Conformance Class IEC/IEEE 60802

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Abstract

This document describes an example Conformance Class based on “60802-Steindl-ExampleSelections-0119-v02.pdf” as a starting point for feature alignment.
The parameters and values given in this document are presenting the ongoing discussions. Currently there is no agreement which attributes, parameters and values are mandatory within the profile.

Log

V0.1	Initial version
V0.5	Update with Example Selections “Y” and “Z”
V0.6	Update after discussion in IEC/IEEE 60802
V0.7	Update after discussion in IEC/IEEE 60802
V1.0	Initial public version for IEC/IEEE 60802

Content

Figures

Es konnten keine Einträge für ein Abbildungsverzeichnis gefunden werden.

Tables

1 References

60802-industrial-use-cases-0918-v13.pdf

60802-Steindl-ExampleSelections-0119-v02.pdf

60802-Steindl-QuantityFigures-0519-v01.pdf

60802-Steindl-TimelinessUseCases-0718-v01.pdf

2 Terms and Definitions

2.1 Definitions

Conformance Class	A selection of IEC and IEEE features and quantities which allows to solve the required use cases.

2.2 IEEE802 terms

Priority regeneration	See IEEE 802.1Q-2018 clause 6.9.4 Regenerating priority
Ingress rate limiting	See IEEE 802.1Q-2018 clause 8.6.5 Flow classification and metering

3 TSN in Industrial Automation

3.1 General

Supporting a Conformance Classes shall allow interoperability for Bridges and End-Station as defined in the scope of IEC/IEEE 60802.

3.2 Conformance Class

3.2.1 Standard selection

3.2.1.1 General

A Conformance Class selects out of the following standards

IEEE802.3-2018 - IEEE Standard for Ethernet

IEEE802.1Q-2018 - Bridges and Bridged Networks

IEEE802.1AB-2016 - Station and Media Access Control Connectivity Discovery

IEEE802.1AS-2019[1] - Timing and Synchronization for Time-Sensitive Applications

IEEE802.1CB-2017 - Frame Replication and Elimination for Reliability

3.2.1.2 Terms

Supported:
This feature is used in any class of device

Support, but optional:
This feature is intended to be used in some class of device

Not used:
The used and thus the support of this feature is not intended

TBD:
Not provided until agreed release date for initial version

—:
No quantities, because the assigned feature is not supported

[1] Assumes that IEEE802.1AS will be updated in 2019

3.2.1.3 IEEE 802.3

Table 1 shows the selection.

Table 1: IEEE 802.3 selection

Attribute	Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
Data rate	Selection out of a list	10Mbps, 100Mbps, 1Gbps, 2,5Gbps, 5Gbps, 10Gbps	10Mbps, 100Mbps, 1Gbps	10Mbps, 100Mbps, 1Gbps, 2,5Gbps, 5Gbps, 10Gbps	10Mbps, 100Mbps, 1Gbps, 2,5Gbps, 5Gbps, 10Gbps	100Mbps, 1Gbps	10Mbps(T1L), 100Mbps, 1Gbps, 2,5Gbps, 5Gbps, 10Gbps	10Mbps, 100Mbps, 1Gbps, 2,5Gbps, 5Gbps, 10Gbps
Frame size	Quantity	1532	1532	1532	1532	2000	1532	1532
Link length	Information	At least 100m	Depends on media	Depends on media	Depends on media	Depends on media	Depends on media	Depends on media
Preemption	Feature	Supported for 10Mbps[2] to 2,5Gbps	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Not used	Supported

[2] Change in IEEE802.3-2018 needed to move from 100Mbps to 10Mbps

3.2.1.4 IEEE 802.1Q

Table 2 shows the selection.

Table 2: IEEE 802.1Q selection

Attribute	Classification	Example Selection "SI"	Example Selection "TT"	Example Selection "RA"	Example Selection "AB"	Example Selection "MI"	Example Selection "YO"	Example Selection "BR"
Stream identification	Selection out of a list within 802.1CB							
Null Stream (DMAC + TCI.VID based)	Feature	Supported	Supported	Supported	Supported	Supported	Supported	Supported
IP stream	Feature	Not Used	Not Used	Supported	Supported but Optional	Not used	Supported	Supported but Optional
Queues 802.1Q 8.6.6	Quantity	Eight	Eight	Four	Eight	Eight	Four[3]	Eight
Preassigned PCPs	Quantity	Example: PCP:7 for network mgmt., PCP:6 for High streams, PCP:5 for Low stream, PCP:4-2 for in domain, and PCP:1-0 for inter domain	Example: PCP:7-2 for Isochronous streams, and PCP:1-0 for inter domain	3	Example: PCP:6 for High/Isochronous streams, PCP:5 for Low/cyclic stream	Example: PCP:7 High streams, PCP:0 for Low streams	Not used	TBD
VLAN Identification	Quantity	Up to 8 VIDs Four for streams, rest for non-stream	Up to 8 VIDs	TBD	Up to 8 VIDs Seven for streams, rest for non-stream	Up to 8 VIDs	Up to 8 VIDs	Up to 8 VIDs
Individual VLAN learning	Feature	Supported	Supported	Supported but Optional	Supported	Supported but Optional	Supported but Optional	TBD
Learning disable for VLANs used for streams	Feature	Supported	Supported	Supported	Supported	Supported but Optional	Supported but Optional	TBD
Default forwarding rule for VLANs used for streams	Feature	Drop	Drop	TDB	Drop	Flooding	Drop	TBD
FDB size 802.1Q 8.8	Quantity	8192 static MC entries[4] used for streams + 2048 static/dynamic entries for remaining VLAN(s)	512 static MC entries for streams + 128 static/dynamic entries for remaining VLAN(s)	4096 static MC entries for streams + 1024 static/dynamic entries for remaining VLAN(s)	8192 static MC entries[5] for streams + TDB static/dynamic entries for remaining VLAN(s)	1 static MC entries for streams + TDB static/dynamic entries for remaining VLAN(s)	16384 entries – useable for streams and default VLAN(s)	TBD
Spanning tree 802.1Q 13	Feature	For non-stream VLAN(s)	Supported but Optional	Supported but Optional	TBD	Supported but Optional	Supported but Optional	For non-stream VLAN(s)

[3] Four for Line/Ring and Eight for Star topologies
[4] A minimum 2048 per VLAN
[5] A minimum 2048 per VLAN

Attribute	Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
		Supported but Optional						
Transmission selection control 802.1Q 8.6.8	Selection out of a list	• Strict priority	• Strict Priority • Credit based shaper	• Strict priority	• Strict Priority • Credit based shaper (Supported, but Optional)	• Strict priority	• Strict Priority • Credit based shaper (Supported, but Optional)	• Strict Priority • Credit based shaper
Scheduled traffic 802.1Q 8.6.9, 8.6.8.4	Selection out of a list	• Scheduled traffic for 10Mbps and 100Mbps	• Time aware shaper	• Time aware shaper	• Time aware shaper • Cyclic queuing and forwarding (Supported, but Optional)	• Time aware shaper	• Time aware shaper	• Time aware shaper
Gate Control List entries 802.1Q 8.6.8.4	Quantity	3	At least 256	At least 3	256	At most 8	At least 3	At least 256
Tick granularity 802.1Q 8.6.8.4	Quantity	10ns	100ns	10ns	10ns	16ns	=< 100ns	TBD
Admin Cycle Time range 802.1Q 8.6.8.4	Quantity	100Mbps: 250µs to 1ms >=1Gbps: 31,25µs to 1ms	62,5µs to 10ms	250µs to 1ms	20µs to 20ms	31,25µs to 1s	1ms	20µs to 10ms
Timing points for scheduled traffic 802.1Q 12.29.2[6]	Quantity	10ns	10ns	10ns	10ns	16ns	=< 100ns	TBD
Maximum gap for transmission of consecutive frames[7]	Quantity	IPG	IPG	IPG	IPG	IPG	IPG	TBD
Ingress rate limiter / Flow classification and metering 802.1Q 8.6.5 (MEF 10.3)								
Unicast	Feature	Supported	Not Used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	TBD
Multicast / Broadcast	Feature	Supported	Not Used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	TBD
Ingress filtering and policing (Qci) 802.1Q 8.6.5.1								

[6] Minimum and maximum for the delay before the first frame is transmitted after gate open
[7] Getting the value for calculating window sizes

Attribute	Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
Number of streams	Quantity	—	TBD	TBD	TBD	At least 8	8000	TBD
Stream Gates 802.1Qcr 8.6.5.3.1	Feature	Not Used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Not used	Supported
Number of stream gates	Quantity	—	TBD	TBD	8	At least 8	—	TBD
Flow Meters 802.1Qcr 8.6.5.3.2	Feature	Not Used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Supported
Number of flow meters	Quantity	—	TBD	TBD	8	At least 8	TBD	TBD
Stream Filter 802.1Qcr 8.6.5.1	Feature	Not Used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	TBD
Priority regeneration (PCP) 802.1Q 6.9.4	Feature	Supported	Supported	Supported	Supported but Optional	Supported but Optional	Supported	TBD
VLAN stripping and adding 802.1Q 6.9 and 8.8.2	Feature	Supported	Supported	Supported	Supported	Supported but Optional	Supported	Supported
Preemption 802.1Q 6.7.2	Feature	Supported	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Not Used	Supported
First fragment size	Quantity	128	64	TBD	TBD	64	—	128
Number of Hold & Release events 802.1Q 12.30.1	Quantity	2	256	TBD	TBD	6	—	TBD
Synchronized network access								
Start of cycle trigger[8]	Feature	Supported	Supported	Supported but Optional	Supported but Optional	Supported	Supported	Supported
Per stream trigger 802.1Qcc 46.6.2.5.3.5	Feature	Not Used	Supported	Not Used	Supported but Optional	Not usedf	Not used	Supported
Maximum gap for transmission of consecutive frames[9]	Quantity	IPG	IPG	IPG	IPG	20 Octet times	IPG	TBD
Bridge / Forwarding resources[10]	Specify attributes for the resource management. Ensure buffering of non-stream traffic during stream transmission							

[8] Specified as a special case of the per stream trigger by using “time aware offset = 0” for all streams
[9] Getting the value for network calculus and calculating window sizes
[10] Model for resource calculation needed due to implementation dependency. What needs to be achieved? What is the goal?

Attribute		Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
	Real-Time traffic Stream High in-class interference	Quantity	>= 1Gbps: Up to 200µs for a 1ms Admin Cycle time 100Mbps: Up to 500µs for a 1ms Admin Cycle time	TBD	TBD	TBD	TBD	TBD	TBD
	Real-Time traffic Stream Low intra- and in-class interference	Quantity	>= 1Gbps: Up to 200µs for a 1ms Admin Cycle time 100Mbps: Up to 500µs for a 1ms Admin Cycle time	TBD	TBD	TBD	TBD	TBD	TBD
	Real-Time traffic	Quantity	<= 100 Mbps: Minimum of 6,5 Kbytes per port >= 1Gbps: Minimum of 25 Kbytes per port	Minimum of 16k per port	Minimum of 16k per port	<= 100 Mbps: Minimum of 3,25 Kbytes per port >= 1Gbps: Minimum of 16 Kbytes per port	Minimum of 2k per port	<= 100 Mbps: Minimum of 5 Kbytes per port >= 1Gbps: Minimum of 25 Kbytes per port	TBD
	Non real-time traffic	Quantity	<= 100 Mbps: Minimum of 6,5 Kbytes per port >= 1Gbps: Minimum of 25 Kbytes per port	Minimum of 16k per port	Minimum of 16k per port	<= 100 Mbps: Minimum of 3,25 Kbytes per port >= 1Gbps: Minimum of 16 Kbytes per port	Minimum of 2k per port	<= 100 Mbps: Minimum of 5 Kbytes per port >= 1Gbps: Minimum of 25 Kbytes per port	TBD
VendorSpecific.Cut through		Add on feature							
	Delayed Cut-through[11]	Feature	Supported	Not Used	Supported	Supported but Optional	Supported	Not Used	Supported but Optional
	Direct Cut-through	Feature	Supported	Supported	Supported	Supported but Optional	Not used	Not Used	Supported
	Number of queues supporting it	Quantity	8	1 Isochronous queue only	8	TBD	8	—	TBD
Configuration-Centralized									
	scheduling	Feature	Class based	Stream based	Class based	• Class based • Stream based	Class based	Class based	Stream based
	path computation	Feature	Supported	Supported	Supported	Supported but Optional	Supported	Supported	Supported

[11] Not limited to port being free on receive. Packet is forward to the DST port as soon as the port is free. No need to wait for the complete packet reception

Attribute		Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
	network calculus	Feature	Supported	Supported	Supported	Supported but Optional	Supported	Supported	Supported
	topology discovery	Feature	Supported	Supported	Supported	Supported	Supported	Supported	Supported
	device network feature discovery	Feature	Supported	Supported	Supported	TBD	Supported	Supported	Supported
	management protocol	Feature	SNMP (if YANG Models are still missing) + NETCONF	NETCONF SSH Mandatory TLS optional	NETCONF	SNMP (if YANG Models are still missing) + NETCONF	SNMP (if YANG Models are still missing) + NETCONF	NETCONF	NETCONF
	CNC Election (making sure there is only one active CNC per domain)	Feature	Supported	Supported	Supported	TBD	Supported	Supported	Supported
	Dynamic configuration	Feature	Supported	Supported	Supported	TBD	Supported but Optional	Supported	Supported
	Standardized stream reservation request from end-stations	Feature	Supported	Supported	Supported	Supported	Supported but Optional	Supported	Supported
	Number of supported streams	Quantity	8192	512	TBD	TBD	TBD	TBD	TBD
	Number of devices (bridges and end-stations) per TSN domain	Quantity	1000	200	1000	TBD	256	2000	TBD
Configuration-Distributed (M2M communication) LRP/RAP									
	path computation	Feature	Supported	Not Used	Supported	Supported but Optional	Supported	Supported	Not used
	Standardized stream reservation request from end-stations	Feature	Supported	Not Used	Supported	Supported but Optional	Supported but Optional	Supported	Not used
	Number of supported streams	Quantity	256	—	256	TBD	TBD	256	—
	Number of devices (bridges and end-stations) per TSN domain	Quantity	TBD	—	TBD	TBD	TBD	TBD	—

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3.2.1.5 IEEE 802.1AB

Table 3 shows the selection.

Table 3: IEEE 802.1AB selection

Attribute	Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
TSN Domain TLV (IEEE802.1Q TLV or IEC/IEEE60802 TLV)	Feature	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Preemption	Feature	Supported	Supported	Supported but Optional	Supported but Optional	Supported but Optional	Not used	Supported
802.3 extension	Feature	Supported	TBD	Not used	Supported but Optional	Not used	Not used	TBD
802.1 extension	Feature	Supported	TBD	Not used	Supported but Optional	Not used	Not used	TBD
802.1AB “Transmit on data change”	Feature	Supported	Supported	Supported but Optional	TBD	TBD	Supported	TBD
802.1AB “Topology Discovery”	Feature	Supported	Supported	Supported	Supported	Supported	Supported	Supported

3.2.1.6 IEEE 802.1AS

Table 4 shows the selection.

Table 4: IEEE 802.1AS selection

Attribute	Classification	Example Selection “SI”	Example Selection “TT”	Example Selection “RA”	Example Selection “AB”	Example Selection “MI”	Example Selection “YO”	Example Selection “BR”
SyncMaster	Feature	Supported but Optional	Supported but Optional	Supported but Optional	Supported	Supported but Optional	Supported but Optional	Supported
SyncSlave	Feature	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Sync Domains								
Working Clock	Quantity	1	1	TBD	1	1	1	1
Global Time	Quantity	1	1	TBD	1	1	1	1
Seamless redundancy – Hot Standby	Feature	Supported but Optional	Supported but Optional	Not used	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional
Working Clock	Quantity	1	1	—	1	1	1	1
Global Time	Quantity	1	1	—	1	1	1	1
BMCA Redundancy – Cold Standby	Feature	Not Used	Supported	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Supported
Externally Managed Sync Trees (YANG/MIB)	Feature	Supported	Supported but Optional	Not Used	Not used	TBD	Not Used	Supported
802.1AS “Announce”	Feature	Not Used	Supported	Supported	Supported	Supported	Supported	Supported
802.1AS “Signal”	Feature	Not Used	Supported but Optional	Supported	Supported	Supported	Supported	Supported

3.2.1.7 IEEE 802.1CB

Table 5 shows the selection.

Table 5: IEEE 802.1CB selection

Attribute		Classification	Example Selection "SI"	Example Selection "TT"	Example Selection "RA"	Example Selection "AB"	Example Selection "MI"	Example Selection "YO"	Example Selection "BR"
1CB seamless redundancy (Frame replication and Frame elimination)		Feature	Not used	Supported	Supported but Optional	Supported but Optional	Supported but Optional	Supported but Optional	Supported
	1CB TAG Supported	Feature	Not used	Supported	Supported but Optional	Supported but Optional	TBD	Supported	Supported
	HSR TAG Supported	Feature	Not used	Supported	Not used	Supported but Optional	TBD	Not used	TBD
	PRP Trailer Supported	Feature	Not used	Supported but Optional	Supported but Optional	Supported but Optional	TBD	Not used	TBD
	Vendor specific Trailer Supported FRER in end-stations only	Feature	Supported	Not used	Not used	Not Used	TBD	Not Used	Not used
	Number of streams	Quantity	4096	128	4096	TBD	TBD	8000	TBD

Literature and related Contributions

Literature:

[1] “Cyber Physical Systems: Design Challenges”, E. A. Lee, Technical Report No. UCB/EECS-2008-8; http://www.eecs.berkeley.edu/Pubs/TechRpts/2008/EECS-2008-8.html

[2] Beckers, K. (2015). Pattern and Security Requirements: Engineering-Based Establishment of Security Standards; Springer; ISBN 9783319166643

[3] PI: Isochronous Mode – Guideline for PROFINET IO; V1.0; June 2016; available at http://www.ieee802.org/1/files/private/liaisons

Related contributions:

[4] LNI traffic patterns for TSN: http://www.ieee802.org/1/files/public/docs2018/new-Bruckner-LNI-traffic-patterns-for-TSN-0118.pdf

[5] Multivendor Motion Control: http://ieee802.org/1/files/public/docs2018/new-industrial-enzinger-multivendor-motion-control-0318-v01.pdf

[6] Hierarchical Domain based Network: http://www.ieee802.org/1/files/public/docs2018/60802-harima-industrial-use-case-0518-v04.pdf

[7] Process Automation System Quantities: http://www.ieee802.org/1/files/public/docs2018/60802-sato-pa-system-quantities-0718-v01.pdf

[8] TSN Interdomain Communications: http://www.ieee802.org/1/files/public/docs2018/60802-Hantel-TSN-Interdomain-Communications-0718.pdf

[9] Cycle Timing Models: http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-cycle-timing-models-0718-v04.pdf

[10] Isochronous Drive Synchronization: http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-use-case-isochronous-drive-synchronization-0718-v01.pdf

[11] Machine Internal and Machine to Cell Controller (M2C) Embedded Communication: http://www.ieee802.org/1/files/public/docs2018/60802-essler-additional-use-case-0718-v01.pdf

[12] Coexistence & Convergence in TSN-based Industrial Automation Networks:
http://www.ieee802.org/1/files/public/docs2018/60802-stanica-convergence-coexistence-0718-v03.pptx

[13] Flexible Manufacturing System (FMS) for Small Batch Customized Production:
http://www.ieee802.org/1/files/public/docs2018/60802-Bai-small-batch-customized-production-0718-v01.pdf

[14] Multi-traffic transmission in industrial backbone network:
http://www.ieee802.org/1/files/public/docs2018/60802-chen-multi-traffic-transmission-on-backbone-0918.pdf