PRODUCT NOTE

Sentinel

Measurement of Asymmetry in a Fiber Pair

Introduction

It is possible to measure the asymmetry of a fiber pair to a high accuracy using the existing time transmitter and a measurement instrument on the receive side able to measure the forward delay (T_2–T_1) on two channels simultaneously. It is not necessary for the clocks at either end to be synchronized or even syntronized and the measurement is largely immune to any wander present on the clocks.

Measurement Principle

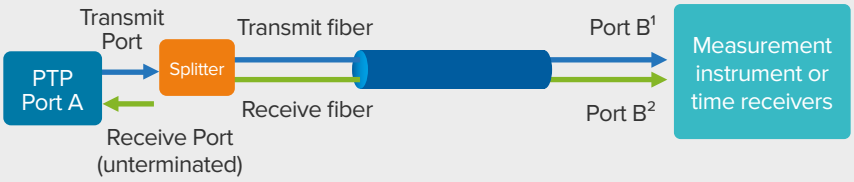
The procedure measures the forward delay (T_2–T_1) on both fibers. The asymmetry is the difference between the two measured forward delays:

<delayAsymmetry> = (T_2–T_1 on forward path) – (T_2–T_1 on reverse path)

It is not necessary that the clocks be synchronized at either end of the connection. Because the measurements are made simultaneously on the two fibers, any differences in the time at the transmit and receive sides is cancelled out in the calculation.

It is necessary that the transmit side be able to regularly send sync and follow-up messages, if two step operation is used, when no response is received from the time receiver.

Any error due to wander is common mode on the two paths and does not affect the measurement. The clocks used at either end of the fiber pair do not have to be synchronous as any time offset between the two sides is cancelled out in the calculation. The procedure does require two PTP ports on the receive side that are using the same clock as each other for timestamping.



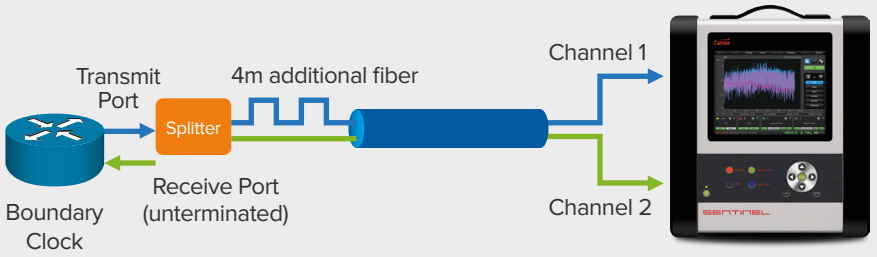
Duplex fiber connection with one transmitter

To make the measurement, the transmit signal from a PTP Time Transmitter is split. The duplicate signals are sent down the transmit and receive side of the fiber pair. Attention must be given that there is sufficient signal strength on each fiber to be decoded at the far end. Also, this implementation may not work for unicast unless both receive ports can be at the same address to recognise the received signals and independently measure T_2–T_1. The procedure assumes that there are no unidirectional components in the signal path.

The measurement instrument must be able to measure the forward delay (T_2–T_1) in the absence of a full PTP exchange.

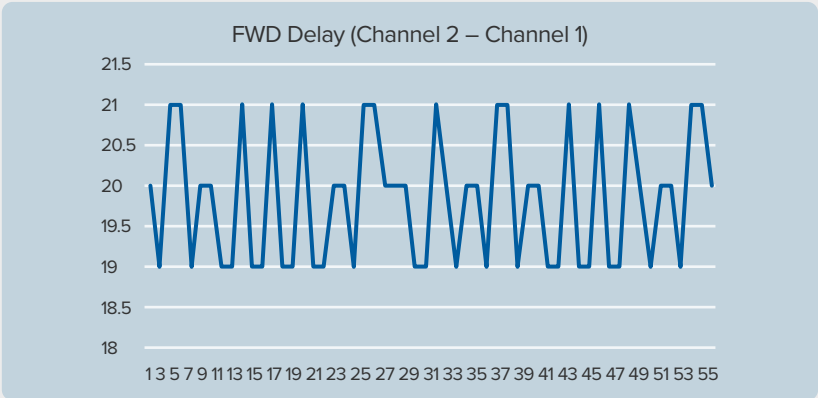
The Sentinel Solution

In this measurement, the output of a switch with boundary clock functionality is split into two streams. One feeds the return path and the other the transmit path. 4m of fiber has been added to the transit path.



Asymmetry measurement with Sentinel

Sentinel measures the forward delay (T_2–T_1) on channel 1 and 2. The two delays are displayed, and the difference can be observed. The measurement data has also been downloaded and graphed below.



The results indicate a 20ns delay difference consistent with the 4m of added fiber.