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OPC UA TSN – Update
4th IIoT Innovation Day

B&R Booth : (C Hall) 3-D140

B&R Industrial Automation Co., Ltd.

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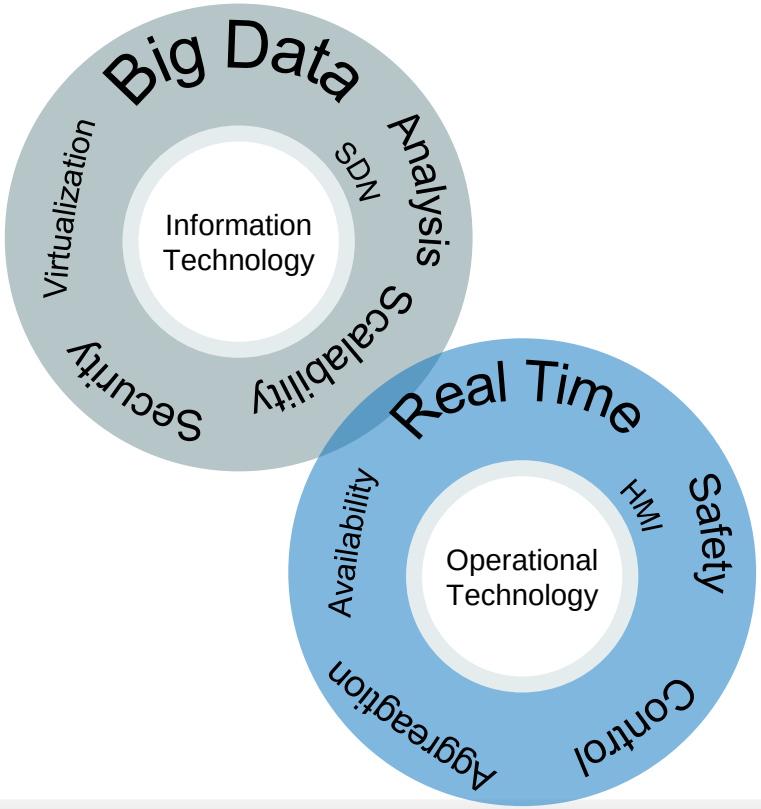
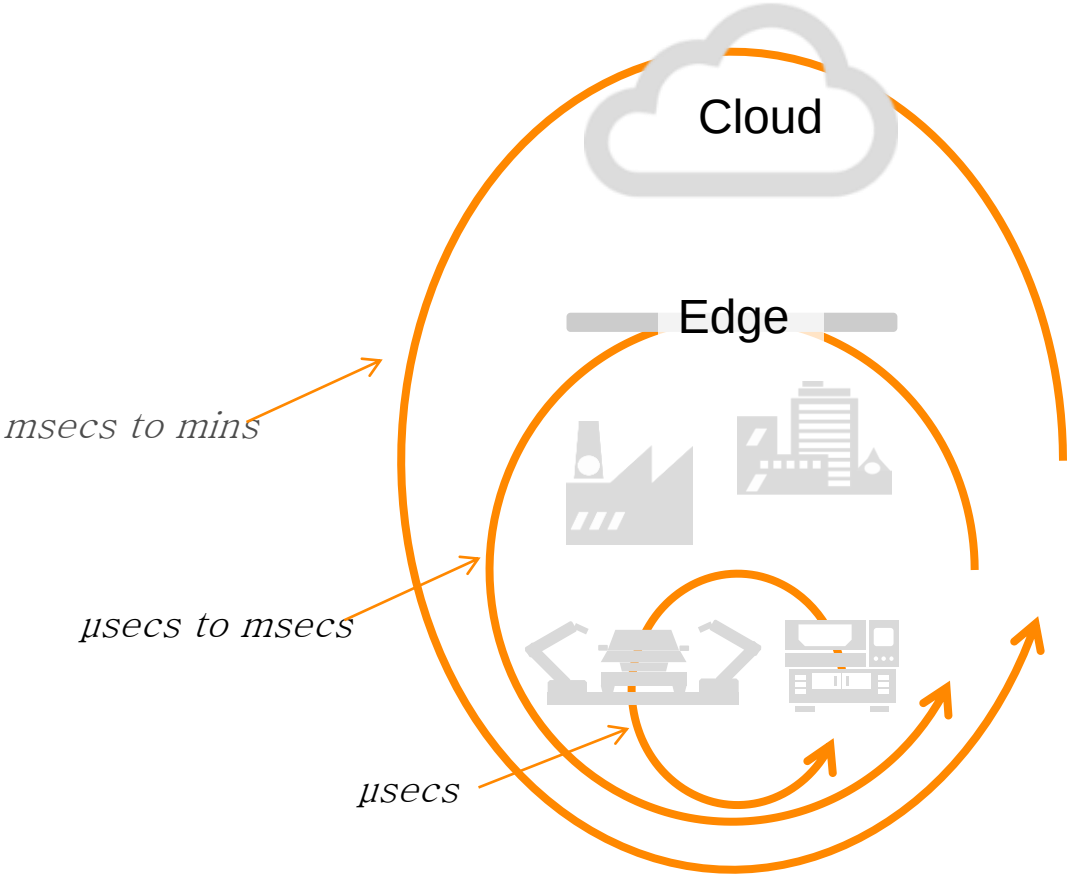
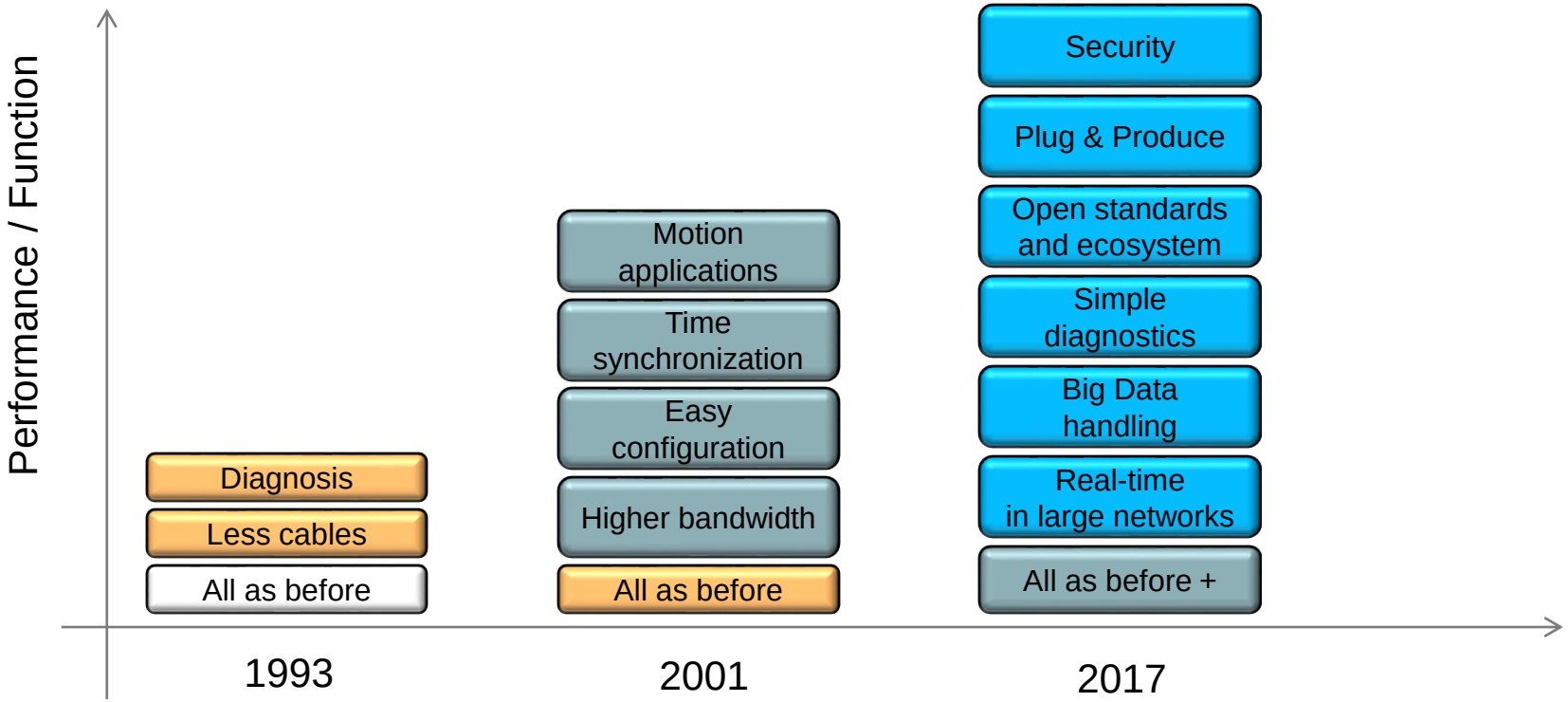
Required Industrial communication time

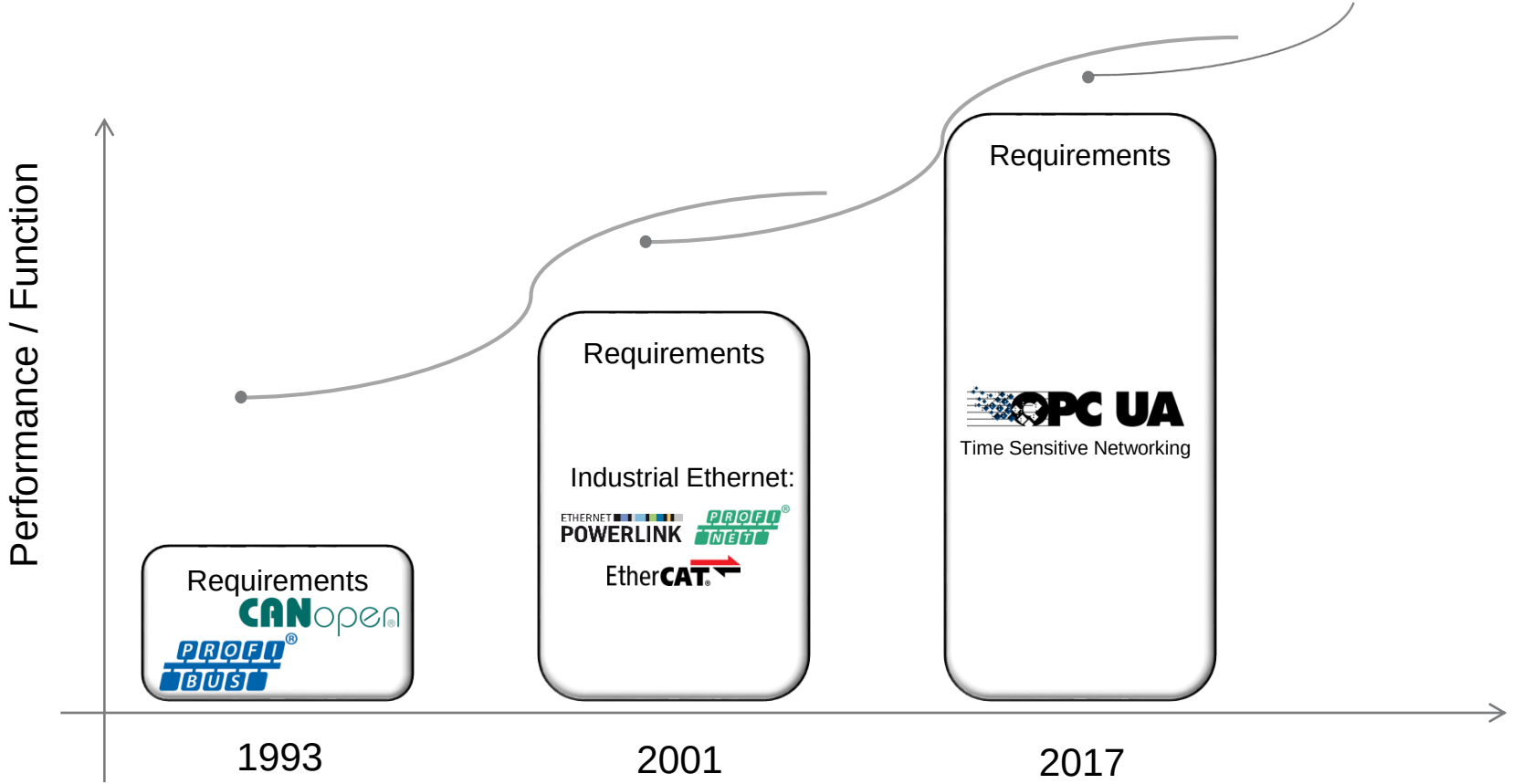




Requirements are changing - IIoT Innovation Day, 2018



How technology evolves – IIoT Innovation Day, 2018



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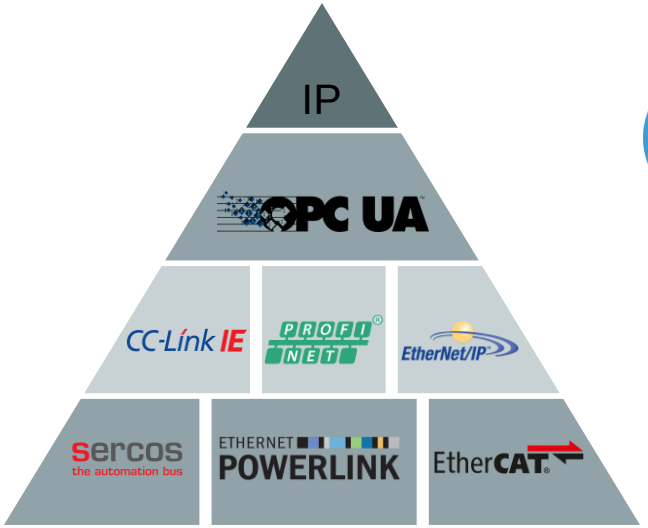
OPC UA over TSN

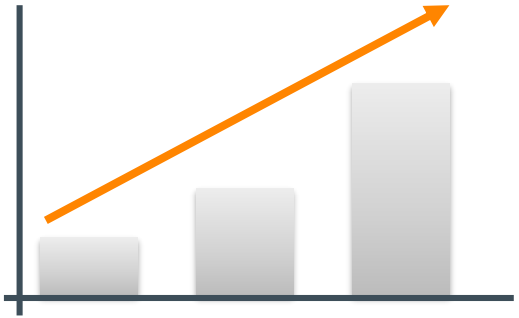
Intro

Today’s situation



Lack of connectivity
Fragmented eco-system

IoT challenges



Increasing requirements

Industrial IoT Communication Architecture

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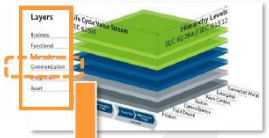
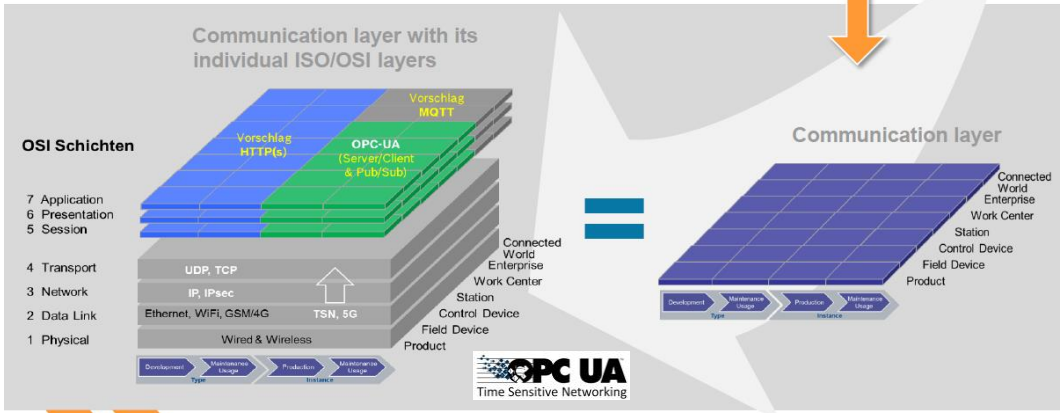
Reference Architectural Model industrie 4.0(RAMI4.0) - 2018.08.09

PLATTFORM INDUSTRIE 4.0

RAMI 4.0 – Communication layer
Agreements on communication





Basis for **standardized communication** between Administration Shells

Connected World

Smart Factory

Smart Products

Federal Ministry for Economic Affairs and Energy
Federal Ministry of Education and Research

Reference: RAMI 4.0, http://www.plattform-i40.de

Industrial IoT Communication Architecture

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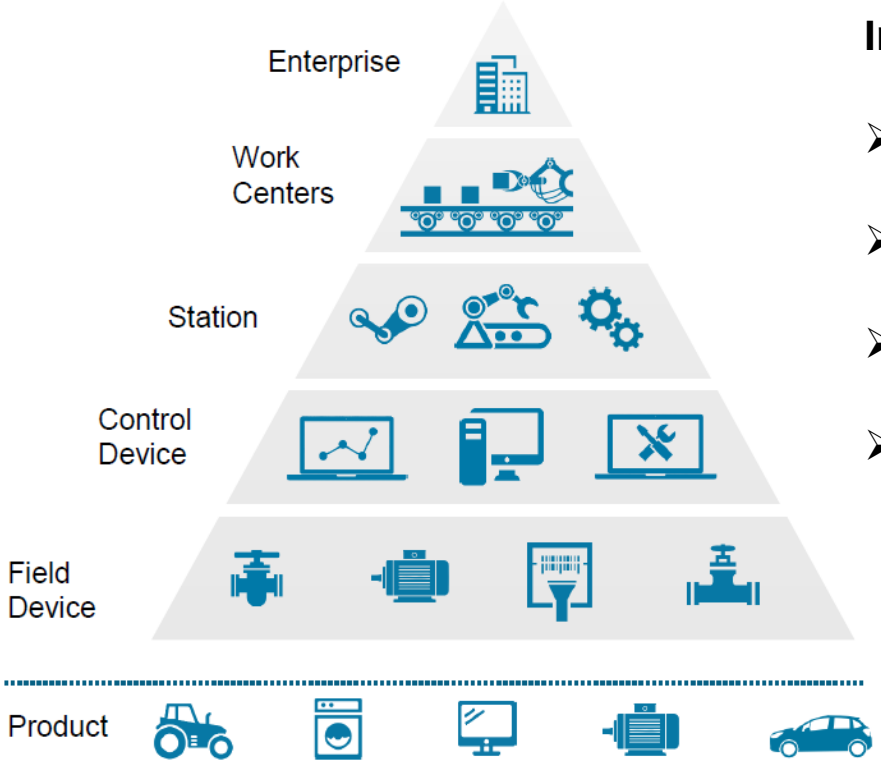
transition from hierarchical to flat meshed networks



Industrie 3.0 = the old world

- Hardware defines the structure.
- Functions are linked to hardware.
- Communication from one level to the other.
- The product is isolated.

Reference: RAMI 4.0, http://www.plattform-i40.de

Industrial IoT Communication Architecture

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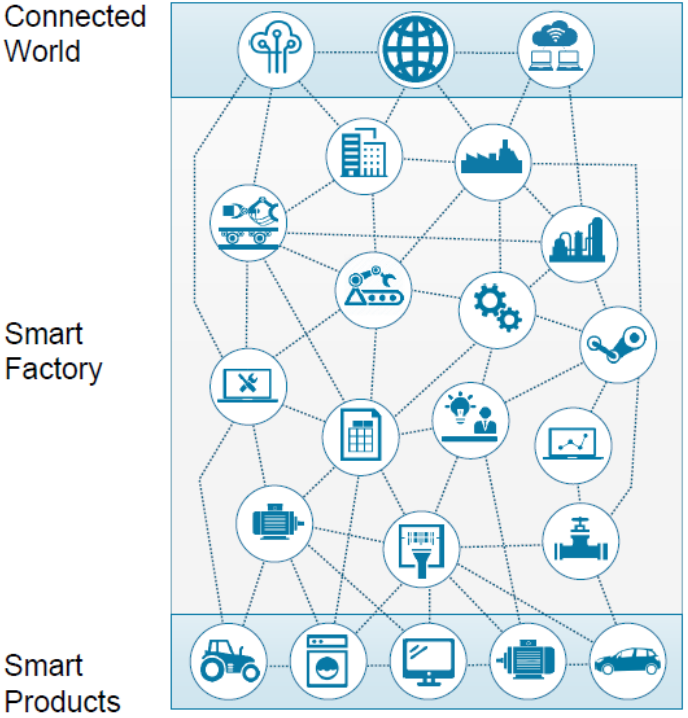
transition from hierarchical to flat meshed networks



Industrie 4.0 = the new world

- Flexible systems and machines; functions are distributed through the network.
- The network can cross company boundaries.
- Participants interact across hierarchical levels.
- All participants are able to communicate with each other.
- Products are part of the network.

Reference: RAMI 4.0, http://www.plattform-i40.de

Value of OPC UA over TSN

Industrial IoT

OPC UA over **TSN**

ETHERNET POWERLINK

OPC UA over TSN with B&R

Global market leaders sharing one vision

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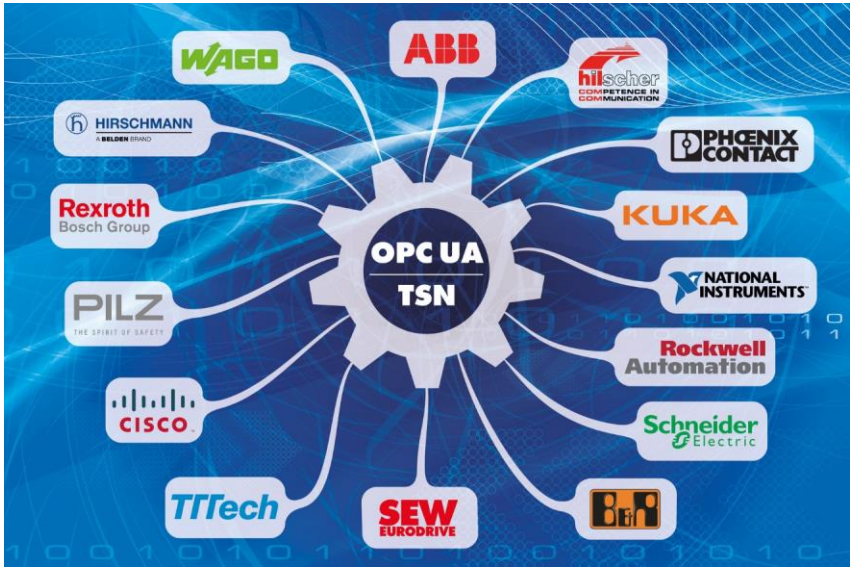

*An open, **unified**, standards-based Industrial IoT communication solution for **real-time and sensor-to-cloud** applications in industrial operations.*

All activities are coordinated in OPC Foundation

OPC FOUNDATION

B&R is initiator, driver and technology leader

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OPC FOUNDATION

PLCopen®
for efficiency in automation

VDMA

EUROMAP
European Plastics and Rubber Machinery

OMAC
The Organization for Machine Automation and Control

IEEE

industrial internet® CONSORTIUM

Edge Computing CONSORTIUM

LNI4.0 LABS NETWORK INDUSTRIE 4.0

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Activity coordination &
Semantic self description

Standardized usability

Plug-and-produce

Maximum scalability

Guaranteed
interoperability

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OPC UA over TSN

Technology

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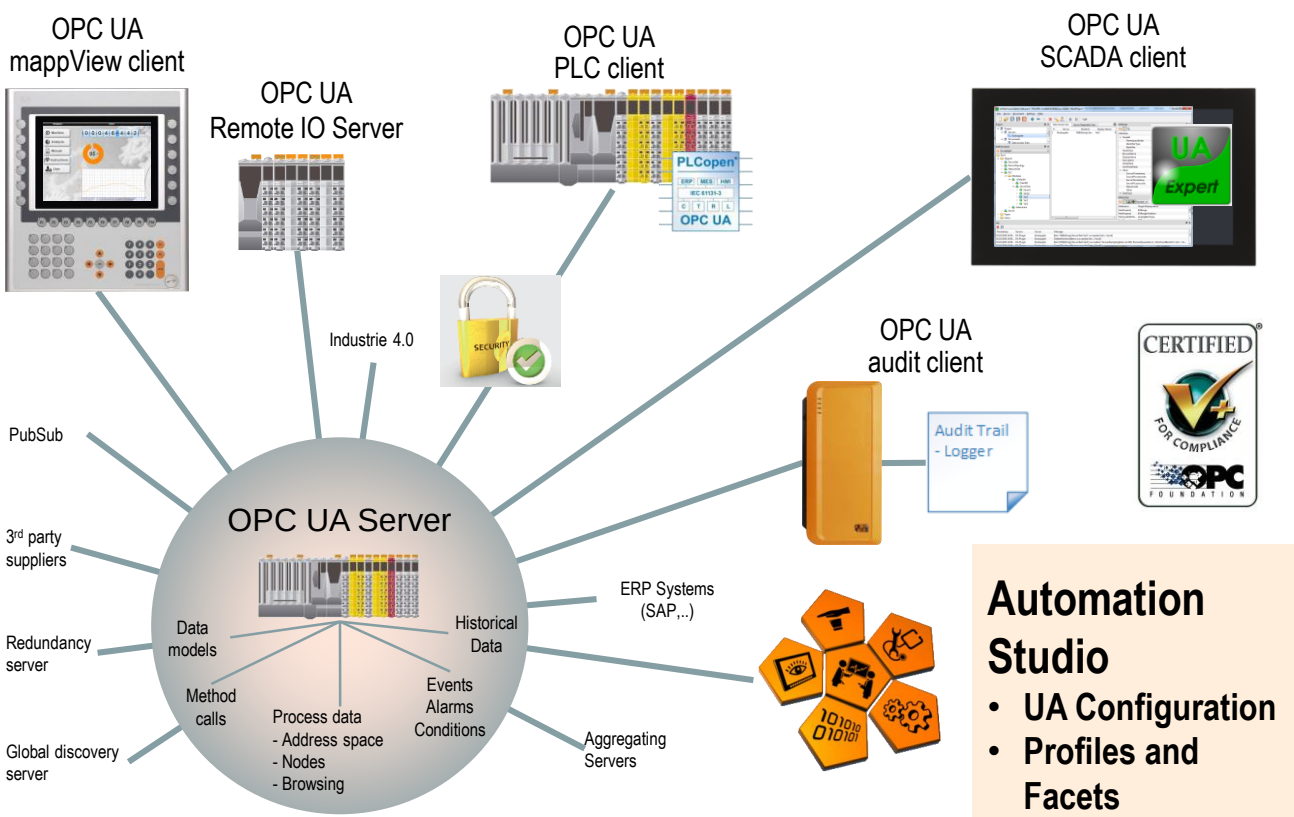
OPC UA over TSN

OPC UA brings secure data exchange and semantic self-description

TSN guarantees deterministic communication

OPC UA @ B&R today



OPC Unified Architecture

OPC UA Highlights

- Standard IEC 62541
- Secure and Reliable
- Manufacturer independent
- Platform independent
- Information models
- Solution for Industrie 4.0

Automation Studio

- UA Configuration
- Profiles and Facets

OPC UA Conception

- Address Space model
- Base Information model

OPC UA secure data exchange and semantic self-description

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OPC UA

Companion specifications → Robot with tools for welding and drilling is currently welding

Information model → Object with variables, methods and events

Security → ********** ********** ********** **********

→ 10100100100100101010010111011010101101100101001010100101010010100101001010

Current Fieldbuses

Machines

Sensors and Actors

Robots

Plants

OPC UA over TSN - Building blocks

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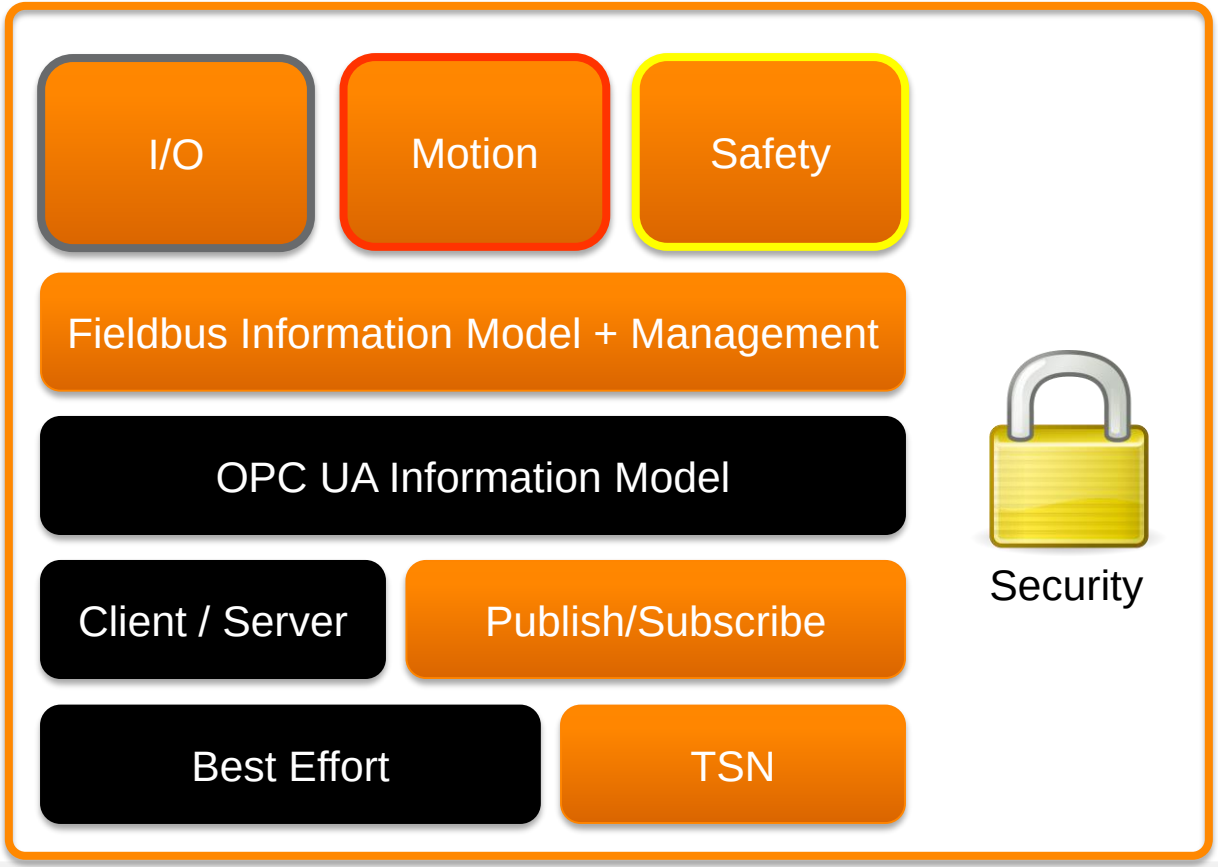
Standardization on all layers for maximum interoperability

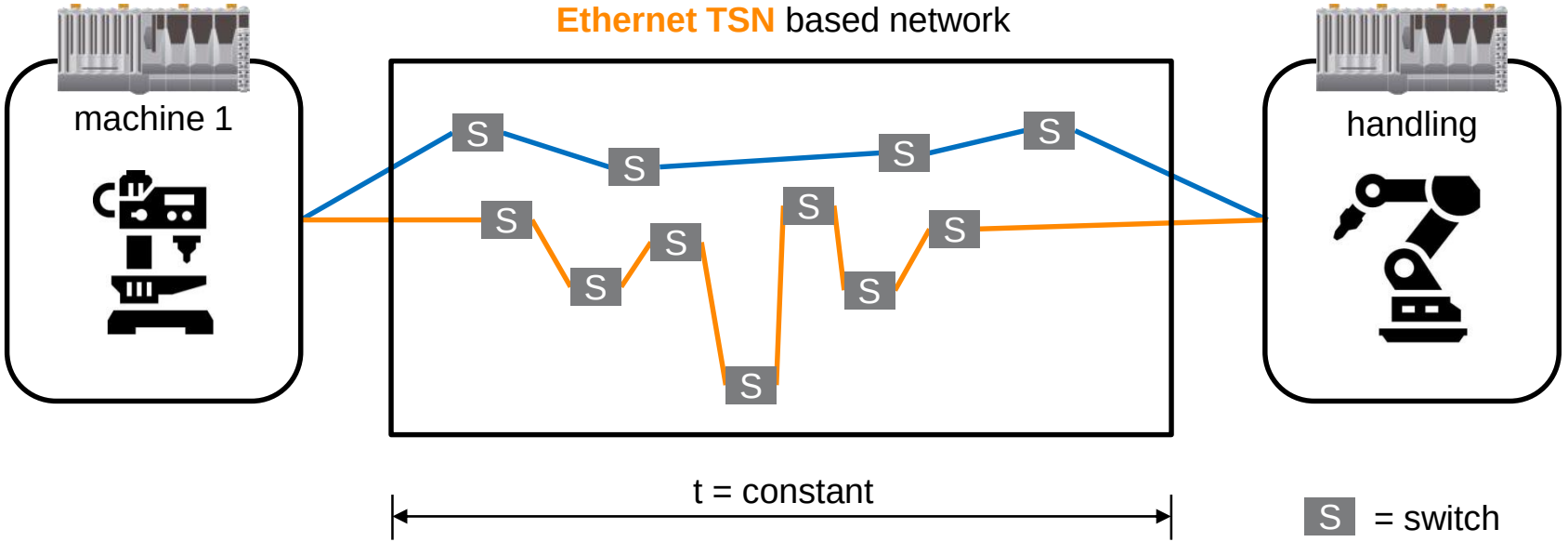


Time Sensitive Networking (TSN)

deterministic communication in large scale networks

uniform timing of all participants

traffic shaping



Time Sensitive Networking (TSN) - Standards

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According to IEC / IEEE 60802 joint working group

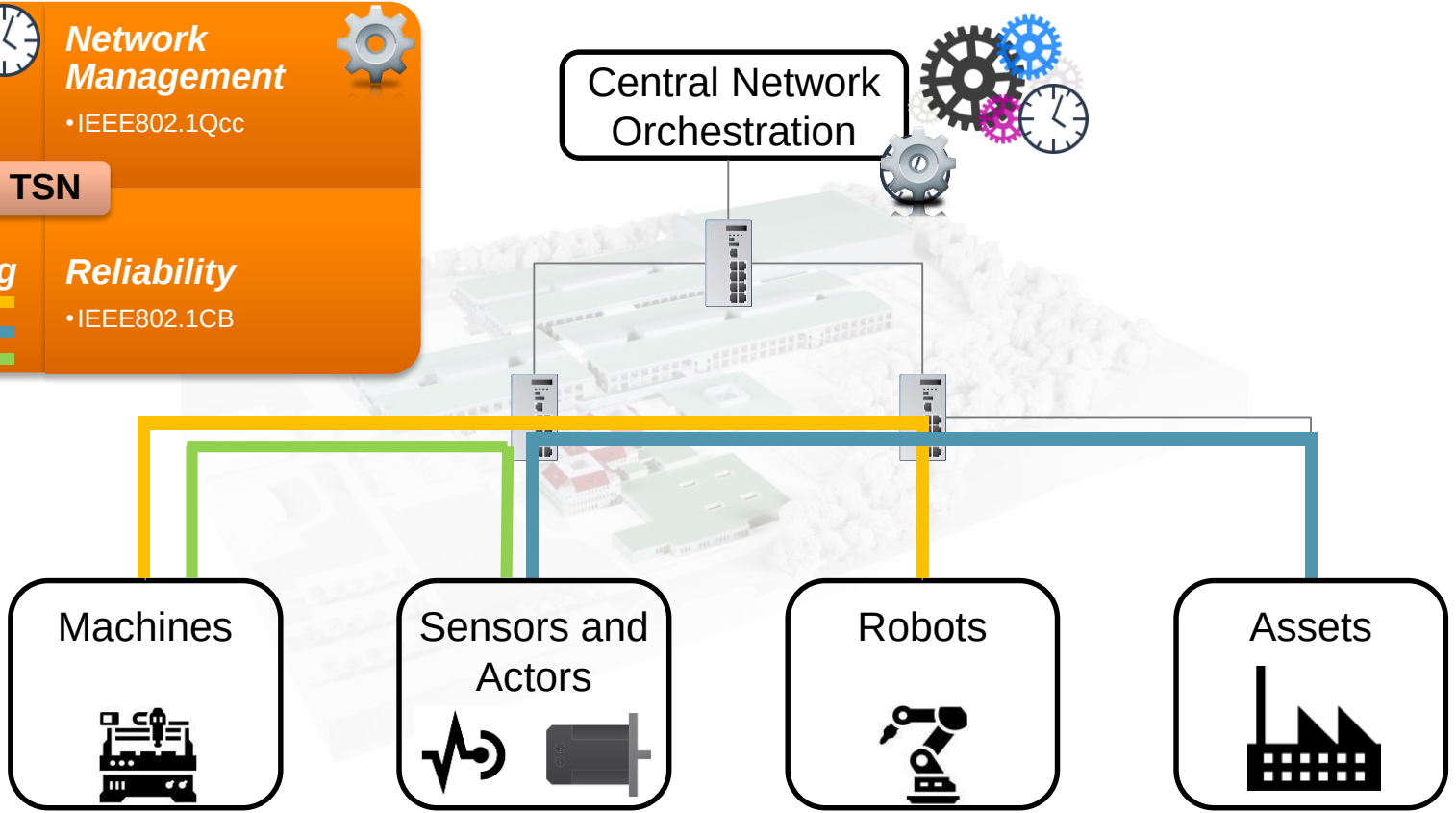
TSN

Time Synchronization
- IEEE802.1AS/AS-2019

Network Management
- IEEE802.1Qcc

Latency & Queuing
- IEEE802.1Qbv
- IEEE802.1Qav

Reliability
- IEEE802.1CB



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TSN network configuration

TSN network configuration - use case „machine fieldbus“

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B&R Automation Studio configures network & PLC distributes configuration

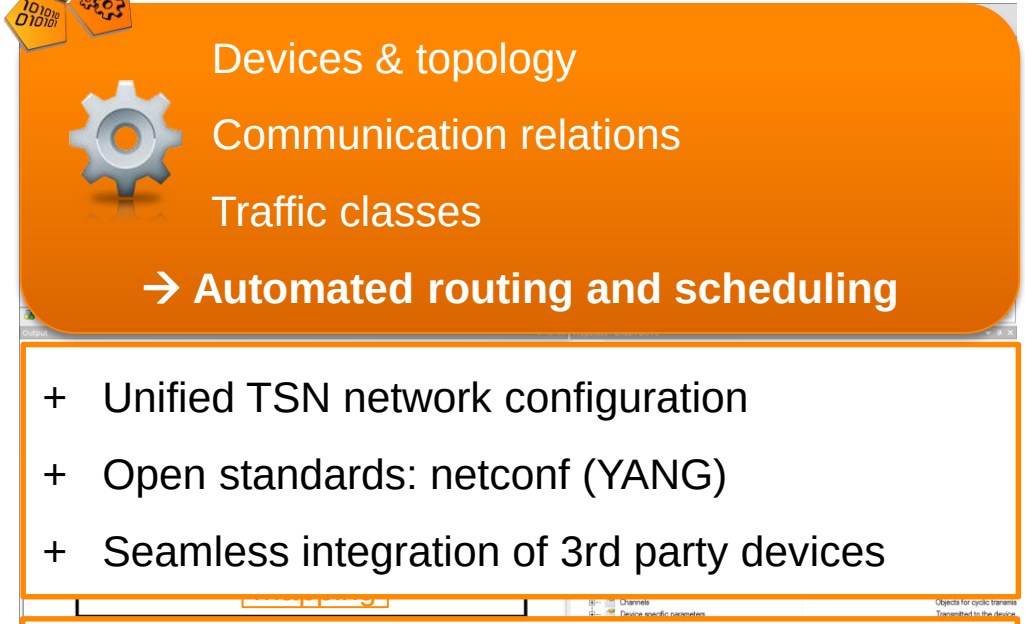
B&R Automation Studio

Devices & topology

Communication relations

Traffic classes

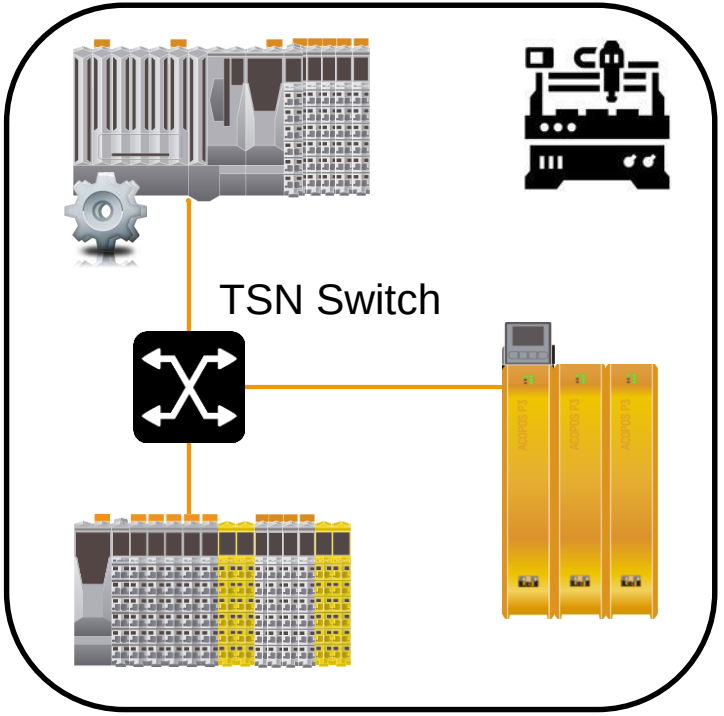
→ **Automated routing and scheduling**



+ Unified TSN network configuration
+ Open standards: netconf (YANG)
+ Seamless integration of 3rd party devices

Flexible & fast machine engineering

Machine



TSN network configuration - use case „machine line“ (C2C)

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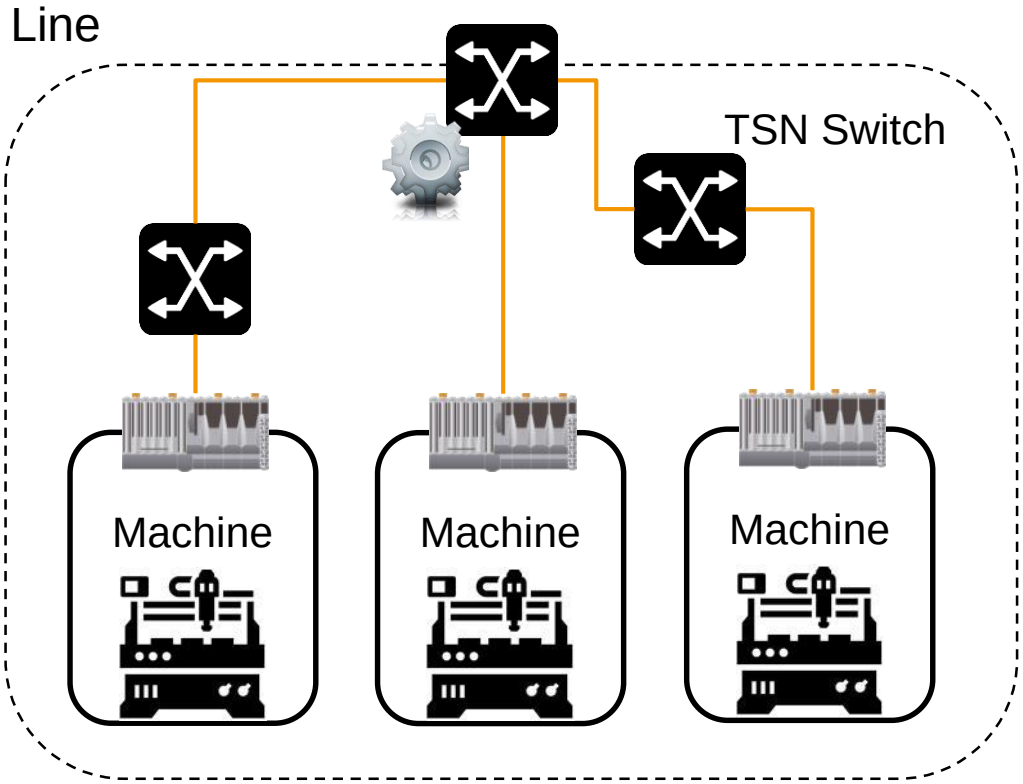
B&R Automation Studio OR 3rd-party tool configures network | switch distributes configuration



+ Unified TSN network configuration
+ Open standards:
  - netconf (YANG)
  - OPC UA information model (companion specfications)
+ Seamless integration of 3rd-party machines

Plug & produce commissioning

IoT enabled future of factory automation

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Internet

Industrial

OPC UA over TSN

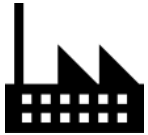
Things

Machines

Sensors and Actuators

Robots

Assets



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Performance

Fieldbus Performance

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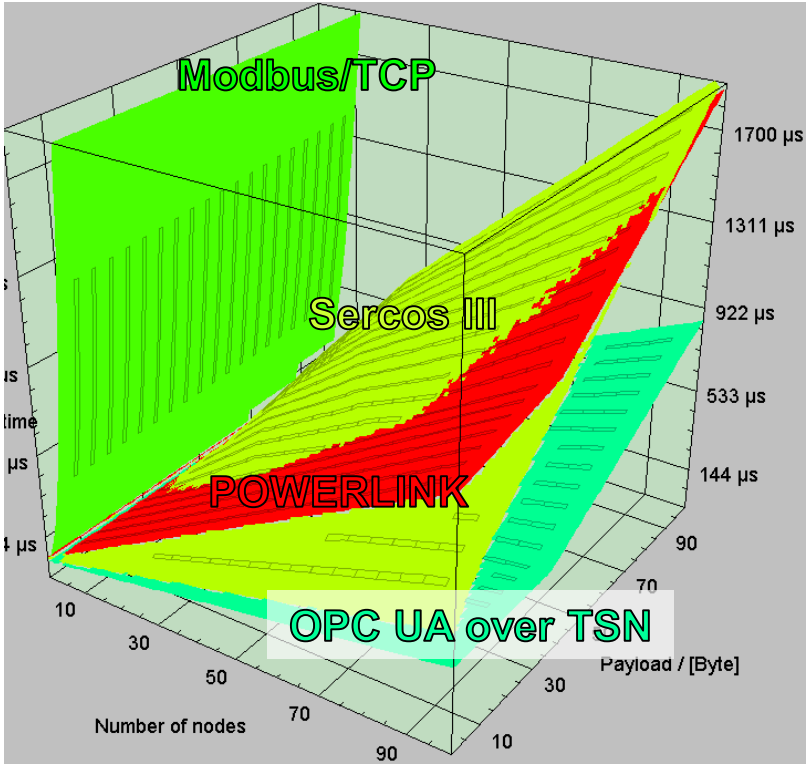
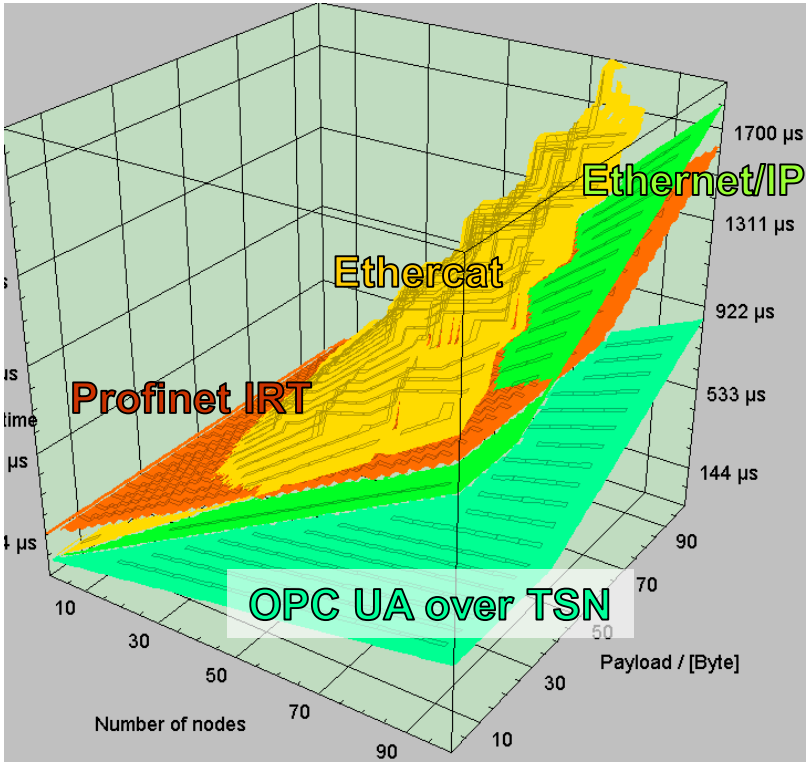
100 MBit





OPC UA PubSub over TSN using IEEE 802.1Qbv (exclusive)
D. Bruckner, et al.: OPC UA TSN - A new Solution for Industrial Communication. Whitepaper. Jan 2018.

Fieldbus Performance

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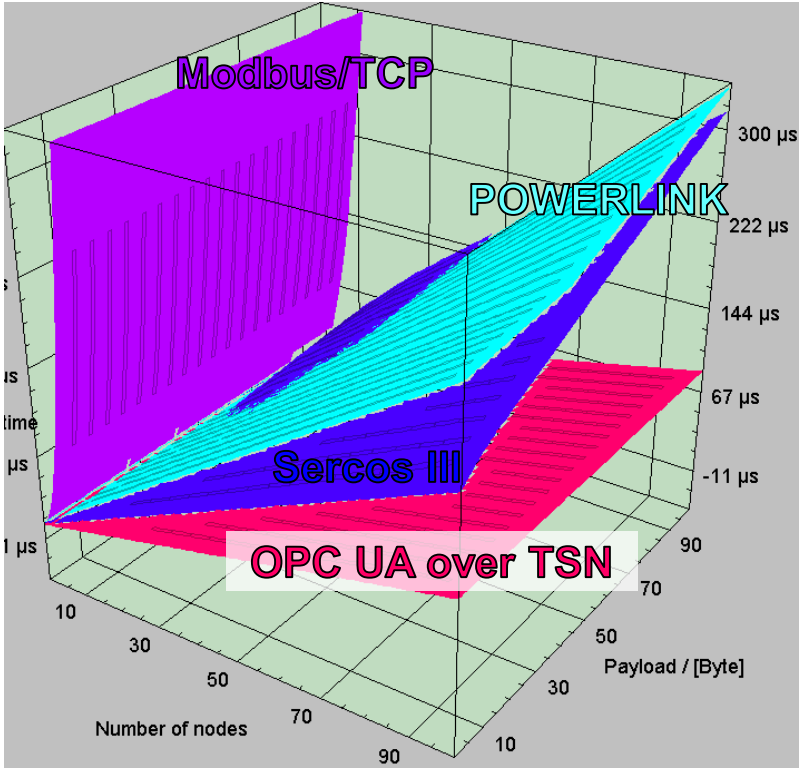
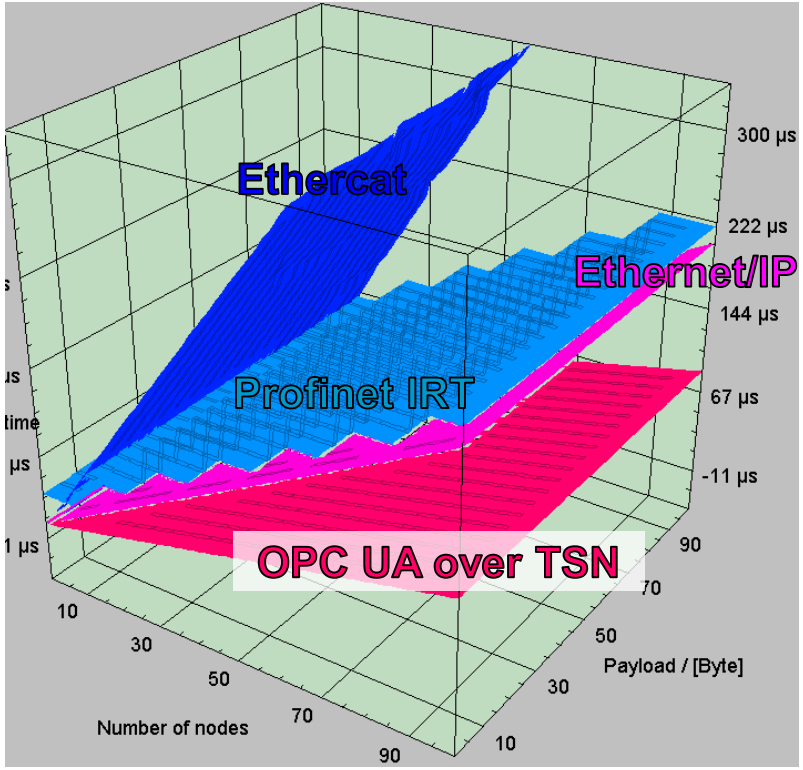
1000 MBit

The figures are not meant for exactly comparing the performance of Ethernet-based fieldbusses on 1000 MBit physics, but represent the theoretical range based on an educated guess on the implementation with unchanged behavior. Depending on devices' parameters, the individual planes may change.





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Performance

OPC UA over TSN @ 1 Gbit MBit vs. current ma

Performance Improvement:

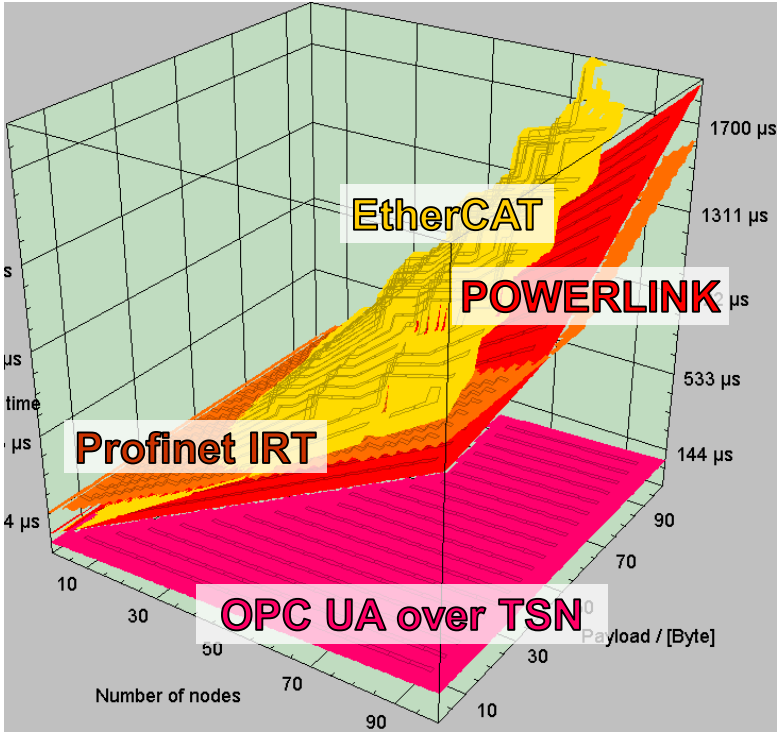
Up to **factor 18** to

everything existing today

Performance Improvement:

Up to **+80%** to

potential future Gigabit fieldbuses



OPC UA PubSub TSN using IEEE 802.1Qbv (exclusive)
D. Bruckner, et al.: OPC UA TSN - A new Solution for Industrial Communication. Whitepaper. Jan 2018.

OPC UA TSN – The communication standard for Industrial IoT

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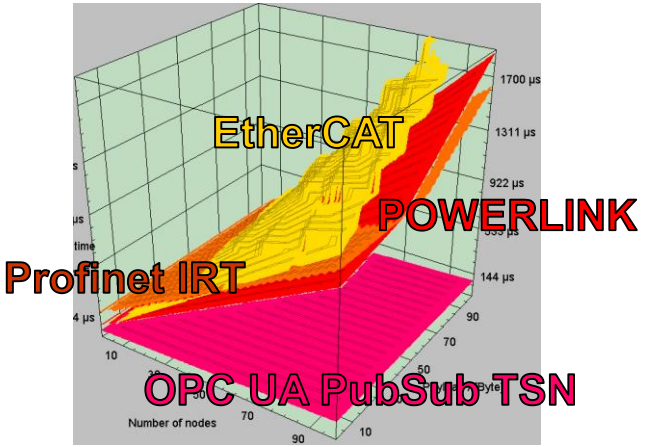
Future proof technology for highest investment protection

18 x faster than today‘s fastest solution

< 10µs minimum cycle time

> 10k nodes connected in real-time

Integrated **Safety** and **Security**



D. Bruckner, et al.: OPC UA TSN - A new Solution for Industrial Communication. Whitepaper. Jan 2018.

Better machines and lower TCO – best investment

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Enhancing OT-applications with IT capabilities

- Seamless communication
- Unified semantics from sensor to cloud
- Plug & produce
- Up to 10.000 nodes in one network
- Security down to the sensor
- The largest eco-system “ever in history”

First product ready demonstrator from B&R @ SPS 2018

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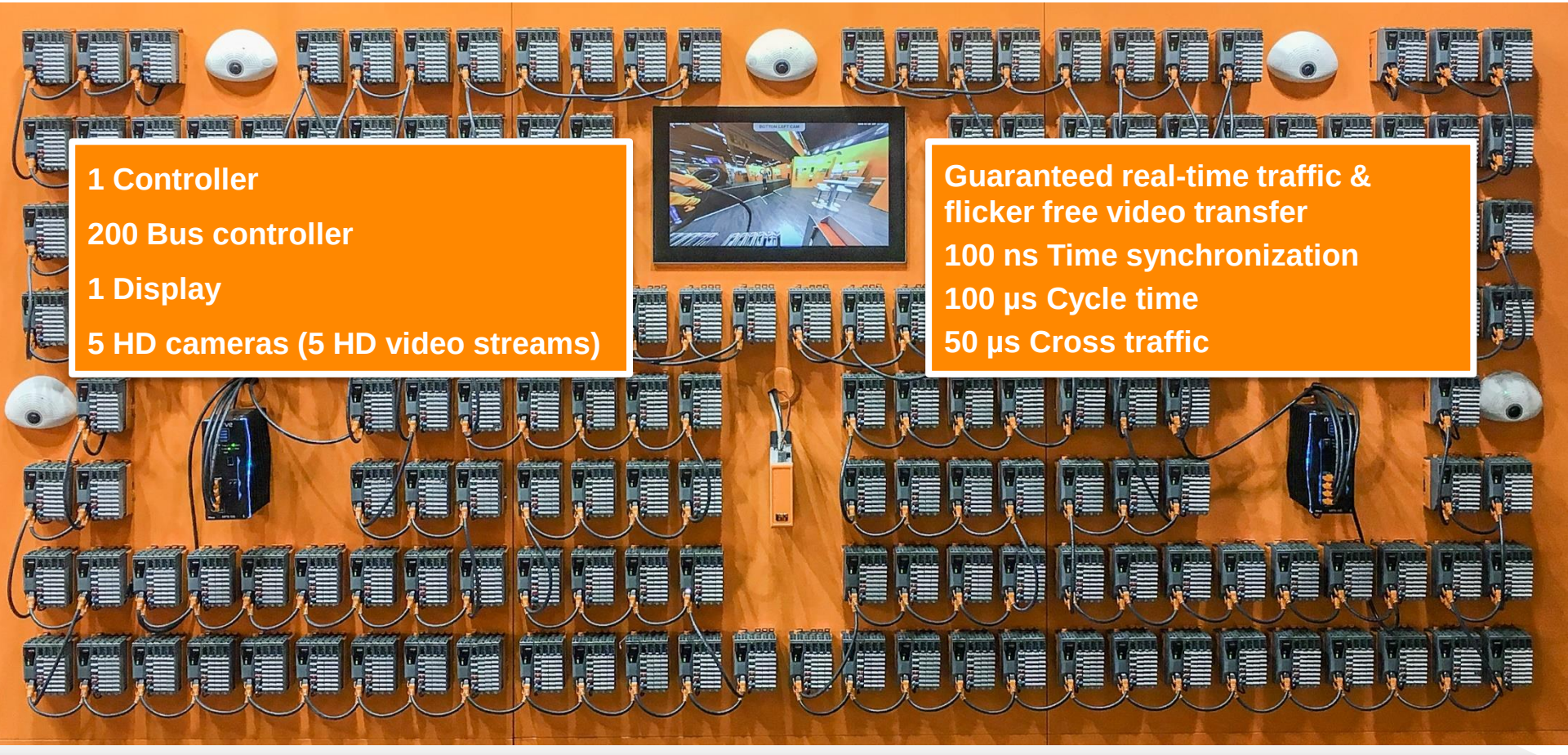

- 1 Controller
- 200 Bus controller
- 1 Display
- 5 HD cameras (5 HD video streams)

- Guaranteed real-time traffic & flicker free video transfer
- 100 ns Time synchronization
- 100 µs Cycle time
- 50 µs Cross traffic

Value proposition

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OEM benefits

+ One open standard (I/O,Motion & Safety)
+ Largest ecosystem
+ Best performance
+ Better security
+ **Better machines**

END user benefits

+ Unified factory network (IT/OT convergence)
+ Multi-vendor interoperability (one standard)
+ Plug & produce commissioning
+ Easy process optimization
+ **Lower TCO**

Best investment protection

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Applications

Machine-to-Machine and IO communication

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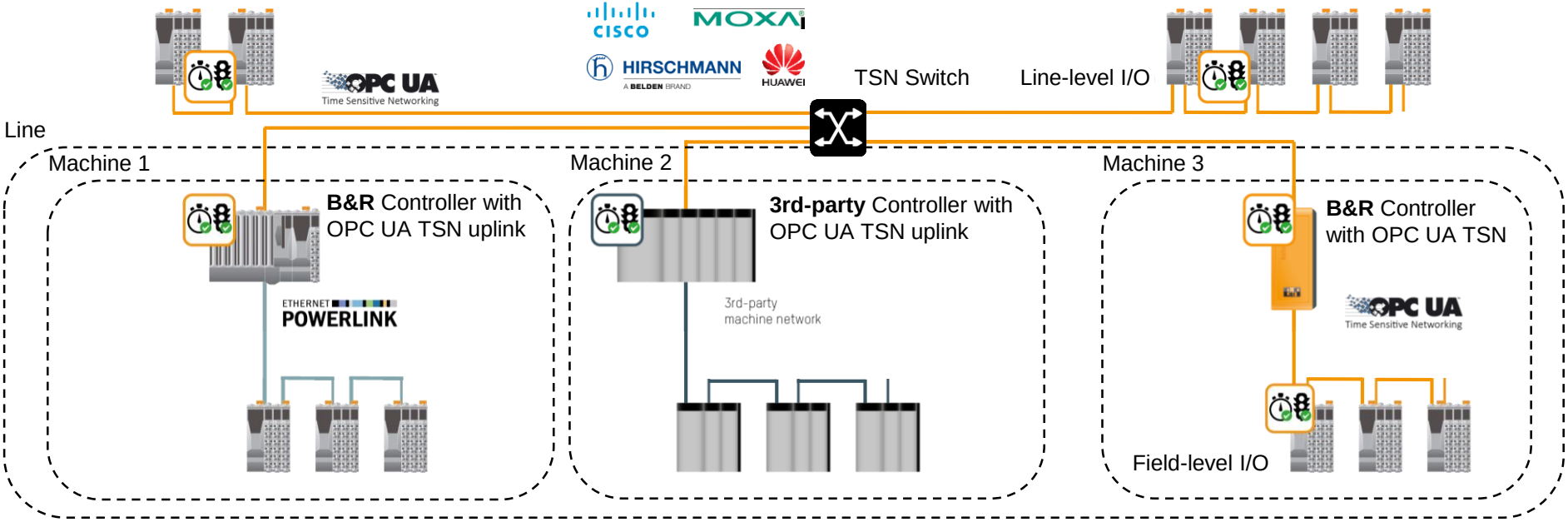
Seamless cross-vendor real-time communication



Machine-to-Machine and IO communication

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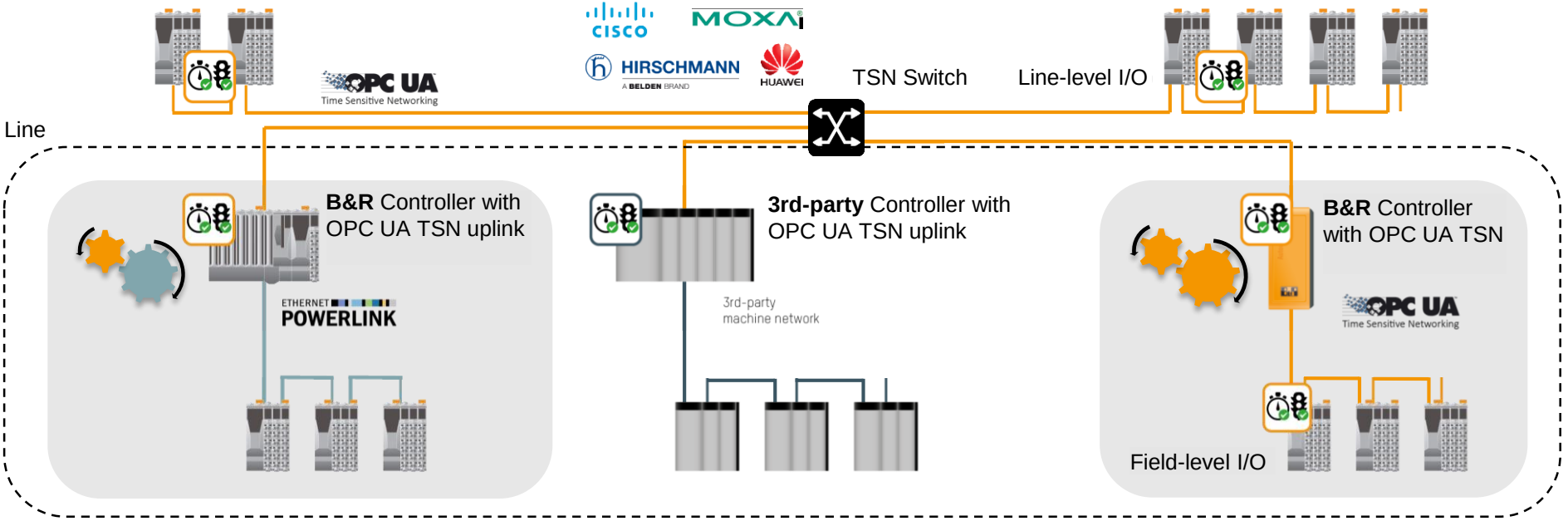
Seamless cross-vendor real-time communication



IT / OT Convergence

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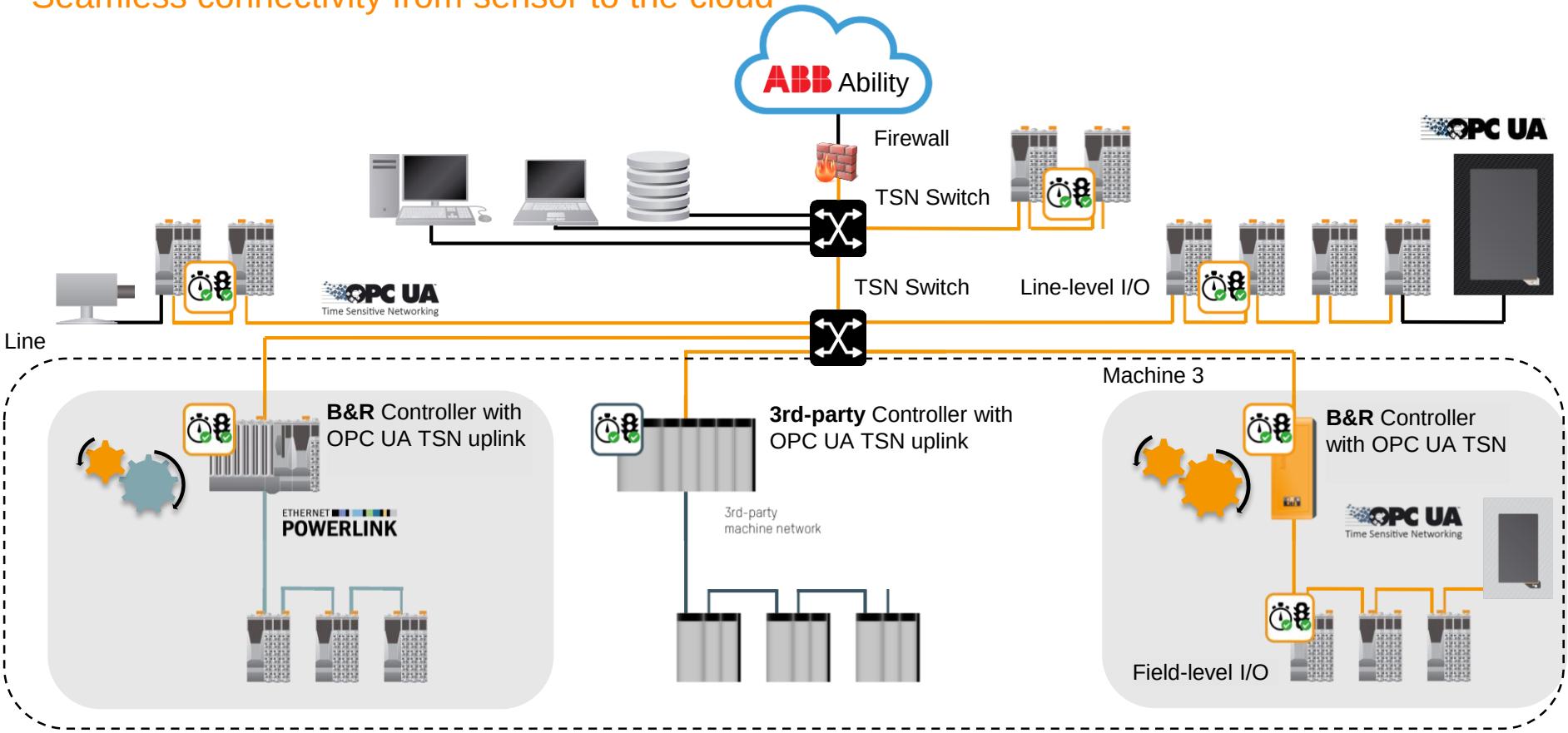
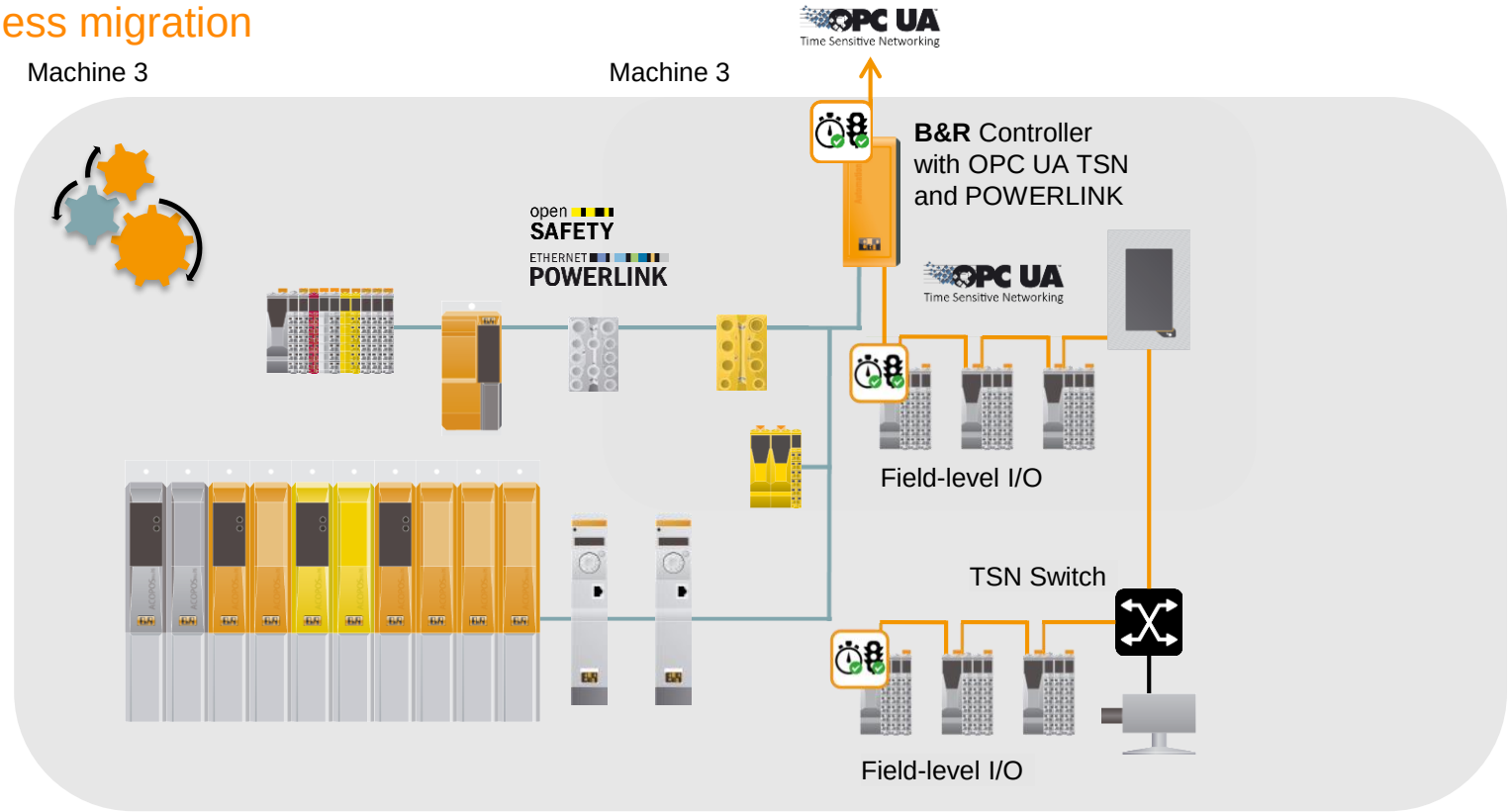
Seamless connectivity from sensor to the cloud



POWERLINK Integration

Seamless migration



Motion Control (2020)

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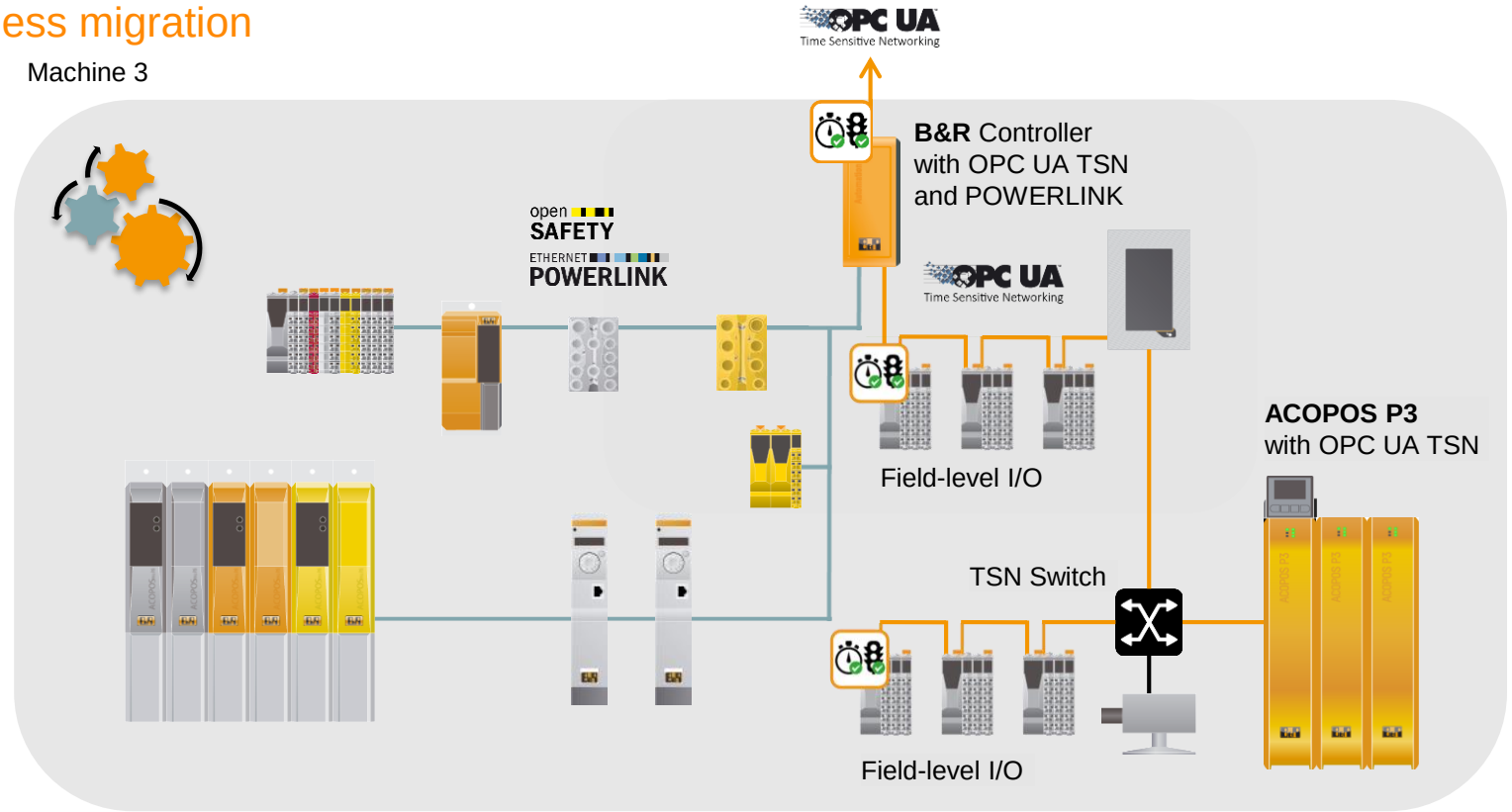
Seamless migration



Shaping the future for IoT communication

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OPC FOUNDATION MEMBER

IEEE

industrial internet CONSORTIUM

AVNU

LNI4.0 LABS NETWORK INDUSTRIE 4.0

Edge Computing CONSORTIUM

VDMA

B&R'S HEARTBEAT TECHNOLOGY

C홀 3-D140

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