IEEE 802 LAN/MAN STANDARDS COMMITTEE (LMSC)

CRITERIA FOR STANDARDS DEVELOPMENT (CSD)

P802.1ASec Standard for Local and Metropolitan Area Networks – Timing and Synchronization for Time-Sensitive Applications Amendment: Fault-Tolerant Timing with Time Integrity

1. IEEE 802 criteria for standards development (CSD)

The CSD documents an agreement between the WG and the Sponsor that provides a description of the project and the Sponsor's requirements more detailed than required in the PAR. The CSD consists of the project process requirements, 1.1, and the 5C requirements, 1.2.

1.1 Project process requirements

1.1.1 Managed objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

a) The definitions will be part of this project.
b) The definitions will be part of a different project and provide the plan for that project or anticipated future project.
c) The definitions will not be developed and explain why such definitions are not needed.

Item a) is applicable. Additional managed objects will be specified as part of the fault-tolerant timing with time integrity feature of this project.

IEEE P802.1ASdn is specifying YANG and is expected to finish in time to be referenced by this project. Accordingly, this project will specify YANG for its managed objects.

1.1.2 Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

a) Will the WG create a CA document as part of the WG balloting process as described in Clause 13? (yes/no)
b) If not, explain why the CA document is not applicable.

Item b) is applicable. This project is not a wireless project; therefore, the CA document is not applicable.

1.2 5C requirements

1.2.1 Broad market potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.
b) Multiple vendors and numerous users.

a) This project applies first and foremost to time-sensitive applications in which the loss of time or the acceptance of erroneous time due to a fault in the system could jeopardize something of vital importance (e.g., a mission, a life).

   It could also apply to any time-sensitive application in which the loss of time or the acceptance of erroneous time due to a fault in the system has a significance (e.g., monetary loss) that makes it worthwhile to make the application tolerant to faults.

b) The need for this project is driven by requirements of aerospace applications, as part of ongoing work in IEEE P802.1DP Time-Sensitive Networking for Aerospace Onboard Ethernet Communications. These requirements include:

   - The ability to increase the availability of time to the time-sensitive application.
   - The ability to detect and/or overcome a failure in the availability of a source of time to the time-sensitive application.
   - The ability to detect and/or overcome a failure in the integrity of a source of time to the time-sensitive application.

   The IEEE P802.1DP project applies to many applications such as commercial aircraft, military aircraft, satellites, spacecraft, and space stations. Multiple vendors and users are participating in the development of this project.

   The need for this project could extend to automotive and industrial applications, where fault-tolerant timing could also be important. The projects associated with these applications, IEEE P802.1DG and IEC/IEEE 60802, respectively, have other vendor and user participants.

1.2.2 Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

a) Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?
b) If the answer to a) is no, supply the response from the IEEE 802.1 WG.

a) Yes, the proposed standard will comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q.

b) Not applicable.

The review and response is not required if the proposed standard is an amendment or revision to an existing standard for which it has been previously determined that compliance with the above IEEE 802 standards is not possible. In this case, the CSD statement shall state that this is the case.

1.2.3 Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

IEEE P802.1ASdm specifies the distribution of synchronized time with provisions for hot-standby as a method to provide timing redundancy to address loss of time due to network or Grandmaster failures. While the hot-standby method can increase the availability of time provided to an application, it does not address the integrity of that time. This is because only one generalized Precision Time Protocol (gPTP) domain is taken into consideration at any given moment and because the secondary gPTP domain has a dependency on the primary gPTP domain.

There is no IEEE standard or project that enables fault-tolerant timing, simultaneously covering both the availability and the integrity of time, using IEEE Std 802.1AS. Specifically, there is no IEEE standard or project that enables:

- An increase in the availability of time by using three or more gPTP domains.
- The checking of timing integrity and the selection of a trustworthy time from two or more gPTP domains.

1.2.4 Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.
b) Proven similar technology via testing, modeling, simulation, etc.

a) The use of two gPTP domains and of two time distribution paths has already been established in IEEE 802.1AS systems.
   Methods for estimating and for measuring the maximum time error contribution of a network instance are commonly practiced.
   The principles of dual modular redundancy (DMR), triple modular redundancy (TMR), and N-modular redundancy (NMR) are commonly used to enhance the availability and the integrity of functions that can fail.
   This project would expand the usage to more than two gPTP domains and incorporate the other items from above to detect failures in the availability and the integrity of time.

b) This project could use the items listed in a) along with a recognized algorithm or a novel algorithm to identify and select a trustworthy time for the application. A novel algorithm could be simulated to prove its operation.

1.2.5 Economic Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) Balanced costs (infrastructure versus attached stations).
b) Known cost factors.
c) Consideration of installation costs.
d) Consideration of operational costs (e.g., energy consumption).
e) Other areas, as appropriate.

a) The well-established cost balance between infrastructure and attached stations will not be changed by the proposed standard.

b) The cost factors are known for the IEEE 802.1AS standard and will apply to the proposed standard. Specifically, it is expected that fault-tolerant timing can be implemented with the additional costs that are associated with adding redundancy.

c) Incremental installation costs associated with adding redundancy will apply to the proposed standard.

d) Incremental operational costs associated with adding redundancy will apply to the proposed standard.

e) No other areas have been identified.