

# Status & Content of the IEEE TSN Auto Profile

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# Overview

- How IEEE 802.1 Works
- Status of the Auto Profile
- Content of the Auto Profile
- Summary

# How IEEE 802.1 Works

<http://www.ieee802.org/1/files/public/docs2018/tsn-farkas-intro-0318-v01.pdf>



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# How IEEE 802.1 Works



- IEEE 802.1 works on 3 types of standards development projects:
  - Base standards
    - Are stand-alone documents
    - Use upper case letters in the name to indicate the document is a Base standard since about 2003
    - Examples: IEEE 802.1Q (bridging), IEEE 802.1AS (precise timing), IEEE 802.1CB (redundancy)
  - Amendments to Base standards
    - Updates to a Base standard where only the project’s changes are open for ballot comments
    - Use lower case letters in the name after the upper case letters of the Base standard being updated
    - Examples: IEEE 802.1Qbv (TAS), IEEE 802.1ASdm (hot standby), IEEE 802.1CBdb (enhance stream ID)
  - Revisions to Base standards
    - Updates to a Base standard where the entire document could be open for ballot comments
      - Used to roll up Amendments into a new Base standard – in this case the Scope prevents feature additions
    - Uses upper case letters in the name followed by “-Rev” until complete where “Rev” is replaced w/the year
    - Examples: IEEE 802.1Q-Rev (a roll up), IEEE 802.1AS-Rev (entire doc was open)

# How IEEE 802.1 Works – What is a Profile?

- Within the 3 types of standards, IEEE 802.1 focuses on 2 categories:
  - Standards that define features, protocols & how to manage them
    - Many standards have both mandatory features & optional features
  - Profile standards define the set or sub-set of Base standards needed for an application along with defining which optional features are now mandatory to be conformant to the Profile
    - For example: No product in the world implements ALL the features defined in IEEE 802.Q
    - Profiles cannot define new features or protocols (IEEE 802.1 rule), instead it defines the conformant set
- List of IEEE 802.1 TSN Profiles (those with dates indicate the year of their completion)
  - IEEE 802.1BA-2011: AVB (the plug-and-play Audio Video Bridging profile)
  - IEEE 802.1CM-2018: TSN Profile for Fronthaul Networks
  - IEC/IEEE 60802: TSN Profile for Industrial Automation
  - IEEE 802.1DF: TSN Profile for Service Provider Networks
  - IEEE 802.1DG: TSN Profile for Automotive In-Vehicle Ethernet Communications

# How IEEE 802.1 Works – Stages of Standard Development

- Start with ideas and presentations – need to show there is a need & a market
  - New ideas and problems are welcome as long as they are in the scope of IEEE 802.1's work
- Create a PAR – to get official IEEE approval to work on the standard development
  - There needs to be enough support from the 802.1 voters for this step to pass
- Task Group Ballots – collection of requirements/features with solutions worked out
  - Anybody can comment & vote on Task Group ballots
- Working Group Ballots – validate the solutions defined in the Task Group process
  - Anybody can comment (and all comments are addressed), but only 802.1 voter's votes count
- SA Ballots – last IEEE step, used to verify all IEEE procedures have been followed, etc.
  - Anybody can join the SA ballot pool to comment & vote
- STD! Complete
  - And then its published!

New Idea →



**Standard!**

# Status of the Auto Profile

IEEE 802.1DG - <https://1.ieee802.org/tsn/802-1dg/>  
(for continuously updated status & links to the public presentations)



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# IEEE 802.1DG TSN Automotive Profile – Status

Where this project is:



Time Line:



**Standard!**

- PAR (Project Authorization Request) completed & approved – 08 Feb 2019
- Non-balloted drafts:
  - 0.0 – 28 Mar 2019
  - 0.1 – 27 Apr 2019
  - 1.0 – 18 Sep 2019
- Task Group Draft 1.1 – 09 Oct 2019: 1<sup>st</sup> balloted draft. 37 commenters w/182 comments
- Task Group Draft 1.2 – 16 Mar 2020: 2<sup>nd</sup> balloted draft. 12 commenters w/160 comments
  - These initial drafts have been focusing on informative tutorials & the document's structure
- The project is currently in Task Group balloting where Requirements are being collected
  - This is **THE** time for more participation from OEMs so all the needed requirements are included

# IEEE 802.1DG TSN Automotive Profile – PAR's Scope & Purpose

- **Project's Scope:** This standard specifies profiles for secure, highly reliable, deterministic latency, automotive in-vehicle bridged IEEE 802.3 Ethernet networks based on IEEE 802.1 Time-Sensitive Networking (TSN) standards and IEEE 802.1 Security standards.
- **Project's Purpose:** This standard provides profiles for designers and implementers of deterministic IEEE 802.3 Ethernet networks that support the entire range of in-vehicle applications including those requiring security, high availability and reliability, maintainability, and bounded latency.
- While 802.1 **Profiles are not allowed to create new features or protocols**, if any deficiencies are found, the IEEE 802.1 group can & has started new amendments to improve existing standards
  - The earlier these deficiencies are identified, the quicker they can get fixed (like ASdm hot standby)
  - Thus this project is requesting ALL use cases, even those that go beyond 802.3 networks

# IEEE 802.1DG TSN Automotive Profile – Contributions

Presentations in Newest to Oldest Order	Contributors & their Affiliation
IEEE P802.1DG Profile Format	Michael Potts, Molex
Update of TSN use cases from JASPAR	Yoshihiro Ito, Nagoya Institute of Technology Tatsuya Izuya, Sumitomo Electric Takumi Nomura, Honda Hideki Gotoh, Toyota
Time Sync in 10BASE-T1S networks - Pdelay mechanism in multidrop topology	Georg Janker, Ruetz Systems
IEEE 802.1AS-2020 Addendum for “Hot-Standby” with multiple domain definition	Michael Potts, Molex
Overview of TSN use cases from JASPAR	Takumi Nomura, Honda Hideki Gotoh, Toyota Yoshihiro Ito, Nagoya Institute of Technology
Requirements and use cases for Base and Extended TSN capabilities	Soheil Samii, General Motors
P802.1DG Automotive Use Cases & Requirements (v0.4)	Don Pannell, NXP

# IEEE 802.1DG TSN Automotive Profile – Contributions page 2

Presentations in Newest to Oldest Order	Contributors & their Affiliation
Use Case – Network Reliability from the Perspective of Autonomous Driving	Allan Zhu, Futurewei Technologies
Automotive In-Vehicle Traffic Type	Lihao Chen, Huawei
Automotive TSN profile based on features, architectures or requirements?	Daniel Hopf & Helge Zinner, Continental
Asymmetrical Use Case	William Lo, Axonne
AUTOSAR Time Sync over Ethernet	Rodney Cummings, National Instruments
Automotive E/E Architecture evolution and the impact on the network	Helge Zinner, Continental
Suggestions for Automotive Profile outline	Norm Finn, Huawei

- This is a partial list of presentations given since the PAR was submitted
- For a complete list that also includes presentations given prior to the PAR approval go to: <https://1.ieee802.org/tsn/802-1dg/>

# Content of the Auto Profile

IEEE 802.1DG - <http://www.ieee802.org/1/files/private/dg-drafts/>  
(drafts are password protected – see the Summary)



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# IEEE 802.1DG TSN Automotive Profile – Content

- This is the 1<sup>st</sup> time an IEEE 802.1 standards goes beyond defining only “what” is required
  - To help readers understand the subtleties and side effects of various features contained in the Base standards being used, system level Tutorial sections are being added
    - This information is in an informative Annex which is called “TSN-based Network Design Considerations”
  - The current draft includes tutorials on IEEE 802.1CB (FRER) and IEEE 802.1AS-2020 (PTP)
    - Discussions cover topics like:
      - In-order vs. out-of-order packet delivery (FRER)
      - Intermittent streams vs. Bulk streams (FRER)
      - Individual and Sequence recovery functions (FRER)
      - When Pdelay messages are needed (PTP)
      - The concept of multiple clock domains and timescales (PTP)
  - Future drafts plan to include topics on Filtering & Policing, and on Scheduled Traffic
  - Topics get added based on need (Use Cases) and [on input from participants](#)
  - The initial drafts have focused on the Tutorial with future drafts focusing on the Profiles

# IEEE 802.1DG TSN Automotive Profile – Document Structure

1. Overview
2. Normative references
3. Definitions
4. Abbreviations
5. Conformance
6. Automotive In-Vehicle Networks – scoping addressing constraints & topology considerations
7. Life Cycle – possibly needed per Norm Finn’s presentation – currently a place holder
8. Security – possibly needed per Norm Finn’s presentation – currently a place holder
9. Traffic Separation – Methods to separate different traffic types & services on the same wire
10. Synchronized time – PTP, levels of robustness and/or security needed
11. Latency and congestion loss – covers the available tools in the 802.1 tool box
12. Topology and redundancy – covers the available tools in the 802.1 tool box
13. Protocols – possibly needed per Norm Finn’s presentation – currently a place holder
14. **Profiles – the main section of this standard** – the next balloted draft will have this structure defined

*Note: This document structure is likely to change over time – this structure is for Draft 1.2*

# IEEE 802.1DG TSN Automotive Profile – Potential Content?

- 10BASE-T1S Considerations

- 10BASE-T1S has been brought up, but without other standards work TSN support is limited
  - PTP (802.1AS) currently does not support the multi-drop 10BASE-T1S media – needs an AS amendment
    - There is a desire for any changes to 802.1AS be minimal so that Bridges with point-to-point & multi-drop ports can use the same software stack
  - Differentiated Services (or priorities) are not supported on the 10BASE-T1S media – needs 802.3 support
    - Differentiated Services reduces the worst case latency for critical flows
    - Flows that use the 10BASE-T1S links need to take the lack of Differentiated Services support into consideration
- Are either of these features needed? Please let us know!

- Possible AS Amendments

- Add PTP support for 10BASE-T1S? (no PAR yet – at the idea stage)
- Define Hot Standby for redundant PTP clocks – 802.1ASdm (PAR approved 3 Jun 2020)
  - This project was started by the TSN Profile for Industrial Automation (IEC/IEEE 60802)
  - This work will be applicable to Automotive where redundant PTP clocks are needed



# Summary

# IEEE 802.1DG TSN Automotive Profile – Summary

- The project is well on its way with a proposed document & profile structure
- While multiple contributors have presented many Use Cases and Requirements (publicly available), your needs may not be being worked on, simply due to them not being known
  - Please consider participation in this phase of the standards development process by contributing
  - For help (or anonymity) please contact the 802.1DG Editor ([craig.gunther@yahoo.com](mailto:craig.gunther@yahoo.com))
- The extensive tutorial information added to this Profile is new for IEEE 802.1 standards
  - This standard will be the go-to document for this “How these Standards Work” kind of information
  - During standards development the drafts are in a password protected area, so to get access to this tutorial information now, you need to participate in the standard work, as the password is available to participants
  - To become a participant go to <https://1.ieee802.org/tsn/802-1dg/> & then scroll down to “Joining the Task Group and Voting” and then click on join the “Main 802.1 List” link
- **Help us insure this Profile is relevant to you!**



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