

IEEE 802.1 TSN Profiles

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this presentation intends to give a brief insight to IEEE 802.1 TSN profiles

Time-Sensitive Networking (TSN) Profiles (Selection and Use of TSN tools)

Audio Video Bridging
[802.1BA]

Fronthaul
[802.1CM/de]

Industrial Automation
[IEC/IEEE 60802]

Automotive In-Vehicle
[P802.1DG]

Service Provider
[P802.1DF]

Aerospace
[P802.1DP]

TSN Components

(Tools of the TSN toolbox)

Time synchronization:

Timing and Synchronization [802.1AS-2020]
(a profile of IEEE 1588)
Hot Standby [P802.1ASdm]
YANG [P802.1ASdn]

Synchronization

High availability / Ultra reliability:

Frame Replication and Elimination [802.1CB]
Path Control and Reservation [802.1Qca]
Per-Stream Filtering and Policing [802.1Qci]
Reliability for Time Sync [802.1AS-2020]

Reliability

Latency

Bounded low latency:

Credit Based Shaper [802.1Qav]
Frame Preemption [802.1Qbu & 802.3br]
Scheduled Traffic [802.1Qbv]
Cyclic Queuing and Forwarding [802.1Qch]
Asynchronous Traffic Shaping [802.1Qcr]
QoS Provisions [P802.1DC]

Resource Management

Dedicated resources & API:

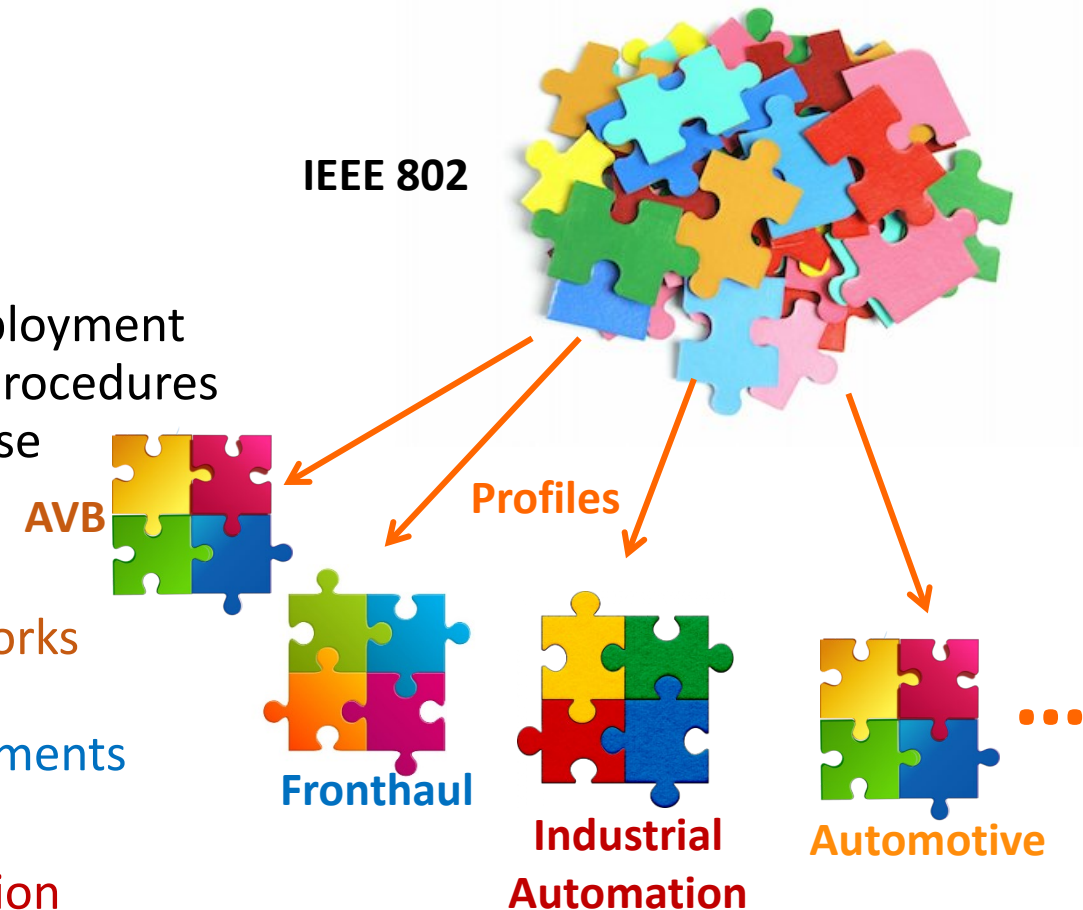
Stream Reservation Protocol [802.1Qat]
Link-local Registration Protocol [802.1CS]
TSN Configuration [802.1Qcc]
Foundational Bridge YANG [802.1Qcp]
YANG for CFM [P802.1Qcx]
YANG for LLDP [P802.1ABcu]
YANG for 802.1Qbv/Qbu/Qci [P802.1Qcw]
YANG & MIB for FRER [P802.1CBcv]
Extended Stream Identification [P802.1CBdb]
Resource Allocation Protocol [P802.1Qdd]
TSN Configuration Enhancements [P802.1Qdj]
LLDPv2 for Multiframe Data Units [P802.1ABdh]
Multicast and Local Address Assignment [P802.1CQ]

Zero congestion loss =
Bounded latency

Note: A 'P' in front of an ID indicates an ongoing Project.

TSN Profiles

- Wide breadth of choices in IEEE 802 standards
- A TSN Profile
 - Narrows the focus → ease interoperability and deployment
 - Selects features, options, defaults, protocols, and procedures
 - Describes how to build a network for a particular use
 - Provides configuration guideline if needed
- TSN profile standards:
 - IEEE Std 802.1BA Audio-Video Bridging (AVB) networks
 - IEEE Std 802.1CM TSN for Fronthaul
 - IEEE Std 802.1CMde Amendment on Sync enhancements
- Ongoing TSN profile projects:
 - IEC/IEEE P60802 TSN Profile for Industrial Automation
 - IEEE P802.1DG TSN Profile for Automotive In-Vehicle Ethernet Communications
 - IEEE P802.1DF TSN Profile for Service Provider Networks
 - IEEE P802.1DP TSN for Aerospace Onboard Ethernet Communications



Different Characteristics

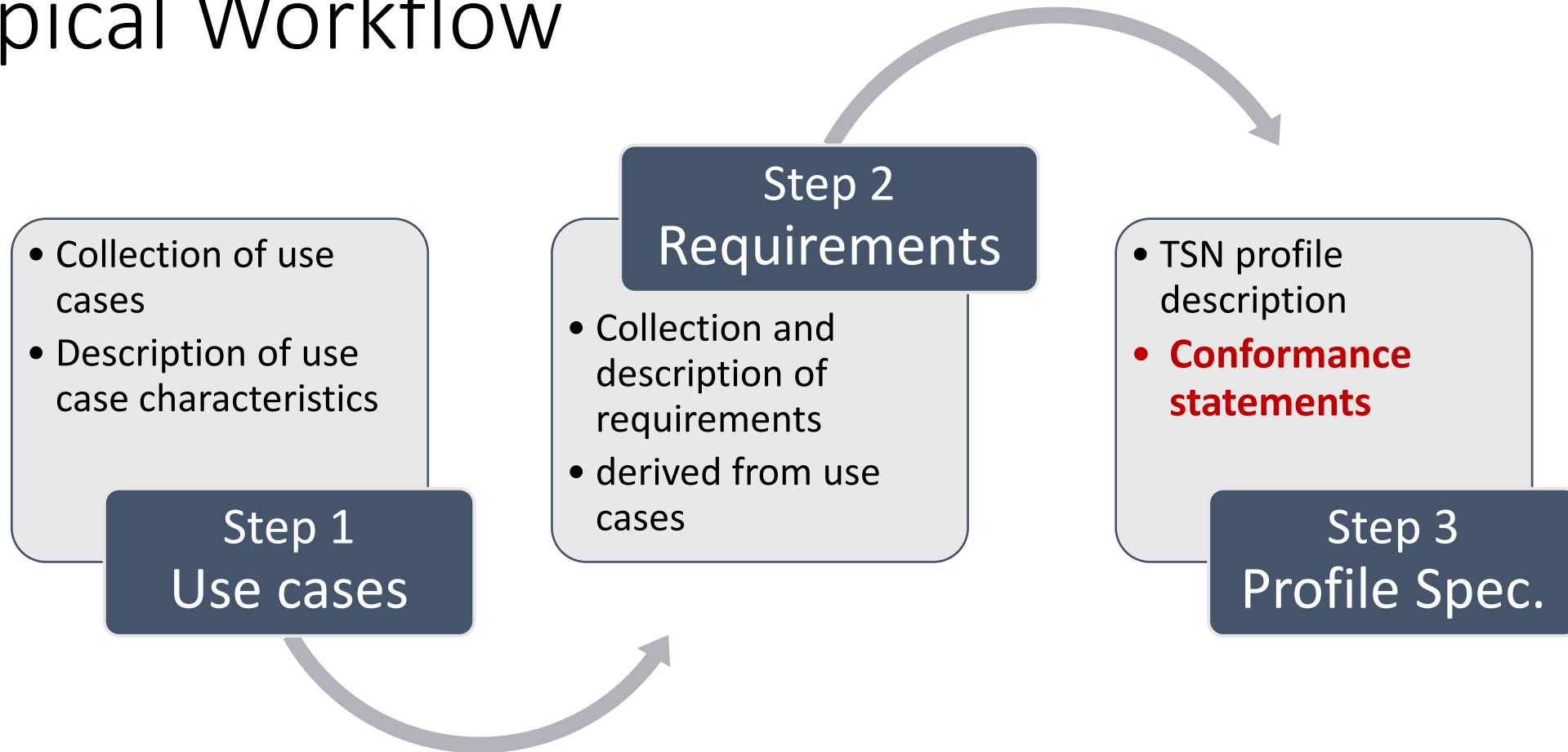
- IEEE Std 802.1BA for Audio-Video Bridging (AVB) networks
 - Plug & Play → defaults are essential
- IEEE Std 802.1CM TSN for Fronthaul
 - Fully engineered → configuration guidelines are given (in addition to device conformance)
- IEC/IEEE 60802 TSN Profile for Industrial Automation
 - Plug & Produce
 - Engineering
- IEEE P802.1DG TSN Profile for Automotive In-Vehicle Ethernet Communications
 - Fully engineered, closed network

Way of Working: Collaboration

- Bring experts together
 - Experts of the application area / use case
 - Experts of the technology: TSN
- Mutual benefits
- Solid outcome



Typical Workflow



- sections in the spec, e.g.: [IEEE Std 802.1CM](#)

and/or

- separate documents, e.g.: [IEC/IEEE 60802](#), [IEEE P802.1DG](#)

Conformance to IEEE 802.1 TSN Profiles

a) Conformance Clause (typically Clause 5)

- 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) (typically Annex A)

- Matches Conformance Clause
- 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 in 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 Std 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 []

Summary

- TSN is evolving
- The TSN toolbox is being expanded
- TSN profile specifications are essential
- Collaboration of experts of the application area and TSN experts is key
- IEEE 802 provides several benefits

Thank You!