

1 Conformance Class

2 IEC/IEEE 60802

3

4 Contributor group

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5

6 Abstract

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

12

13 Parameters are moved to “60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf”.

14 **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
V1.2	Version created during Edinburgh meeting
V1.3	Version created in preparation for Hawaii meeting
V1.4	Version created during Hawaii meeting
V1.5	Version created after Hawaii meeting
V1.6	Update after discussion in IEC/IEEE 60802
V1.7	Tables moved to Excel for easier handling
V1.8	Questionnaire updated
V2.2	Feedback integrated (YO, SI)

15

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144 **Tables**

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149 1 References

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151 60802-industrial-use-cases-0918-v13.pdf

152 60802-Steindl-ExampleSelections-0119-v02.pdf

153 60802-Steindl-QuantityFigures-0519-v01.pdf

154 60802-Steindl-TimelinessUseCases-0718-v01.pdf

155 60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf

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168 **2 Terms and Definitions**

169 **2.1 Definitions**

Conformance Class

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

170 **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

171 **3 Devices classes**

172 **3.1 General**

173 This document addresses two device classes:

- 174 – Full-blown
- 175 – Constraint
- 176

177 The term “Full-blown” is used to classify a device class which supports all needed features.
178 This class is almost not constraint by compute power, power consumption, required
179 memory size,

180 The term “Constraint” is used to classify a device class which has limitations in the area of
181 compute power, power consumption, required memory size,

182

183 The understanding of the limitations of “constraint” devices (better: What are the
184 expectations?) needs to be aligned between the different contributors.
185 The following chapters show the understanding of the contributors.
186

187 3.2 Question

188 Following questions are of interest for the discussion:

- 189
- 190 1. What is your understanding of constraint bridge or end-station?

191
192 *Editor’s note: Why do you intend to develop two classes of devices?*

193

194

- 195 2. Shall a vendor independent mix between “full-blown” and “constraint” devices in one
196 TSN Domain be supported?

197

198 *Editor’s note: This means, that a vendor independent configuration of the network portion
199 of each device according to IEC/IEEE 60802 is supported.*

200

201

- 202 3. Shall a vendor independent mix between “full-blown” devices in one TSN Domain
203 be supported?

204

205 *Editor’s note: Follow-up to Question 2 – or is this only required for class full-blown?*

206

207

- 208 4. Shall a vendor independent mix between “constraint” devices in one TSN Domain
209 be supported?

210

211 *Editor’s note: Let’s assume that in a TSN Domain only class constraints is supported. This
212 means, that a **vendor independent** configuration of the network portion of each device
213 according to IEC/IEEE 60802 is supported.*

214

215

216

217 5. Shall a mix between vendor independent “full-blown” and vendor dependent
218 “constraint” devices in one TSN Domain be supported?
219

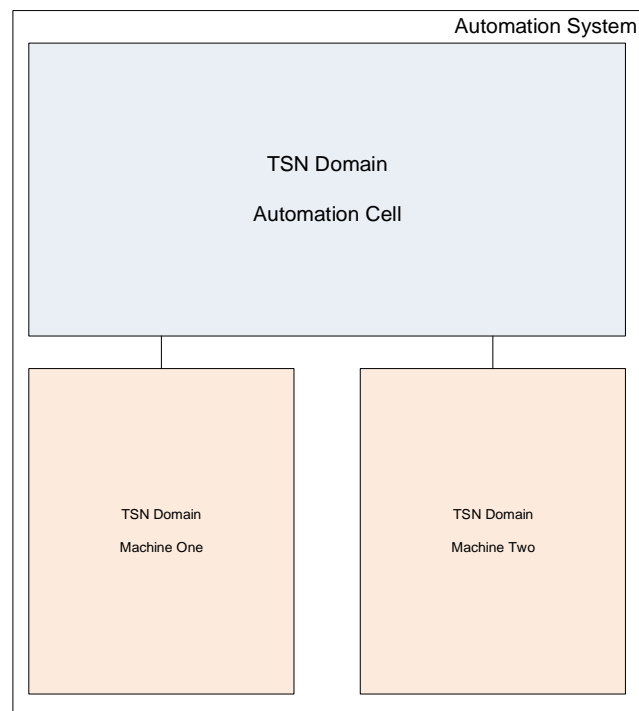
220 *Editor’s note: This means, that a mixture between **vendor dependent** configuration and*
221 *vendor independent according to IEC/IEEE 60802 definitions of the network portion - is*
222 *supported.*
223

224
225 6. Does for the end-stations the same usage model apply?
226

227 *Editor’s note: Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-*
228 *stations, without integrated bridge, do have lesser impact to the overall interoperability.*
229 *Thus, it’s unclear to the editor whether we need two classes for them.*
230
231

232 3.3 Drawings

233 Figure 1 shows the principle structure of an Automation System.



234

235 **Figure 1 – Principle structure of an Automation System**

236

237 Figure 2 shows one example for a possible usage of full-blown and constraint devices.

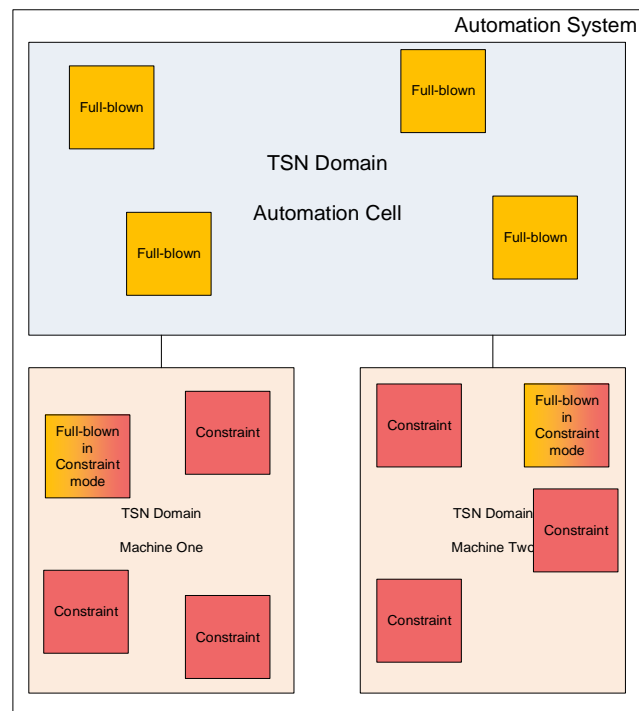


Figure 2 – Example for possible intended usage

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239

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241 3.4 Feedback from contributors

242 3.4.1 Siemens

243 Ethernet is the basis of the industrial communication. TSN is now part of Ethernet and thus, basis
244 of the industrial communication, too.

245 Devices are intended to be used at all layers of the automation pyramid. Thus, the basic Ethernet
246 requirements are identical for all devices.

247 Constraints are only acceptable if they do not interfere with the convergence. Do not disturb the
248 others!

249 3.4.1.1 What is your understanding of constraint bridge or end-station?

250 The understanding of the term "Constraint" needs to be aligned among each contributor.

251 Constraints are only acceptable if they do not interfere with the convergence.

252 3.4.1.2 Shall a vendor independent mix between "full-blown" and "constraint" devices in one TSN 253 Domain be supported?

254 (This means, that a vendor independent configuration of the network portion of each device
255 according to IEC/IEEE 60802 is supported.)

256 Yes

257 3.4.1.3 Shall a vendor independent mix between "full-blown" devices in one TSN Domain be 258 supported?

259 (Follow-up to Question 2 – or is this only required for class full-blown?)

- 260 Yes
- 261 **3.4.1.4** *Shall a vendor independent mix between “constraint” devices in one TSN Domain be*
262 *supported?*
- 263 (Let's assume that in a TSN Domain only class constraints is supported. This means, that a vendor
264 independent configuration of the network portion of each device according to IEC/IEEE 60802 is
265 supported.)
- 266 Yes
- 267 **3.4.1.5** *Shall a mix between vendor independent “full-blown” and vendor dependent “constraint”*
268 *devices in one TSN Domain be supported?*
- 269 (This means, that a mixture between vendor dependent configuration and vendor independent
270 according to IEC/IEEE 60802 definitions of the network portion - is supported.)
- 271 No
- 272 **3.4.1.6** *Is it enough to support a vendor dependent mix of “constraint” devices in one TSN*
273 *Domain?*
- 274 No
- 275 **3.4.1.7** *Does the usage of end-stations follow the same model?*
- 276 (Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-stations, without
277 integrated bridge, do have lesser impact to the overall interoperability. Thus, it's unclear to the
278 editor whether we need two classes for them.)
- 279 Yes
- 280 **3.4.2** **Rockwell**
- 281 TBD
- 282 **3.4.2.1** *What is your understanding of constraint bridge or end-station?*
- 283 The understanding of the term “Constraint” needs to be aligned among each contributor.
- 284 **3.4.2.2** *Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN*
285 *Domain be supported?*
- 286 (This means, that a vendor independent configuration of the network portion of each device
287 according to IEC/IEEE 60802 is supported.)
- 288 TBD
- 289 **3.4.2.3** *Shall a vendor independent mix between “full-blown” devices in one TSN Domain be*
290 *supported?*
- 291 (Follow-up to Question 2 – or is this only required for class full-blown?)
- 292 TBD
- 293 **3.4.2.4** *Shall a vendor independent mix between “constraint” devices in one TSN Domain be*
294 *supported?*
- 295 (Let's assume that in a TSN Domain only class constraints is supported. This means, that a vendor
296 independent configuration of the network portion of each device according to IEC/IEEE 60802 is
297 supported.)
- 298 TBD

299 **3.4.2.5 Shall a mix between vendor independent “full-blown” and vendor dependent “constraint”**
300 **devices in one TSN Domain be supported?**

301 (This means, that a mixture between vendor dependent configuration and vendor independent
302 according to IEC/IEEE 60802 definitions of the network portion - is supported.)

303 No, but may be supported with some restrictions (limited performance, topology, etc.)

304 **3.4.2.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN**
305 **Domain?**

306 TBD

307 **3.4.2.7 Does the usage of end-stations follow the same model?**

308 (Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-stations, without
309 integrated bridge, do have lesser impact to the overall interoperability. Thus, it’s unclear to the
310 editor whether we need two classes for them.)

311 TBD

312 **3.4.3 Mitsubishi**

313 **3.4.3.1 What is your understanding of constraint bridge or end-station?**

314 A three-port-Bridge which has constrained CPU and memory resources. Constrained bridge is
315 mainly used in machine. It supports TSN features which is needed to converge isochronous and/or
316 cyclic and none delay bounded communication with $\pm 1\mu\text{s}$ TER over 100hops.

317 Constrained Bridge can reduce the functionality from Full Bridge

- 318 • by pre-configuring parameters in centralized model
- 319 • by specifying use case, line topology with 2 ports devices.

320 [http://www.ieee802.org/1/files/public/docs2019/60802-Hotta-Traffic-Types-Mapping-to-TSN-](http://www.ieee802.org/1/files/public/docs2019/60802-Hotta-Traffic-Types-Mapping-to-TSN-Mechanism-0119-v01.pdf)
321 [Mechanism-0119-v01.pdf](http://www.ieee802.org/1/files/public/docs2019/60802-Hotta-Traffic-Types-Mapping-to-TSN-Mechanism-0119-v01.pdf)

- 322 • by using application-layer specific mechanisms

323 and can be connected with Backbone network via Full Bridge.

324 [Comment from the editor:

325 It is assumed that constraint devices ONLY support two external ports;

326 It is assumed that constraint devices NEVER used as TSN domain boundary;]

327 **3.4.3.2 Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN**
328 **Domain be supported?**

329 No, but if they support common functions, they can be mixed.

330 **3.4.3.3 Shall a vendor independent mix between “full-blown” devices in one TSN Domain be**
331 **supported?**

332 Yes.

333 **3.4.3.4 Shall a vendor independent mix between “constraint” devices in one TSN Domain be**
334 **supported?**

335 No, but if they support common functions, they can be mixed.

336 **3.4.3.5 Shall a mix between vendor independent “full-blown” and vendor dependent “constraint”**
 337 **devices in one TSN Domain be supported?**

338 Yes, within the features of Constraint devices.

339 **3.4.3.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN**
 340 **Domain?**

341 No. Full-blown devices can be mixed.

342 **3.4.3.7 Does the usage of end-stations follow the same model?**

343 Yes.

344 3.4.4 Yokogawa

345 This chapter provides the author's answers with supporting information from Process Automation
 346 (PA) viewpoints, to the questions distributed to the contributors for further discussions.

347 Full-blown Bridge & End-station

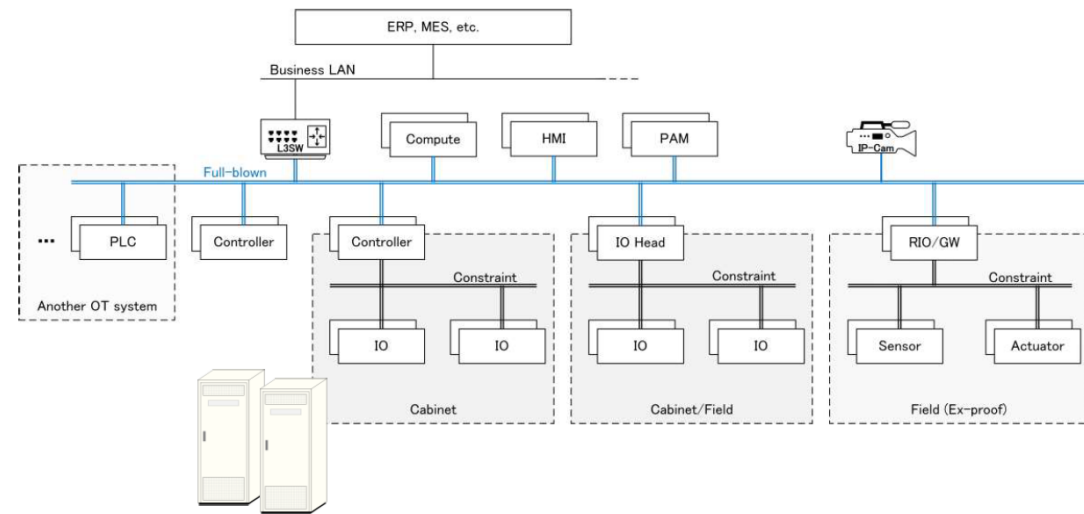
348 Typically used for a backbone network, on which a bunch of IA-Devices communicate each other
 349 using variety of OT protocols with various data rates and traffic types.

350 Constraint Bridge & End-station

351 Typically used for an (in cabinet) IO network or a field network, on which a limited number of
 352 friendly neighbor IA-Devices communicate each other using an OT protocol with limited data rate
 353 options and traffic types.

354

Example PA System Architecture



355

356 *Figure 3 -- Yokogawa example system architecture*

357

CC Mapping Proposal (Plan A, 3 cc)

Add ccC for Constraint PA if ccB can meet Full-blown PA requirements.

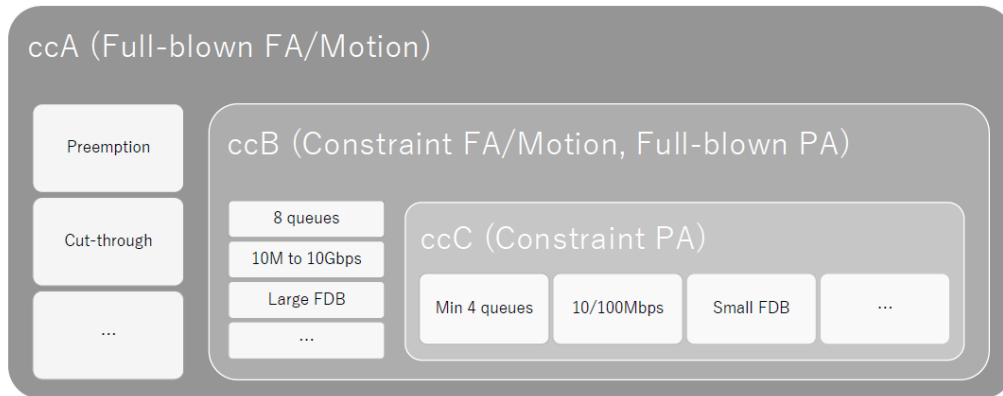


Figure 4 -- Yokogawa example CC mapping

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CC Mapping Proposal (Plan B, 2 cc)

Separate FA/Motion specific attributes and make them optional for PA in each class.

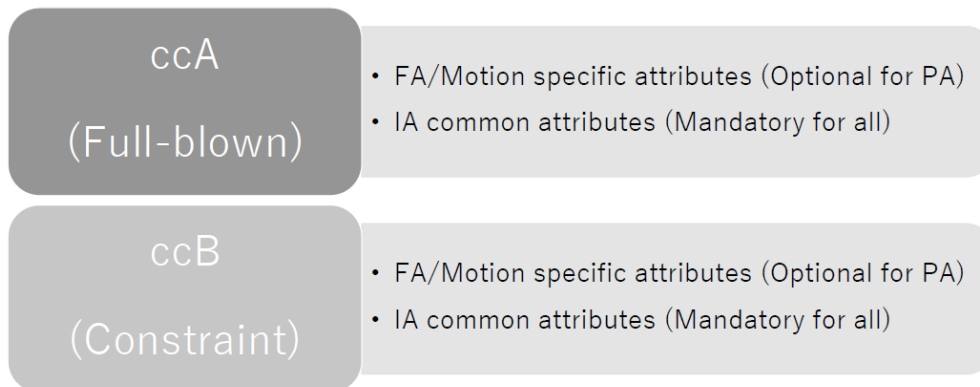


Figure 5 -- Yokogawa example CC mapping

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362
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CC Mapping Proposal (Plan C, 4 cc)

Add ccC for Full-blown PA and ccD for Constraint PA to keep ccA & ccB perfectly fit to FA/Motion.

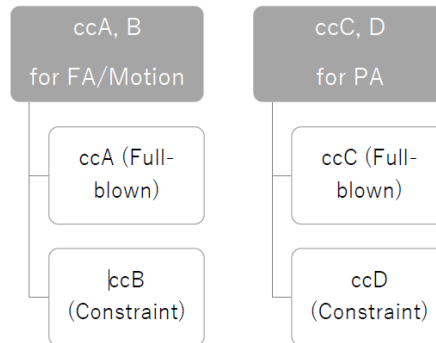


Figure 6 -- Yokogawa example CC mapping

364

365

366

3.4.4.1 What is your understanding of constraint bridge or end-station?

The understanding of the term "Constraint" needs to be aligned among each contributor.

Typically used for an (in-cabinet) IO network or a field network, on which a limited number of friendly neighbor IA-Devices communicate each other using an OT protocol with limited data rate options and traffic types.

Typical constraint factors:

- Limited resources due to power consumption
- e.g. MPU power, memory size
- Single OT protocol with limited functionality
- Limited Traffic Types
- Limited power source

Hazardous area installation

- Explosion-proof (limited power consumption)
- Water-/Dust-/Salt-damage-/Corrosion-/... proof
- Special physical layer (e.g. APL, optical fiber) support
 - For noise protection
 - For long distance connection

In-cabinet installation

- Limited data rate for heat control
- Limited footprint

Switch-less installation requirement

- Limited topologies (line/ring)

Less strict performance requirements on:

- Time error

- 391 • Timestamp accuracy
 392 • Minimum network cycle
 393 • ...

394 ***3.4.4.2 Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN Domain be supported?***

395
 396 (This means, that a vendor independent configuration of the network portion of each device
 397 according to IEC/IEEE 60802 is supported.)

398 No, but may be supported with some restrictions (limited performance, topology, etc.)

399 ***3.4.4.3 Shall a vendor independent mix between “full-blown” devices in one TSN Domain be supported?***

400
 401 (Follow-up to Question 2 – or is this only required for class full-blown?)

402 Yes

403 ***3.4.4.4 Shall a vendor independent mix between “constraint” devices in one TSN Domain be supported?***

404
 405 (Let's assume that in a TSN Domain only class constraints is supported. This means, that a vendor
 406 independent configuration of the network portion of each device according to IEC/IEEE 60802 is
 407 supported.)

408 Yes, but only a single OT protocol (based on the same configuration mechanism) would be
 409 supported in that TSN Domain.

410 ***3.4.4.5 Shall a mix between vendor independent “full-blown” and vendor dependent “constraint” devices in one TSN Domain be supported?***

411
 412 (This means, that a mixture between vendor dependent configuration and vendor independent
 413 according to IEC/IEEE 60802 definitions of the network portion - is supported.)

414 No, but may be supported with some restrictions (limited performance, topology, etc.)

415 ***3.4.4.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN Domain?***

416
 417 TDB

418 ***3.4.4.7 Does the usage of end-stations follow the same model?***

419 (Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-stations, without
 420 integrated bridge, do have lesser impact to the overall interoperability. Thus, it's unclear to the
 421 editor whether we need two classes for them.)

422 Yes, available resources of pure end-stations could also be restricted according to the same
 423 constraint factors.

424 **3.4.5 ABB**

425 "Constraint" means an end station or a bridge which presents limitations, in terms of:

- 426 • Hardware
 427 • Ports count (i.e. less than three external ports): exception for "constraint bridges", not
 428 applicable for "constraint end stations": I would propose to avoid considering this topic as
 429 relevant for the "constraint" bridges discussion, even if it intuitively belongs here. I believe
 430 this is related to the chosen topology, see again the example system.
 431 • Ports data rate (i.e. power dissipation constraints, due to form factor size)
 432 • Power supply (i.e. redundant or not)

- 433 • Timestamping capabilities
 - 434 • Ingress and egress queue size
 - 435 • ...
 - 436 • Software
 - 437 • QoS functions (i.e. traffic shapers, cut-through capabilities, frame preemption, ingress
 - 438 policing, presence of more than one TSN configuration mechanism)
 - 439 • Clock synchronization functions
- 440 Network Access capabilities
- 441 • Media redundancy functions
 - 442 • ...
- 443 We should be able to mix in a TSN domain, both constrained and fully capable end stations
- 444 Mixing constrained and fully capable bridges in a system is dependent on the topology and less on
- 445 the TSN domains demarcation, see my example system
- 446 *3.4.5.1 What is your understanding of constraint bridge or end-station?*
- 447 The understanding of the term “Constraint” needs to be aligned among each contributor.
- 448 TBD
- 449 *3.4.5.2 Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN*
- 450 *Domain be supported?*
- 451 (This means, that a vendor independent configuration of the network portion of each device
- 452 according to IEC/IEEE 60802 is supported.)
- 453 TBD
- 454 *3.4.5.3 Shall a vendor independent mix between “full-blown” devices in one TSN Domain be*
- 455 *supported?*
- 456 (Follow-up to Question 2 – or is this only required for class full-blown?)
- 457 TBD
- 458 *3.4.5.4 Shall a vendor independent mix between “constraint” devices in one TSN Domain be*
- 459 *supported?*
- 460 (Let’s assume that in a TSN Domain only class constraints is supported. This means, that a vendor
- 461 independent configuration of the network portion of each device according to IEC/IEEE 60802 is
- 462 supported.)
- 463 TBD
- 464 *3.4.5.5 Shall a mix between vendor independent “full-blown” and vendor dependent “constraint”*
- 465 *devices in one TSN Domain be supported?*
- 466 (This means, that a mixture between vendor dependent configuration and vendor independent
- 467 according to IEC/IEEE 60802 definitions of the network portion - is supported.)
- 468 No, but may be supported with some restrictions (limited performance, topology, etc.)
- 469 *3.4.5.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN*
- 470 *Domain?*
- 471 TBD

472 **3.4.5.7 Does the usage of end-stations follow the same model?**
473 (Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-stations, without
474 integrated bridge, do have lesser impact to the overall interoperability. Thus, it's unclear to the
475 editor whether we need two classes for them.)

476 TBD

477 **3.4.6 Others**

478 TBD

479

480 4 TSN in Industrial Automation

481 4.1 General

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

484 The document contains chapters for full-blown and constraint devices.

485

486 *Editor's note:*

487 *Please make all changes with "track changes on"*

488

489 4.2 Conformance Class

490 4.2.1 Standard selection

491 4.2.1.1 General

492 A Conformance Class selects out of the following standards

493 IEEE802.3-2018 - IEEE Standard for Ethernet

494 IEEE802.1Q-2018 - Bridges and Bridged Networks

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

496 IEEE802.1AS-2020 - Timing and Synchronization for Time-Sensitive Applications

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

498

499 4.2.1.2 Terms

500 **Supported:**

501 This feature is used in any class of device

502 **Support, but optional:**

503 This feature is intended to be used in some class of device.

504 For silicon vendors, these topics may be "supported", too.

505 **Not used:**

506 The used and thus the support of this feature is not intended.

507 **Ω / TBD:**

508 Not provided until agreed release date for this version.

509 **—:**

510 No quantities, because the assigned feature is not supported.

511 **???:**

512 The responsible editor is not able to fill this cell without a discussion with the other
513 contributors.

514

515 **4.3 Full-blown devices**

516 **4.3.1 Common**

517 **4.3.1.1 IEEE 802.3**

518 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

519 2019-11-12:

520 Restricting the supported data rates in the profile seems not to be needed.

521 **4.3.2 Bridge**

522 **4.3.2.1 IEEE 802.1Q**

523 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

524 **4.3.2.2 IEEE 802.1AB**

525 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

526 **4.3.2.3 IEEE 802.1AS**

527 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

528 **4.3.2.4 IEEE 802.1CB**

529 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

530 **4.3.2.5 IEC standards**

531 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

532 **4.3.3 End-station**

533 **4.3.3.1 General**

534 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

535 **4.4 Constraint devices**

536 **4.4.1 Common**

537 **4.4.1.1 IEEE 802.3**

538 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

539 2019-11-12:

540 Restricting the supported data rates in the profile seems not to be needed.

541 **4.4.2 Bridge**

542 **4.4.2.1 IEEE 802.1Q**

543 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

544 **4.4.2.2 IEEE 802.1AB**

545 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

546 **4.4.2.3 IEEE 802.1AS**

547 See "60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf"

548 **4.4.2.4 IEEE 802.1CB**
549 See “60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf”

550 **4.4.2.5 IEC standards**
551 See “60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf”

552 **4.4.3 End-station**

553 **4.4.3.1 General**
554 See “60802-Steindl-et-al-ExampleSelectionTables-1119-v17.pdf”

555
556 Literature and related Contributions

557 Literature:

558 [1] “Cyber Physical Systems: Design Challenges”, E. A. Lee, Technical Report No.
559 UCB/EECS-2008-8; [http://www.eecs.berkeley.edu/Pubs/TechRpts/2008/EECS-2008-](http://www.eecs.berkeley.edu/Pubs/TechRpts/2008/EECS-2008-8.html)
560 [8.html](http://www.eecs.berkeley.edu/Pubs/TechRpts/2008/EECS-2008-8.html)

561
562 [2] Becker’s, K. (2015). Pattern and Security Requirements: Engineering-Based
563 Establishment of Security Standards; Springer; ISBN 9783319166643

564
565 [3] PI: Isochronous Mode – Guideline for PROFINET IO; V1.0; June 2016; available at
566 <http://www.ieee802.org/1/files/private/liasons>
567

568 Related contributions:

569 [4] LNI traffic patterns for TSN: [http://www.ieee802.org/1/files/public/docs2018/new-](http://www.ieee802.org/1/files/public/docs2018/new-Bruckner-LNI-traffic-patterns-for-TSN-0118.pdf)
570 [Bruckner-LNI-traffic-patterns-for-TSN-0118.pdf](http://www.ieee802.org/1/files/public/docs2018/new-Bruckner-LNI-traffic-patterns-for-TSN-0118.pdf)

571
572 [5] Multivendor Motion Control: [http://www.ieee802.org/1/files/public/docs2018/new-industrial-](http://www.ieee802.org/1/files/public/docs2018/new-industrial-enzinger-multivendor-motion-control-0318-v01.pdf)
573 [enzinger-multivendor-motion-control-0318-v01.pdf](http://www.ieee802.org/1/files/public/docs2018/new-industrial-enzinger-multivendor-motion-control-0318-v01.pdf)

574
575 [6] Hierarchical Domain based Network:
576 [http://www.ieee802.org/1/files/public/docs2018/60802-harima-industrial-use-case-0518-](http://www.ieee802.org/1/files/public/docs2018/60802-harima-industrial-use-case-0518-v04.pdf)
577 [v04.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-harima-industrial-use-case-0518-v04.pdf)

578
579 [7] Process Automation System Quantities:
580 [http://www.ieee802.org/1/files/public/docs2018/60802-sato-pa-system-quantities-0718-](http://www.ieee802.org/1/files/public/docs2018/60802-sato-pa-system-quantities-0718-v01.pdf)
581 [v01.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-sato-pa-system-quantities-0718-v01.pdf)

582
583 [8] TSN Interdomain Communications:
584 [http://www.ieee802.org/1/files/public/docs2018/60802-Hantel-TSN-Interdomain-](http://www.ieee802.org/1/files/public/docs2018/60802-Hantel-TSN-Interdomain-Communications-0718.pdf)
585 [Communications-0718.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-Hantel-TSN-Interdomain-Communications-0718.pdf)

586
587 [9] Cycle Timing Models: [http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-](http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-cycle-timing-models-0718-v04.pdf)
588 [cycle-timing-models-0718-v04.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-cycle-timing-models-0718-v04.pdf)
589

- 590 [10] Isochronous Drive Synchronization:
591 [http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-use-case-isochronous-
593 drive-synchronization-0718-v01.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-enzinger-use-case-isochronous-
592 drive-synchronization-0718-v01.pdf)
- 594 [11] Machine Internal and Machine to Cell Controller (M2C) Embedded Communication:
595 [http://www.ieee802.org/1/files/public/docs2018/60802-essler-additional-use-case-0718-
597 v01.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-essler-additional-use-case-0718-
596 v01.pdf)
- 598 [12] Coexistence & Convergence in TSN-based Industrial Automation Networks:
599 [http://www.ieee802.org/1/files/public/docs2018/60802-stanica-convergence-coexistence-
601 0718-v03.pptx](http://www.ieee802.org/1/files/public/docs2018/60802-stanica-convergence-coexistence-
600 0718-v03.pptx)
- 602 [13] Flexible Manufacturing System (FMS) for Small Batch Customized Production:
603 [http://www.ieee802.org/1/files/public/docs2018/60802-Bai-small-batch-customized-
605 production-0718-v01.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-Bai-small-batch-customized-
604 production-0718-v01.pdf)
- 606 [14] Multi-traffic transmission in industrial backbone network:
607 [http://www.ieee802.org/1/files/public/docs2018/60802-chen-multi-traffic-transmission-on-
609 backbone-0918.pdf](http://www.ieee802.org/1/files/public/docs2018/60802-chen-multi-traffic-transmission-on-
608 backbone-0918.pdf)
- 610
- 611