

Synchronous Ethernet ESMC and SSMs

Synchronous Ethernet (SyncE) is a network synchronization technology that ensures:

- Ethernet synchronization via physical layer timing.
- High-quality clocking for telecom and data transport, similar to Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH).

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Synchronous Ethernet and clock selection in routers

SyncE, defined in ITU G.781, aligns Ethernet link bit clocks to high-quality, stratum-1-traceable signals, similar to SONET and SDH.

SyncE provides clock synchronization to Ethernet, ensuring the reliability of SONET, SDH, and T1/E1 networks. It uses Synchronization Status Message (SSM) and Ethernet Synchronization Message Channel (ESMC) for clock synchronization.

Ethernet synchronization message channel

ESMC uses the SSM from SONET or SDH networks. Unlike SONET and SDH, which use fixed frame locations, ESMC transmits SSM via IEEE 802.3 Organization-Specific Slow Protocol (OSSP).

ESMC quality level

ESMC carries a Quality Level (QL) to indicate clock quality, helping nodes select reliable sources and prevent timing loops.

Clock synchronization in routers

When SyncE configured on the router, it synchronizes to the best available clock source. If no better clock source is available, the router stays synchronizes to the current source.

Clock selection modes

The router supports two clock selection modes for selecting the best clock source.

- QL-enabled
- QL-disabled

This table describes the clock selection modes.

Table 1: Clock modes

Mode	Description
QL-enabled Mode	It uses these QL values to select the best clock source: • clock quality level (QL), • clock availability, and • priority
QL-disabled mode	It uses these alternative criteria to select the clock source: • clock availability, or • Priority

Configure synchronous Ethernet ESMC and SSM

Perform these steps to configure Synchronous Ethernet ESMC and SSM on the router.

Procedure

Step 1 Use the **enable** coammand to enable the privileged EXEC mode.

Example:

```
Router# enable
```

Enter your password if prompted.

Step 2 Use the **configure terminal** command to enter global configuration mode.

Example:

```
Router# configure terminal
```

Step 3 Use the **network-clock synchronization automatic** command to enable the network clock selection algorithm for automatic configuration and proceed to step 6; otherwise, proceed with step 4.

Example:

```
Router(config)# network-clock synchronization automatic
```

This command disables the Cisco-specific network clock process and turns on the G.781-based automatic clock selection process.

Note
This command must be configured before any input source.

Step 4 Use the **network-clock eec** command to specify the Ethernet Equipment Clock (EEC) type as a network clock.

Example:

```
Router(config)# network-clock eec 1
```

The Ethernet Equipment Clock (EEC) types are:

- 1—ITU-T G.8262 option 1 (2048)
- 2—ITU-T G.8262 option 2 and Telcordia GR-1244 (1544)

Step 5 Use the **network-clock synchronization ssm option** command to configure the G.781 synchronization option.

Example:

```
Router(config)# network-clock synchronization ssm option 2 GEN1
```

The G.781 synchronization option guidelines to send synchronization messages.

- Option 1 refers to G.781 synchronization option 1, which is designed for Europe. This is the default value.
- Option 2 refers to G.781 synchronization option 2, which is designed for the United States.
- GEN1 specifies option 2 Generation 1 synchronization.
- GEN2 specifies option 2 Generation 2 synchronization.

Step 6 Use the **network-clock input-source** command to provide the input clock source in the network.

Example:

```
Router(config)# network-clock input-source 1 interface GigabitEthernet 0/0/0
Router(config)# network-clock input-source 1 external R0 1hz
Router(config)# network-clock input-source 2 controller t1 0/2/0
Router(config)# network-clock input-source 3 ptp domain 4
```

Enables you to select an interface as an input clock for the router. You can select WAN interfaces (Gigabit Ethernet 0/0/0, Gigabit Ethernet 0/0/1), T1/E1 controllers, or an external interface. Selection priority for the clock source (1 is the highest priority). When the higher-priority clock source fails, the next-higher-priority clock source is selected.

Note
Before configuring Ethernet interface as clock source, you should configure synchronous mode under interface configuration.

SyncE is not supported on LAN interfaces.

Step 7 Use the **network-clock synchronization mode ql-enabled** command to enable automatic selection of a clock source based on quality level.

Example:

```
Router(config)# network-clock synchronization mode ql-enabled
```

Step 8 Use the **network-clock wait-to-restore** command to configure a global wait-to-restore timer for synchronous Ethernet clock sources in seconds.

Example:

```
Router(config)# network-clock wait-to-restore 70 global
```

(Optional) The timer specifies how long the router waits before including a restored clock source in the clock selection process.

Valid values are 0 to 86,400 seconds. The default value is 300 seconds.

It is recommended not to configure a very low wait-to-restore value. A momentarily unstable clock source may trigger frequent and disruptive timing shifts, degrading network performance. By introducing an adequate delay, the router ensures that the restored clock source is stable before it is reselected.

Step 9 Use the **esmc process** command to enable ESMC process globally.

Example:

```
Router(config)# esmc process
```

Step 10 Use the **network-clock quality-level** command to specify a quality level for a line or external clock source.

Example:

For Tx QL:

```
Router(config)# network-clock quality-level tx QL-SSU-A interface GigabitEthernet 0/0/0
```

For Rx QL as SSU:

```
Router(config)# network-clock quality-level rx QL-SSU-A  interface GigabitEthernet 0/0/0
```

For Rx QL as PRC:

```
Router(config)# network-clock quality-level rx ql-prc external r0 1hz
```

The available quality values depend on the G.781 synchronization settings specified by the **network-clock synchronization ssm option** command:

The syntax of the command: **network-clock quality-level**{**tx** | **rx**} *value* {**interface** *interface-id* | **controller** [**E1** | BITS] slot/card/port | **external** [2m | 10m] }

Table 2: Syntax description

Keyword	Description
tx	Sets the tx quality level for the source.
rx	Sets the rx quality level for the source.
value	The quality indicator to apply. The supported values include QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, QL-DNU (actual list depends on hardware/software).
interface-id	Provides an Ethernet interface used for SyncE.
E1	An E1 controller port carrying SSM over TDM.
BITS	A Building Integrated Timing Supply port.

Keyword	Description
external	Provides an external frequency reference input and specifies its frequency (2 MHz or 10 MHz).

- Option 1—Available values are QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, and QL-DNU.
- Option 2, GEN1—Available values are QL-PRS, QL-STU, QL-ST2, QL-SMC, QL-ST4, and QL-DUS.
- Option 2, GEN 2—Available values are QL-PRS, QL-STU, QL-ST2, QL-TNC, QL-ST3, QL-SMC, QL-ST4, and QL-DUS.

Step 11 Use the **interface** command to specify a trunk interface and to enter into a interface configuration mode.*interface-id*

Example:

```
Router(config)# interface gigabitethernet 0/0/0
```

Step 12 (Optional) Use the **network-clock source quality-level** command to provide the forced QL value to the local clock selection process.

Example:

```
Router(config-if)# network-clock source quality-level QL-PRS tx
```

Step 13 Use the **synchronous mode** command to configure the Ethernet interface to synchronous mode and enable the ESMC and QL process on the interface.

Example:

```
Router(config-if)# synchronous mode
```

Step 14 Use the **end** command to exit interface configuration mode and returns to the privileged EXEC mode.

Example:

```
Router(config-if)# end
```

Exits interface configuration mode and returns to privileged EXEC mode.