Configuring Clocking and Timing

Clock synchronization is important for a variety of applications, including synchronization of radio cell towers. While legacy TDM protocols incorporate timing features, packet-switched networks such as Ethernet do not natively include these features. The Cisco ME 3600X 24CX Series Switch supports legacy TDM technologies while supporting a variety of technologies that distribute clocking information over packet-switched networks.

The following sections describe the clocking and timing features available on the Cisco ME 3600X 24CX Series Switch.

- Network Clocking Overview
- Configuring Clocking and Timing
- Clocking Sample Configurations

Network Clocking Overview

Clocking is typically distributed from the core network outward to the BTS or Node B at the network edge. The Cisco ME 3600X 24CX Series Switch receives and transmits clocking information using any of the following ports:

- T1/E1
- GigabitEthernet
- BITS/SYNC port
- 1PPS
- 10Mhz
- ToD

The Cisco ME 3600X 24CX Series Switch supports the following clocking types:

- Precision Timing Protocol (PTP)
- Synchronous Ethernet

Precision Timing Protocol (PTP)

The Cisco ME 3600X 24CX Series Switch supports the Precision Time Protocol (PTP) as defined by the IEEE 1588-2008 standard. PTP provides for accurate time synchronization on over packet-switched networks. Nodes within a PTP network can act in one of the following roles:
Network Clocking Overview

• Ordinary clock—An ordinary clock is a 1588 clock with a single PTP port that can serve in one of the following roles:
  – Master mode—Distributes timing information over the network to one or more slave clocks, thus allowing the slave to synchronize its clock to the master.
  – Slave mode—Synchronizes its clock to a master clock. You can enable slave clocking on up to two interfaces simultaneously in order to connect to two different master clocks.
• Boundary clock—The device participates in selecting the best master clock and can act as the master clock if no better clocks are detected.
• Transparent clock—A transparent clock is a device or a switch that calculates the time it requires to forward traffic and updates the PTP time correction field to account for the delay, making the device transparent in terms of time calculations.

**Note**
Time stamping of packets with these labels is supported—VLAN, MPLS, MPLS LDP, MPLS BGP, MPLS VRF/VPN, MPLS TE-FRR.

**Note**
The 1588-2008 standard defines other clocking devices that are not described here.

**Note**
When a shut/no shut is carried on the loopback interface, the PTP port is deleted and recreated. This causes the PTP counters to reset.

### Transparent Clocking

A transparent clock is a network device such as a switch that calculates the time it requires to forward traffic and updates the PTP time correction field to account for the delay, making the device transparent in terms of timing calculations. The transparent clock 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**
The Cisco ME 3600X 24CX Series Switch does not currently support peer-to-peer transparent clock mode.

For information on how to configure the Cisco ME 3600X 24CX Series Switch as a transparent clock, see Configuring a Transparent Clock, page 10-11.
Clock Synchronization

PTP master devices periodically launch an exchange of messages with slave devices to help each slave clock recompute the offset between its clock and the master clock. Periodic clock synchronization mitigates any drift between the master and slave clocks.

Synchronous Ethernet

Synchronous Ethernet is a timing technology that allows the Cisco ME 3600X 24CX Series Switch switch to transport frequency information over Ethernet. Because frequency is embedded in Ethernet packets, synchronous Ethernet must be supported by each network element in the synchronization path. Synchronous Ethernet is defined in the ITU-T G.781, G.8261, G.8262, and G.8264, Telcordia GR-253-CORE, and Telcordia GR-1244-CORE standards.

Synchronous Ethernet ESMC and SSM

The Cisco ME 3600X 24CX Series Switch supports Ethernet Synchronization Message Channel (ESMC) and Synchronization Status Message (SSM) to provide clock synchronization on Synchronous Ethernet. For more information about Ethernet ESMC and SSM, see Chapter 5, “Configuring PTP Clocking.”

Note

SSM is only supported on BITS interface.

Configuring Clocking and Timing

The Cisco ME 3600X 24CX Series Switch switch supports the following network clocking types:

- Precision Time Protocol (PTP)—Clocking and clock recovery based on the IEEE 1588-2008 standard; allows the Cisco ME 3600X 24CX Series Switch switch to receive clocking from another PTP-enabled device or provide clocking to a PTP-enabled device. To configure PTP clocking, see Configuring PTP Clocking.
- Synchronous Ethernet—Allows the network to transport frequency and time information over Ethernet. To configure synchronous Ethernet, see Configuring Synchronous Ethernet.
- Verifying Clock Settings—To verify a clocking configuration, see Verifying Clock-Related Settings.

Configuring PTP Clocking

There is no specific configuration required to support PTP over MPLS.

This section describes how to configure PTP-based clocking on the Cisco ME 3600X 24CX Series Switch.

- Prerequisites for Configuring PTP Clocking, page 5-4
- Configuring an Ordinary Clock, page 5-4
- Configuring a Boundary Clock, page 5-8
Configuring Clocking and Timing

- Configuring a Transparent Clock, page 5-11

Note

The settings shown in this section are an example only; you must determine the appropriate PTP settings based upon your network clocking design.

Note

The configuration sections describing the 1PPS and 10Mhz timing ports only apply to the Cisco ME 3600X-24CX switch.

Prerequisites for Configuring PTP Clocking

- To enable PTP functionality, follow these steps:
  a. Go to the bootloader prompt.
  b. Type the following:
     
     ```
     ENABLE_PTP_CPU=1
     ```
  c. Perform a reset.
- To enable PTP v2 Ordinary Slave Clock, one of the following base licenses must be installed on the switch:
  - Metro IP Access
  - Advanced Metro IP Access
- An additional 1588 feature license is required to enable the Ordinary master clock and boundary clock functionality.
- You must reload the switch to activate the license.
- The path from the master clock to the slave clock must be the same (symmetric).
- Use only the `archive download-sw` command on the Cisco ME 3600X-24CX switch to download a new image from a TFTP server.

Configuring an Ordinary Clock

The following sections describe how to configure the switch as an ordinary clock.

- Configuring a Master Ordinary Clock, page 5-5
- Configuring a Slave Ordinary Clock, page 5-6
## Configuring a Master Ordinary Clock

Enter the following commands to configure the switch to act as a master ordinary clock:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Switch&gt; enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
</tbody>
</table>

| **Step 2** configure terminal                | Enters global configuration mode. |
| **Example:**                                |         |
| `Switch# configure terminal`                |         |

| **Step 3** ptp clock { ordinary | boundary | e2e-transparent } domain domain-number [ hybrid ] | Configures the PTP clock. You can create the following clock types: |
| **Example:**                                |         |
| `Switch(config)# ptp clock ordinary domain 0` | • Ordinary—A 1588 clock with a single PTP port that can operate in Master or Slave mode. |
|                                               | • Boundary—Participates in selecting the best master clock and can act as the master clock if no better clocks are detected. |
| **Note**                                    | Hybrid mode is not supported on the Cisco ME 3600X 24CX switch. |

| **Step 4** priority1 priorityvalue           | Sets the preference level for a clock. Slave devices use the priority1 value when selecting a master clock: a lower priority1 value indicates a preferred clock. The priority1 value is considered above all other clock attributes. |
| **Example:**                                |         |
| `Switch(config-ptp-clk)# priority1 128`     | Valid values are from 0-255. The default value is 128. |

| **Step 5** priority2 priorityvalue           | Sets a secondary preference level for a clock. Slave devices use the priority2 value when selecting a master clock: a lower priority2 value indicates a preferred clock. The priority2 value is considered only when the router is unable to use priority1 and other clock attributes to select a clock. |
| **Example:**                                |         |
| `Switch(config-ptp-clk)# priority2 128`     | Valid values are from 0-255. The default value is 128. |

| **Step 6** clock-port port-name { master | slave } | Sets the clock port to PTP master or slave mode; in master mode, the port exchanges timing packets with PTP slave devices. |
| **Example:**                                |         |
| `Switch(config-ptp-clk)# clock-port Master master` |         |
| `Router(config-ptp-port)#`                  |         |

| **Step 7** transport ipv4 unicast interface interface-type interface-number [ negotiation ] | Sets port transport parameters. |
| **Example:**                                |         |
| `Switch(config-ptp-port)# transport ipv4 unicast interface loopback 0 negotiation` | The **negotiation** keyword configures the router to discover a PTP master clock from all available PTP clock sources. |
| **Note**                                    |         |
| PTP redundancy is supported only on unicast negotiation mode. |
Configuring Clocking and Timing

Chapter 5  Configuring Clocking and Timing

Configuring a Slave Ordinary Clock

Follow these steps to configure the switch to act as a slave ordinary clock.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Switch# configure terminal</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>ptp clock {ordinary</td>
</tr>
</tbody>
</table>
| &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&n...
### Configuring Clocking and Timing

#### Step 4

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>priority2 priorityvalue</td>
<td>Sets a secondary preference level for a clock. Slave devices use the priority2 value when selecting a master clock: a lower priority2 value indicates a preferred clock. The priority2 value is considered only when the router is unable to use priority1 and other clock attributes to select a clock. Valid values are from 0-255. The default value is 128.</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-clk)# priority2 128
```

#### Step 5

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>clock-port port-name {master</td>
<td>slave}</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-clk)# clock-port Slave slave
```

#### Step 6

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>transport ipv4 unicast interface interface-type interface-number [negotiation]</td>
<td>Sets port transport parameters. The <code>negotiation</code> keyword configures the router to discover a PTP master clock from all available PTP clock sources.</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-port)# transport ipv4 unicast interface loopback 0 negotiation
```

#### Step 7

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>clock-source source-address</td>
<td>Specifies the address of a PTP master clock.</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-port)# clock-source 8.8.8.1
```

#### Step 8

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>sync interval value</td>
<td>Specifies the sync interval.</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-port)# sync interval 1
```

#### Step 9

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>announce timeout value</td>
<td>Specifies the number of PTP announcement intervals before the session times out. Valid values are 1-10.</td>
</tr>
</tbody>
</table>

**Example:**

```
Switch(config-pts-port)# announce timeout 8
```
### Configuring a Boundary Clock

Follow these steps to configure the switch to act as a boundary clock.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Switch# configure terminal</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Router(config)# ptp clock {ordinary</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Switch(config)# ptp clock boundary domain 0</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>clock-port port-name {master</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Switch(config-tp-clk)# clock-port SLAVE slave</td>
</tr>
</tbody>
</table>
### Configuring PTP Input and Output

You can use the 1pps, 10Mhz and BITS timing ports on the Cisco ME 3600X-24CX to do the following:

- Provide or receive 1PPS time of day messages
- Provide output clocking at 10Mhz, 2.048Mhz, and 1.544Mhz
- Receive input clocking at 10Mhz, 2.048Mhz, and 1.544Mhz

**Note**

This section applies only to the Cisco ME 3600X-24CX.

The following section describes how to configure time of day messages, output clocking, and input clocking in master clock mode.

- If you want to configure input clocking using the 10Mhz or BITS timing port, use the following command:

### Table: Configuring PTP Input and Output

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>transport ipv4 unicast interface-type interface-number [negotiation]</td>
<td>Sets port transport parameters. The <strong>negotiation</strong> keyword configures the router to discover a PTP master clock from all available PTP clock sources.</td>
</tr>
<tr>
<td>Example</td>
<td>Switch(config-ptp-port)# transport ipv4 unicast interface Loopback 0 negotiation</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>clock-source source-address [priority]</td>
<td>Specifies the address of a PTP master clock. You can specify a priority value as follows:</td>
</tr>
<tr>
<td>Example</td>
<td>Switch(config-ptp-port)# clock source 133.133.133.133</td>
<td>- No priority value—Assigns a priority value of 0.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1—Assigns a priority value of 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 2—Assigns a priority value of 2, the highest priority.</td>
</tr>
<tr>
<td></td>
<td>Note: This command is optional if PTP is configured in unicast negotiation mode.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>clock-port port-name {master</td>
<td>slave}</td>
</tr>
<tr>
<td>Example</td>
<td>Switch(config-ptp-port)# clock-port Master master</td>
<td>Note: The master clock-port does not establish a clocking session until the slave clock-port is phase aligned.</td>
</tr>
<tr>
<td>7</td>
<td>transport ipv4 unicast interface-type interface-number [negotiation]</td>
<td>Sets port transport parameters. The <strong>negotiation</strong> keyword configures the router to discover a PTP master clock from all available PTP clock sources.</td>
</tr>
<tr>
<td>Example</td>
<td>Switch(config-ptp-port)# transport ipv4 unicast interface Loopback 1 negotiation</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Switch(config-ptp-port)# end</td>
<td>Exit configuration mode.</td>
</tr>
</tbody>
</table>
Configuring Clocking and Timing

Use the `network-clock input-source` command to enable input clocking at 10Mhz, 2.048Mhz, or 1.544Mhz.

```
Switch(config)# network-clock input-source 2 external 1/0/0 10m
```

Input clocking applies when the switch is in master mode.

- To configure output clocking using the 10Mhz or BITS timing port, use the `network-clock output-source` command to specify 10Mhz, 2.048Mhz, or 1.544Mhz output. Use this command when the switch is in slave mode.

```
Switch(config)# network-clock output-source system 2 external 1/0/0 10m
```

- To configure the switch to send time of day messages using the 1PPS port, use the `output 1pps` command. Use the `input` or `output` parameters to specify the direction.

```
Switch(config)# ptp clock ordinary domain 0
Switch(config-ptp-clk)# output 1pps 0/0
```

**Note**

Input 1pps is only supported in master mode. Output 1pps configuration is supported in slave or boundary clock mode.

- To configure the time of day message format, use the `tod` command.

```
Switch(config)# ptp clock ordinary domain 0
Switch(config-ptp-clk)# tod 0/0 ubx
```

**Configuration Examples**

Use commands below for input and output.

```
network-clock input-source 2 external 1/0/0 10m
```

```
Switch(config)# network-clock input-source 2 external 1/0/0 ?
10m 10 MHz signal mode
2048k Option 1 2048kHz on BITS/SSU port
e1 E1 Signal Mode
```

Tod and 1pps configuration.

Master:

```
Switch(config)# ptp clock ordinary domain 0
Switch(config-ptp-clk)# input 1pps 0/0
Switch(config-ptp-clk)# tod 0/0 ?
cisco Set TOD format to CISCO
nmea Set TOD format to NMEA ZDA
ntp Set TOD format to NTP
ubx Set TOD format to UBX
```

Slave:

```
Switch(config)# ptp clock ordinary domain 0
Switch(config-ptp-clk)# output 1pps 0/0 ?
offset 1PPS output offset
pulse-width 1PPS output pulse width
Switch(config-ptp-clk)# tod 0/0 ?
cisco Set TOD format to CISCO
nmea Set TOD format to NMEA ZDA
ntp Set TOD format to NTP
```
ubx    Set TOD format to UBX

Note  To see further configuration examples for input and output timing, see Clocking Sample Configurations.

## Configuring a Transparent Clock

Follow these steps to configure the Cisco ME 3600X 24CX Series Switch as an end-to-end transparent clock.

Note  The Cisco ME 3600X 24CX Series Switch does not support peer-to-peer transparent clock mode.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Router# configure terminal</td>
</tr>
<tr>
<td>Step 2</td>
<td>ptp clock { ordinary</td>
</tr>
<tr>
<td></td>
<td>Note  Peer-to-peer transparent clock mode is not supported.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Router(config)# end</td>
</tr>
</tbody>
</table>

## Configuring Synchronous Ethernet

The following sections describe how to configure synchronous Ethernet timing on the Cisco ME 3600X 24CX Series Switch switch.

Note  Hybrid mode is not supported therefore, network-clock input-source command cannot be configured with Ordinary Slave mode or Boundary Clock mode.

### Configuring an External Clock Source

To configure an external clock source using Synchronous Ethernet, use the network-clock input-source priority external 1/0/0 \{ \{ E1 \{ crc4 | cas | fas \} \} \{ T1 \{ d4 | sf | esf \} \} \} command.

Switch(config)# network-clock input-source 1 external 1/0/0

### Configuring Synchronous Ethernet ESMC and SSM

For instructions on how to configure synchronous Ethernet Synchronization Message Channel (ESMC) and Synchronization Status Message (SSM), see Configuring Synchronous Ethernet in Cisco ME 3800x and ME 3600x Switch Software Configuration Guide.
Verifying Clock-Related Settings

Use the following commands to verify the clock settings:

- `show ptp clock dataset`
- `show ptp port dataset`
- `show ptp clock running`
- `show platform ptp all`

For more information about these commands, see the *Cisco ME 3800X and ME 3600X Switch Command Reference, Release 15.2(4)S*.

Clocking Sample Configurations

The following sections show a sample configurations for clocking features on the switch.

**Ordinary Clock—Slave**

```plaintext
ptp clock ordinary domain 0
clock-port Slave slave
transport ipv4 unicast interface loopback 0 negotiation
clock-source 8.8.8.1
sync interval 1
announce timeout 7
delay-req interval 3
```

**Ordinary Clock—Master**

```plaintext
ptp clock ordinary domain 0
clock-port Master master
transport ipv4 unicast interface loopback 0 negotiation
```

**Unicast Configuration—Slave Mode**

```plaintext
ptp clock ordinary domain 0
clock-port Slave slave
transport ipv4 unicast interface loopback 0
clock-source 8.8.8.1
```

**Unicast Configuration—Master Mode**

```plaintext
ptp clock ordinary domain 0
clock-port Master master
transport ipv4 unicast interface loopback 0
clock-destination 8.8.8.2
sync interval 1
announce interval 2
```

**Unicast Negotiation—Slave**

```plaintext
ptp clock ordinary domain 0
priority1 2
priority2 4
clock-port Slave slave
transport ipv4 unicast interface Loopback0 negotiation
```
Clocking Sample Configurations

clock-source 8.8.8.1
sync interval 3
announce timeout 7
delay-req interval 3

**Unicast Negotiation—Master**

ptp clock ordinary domain 0
  priority1 4
  priority2 2
  clock-port Master master
    transport ipv4 unicast interface Loopback0 negotiation
  sync interval 3
  announce timeout 7

**Boundary Clock**

ptp clock boundary domain 0
  priority1 2
  priority2 4
  clock-port Slave slave
    transport ipv4 unicast interface Loopback0 negotiation
    clock-source 8.8.8.1
    sync limit 3
    announce timeout 7
    delay-req interval 3
    clock-port Master master
    transport ipv4 interface Loopback1 negotiation
    sync interval 3
    announce interval 7

**Transparent Clock**

ptp clock e2e-transparent domain 0

**Clock Selection Parameters**

network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 external 1/0/0 10m

**ToD/1PPS Configuration—Master**

network-clock input-source 1 external 1/0/0 10m
  ptp clock ordinary domain 0
tod 0/0 ntp
  input 1pps 0/0
clock-port master master
    transport ipv4 unicast interface loopback 0

**ToD/1PPS Configuration—Slave**

ptp clock ordinary domain 0
tod 0/0 ntp
  output 1pps 0/0
clock-port SLA slave
    transport ipv4 unicast interface loopback 0 negotiation
clock source 33.1.1.
Show Commands

Router# **show ptp clock dataset** ?
  current currentDS dataset
default defaultDS dataset
parent parentDS dataset
time-properties timePropertiesDS dataset

Router# **show ptp port dataset** ?
  foreign-master foreignMasterDS dataset
  port portDS dataset

Router# **show ptp clock running domain 0**
  PTP Ordinary Clock [Domain 0]
  State Ports Pkts sent Pkts rcvd Redundancy Mode
  ACQUIRING 1 98405 296399 Track one

PORT SUMMARY

PTP

Master
    Name       Tx Mode      Role        Transport  State      Sessions  Port
    SLAVE      unicast      slave       Lo0        Slave      1
    8.8.8.8

SESSION INFORMATION

SLAVE [Lo0] [Sessions 1]
    Peer addr  Pkts in  Pkts out  In Errs  Out Errs
    8.8.8.8   296399   98405     0        0

Router#

Router# **show platform ptp all**
Slave info : [Loopback0][0x38A4766C]
-----------------------------
clock role : SLAVE
Slave Port hdl : 486539266
Tx Mode : Unicast-Negotiation
Slave IP : 4.4.4.4
Max Clk Srcs : 1
Boundary Clock : FALSE
Lock status : HOLDOVER
Refcnt : 1
Configured-Flags : 0x7F - Clock Port Stream
Config-Ready-Flags : Port Stream
-----------------------------
PTP Engine Handle : 0
Master IP : 8.8.8.8
Local Priority : 0
Set Master IP : 8.8.8.8