

The background image shows a modern industrial factory interior. The ceiling is high with complex piping and lighting. The floor is polished and reflects the overhead lights. Overlaid on this scene are various digital elements: glowing blue binary code (0s and 1s) scattered throughout, yellow rectangular frames that look like data tables or UI panels, and thin yellow lines connecting these elements. The overall aesthetic is high-tech and digital, representing Industry 4.0 or smart manufacturing.

IEC/IEEE P60802 JWG TSN Industrial Profile

Use Cases Status Update 2018-05-14

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60802-industrial-use-cases-0418-v06:

Munich meeting 2018-04-20

Participants	Agenda
<p>Mark Hantel (mrhantel@ra.rockwell.com)</p> <p>Marius-Petru Stanica (marius-petru.stanica@de.abb.com)</p> <p>Guenter Steindl (guenter.steindl@siemens.com)</p> <p>Josef Dorr (josef.dorr@siemens.com)</p> <p>János Farkas (janos.farkas@ericsson.com)</p> <p>Steven A. Zuponcic (sazuponcic@ra.rockwell.com)</p> <p>Thomas Enzinger (thomas.enzinger@inchstone.com)</p> <p>Maximilian Riegel (maximilian.riegel@nokia.com)</p>	<ol style="list-style-type: none">1. Use cases document draft revision 0.6 walk-through<ul style="list-style-type: none">• Comments from Marius-Petru Stanica• Additional comments2. Integration of Taro Harima's Use Case Presentation at the 1604 Telco3. Missing use cases: Configuration and domains (VLANs)4. Definition of areas of interoperability5. Further work (draft update revision 0.61)
→ Use Cases IEC/IEEE 60802 V0.61 (2018-04-30)	
<ul style="list-style-type: none">- Added Interoperability clause (2.1)- Reworked industrial automation traffic patterns clause (2.3.1)- Added VLAN example requirements clause (2.4.11.1)- Added private machine domains sub-clause (2.5.1)	<ul style="list-style-type: none">- Added Machine Diagnostics / Monitoring PC use case (2.5.1)- Added Identification of Devices paragraph (2.7.1)- Elaborated Virtualization use case (2.7.4)- Added some text to Digital Twin use case (2.7.5)

60802-industrial-use-cases-0418-v06:

Added interoperability clause (2.1)

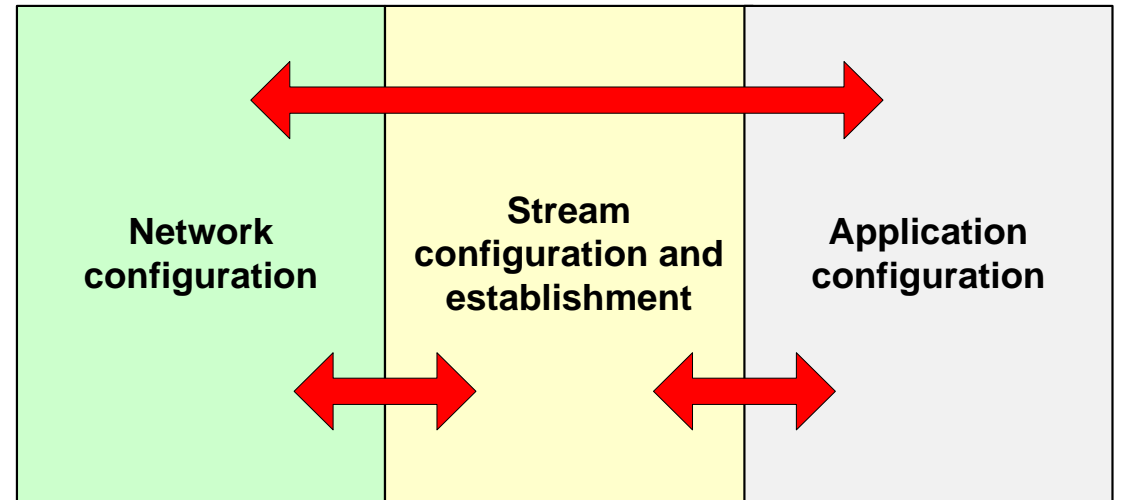
The Machine-to-Machine (M2M) use cases require interoperability.

Three **Interoperability** areas have to be considered:

- Network configuration,
- Stream configuration and establishment, and
- Application configuration.

The three issues mutually affect each other.

Application configuration is not expected to be part of the profile, but the two others are.



60802-industrial-use-cases-0418-v06:

Reworked industrial automation traffic patterns clause (2.3.1)

Property	Description
Data transmission scheme	Periodic or Sporadic
Data transmission constraints	– deadline: ... – latency: ... – bandwidth: ... – none: ...
Data period	...
Data transmission synchronized to network cycle	yes or no.
Application synchronized to working clock	yes or no.
Acceptable jitter	...
Acceptable frame loss
Payload	– fixed: ... – bounded: ...

60802-industrial-use-cases-0418-v06:

Added VLAN requirements example clause (2.4.11.1)

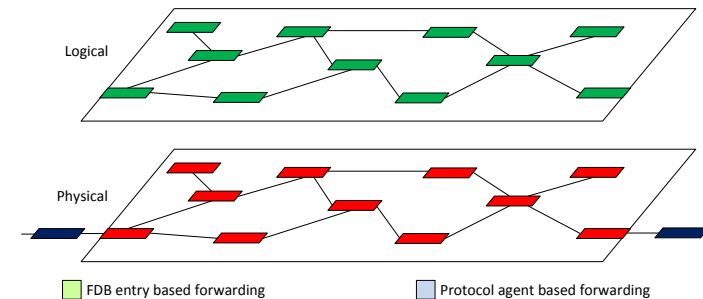
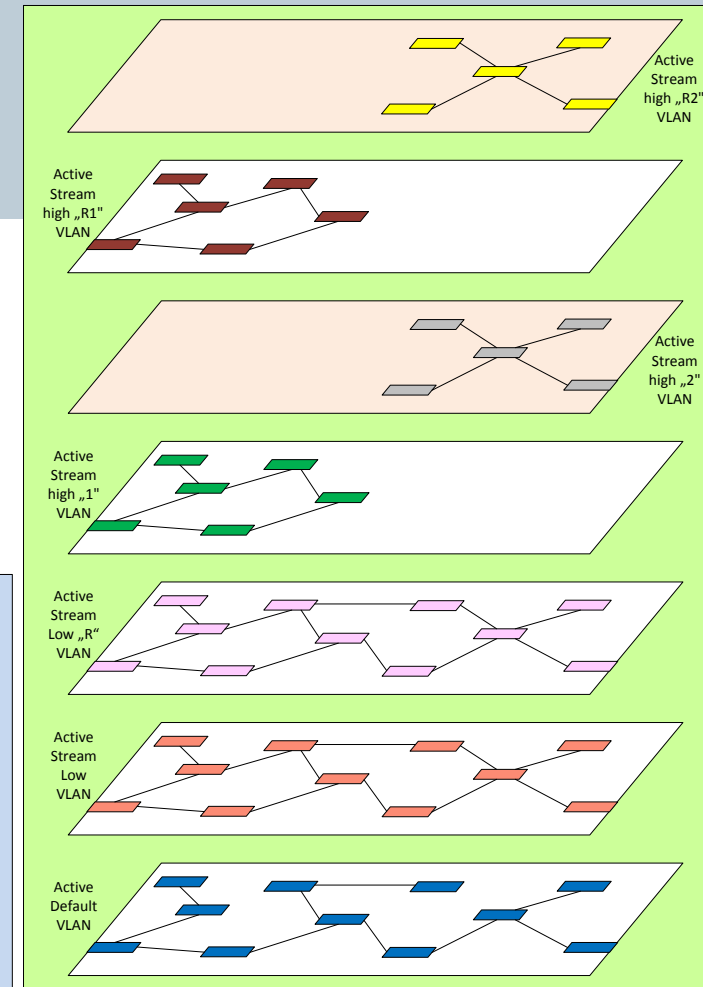
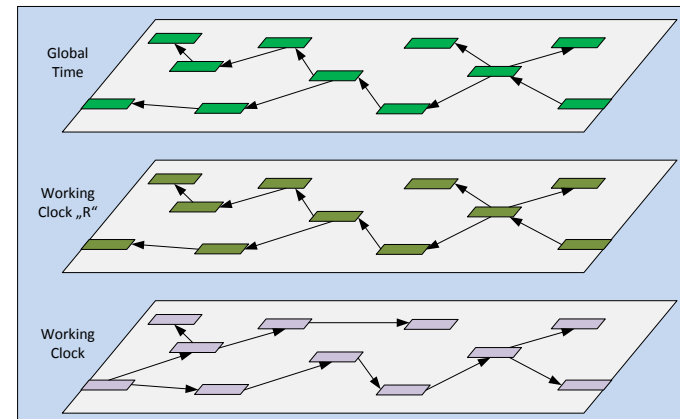
Multiple logical topologies - based on a common physical topology - co-exist.

Logical topologies are built by

- VID (identified by VLAN), or
- protocol (identified by protocol type).

→ Effects minimum required quantities

A representative example for VLAN requirements



60802-industrial-use-cases-0418-v06:

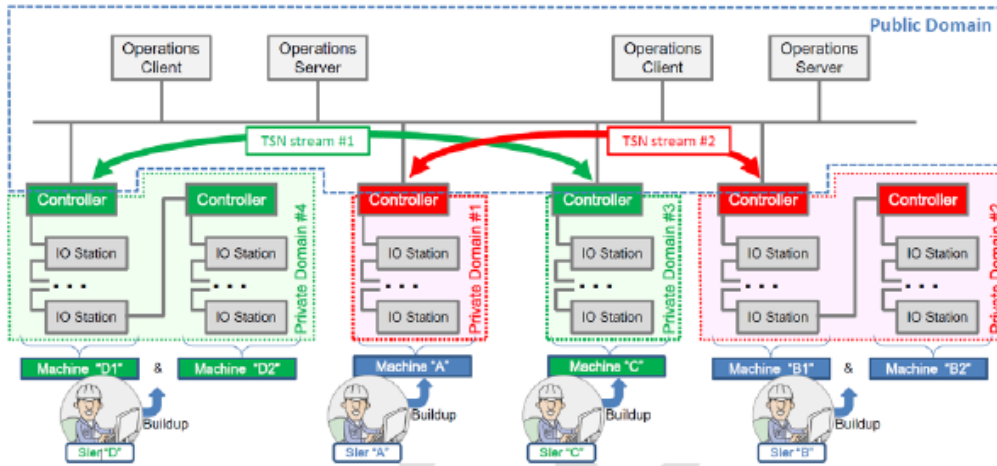
Added private machine domains sub-clause (2.5.1)

Use case 17: Machine to Machine (M2M/C2C) Communication

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Private machine domains

Dedicated machine interfaces can decouple machine internal information and communication as private domain from the public upper layer networks of production cells or plants.



IEC/IEEE JWG TSN Industrial Profile: Machine Diagnostics / Monitoring PC (2.5.1)

Use case 17: Machine to Machine (M2M/C2C) Communication

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Machine Diagnostics / Monitoring PC

Communication is cyclic and must happen within short application cycle times.

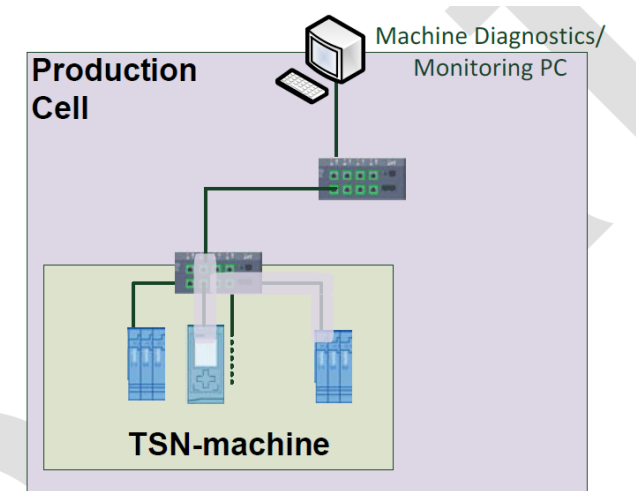


Figure 39 – M2M with diagnostics/monitoring PC

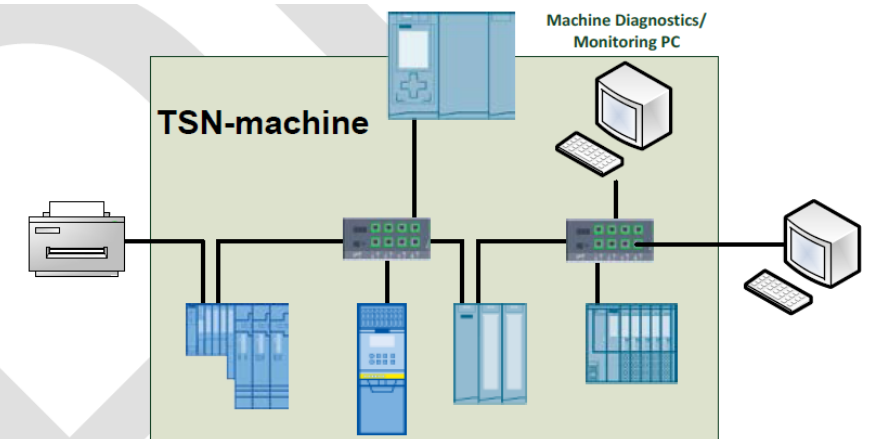


Figure 44 – machine with diagnostics / monitoring PC

Use case 28: Network monitoring and diagnostics

...

Identification of devices

- **Identification** of devices on an industrial Ethernet network must be done in a common, interoperable manner for interoperability on a converged TSN network.
- This identification both needs to show the type of device, and the **topology** of the network.
- **IEEE 802.1AB**, the Link Layer Discovery Protocol (LLDP), provides one possible mechanism for this to be done at layer two, but provides a large degree of variability in implementation.
- The industrial profile shall **leverage** and extend the scope of a discovery protocol such as IEEE 802.1AB to meet the needs of industrial TSN.

IEC/IEEE JWG TSN Industrial Profile: Virtualization Use Case (2.7.4)

Use case 31: Virtualization

Common models for connecting virtual entities to Ethernet added.

Requirement: Profile shall cover this use case as well.

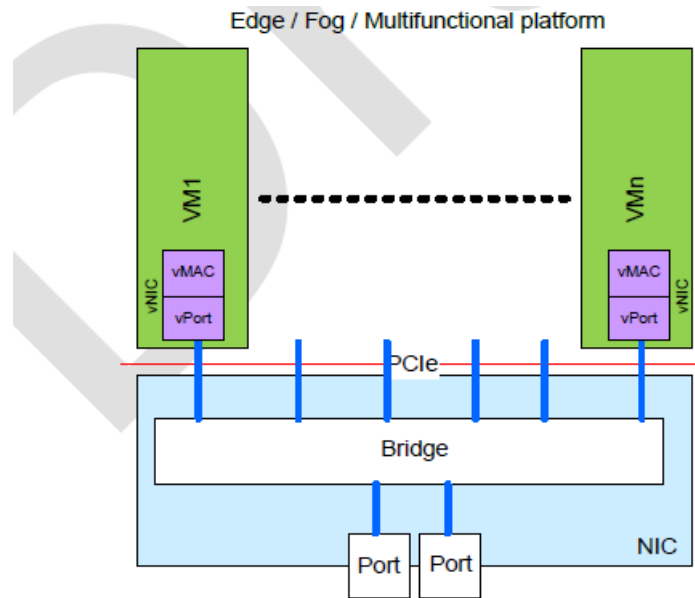


Figure 56 – Ethernet interconnect with PCIe connected Bridge

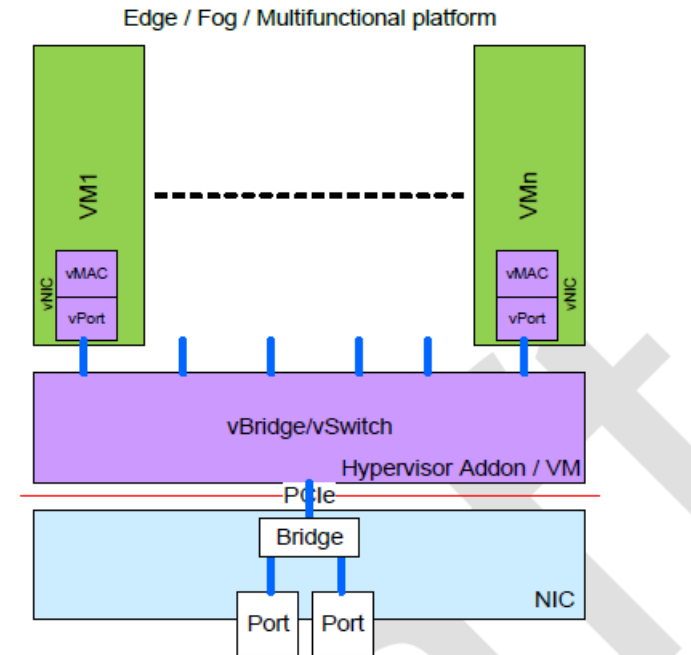


Figure 55 – Ethernet interconnect with VM based vBridge

IEC/IEEE JWG TSN Industrial Profile: Digital Twin Use Cases (2.7.5)

Digital twin objectives:

- Faster development and testing
- Virtual pre-commissioning
- ...

Requirement:

Reliable planning, development, testing, simulation and optimization results shall be possible.

Backup

IEC/IEEE JWG TSN Industrial Profile: Overview

Use Cases (1)

	Use Case	V0.4	V0.5	V0.61
	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: Overview

Use Cases (2)

	Use Case	V0.4	V0.5	V0.61
	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: Overview

Use Cases (3)

	Use Case	V0.4	V0.5	V0.61
	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: Overview

Use Cases (4)

	Use Case	V0.4	V0.5	V0.61
	Further Industrial automation use cases			
28	Network monitoring and diagnostics	-	(√)	√
29	Security	-	(√)	√
30	Firmware update	-	(√)	√
31	Virtualization	-	(√)	√
32	Digital twin	-	-	√

Thank You!

