CHAPTER 10

Timing

This chapter provides information about Cisco ONS 15454 SONET timing. To provision timing, refer to the *Cisco ONS 15454 Procedure Guide*.

Chapter topics include:

10.1 Timing Parameters

SONET timing parameters must be set for each ONS 15454. In addition, an SDH external timing source can be selected so that a SONET shelf can be deployed in a network using SDH timing. SDH timing is typically used when the SONET platform is deployed for AU3 SDH applications. Each ONS 15454 independently accepts its timing reference from one of the following sources:

- The building integrated timing supply (BITS) pins on the ONS 15454 backplane.
- An OC-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 TCC2/TCC2P card.

You can set ONS 15454 timing to one of three modes: external, line, or mixed. If timing is coming from the BITS pins, set ONS 15454 timing to external. If the timing comes from an OC-N card, set the timing to line. In typical ONS 15454 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 trunk (span) cards.

You can set three timing references for each ONS 15454. 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 TCC2/TCC2P card. 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 node becomes isolated, timing is maintained at the ST3 level.

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

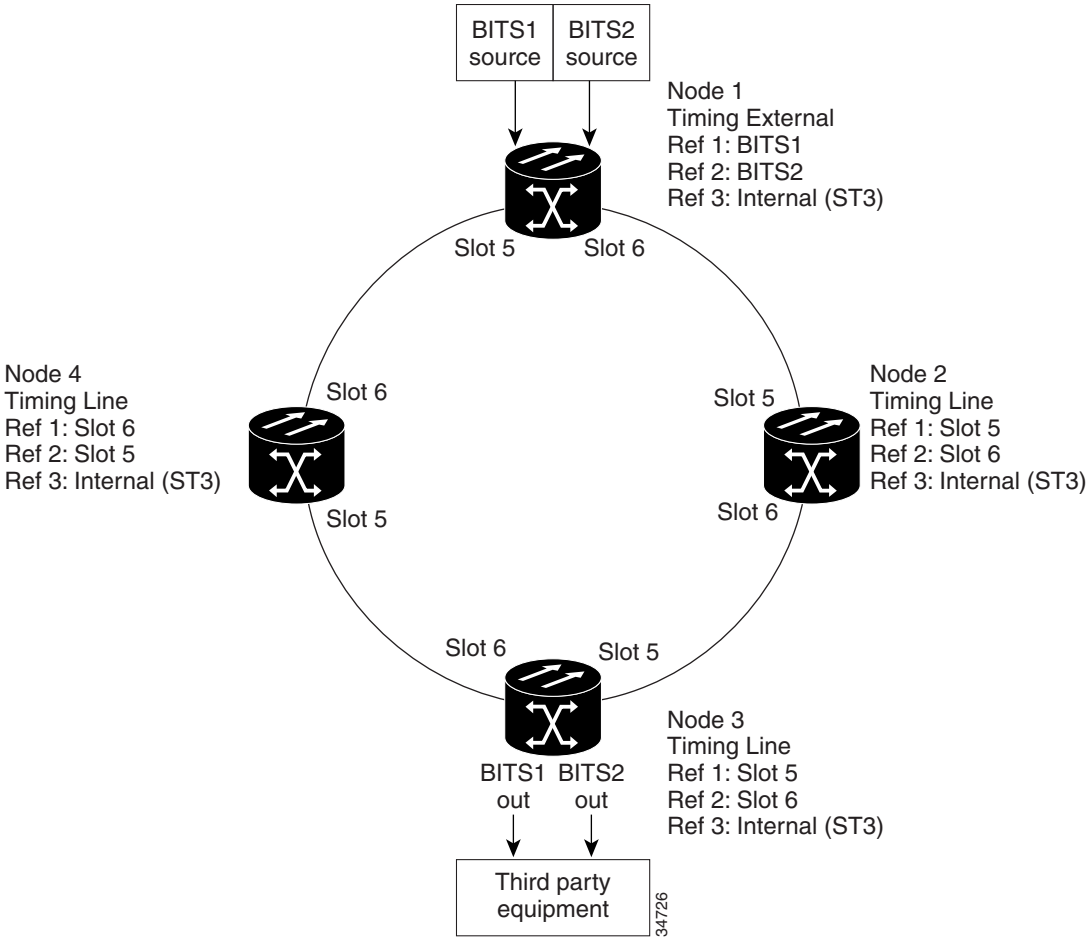
Caution Mixed timing allows you to select both external and line timing sources. However, Cisco does not recommend its use because it can create timing loops. Use this mode with caution.

10.2 Network Timing

Figure 10-1 shows an ONS 15454 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 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 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 an equal distance from Node 1.

Figure 10-1 ONS 15454 Timing Example



10.3 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.

10.3.1 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 15454, consult your timing reference documentation to determine which message set to use. Table 10-1 and Table 10-2 show the SONET Generation 1 and Generation 2 message sets.

Table 10-1 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 10-2 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

Table 10-2 SONET SSM Generation 2 Message Set

Message	Quality	Description
DUS	9	Do not use for timing synchronization
RES	—	Reserved; quality level set by user

10.3.2 SDH SSM Messages

If you enable SDH SSM for the ONS 15454, consult your timing reference documentation to determine which message set to use. Table 10-3 shows the SDH SSM messages.

Table 10-3 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