	**end** **Example:** `Router(config-ptp-port)# end`	Exits global configuration mode.

What to do next

Examples

The following example shows how to configure input time-of-day messages:

```
Router# configure terminal
Router(config)# ptp clock ordinary domain 0
Router(config-ptp-clk)# tod R0 ntp
Router(config-ptp-clk)# input
1pps R0
Router(config-ptp-clk)# clock-port MASTER master
Router(config-ptp-port)# transport ipv4 unicast interface
Loopback11
 negotiation
Router(config-ptp-port)# clock destination
20.20.20.20

Router(config-ptp-port)# end
```

Configuring Output Time-of-Day Messages

This section describes how to configure output time-of-day messages.

Note You can configure ToD output only on secondary PTP clock ports.

SUMMARY STEPS

1. **configure terminal**
2. ptp clock ordinary domain domain_number
3. **tod {R0 | R1} {cisco | ntp}**
4. **output [1pps] { R0 | R1 }**
5. clock-port *name* slave
6. **transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]**
7. **clock source** *ip-address*
8. **end**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	ptp clock ordinary domain domain_number **Example:** `Router(config)# ptp clock ordinary domain 0`	Creates a PTP clock and specifies the clock mode.
Step 3	**tod {R0 | R1} {cisco | ntp}** **Example:** **Example:** `Router(config-ptp-clk)# tod R0 ntp`	Configures the time-of-day message format used by the 1PPS or BITS interface. **Note** Currently, only R0 1PPS port is supported; R1 is not valid. Also, only ntp mode is supported, not cisco mode.
Step 4	**output [1pps] { R0 | R1 }** **Example:** `Router(config-ptp-clk)# output R0 ntp`	Enables output of time-of-day messages using a 1PPS interface. **Note** Currently, only R0 1PPS port is supported; R1 is not valid.
Step 5	clock-port *name* slave **Example:** `Router(config-ptp-clk)# clock-port SLAVE slave`	Specifies the clocking mode of a PTP port and enters the clock port configuration mode.
Step 6	**transport ipv4 unicast interface {GigabitEthernet | Loopback}** *interface-number* **[negotiation]** **Example:**	Specifies the IP version, transmission mode, and interface that a PTP clock port uses to exchange timing packets.

	Command or Action	Purpose
	`Router(config-ptp-port)# transport ipv4 unicast interface Loopback11 negotiation`	The **negotiation** keyword specifies the unicast negotiation mode where the secondary and primary clock exchange negotiation messages before establishing a relationship. **Note** Only Loopback interface type is supported.
Step 7	**clock source** *ip-address* **Example:** `Router(config-ptp-port)# clock source 10.10.10.10`	Specifies the source IP address of a PTP master clock. **Note** You can specify only 1 primary clock IP address. Priority-based clock source selection is not supported.
Step 8	**end** **Example:** **Example:** `Router(config-ptp-port)# end`	Exits global configuration mode.

What to do next

Examples

The following example shows how to configure output time-of-day messages:

```
Router# configure terminal
Router(config)# ptp clock ordinary domain 0
Router(config-ptp-clk)# tod R0 ntp
Router(config-ptp-clk)# output
1pps R0
Router(config-ptp-clk)# clock-port MASTER master
Router(config-ptp-port)# transport ipv4 unicast interface
Loopback11
 negotiation
Router(config-ptp-port)# clock source
10.10.10.10
Router(config-ptp-port)# end
```

Configuration Examples for IEEE 1588v2 PTP on a Cisco ASR1002-X Router

This example shows how to configure IEEE 1588v2 PTP on a Cisco ASR1002-X Router:

Unicast Negotiation Mode

```
Master Clock
ptp clock ordinary domain 1
tod R0 ntp
input 1pps R0
clock-port  MASTER master
transport ipv4 unicast interface loopback 0 negotiation
Slave clock
```

```
ptp clock ordinary domain 1
tod R0 ntp
output 1pps R0
clock-port SLAVE slave
transport ipv4 unicast interface loopback 0 negotiation
clock source 10.1.1.1
Boundary clock

ptp clock boundary domain 1
clock-port SLAVE slave
transport ipv4 unicast interface loopback 0 negotiation
clock source 10.1.1.1
clock-port  MASTER master
transport ipv4 unicast interface loopback 1 negotiation
```

Unicast Mode

```
Master Clock
ptp clock ordinary domain 1
tod R0 ntp
input 1pps R0
clock-port  MASTER master
transport ipv4 unicast interface loopback 0
clock destination 20.1.1.1
Slave clock

ptp clock ordinary domain 1
tod R0 ntp
output 1pps R0
clock-port SLAVE slave
transport ipv4 unicast interface loopback 0
clock source 10.1.1.1
```

Verifying the IEEE 1588v2 PTP Configuration

Use the following commands to verify the IEEE 1588v2 PTP configuration:

- Use the **show ptp clock running domain 0** command to display the output:

```
Router# show ptp clock running domain 0
On the MASTER:
                     PTP Ordinary Clock [Domain 0]
         State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
         FREQ_LOCKED    1              31522149       10401171       Hot standby
                               PORT SUMMARY
                                                                        PTP Master
Name   Tx Mode      Role         Transport    State        Sessions     Port Addr
MASTER unicast      master       Lo1          Master       1            -
                            SESSION INFORMATION
MASTER [Lo1] [Sessions 1]
Peer addr          Pkts in    Pkts out   In Errs    Out Errs
11.11.11.11        10401171   31522149   0          0
On the SLAVE:
                     PTP Ordinary Clock [Domain 0]
         State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
         PHASE_ALIGNED  1              4532802        13357682       Track one
                               PORT SUMMARY
                                                                      PTP Master
Name  Tx Mode      Role         Transport    State        Sessions     Port Addr
SLAVE unicast      slave        Lo20         Slave        1            10.10.10.10
                            SESSION INFORMATION
```

```
SLAVE [Lo20] [Sessions 1]
Peer addr          Pkts in    Pkts out   In Errs    Out Errs
10.10.10.10        13357682   4532802    0          0
```

- Use the **show platform software ptp tod** command to check the time-of-day information:

```
PTPd ToD information:
Time: 06/24/14 02:06:29
```

- Use the **show platform ptp tod all** command to check the time-of- day state:

```
Router# show platform ptp tod all
On the MASTER
--------------------------------
ToD/1PPS Info for : R0
--------------------------------
RJ45 JACK TYPE        : RS422
ToD CONFIGURED        : YES
ToD FORMAT            : NTPv4
ToD DELAY             : 0
1PPS MODE             : INPUT
1PPS STATE            : UP
ToD STATE             : UP
--------------------------------
On the SLAVE:
--------------------------------
ToD/1PPS Info for : R0
--------------------------------
RJ45 JACK TYPE        : RS422
ToD CONFIGURED        : YES
ToD FORMAT            : NTPv4
ToD DELAY             : 0
1PPS MODE             : OUTPUT
OFFSET                : 0
PULSE WIDTH           : 0
--------------------------------
```

Additional References

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at this URL: {start hypertext}http://www.cisco.com/go/mibs{end hypertext}

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	{start hypertext}http://www.cisco.com/cisco/web/support/index.html{end hypertext}

Feature Information for IEEE 1588v2 PTP Support

{start cross reference}Table 13-2{end cross reference} lists the features in this module and provides links to specific configuration information.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to {start hypertext}http://www.cisco.com/go/cfn{end hypertext}. An account on Cisco.com is not required.

Note {start cross reference}Table 13-2{end cross reference} lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 2: Feature Information for Network Synchronization Support

Feature Name	Releases	Feature Information
IEEE 1588v2 PTP Support	Cisco IOS XE 3.13S	In Cisco IOS XE Release 3.13S, this feature was introduced on the Cisco ASR 1002-X Routers.