



Time Sync for Aerospace | July 2022

P802.DP Time Sync

Availability and Integrity

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Objective



- **Review integrity and availability requirements for aerospace**
- **Review 802.1AS features to support aerospace requirements**
- **Identify features, options, configurations, procedures for AS based time sync for aerospace**
- **Identify changes, if any, required in 802.1AS base standard**

Time Synchronization Requirements for Aerospace



Performance:

- 90% use case coverage: 1 usec accuracy across 5 hops (max time error relative to GM = +/- 500 nsec)
- 100% use case coverage: 1 usec accuracy across 15 hops (max time error relative to GM = +/- 500 nsec)

Availability:

- High availability in the presence of link, bridge, end station, and GM faults and failures
 - Requirement to tolerate multiple (typically 2) simultaneous arbitrary faults
- System design is responsible for achieving the desired level of availability utilizing PTP and non-PTP solutions
- PTP can enable/support that design with native redundancy features (e.g., Hot standby, multiple domains and instances)

Time Synchronization Requirements for Aerospace



Integrity:

- High time integrity in the presence of link, bridge, end station, and GM faults and failures
 - Requirement to tolerate multiple (typically 2) simultaneous arbitrary faults
- Since PTP requires computations along the network path, end-to-end (higher-level) integrity mechanisms do not work. PTP must natively address integrity.
- System design is responsible for achieving the desired integrity level utilizing mostly/exclusively PTP features
- Under faulty conditions, a correctly operating end station shall be able to maintain the target max time error relative the correctly operating GM. If unable to maintain the max time error, the correctly operating end station shall detect an erroneous time sync state.
 - Assumes that system design provides for a non-faulty time distribution tree between the clock source and clock target

802.1AS Components to support Aerospace Time Synchron



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. Method to drive clock target using multiple PTP instances **[key integrity component]**
 1. Outside of PTP
 2. Inside PTP (do it as part of the profile)
5. Redundant paths of for a given domain

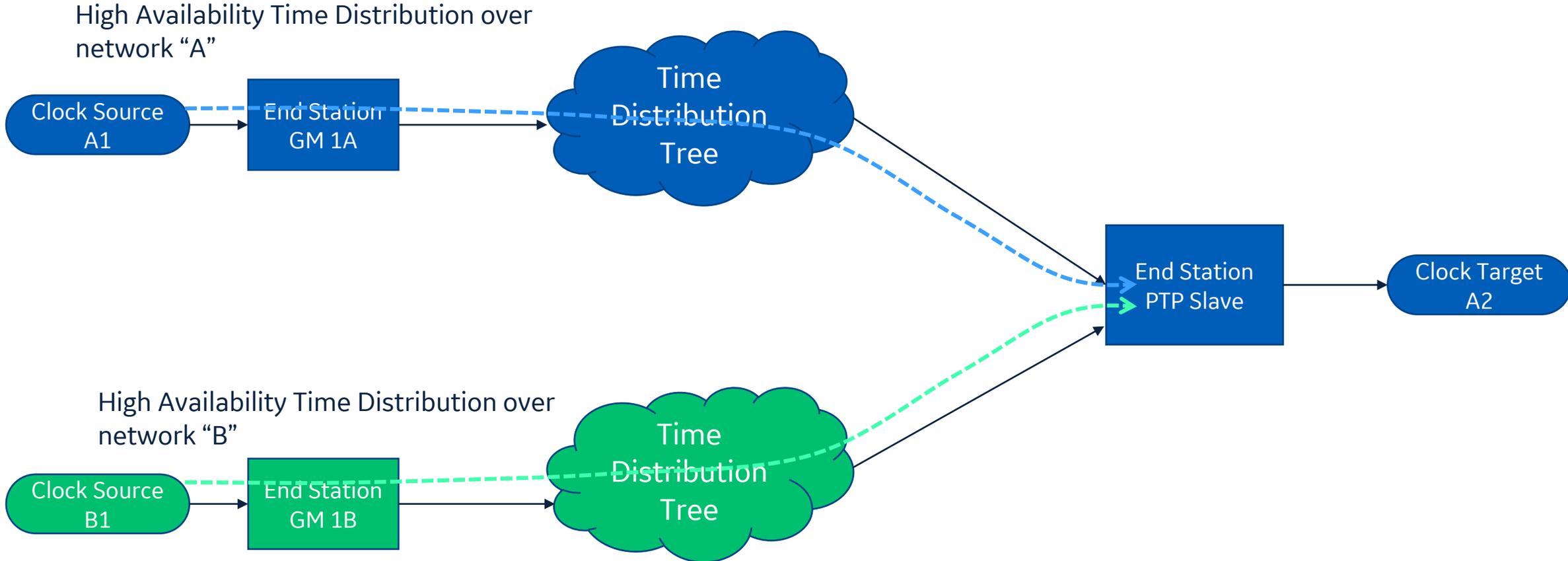
802.1AS Components to support Aerospace Time Synch



Available AS Redundancy Methods:

- 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 on multiple domains

Trivial Example



Trivial Example



High Availability Time Distribution over network "A"

