

The background image shows a modern industrial factory floor with complex machinery and conveyor systems. Overlaid on this are various digital elements: yellow rectangular frames representing object detection or tracking, and streams of blue binary code (0s and 1s) floating in the air, symbolizing Industry 4.0 or IIoT.

IEC/IEEE P60802 JWG TSN Industrial Profile

Status Use Cases

Josef Dorr
Siemens AG

Use Cases Document revisions

Version	Date	Comment
V0.1-V0.3		working drafts
V0.4	2018-03-02	Revised after circuit meeting presented at Rosemont meeting
V0.5	2018-03-07	Revised and during Rosemont meeting
V0.6	2018-04-13	(1) Elaborated additional use cases from Rosemont (2) Five additional use cases (3) Introduced grouping of use cases - Synchronization - IA mode of operation - IA networks - IA machines, production lines, production cells - Further use cases

IEC/IEEE JWG TSN Industrial Profile: Use Cases (1)

	Use Case	V0.4	V0.5	V0.6
	Synchronization			
01	Sequence of events	-	(√)	√
	Industrial automation mode of operation			
02	Control Loops with guaranteed low latency	-	(√)	√
03	Control Loops with bounded latency	-	-	√
04	Reduction ratio of network cycle	√	√ ¹	√
05	Drives without common application cycle	-	√	√
06	Drives without common application cycle but common network cycle	-	-	√

^[1] Cycle Times

IEC/IEEE JWG TSN Industrial Profile: Use Cases (2)

	Use Case	V0.4	V0.5	V0.6
	Industrial automation networks			
07	Redundant networks	-	-	✓
08	High Availability	-	✓	✓
09	Wireless	-	(✓)	✓
10	Ethernet Sensor	-	(✓)	✓
11	Fieldbus gateway	-	(✓)	✓
12	Brownfield integration	✓	✓	✓
13	Mixed link speeds	-	(✓)	✓
14	Multiple isochronous domains	✓	✓ ²	✓
15	Auto domain protection	-	(✓)	✓
16	Vast number of connected stations	-	-	✓

^[2] Different domain sizes for different Traffic Pattern

IEC/IEEE JWG TSN Industrial Profile: Use Cases (3)

	Use Case	V0.4	V0.5	V0.6
	Industrial automation machines, production cells, production lines			
17	Pass-through traffic	√	√	√
18	Machine-to-machine communication	√	√	√
19	Modular machine assembly	√	√	√
20	Tool changer	√	√	√
21	Dynamic plugging and unplugging of machines (subnets)	√	√	√
22	Energy saving	√	√	√
23	Add machine, production cell or production line	-	(√)	√
24	Multiple applications in a station using TSN	-	(√)	√
25	Functional safety	-	(√)	√
26	DCS device level reconfiguration	√	√	√
27	DCS system level reconfiguration	√	√	√

IEC/IEEE JWG TSN Industrial Profile: Use Cases (4)

	Use Case	V0.4	V0.5	V0.6
	Further Industrial automation use cases			
28	Network monitoring and diagnostics	-	(√)	(√)
29	Security	-	(√)	√
30	Firmware update	-	(√)	(√)
31	Virtualization	-	(√)	(√)
32	Digital twin	-	-	(√)

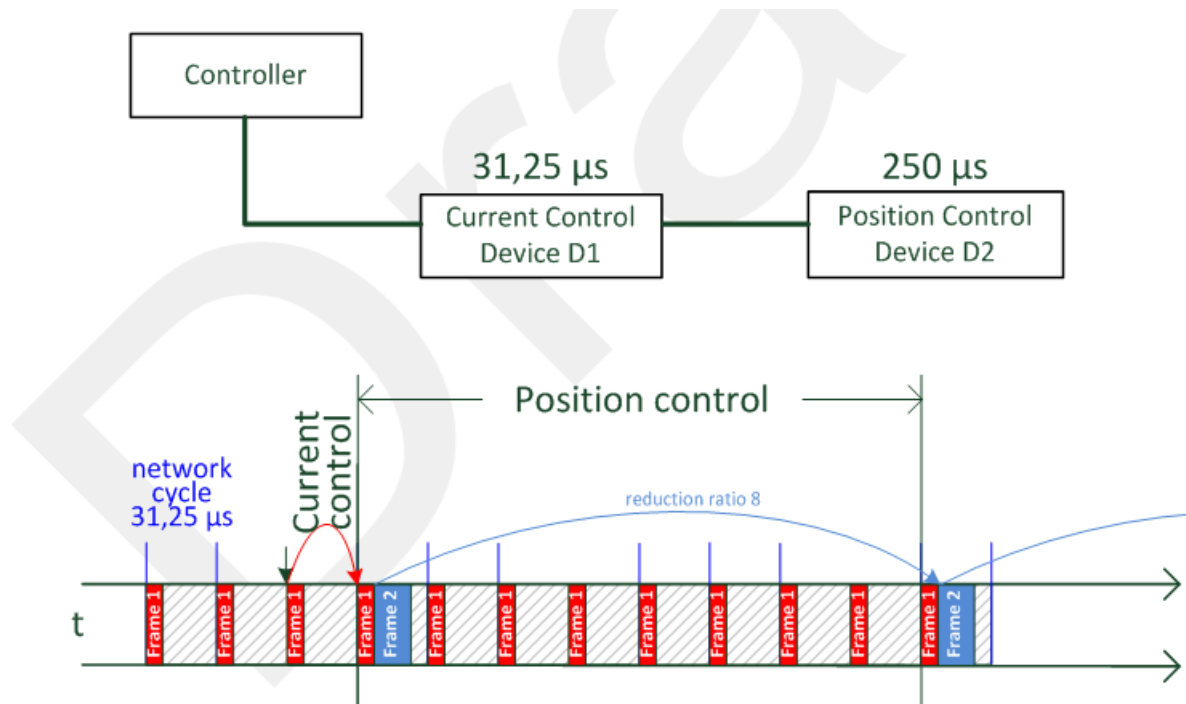
Additional Use Cases

Control Loops with bounded latency

- Control loops with bounded latency implement a cyclic traffic pattern.
- More relaxed control reaction time requirements (e.g. 10-80 ms) allow free running applications instead of isochronous applications.
- In consequence transfer time requirements are more relaxed as well.
- The transfer time may be longer than the network cycle in this use case.

Drives without common application cycle but common network cycle

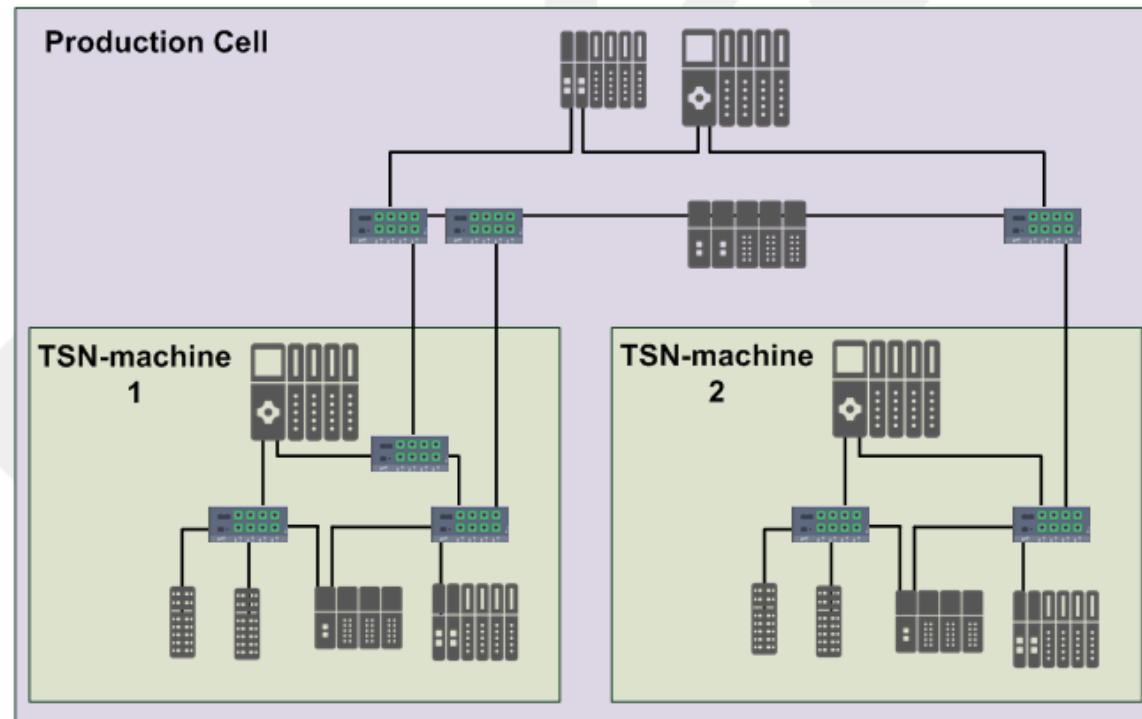
- The concept of multiple different application cycles which are based on a common network cycle is described in Use case 04: Reduction ratio of network cycle.



IEC/IEEE JWG TSN Industrial Profile: NEW Use Cases

Redundant networks

- Ring topologies are the basic industrial network architecture for switch-over or seamless redundancy.



Vast number of connected stations

- Some industrial applications need a massive amount of connected stations, e.g.
 - Car production sites
 - Dubai International Airport
 - 234 PLC's
 - 16,500 geared drives
 - [xxxx digital IOs]

Digital Twin

- Offline vs. Online
- Offline planning, development and testing, simulation, optimization
- Reliable simulation results must be possible

Thank You!

