P1588 New Features Highlights and Status

Maciej Lipiński

On behalf of the P1588 New Features Subcommittee

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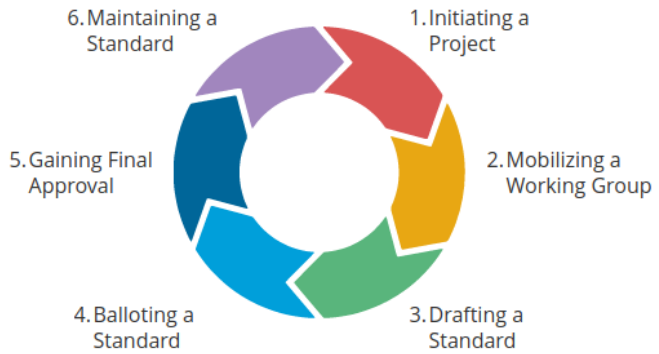

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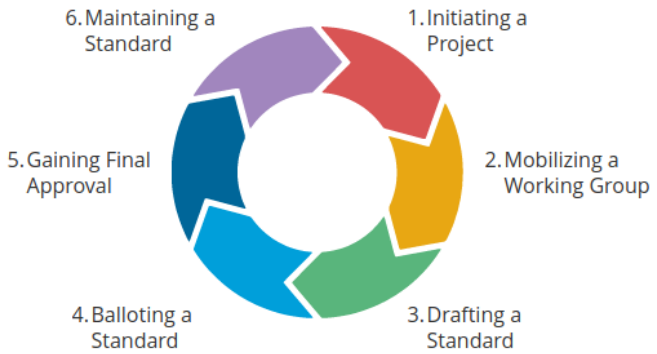

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    - Enhanced Synchronization Accuracy Metrics TLV
    - Optional Mechanism for Managing Announce Receipt Timeout
    - BMCA Basic Introduction
    - Theoretical Example of an Alternate BMCA Using Enhanced Accuracy TLV

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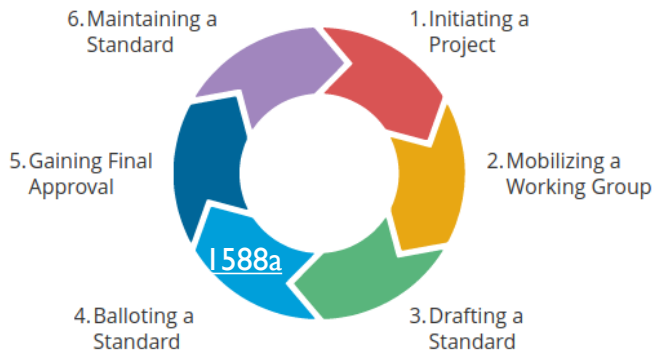

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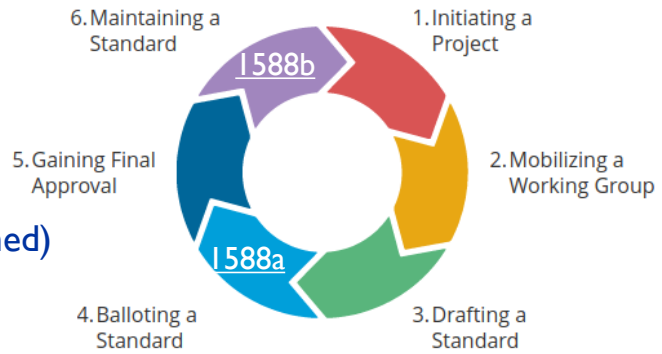

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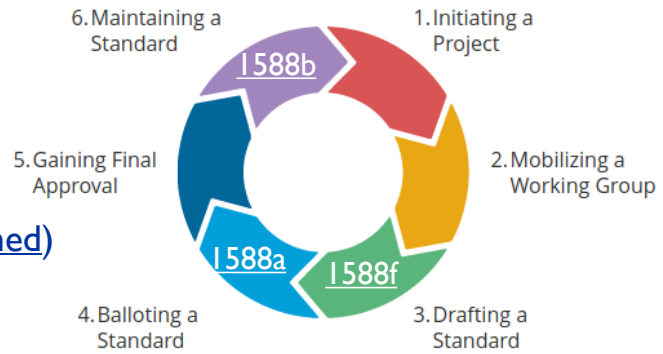

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1588a: Enhancements for BMCA mechanisms

Enhanced Synchronization Accuracy Metrics TLV

- The current IEEE1588-2019 includes optional feature: 16.12 Enhanced synchronization accuracy metrics

In IEEE 1588-2019:

Table 130—ENHANCED_ACCURACY_METRICS TLV format

Bits								Octets	TLV offset
7	6	5	4	3	2	1	0		
tlvType								2	0
lengthField								2	2
bcHopCount								1	4
tcHopCount								1	5
Reserved								2	6
maxGmInaccuracy								8	8
varGmInaccuracy								8	16
maxTransientInaccuracy								8	24
varTransientInaccuracy								8	32
maxDynamicInaccuracy								8	40
varDynamicInaccuracy								8	48
maxStaticInstanceInaccuracy								8	56
varStaticInstanceInaccuracy								8	64
maxStaticMediumInaccuracy								8	72
varStaticMediumInaccuracy								8	80

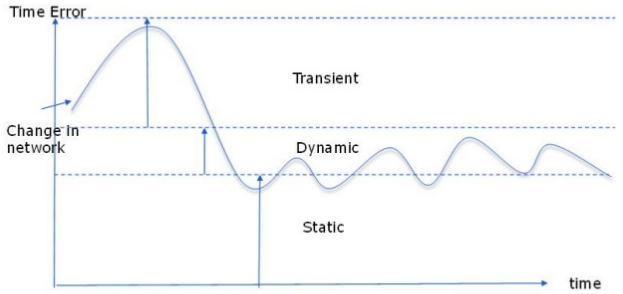

Figure 47—Contributions to degradation in time distribution

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Enhanced Synchronization Accuracy Metrics TLV

- The current IEEE1588-2019 includes optional feature: 16.12 Enhanced synchronization accuracy metrics
- The amendment proposes updates to 16.12:
  - Provides clarifications on:
    - Generation and propagation of the TLV
    - Operation when the feature is disabled
    - Definition of "var"

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bcHopCount								1	4
tcHopCount								1	5
exclusionFlags ~~Reserved~~								2	6
maxGmInaccuracy								8	8
varGmInaccuracy								8	16
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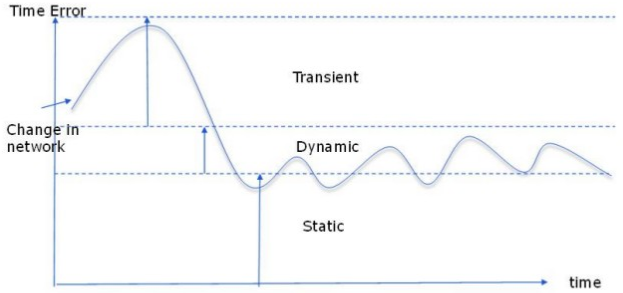

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  - Adds flexibility in the TLV content:
    - Sub-set of fields can be transmitted
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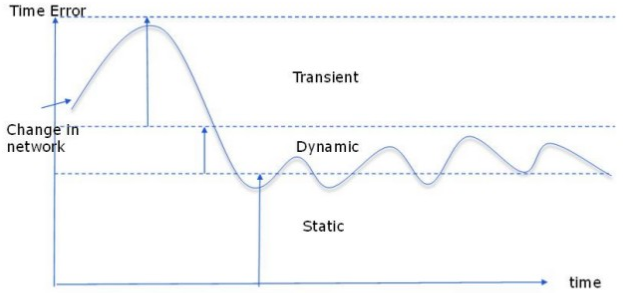

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  - Adds flexibility in the TLV content:
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  - Ensures backward compatible with the TLV in IEEE1588-2019
  - Adds information about interoperability

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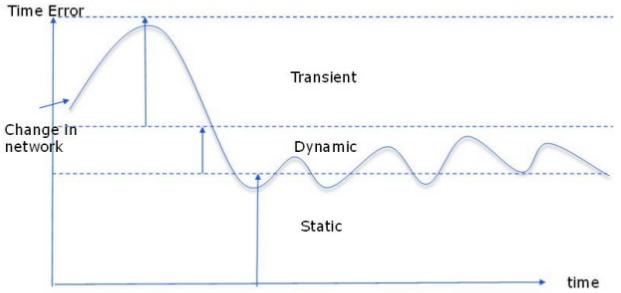

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1588a: Enhancements for BMCA mechanisms

Optional Mechanism for Managing Announce Receipt Timeout

- The current IEEE1588-2019 mandates uniform configuration of the Announce Receipt Timeout Interval throughout PTP domain, separate configuration for each PTP Instance, while …
  … the logAnnounceInterval is transmitted in the header of the Announce message

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- The amendment proposes new optional feature "*Computation of <announceReceiptTimeoutInterval> and FOREIGN_MASTER_TIME_WINDOW interval using the received logAnnounceInterval*":

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  - Handles transitory situations, when the value changes
  - Adds dataset members to enable/disable the feature and read the logAnnounceInterval
  - Adds clarifications on FOREIGN_MASTER_TIME WINDOW calculations

1588a: Enhancements for BMCA mechanisms

BMCA Basic Introduction

- The Best Master Clock Algorithm (BMCA)
  - Distributed algorithm to establish synchronisation hierarchy in a PTP Network
  - An excellent explanation of an old version of BMCA (IEEE1588-2002) in John Eidson's book*

(*) Edison, John. (2006). Measurement, Control, and Communication Using IEEE 1588. 10.1007/1-84628-251-9.

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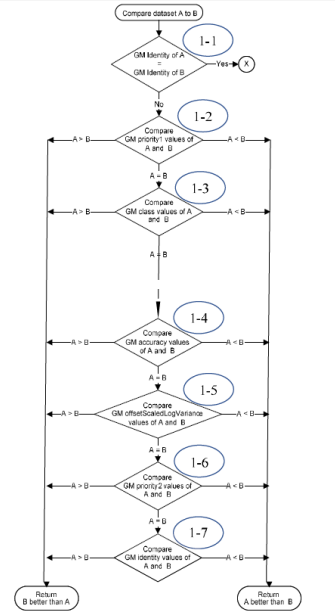

Figure Q.1 First part of the "data set comparison algorithm"

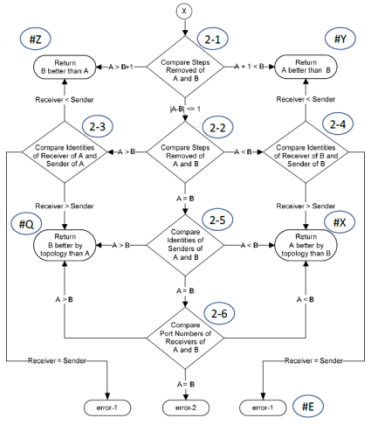

Figure Q.2 Second part of the "data set comparison algorithm"

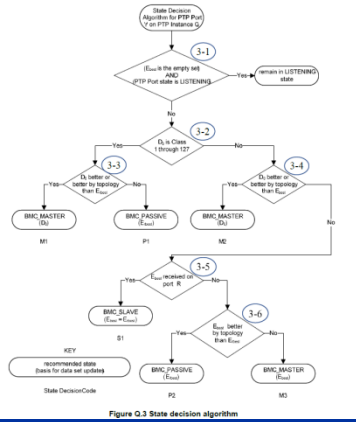

Figure Q.3 State decision algorithm

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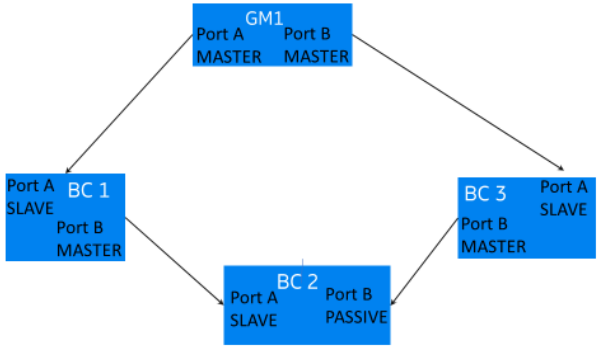
  - Explains operation of BMCA in a simple network



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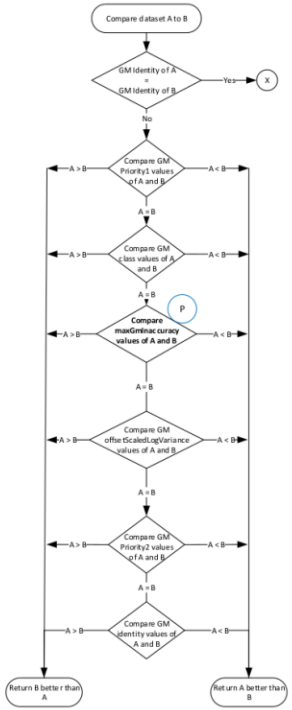

Figure P2.3 Alternate data set comparison algorithm, part 1, modified to consider the optional enhanced accuracy TLV

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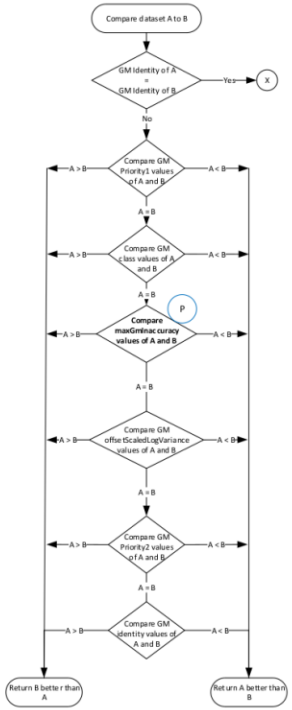
- **Status of the 1588a amendment:** review of comments from SA Ballot



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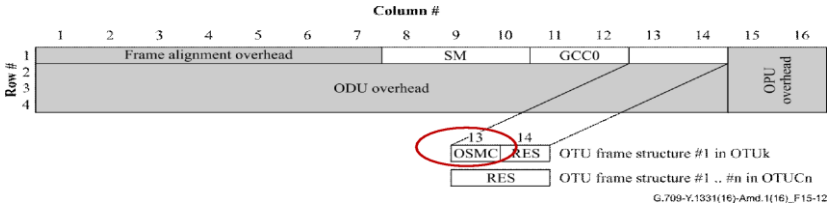
    - Generic Framing Procedure, frame-mapped (GFP-F) for PTP message encapsulation, except leaving it impl-specific for OSC
    - Timestamp generation to follow ITU-T G.709 and ITU-T G.709.1, except leaving it impl-specific for OSC



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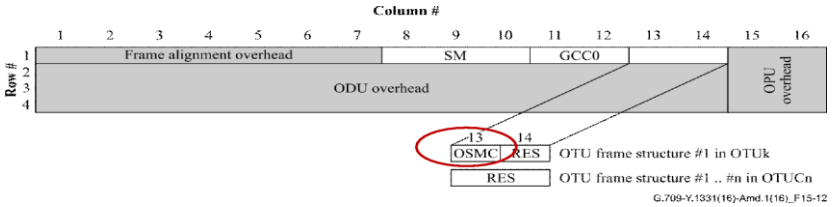
  - Covers Boundary Clocks and Ordinary Clocks



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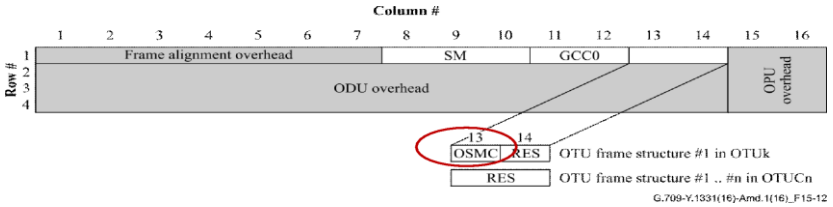
- **Status:** approved and published by IEEE: https://ieeexplore.ieee.org/document/9895348



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  - Medium asymmetry estimation for unidirectional fibers only (prior calibration of <delayCoefficient> required) – 16.8

1588f: Enhancements for latency/asymmetry calib.

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  - Medium asymmetry estimation for unidirectional fibers only (prior calibration of <delayCoefficient> required) – 16.8
- Within the scope of the amendment:
  - Part 1: Procedures and tools for in-situ delay asymmetry calculation (<delayAsymmetry>)
  - Part 2: Support for absolute ingress/egress latency calibration

1588f: Enhancements for latency/asymmetry calib.

Procedures and tools for in-situ link asymmetry calibration

- Mechanism for delay asymmetry measurement when using:
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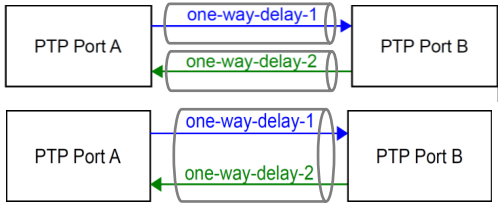
  - Single bidirectional medium backward/forward path, e.g one bidirectional fiber
- Two procedures controlled by a Network Management System (NMS)



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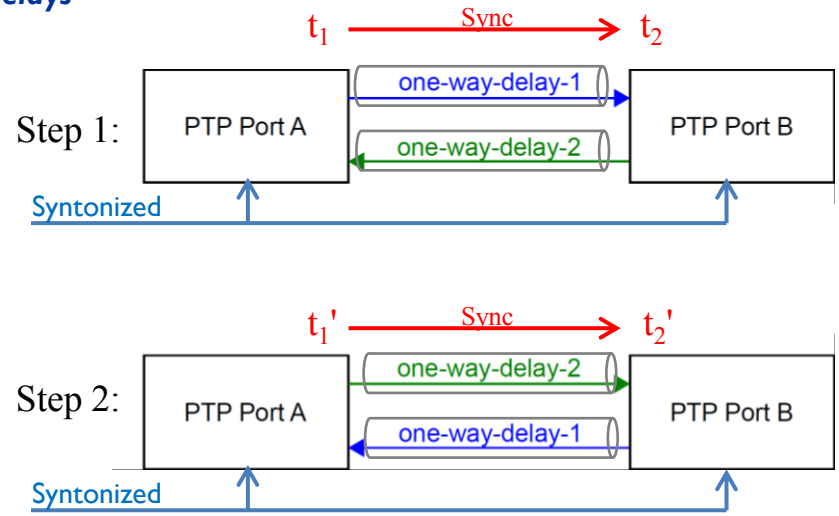

<delayAsymmetry> =

$[t_2 - t_1 - (t_2' - t_1')] / 2$

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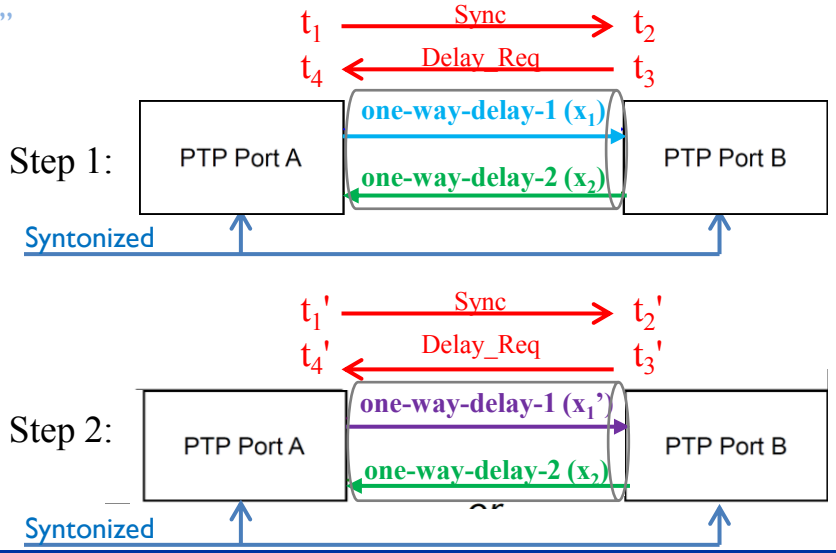

For fibers: x_1, x_1', x_2, represent different wavelengths

$$RTT(x_1, x_2) = (t_4 - t_1) - (t_3 - t_2)$$

$$RTT(x_1', x_2) = (t_4' - t_1') - (t_3' - t_2')$$

$$\text{<delayAsymmetry>} = \frac{(x_1 - x_2)(RTT(x_1, x_2) - RTT(x_1', x_2))}{2 \cdot (x_1 - x_1')}$$

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- Delay Asymmetry Calculation methods – information/guidance on algorithms, details implementation specific

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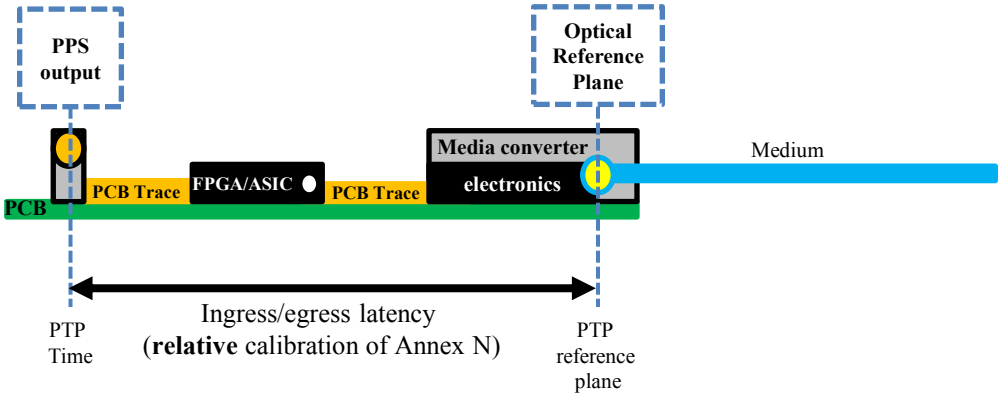
Support for absolute ingress/egress latency calibration – **under study**

Relative calibration



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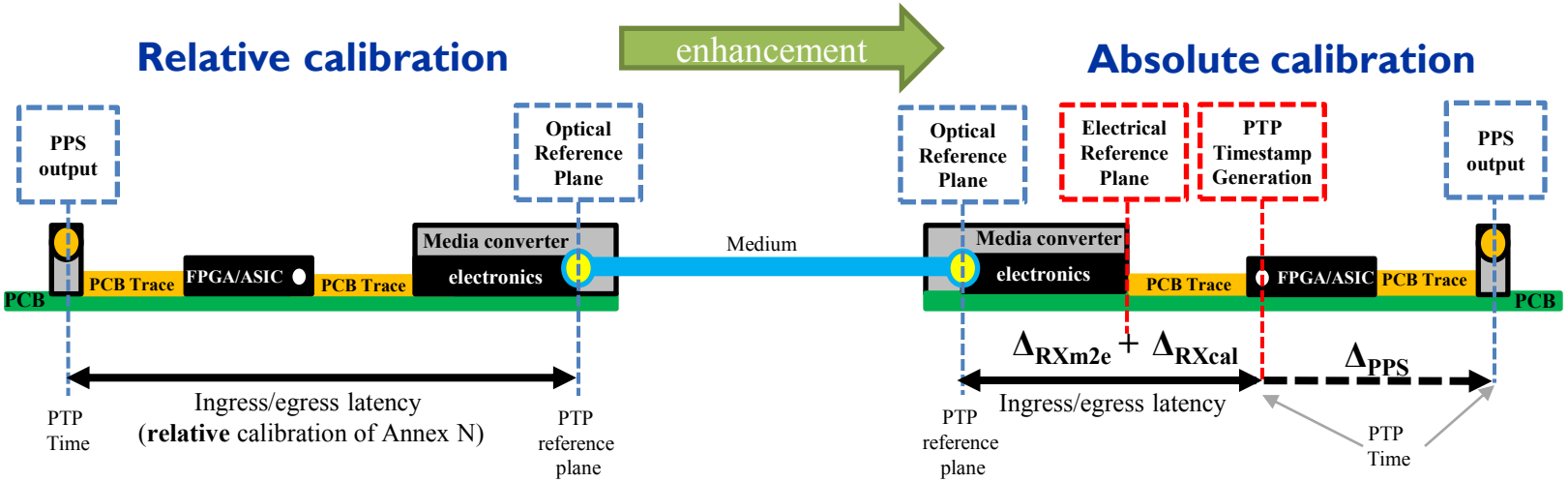
Support for absolute ingress/egress latency calibration – **under study**



Under study within the scope of the amendment:

- Reference planes definitions (electrical, optical)
- Procedures for absolute calibration (electrical, optical)
- Data sets for storing parameters e.g. : unique primary calibration source IDs, physical properties (liaison with Storage Networking Industry Association)

Summary

- Details of non-published amendments could potentially change
- Status of New Features subcommittee projects:
  - **1588a**: Enhancements for BMCA – **SA Ballot**
  - **1588b**: PTP mapping OTN – **published**
  - **1588f**: Enhancements for latency and/or asymmetry calibration – **drafting of part 1**
- Everyone is welcome to participate, see P1588 WG's page to learn how to join: https://sagroups.ieee.org/1588/how-to-join-p1588/