



CHAPTER 6

Timing

This chapter provides information about Cisco ONS 15600 SDH timing. To provision timing, refer to the *Cisco ONS 15600 SDH Procedure Guide*.

Chapter topics include:

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6.1 Timing Parameters

SDH timing parameters must be set for each ONS 15600 SDH node. Each ONS 15600 SDH independently accepts its timing reference from one of three sources:

- The building integrated timing supply (BITS) pins on the Customer Access Panel (CAP/CAP2).
- A port on an STM-N card installed in the ONS 15600 SDH. The timing is traceable to a node that receives timing through a BITS source.
- The internal Stratum 3E clock (ST3E) on the TSC card.

You can set ONS 15600 SDH timing to one of three modes: external, line, or mixed. If the timing comes from BITS, set ONS 15600 SDH timing to external. If the timing comes from an STM-N port, set the timing to line. If the timing comes from both BITS and STM-N port, set ONS 15600 SDH timing to mixed. In typical ONS 15600 SDH networks:

- One node is set to external timing. 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.
- Other nodes are set to line timing. The line nodes derive timing from the externally timed node through the STM-N trunk cards.

You can set three timing references for each ONS 15600 SDH. The first two references are typically two BITS-level sources, or two line-level sources optically traceable to a node with a BITS source. The third reference is the internal ST3E clock provided on every ONS 15600 SDH TSC card. If an ONS 15600 SDH becomes isolated, the TSC maintains timing at the ST3E level.

6.2 Network Timing

Figure 6-1 shows an ONS 15600 SDH network timing example. Node 1 is set to external timing. Two timing references 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 event of a failure of one of the TSC modules, the redundant TSC module provides timing for BITS Out. There are some restrictions on the provisioning of BITS Out:

If the system is BITS timed:

- BITS-1 Out can have one reference if a 1+1 protected pair is chosen, or two references if unprotected line sources are chosen.
- BITS-2 Out can have one reference if a 1+1 protected pair is chosen, or two references if unprotected line sources are chosen.

If system is line timed:

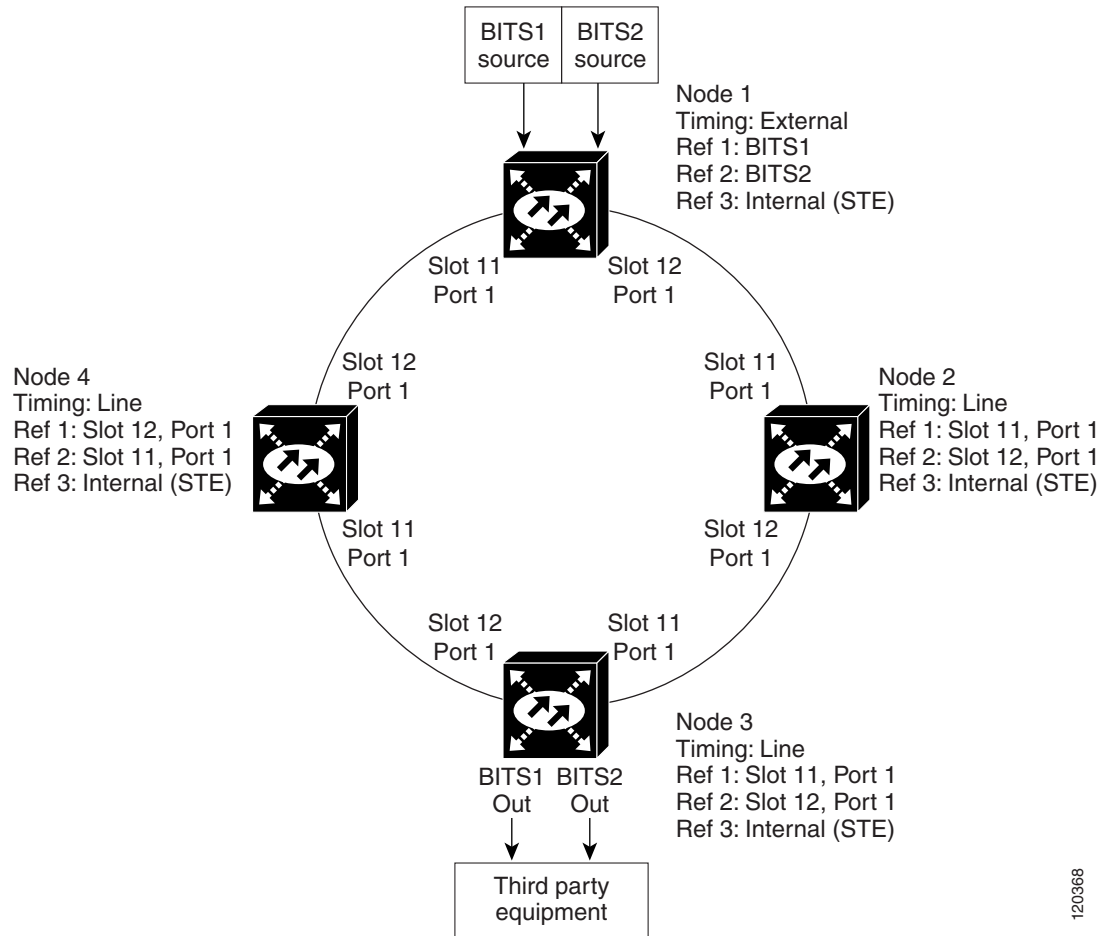
- BITS-1 Out can have one unprotected line source and either or both of the network element (NE) references.
- BITS-2 Out can have one unprotected line source and either or both of the NE references.

If the system is in mixed mode:

- BITS-1 Out can have one unprotected line source and any line source selected as NE reference Ref-1 or Ref-2.
- BITS-2 Out can have one unprotected line source and any line source selected as NE reference Ref-1 or Ref-2.

In the example, Slots 11 and 12 of Node 1 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 according to the distance from the BITS source. Reference 1 is set to the trunk card closest to the BITS source. At Node 2, Reference 1 is Slot 11/Port 1 because it is connected to Node 1. At Node 4, Reference 1 is set to Slot 12/Port 1 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.

Figure 6-1 ONS 15600 SDH Timing Example



6.3 Synchronization Status Messaging

Synchronization status messaging (SSM) is a SONET and SDH protocol that communicates information about the quality of the timing source. SSM messages are transported as follows:

- If SSM is carried over an optical line, for both SONET and SDH the SSM is transported in the S1 byte.
- If SSM is carried over an electrical line:
 - for SDH, the SSM is transported in the Sa bit of E1.
 - for SONET, the SSM is transported in the outband loop code.

The SSM messages enable SONET and SDH devices to select the highest quality timing reference automatically and to avoid timing loops.

6.3.1 SONET SSM Messages

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 SONET SSM for the ONS 15600 SDH, consult your timing reference documentation to determine which message set to use. [Table 6-1](#) and [Table 6-2](#) show the SONET Generation 1 and Generation 2 message sets.

Table 6-1 SONET 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 6-2 SONET 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 3E
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

6.3.2 SDH SSM Messages

If you enable SDH SSM for the ONS 15600 SDH, consult your timing reference documentation to determine which message set to use.



Note

Mapping from DS1 SSM to E1 SSM is possible when DS1 timing is used on the 15600 SDH platform.

[Table 6-3](#) shows the SDH SSM messages.

Table 6-3 **SDH SSM Messages**

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

