



Time Sync Scenarios | June 2022

# P802.DP Time Sync

*Availability and Integrity*

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# Objective



- **Review 802.1AS based use cases/scenarios for aerospace**
- **Review integrity and availability requirements for aerospace**

# Requirements



## **Aerospace Requirement:**

90% use case coverage: 1 usec accuracy across 5 hops

100% use case coverage: 1 usec accuracy across 15 hops

DP should say something about:

1. Performance of Time Sync for aerospace
2. Availability of time sync for aerospace
3. Integrity of time sync for aerospace

For the following conditions:

1. Normal operating conditions
2. Failure conditions

Options to consider

1. Default provided by 802.1AS (and allowed options) vs.
2. Allowed enhancements in 802.1DP vs,
3. New features

## **Notes from discussion**

AS by default has some performance requirements directed towards AVB.

Asdm provides some redundancy.

No integrity requirements.

# Time Integrity for 802.1AS



1. Faults (or failures) at run time, that did not occur at design, test, validation, and startup
2. Faults: arbitrary misbehavior in GM end station and bridges
3. Faults in one or more devices (es and bridges), simultaneously
4. Under faulty conditions, a correctly operating end station shall be able to maintain the target max time error relative the non-faulty or remaining correct GM . Assuming there exists a non-faulty path between the correct GM and the end station under consideration.
5. If there is a transient, the correctly operating end PTP instance shall not exceed the target max time error relative to the currently operating GM for than x msec (duration). This implies that no two correctly operating end stations differ in their PTP time by more than 1 usec. If they do, that non-conformant duration shall be limited to x msec.
6. Reporting requirements for misbehaving PTP instance/end station/GM/bridge

# Time Integrity for 802.1AS – Required Elements



1. Time Distribution to an end station from multiple GMs over diverse paths

## **AS aspects:**

- a) Stand by GMs on a single domain with BMCA or higher-level entity reconfiguring after failures
- b) Multiple clock slave entities (on multiple clock domains) synced to different GMs and a user defined method to go from clock slave entities to the clock target
- c) Hot Standby (Asdm-like): instantiate GM multiple domains

## **Recipe Ingredients:**

1. Multiple GMs
  1. Externally synchronized (outside of PTP)
  2. Synchronized via PTP
2. Multiple Domains in the network
  1. Separate domains
  2. Time transfer within domains (e.g. ASdm split functionality)
3. Multiple PTP instances at end stations (typically 3, but different number are allowed)
4. Transforming Multiple PTP instances to clock target method **[time integrity requirement resides here]**
  1. Outside of PTP
  2. Inside PTP (do it as part of the profile)
5. Redundant paths of for a given domain

Action Item for committee : Define the interfaces between clock slave and clock target to enable user defined combination

Read Clause 9 in AS-2020

# Questions Collected over time



- How can a Grand Master fail?
  - Loss?
    - How does this affect the data transport function of the network?
  - Intermittent Loss?
    - How does this affect the data transport function of the network?
  - Erroneous?
    - How does this affect the data transport function of the network?
- How can an end node / bridge fail to follow the Grand Master?
  - Filter Failure/variance in filter design
    - How does this affect the data transport function of the network?
  - Decision to not follow?
    - How does this affect the data transport function of the network?

What happens to traffic during GM switchover?

what happens when you want to join two TSN networks? Are there mechanisms to sync to the same relative clock source such that time sensitive communications are possible?

Where are the vulnerabilities in the AS protocol that could cause the inability (loss) to communicate on a time sensitive network or cause the inability to detect erroneous transmission (bit, or delay)? (and what design elements does DP need to provision for to mitigate these vulnerabilities)