

**OPC DAY**  
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# Extending OPC UA to the field OPC UA Field eXchange (FX)

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Editor Field Level Communications



FINNISH SOCIETY OF AUTOMATION  
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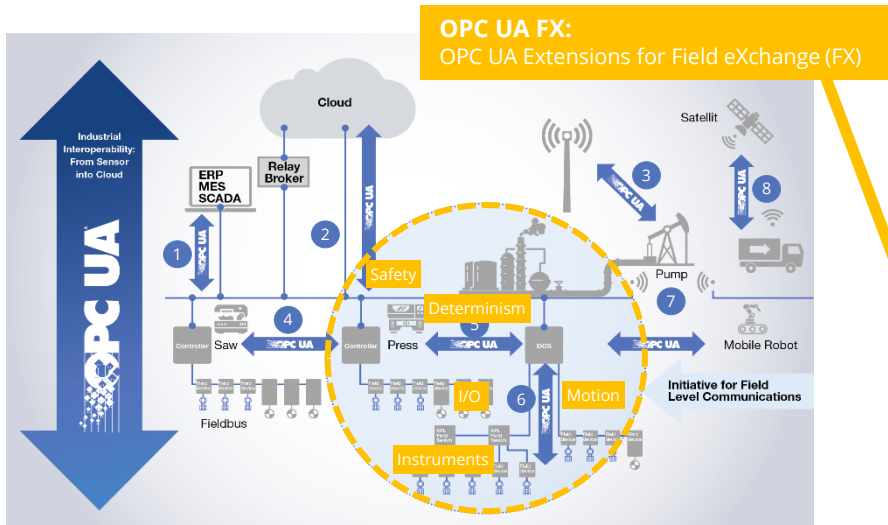
**Schneider**  
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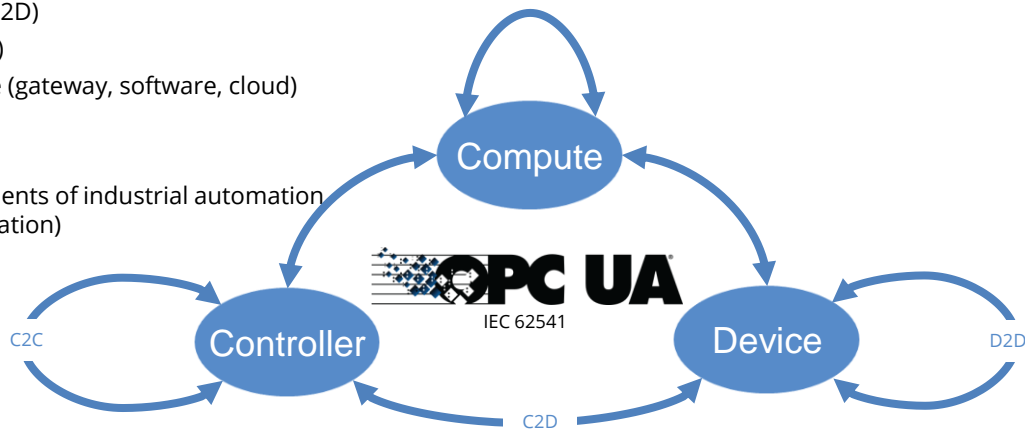
# OPC UA FX: Extending OPC UA to the field incl. Determinism, Safety & Motion



- 1 IT / OT Communication
  - 2 Cloud Integration
  - 3 Secure Remote Access
  - 4 Local OT Communication
- 
- 5 Controller to Controller
  - 6 Controller to Device  
Device to Device
- 
- 7 Wireless Integration (5G)
  - 8 Future Ready

## Vision of the OPC Foundation and the FLC Initiative: Open, unified, standards-based IIoT communication solution ...

- ▶ Controller to Controller (C2C)
  - ▶ Controller to Device (C2D)
  - ▶ Device to Device (D2D)
  - ▶ Controller to Compute (gateway, software, cloud)
  - ▶ Device to Compute
  - ▶ Compute to Compute
- ... addressing all requirements of industrial automation  
(Factory & Process Automation)





# OPC UA FLC Initiative Sub-Organisation

## ▶ Technical Working Groups

- 9 working groups
- 332 members from 65 companies
- All leading automation companies participate
- Open for everyone

## ▶ Responsible for

- OPC UA FX specification (Parts of OPC UA base specification)
- Profiling including Motion, IO, and Safety
- Prototyping
- Conformance Test Specification

## ▶ Steering committee

- 27 companies
- Sponsoring FLC development

## ▶ FA/PA Requirement Working Group

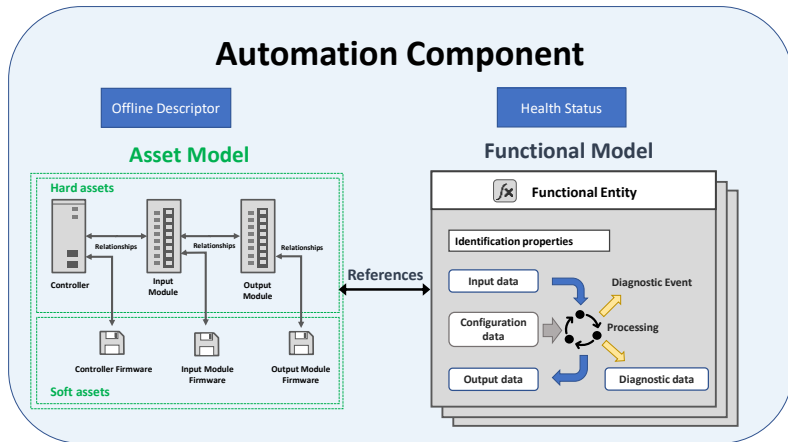
## ▶ Responsible for requirements, roadmap...

Steering committee member companies



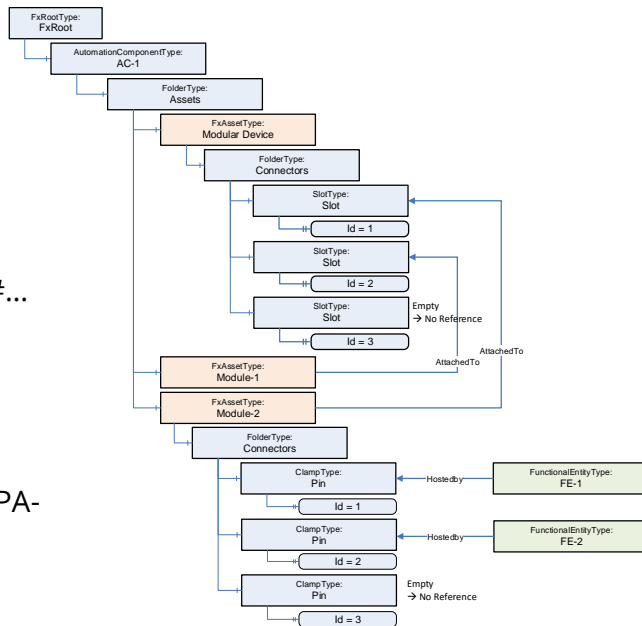
# OPC UA FX Information Model

- Harmonization of asset and functional model for automation components
- Uniform access to information in automation components, independent of
  - being device or controller
  - being drive, PLC or temperature sensor
  - Factory or Process Automation



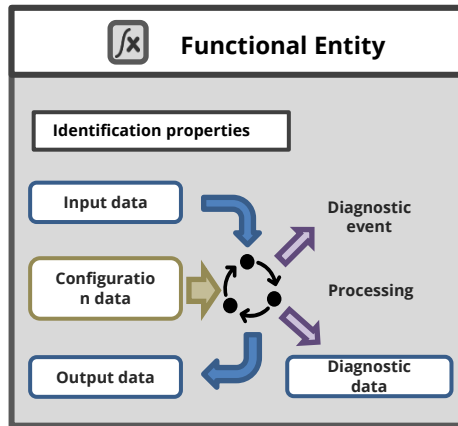
# Asset Model

- Describes world of things
  - Physical things
  - Software, firmware, licenses
- Offers nameplate information
  - Vendor, Product, Firmware Version, Serial #...
- Allows to assign tags
  - AKZ, OKZ...
- Supports compatibility verification
- Based on OPC UA DI (Part 100)
- Allows extension of existing companion specs (PA-DIM...)



# Functional Model

- Describes world of functionality
  - As simple as a digital input, or a temperature sensor
  - As complex as a drive
- Supports identity verification
- Supports semantics, data type, security...
- Supports real time data exchange
- Allows extension of existing companion specs (PA-DIM...)

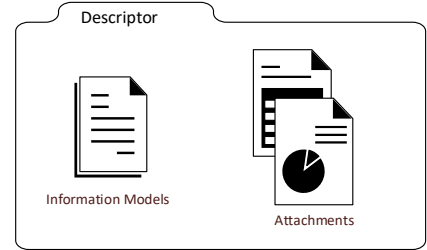






# Offline Engineering

- Offline Descriptor describes capabilities, functionality, configuration and assets of an automation component
- Essential part for development, commissioning, operation, and maintenance phases of an automation system
- Open Packaging Convention document (ECMA-376)
  - Packaging of Modelling and Attachment files
  - Relationships (internal and external)
  - Digital Signature
- Information Model described using AutomationML (AML) (IEC 62714)
  - XML-based data exchange format for plant engineering
- Attachments
  - Integration of “other” Information Models (e.g. PLCOpen, Yang,...)
  - Document, manuals, drawings ...

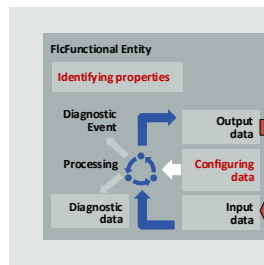




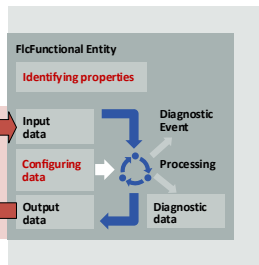
## Logical connections

- Enables data exchange between functional entities
- Establishing logical connections includes
  - Verification (Assets and Functional Entity)
  - Ownership
  - Application configuration
  - Persistence
- Data Exchange
  - Built on OPC UA PubSub
  - Safety
  - Security (Authentication, Encryption)
  - QualityOfService (Priority, Guaranteed Bandwidth, Latency, Deadline) including TSN
  - Various transports (ETH, UDP, AMQP, MQTT)
  - Monitoring of connections

Automation Component (AC) A



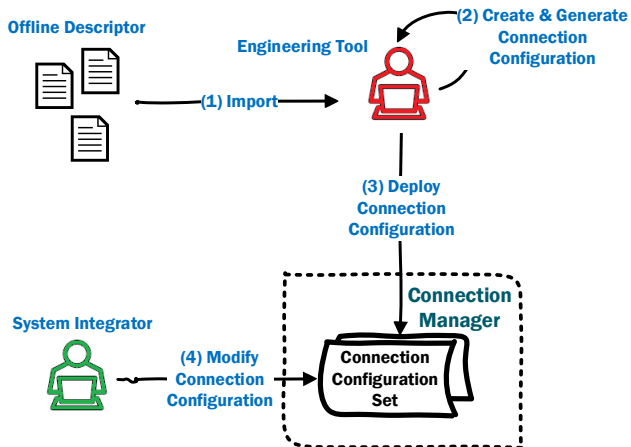
Automation Component (AC) B



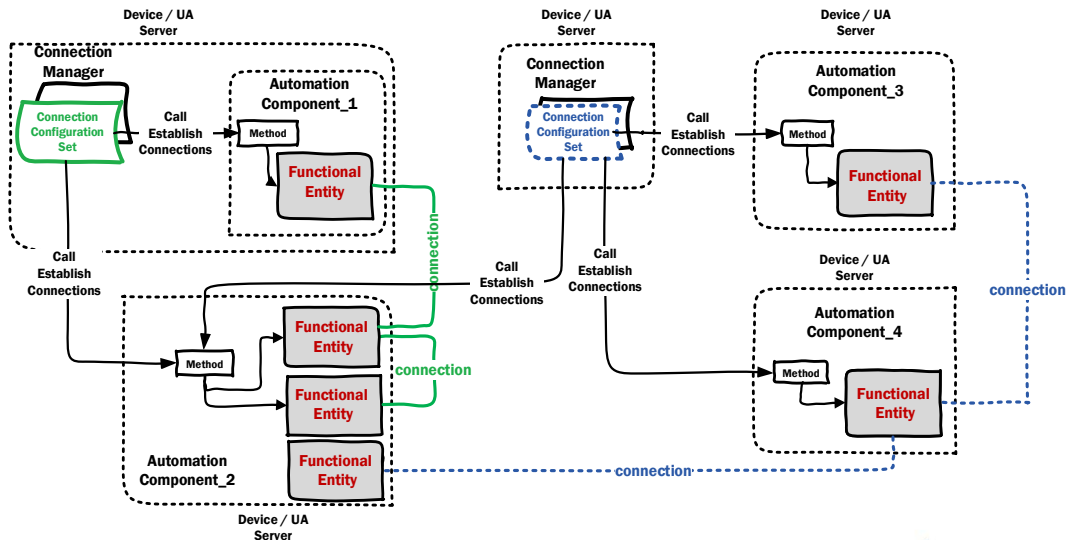
Logical Connection

Data Exchange

## Connection Configuration



## Connection Establishment

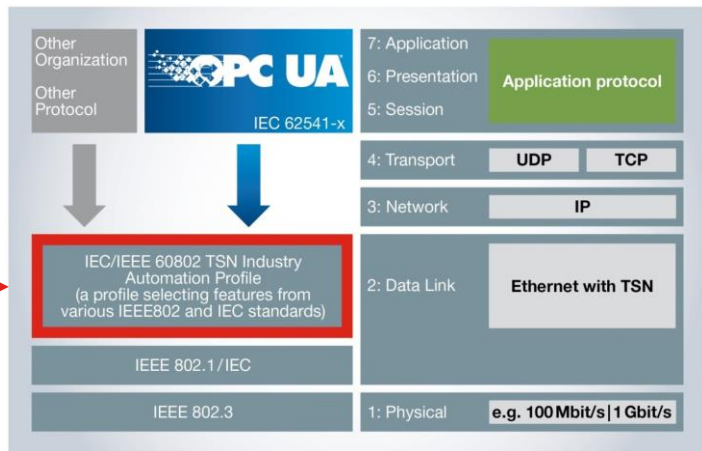


# Determinism & Network Convergence with TSN

OPC UA FX closely aligns with the **TSN Profile for Industrial Automation** which is currently being standardized by the **IEC/IEEE 60802** joint project.

## Goals for OPC UA FX

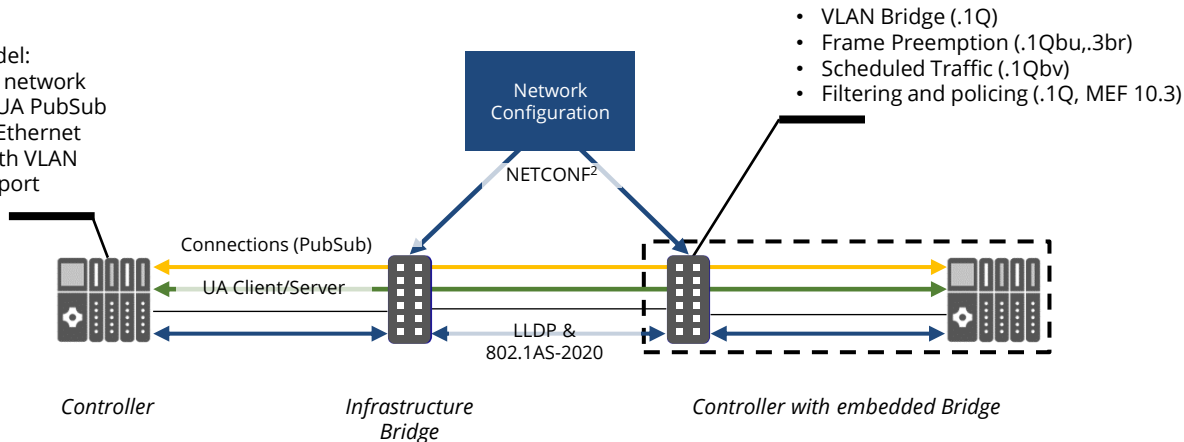
- ▶ Converged TSN network: OPC UA can share multi-vendor TSN network with other network participants and protocols
- ▶ Common HW and SW components



## TSN in the OPC UA FX C2C Release

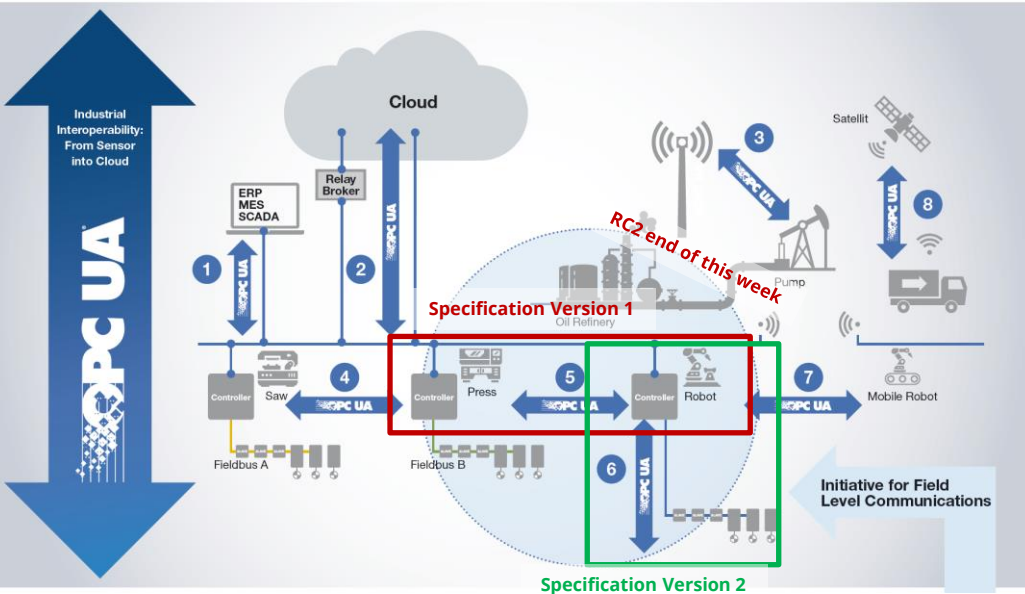
1<sup>st</sup> meaningful step towards full TSN support<sup>1</sup>

- UA info model:  
Selection of network  
priority for UA PubSub
- Traditional Ethernet  
interface with VLAN  
tagging support



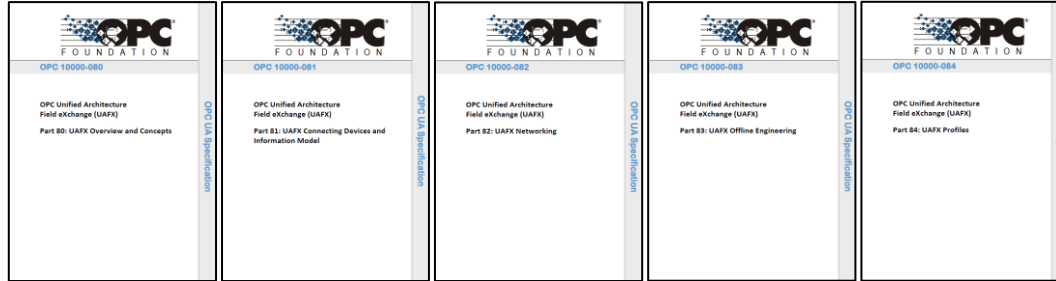
<sup>1</sup> TSN depends on outcomes in various IEEE groups, which will not be available in our release timeframe (60802, YANG...)

<sup>2</sup> First directional step, not complete configuration solution



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## OPC UA FX RC2 – close to member review

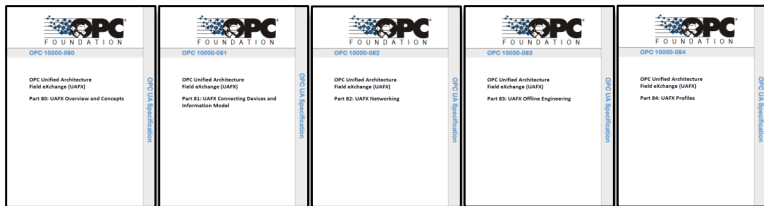


- Focus on **Controller-to-Controller (C2C)**
  - Consists of 5 Parts: OPC 10000-080, 10000-081, 10000-082, 10000-083, 10000-084
- These specifications lay foundation also for **Controller-to-Device (C2D)** and **Device-to-Device (D2D)** use cases



## Conclusions

- OPC UA FX is extending OPC UA to the field level to meet requirements for Factory Automation & Process Automation
- TSN and IEC/IEEE 60802 enable determinism and network convergence for OPC UA FX
- Upcoming OPC UA FX C2C Release as meaningful first step towards Plug & Produce TSN



OPC UA FX C2C IOP  
Demo @ SPS 2021

**Booth H5-140**

>15 vendors  
>20 prototypes



Looking for more information? Brochures, Recordings, Slides, ...

<https://opcfoundation.org/>

<https://opcfoundation.org/flc>

<https://opcfoundation.org/apl>

## Thank you! Any Questions?

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