802.1ASdm Contribution- New Drift Tracking TLV

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14 March 2023
Version 1

Proposed additions and modifications to 802.1AS-2020…

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.

10.3.3 stepsRemoved

NOTE –PTP Instances may optionally support the Drift_Tracking function, in which case they have a syncStepsRemoved variable. This value may be used to improve tracking of clock drift and compensate for associated errors. It is set by optional information carried in a Sync message and is not interchangeable with the stepsRemoved value derived from information in Announce messages.

11.4.3.1 General Sync message specifications

If the twoStep flag of the PTP common header (see Table 10-9) of the Sync message is TRUE, the fields of the Sync message shall be as specified in Table 11-8. If the twoStep flag of the PTP common header of the Sync message is FALSE, the fields of the Sync message shall be as specified in Table 11-9 and 11.4.3.2. In the latter case, carrying the Drift_Tracking TLV is optional.

Table 11-19 – Sync message fields if twoStep flag is FALSE

Bits								Octets	Offset
7	6	5	4	3	2	1	0		
header (see 11.4.2)								34	0
0riginTimestamp								10	34
Follow_Up information TLV								32	44
Drift_Tracking TLV (optional)								30	76

11.4.3.2.2 Drift_Tracking TLV

The Sync message may carry the Drift_Tracking TLV, defined in 11.4.4.4. When carried, this TLV shall be the second TLV after the fixed fields.

11.4.4.1 General Follow_Up message specifications

The fields of the Follow_Up message shall be as specified in Table 11-10 and 11.4.4.2. Carrying the Drift_Tracking TLV is optional.

Table 11-10 – Follow_Up message fields

Bits								Octets	Offset
7	6	5	4	3	2	1	0		
header (see 11.4.2)								34	0
preciseOriginTimestamp								10	34
Follow_Up information TLV								32	44
Drift_Tracking TLV (optional)								30	76

11.4.4.2.3 Drift_Tracking TLV

The Follow_Up message may carry the Drift_Tracking TLV, defined in 11.4.4.4. When carried, this TLV shall be the second TLV after the fixed fields.

11.4.4.3 Follow_Up information TLV definition

The fields of the Follow_Up information TLV shall be as specified in Table 11-11 and in 11.4.4.3.2 through 11.4.4.3.9. 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.

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 11.4.4.4.8. 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

7	6	5	4	3	2	1	0	Octets	Offset
								Bits	
tlvType								2	0
lengthField								2	2
organisationID								3	4
organisationSubType								3	7
syncOriginTimestamp								10	10
syncGrandmasterIdentity								8	20
syncStepsRemoved								2	28

11.4.4.4.2 tlvType (Enumeration16)

The value of the tlvType field is 0x3.

NOTE—This value indicates the TLV is a vendor and standard organization extension TLV, as specified in 14.3.2.1 and Table 52 of IEEE Std 1588-2019. The tlvType is specified in that standard as ORGANIZATION_EXTENSION with a value of 0x3.

11.4.4.4.3 lengthField (UInteger16)

The value of the lengthField is 26.

11.4.4.4.4 organizationId (Octet3)

The value of organizationId is 00-80-C2.

11.4.4.4.5 organizationSubType (Enumeration24)

The value of organizationSubType is 6.

11.4.4.4.6 syncOriginTimestamp (Timestamp)

The value is the seconds and nanoseconds portion of the syncEventEgressTimestamp of the associated Sync message (see 11.4.3.2).

11.4.4.4.7 syncGrandmasterIdentity (ClockIdentity)

The value is the value of the clockIdentity component of the rootSystemIdentity of the gmPriorityVector (see 10.3.5) of the PTP Instance that sent the Sync message.

11.4.4.4.8 syncStepsRemoved (UInteger16)

The value is the value of syncMasterStepsRemoved (see 10.3.9.3) for the PTP Instance that transmits the Sync message.

In Addition...

New global variables (10.2):

- syncGrandmasterIdentity
- syncStepsRemoved

New managed objects in a new dataset (14):

- driftTrackingTLVSupport
  - If absent (i.e. in legacy device) then default is FALSE
-

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…
    - Update syncGrandmasterIdentity (same as incoming field)
    - Process syncStepsRemoved (incoming field +1)
    - Process NRR
  - If incoming Sync message does not include driftTrackingTLV (FALSE)…
    - Update syncGrandmasterIdentity to UNKNOWN
    - Update syncStepsRemoved to UNKNOWN
    - Do not process NRR

  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
    - syncOriginTimestamp is timestamp of Sync egress
  - 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
    - syncOriginTimestamp is timestamp of Sync egress

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).

Left diagram:

GM
Supports Drift
Tracking TLV

↓ GM ID: OK
stepsRemoved: 0

1
Supports Drift
Tracking TLV

GM ID: OK
stepsRemoved: 1

↓ GM ID: OK
stepsRemoved: 1

2
Supports Drift
Tracking TLV

GM ID: OK
stepsRemoved: 2

↓ GM ID: OK
stepsRemoved: 2

3
Supports Drift
Tracking TLV

GM ID: OK
stepsRemoved: 3

↓ GM ID: OK
stepsRemoved: 3

4
Supports Drift
Tracking TLV

GM ID: OK
stepsRemoved: 4

Right diagram:

GM
Supports Drift
Tracking TLV

↓ GM ID: OK
stepsRemoved: 0

1
Supports Drift
Tracking TLV

GM ID: OK
stepsRemoved: 1

↓ GM ID: OK
stepsRemoved: 1

2
Does Not Support
Drift Tracking TLV

↓

3
Supports Drift
Tracking TLV

GM ID: UNKNOWN
stepsRemoved: UNKNOWN

↓ GM ID: UNKNOWN
stepsRemoved: UNKNOWN

4
Supports Drift
Tracking TLV

GM ID: UNKNOWN
stepsRemoved: UNKNOWN