



Contents of IEEE 802.1 TSN Profile Specifications So Far

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Outline



- Goals and non-goals of this presentation
- Contents of an IEEE-SA standard
- Normative and informative material
- Normative language: shall, should, may
- IEEE 802.1 TSN Profiles published so far
- Conformance to current IEEE 802.1 TSN Profiles
- Conformance examples
- Data flow requirements in IEEE Std 802.1CM
- Configuration guidelines in IEEE Std 802.1CM
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Goals and Non-Goals of this Presentation



- Give an overview of typical contents of IEEE 802.1 standards, TSN Profiles in particular
 - Provide lessons learned during the development of the current TSN Profiles
 - Aid the reading of IEEE standards
 - Help the discussions on the contents of the IEC/IEEE 60802 drafts and standard
- It is understood that the IEC template is used and not the IEEE-SA template as per section 3.4 in http://standards.ieee.org/develop/intl/iec_ieee_coop.pdf
 - This presentation **does NOT** suggest outline or anything like that
- The content of the IEC/IEEE 60802 standard is to be approved by both IEC and IEEE-SA
 - http://standards.ieee.org/develop/intl/iec_ieee_coop.pdf
 - <http://www.ieee802.org/1/files/public/docs2018/admin-IEC-IEEE-JWG-cooperation-process-0118.pdf>
- **This presentation considers content not template**
- Note: the [IEEE-SA Standards Style Manual](#) is a lot more than just style, it provides guideline on many aspects

Contents of an IEEE-SA Standard



- Frontmatter: Introduction (often includes the Scope of the PAR), Table of Contents, etc.
- Overview
 - Includes the scope** of the standard which shall be within the scope of that given on the PAR. The overview **may include optional topics such as a purpose, applications, and other areas that the group considers relevant**. These optional topics should be presented as separate subclauses of the overview.
- Normative references: the documents that contain material that must be understood and used to implement the standard
 - Each normative reference shall be cited in normative text and the role and relationship of each referenced document shall be explained in the body of the standard.
- Definitions
- Acronyms and abbreviations
- The body includes normative and informative text
 - **Normative** material is information required to implement the standard and is therefore officially part of the standard
 - **Informative** material is provided for information only and is therefore not officially part of the standard
- Annexes, which can be normative or informative, e.g., bibliography

Normative and Informative Material



- **Normative** text (information *required* to implement the standard) includes the following:
 - The main clauses of the documents including figures, tables, and equations
 - Footnotes to tables
 - Footnotes to figures
 - Annexes marked “(normative)”
- **Informative** text (text provided for information only) includes the following:
 - Frontmatter
 - Notes to text, tables, and figures
 - At the first instance of a note associated with text, a table, or a figure, the following should appear: “Notes to text, tables, and figures are for information only and do not contain requirements needed to implement the standard.”
 - Annexes marked “(informative),” e.g., Bibliography
- *Interspersed normative and informative text is not allowed.* As such, neither clauses nor subclauses shall be labeled as informative.

Normative Language: Shall, Should, May



- The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).
 - Note that the use of the word *must* is deprecated and shall not be used when stating mandatory requirements; *must* is used only to describe unavoidable situations. The use of the word *will* is deprecated and shall not be used when stating mandatory requirements; *will* is only used in statements of fact.
- The word *should* indicates that among several possibilities, one is recommended as particularly suitable without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).
 - Note that the behaviors described by *should* and *should not* are both permissible but not equally desirable choices, as explained in IEEE 802.1 standards
- The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).
 - Note that *may* and *may not* mean precisely the same thing, as explained in IEEE 802.1 standards
- The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

IEEE 802.1 TSN Profiles Published So Far



— [IEEE Std 802.1BA Audio Video Bridging Systems](#)

- Specifies defaults and Profiles that manufacturers of LAN equipment can use to develop AVB-compatible LAN components, and to enable a person not skilled in networking to build a network, using those components, that does not require configuration to provide working audio and/or video services
- Describes Architecture of AVB networks
 - End stations, bridges, AVB domain, use of SR classes, etc.
- Describes AVB functions
 - additional functions that are important, but not specified in the base standards
- Describes AVB Profiles
 - Specified via Profile Conformance Statements (PCS)
- Does not include conformance clause

— [IEEE Std 802.1CM Time-Sensitive Networking for Fronthaul](#)

- Specifies defaults and Profiles that enable the transport of time-sensitive fronthaul streams in Ethernet bridged networks, which are managed networks
- Describes fronthaul (i.e., the use case)
- Describes the fronthaul requirements
- Describes bridge and synchronization functions that are important to the operation of a fronthaul bridged network
- Describes fronthaul Profiles to meet the requirements of fronthaul data flows (textual description)
 - Includes configuration guidance (see: “configured”)
- Discusses how the time synchronization requirements can be met (textual description)
- Includes conformance clause
- Includes Profile Conformance Statements (PCS)

Conformance to Current IEEE 802.1 TSN Profiles



a) Conformance Clause

- Collects the mandatory and the optional requirements that a bridge or end station claiming conformance to the standard has to meet
- Textual description
- Uses conformance language: Shall, May, (Should)

b) Profile Conformance Statements (PCS) – matches Conformance Clause, if any

- The supplier of an implementation that is claimed to conform to a particular Profile defined in a given standard shall complete the corresponding PCS proforma
- Tabular format
- **Important: Who fills it and when**

c) Configuration guidance

- No conformance statement can be made to the administrator of a network
- Instead, the need to configure conformant bridges to meet the requirements addressed by a given Profile is highlighted using the term “is configured” or “are configured”
- For instance: “the maximum frame size is configured at each port of the fronthaul bridged network according to the maximum frame size rules that apply to IEEE 802.3 frames”

example on next slide

Conformance Examples from IEEE Std 802.1CM



a) Conformance Clause

5.5 End station requirements

This subclause defines the conformance requirements for end station implementations claiming conformance to this standard. An end station implementation that conforms to the provisions of this standard shall:

- a) Support priority-tagged (see 3.184 of IEEE Std 802.1Q-2018) or VLAN-tagged frames on all ports;
- b) Support a minimum of three traffic classes on all ports.

b) Profile Conformance Statements (PCS)

Item	Feature	Status	References	Support
E-Q-1	Does the end station support untagged frames on all ports?	E-S-1:M	Q:3.249, 5.6, 5.6.1: a), Clause 8	Yes [] No []
E-Q-2	Does the end station support priority-tagged frames on all ports?	O:5	Q:3.158, 5.5: a), Clause 8	Yes [] No []
E-Q-3	Does the end station support VLAN-tagged frames on all ports?	O:5	Q:9, 5.5: a), Clause 8	Yes [] No []
E-Q-4	Does the end station support at least three traffic classes on all ports?	M	Q:3.239, 5.5: b), Clause 8	Yes []

Data Flow Requirements in IEEE Std 802.1CM



- Requirements provided by CPRI Cooperation in a separate document, which is in the bibliography:
 - [B6] Common Public Radio Interface: Requirements for the eCPRI Transport Network, Version 1.1 (Requirements Specification).
- 802.1CM describes the essential parts of [B6], but does not include the whole [B6]
- Traffic classes come from the requirements
 - [B6] distinguishes and provides requirements for three traffic
 - Consequently, 802.1CM distinguishes three traffic classes
 - Conformant bridges shall support a minimum of three traffic classes, and at least priority tagging
- Example text on requirements
 - “The maximum end-to-end one-way latency is $100\ \mu\text{s}$ for IQ data between an edge port connected to an REC and another edge port connected to an RE.” (REC and RE are end stations)
 - “The maximum tolerable FLR between edge ports of a fronthaul bridged network for an IQ data flow is 10^{-7} .” (FLR: Frame Loss Ratio)

Configuration Guidelines in IEEE Std 802.1CM



- 802.1CM is for managed networks
- Configuration of conformant bridges to meet the requirements addressed by a given Profile is highlighted using the term “is configured” or “are configured”
- Profiles explain how to engineer the network taking into account the worst-case
 - Formulas for worst-case latency calculation
- Profiles also explain how to enforce the engineered network design
- Guidelines on
 - configuration of the traffic classes
 - frame size



Questions?