



AS6675 Update | SAE 2024 Spring Meeting

SAE AS6675/ IEEE P802.1DP TSN Profile for Aerospace

Status Overview

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GE Research

Objective



- ***Overview of TSN Aerospace profile standardization***
- ***Review progress of profile development***
- ***Chart a path forward***



IEEE P802.1DP/SAE AS 6675

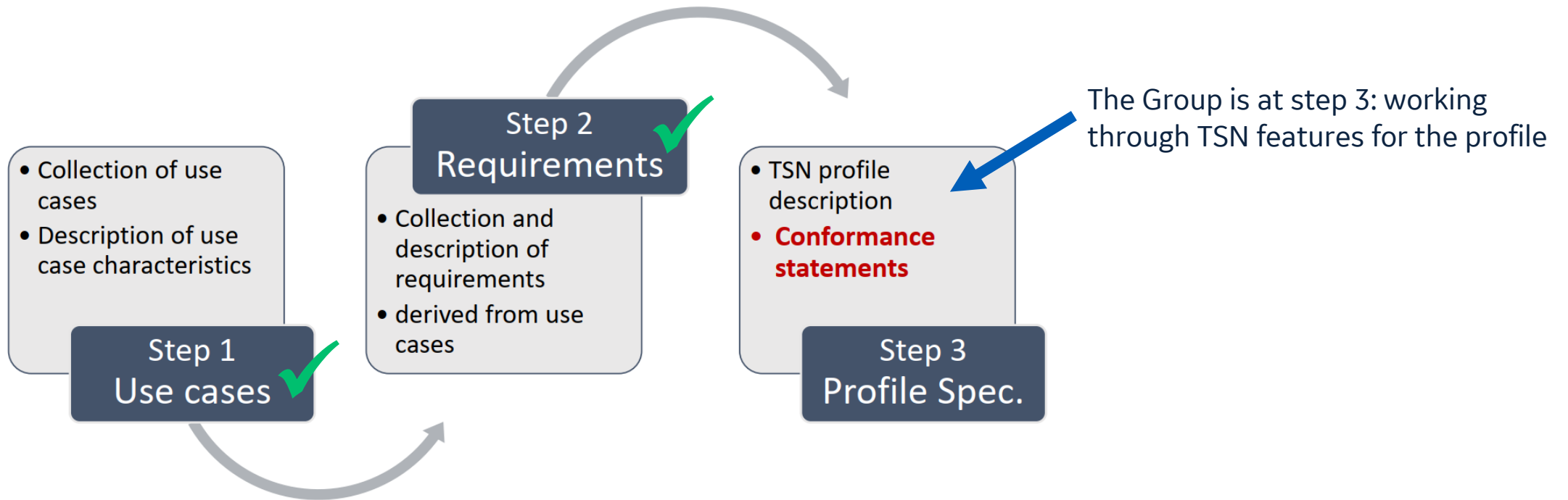
TSN for Aerospace Onboard Ethernet Communications

- Joint project between IEEE 802.1 TSN TG and SAE AS1-A2 Committee (Dual Logo Standard)
- Combining SAE committee's domain expertise with IEEE task group's TSN expertise
- Developed through IEEE meeting room; requires approval from both IEEE and SAE
- Co-Chairs: Janos Farkas and Abdul Jabbar
- Editor: Abdul Jabbar
- Weekly meetings: Wednesdays 10:00 AM to 12:00 PM ET
- Face-to-Face Meetings: 3 IEEE Interim Sessions, 3 IEEE Plenary Sessions, 2 SAE meetings
- Participation from Aerospace OEMs, Tier 1/2/3 suppliers, TSN Experts

<https://1.ieee802.org/tsn/802-1dp/>

<https://standardsworks.sae.org/standards-committees/1a-avionic-networks-committee#wips>

TSN Aerospace Profile Development



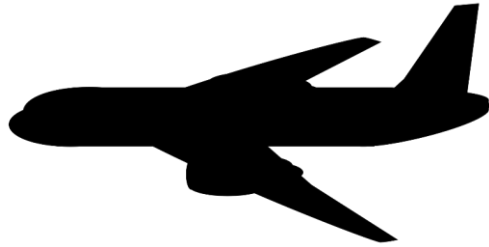
Reference: IEEE 802.1 TSN Profiles, Janos Farkas
<https://www.ieee802.org/1/files/public/docs2021/dp-farkas-TSN-profiles-0221-v01.pdf>

Status Summary



- Use cases collected and requirements derived
- Two profile approach is being adopted – Synchronous and Asynchronous Profile
- TSN features/standards necessary to support the necessary functions are being discussed
- Attention is being paid to the safety critical nature of aerospace and regulatory certification needs
- Scope, direction, and approach are well aligned with the aerospace industry and committee participants
- Second TG ballot completed. Comment resolution in progress
- Going for IEEE Work Group Ballot and SAE committee ballot next

Use Cases Documented



Commercial/Civil Aircraft

- Aircraft Control Domain Network (ACD)
small and large passenger aircraft
- Cabin Network (ACD, AISD, PIESD)
large passenger aircraft



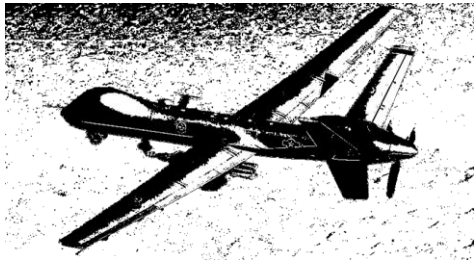
Fixed Wing Military Aircraft

- Mission Network (small, combat, large)
- Flight Network (VMS)
- Fiber Channel over TSN (convergence)

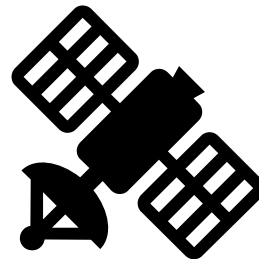


Rotary Wing Military Aircraft

- Mission Network
- Flight Network



Unmanned Military Aircraft Network



Satellite

- Platform Network
- Payload Network

11 detailed use cases contributed by OEMs and tier1/2/3 suppliers documenting both network and traffic characteristics

Two Profile Approach



Asynchronous Profile

targets current Ethernet based use cases

- Asynchronous with slower cycle times (> 50 msec)
- Latency bounded with acceptable delay variation (jitter) up to latency bound
- Comfortable with rate constrained shaping
- Controlled network – no undefined traffic on the network
- Highly static – designed, analyzed, configured well ahead of operation
- Certification burden is significant – simplicity is valuable
- Simple network redundancy (end system based)

Asynchronous profile to provide an equivalent network solution

Synchronous Profile

targets current non-Ethernet and future use cases

- Segmented/partitioned subsystems
- Synchronous with cycle times in the order of 1 msec. Future use cases with sub-millisecond cycle times
- Sensitive to latency (or deadline) and delay variation (jitter)
- Convergence of mixed critical traffic
- Interoperability of legacy buses on top TSN backbone
- Platform wide clock time distribution
- Potential for dynamic (re)configuration
- Flexible redundancy

Synchronous profile to provide an Ethernet based converged network solution

TSN Profile for Aerospace Progress

Status



Functions	Profile Specification	Status (open items)
Time Synchronization	802.1AS-2020*	Fault Tolerant Timing Module (FTTM)
Egress Traffic Shaping	Credit Based Shaper Time Aware Shaper*	No significant open issues
Redundancy	Frame Replication and Elimination	Minor: FRER for integrity by sending multiple frames to the application
Ingress Policing	Per-Stream Filtering and Policing	No significant issues. Small differences in the filters compared to A664.
Stream Separation	Stream identification, transformation, and separation	Aerospace bridges may require significantly higher number of stream entries.
Configuration	Fully centralized, Yang models	YANG model for CBS at SA ballot stage
Forwarding	Per-stream static forwarding	Minor: Policy-based forwarding with TCAM will not be standardized for brownfield use cases
Management and Monitoring	Required error, fault, and performance metrics	Management objects for FTTM

Next Steps



- Complete FTTM specification and monitoring objects
- Potentially conduct time sync simulations with FTTM
- Balloting and comment resolution – Goal is to get to SA ballot in IEEE and Aerospace Council ballot in SAE

Both SAE and 802.1 is contribution driven – need contributions to advance the specification

Simplified coordination of SAE and IEEE balloting process

