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Timing Reference

Introduction

This document provides information about and users and node timing.

Note Unless otherwise specified, "ONS 15454" refers to both ANSI and ETSI shelf assemblies.

Note Cisco ONS 15454 M2 chassis has reached its end-of-life status. For more information, see the Retirement Notification page.

The document contains the topics mentioned below.

Node Timing Parameters

SONET timing parameters must be set for each Cisco ONS 15454 Cisco NCS shelf. Each ONS 15454 independently accepts its timing reference from one of three sources: The NCS independently accepts its timing reference from the internal ST3 clock of the control card.

- The building integrated timing supply (BITS) pins on the ONS 15454 backplane (ANSI) or MIC-C/T/P coaxial connectors (ETSI).

- An OC-N/STM-N card installed in the ONS 15454. The card is connected to a node that receives timing through a BITS source.

- The internal ST3 clock on the control card.

You can set ONS 15454 timing to one of three modes: external, line, or mixed. If timing is received from a BITS source, set ONS 15454 timing to external. If timing is received from an OC-N/STM-N card, set the timing to line. The BITS connection on Cisco ONS 15454 M6 Cisco NCS 2006 shelf is through the external connection unit (ECU) and is through the power module on Cisco ONS 15454 M2 Cisco NCS 2002 shelf.

In typical ONS 15454 NCS networks:

- One node is set to external. The external node derives its timing from a BITS source wired to the BITS backplane pins. The BITS source, in turn, derives its timing from a primary reference source (PRS) such as a Stratum 1 clock or global positioning satellite (GPS) signal.

- The other nodes are set to line. The line nodes derive timing from the externally timed node through the OC-N/STM-N trunk (span) cards. The DWDM node normally derives timing from the line using the OSCM or OSC-CSM card that are inside an OC-3/STM-1 channel.

You can set three timing references for each ONS 15454 NCS. The first two references are typically two BITS-level sources, or two line-level sources optically connected to a node with a BITS source. The third reference is usually assigned to the internal clock provided on every ONS 15454 NCS control cards. However, if you assign all three references to other timing sources, the internal clock is always available as a backup timing reference. The internal clock is a Stratum 3 (ST3), so if an ONS 15454 NCS node becomes isolated, timing is maintained at the ST3 level.

The CTC Maintenance > Timing > Report tab show current timing information for an ONS 15454 NCS, including the timing mode, clock state and status, switch type, and reference data.

⚠️ **Caution**   Mixed timing allows you to select both external and line timing sources. However, Cisco does not recommend its use because it can create timing loops. Use this mode with caution.

The OC3 port of the TNC/TNCE/TSC/TSCE/TNCS/TNCS-O card can be set as the timing reference. In the NCS 2002 shelf, BITS-2 is not supported.

The TNCS-O card does not support OC3 timing as the OSC and OTDR ports on the TNCS-O card support the FE payload only.

When you provision timing reference on a control card and it is locked, but the reference is lost in less than 140 seconds due to any reason, the system Phase Lock Loop (PLL) state changes. The system PLL state changes to FREE-RUN state when provisioning the TNC card or it changes to HOLDOVER state when provisioning the TNCS-2, TNCS-2O, and TNCP card.

Network Timing

The following figure shows an ONS 15454 NCS network timing setup example. Node 1 is set to external timing. Two timing references are set to BITS. These are Stratum 1 timing sources wired to the BITS input pins on the Node 1 backplane. The third reference is set to internal clock. The BITS output pins on the backplane of Node 3 are used to provide timing to outside equipment, such as a digital access line access multiplexer.

In the example, Slots 5 and 6 contain the trunk (span) cards. Timing at Nodes 2, 3, and 4 is set to line, and the timing references are set to the trunk cards based on distance from the BITS source. Reference 1 is set to the trunk card closest to the BITS source. At Node 2, Reference 1 is set to Slot 5 because it is connected to Node 1. At Node 4, Reference 1 is set to Slot 6 because it is connected to Node 1. At Node 3, Reference 1 could be either trunk card because they are at an equal distance from Node 1.
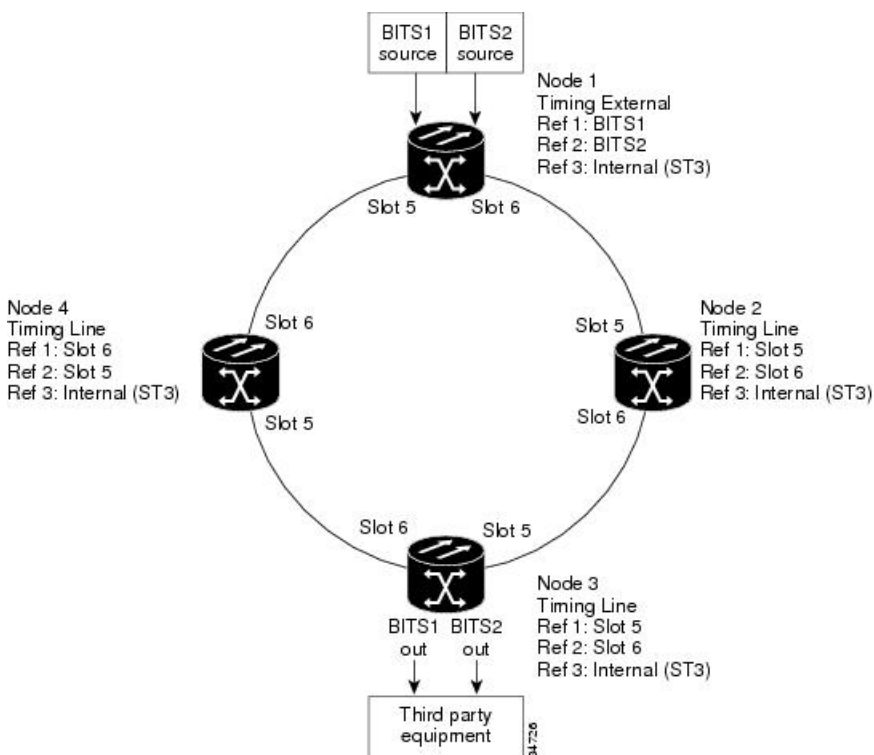
Synchronization Status Messaging

Synchronization status messaging (SSM) is a SDH and SONET protocol that communicates information about the quality of the timing source. SSM messages are carried on the S1 byte of the SONET Line layer or on S1 byte of the SDH section overhead. They enable SONET or SDH devices to automatically select the highest quality timing reference and to avoid timing loops.

SSM messages are either Generation 1 or Generation 2. Generation 1 is the first and most widely deployed SSM message set. Generation 2 is a newer version. If you enable SSM for the ONS 15454 or the ONS 15454 SDH NCS, consult your timing reference documentation to determine which message set to use.

The following table shows the SDH message set.

Table 1: SDH SSM Message Set

Message	Quality	Description
G811	1	Primary reference clock
STU	2	Sync traceability unknown
G812T	3	Transit node clock traceable
G812L	4	Local node clock traceable
SETS	5	Synchronous equipment
DUS	6	Do not use for timing synchronization

The following two tables show the Generation 1 and Generation 2 message sets for SONET.

Table 2: SSM Generation 1 Message Set

Message	Quality	Description
PRS	1	Primary reference source—Stratum 1
STU	2	Synchronization traceability unknown
ST2	3	Stratum 2
ST3	4	Stratum 3
SMC	5	SONET minimum clock
ST4	6	Stratum 4
DUS	7	Do not use for timing synchronization
RES	—	Reserved; quality level set by user

Table 3: SSM Generation 2 Message Set

Message	Quality	Description
PRS	1	Primary reference source—Stratum 1
STU	2	Synchronization traceability unknown
ST2	3	Stratum 2
TNC	4	Transit node clock
ST3E	5	Stratum 3 E
ST3	6	Stratum 3
SMC	7	SONET minimum clock
ST4	8	Stratum 4
DUS	9	Do not use for timing synchronization
RES	—	Reserved; quality level set by user

Procedures for Cisco ONS 15454 and Cisco NCS Timing

This section contains the procedure related to Cisco ONS 15454 and Cisco NCS timing.

NTP-G53 Set Up Timing

Purpose	This procedure provisions Cisco ONS 15454 Cisco NCS timing.
Tools/Equipment	None
Prerequisite Procedures	"NTP-G51 Verify DWDM Node Turn Up" procedure in "Turn Up a Network" chapter of the *Cisco ONS 15454 DWDM Network Configuration Guide Cisco NCS 2002 and NCS 2006 Network Configuration Guide* "DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Step 1   Complete the DLP-G95 Set Up External or Line Timing task if an external building integrated timing supply (BITS) source is available. This is the most common ONS 15454 NCS timing setup method.

Step 2   If an external BITS source is not available, complete the DLP-G96 Set Up Internal Timing task. This task can provide only Stratum 3 timing.

Step 3   Repeat this procedure at each node in the network.

DLP-G95 Set Up External or Line Timing

Purpose	This task defines the ONS 15454 and NCS timing source (external or line).
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	Required
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Step 1   In node view (single-node mode) or shelf view (multishelf mode), click the **Provisioning > Timing > General** tabs.

Step 2   In the General Timing area, complete the following information:

- Timing Mode-Choose **External** if the ONS 15454 NCS derives its timing from a BITS source wired to the backplane pins (ANSI) or a MIC-C/T/P front-mount electrical connection (FMEC) (ETSI); choose **Line** if timing is derived from an OSC-CSM or OSCM card that is optically connected to the timing node. A third option, Mixed, allows you to set both external and line timing references. Because Mixed timing might cause timing loops, we do not recommend its use. Use this mode with care.

   Note   In ONS 15454 M6 NCS 2006 the BITS is connected to ECU or ECU2 BITS Connectors. Refer to "DLP-G296 Install Timing Wires on ONS 15454 M6 - ANSI*DLP- L27 Installing Timing Wires on NCS 2006 - ANSI*" in the *Cisco ONS 15454 Hardware Installation Guide Cisco NCS 2002 and NCS 2006 Hardware Installation Guide*. In ONS 15454 M2 NCS 2002 he BITS is connected to BITS connectors on the Power Unit.

- SSM Message Set-Choose the Generation 2 synchronization status messaging (SSM) option. See the section Synchronization Status Messaging, on page 3 for more information about SSM, including definitions of the SONET timing levels.

   Note   Generation 1 is used only by SONET or SDH ONS 15454 NCS nodes that are connected to equipment that does not support Generation 2.

- Quality of RES-Sets the timing quality for the user-defined, reserved (RES) S1 byte if your timing sources supports RES. Most timing sources do not use RES. If it does not support RES, choose RES=DUS (do not use for timing reference). Qualities are displayed in descending quality order as ranges. For example, in Generation 1 SSM, ST3<RES<ST2 means that the timing reference RES is higher than a Stratum 3 (ST3) and lower than a Stratum 2 (ST2)

- Revertive-Select this check box if you want the ONS 15454 NCS to revert to a primary reference source after the conditions that caused it to switch to a secondary timing reference are corrected.

When a NE shelf timing is set with revertive time, the timing reference switch from lower priority to higher priority reference does not follow Wait-To-Restore (WTR) period when SSM value on lower priority timing reference becomes same or less than higher priority timing reference.

- Reversion Time-If Revertive is checked, choose the amount of time that the ONS 15454 NCS will wait before reverting to its primary timing source. Five minutes is the default.

Step 3   In the Reference Lists area, complete the following information:

Note   You can define up to three timing references for the node and up to six BITS Out references. BITS Out references define the timing references used by equipment that can be attached to the node's BITS Out pins on the backplane (ANSI) or the MIC-C/T/P FMEC (ETSI). If you attach equipment to BITS Out pins, you normally attach it to a node with Line mode, because equipment near the external timing reference can be directly wired to the reference.

- NE Reference-Allows you to define three timing references (Ref 1, Ref 2, Ref 3). The node uses Reference 1 unless a failure occurs to that reference, in which case the node uses Reference 2. If Reference 2 fails, the node uses Reference 3, which is typically set to Internal Clock. Reference 3 is the Stratum 3 clock provided on the control card. The options that appear depend on the Timing Mode setting.

    - If the Timing Mode is set to External, your options are BITS-1, BITS-2, and Internal Clock.

    - If the Timing Mode is set to Line, your options are the node's working OSCM cards, OSC-CSM cards, transponder (TXP) cards, muxponder (MXP) cards, and Internal Clock. Choose the cards or ports that are directly or indirectly connected to the node wired to the BITS source. Set Reference 1 to the card that is closest to the BITS source. For example, if Slot 5 is connected to the node wired to the BITS source, choose Slot 5 as Reference 1.

    - If the Timing Mode is set to Mixed, both BITS references and the OSCM, OSC-CSM, TXP, or MXP cards are available, allowing you to set a mixture of external BITS clocks and OSCM, OSC-CSM, TXP, or MXP cards as timing references.

- BITS-1 Out/BITS-2 Out-Sets the timing references for equipment wired to the BITS Out backplane (ANSI) or MIC-C/T/P FMEC (ETSI) pins. BITS-1 Out and BITS-2 Out are enabled when BITS-1 Out and BITS-2 Out facilities are put in service. If Timing Mode is set to external, choose the OSCM, OSC-CSM, TXP, or MXP card used to set the timing. If Timing Mode is set to Line, you can choose an OSCM, OSC-CSM, TXP, or MXP card or choose NE Reference to have the BITS-1 Out, BITS-2 Out, or both, follow the same timing references as the network element (NE).

Note   All TXP or MXP card client ports are available for timing regardless of the card's termination mode. TXP or MXP trunk ports can be a timing reference when ITU-T G.709 is set to OFF and the Termination Mode is set to LINE. You cannot choose TXP_MR_2.5G and OTU2_XP card client ports as a timing reference.

Note   The system prevents BITS In and BITS Out timing to be set on the same node.

Step 4   Click **Apply** .

Step 5   Click the **BITS Facilities** tab.

Note   The BITS Facilities section sets the parameters for your BITS-1 and BITS-2 timing references. Many of these settings are determined by the timing source manufacturer. If equipment is timed through BITS Out, you can set timing parameters to meet the requirements of the equipment.

Step 6 In the BITS In area, complete the following information:

- Facility Type-(TCC2P/TNC/TNCE/TSC/TSCE/TNCS/TNCS-O only) Choose the BITS signal type supported by your BITS clock, either DS1 or 64KHz+8KHz.

- BITS In State-If Timing Mode is set to External or Mixed, set the BITS In state for BITS-1, BITS-2, or both, to **IS** (in service) depending on whether one or both BITS input pin pairs are connected to the external timing source. If Timing Mode is set to Line, set the BITS In state to **OOS** (out of service).

Step 7 If the BITS In state is set to OOS, continue with Step 8. If the BITS In state is set to IS, complete the following information:

- Coding-Choose the coding used by your BITS reference, either B8ZS (binary 8-zero substitution) or AMI (alternate mark inversion).

- Framing-Choose the framing used by your BITS reference, either ESF (Extended Super Frame) or SF (D4) (Super Frame).

- Sync Messaging-Check this check box to enable SSM. SSM is not available if Framing is set to Super Frame.

- Admin SSM-If the Sync Messaging check box is not checked, you can choose the SSM Generation 2 type from the drop-down list. Choices are PRS (Primary reference source; Stratum 1), ST2 (Stratum 2), TNC (Transit Node Clock), ST3E (Stratum 3E), ST3 (Stratum 3), SMC (SONET minimum clock), and ST4 (Stratum 4).

Step 8 In the BITS Out area, complete the following information, as needed:

- Facility Type-(TCC2P/TNC/TNCE/TSC/TSCE/TNCS/TNCS-O only) Choose the BITS Out signal type, either DS1 or 64KHz+8KHz for ANSI and E1, 2Mhz, or 64Khz for ETSI.

- BITS Out state-If equipment is connected to the node's BITS output pins on the backplane (ANSI) or MIC-C/T/P FMEC (ETSI) and you want to time the equipment from a node reference, set the BITS Out state for BITS-1, BITS-2, or both, to **IS** , depending on which BITS Out pins are used for the external equipment. If equipment is not attached to the BITS output pins, set the BITS Out state to **OOS** .

Step 9 If the BITS Out state is set to OOS, continue with Step 10. If the BITS Out state is set to IS, complete the following information:

- Coding-Choose the coding used by your BITS reference, either B8ZS, AMI, or HDB3.

- Framing-Choose the framing used by your BITS reference, either ESF, SF (D4), or FAS+CAS+CRC.

- AIS Threshold-If SSM is disabled or Super Frame is used, choose the quality level where a node sends an alarm indication signal (AIS) from the BITS 1 Out and BITS 2 Out backplane pins (ANSI) or MIC-C/T/P FMEC (ETSI). An AIS alarm is raised when the optical source for the BITS reference falls to or below the SSM quality level defined in this field.

- LBO-If an external device is connected to the BITS Out pins, set the line build-out (LBO) distance between the ONS 15454 NCS and an external device. If an external device is connected to BITS Out, choose the distance between the device and the ONS 15454 NCS. Options are: 0-133 ft (default), 134-266 ft, 267-399 ft, 400-533 ft, and 534-655 ft. Line build out (LBO) relates to the BITS cable length. If an external device is not connected to BITS Out, leave this field set to the default.

Step 10 Click **Apply**.

> **Note** Refer to *Cisco ONS 15454 DWDM Troubleshooting Guide* Cisco NCS 2002 and NCS 2006 Troubleshooting Guide for timing-related alarms.

Step 11   Return to your originating procedure (NTP).

DLP-G96 Set Up Internal Timing

Purpose	This task sets up internal timing (Stratum 3) for an ONS 15454 and NCS.
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	As needed (use only if a BITS source is not available)
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

⚠️ **Caution**   Internal timing is Stratum 3 and is not intended for permanent use. All ONS 15454 SONET (ANSI) or SDH (ETSI) NCS nodes should be timed to a Stratum 2 (or better) primary reference source. Internal timing is appropriate for DWDM nodes.

Step 1   In node view (single-node mode) or shelf view (multishelf mode), click the **Provisioning > Timing > General** tabs.

Step 2   In the General Timing area, complete the following information:

- Timing Mode-Choose **External**
- SSM Message Set-Set to **Generation 1**.
- Quality of RES-Does not apply to internal timing.
- Revertive-Does not apply to internal timing.
- Reversion Time-Does not apply to internal timing.

Step 3   In the Reference Lists area, enter the following information:

- NE Reference
  - Ref 1-Set to **Internal Clock**.
  - Ref 2-Set to **Internal Clock** .
  - Ref 3-Set to **Internal Clock** .

- BITS-1 Out/BITS-2 Out-Set to **None**.

Step 4   Click **Apply** .

Step 5   Click the **BITS Facilities** tab.

Step 6   In the BITS Facilities area, change the BITS In state and BITS Out state to **OOS** for BITS 1 and BITS 2. Disregard the other BITS Facilities settings; they are not relevant to internal timing.

Step 7   Click **Apply**.

Step 8   Return to your originating procedure (NTP).

NTP-G87 Change Node Timing Parameters

Purpose	This procedure changes the timing parameters for the ONS 15454 and NCS. To switch the timing reference, see the NTP-G112 Change the Node Timing Reference, on page 11 procedure.
Tools/Equipment	None
Prerequisite Procedures	NTP-G53 Set Up Timing , on page 4
	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

⚠️

Caution   The following procedure might be service affecting and should be performed during a scheduled maintenance window.

Step 1   Complete the "NTP-G103 Back Up the Database" procedure in the chapter, "Maintaining the Node" of the *Cisco ONS 15454 DWDM Network Configuration Guide Cisco NCS 2002 and NCS 2006 Network Configuration Guide*.

Step 2   Click the **Provisioning > Timing > General** tabs.

Step 3   In the General Timing section, change any of the following information:

- Timing Mode

   Note   Because mixed timing can cause timing loops, Cisco does not recommend using the Mixed Timing option. Use this mode with care. Because mixed timing can cause timing loops, Cisco does not recommend using the Mixed Timing option. Use this mode with care.

- SSM Message Set

- Quality of RES

- Revertive

- Revertive Time

See the NTP-G53 Set Up Timing , on page 4 task for field descriptions.

Step 4   In the Reference Lists area, you can change the following information:

Note	Reference lists define up to three timing references for the node and up to six BITS Out references. BITS Out references define the timing references used by equipment that can be attached to the node's BITS Out pins on the backplane. If you attach equipment to BITS Out pins, you normally attach it to a node with Line mode because equipment near the external timing reference can be directly wired to the reference.

- NE Reference

- BITS 1 Out

- BITS 2 Out

Step 5   In node view (single-shelf mode) or shelf view (multishelf mode), click the **Provisioning > Timing > BITS Facilities** tabs.

Step 6   In the BITS In section, you can change the following information:

Note	The BITS Facilities section sets the parameters for your BITS1 and BITS2 timing references. Many of these settings are determined by the timing source manufacturer. If equipment is timed through BITS Out, you can set timing parameters to meet the requirements of the equipment.

- BITS In State

- Coding

- State

- Framing

- Sync Messaging

- Admin SSM

Step 7   In the BITS Out section, you can change the following information:

- Coding

- Framing

- AIS Threshold

- LBO

Step 8   Click **Apply**. Confirm that the changes appear.

Caution	Internal timing is Stratum 3 and is not intended for permanent use. All ONS 15454 and NCS should be timed to a Stratum 2 or better primary reference source.

Step 9   Complete the "NTP-G103 Back Up the Database" procedure in the chapter, "Maintaining the Node" of the *Cisco ONS 15454 DWDM Network Configuration Guide Cisco NCS 2002 and NCS 2006 Network Configuration Guide*.

Stop. You have completed this procedure.

NTP-G112 Change the Node Timing Reference

Purpose	This procedure enables automatic timing reference switching or returns the node timing to normal operation.
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Maintenance or higher

Step 1 Complete the DLP-G259 Manual or Force Switch the Node Timing Reference , on page 11 task as needed.

Step 2 Complete the DLP-G260 Clear a Manual or Force Switch on a Node Timing Reference, on page 12 task as needed.

Stop. You have completed this procedure.

DLP-G259 Manual or Force Switch the Node Timing Reference

Purpose	This task commands the node to switch to the timing reference you have selected.
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Maintenance or higher

Step 1 In node view (single-shelf mode) or shelf view (multishelf mode), click the **Maintenance > Timing > Source** tabs.

Step 2 From the Reference drop-down list for the desired Clock, choose the desired reference.

Step 3 From the Operation drop-down list for the desired Clock, choose one of the following options:

- **Manual** -This operation commands the node to switch to the reference you have selected if the synchronization status message (SSM) quality of the reference is not lower than the current timing reference.

- **Force**-This operation commands the node to switch to the reference you have selected, regardless of the SSM quality (if the reference is valid).

Note	For information about the Clear option, see the DLP-G260 Clear a Manual or Force Switch on a Node Timing Reference, on page 12 task.

Step 4   Click **Apply** next to the timing source.

Step 5   Click **Yes** in the confirmation dialog box. If the selected timing reference is an acceptable valid reference, the node switches to the selected timing reference. If the selected timing reference is invalid, a warning dialog box appears. Click **OK**; the node will not switch to the new timing reference.

Step 6   Return to your originating procedure (NTP).

DLP-G260 Clear a Manual or Force Switch on a Node Timing Reference

Purpose	This task clears a Manual or Force switch on a node timing reference and reverts the timing reference to its provisioned reference.
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Maintenance or higher

Step 1   In node view (single-shelf mode) or shelf view (multishelf mode), click the **Maintenance > Timing > Source** tabs.

Step 2   Find the Clock reference that is currently set to Manual or Force in the Operation drop-down list.

Step 3   From the Operation drop-down list, choose **Clear** .

Step 4   Click **Apply**.

Step 5   Click **Yes** in the confirmation dialog box. If the normal timing reference is an acceptable valid reference, the node switches back to the normal timing reference as defined by the system configuration. If the normal timing reference is invalid or has failed, a warning dialog box appears. Click **OK**; the timing reference will not revert.

Step 6   Return to your originating procedure (NTP).

NTP-G113 View the Cisco ONS 15454 and Cisco NCS Timing Report

Purpose	This procedure displays the current status of the Cisco ONS 15454 and Cisco NCS timing references.
Tools/Equipment	None
Prerequisite Procedures	"DLP-G46 Log into CTC" task in Connect the PC and Log into the GUI document.

Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Maintenance or higher

Step 1   In node view (single-shelf mode) or shelf view (multishelf mode), click the **Maintenance > Timing > Report** tabs.

Step 2   In the Timing Report area, you can view node timing information. The date and time of the report appear at the top of the report. The time stamp is the same as the alarms time stamp and can be configured using the DLP-G118 Display Alarms and Conditions Using Time Zone task in the Alarm and TCA Monitoring and Management document.

Step 3   To update the report, click **Refresh**. The following table describes the report fields and entries.

Table 4: Cisco ONS 15454 and Cisco NCS Timing Report

Item	Description	Option	Option Description
Clock	Indicates the timing clock. The report section that follows applies to the timing clock indicated.	NE	The node timing clock.
		BITS-1 Out	The BITS-1 Out timing clock.
		BITS-2 Out	The BITS-2 Out timing clock.

Item	Description	Option	Option Description
Status	Indicates the status of the timing clock.	INIT_STATE	The timing reference has not been provisioned. For an NE reference, this status appears just before the first provisioning messages when the control card is booting. Timing is provisioned to the internal clock of the node.
		HOLDOVER_STATE	The clock was locked onto a valid timing reference for more than 140 seconds when a failure occurred. Holdover state timing is a computation based on timing during the normal state combined with the node's internal clock. The node holds onto this frequency until the valid reference is restored. This status appears for NE references only.
		FREERUN_STATE	The node is running off its internal clock without any modification except the calibrated value to bring timing to 0 PPM. Freerun state can occur when a Force switch to the Internal clock is initiated, when all references fail without the 140 seconds of holdover data, or when only Internal timing references are defined. This status appears for NE references only.
		NO_SYNC_STATE	A synchronization timing reference is not defined. BITS-1 Out or BITS-2 Out default to this status until an OC-N/STM-N card is defined as its reference on the Provisioning > Timing tab. This status appears for external references only.
		NE_SYNCH_STATE	BITS-1 Out and BITS-2 Out use the same timing source as the NE. This is displayed when NE Reference is selected in the BITS-1 Out and BITS-2 Out Reference List on the Provisioning > Timing tab.
		NORMAL_STATE	The timing reference is locked onto one of its provisioned references. The reference cannot be Internal or NO SYNC STATE.
		FAST_START_STATE	The node has switched references, but the reference is too far away to reach NORMAL_STATE within an acceptable amount of time. FAST_START_STATE is a fast acquisition mode to allow the node to quickly acquire the reference. After it achieves this goal, the node progresses to NORMAL_STATE.
		FAST_START_FAILED_STATE	

Item	Description	Option	Option Description
			A timing reference is too far away to reach in normal state. The FAST_START_STATE could not acquire sufficient timing information within the allowable amount of time.
Status Changed At	Date and time of the last status change.	-	-
Switch Type	Type of switch.	AUTOMATIC	The timing switch was system-generated.
		Manual	The timing switch was a user-initiated Manual switch.
		Force	The timing switch was user-initiated Force switch.
Reference	Indicates the timing reference.	Three timing references are available on the Provisioning > Timing tab.	-
Selected	Indicates whether the reference is selected.	Selected references are indicated with an X.	-
Facility	Indicates the timing facility provisioned for the reference on the Provisioning > Timing tab.	BITS-1	The timing facility is a building integrated timing supply (BITS) clock attached to the node's BITS-1 pins.
		BITS-2	The timing facility is a BITS clock attached to the node's BITS-2 pins.
		OC-N/STM-N card with port number	If the node is set to line timing, this is the OC-N/STM-N card and port provisioned as the timing reference.
		Internal clock	The node is using its internal clock.
State	Indicates the timing reference state.	IS	The timing reference is in service.
		OOS	The timing reference is out of service.
Condition	Indicates the timing reference state.	OKAY	The reference is valid to use as a timing reference.
		OOB	Out of bounds; the reference is not valid and cannot be used as a timing reference, for example, a BITS clock is disconnected.
Condition Changed	Indicates the date and time of the last status change in MM/DD/YY HH:MM:SS format.	-	-

Item	Description	Option	Option Description
SSM	Indicates whether SSM is enabled for the timing reference.	Enabled	SSM is enabled.
		Disabled	SSM is not enabled.
SSM Quality	Indicates the SSM timing quality.	8 to 10 SSM quality messages might be displayed.	For a list of SSM message sets, see Timing Reference chapter.
SSM Changed	Indicates the date and time of the last SSM status change in MM/DD/YY HH:MM:SS format.	-	-

When the timing reference is provisioned for a node with the TNCS-2/TNCS-2O card, the timing status of the node moves from the FREERUN_STATE to HOLDOVER_STATE for a few seconds. When the timing reference state is OKAY, the timing status of the node moves to the NORMAL_STATE. If the timing status is not OKAY, the timing status remains in the HOLDOVER_STATE.

Stop. You have completed this procedure.

Configuring Synchronous Ethernet

Synchronous Ethernet Overview

With Ethernet equipment gradually replacing existing SONET and Synchronous Digital Hierarchy (SDH) equipment in service provider networks, frequency synchronization is required to provide high-quality clock synchronization over Ethernet ports.

Synchronous Ethernet (SyncE) provides synchronized timing to multiple remote network elements (NEs) without using an external circuit for timing. SyncE provides the required synchronization at the physical level. Operation messages maintain SyncE links and ensure that a node always derives timing from the most reliable source.

SyncE uses the Ethernet Synchronization Message Channel (ESMC) to enable traceability of the best clock source to correctly define the timing source and prevent a timing loop. As the Ethernet does not have the Quality Level (QL) information in its header, it requires ESMC for QL information.

SyncE clocks are compatible with the clocks used in the SONET or SDH synchronization network.

SyncE is supported on TNCS and TNCS-O controller cards. You must enable ESMC on an OSC port to configure it as a clock source. In a Node Controller (NC) and subtended shelf setup, the NC derives its clock from SyncE on the OSC port.

⚠

Warning Do not enable SyncE on TNC and TNCE controller cards.

SyncE Limitations

- You can configure the clock source only on OSC ports of the TNCS and TNCS-O controller card.

- Only one port per slot can be used as a clock source.

- In a multishelf setup, only the node controller and one subtended shelf port can be used as a clock source. Other shelves in the setup are synced using BITS.

- OSI-connected nodes are not supported for ESMC.

- If an OSC port is only ESMC-enabled and not a clock source, it can only transmit ESMC packets.

- During an OTDR scan, the node chooses the next configured clock as the timing source or switches to the holdover mode.

- You can configure SyncE between two TNCS cards or TNCS to TNC-O cards or vice versa.

- SyncE alarms are raised at port level only on reference ports or clock sources. When Ethernet-related alarms such as SYNC_LOSS or CARRIER_LOSS are raised against a port then SSM QL or ESMC_FAIL alarms will not be raised against the port.

SyncE During Switchover

- The clock and Synchronization Status Messages (SSM) quality values are shared with the active and standby cards.

- Each OSC port (on active and standby TNCS/TNCS-O cards) can act as an independent clock source and after a switchover of the TNCS/TNCS-O card, the original Primary Reference Clock (PRC) is used as the PRC.

- When the active card fails or reboots, the same clock is available to the standby card. During switchover, the standby card takes over, and reuses the clock. The standby card also runs the selection process and sends the ESMC packets.

Multishelf Support

- You can enable ESMC and configure a maximum of two ports each on a subtended shelf and a node controller as a clock source. However, only the node controller and one subtended shelf port are used as a clock source. Other shelves in the setup are synced using BITS.

- You must not connect the NC and subtended shelf of the same node using an OSC link.

- Subtended shelf ports can send and receive ESMC packets.

NTP-G360 Configuring Synchronous Ethernet on TNCS or TNCS-O Cards

Purpose	(Cisco NCS 2002, NCS 2006, ONS 15454 M2, ONS 15454 M6, NCS 2015) This task configures SyncE on TNCS or TNCS-O cards.
Tools/Equipment	TNCS/TNCS-O card.
Prerequisite Procedures	• DLP-G46 Log into CTC • DLP-G788 Configuring Operating Mode for the TNC, TNCE, TNCS, and TNCS-O Cards
Required/As Needed	As Needed
Onsite/Remote	Onsite or Remote
Security Level	None

Step 1 Complete the DLP-G605 Provisioning PPM and Port for the TNC, TNCE, and TNCS Cards

Note	For provisioning SyncE, you must choose FE as the port type from the **Port Type** drop-down list when you configure the OSC port of a TNCS card.

Step 2   Complete the NTP-G38 Provisioning OSC Terminations to choose the OSC ports and create an OSC link.

Step 3   Complete the DLP-G794 Configuring ESMC on OSC ports of TNCS/TNCS-O Cards, on page 18.

Step 4   Choose **Timing > Report** tabs to view the Timing Report.

Stop. You have completed this procedure.

DLP-G794 Configuring ESMC on OSC ports of TNCS/TNCS-O Cards

Purpose	(Cisco NCS 2002, NCS 2006, ONS 15454 M2, ONS 15454 M6, NCS 2015) This task lets you enable ESMC on an OSC port of TNCS/TNCS-O Cards.
Tools/Equipment	TNCS/TNCS-O card
Prerequisite Procedures	• DLP-G46 Log into CTC • DLP-G788 Configuring Operating Mode for the TNC, TNCE, TNCS, and TNCS-O Cards • DLP-G605 Provisioning PPM and Port for the TNC, TNCE, and TNCS Cards
Required/As Needed	As Needed
Onsite/Remote	Onsite or Remote
Security Level	None

Step 1   In the node view (single-shelf mode) or shelf view (multishelf view), double-click the TNCS or TNCS-O card.

Step 2   Click the **Provisioning > Line > Ethernet Lines** tabs.

The **Ethernet Lines** tab appears only if you choose FE as the port type when you configure the OSC port of a TNCS or TNCS-O card.

Step 3   Check the **ESMC Enable** check box to enable ESMC on the OSC port.

If you have two nodes, you must enable ESMC on both ends of the OSC link.

Step 4   Click **Apply**.

After you enable ESMC on an OSC port, the port appears in the Clock reference list (click the **Provisioning > Timing > General** tabs).

Step 5   In the node view (single-node mode) or shelf view (multishelf mode), click the **Provisioning > Timing > General** tabs.

Step 6   In the **General Timing** area, configure the following parameters:

a)   Choose Line or Mixed from the **Timing Mode** drop-down list.

b)   Choose Generation 2 from the **SSM Message** drop-down list.

Note	Generation 1 timing mode is not supported for SyncE configuration.

Step 7   In the **Reference Lists** area, choose the ESMC-enabled OSC port as Reference 1 for NE Reference.

Note	When an ESMC-enabled OSC port is configured as a clock source, it can transmit and receive ESMC packets.

If the SyncE reference fails, the node chooses the next best reference clock or enters the hold-over mode, if available.

What to do next

Click the **Maintenance > Timing > Report** tabs. For more details, see NTP-G113 View the Cisco ONS 15454 and Cisco NCS Timing Report, on page 12.

Short Description

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