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Pdelay – IEEE P802.1AS-Rev vs IEEE P1588-Rev

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Pdelay P802.1AS-Rev vs P1588

- IEEE P802.1AS-Rev uses the IEEE P1588-Rev common mean link delay feature
- IEEE Std 802.1AS provided a Pdelay mechanism using domain 0
- The IEEE Std 802.1AS and IEEE Std 1588v2 mechanisms are mathematically equivalent
- **But:**
  - **The defined equations are not equivalent!**
  - **The frames on the wire are not equivalent!**
- This is an issue for the mean link delay feature
- What representation is used on the wire?
- What equations are used?
- Currently IEEE P802.1AS-Rev breaks IEEE P1588-Rev and vice versa.

P802.1AS-Rev Pdelay meanLinkDelay equation

- meanLinkDelay = (r*(t4 - t1) - (t3 - t2)) / 2

- t3 = responseOriginTimestamp + correctionField of Pdelay_Resp_Follow_Up
- t2 = requestReceiptTimestamp + correctionField of Pdelay_Resp

- meanLinkDelay = (r*(t4 - t1) -
  (responseOriginTimestamp + correctionField of Pdelay_Resp_Follow_Up
  - (requestReceiptTimestamp + correctionField of Pdelay_Resp))/2

- meanLinkDelay = (r*(t4 - t1) - (responseOriginTimestamp
  - requestReceiptTimestamp
  - correctionField of Pdelay_Resp
  + correctionField of Pdelay_Resp_Follow_Up)/2

P1588-Rev Pdelay meanLinkDelay equation

- meanLinkDelay = ((t4 - t1) - (t3 - t2)) / 2

- meanLinkDelay = ((t4 - t1) - (responseOriginTimestamp
  - requestReceiptTimestamp)
  - correctionField of Pdelay_Resp
  - correctionField of Pdelay_Resp_Follow_Up)/2

- meanLinkDelay = ((t4 - t1) - (responseOriginTimestamp
  - requestReceiptTimestamp
  + correctionField of Pdelay_Resp
  + correctionField of Pdelay_Resp_Follow_Up)/2

Comparision

IEEE P802.1AS-Rev:

- meanLinkDelay = (r*(t4 - t1) - (responseOriginTimestamp
  - requestReceiptTimestamp
  - correctionField of Pdelay_Resp
  + correctionField of Pdelay_Resp_Follow_Up)/2

IEEE P1588-Rev:

- meanLinkDelay = ((t4 - t1) - (responseOriginTimestamp
  - requestReceiptTimestamp
  + correctionField of Pdelay_Resp
  + correctionField of Pdelay_Resp_Follow_Up)/2

Definitions IEEE P802.1AS-Rev

- “**correctionField is set equal to the fractional ns portion** of the <pdelayReqEventIngressTimestamp> of the corresponding Pdelay_Req message“

- “**correctionField is set equal to the fractional ns portion** of the <pdelayRespEventEgressTimestamp> of the corresponding Pdelay_Resp message“

Definitions IEEE P1588-Rev

- “Copy the correctionField from the Pdelay_Req message to the correctionField of the Pdelay_Resp_Follow_Up message, and **set correctionField of the Pdelay_Resp message to 0**”

- “In the Pdelay_Resp message, set the requestReceiptTimestamp field to the seconds and nanoseconds portion of the time t2, **and subtract any fractional nanosecond portion of t2 from the correctionField**”

- “In the Pdelay_Resp_Follow_Up message, set the responseOriginTimestamp field to the seconds and nanoseconds portion of the time t3, and add any fractional nanosecond portion of t3 to the correctionField”

➔ This means the current equation of IEEE Std 802.1AS produces the correct results

➔ But IEEE 802.1AS Pdelay is not compatible with IEEE 1588 Pdelay

Additional Differences

- “Prior to transmission on an egress PTP Port, the correctionField of the transmitted Pdelay_Req message shall be **modified by subtracting the value of the egress path <delayAsymmetry> from the correctionField** of the transmitted Pdelay_Req message.”

- “Shall correct for asymmetry of the path connected to the ingress PTP Port by **adding the value of the ingress path <delayAsymmetry> to the correctionField** of the received Pdelay_Resp message prior to any use of the correctionField in the following computations”

Summary

- Currently the common meanLinkDelay mechanism of IEEE P802.1AS-Rev and IEEE P1588-Rev are not compatible
- As they look the same on the wire, they break each other
- We need two Pdelay mechanisms in IEEE P802.1AS-Rev:
  - One for backward compatibility using the old IEEE 802.1AS type of calculation in case the old (IEEE Std 802.1AS) Pdelay mechanism is used
  - One using the IEEE P1588-Rev common meanLinkDelay mechanism
- We should copy the exact behavior of the meanLinkDelay feature of IEEE P1588-Rev and not alter it. This includes:
  - Use the whole correctionField to calculate the timestamps, not only the sub nanoseconds
  - Subtract the delayAsymmetry from the correctionField when sending a Pdelay request and adding the delayAsymmetry to the correctionField of received Pdelay_Resp messages
  - “Copy the correctionField from the Pdelay_Req message to the correctionField of the Pdelay_Resp_Follow_Up” then add the sub nanosecond portion.

Thank You