Time Sync for Aerospace

Continued...

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Objective

• Review DP approach to Time Synchronization
• Seek input from group
Time Synchronization Requirements for Aerospace

Lost of discussion on the use of Time Sync for aerospace – particularly around availability and integrity.

See contributions on DP home page.

**Objectives for today:**

1. Continued validation of the proposed approach by the group
2. AS Clarifications
   1. PTP instances for Bridges
   2. PTP domain and clock identity
3. Example design patterns being considered
Time Synchronization Requirements for Aerospace

**Fault Tolerance**

Tolerate multiple (typically 2) simultaneous arbitrary faults in end stations, bridges, links, GMs

Under faulty conditions, a correctly operating end station shall maintain the target max time error relative to the correctly operating GM. If unable to maintain the max time error, the correctly operating end station shall detect an erroneous time sync state.

**Availability:**
- Reception of a time value at a given PTP receiver (instance)
- Deals with loss of SYNC/FOLLOW_UP message due to link, bridge, end station, and GM faults/failures

**Integrity:**
- Correctness of a time value received at a given PTP receiver (instance)
- Deals with error in the SYNC/FOLLOW_UP message due to arbitrary faults in the link, bridge, end station, and GM
1. Fault-tolerant module as an application function. Defines structure, interfaces, and a default selection algorithm(s). Applies to both end stations and bridges.

2. Devices shall support at least 2 domains and should support 4 domains. A quality local clock may serve as an additional time reference for integrity calculations.
Example Design Patterns

Domain 1 Sync Tree
Domain 2 Sync Tree
Domain 3 Sync Tree

Time Agreement (outside the scope of AS)

Clock Source A
End Station A1 (GM)
Bridge A1
End Station B2
Clock target

Clock Source B
End Station B1 (GM)
Bridge B1

Clock Source C
End Station C1 (GM)
Bridge C1

Question: Do Bridges need PTP end instance to acquire high integrity time sync in order to drive TAS?
Example Design Patterns

GM1
GM2
GM3

PTP 1A
PTP 2A
PTP 3A

PTP 1B
PTP 2B
PTP 3B

All time domains

End instance
End instance
End instance

High Integrity Module

Best ToD

End Station

Credit: Example produced by Richard Tse
Summary

- Time from **one clock source** distributed over redundant paths and/or by redundant GMs could improve the availability of time from that source (at receiver devices)
  - *Same idea as hot standy (ASdm), but not limited to only two GMs/domains*
  - *Term for a time aware system with multiple PTP end instances?*

- Time from **different clock sources** could improve the integrity of time (at receiver devices)

- In aerospace clock source matters - two GMs distributing time from one source is not the same as two GMs distributing time from different sources.

- Aerospace profile is trying to define an application layer fault-tolerant module that would allow users to address high availability, high integrity, or both.

- Comments?