802.1ASdm Contribution-New Drift Tracking TLV

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Version 5

Revision History:

Version 1, 14 March 2023: Original Draft [d0.7]
Version 2, 17 March 2023: Updates following discussion during IEEE 802 March Plenary meeting [d0.7]
Version 3, 18 April 2023: Following discussion, changed syncOriginTimestamp to syncEgressTimestamp [d0.7]
Version 4, 30 June 2023: Added field to transfer Rate Ratio Drift Rate [d0.7]
Version 5, 30 June 2023: Modified to address d1.1 rather than d0.7

Proposed additions and modifications to 802.1ASdm d1.1…

Background

See previous presentations on need for TLV.

https://www.ieee802.org/1/files/public/docs2022/60802-McCall-Time-Sync-Ad-Hoc-Meeting-15-Nov-1122-v1.pdf

Max Turner raised potential issue of conflict between stepsRemoved and grandmasterID in Announce message.

https://www.ieee802.org/1/files/public/docs2023/dm-turner-Announce-0123-v01.pdf

Announce information is updated on Announce Interval. Could be updated earlier (not prohibited) but there is no requirement to update when information changes (on reconfiguration). So, information in announce could take a long time to progress down a chain of devices.

This might change in a future version (i.e. require update when information changes) but even then there is no requirement on how quickly this must be done (no equivalent of Residence Time for Announce messages), so information could still mismatch with that in Sync when there is a reconfiguration.

Proposed solution is to have clear delineation between the two state machines. Do not mix and match stepsRemoved and grandmasterID between the two.

Changes to address the above points were made between d0.7 and d1.0.

Following further analysis it was recognised that transferring the measured estimate of Rate Ratio Drift via the Drift_Tracking TLV would be beneficial.

https://www.ieee802.org/1/files/public/docs2023/60802-McCall-RR-Drift-Tracking-Error-Compensation-0523-v02.pdf

The following additions / changes are proposed vs. d1.1…

Table 10-1

[Add the line…]

Variable name	Subclause of definition	Per PTP Instance (i.e., per domain)	Per PTP Instance, per PTP Port	Instance used by CMLDS (i.e., variable is common across all LinkPorts)	Instance used by CMLDS, per LinkPort
rateRatioDrift	10.2.4.26	Yes	No	No	No

10.2.4.27 rateRatioDrift: the value of the rateRatioDrift field of the Drift_Tracking TLV carried by the most recently received Sync message (twoStep flag FALSE) or Follow_Up message (twoStep flag TRUE). If the received Sync or Follow_Up message does not carry a Drift_Tracking TLV, rateRatioDrift is set to 0xFFFF. The data type for syncStepsRemoved is Integer32.

[Renumber current 10.2.4.27 and subsequent clauses as required.]

11.4.4.4 Drift_Tracking TLV definition

11.4.4.4.1 General

The fields of the Drift_Tracking TLV shall be as specified in Table 11-12 and in 11.4.4.4.2 through 11.4.4.4.9. This TLV is a standard organization extension TLV for the Sync or Follow_Up message, as specified in 14.3 of IEEE Std 1588-2019.

Table 11-12 – Drift_Tracking TLV

Bits								Octets	Offset
7	6	5	4	3	2	1	0		
tlvType								2	0
lengthField								2	2
organizationID								3	4
organizationSubType								3	7
syncEgressTimestamp								10	10
syncGrandmasterIdentity								8	20
syncStepsRemoved								2	28
rateRatioDrift								4	32

11.4.4.4.9 rateRatioDrift (Integer32)

The value of rateRatioDrift is equal to the (RRdrift – 1.0) x (2^{41}), truncated to the next smaller signed integer, where RRdrift is the measured estimate of the rate of change per second of the frequency of

the Grandmaster Clock to the frequency of the Local Clock entity in the PTP Instance that sends the message.

NOTE—The above scaling allows the representation of rates of change of fractional frequency offset in the range $[-(2^{-10} - 2^{-41}), 2^{-10} – 2^{-41}]$ s^{-1}, with granularity of 2^{-41}. This range is approximately $[-9.766 \times 10^{-4}, 9.766 \times 10^{-4}]$ s^{-1}.

In Addition…

Revised Sync State Machines (11.1.3 & 11.2) to add processing of TLV:

- When Sync is received, check if DriftTrackingTLVSupport is TRUE. If TRUE…
  - If incoming Sync message includes DriftTrackingTLV (TRUE)… and that If both TRUE…
    - Process rateRatioDrift
  - If incoming Sync message does not include driftTrackingTLV (FALSE)…
    - Do not process rateRatioDrift
  If DriftTrackingTLVSupport is FALSE…
  - Do nothing
- When Sync is transmitted, check if driftTrackingTLVSupport is TRUE. If TRUE…
  - If GM send Sync or Follow_Up with Drift_Tracking TLV…
    - syncGrandmasterIdentity is GM ID
    - syncStepsRemoved is 0
    - syncEgressTimestamp is timestamp of Sync egress
    - rateRatioDrift is the measured estimate of the rate of change per second of the frequency of the Grandmaster Clock to the frequency of the Local Clock at the Grandmaster
      - If the Grandmaster Clock and the Local Clock at the Grandmaster are the same, rateRatioDrift is 0
  - If not GM send Sync or Follow_Up with Drift_Tracking TLV
    - syncGrandmasterIdentity is as set on Sync receive
    - syncStepsRemoved is as set on Sync receive
    - syncEgressTimestamp is timestamp of Sync egress
    - rateRatioDrift is the measured estimate of the rate of change per second of the frequency of the Grandmaster Clock to the frequency of the Local Clock at the PTP instance that sends the message
  If DriftTrackingTLVSupport is FLASE
  - Do nothing

Note that behaviour when not in Sync locked mode and Sync message timeout triggers needs to be nailed down.

Informative text regarding implementation choices of how to calculate NRR based on Sync on (on TimeReceiver port) vs pDelayResp (on all other ports).

Note on Legacy Compatibility

UNKNOWN values for syncGrandmasterID and syncStepsRemoved are necessary to ensure compatibility with legacy nodes that don't support Drift_Tracking TLV. See diagram below. If GM ID and stepsRemoved are UNKNOWN implementation may use values from Announce (with the problems that entails).