



Network Synchronization for the Cisco 4000 Series Integrated Services Routers

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To maintain the quality of the services offered by the network and to operate efficiently, devices must operate at the same clock rates. This document explains how to configure network synchronization between two devices—the router and a network interface module (NIM), such as the Cisco Fourth-Generation T1/E1 Voice and WAN Network Interface Module.

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Finding Feature Information

Your software release might not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

Information About Network Synchronization

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Network Efficiency

Most of the services that are provided over networks must be fully synchronized with one another in order to operate efficiently. If the network devices that constitute a network do not operate at the same clock rates, there is an overall decrease in the performance of the network and a consequent degradation in the quality of the services offered by the network.

Synchronization between the NIM and the Router

Network synchronization is supported for Cisco Fourth-Generation T1/E1 Voice and WAN Network Interface Modules (NIMs) on the Cisco 4000 Series ISR, by using the **network-clock synchronization automatic** global configuration command. By default, this command is disabled and user must configure it on Cisco 4000 Series ISR. This command is made ineffective for a particular NIM if you use the **no network-clock participation slot/subslot** command. See [Example 3: Disabling and Enabling a Module from Participating in the Backplane Clock, page 6](#). This causes the NIM to have its own separate clock domain.

Prerequisites for Network Synchronization

The following goals must be taken into account while designing the synchronization plan for a network:

- Synchronize the greatest number of network elements to the smallest number of independent clock sources. Ideally, all network elements should be synchronized to a single clock source.
- Use high-quality clock sources for stability and long-term accuracy.
- To ensure the resiliency of synchronization, plan for possible failure of clock sources, network elements, and network trunks.

Restrictions for Network Synchronization

This section lists the restrictions for configuring network synchronization on a router. Network synchronization can be configured only for a Cisco Fourth-Generation T1/E1 Voice and WAN Network Interface Module.

- You can configure two ports per NIM as clock sources on a router.
- We recommend that you do not configure multiple input sources with the same priority because this impacts the T_{SM} (switching message delay).
- The quality of a clock source is not considered by the router. Synchronization Status Messages (SSMs), which inform neighboring network elements about the quality level of a clock, are not supported by the router. The router uses a clock source based on the source's availability and priority.

How to Configure Network Synchronization

- [Configuring Clock Recovery with a Primary Clock Source](#)
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Configuring Clock Recovery with a Primary Clock Source

This section describes how to configure clock recovery with a primary or secondary clock source.

SUMMARY STEPS

1. **configure terminal**
2. **network-clock synchronization automatic**
3. **controller [t1|e1] slot/bay/port**

4. **clock source line primary**
5. **network-clock input-source priority controller [t1|e1] slot/bay/port**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	<code>configure terminal</code> Example: Router# <code>configure terminal</code>	Enters the global configuration mode.
Step 2	<code>network-clock synchronization automatic</code> Example: Router(config)# <code>network-clock synchronization automatic</code>	Enables the network clock selection algorithm. (Note that network clock synchronization is disabled by default.) Disables the Cisco-specific network clock process, and turns on the G.781-based automatic clock selection process.
Step 3	<code>controller [t1 e1] slot/bay/port</code> Example: Router(config)# <code>controller t1 0/2/0</code>	Selects the controller.
Step 4	<code>clock source line [primary secondary]</code> Example: Router(config)# <code>clock source line primary</code>	Sets the controller to be a primary or secondary clock source. It is recommended to at least set a controller to be the primary clock source, then optionally set another controller as a secondary clock source, to act as a back-up, going to the same network.
Step 5	<code>network-clock input-source priority controller [t1 e1] slot/bay/port</code> Example: Router(config)# <code>network-clock input-source 1 controller t1 0/2/0</code>	Assigns a controller to be the primary or secondary clock source. To set the controller to be a primary clock source, set the value of <i>priority</i> for the input source to be low value, such as 2, (a low value indicates a high priority). Note The <code>network-clock input-source priority</code> command, which selects the configured controller clock as the backplane clock source, is only available if the module is participated to the backplane.
Step 6	<code>exit</code> Example: Router(config)# <code>exit</code>	Exits the global configuration mode.

Configuring the Deselection of a Primary Clock Source

This section describes how to deselect a clock source. This ensures that the clock source does not reappear after the router is rebooted.

SUMMARY STEPS

1. **configure terminal**
2. **no network-clock input-source priority controller [t1 | e1] slot/bay/port**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router# configure terminal	Enters the global configuration mode.
Step 2	no network-clock input-source priority controller [t1 e1] slot/bay/port Example: Router(config)# no network-clock input-source 1 controller t1 0/2/0	Deselects the clock source.

Example: Deselection of a Clock Source

In this example, the 0/2/0 T1 controller, which has been deselected, does not appear in the list of clock sources shown by the **show network-clocks synchronization** command.

```
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
```

```
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : Internal
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
```

```
  Interface          SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
* Internal           NA           NA/Dis       251   QL-SEC  NA       NA
```

Configuring Participation of a Module in the Backplane Clock

By default, a NIM (module) participates in the backplane clock. In the first two examples below, the **show platform hardware subslot *slot/subslot* module device networkclock** command verifies that a module participates in the backplane clock.

If you do not want clock synchronization with the backplane clock for a NIM, you can use the **no network-clock synchronization participate *slot/subslot*** command shown in [Example 3: Disabling and Enabling a Module from Participating in the Backplane Clock](#), page 6.

Example 1: Verifying that a Module Participates in the Backplane Clock

In this example, the **show platform hardware subslot *slot/subslot* module device networkclock** command shows:

“ntwk_clk_selected No”—none of the ports of the NIM 0/2 are configured as an input-source. To assign a controller to be an input clock source, see the command **network-clock input-source priority controller [t1|e1] *slot/bay/port*** in the [“Configuring Clock Recovery with a Primary Clock Source” section on page 3](#).

“ntwk_clk_participate Yes”—the NIM 0/2 participates in the router’s backplane clock. This is the default for a NIM attached to the router.

```
Router# show platform hardware subslot 0/2 module device networkclock

primary clock 255, secondary clock 0, ntwk_clk_selected No, ntwk_clk_participate Yes,
current clock = 0
PLL status= 1, and cnt1 = 7
```

Example 2: Verifying that a Module Participates in the Backplane Clock and is Selected as a Source

In this example, the **network-clock input-source priority controller [t1|e1] *slot/bay/port*** command configures NIM 0/2/0 as an input clock source.

The **show platform hardware subslot *slot/subslot* module device networkclock** command shows:

“ntwk_clk_selected Yes”—a port on the NIM 0/2 T1 controller is selected as an input clock source.

“ntwk_clk_participate Yes”—the NIM 0/2 T1 controller participates in the router’s backplane clock.

```
Router# configure terminal
Router(config)# network-clock input-source 150 controller T1 0/2/0
Router(config)# end
Router# show platform hardware subslot 0/2 module device networkclock

primary clock 255, secondary clock 0, ntwk_clk_selected Yes, ntwk_clk_participate Yes,
current clock = 0
PLL status= 1, and cnt1 = 17
```

Example 3: Disabling and Enabling a Module from Participating in the Backplane Clock

In the following example, NIM 0/2 is disabled from participating in the backplane clock, using the **no network-clock synchronization participate 0/2** command. This is displayed by the **show platform hardware subslot *slot/subslot* module device networkclock** command. `ntwk_clk_participate = “No”` indicates that module participation is disabled.

```

Router# configure terminal
Router(config)# no network-clock synchronization participate 0/2
Router(config)# end
Router# show platform hardware subslot 0/2 module device networkclock
primary clock 255, secondary clock 0, ntwk_clk_selected No, ntwk_clk_participate No,
current clock = 0
PLL status= 2, and cnt1 = 6

```

Then NIM 0/2 is made to participate in the backplane clock, by using the **network-clock synchronization participate 0/2** command. This is verified by the **show platform hardware subslot *slot/subslot* module device networkclock** command. `ntwk_clk_participate = "Yes"` indicates that the module participation is enabled.

```

Router# configure terminal
Router(config)# network-clock synchronization participate 0/2
Router(config)# end
Router# show platform hardware subslot 0/2 module device networkclock

primary clock 255, secondary clock 0, ntwk_clk_selected No, ntwk_clk_participate Yes,
current clock = 0
PLL status= 2, and cnt1 = 6

```

Configuring Network Clocking with Revertive Mode

Revertive mode can be set for a clock source or reference. For example, if an original source is set to be in revertive mode and there is a failure in the original source, the clock switches to using an alternate source. After the original clock source recovers from a failure, the clock source reverts back to this original source, independent of the condition of the alternate source.

The default value for network clock synchronization is non-revertive mode. In non-revertive mode, if a failure occurs for the original clock source, a switch to an alternate clock source occurs. This alternate clock source continues to be used, even after the original source recovers from the failure that caused the switch.

SUMMARY STEPS

1. **network-clock revertive**
2. **show network-clocks synchronization**

DETAILED STEPS

	Command	Purpose
Step 1	network-clock revertive Example: Router(config)# network-clock revertive	Configures revertive mode for the network clock.
Step 2	show network-clocks synchronization Example: Router# show network-clocks synchronization	Verifies that the network clock is now in revertive mode.

Example: Configuring Network Clocking with Revertive Mode

The following example starts by setting two clock sources:

- T1 0/3/0—secondary clock source (lower priority than T1 0/2/0)
- T1 0/2/0—primary clock source (higher priority than T1 0/3/0)

Revertive mode is set for network clocking using the **network-clock revertive** command for the primary clock source.

Because T1 0/2/0 has a higher priority than T1 0/3/0, T1 0/2/0 is selected as the clock source. The first **show network-clocks synchronization** command in the example shows the T1 0/2/0 clock source selected and in revertive mode.

This example supposes that the primary clock source goes down after the first **show network-clocks synchronization** command. In this situation, T1 0/3/0 is selected as the clock source. The state of QL-IN is shown as “QL-FAILED” in the second **show network-clocks synchronization** command below.

Later, as a result of setting revertive mode, when clock source T1 0/2/0 comes back up again, the selected clock reverts to T1 0/2/0. This is shown by the third **show-network-clocks synchronization** command in the example. (If revertive mode had not been set, when T1 0/2/0 came back up, the clock source would stay as T1 0/3/0 and not revert to T1 0/2/0.)

```
Router# configure terminal
Router(config)# network-clock synchronization automatic
Router(config)# network-clock revertive
Router(config)# controller t1 0/2/0
Router(config-controller)# clock source line primary
Router(config)# network-clock input-source 1 controller t1 0/2/0
Router(config)# controller t1 0/3/0
Router(config-controller)# clock source line secondary
Router(config)# network-clock input-source 50 controller t1 0/3/0
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
             NA - Not Applicable
             * - Synchronization source selected
             # - Synchronization source force selected
             & - Synchronization source manually switched
```

```
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : Yes
```

Nominated Interfaces

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
Internal	NA	NA/Dis	251	QL-SEC	NA	NA
*T1 0/2/0	NA	NA/Dis	1	QL-SEC	NA	NA
T1 0/3/0	NA	NA/Dis	50	QL-SEC	NA	NA

(At this point, the primary clock source T1 0/2/0 becomes unavailable; for example, due to a signal failure.)

```
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
             NA - Not Applicable
```



```

* - Synchronization source selected
# - Synchronization source force selected
& - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : Yes
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN      ESMC Tx  ESMC Rx
Internal         NA           NA/Dis       251   QL-SEC     NA       NA
T1 0/2/0         NA           NA/Dis       1     QL-FAILED  NA       NA
*T1 0/3/0        NA           NA/Dis       50    QL-SEC     NA       NA

```

(At this point, the primary clock source T1 0/2/0 becomes available again.)

```
Router# show network-clocks synchronization
```

```

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : Yes
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN      ESMC Tx  ESMC Rx
Internal         NA           NA/Dis       251   QL-SEC     NA       NA
*T1 0/2/0        NA           NA/Dis       1     QL-SEC     NA       NA
T1 0/3/0         NA           NA/Dis       50    QL-SEC     NA       NA

```

Configuring the Wait-to-Restore Timer

Use the **network-clock wait-to-restore timer** global command to specify how long the router waits before including a primary clock source in the clock selection process; for example, after a signal failure has affected the primary clock source.

SUMMARY STEPS

1. **network-clock wait-to-restore timer global**
2. **show network-clocks synchronization**

DETAILED STEPS

	Command	Purpose
Step 1	network-clock wait-to-restore timer global Example: Router# network-clock wait-to-restore 500 global	Changes the wait-to-restore timeout period. The default <i>timer</i> value is 300 ms.
Step 2	show network-clocks synchronization Example: Router# show network-clocks synchronization	Verifies the wait-to-restore timeout period has been set to the correct value.

Example: Configuring the Wait-to-Restore Timer

The first part of this example is the same as shown in the “[Configuring Network Clocking with Revertive Mode](#)” section on page 7. The example starts after two clock sources have been set: T1 0/2/0 and T1 0/3/0. T1 0/2/0 is the primary clock source—it has a higher priority than the T1 0/3/0 clock source.

Revertive mode is set for network clocking using the **network-clock revertive** command.

If a signal failure occurs, the system goes to hold-over (selects the “Internal” clock source) and waits for the period determined by the ‘wait-to-restore’ timer value, before switching back to the first clock source.

The **show network-clocks synchronization** command shows the timer to be 300 seconds. Next, the wait-to-restore timeout is changed using the **network-clock wait-to-restore timer** command. In this example, the wait-to-restore time is set to 500 seconds. You can configure the wait-to-restore time to any value between 0 to 86400 seconds. The default value is 300 seconds.

Entering the **show network-clocks synchronization** command now shows the wait-to-restore value of 500 seconds.

```
Router(config)# network-clock revertive
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
```

```
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
Internal        NA           NA/Dis       251   QL-SEC NA       NA
*T1 0/2/0       NA           NA/Dis       2     QL-SEC NA       NA
T1 0/3/0        NA           NA/Dis       2     QL-SEC NA       NA
```

```

Router(config)# network-clock wait-to-restore 500 global
Router(config)# end
Router# show network-clocks synchronization

Feb  5 11:11:42.273 IST: %SYS-5-CONFIG_I: Configured from console by console
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 500 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface          SigType    Mode/QL    Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal           NA         NA/Dis     251   QL-SEC NA       NA
  T1 0/1/1           NA         NA/Dis     50    QL-SEC NA       NA
  *T1 0/2/0          NA         NA/Dis     150   QL-SEC NA       NA

```

Configuring the Hold-Off Timer

Use the **network-clock hold-off timer** command to specify the length of time that the router waits when a primary clock source fails before removing the primary clock source from the clock selection process.

SUMMARY STEPS

1. **network-clock hold-off timer global**
2. **show network-clocks synchronization**

DETAILED STEPS

	Command	Purpose
Step 1	network-clock hold-off timer global Example: Router# network-clock hold-off 500 global	Changes the hold-off timeout period. The <i>timer</i> default value is 300 ms.
Step 2	show network-clocks synchronization Example: Router# show network-clocks synchronization	Verifies the hold-off timeout period has been set to the correct value.

Example: Configuring the Hold-off Timer

The **show network-clocks synchronization** command shows the hold-off time to be 300 milliseconds (the default value). The hold-off timeout is changed using the command **network-clock hold-off 500 global** command. Entering the **show network-clocks synchronization** command shows that the hold-off value is now 500 milliseconds.

```
Router# show network-clocks synchronization

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 500 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal       NA           NA/Dis       251   QL-SEC NA       NA
  T1 0/1/1       NA           NA/Dis       50    QL-FAILED NA       NA
  *T1 0/2/0      NA           NA/Dis       150   QL-SEC  NA       NA

Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)# network-clock hold-off 500 global
Router(config)# end
Router# show network-clocks synchronization

Feb 18 15:03:30.597 IST: %SYS-5-CONFIG_I: Configured from console by console
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 500 ms
Wait-to-restore (global) : 500 sec
```

Configuring Lockout of a Clock Source

The **network-clock set lockout controller** command may be useful during testing and debugging.



Note

To clear the lockout on a source, use the **network-clock clear lockout** command.

SUMMARY STEPS

1. **network-clock set lockout controller** [t1 | e1] slot/bay/port
2. **show network-clocks synchronization**

DETAILED STEPS

	Command	Purpose
Step 1	<pre>network-clock set lockout controller [t1 e1] slot/bay/port</pre> <p>Example: Router# network-clock set lockout controller t1 0/2/0</p>	Sets a lockout on a controller clock source.
Step 2	<pre>show network-clocks synchronization</pre> <p>Example: Router# show network-clocks synchronization</p>	Displays whether the clock has been set to revertive mode.

Example: Configuring Lockout of a Clock Source

The following example starts with a configuration in which several clock sources have different priority levels.

To start with, T1 0/1/1 is the primary clock source as shown by the first **show network-clocks synchronization** command. T1 0/2/0 is then locked out using the **network-clock clear lockout controller** command. A **show network-clocks synchronization** command shows the primary clock source is now T1 0/1/1. In the example, T1 0/1/1 goes down at this point.

T1 0/2/0 is not selected as the primary clock source—Internal is selected instead, as shown by another **show network-clocks synchronization** command. The initial primary clock source is then cleared using the **network-clock clear lockout controller** command. Another **show network-clocks synchronization** command shows that the primary clock source is now T1 0/2/0 (T1 0/1/1 is still down).

```
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
```

```
Automatic selection process : Enable
```

```
Equipment Clock : 2048 (EEC-Option1)
```

```
Clock Mode : QL-Disable
```

```
ESMC : Disabled
```

```
SSM Option : 1
```

```
T0 : T1 0/1/1
```

```
Hold-off (global) : 300 ms
```

```
Wait-to-restore (global) : 0 sec
```

```
Tsm Delay : 180 ms
```

```
Revertive : No
```

```
Nominated Interfaces
```

```
Interface          SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
```

```

Internal          NA          NA/Dis      251  QL-SEC  NA      NA
*T1 0/1/1        NA          NA/Dis      50   QL-SEC  NA      NA
T1 0/2/0         NA          NA/Dis      150  QL-SEC  NA      NA

```

```
Router# network-clock set lockout controller T1 0/2/0
```

```
Router# show network-clocks synchronization
```

```

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

```

```
Automatic selection process : Enable
```

```
Equipment Clock : 2048 (EEC-Option1)
```

```
Clock Mode : QL-Disable
```

```
ESMC : Disabled
```

```
SSM Option : 1
```

```
T0 : T1 0/1/1
```

```
Hold-off (global) : 300 ms
```

```
Wait-to-restore (global) : 0 sec
```

```
Tsm Delay : 180 ms
```

```
Revertive : No
```

```
Nominated Interfaces
```

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
Internal	NA	NA/Dis	251	QL-SEC	NA	NA
*T1 0/1/1	NA	NA/Dis	50	QL-SEC	NA	NA
T1 0/2/0	NA	NA/Dis	150	QL-SEC	NA	NA

```
Router#
```

```
Feb 4 11:34:36.288 IST: %NETCLK-6-SRC_UPD: Synchronization source T1 0/2/0 status (set lockout) is posted to all selection process.
```

```
(T1 0/1/1 goes down.)
```

```
Router# show network-clocks synchronization
```

```

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

```

```
Automatic selection process : Enable
```

```
Equipment Clock : 2048 (EEC-Option1)
```

```
Clock Mode : QL-Disable
```

```
ESMC : Disabled
```

```
SSM Option : 1
```

```
T0 : Internal
```

```
Hold-off (global) : 300 ms
```

```
Wait-to-restore (global) : 0 sec
```

```
Tsm Delay : 180 ms
```

```
Revertive : No
```

```
Nominated Interfaces
```

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
*Internal	NA	NA/Dis	251	QL-SEC	NA	NA
T1 0/1/1	NA	NA/Dis	50	QL-FAILED	NA	NA
T1 0/2/0	NA	NA/Dis	150	QL-SEC	NA	NA

```
Router# network-clock clear lockout controller t1 0/2/0
```

```
Router# show network-clocks synchronization
```

```

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

```

```
Automatic selection process : Enable
```

```
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 0 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
```

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
Internal	NA	NA/Dis	251	QL-SEC	NA	NA
T1 0/1/1	NA	NA/Dis	50	QL-FAILED	NA	NA
*T1 0/2/0	NA	NA/Dis	150	QL-SEC	NA	NA

Configuring Network Clocking with Force Switching

Instead of configuring using the **set lockout controller** command, you can force the network clock source to change to another clock source using the **network-clock switch force controller** command, irrespective of whether the source is available, and within range.

For example, this command is useful when you want to remove the module of the first controller for maintenance purposes. Use the **network-clock switch force** command to forcefully select another clock source.

Another command that performs the same function as **network-clock switch force controller** is the **network-clock switch manual controller** command. This command manually selects a synchronization source. The following example shows how to configure force switching:

```
Router# network-clock switch force controller t1 0/3/0 t0
```

You can later use the **network-clock clear switch controller-id** command to clear the effect of either a **network-clock switch force controller** command or **network-clock switch manual controller** command.

SUMMARY STEPS

1. **network-clock force controller [t1|e1] slot/bay/port**
2. **show network-clocks synchronization**

DETAILED STEPS

	Command	Purpose
Step 1	<pre>network-clock switch force controller [t1 e1] slot/bay/port t0</pre> <p>Example: <pre>Router# network-clock force controller t1 0/3/0 t0</pre></p>	Forces the specified controller clock source to be the primary clock source.
Step 2	<pre>show network-clocks synchronization</pre> <p>Example: <pre>Router# show network-clocks synchronization</pre></p>	Displays whether the primary clock source has been set to the required controller.

Example: Configuring Network Clocking with Force Switching

The following example starts with a configuration in which several clock sources have different priority levels.

The command **network-clock switch force controller [t1 | e1] slot/bay/port t0** switches the network clock source to a second priority clock source. You can verify that the primary clock source is now 0/3/0 T1 controller using the **show network-clocks synchronization** command. The switch is then cleared using the **network-clock clear switch t0** command.


```

Router# network-clock switch force controller t1 0/2/0
Router# show network-clocks synchronization

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/1/1
Hold-off (global) : 300 ms
Wait-to-restore (global) : 0 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal       NA           NA/Dis       251   QL-SEC NA       NA
*T1 0/1/1       NA           NA/Dis       50    QL-SEC NA       NA
  T1 0/2/0       NA           NA/Dis       150   QL-SEC NA       NA
Router# network-clock switch force controller T1 0/2/0 t0
Router# show network-clocks synchronization

Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 0 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal       NA           NA/Dis       251   QL-SEC NA       NA
  T1 0/1/1       NA           NA/Dis       50    QL-SEC NA       NA
#T1 0/2/0       NA           NA/Dis       150   QL-SEC NA       NA
Router# network-clock clear switch t0

```

Configuration Examples for Network Synchronization

- [Example 1: Configuring Clock Recovery with a Primary Clock Source \(Single Clock Source\), page 18](#)
- [Example 2: Configuring Clock Recovery with a Primary Clock Source \(Two Clock Sources\), page 18](#)
- [Example 3: Switchover from Primary Clock Source due to Loss of Signal, page 19](#)
- [Example 4: Switching of Input Source Clock, page 19](#)

Example 1: Configuring Clock Recovery with a Primary Clock Source (Single Clock Source)

The following example shows how to configure clock recovery for controller T1 on the 0/2/0 slot/bay/port as the primary clock source.

In this example, the 0/2/0 T1 controller has a higher priority (value = 1) than the internal clock. T1 0/2/0 is the primary clock source as indicated by the asterisk "*" in the interfaces listed below ("*T1 0/2/0").

```
Router# configure terminal
Router(config)# network-clock synchronization automatic
Router(config)# no network-clock synchronization participate 0/2
Router(config)# controller t1 0/2/0
Router(config-controller)# clock source line primary
Router(config-controller)# end
Router# show network clocks synchronization
```

Symbols: En - Enable, Dis - Disable, Adis - Admin Disable
 NA - Not Applicable
 * - Synchronization source selected
 # - Synchronization source force selected
 & - Synchronization source manually switched

Automatic selection process : Enable
 Equipment Clock : 2048 (EEC-Option1)
 Clock Mode : QL-Disable
 ESMC : Disabled
 SSM Option : 1
 T1 : 0/2/0
 Hold-off (global) : 300 ms
 Wait-to-restore (global) : 300 sec
 Tsm Delay : 180 ms
 Revertive : No
 Nominated Interfaces

Interface	SigType	Mode/QL	Prio	QL_IN	ESMC Tx	ESMC Rx
Internal	NA	NA/Dis	251	QL-SEC	NA	NA
*T1 0/2/0	NA	NA/Dis	1	QL-SEC	NA	NA

Example 2: Configuring Clock Recovery with a Primary Clock Source (Two Clock Sources)

The following example shows how to configure clock recovery for controller T1 on the 0/2/0 slot/bay/port as the primary clock source.

In this example, the 0/2/0 T1 controller is shown to have a high priority (value = 1) which is higher than the priority of the 0/3/0 T1 controller (value = 2); therefore the 0/2/0 T1 controller is the primary clock source.

```
Router# configure terminal
Router(config)# network-clock synchronization automatic
Router(config)# controller t1 0/2/0
Router(config)# clock source line primary
Router(config)# network-clock input-source 1 controller t1 0/2/0
Router(config)# exit
Router# show network-clocks synchronization
```

Symbols: En - Enable, Dis - Disable, Adis - Admin Disable
 NA - Not Applicable
 * - Synchronization source selected
 # - Synchronization source force selected

```

& - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/2/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface          SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal           NA           NA/Dis       251   QL-SEC NA       NA
  *T1 0/2/0          NA           NA/Dis       1     QL-SEC NA       NA
  T1 0/3/0           NA           NA/Dis       2     QL-SEC NA       NA

```

Example 3: Switchover from Primary Clock Source due to Loss of Signal

The following example shows how a primary clock source is affected by a signal failure which causes the primary clock source to change or switch to a different source.

```

Router# config terminal
Router(config)# network-clock input-source 1 controller t1 0/2/0
Perform a signal failure of the primary clock source, by shutting down the remote end or causing an “Out of Resource” condition of the primary clock source, by disconnecting a cable.

```

After the above signal failure or “Out of Resource,” verify the feature using the following **show network-clocks synchronization** command. Note that the output shows the primary clock source, T1 0/2/0, as having a QL_IN value of QL-FAILED and therefore the primary clock source has switched to the “Internal” clock (shown by an asterisk “*”).

```

Router# show network-clocks synchronization
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : Internal
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface          SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  *Internal           NA           NA/Dis       251   QL-SEC NA       NA
  T1 0/2/0           NA           NA/Dis       2     QL-FAILED NA       NA

```

Example 4: Switching of Input Source Clock

This example shows a primary clock source being affected by a signal failure, which then causes a different clock source to be selected.

```

Router# configure terminal

```

```
Router(config)# network-clock input-source 1 controller t1 0/2/0
```

Perform a signal failure of the primary clock source, by shutting the remote end or causing an “Out of Resource” condition of the primary clock source, by disconnecting a cable.

After the above signal failure or “Out of Resource”, verify the feature using the following **show network-clocks synchronization** command. Note that the output shows the primary clock source T1 0/3/0/. The controller T1 0/2/0 has a QL_IN value of QL-FAILED and therefore the primary clock source has switched to the controller T1 0/3/0 clock (shown by an asterisk “*”).

```
Router# show network-clocks synchronization
```

```
Symbols:      En - Enable, Dis - Disable, Adis - Admin Disable
              NA - Not Applicable
              * - Synchronization source selected
              # - Synchronization source force selected
              & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
ESMC : Disabled
SSM Option : 1
T0 : T1 0/3/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 300 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
  Interface      SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
Internal        NA           NA/Dis       251   QL-SEC  NA       NA
T1 0/2/0        NA           NA/Dis       2     QL-FAILED  NA       NA
*T1 0/3/0       NA           NA/Dis       2     QL-SEC  NA       NA
```

Additional References

- [Related Documents, page 20](#)
- [Standards, page 21](#)
- [MIBs, page 21](#)
- [RFCs, page 21](#)
- [Technical Assistance, page 21](#)

Related Documents

Related Topic	Document Title
Cisco IOS commands	<i>Cisco IOS Master Commands List, All Releases</i>

Standards

Standard	Title
None	—

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: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	—

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.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Network Synchronization

Table 1 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 <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

Another similar feature (Network Synchronization Support) is used by the Cisco ASR 1000 Series. See “Synchronous Ethernet Support” in the *Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide*.



Note

Table 1 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 1 Feature Information for Network Synchronization

Feature Name	Releases	Feature Information
Network Synchronization	Cisco IOS XE Release 3.12S	This feature was implemented on the Cisco ISR 4400 Series.

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