Model issues identified during Rosemount / Pittsburgh meetings

-To be discussed-

Prepared by

Günter Steindl
(Siemens AG)

Basic scope

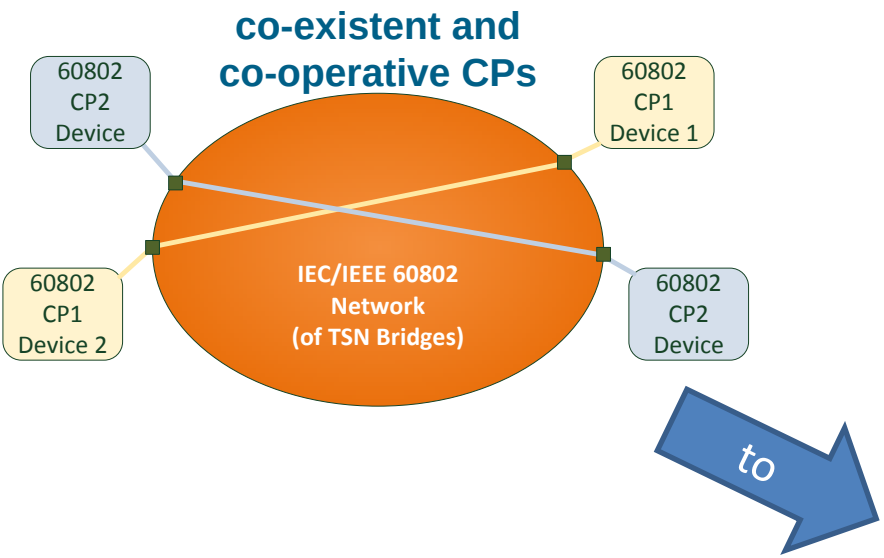
The TSN cloud shown at the initial presentation in Frankfurt is replaced by

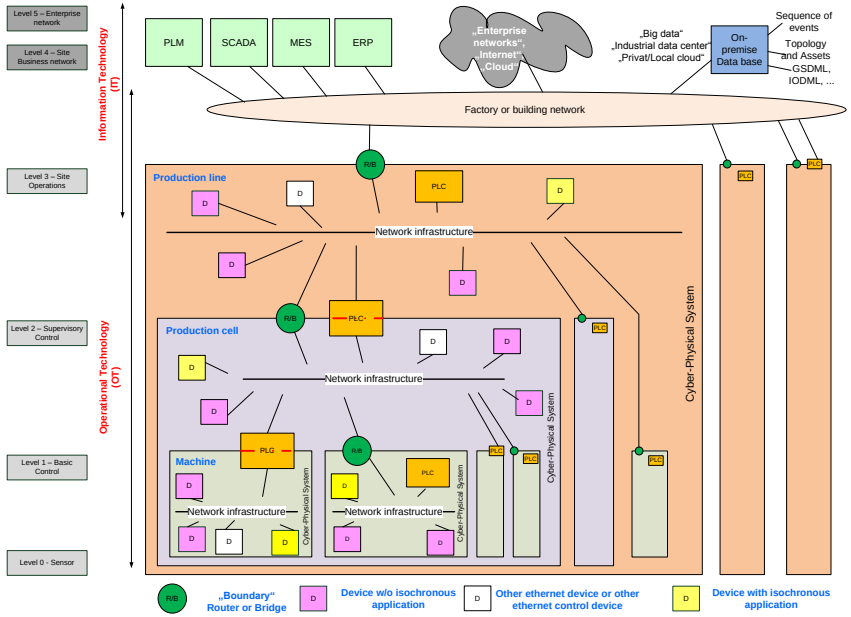
1.) Hierarchical Industrial Automation structure

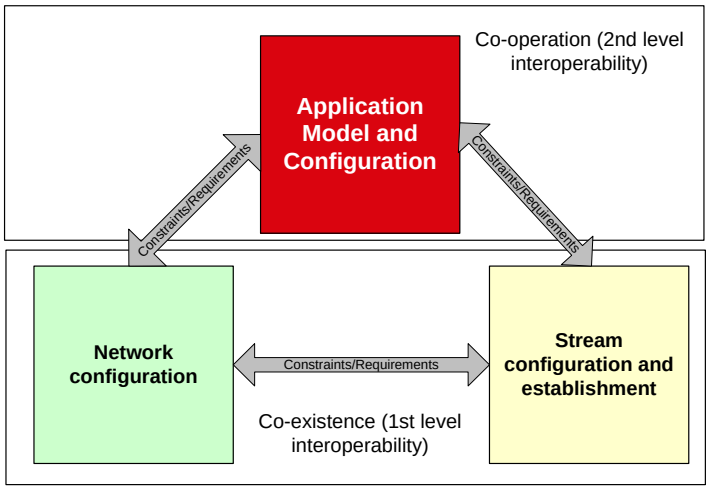
and

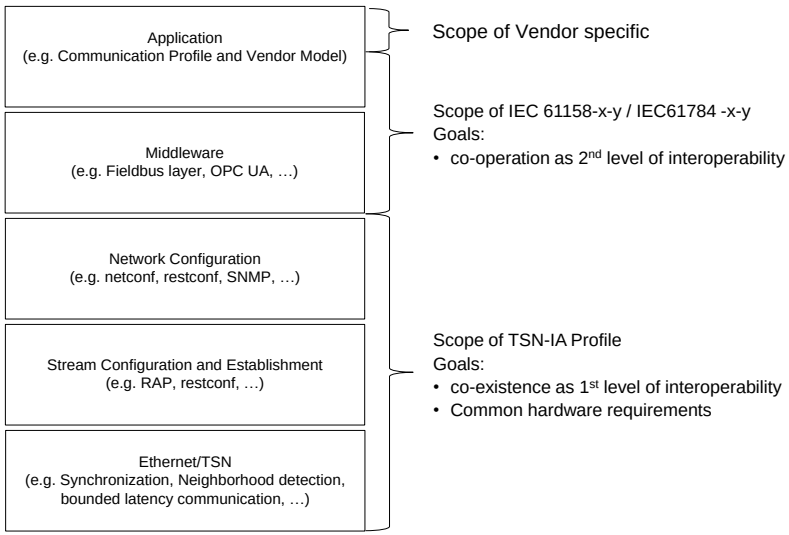
2.) Dependencies triangle

Basic scope

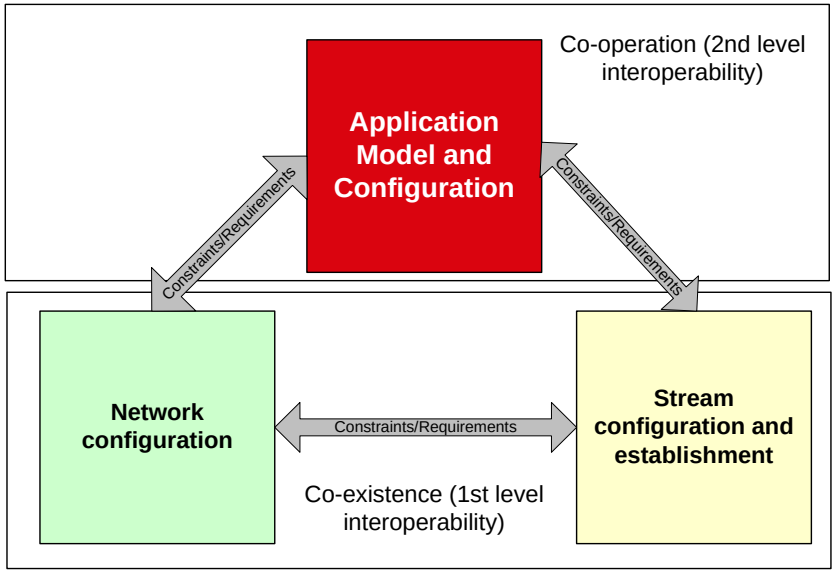

co-existent and
co-operative CPs
60802
CP2
Device
60802
CP1
Device 1
60802
CP1
Device 2
60802
CP2
Device
IEC/IEEE 60802
Network
(of TSN Bridges)
to

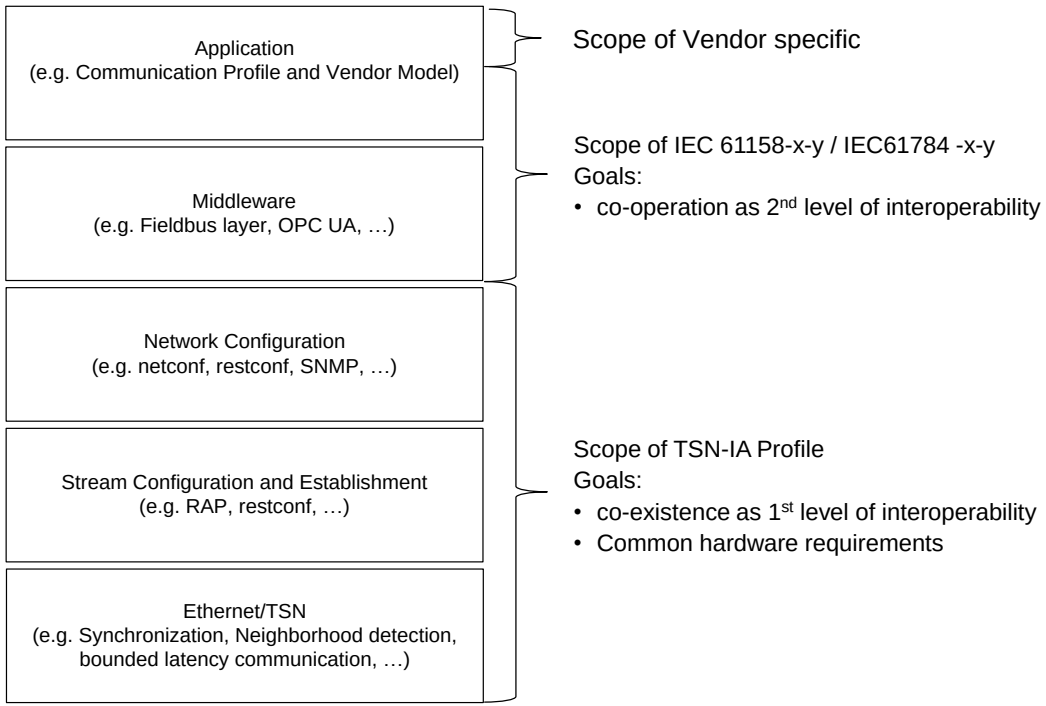

Level 5 – Enterprise network
Level 4 – Site Business network
Level 3 – Site Operations
Level 2 – Supervisory Control
Level 1 – Basic Control
Level 0 - Sensor
Information Technology (IT)
Operational Technology (OT)
PLM
SCADA
MES
ERP
„Enterprise networks", „Internet", „Cloud"
„Big data" „Industrial data center" „Privat/Local cloud"
On-premise Data base
Sequence of events
Topology and Assets
GSDML, IODML, ...
Factory or building network
Production line
Network infrastructure
Production cell
Machine
Cyber-Physical System
„Boundary" Router or Bridge
Device w/o isochronous application
Other ethernet device or other ethernet control device
Device with isochronous application


Application Model and Configuration
Co-operation (2nd level interoperability)
Constraints/Requirements
Constraints/Requirements
Network configuration
Constraints/Requirements
Stream configuration and establishment
Co-existence (1st level interoperability)


Application
(e.g. Communication Profile and Vendor Model)
Middleware
(e.g. Fieldbus layer, OPC UA, …)
Network Configuration
(e.g. netconf, restconf, SNMP, …)
Stream Configuration and Establishment
(e.g. RAP, restconf, …)
Ethernet/TSN
(e.g. Synchronization, Neighborhood detection, bounded latency communication, …)
Scope of Vendor specific
Scope of IEC 61158-x-y / IEC61784 -x-y
Goals:
• co-operation as 2nd level of interoperability
Scope of TSN-IA Profile
Goals:
• co-existence as 1st level of interoperability
• Common hardware requirements

Zoom in


Co-operation (2nd level interoperability)
Application Model and Configuration
Constraints/Requirements
Constraints/Requirements
Network configuration
Constraints/Requirements
Stream configuration and establishment
Co-existence (1st level interoperability)


Application
(e.g. Communication Profile and Vendor Model)
Middleware
(e.g. Fieldbus layer, OPC UA, …)
Network Configuration
(e.g. netconf, restconf, SNMP, …)
Stream Configuration and Establishment
(e.g. RAP, restconf, …)
Ethernet/TSN
(e.g. Synchronization, Neighborhood detection, bounded latency communication, …)
Scope of Vendor specific
Scope of IEC 61158-x-y / IEC61784 -x-y
Goals:
• co-operation as 2nd level of interoperability
Scope of TSN-IA Profile
Goals:
• co-existence as 1st level of interoperability
• Common hardware requirements

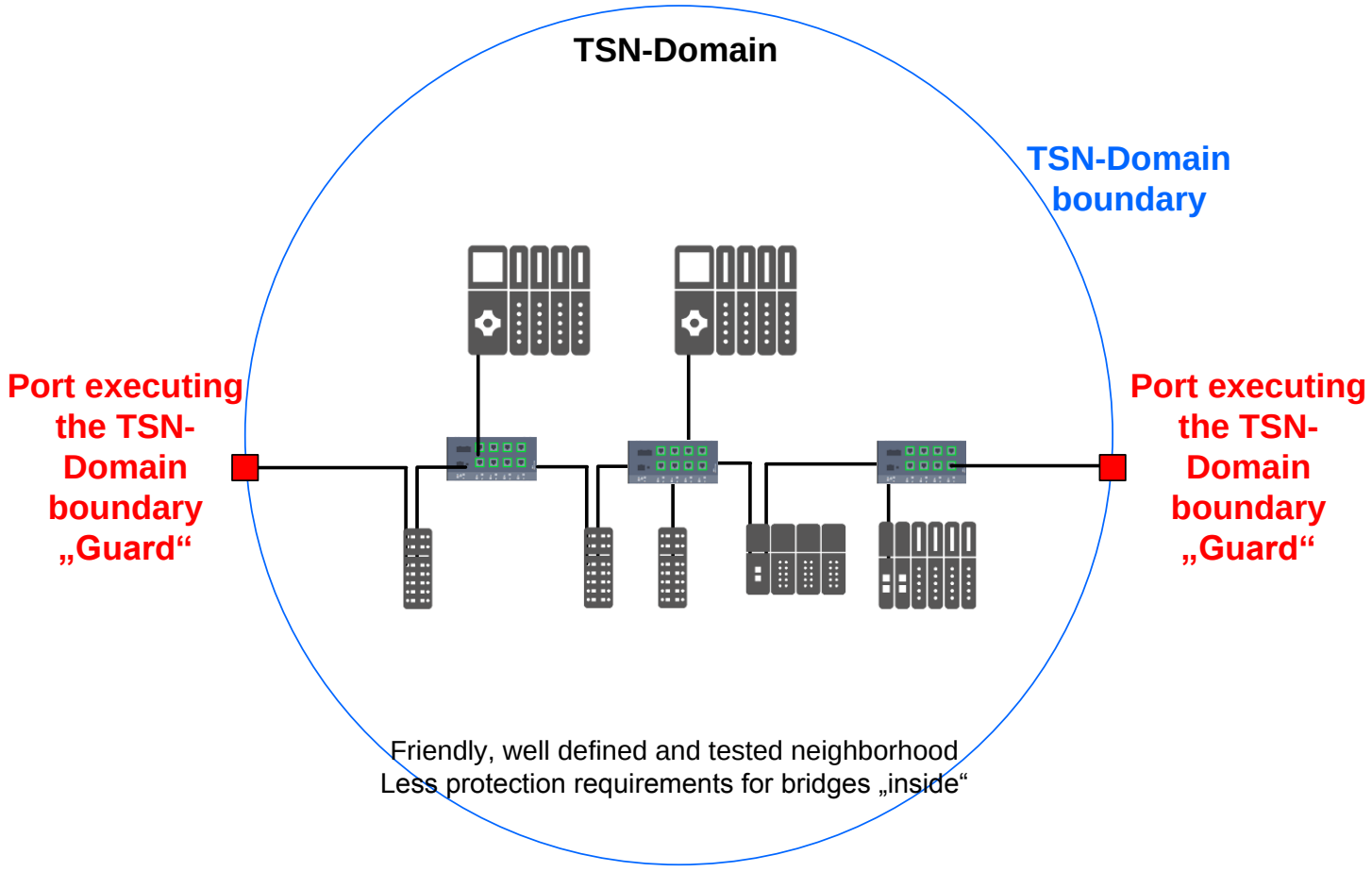
Prinzipal design pattern

Two principle design pattern seems to exist:

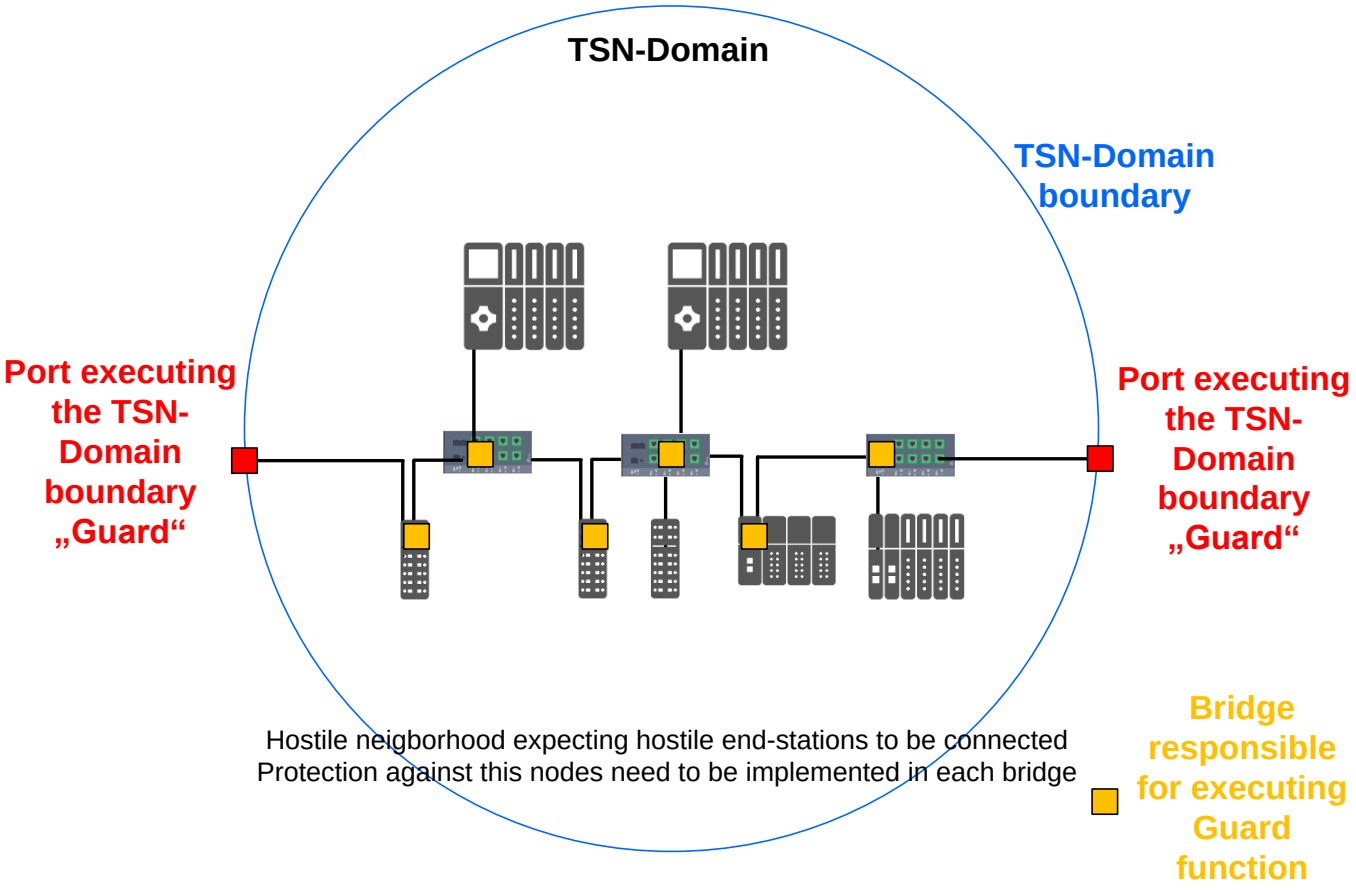
1.) „Friendly, guarded neigborhood“
Well defined TSN-Domain. All nodes in this domain are known during the design time. Traffic patter are known, too.

2.) „hostile neigborhood“
Classical network design pattern. Bridges need to ensure expected/defined patterns due to unknown or even hostile endstation behavior.

Friendly, guarded neighborhood



Hostile neigborhood



Derived design pattern

Assumption:

A „Friendly, guarded neigborhood“ allows the use of simpler shapers/setups to achieve the customer goals.

Example:

Within a TSN-Domain supporting Gigabit links, the use of strict priority together with pre-emption may fit for many customer application including both, isochronuos cyclic real-time and cyclic real-time traffic.

Thank you

Questions?