PTP Calibration Configuration Guide

Application Note

CONFIDENTIAL

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Unresolved directive in <stdin> - include::Microsemi.adoc[]

1. Introduction

This configuration guide provides information on how to make Port-to-port and 1PPS calibrations to improve timing by adjusting the ingress/egress latencies.

2. Feature Description

2.1. Persistence of Calibration Results

The results from performing the calibrations described below are saved to the flash so that they are persistent even if the device is power-cycled or rebooted.

2.2. Persistence to reload-defaults

The results from performing the calibrations described below are persistent also across a reload-defaults.

If a reload-defaults shall reset the calibration to built-in defaults, this should be specified as a parameter to reload-defaults i.e:

```
reload-defaults reset-calib
```

2.3. Automatic Adjustment of Timestamp Plane Reference

The CLI features a command that measures the difference T2-T1 for a PTP port in loopback mode and then automatically adjusts the egress and ingress latencies of the port so that T2 and T1 become equal.

The calibration performed by this command is for the mode only in which the port is actually configured to run. To make a calibration for all modes supported by the port, the command will have to be repeated for each mode.

The syntax for the command is:

```
ptp cal t-plane <port_to_cal> <ext/int>
```

The option 'ext' specifies that an external loopback is being used. When the 'int' option is used, the port shall be configured for internal loopback.

Note: For systems that has a large linkup-to-linkup latency variation (uncompensated serial-to-parallel barrel shifter position) the calibration takes down the link multiple times to ensure that the calibration is done to the middle value (not mean value).

2.4. Port-to-port calibration

The CLI features a command for calibrating a PTP port with respect to another PTP port (reference port) of the same switch.

The calibration performed by this command is for the mode only in which the port is actually configured to run. To make a calibration for all modes supported by the port, the command will have to be repeated for each mode.

The syntax for the command is:

```
ptp cal p2p <reference_port> <port_to_cal> <cable_latency>
```

The PTP slave instance associated with the port being calibrated should run in probe mode so that no adjustments are being made to the PTP time. The calibration procedure will measure the differences T2-T1 and T4-T3 and considering also the cable latency make the following adjustments:

1) Adjust ingress latency for port with T2-T1-cable_latency

2) Adjust egress latency for port with T4-T3-cable_latency

Note: For systems that has a large linkup-to-linkup latency variation (uncompensated serial-to-parallel barrel shifter position) the calibration takes down the link multiple times to ensure that the calibration is done to the middle value (not mean value).

2.5. Calibration to External Reference using 1PPS

The CLI features a command for calibrating a PTP port with respect to an external reference by means of the 1PPS signal.

The calibration performed by this command is for the mode only in which the port is actually configured to run. To make a calibration for all modes supported by the port, the command will have to be repeated for each mode.

The syntax for the command is:

```
ptp cal port <port_to_cal> <cable_latency> start [synce]
```

The synce option makes the port under calibration lock its clock frequency to the reference using SyncE.

As part of the calibration procedure, the PTP slave instance associated with the port under calibration will lock its phase to the reference. Once the PTP slave is fully locked and stabilized, the calibration will measure the mean path delay and make the following adjustments:

1) Ingress latency = Ingress latency + (MeanPathDelay - cable_latency)/2

2) Egress latency = Egress latency + (MeanPathDelay - cable_latency)/2

Note: Following a successful calibration, the mean path delay shall be equal to the cable latency.

Note: For systems that has a large linkup-to-linkup latency variation (uncompensated serial-to-parallel barrel shifter position) the calibration takes down the link multiple times to ensure that the calibration is done to the middle value (not mean value).

2.6. Calibration of 1PPS skew

The 'ptp cal port' command (above) calibrates a PTP port to an external reference using 1PPS. This calibration does however not take into account the output delay of the 1PPS signal for the port under calibration.

In order to make the 1PPS output of the device under calibration coincide with the 1PPS of the reference, the calibration needs to compensated for the 1PPS skew.

The CLI features a command for adjusting the port calibration for the 1PPS output skew.

The calibration performed by this command is for the mode only in which the port is actually configured to run. To make a calibration for all modes supported by the port, the command will have to be repeated for each mode.

The syntax for the command is:

```
ptp cal port <port_to_cal> <cable_latency> offset <skew>
```

Note: For systems that has a large linkup-to-linkup latency variation (uncompensated serial-to-parallel barrel shifter position) the calibration takes down the link multiple times to ensure that the calibration is done to the middle value (not mean value).

2.7. 1PPS Input Calibration

The CLI features a command for adjusting the port calibration for the 1PPS input delay.

The syntax for the command is:

```
ptp cal 1pps <cable_latency>
```

Before issuing the command, the 1PPS output should be connected to the 1PPS input using a cable with a known delay. The cable shall be as short as possible.

The command will enable the 1PPS output and sample the LTC time on the 1PPS input. The sampled LTC time reflects a delay is composed as follows: 1PPS output buffer delay + 1PPS input delay + Cable latency

The 1PPS output buffer delay is typically in the range of 1 ns. The 1PPS input delay should be calculated and saved for later use when PTP is using the 1PPS input.

End of Document.