

1 Conformance Class

2 IEC/IEEE 60802

3

4 Contributor group

	Column
Ademaj, Astrit <astrit.ademaj@tttech.com>	TT
Dorr, Josef <josef.dorr@siemens.com>	SI
Enzinger, Thomas <thomas.enzinger@br-automation.com>	BR
Hantel, Mark <mrhantel@ra.rockwell.com>	RA
Hotta, Yoshifumi <Hotta.Yoshifumi@eb.MitsubishiElectric.co.jp>	MI
Kehrer, Stephan <Stephan.Kehrer@belden.com>	—
Sato, Atsushi (Alex) <a.satou@jp.yokogawa.com>	YO
Seewald, Maik <maseewal@cisco.com>	—
Stanica, Marius-Petru <marius-petru.stanica@de.abb.com>	AB
Steindl, Guenter <guenter.steindl@siemens.com>	SI
Leurs, Ludwig <Ludwig.Leurs@bosch-rewroth.com>	BO

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-xxxx-vxx.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)
V2.3	Feedback integrated (ABB, B&R)
V2.4	Alignment with Example Selection Tables

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132 1 References

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134 60802-industrial-use-cases-0918-v13.pdf

135 60802-Steindl-ExampleSelections-0119-v02.pdf

136 60802-Steindl-QuantityFigures-0519-v01.pdf

137 60802-Steindl-TimelinessUseCases-0718-v01.pdf

138 60802-Steindl-et-al-ExampleSelectionTables-0520-v24.pdf

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151 **2 Terms and Definitions**

152 **2.1 Definitions**

Conformance Class

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

153 **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

154

155

156

157 **3 Feature selection constraints**

158 **3.1 General**

159 The individual selection of features can be sorted into at least two classes:

- 160 – Self-restriction, not influencing others
- 161 – Restricting others

162

163 Its a process to find the right balance between “self-restriction” and “restricting others”.
164 Often, defining features optional or having a few more classes is the way out of this
165 deadlock.

166 **3.2 Self-restriction**

167 If a vendor of an end-station decides to support only a few queues or skip global time
168 support, then this only limits its products, but no one else.

169 **3.3 Restricting others**

170 Any bridge feature is very likely to fall into this class. Thus, the balance between the
171 different interest while getting a convergent network is a key for the success of industrial
172 automation profile.

173 **4 Devices classes**

174 **4.1 General**

175 This document addresses two device classes:

- 176 – Full-blown
- 177 – Constrained

178

179 The term “Full-blown” is used to classify a device class which supports all needed features.

180 The term “constrained” is used to classify a device class which supports only a subset of
181 the “all needed features”.

182 The understanding of the limitations of “constrained” devices (better: What are the
183 expectations?) needs to be aligned between the different contributors.

184 The following chapters show the understanding of the contributors.

185

186 **4.2 Question**

187 Following questions are of interest for the discussion:

188

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

190

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

192

193

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

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

200

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

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

206

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

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

214

215

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

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

223

224

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

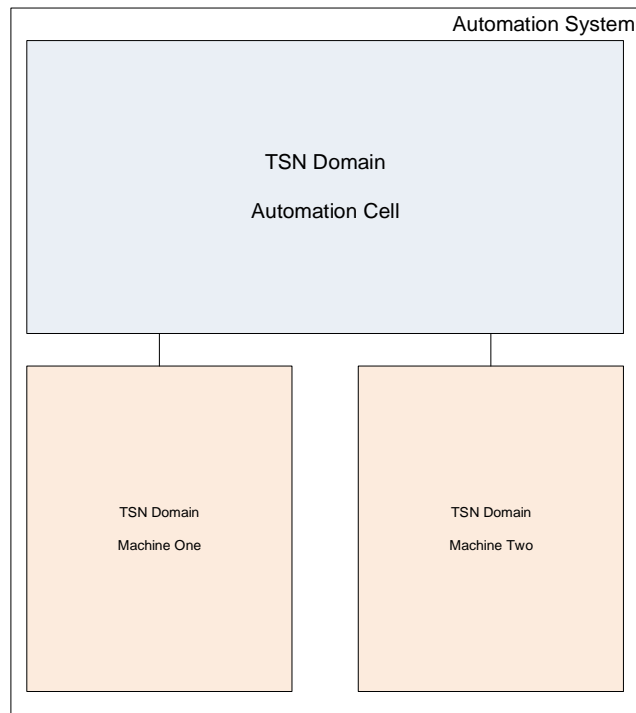
227 *Editor’s note: Same principle – Question 1 to 5 – for end-stations. Assumption: Pure end-*
228 *stations, without integrated bridge, do have lesser impact to the overall interoperability.*
229 *Thus, it’s unclear to the editor whether we need two classes for them.*
230

231

232

231 4.3 Drawings

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



233

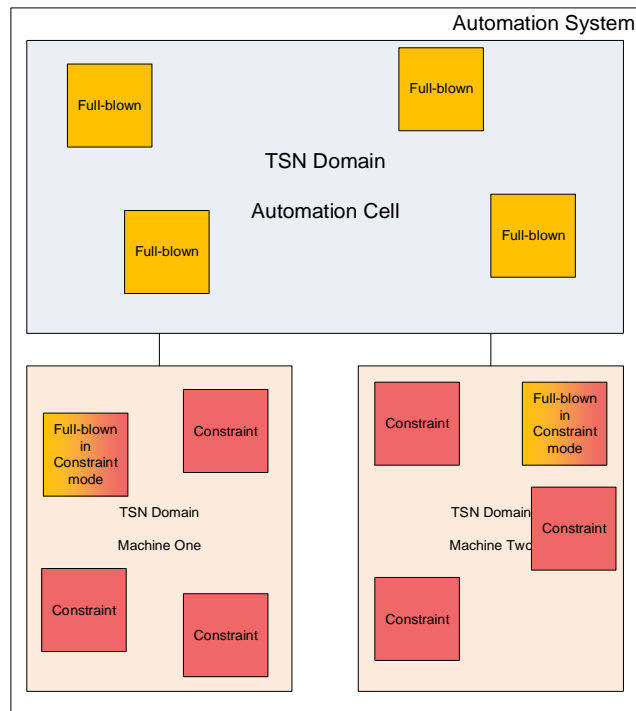
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Figure 1 – Principle structure of an Automation System

235

236

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



237

238

Figure 2 – Example for possible intended usage

239

240 4.4 Feedback from contributors

241 4.4.1 Siemens

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

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

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

248

249 4.4.1.1 *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 4.4.1.2 *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 4.4.1.3 *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 4.4.1.4 *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 4.4.1.5 *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 4.4.1.6 *Is it enough to support a vendor dependent mix of “constraint” devices in one TSN 273 Domain?*

274 No

275 4.4.1.7 *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 **4.4.2 Rockwell**
- 281 TBD
- 282 **4.4.2.1 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 **4.4.2.2 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 **4.4.2.3 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 **4.4.2.4 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 **4.4.2.5 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 **4.4.2.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN**
- 305 **Domain?**
- 306 TBD
- 307 **4.4.2.7 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 **4.4.3 Mitsubishi**
- 313 **4.4.3.1 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

- 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 ***4.4.3.2 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 ***4.4.3.3 Shall a vendor independent mix between “full-blown” devices in one TSN Domain be***
331 ***supported?***

332 Yes.

333 ***4.4.3.4 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 ***4.4.3.5 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 ***4.4.3.6 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 ***4.4.3.7 Does the usage of end-stations follow the same model?***

343 Yes.

344 **4.4.4 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

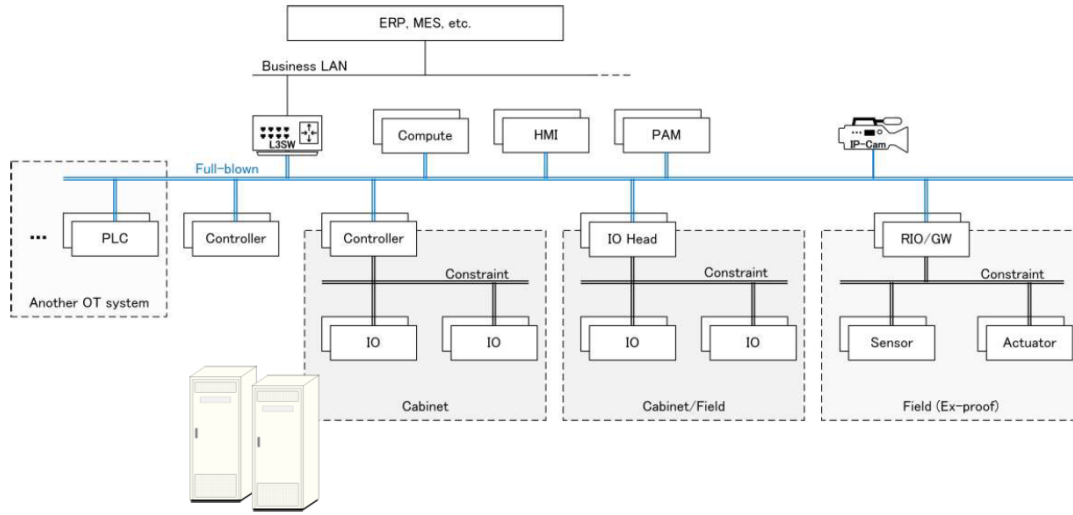


Figure 3 -- Yokogawa example system architecture

CC Mapping Proposal (Plan A, 3 cc)

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

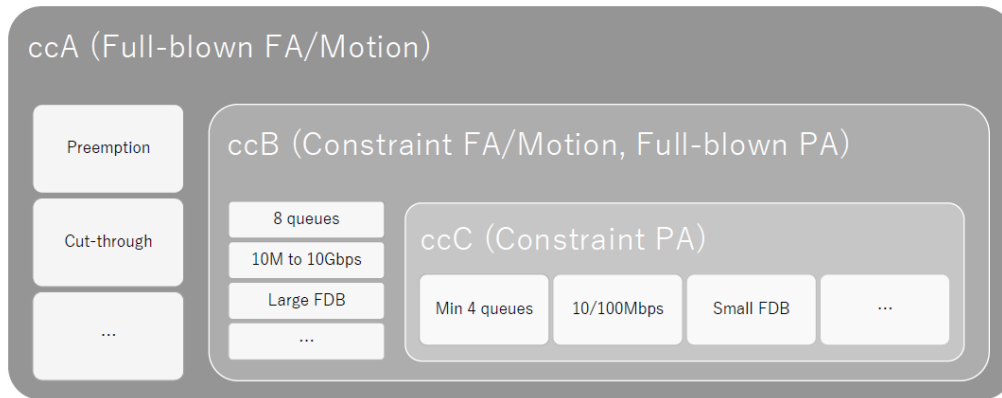


Figure 4 -- Yokogawa example CC mapping

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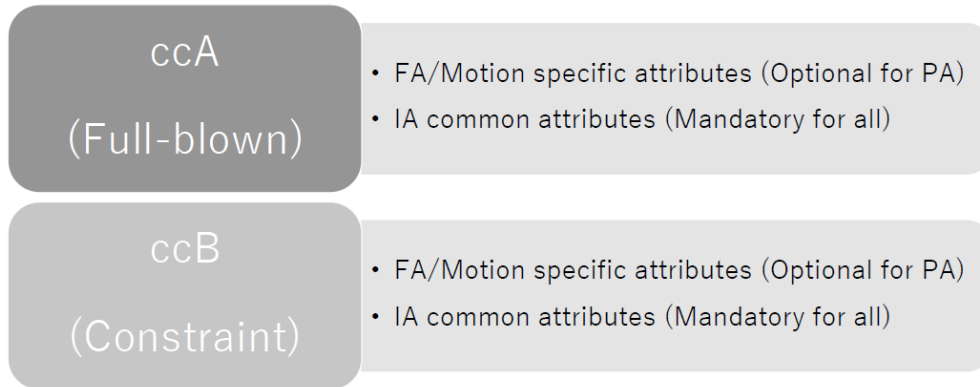
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CC Mapping Proposal (Plan B, 2 cc)

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

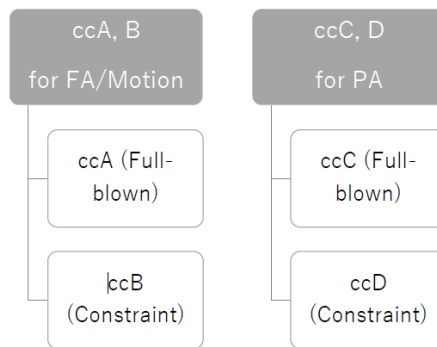


361
362
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Figure 5 -- Yokogawa example CC mapping

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.



364
365
366

Figure 6 -- Yokogawa example CC mapping

4.4.4.1 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

375

- 376 • Limited Traffic Types
 377 • Limited power source
- 378 Hazardous area installation
- 379 • Explosion-proof (limited power consumption)
 380 • Water-/Dust-/Salt-damage-/Corrosion-/... proof
 381 • Special physical layer (e.g. APL, optical fiber) support
 382 ○ For noise protection
 383 ○ For long distance connection

- 384 In-cabinet installation
- 385 • Limited data rate for heat control
 386 • Limited footprint

- 387 Switch-less installation requirement
- 388 • Limited topologies (line/ring)

389 Less strict performance requirements on:

- 390 • Time error
 391 • Timestamp accuracy
 392 • Minimum network cycle
 393 • ...

394 ***4.4.4.2 Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN***
 395 ***Domain be supported?***

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

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

402 Yes

403 ***4.4.4.4 Shall a vendor independent mix between “constraint” devices in one TSN Domain be***
 404 ***supported?***

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

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 **4.4.4.6 Is it enough to support a vendor dependent mix of “constraint” devices in one TSN**
416 **Domain?**
417 TDB

418 **4.4.4.7 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 **4.4.5 ABB (including B&R)**

425 Ethernet is the basis of the industrial communication. TSN is now part of Ethernet and thus, basis of
426 the industrial communication, too.

427 Devices are intended to be used at all layers of the automation pyramid.

428 Nevertheless, a commonly accepted set of Ethernet requirements is under investigation in various
429 SDOs and the 60802 contributes to it by the current definitions of specific TSN-related parameters.

430 The notion of *network convergence* could be seen like the sharing of the same network
431 segment/communication media by several Ethernet-based data exchange technologies (industrial
432 automation or not), in order to achieve systems within the required performance, deployment
433 flexibility, environmental impact and cost savings and without reliability, availability and engineering
434 efficiency losses.

435 Thus, a notion of segmentation may still be required, especially in larger projects/topologies and
436 presence of end stations with various hardware capabilities will still be required by the engineering
437 efficiency, cost savings and environmental impact. Loss of performance due to bottlenecks must be
438 avoided.

439 The cost savings aspect though is multi-faceted: besides the overall system costs, device-level costs
440 and lifecycle-related costs must be considered, thus over-classification of 802.1 and 802.3 specific
441 parameters should be avoided.

442
443 **4.4.5.1 What is your understanding of constraint bridge or end-station?**

444 The understanding of the term “Constraint” needs to be aligned among each contributor.

445 *Constraint bridges* refer mostly to embedded bridges with their external port count which needs to
446 be smaller or equal than two. Additional aspects, for the constraint bridges could potentially be one
447 or more of the ones shown in the attached Excel sheet concerning the example selection.

448 Infrastructure Bridges which are independent devices and may be used for connecting more than 2
449 devices together, due to a port count higher than two, can also be seen as constraint if they
450 implement a subset of features specified in the attached Excel sheet concerning the example
451 selection for constrained bridges.

452 The rest of Infrastructure Bridges cannot be seen as constraint, due to the high number of
453 deployment scenarios they must have the flexibility to support.

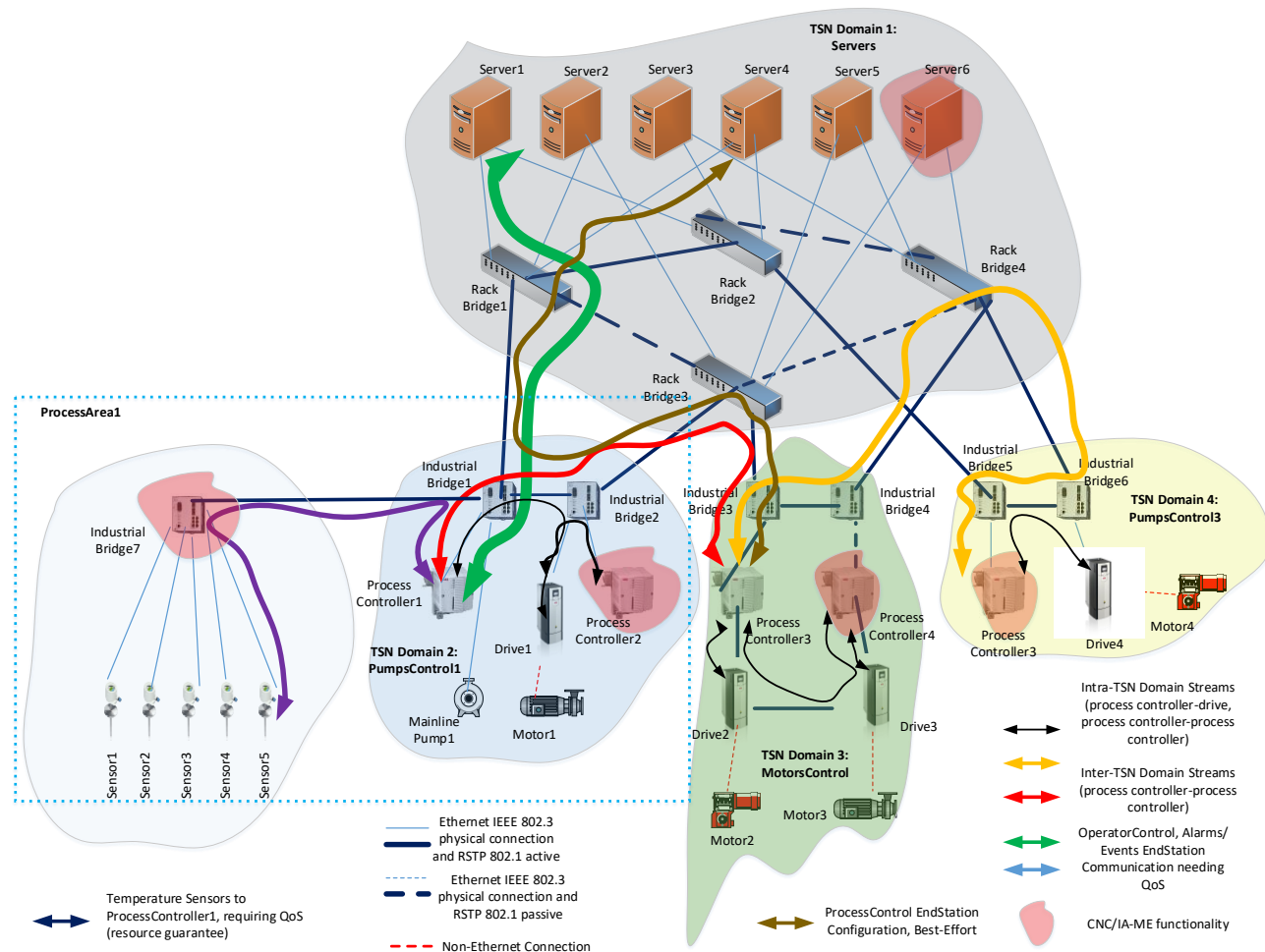
454

455

456 *Constraint end stations* may exhibit a somewhat larger variation than bridges, in terms of:

- 457 • Hardware chipset
 - 458 • Processing power
 - 459 • Memory sizes (of various types)
- 460 • Other aspects as described in the attached Excel sheet concerning the example selection

461 Mixing constrained and fully capable devices in a system is dependent on the required topology
 462 and less on the TSN domains demarcation, see example:



463

464

465 **4.4.5.2 Shall a vendor independent mix between “full-blown” and “constraint” devices in one TSN**
 466 **Domain be supported?**

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

469 Yes, see the example system above.

470 **4.4.5.3 Shall a vendor independent mix between “full-blown” devices in one TSN Domain be**
 471 **supported?**

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

473 Yes

474 **4.4.5.4** *Shall a vendor independent mix between “constraint” devices in one TSN Domain be*
475 *supported?*

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

479 Yes

480 **4.4.5.5** *Shall a mix between vendor independent “full-blown” and vendor dependent “constraint”*
481 *devices in one TSN Domain be supported?*

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

484 See 4.4.5.2

485 **4.4.5.6** *Is it enough to support a vendor dependent mix of “constraint” devices in one TSN*
486 *Domain?*

487 It depends on the requirements of the TSN domain. It could be that a number of constrained
488 bridges and constrained end stations may be sufficient in some cases.

489 No

490 **4.4.5.7** *Does the usage of end-stations follow the same model?*

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

494 Yes

495 **4.4.6 Others**

496 TDB

497

498 5 TSN in Industrial Automation

499 5.1 General

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

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

503

504 *Editor's note:*

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

506

507 5.2 Conformance Class

508 5.2.1 Standard selection

509 5.2.1.1 General

510 A Conformance Class selects out of the following standards

511 IEEE802.3-2018 - IEEE Standard for Ethernet

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

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

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

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

516

517 5.2.1.2 Terms

518 **Supported:**

519 This feature is used in any class of device

520 **Support, but optional:**

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

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

523 **Not used:**

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

525 **Ω / TBD:**

526 Not provided until agreed release date for this version.

527 **—:**

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

529 **???:**

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

532

533 **5.3 Full-blown and constrained devices**

534

535 See “60802-Steindl-et-al-ExampleSelectionTables-0520-v24.pdf” available at

536 <http://www.ieee802.org/1/files/public>

537

6 Literature and related Contributions

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551 Related contributions:

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