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Tech Notes

BITS Wiring Information and Looped BITS Timing on ONS 15454

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Contents

Introduction

This document describes Building Integrated Timing Supply (BITS) wiring information and presents a case for looped BITS timing configuration on Cisco ONS 15454.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Cisco ONS 15454

- GR Core Telecordia Standards

Components Used

The information in this document is based on these software and hardware versions:

- Cisco ONS 15454

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

BITS Wiring Information

Each ANSI chassis has two incoming BITS (1 and 2) ports and two outgoing BITS (1 and 2) ports. Two pins are assigned for each clock signal as shown in Table 1.

Table 1 – BITS Wiring Chart

External Device	Function	Contact	Tip or Ring
BITS 1	Out	A3	Ring
	Out	B3	Tip
	In	A4	Ring
	In	B4	Tip
BITS 2	Out	A1	Ring
	Out	B1	Tip
	In	A2	Ring
	In	B2	Tip

A standard T1/E1 connector contains 8 pins with 4 wires (1, 2, 4 and 5) active. The device type (DCE or DTE) defines T1 pins as shown in Table 2.

Table 2 – T1 Pin Out

Pin #	Name	DCE (Network)	DTE (Customer)
1	R	Tx Ring	Rx Ring
2	T	Tx Tip	Rx Tip
4	R1	Rx Ring	Tx Ring
5	T1	Rx Tip	Tx Tip

Note: Here is the key to the terms in Table 2:

- **Tx**: Transmits out of a terminating device.

- **Rx**: Receives in to a terminating device.

- **Tip**: Positive (+).

- **Ring**: Negative (-).

When you connect a DCE to a DTE (a typical configuration), you must use a straight through cable. Otherwise you need a cross-over cable. For example, you need a cross-over cable to connect a DTE to another DTE, so that a Tx Tip communicates with an Rx Tip, and a Tx Ring communicates with an Rx Ring. In such a cable, pin 1 of one connector always terminates on pin 4 of the other connector, and pin 2 of one connector always terminates on pin 5 of the other connector.

Cisco recommends 100-ohm type #22 or #24 AWG shielded twisted pair cable. Category 5 shielded twisted pair cables meet this criterion. Use solid conductors for tight wrapping. Also, provision line build out correctly to minimize cable-related issues.

RJ-48C and RC-45 are two common connectors that you can use for T1 termination. Both have eight pins.

Timing T1/E1 connections involve simplex data, which refers to one-way communication from timing source to receiver. Therefore, you require only two wires for each timing signal. In order to ensure that the port does not go down, the provider can provision an internal loopback for the port. In order to connect BITS clock to BITS In pins, connect ring to ring and tip to tip. For example, for BITS1 In, you must wire pin 1 to A4 and pin 2 to B4.

For the ETSI chassis, four miniature coaxial connectors provide two inputs and two outputs. You can find them in slot 24 MIC-C/T/P card on FMEC. The top two connectors are for BITS 1 (In on the left and Out on the right) and the bottom two connectors are for BITS 2 (In on the left and Out on the right). The cable is a 75-ohm coaxial cable with a 1.0/2.3 miniature coaxial connector.

Looped BITS Timing

A Mixed timing mode uses both external and line inputs as references. The danger with Mixed timing is the potential for timing loops. As an alternative to Mixed timing, you can use the BITS output that you derive from an optical line as an input to a secondary BITS. There are several ways to wire and provision the looped BITS timing (see Figure 1 for an example).
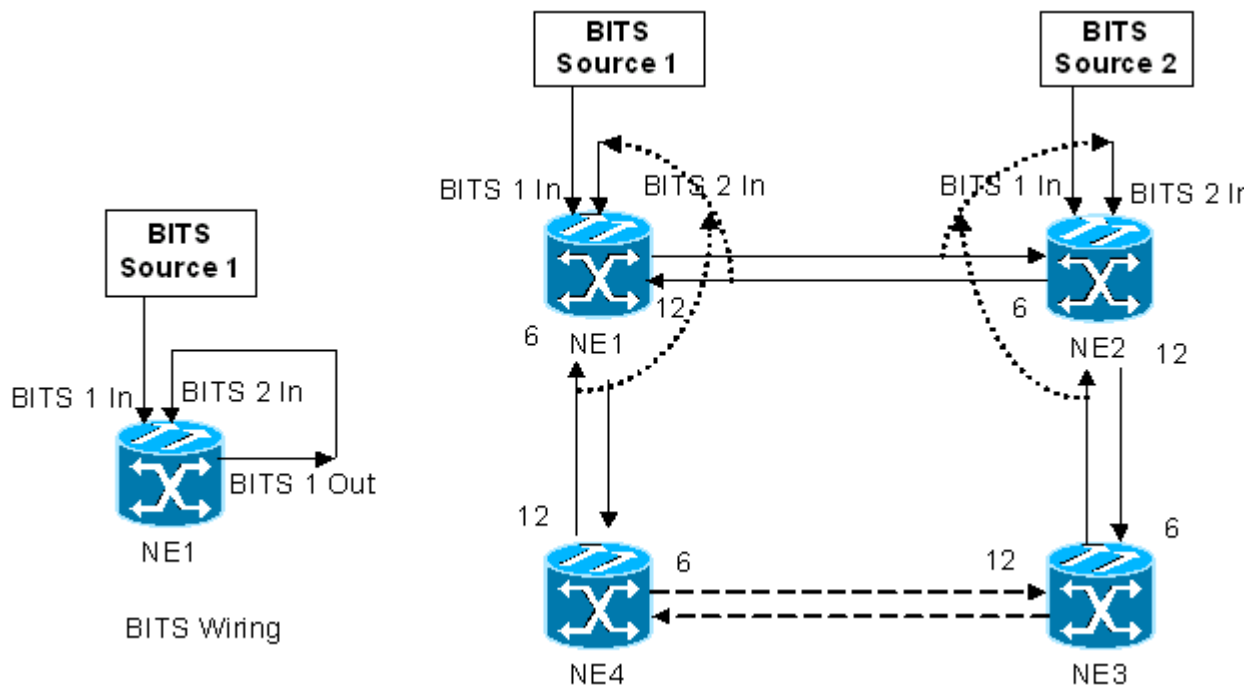
Figure 1 – ONS 15454 Timing Circuit
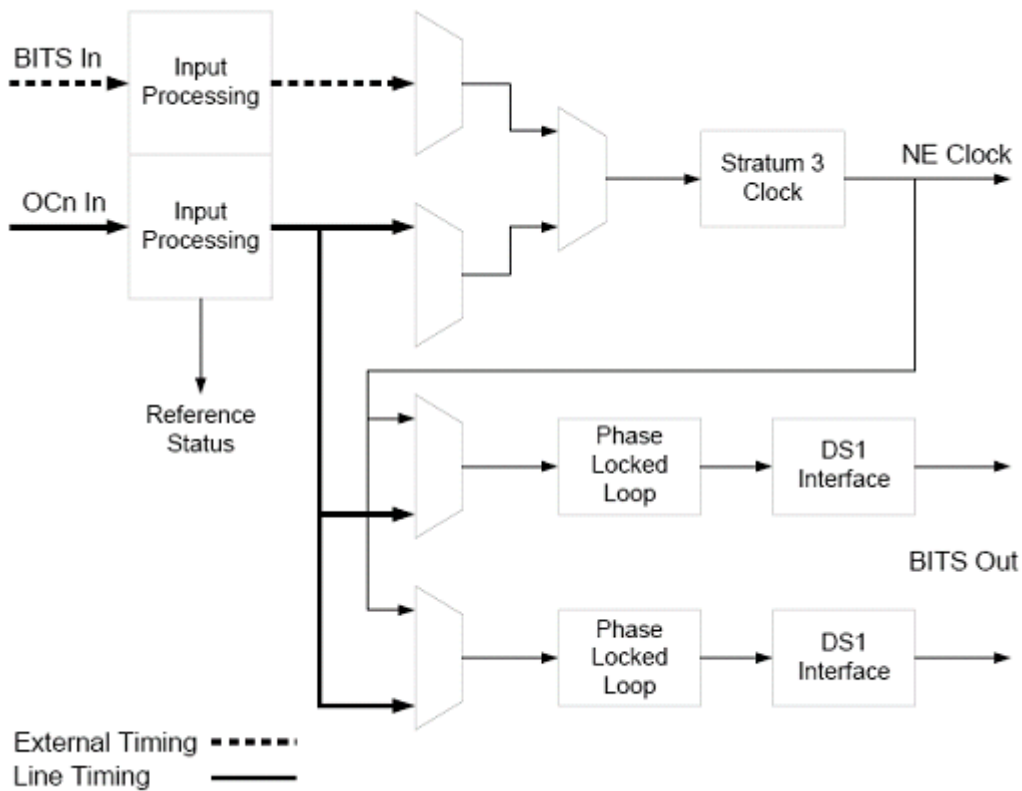
Note: The use of looped BITS configuration does not prevent timing loops. Use the same caution as with the Mixed mode provisioning.

Wire one of the two BITS Out (BITS 1 Out) directly to the second BITS In pins (see Figure 2).

Figure 2 – A Sample Looped BITS Configuration

Wire pin A3 is to pin A2 and pin B3 is to pin B2. Wire BITS 1 In as discussed previously.

Provision BITS 2 In as a second external reference, in addition to the BITS from the attached BITS device (the primary reference). Similarly, wire and provision both NE1 and NE2.

NE4 derives the primary timing from NE1, and secondary timing from NE3. NE3 derives the primary timing from NE2, and secondary timing from NE4. Enable Source Specific Multicast (SSM) on all nodes.

In order to activate BITS Out, provision two lines as the timing sources for BITS 1 Out. On NE1, a port on slot 12 is the primary source and a port on slot 6 is the secondary source. On NE2, slot 6 is the primary source and slot 12 is the secondary source.

Table 3 shows the timing provisioning information for all four nodes.

Table 3 – Timing Provisioning Information

Device	Timing Mode	Primary	Secondary	Third	BITS 1 Out Primary	BITS 1 Out Secondary
NE1	External	BITS 1 In	BITS 2 In	Internal	12	6
NE2	External	BITS 1 In	BITS 2 In	Internal	6	12
NE3	Line	6	12	Internal	-	-
NE4	Line	12	6	Internal	-	-

You can analyze at least three failure scenarios for this timing scheme, as explained here:

- **Scenario 1: BITS Source 1 fails**

  When BITS Source 1 fails, NE1 switches to BITS 2, which is derived from slot 12 and thus from BITS Source 2. There is no timing switch on any other nodes.

- **Scenario 2: Both BITS Source 1 and BITS Source 2 fail**

  When BITS Source 2 also fails after BITS Source 1 failure, NE2 enters the Holdover mode, because NE2 receives DUS from slots 6 and 12. All four nodes are timed from the internal oscillator of NE2.

- **Scenario 3: BITS Source 1 and the link between NE1 and NE2 fail**

  When BITS Source 1 fails and the link between NE1 and NE2 fails thereafter, NE1 enters the Holdover mode because NE1 receives DUS from slot 6. NE4 switches to the secondary source from NE3, and removes the DUS that NE1 receives. Therefore, NE1 is able to switch to BITS 2 In.

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