

# Industrial IoT Adoption / Trends / Vision

**OPC Day Finland 18.10.2016**  
**hosted by BECKHOFF Finland**



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# Value Prop - Summary

- ▶ **Secure and Reliable**
- ▶ **International**
  - **Organization: 437 members worldwide – 216 in Europe**
  - **Specification: OPC-UA is IEC62541**
- ▶ **Scalable: From Sensor to Cloud**
- ▶ **Independent**
  - **Vendor / OS platform / Language / Domain**
- ▶ **Transport: Multiple options – extendable**
  - **TCP / HTTP / UDP / AMQP / MQTT ... future TSN**

# OPC Foundation: Board of Directors

- ▶ International board – democratic elections by members every year
  - Companies from Automation & IT
  - All over the world

## North America

**Honeywell**



## Japan

**YOKOGAWA** ◆

## Europe

**SAP**

**SIEMENS**

**BECKHOFF**  
New Automation Technology

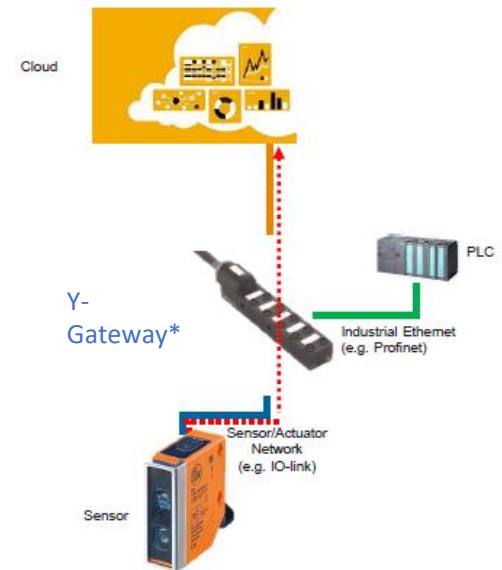
**ascolab**  
automation systems communication laboratory



# Smart Connectivity for Brown-field Sensors – Solution Overview

## OPC UA in couple of IIC Testbeds – e.g. TE & ifm & SAP & OPCF

- Y-Gateway with OPC UA interface offers sensor data to platform tier (OPC UA interface)
- Sensor data is extracted from (real-time) control system without impacting the system's operations
- Conversion of IO-link data with defined semantics
- Local data aggregation
- Remote configuration how/which data is made available
- Provision of device data models to allow for easy sensor configuration



\*Y-Gateway: Is the gateway installed in the machine splitting classical control data and additional data to be send to the platform tier

# Reference Architecture Model Industrie4.0 RAMI4.0

[http://www.zvei.org/Downloads/Automation/5305 Publikation GMA Status Report ZVEI Reference Architecture Model.pdf](http://www.zvei.org/Downloads/Automation/5305_Publikation_GMA_Status_Report_ZVEI_Reference_Architecture_Model.pdf)



- Approach for implementation of a Communication Layer
  - OPC UA: Basis IEC 62541
- Approach for implementation of an Information Layer
  - IEC Common Data Dictionary (IEC 61360 Series/ISO13584-42)
  - Characteristics, classification and tools to eCl@ss
  - Electronic Device Description (EDD)
  - Field Device Tool (FDT)
- Approach for implementation of a Functional and Information Layer
  - Field Device Integration (FDI) as integration technology
- Approach for end-to-end engineering
  - AutomationML
  - ProSTEP iViP
  - eCl@ss (characteristics)

### Industrie 4.0 Full

Target: Standards, Norms and Research, **> 5 Years**

Definition of  
complete industrial  
properties 4.0  
incl. Strategic outlook

### Industrie 4.0 Ready

Target: Supplier, **< 5 Years**

What features  
must you  
have minimal  
in the products to  
participate at  
Industry 4.0 network

### Industrie 4.0 Basic

Target: Customers, Yet

Which products are actual well  
prepared for Industry 4.0

3 levels with target groups orientation and migration path

# Video's from OPC Day Europe

## ▶ Get video presentations from OPC Day Europe 2016

The most important sessions of OPC Day Europe 2016 have been recorded - first part is online available now:

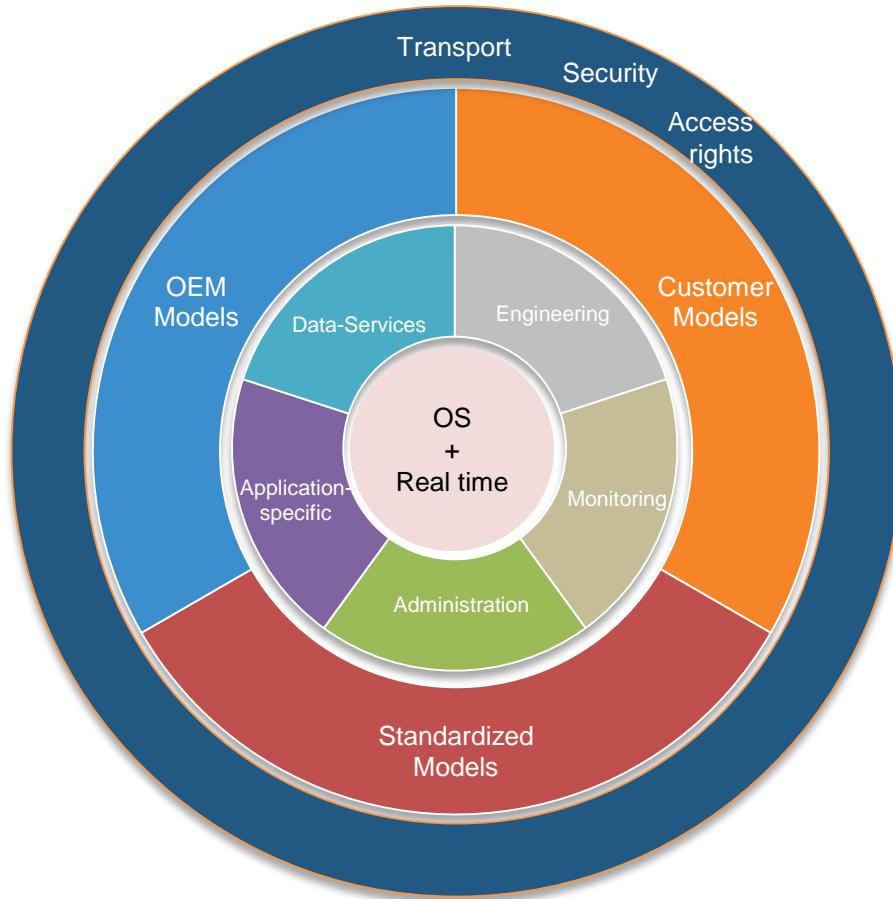
- Industrie 4.0 – Status of standardization, Martin Hankel, Bosch-Rexroth
- Reference Architecture Model Industrie 4.0 (RAMI4.0), Roland Heidel
- Results of the OPC UA security Analysis, Jens Wiesner, BSI

## ▶ Just register and you will receive an email with the links to the first set up available videos:

<https://opcfoundation.org/event-details/?ee=122>



# Connecting to a Device / Machine / Service...



Service Oriented Architecture (SoA) :

- Device / machine provides
  - **Services**  
**requires Information-Modeling**  
Type and Data consistency
  - **Discovery** of Services
- **Standardized** Access  
Generic Clients can interact

Support

- **Interoperability**
- **IT-Security:**  
Rolls of access per user



# OPC UA: Security analyzed by BSI

**Who:** Federal Office for Information Security (German Government BSI)

**Why:** Because of relevance of OPC UA for German Industry

**What:** Security Evaluation of OPC-UA – finalized March 2016

- Analysis of specification / Analysis of Reference Implementation

**Result:** Available on BSI web and OPC web



# OPC UA: Security analyzed by BSI

**Result:**



**“An extensive analysis of the security functions in the specification of OPC UA confirmed that OPC UA was designed with a focus on security and does not contain systematic security vulnerabilities.”**



**"The only communication technology for industrial environments that I currently know of which provides integrated security functionalities and also offers performance potential to tackle the challenges of Industry 4.0 is OPC UA.**

Holger Junker, Head of Unit 'Cyber-Security in critical IT-Systems, Application and Architectures' within the German Federal Office for Information Security

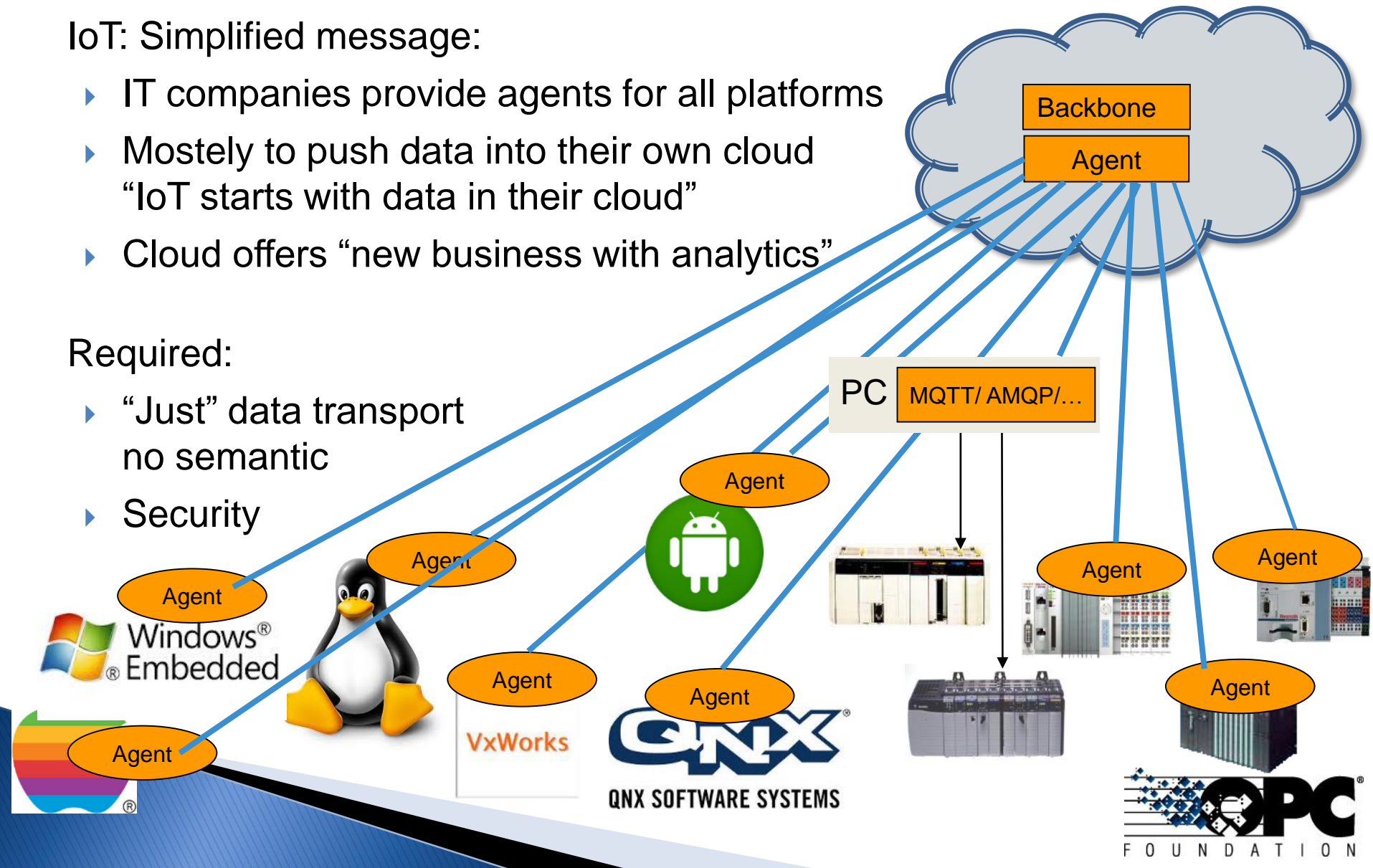
# IoT: Summary (Communication)

IoT: Simplified message:

- ▶ IT companies provide agents for all platforms
- ▶ Mostly to push data into their own cloud  
“IoT starts with data in their cloud”
- ▶ Cloud offers “new business with analytics”

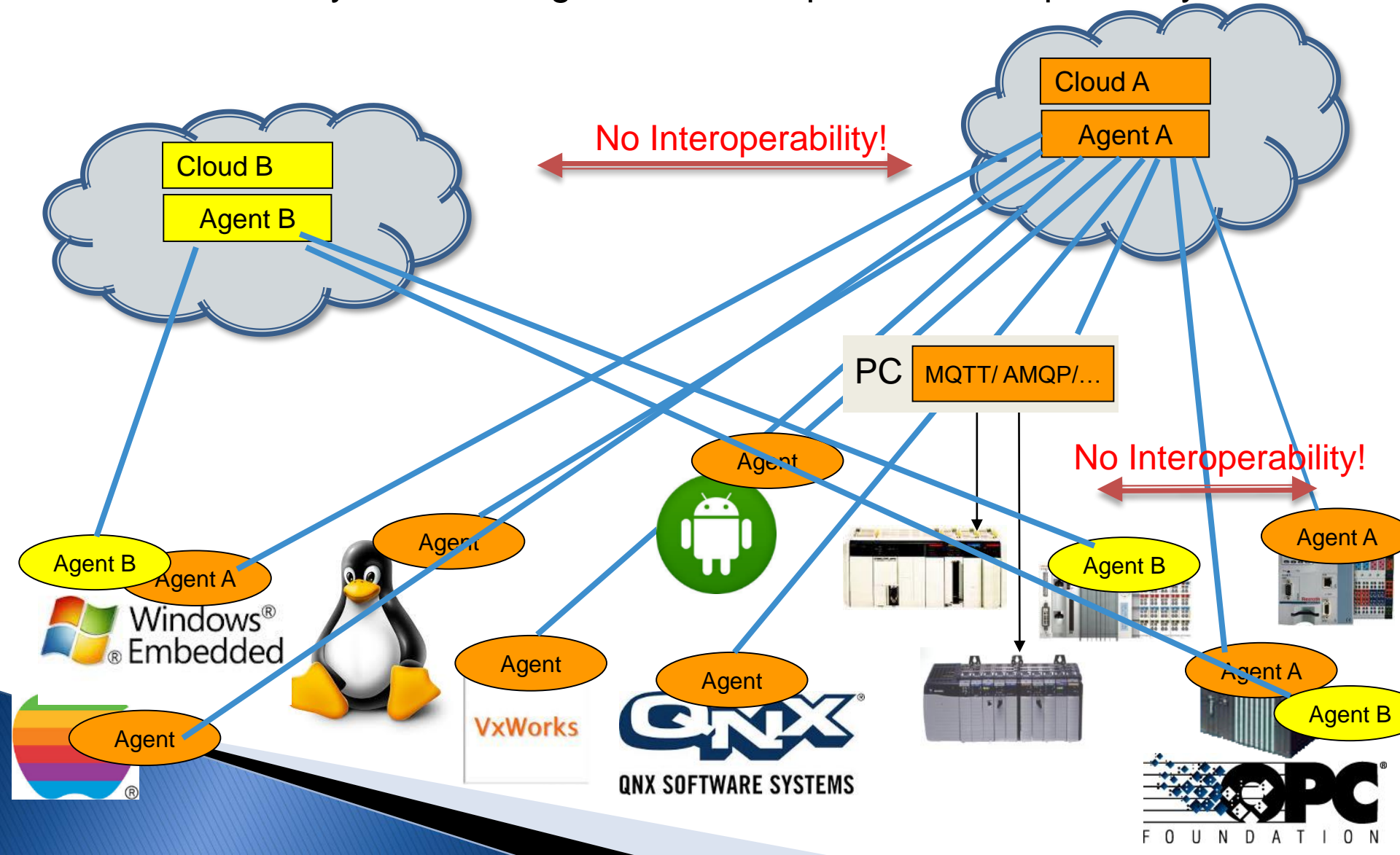
Required:

- ▶ “Just” data transport  
no semantic
- ▶ Security



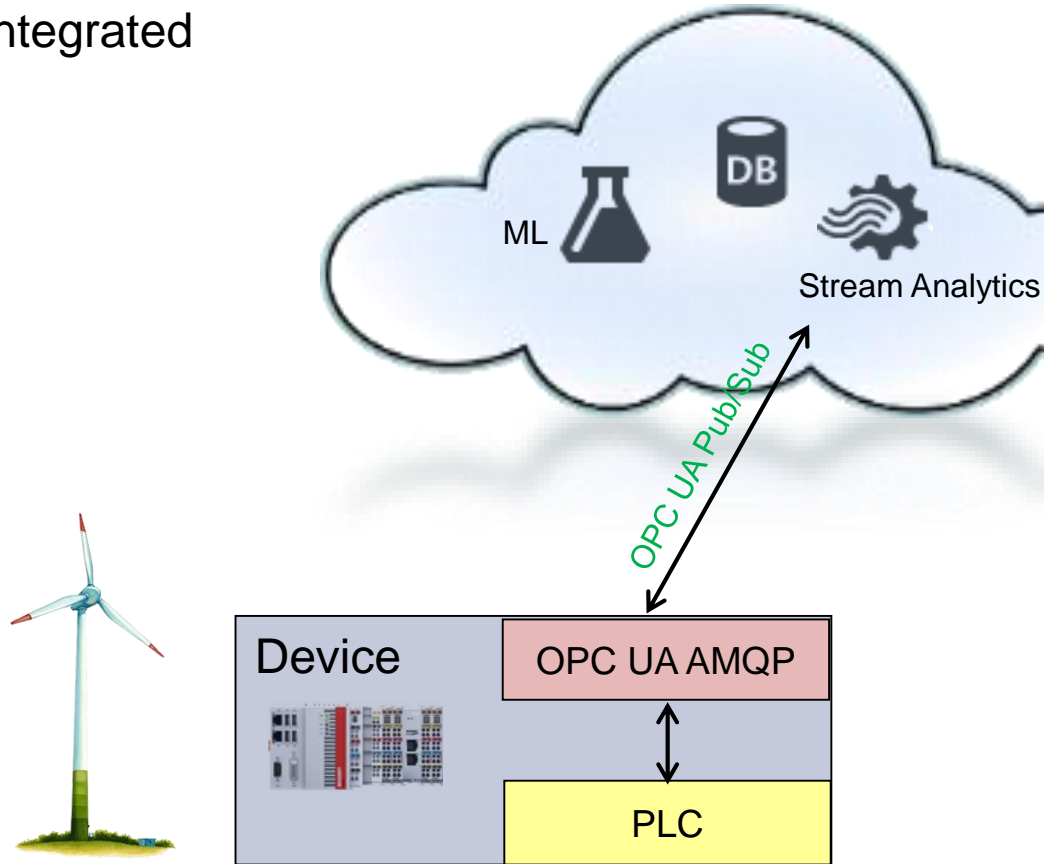
## IIoT connectivity is not enough! It does not provide Interoperability!

## IIoT connectivity is not enough! It does not provide Interoperability!



# Data Communication: Integrated vs Gateway

## Integrated



- PC based controllers allows Integration of IoT solution into controller
  - One device: Highly integrated
  - Directly: PLC code can initiate push of data on demand
  - Save extra hardware costs
  - Minimize components to be configured

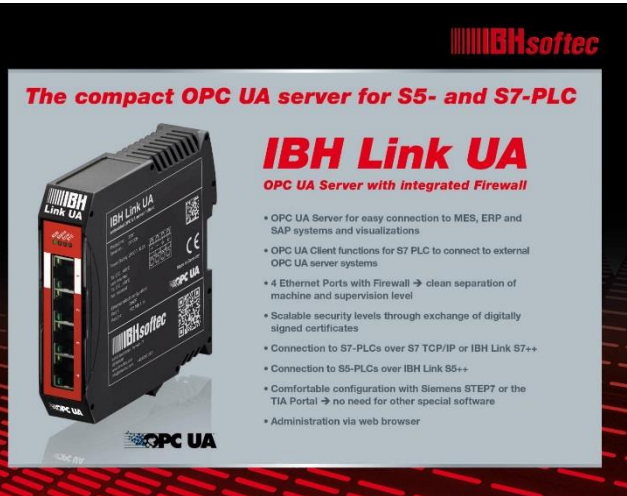
## Gateway Solution



- Gateways allows multiple protocol extensions
  - Multiple protocols out of one box
  - Easy „IoT enabler“ for existing environments
  - Connect one or multiple devices to cloudT
  - Independent from machine status: Not influencing process



# Gateway: connect existing world



- ▶ Direct connection between machines and higher level systems (i.e., ERP, MES, SCADA or SAP), with the integrated OPC UA server
- ▶ Variety of supported PLCs: Siemens SIMATIC S7 and S5, Rockwell ControlLogix and CompactLogix controllers with Modbus TCP and RTU (Wago, Beckhoff, Phoenix, Schneider, etc.), Mitsubishi (Melsec-Q), etc.
- ▶ Network separation by physically independent ports
- ▶ Easy configuration: Symbol import for Siemens and Rockwell PLC, without PLC engineering, online-diagnostic for PLC trouble-shooting



Softing

# Emerson & OPC UA

## ► Emerson Process Management

- **Machinery Health™** Protection System (CSI 6500 ATG)  
native OPC UA Support integrated





# Siemens support OPC UA

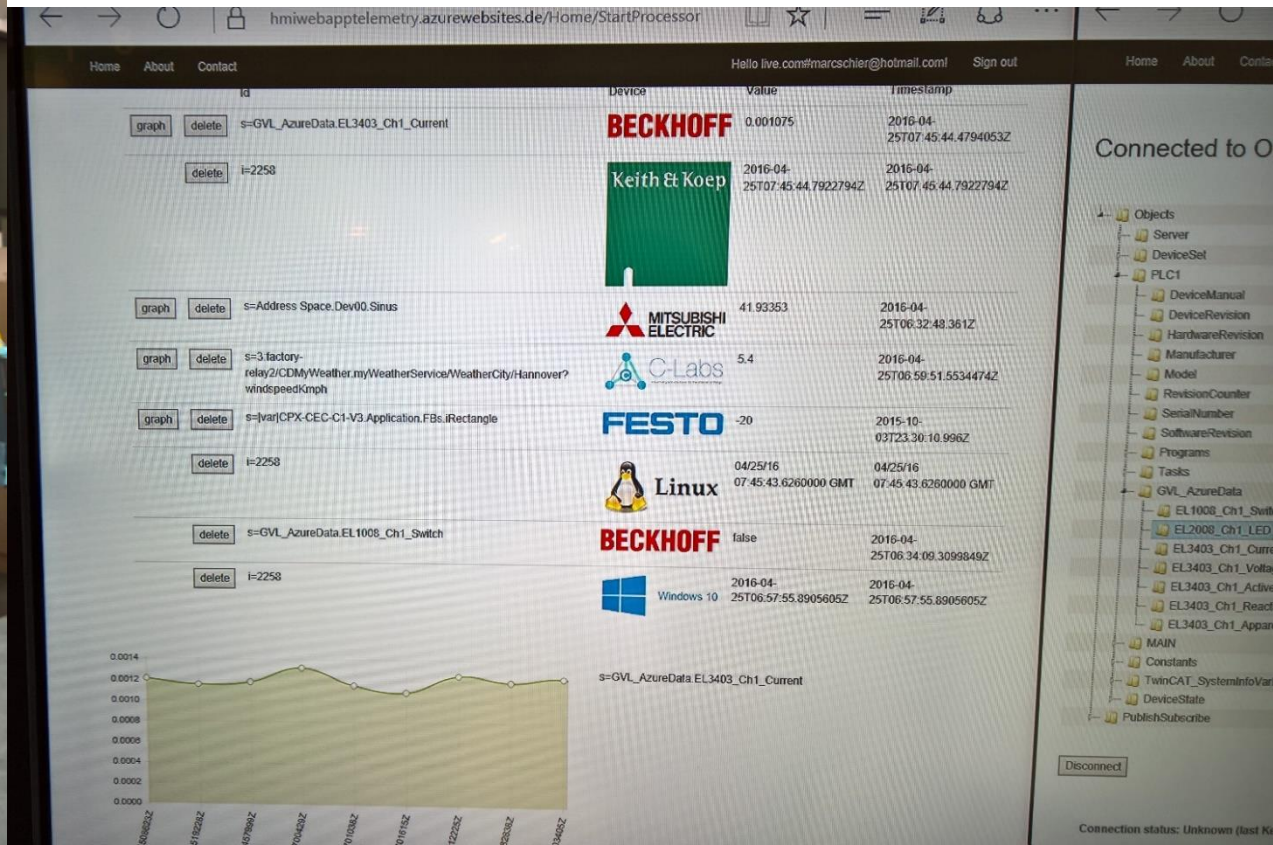
## 11 Siemens products with integrated OPC UA

- SIMATIC S7-1500 PLC Family <https://opcfoundation.org/products/view/434>
- SIMATIC S7-400 with OPC UA CP (CP 443-1 OPC UA) <https://opcfoundation.org/products/view/444>
- RFID Reader SIMATIC RF600 <https://opcfoundation.org/products/view/449>
- SINUMERIK CNC control systems <https://opcfoundation.org/products/view/450>
- SIMOTION IT <https://opcfoundation.org/products/view/199>
- SINEMA Server <https://opcfoundation.org/products/view/446>
- SIMATIC NET OPC Server <https://opcfoundation.org/products/view/202>
- SCADA system SIMATIC WinCC Open Architecture <https://opcfoundation.org/products/view/436>
- SIMATIC B.Data <https://opcfoundation.org/products/view/437>
- SIMATIC HMI Comfort Panels <https://opcfoundation.org/products/view/432>
- SIMOCODE pro Motor Management System <https://opcfoundation.org/products/view/247>

# OPC pod at Microsoft booth

Microsoft Azure showing their openness.... being connected to lot's of devices:

- Independent from vendor
- Independent from vertical market
- Independent from operating system
- With integrated security (also proven by German BSI)
- Without any change in the device





# OPC pod at Microsoft booth

The people who just made it



# OPC pod at Microsoft booth

...always overcrowded...



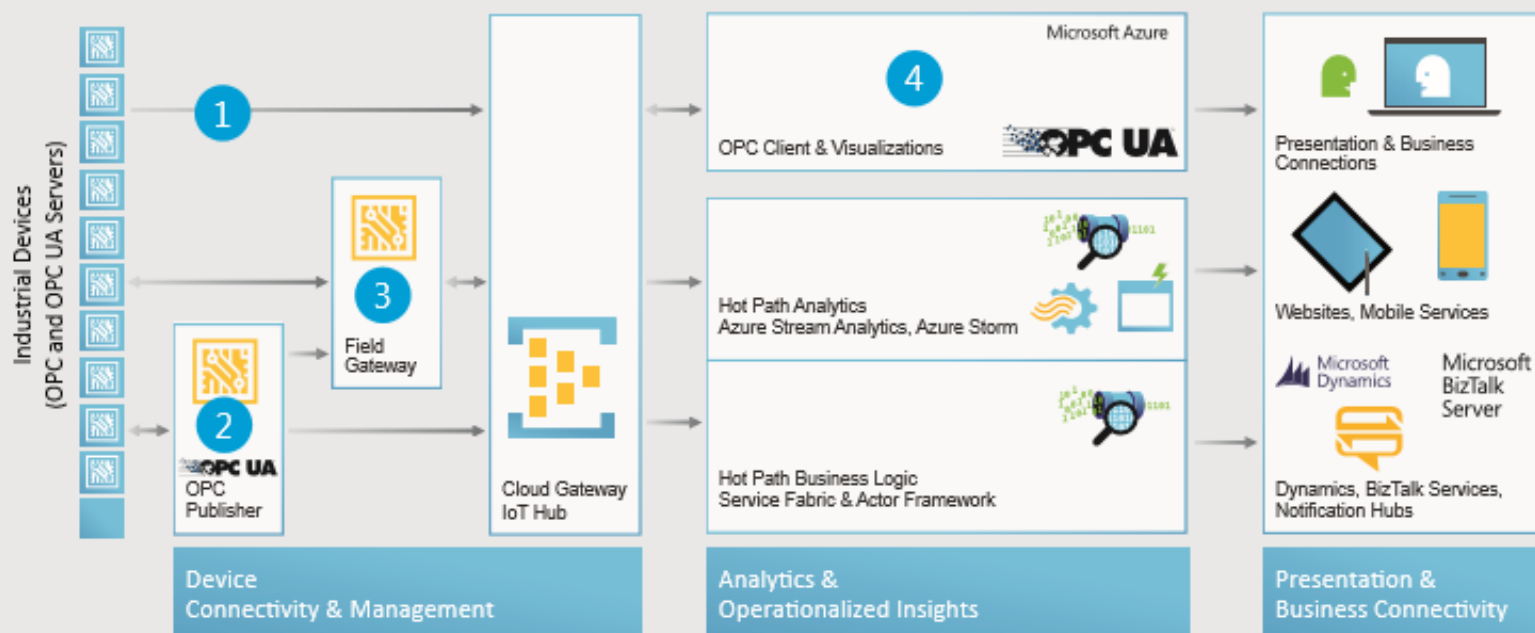


# Azure IoT Support for OPC-UA

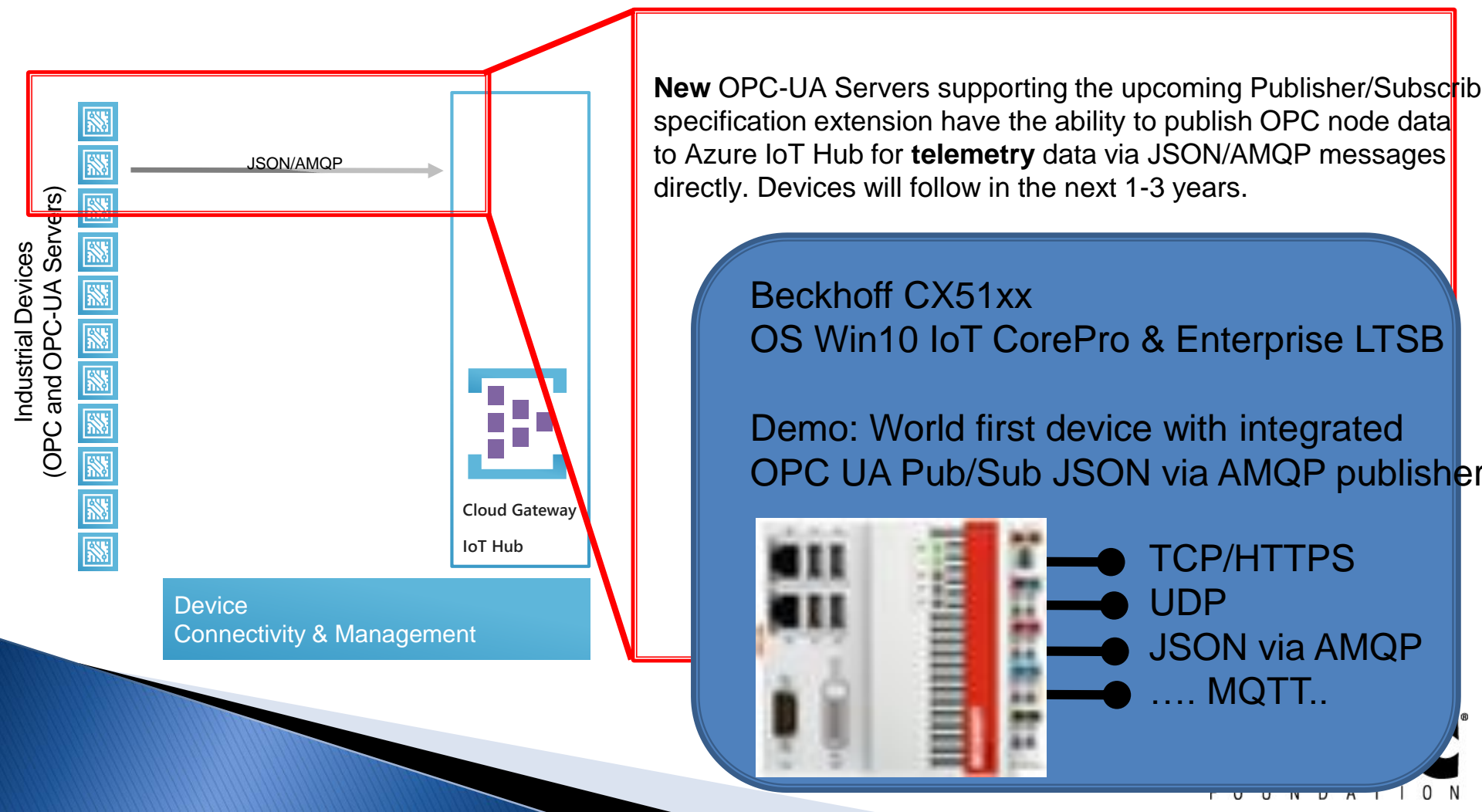
Download flyer here

<https://opcfoundation.org/wp-content/uploads/2016/05/Microsoft-OPCUA-5-Clicks-To-Digital-Factory.pdf>

Microsoft and the OPC Foundation ([www.opcfoundation.org](http://www.opcfoundation.org)) have worked closely together over the last number of months to deeply integrate OPC UA into the Azure IoT Suite. The result of this collaboration is a reference implementation available open-source on the OPC Foundation's GitHub (<https://github.com/opcfoundation>). The architecture of the implementation is shown in the following diagram:



# OPC-UA Integration into Azure IoT Suite (Pub/Sub)



# Microsoft support OPC UA

...drumming for OPC UA

<https://azure.microsoft.com/en-us/blog/microsoft-azure-germany-now-available-via-first-of-its-kind-cloud-for-europe/>

- For businesses, including automotive, healthcare and construction that rely on SAP enterprise applications, SAP HANA is now certified to run in production on Azure, which will simplify infrastructure management, improve time to market and lower costs. Specifically, customers and partners can now take the advantage of storing and processing their most sensitive data.
- Addressing the global scale of IoT while ensuring data resides in-country, Azure IoT Suite enables businesses, including the robust industrial and manufacturing sector in Germany, to adopt the latest cloud and IoT solutions. Azure IoT Suite enables enterprises to quickly get started connecting their devices and assets, uncovering actionable intelligence and ultimately modernizing their business.
- With Industry 4.0-compatible integration of OPC Unified Architecture into Azure IoT Suite, customers and partners can connect their existing machines to Azure for sending telemetry data for analysis to the cloud and for sending commands to their machines from the cloud (i.e. control them from anywhere in the world) without making any changes to their machines or infrastructure, including firewall settings.
- Microsoft, and particularly Azure, has been a significant and growing contributor to open source projects supporting numerous open source programming models, libraries and Linux distributions. Startups, independent software vendors and partners can take advantage of a robust open source ecosystem including Linux environments, Web/LAMP implementations and e-commerce PaaS solutions from partners.
- Furthermore, with the open source .NET Standard reference stack and sample applications Microsoft has recently contributed to the OPC Foundation's GitHub, customers and partners can quickly create and save money maintaining cross-platform OPC UA applications, which easily connect to the cloud via the OPC Publisher samples available for .NET, .NET Standard, Java and ANSI-C.

 OPC UA™



 OPC UA™







# Microsoft support OPC UA

Microsoft Windows 10 Anniversary slide deck:

## CONNECTED THINGS


Open platform that seamlessly connects things, endpoints and the cloud





### Open Standards & Interface

- Standards based approach to IoT and interoperability
  - ALLJOYN/OCF Integration for consumer IoT
  - OPC UA for Industrial IoT
- Ubiquitous connectivity
  - USB, Wi-Fi, BLE, Cellular
- Low level BUS and hardware support



### Azure Cloud Integration

- Secure Azure connection with TPM
- Best in-class connectivity with Azure

“Connected – Windows 10 IoT takes a standards based approach. Interoperability is key in IoT solutions. Windows 10 IoT has ubiquitous connectivity, and we have Alljoyn/OCF integration for consumer IoT and OPC UA for Industrial”

# Trends in Automation

**Transport of Bits & Bytes via OPC UA and TSN is NOT the key  
This is core benefit of fieldbus systems**

**Required:**

- SoA - Service Oriented Architecture**
- Nearly EVERYWHERE**

# Hanover Messe: Impressions

## SAP booth



# SAP Demo: The components to be assembled

- Product: Key chain
- Highly individualized
- Lot size 1

Own text



VIP's get extra chip for IoT tracking  
Flashed at production with personalized data



Colors



Tracking  
steps to  
your mobile





# SAP Demo: The assets to make it happen

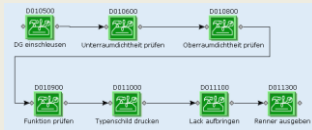


SAP HANA Cloudsystem  
SAP MES

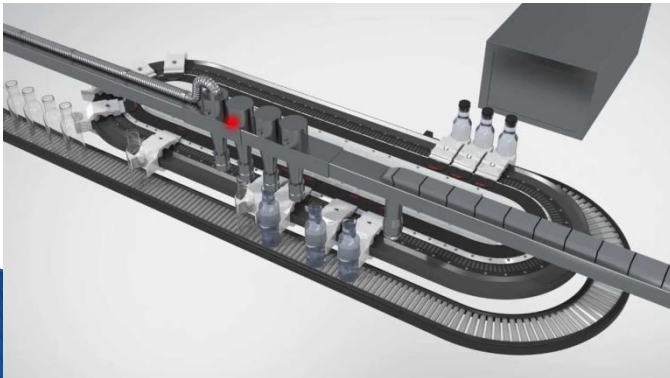
PCo (Plant Connectivity)



Cache



XTS Transport System  
Beckhoff



Robot  
Stäubli



Vision Camera  
Asentics



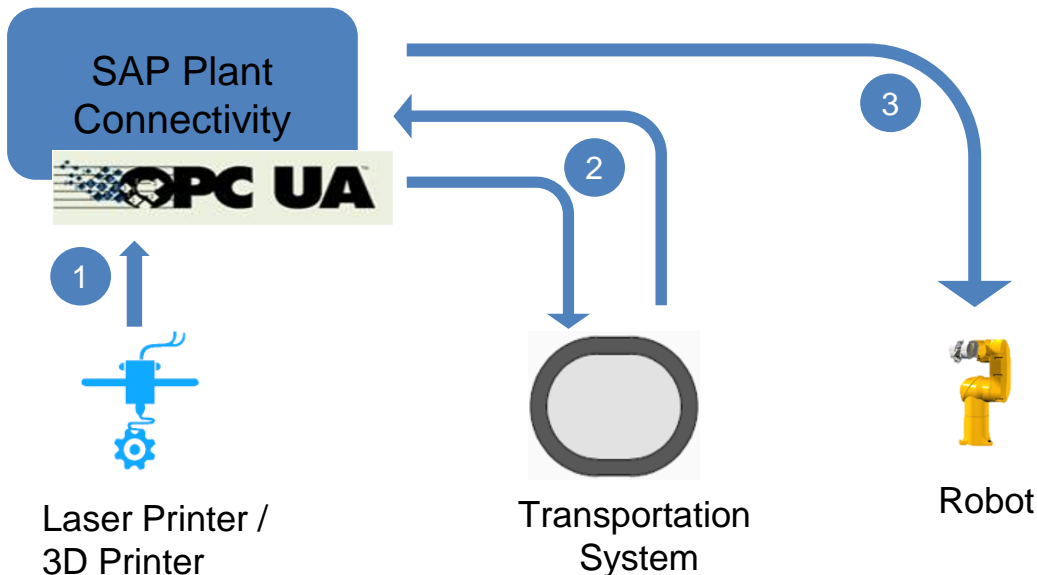
Laser Printer  
CAB



# Orchestration & Synchronization done by SAP

## Orchestration:

- Event occurs on Unit X
- Unit Y is triggered by SAP Plant Connectivity



## Example:

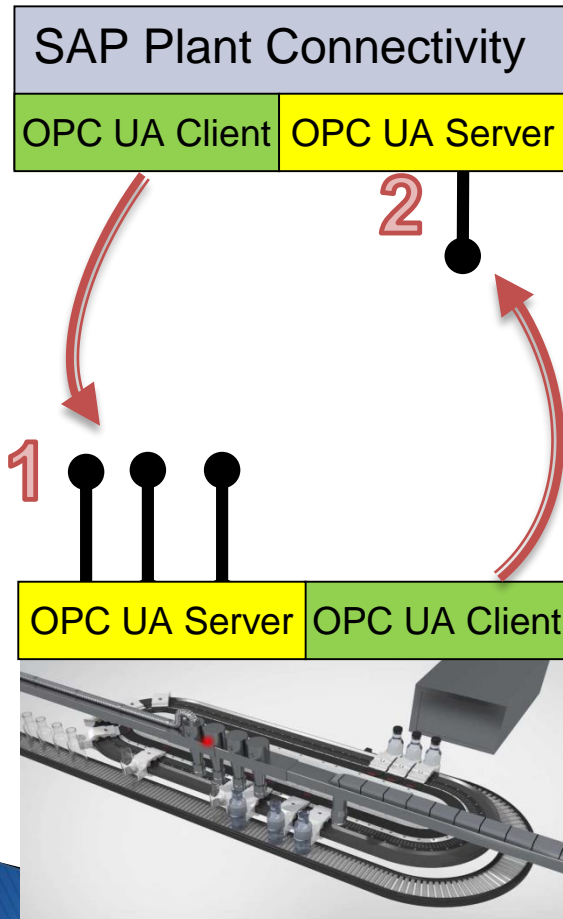
1. Upper Shell for customer order 4711 is printed (Laser Printer ready)
2. Carrier with subshell ordered to assembly station
3. As soon as carrier arrives Robot is triggered to start assembly process

## Benefits:

Simplified System Landscape  
Flexibility / no hard coded steps

# Architecture: What is an asset? 1/3)

- Asset is an intelligent device / machine providing functionality



## 1 XTS Transport system provide functionalities:

- ProvideEmptyTransport (OrderNr, TargetPos)
- ProvideTransport (OrderNr, TargetPos)
- CleanTransport (OrderNr)

## 2 XTS Transport to confirm actions

- JobDone (OrderNr)
- InitializationDone()

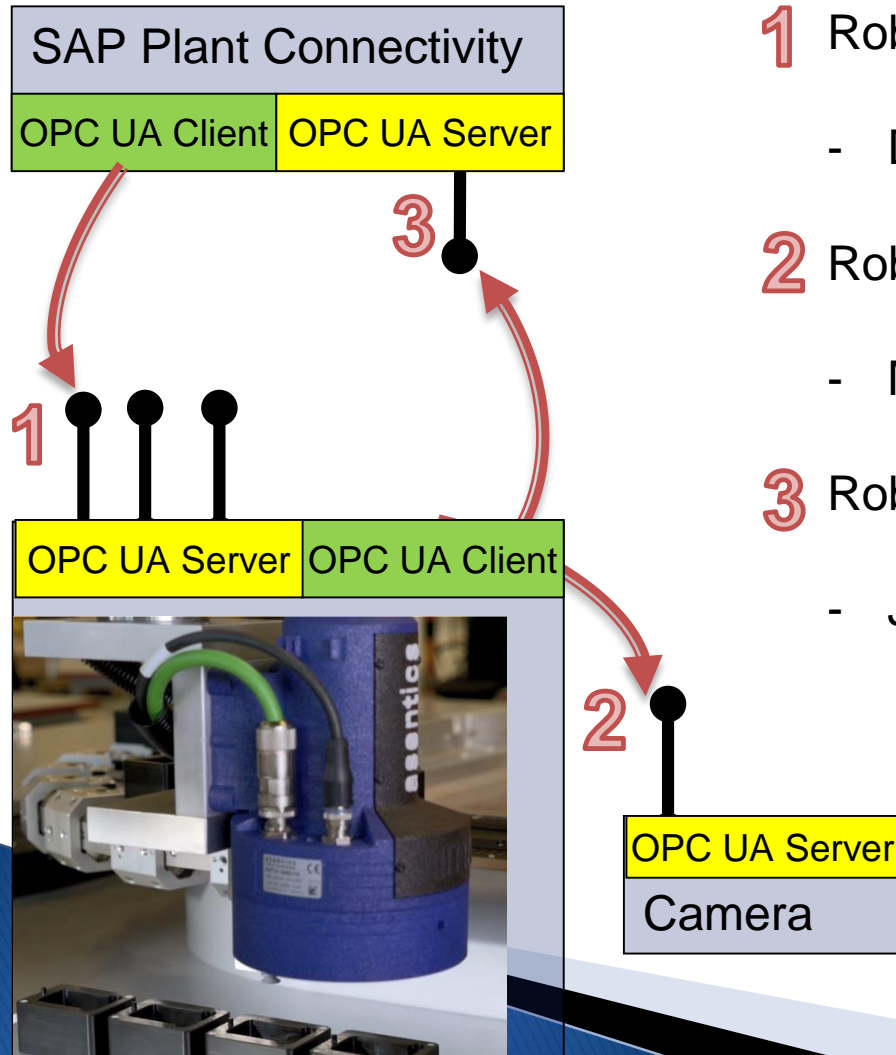
SAP  $\leftrightarrow$  XTS  
Only vertical communication

The transport system is not aware of any other asset!



# Architecture: What is an asset? (2/3)

- Asset is an intelligent device / machine providing functionality



**1** Robot provide functionalities:

- DoPickandPlace(OrderNr, PreTeachedNr)

**2** Robot call service from camera

- MakePictureAndAnalyze(OrderNr)

**3** Robot can confirm job

- JobDone(OrderNr)

Vertical & horizontal communication

- SAP is not aware of vision camera
- The robot appears as a “Smart Robot”

# Architecture: What is an asset? (3/3)

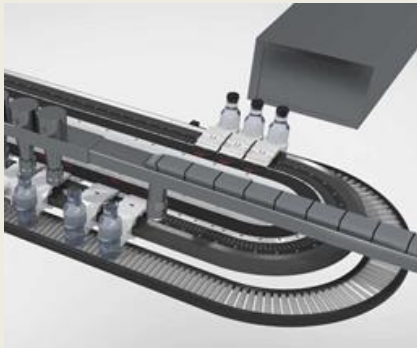


SAP Plant Connectivity

SAP can handle both....what does customer need?

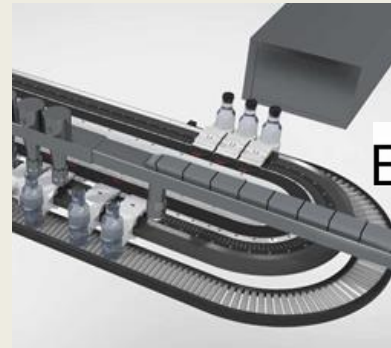
## Individual assets

- Only easy pick & place
- No high speed coordinated actions master slave coupling etc



## Smart assets

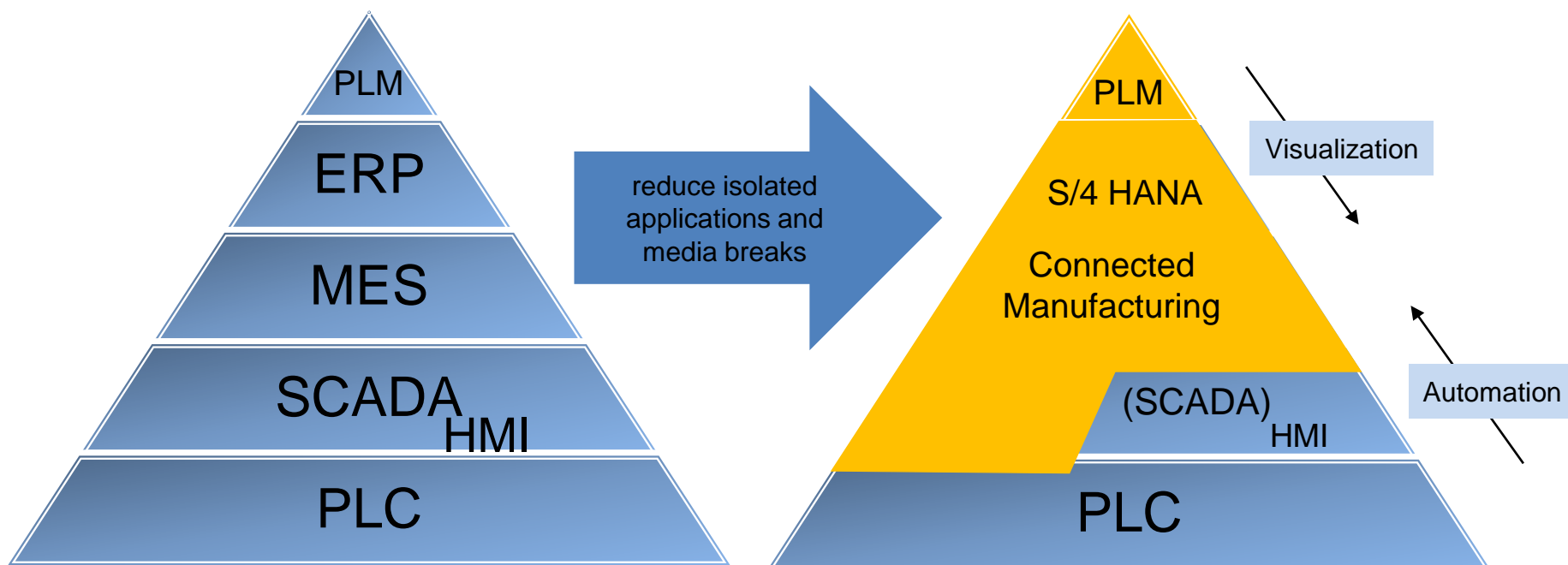
- Internally combined functionality
- High speed coordinated actions on the flyer pick & place etc



EtherCAT®



## SAP Reshapes Automation Pyramid for simplified system landscape



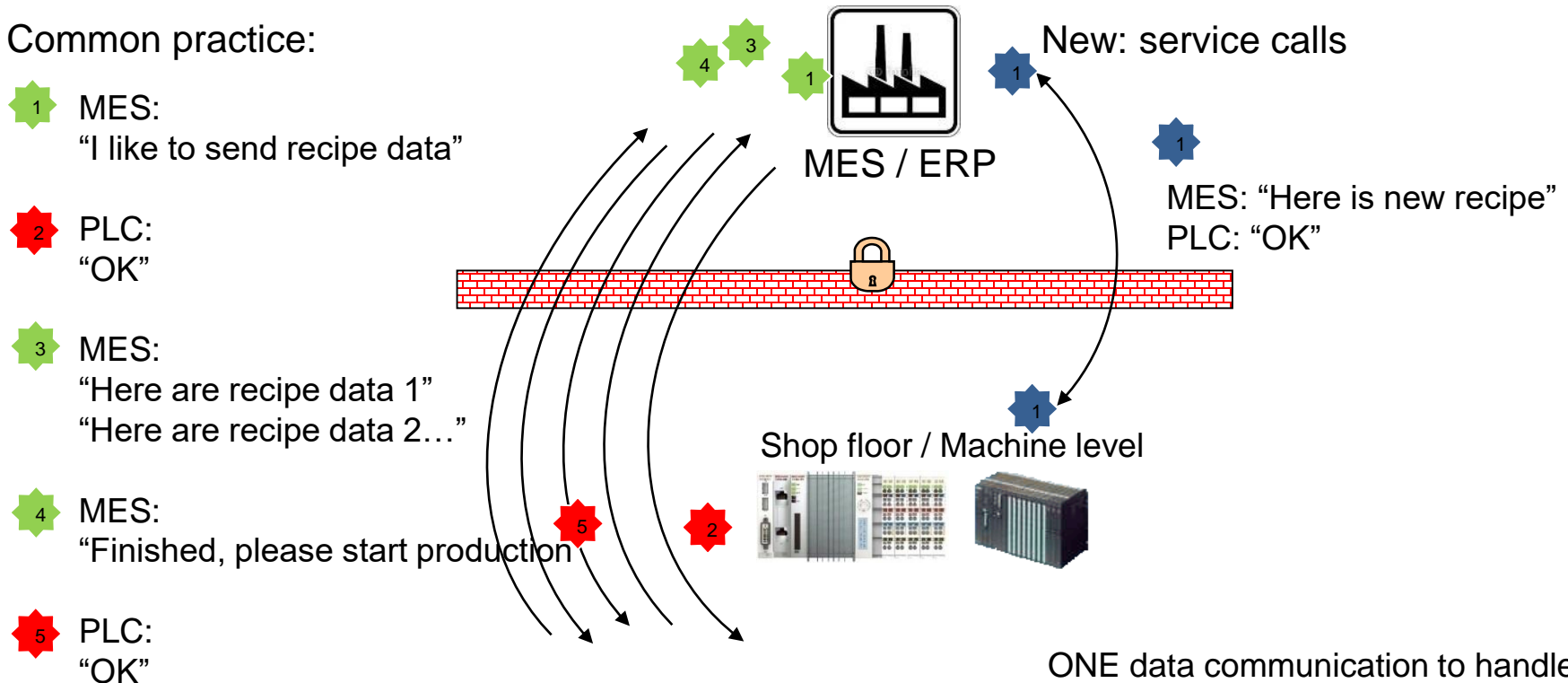
Public

# SOA-PLC: IEC 61131-3 and OPC-UA

## Increase efficiency and data consistency

- ▶ SOA-controller as enabler for IoT and M2M optimized communication  
Service oriented architecture: service calls instead of data (property) exchange

Common practice:



Time consuming handshake mechanism

Increase efficiency

- ONE data communication to handle
- secure transport of inputs
  - code execution and wait on result
  - transport of outputs to caller

# OPC UA for AutoID



Association for Automatic  
Identification and Mobility

## Simplifying the integration of AutoID systems



Association for Automatic Identification and Mobility



OPC-UA provides the fast, secured, manufacturer independent  
and standardized communication interface for AutoID devices

Interoperability:  
From Smart Devices to IT-Cloud



Within just one year:

- Specification +
  - Release Candidate +
  - Prototyp implementation
- Demo on Hanover show 2015

Release at Hanover Messe 2016

Youtube:

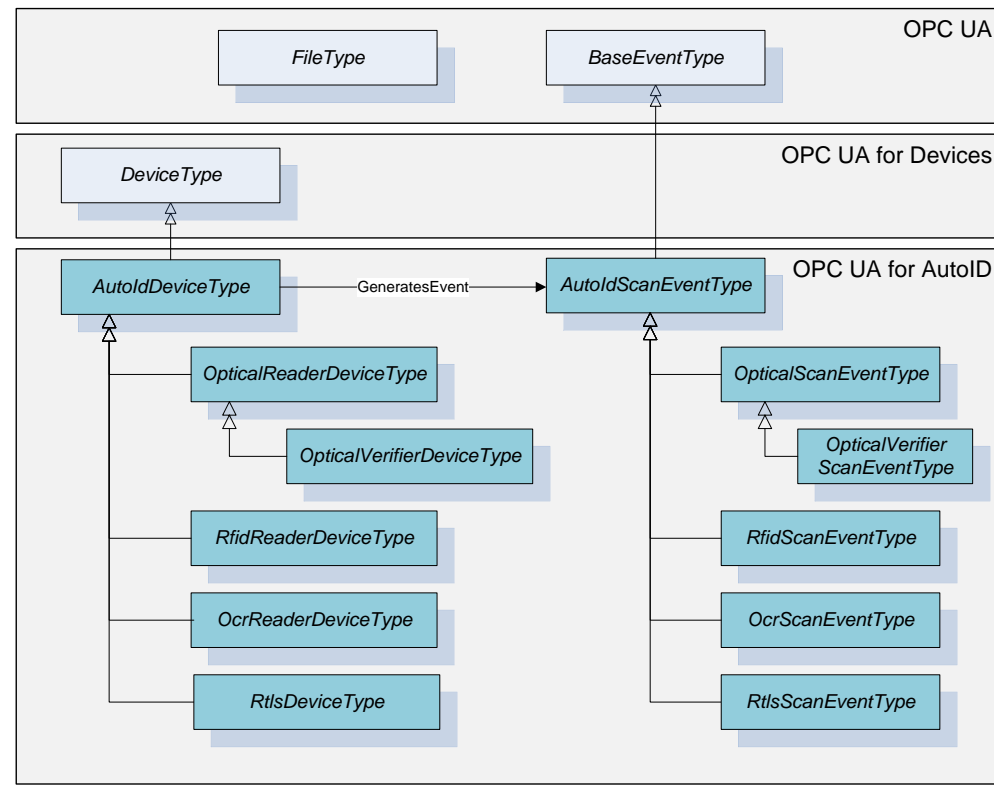
- Wolf R. Hansen, AIM-D  
<https://youtu.be/8JL7ECkMkko>
- Markus Weinländer, Siemens  
[https://youtu.be/O\\_rppDIjWz4](https://youtu.be/O_rppDIjWz4)
- Olaf Wilmsmeier, HARTING  
<https://youtu.be/yktzBFKoy6A>



# SoA: AutoID Companion Specification

**OPC UA: One communication standard for the whole AutoID world**

- ▶ RFID
- ▶ OCR
- ▶ Optical (1D/2D barcode)
- ▶ RTLS

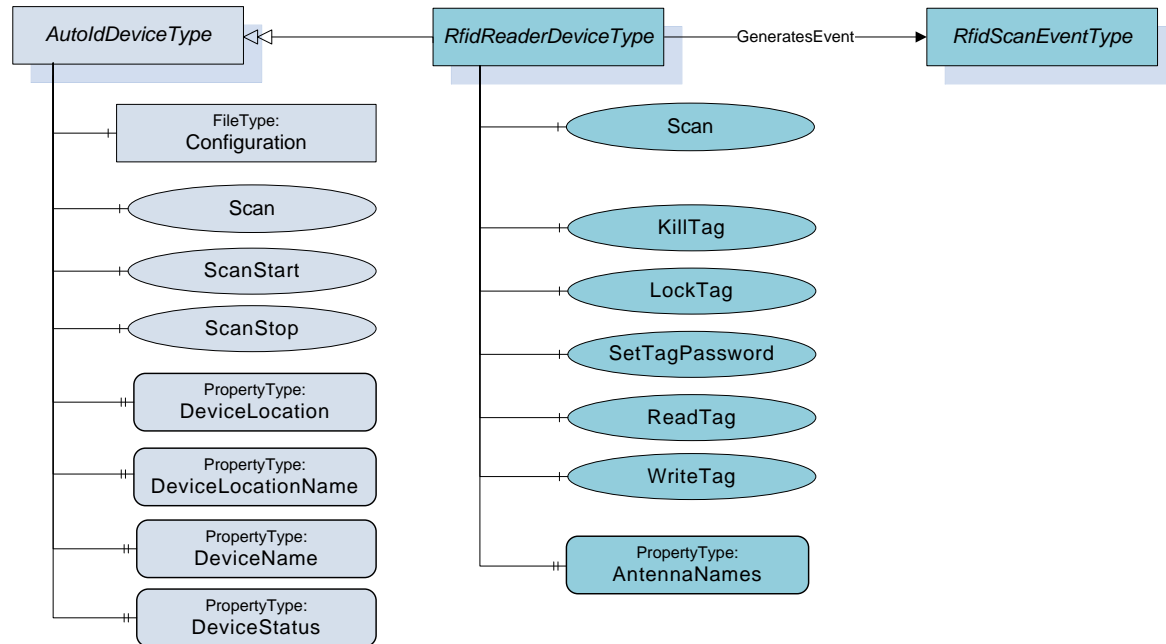




# SoA: AutoID Companion Specification

## Example: RfidReaderDeviceType

RFID Reader provide Services like Scan, ReadTag, WriteTag, ...





# OPC UA: M2M success stories

## Success stories

<https://opcfoundation.org/resources/case-studies/>

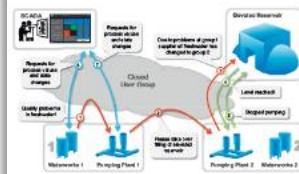
**M2M :** horizontal device to device communication in water treatment  
**IoT:** Energy monitoring & vertical from sensor up into IT cloud

## Water treatment



### Intelligent Water Management with OPC UA Enabled Smart Devices

M2M Communication Based on PLCopen OPC UA Client Function Blocks



Decentralized, independently acting embedded controllers can form an intelligent network for the control of potable water and wastewater plants. OPC UA is the ideal technology to establish secure and standardized M2M interaction at these plants.

The movement toward the 4th industrial revolution, or Industry 4.0, is gaining momentum in a wide range of industries, and water treatment can now be counted as an application example. It regards some of the industry 4.0 initiatives' basic concepts, such as platform and vendor-independent communication, data security, standardization, decentralized intelligence and engineering, then a technology for M2M (Machine-to-Machine) or IoT (Internet of Things) applications is already available in the OPC Unified Architecture (OPC UA).

OPC UA is used for M2M communication between plants for the intelligent networking of decentralized, independently acting, very small embedded controllers. For example, an application with the Joint Water and Wastewater Authority, Vogtland (JWWA) has around 300 potable water plants and 200 wastewater plants (pumping plants, waterworks, elevat-

ed reservoirs, etc.) distributed over 1,600 km<sup>2</sup> and covering 40 cities with 240,000 people.

Real objects (e.g. pumps) were modeled in the TwinCAT IEC 61131-3 PLC software from Beckhoff Automation as complex objects with interactive possibilities; thanks to the OPC UA server integrated in the controller, these objects are automatically available to the outside world as complex data structures for semantic interoperability. The result is decentralized intelligence that makes decisions independently and can transmit information to neighboring systems. In addition, it can query equipment status and values for its own process in order to ensure trouble-free process cycles.

With the standardized PLCopen function blocks, the devices independently initiate communication from the PLC to other process devices such as OPC UA clients, while at the same time being able to respond to their requests or to requests from higher-level systems (SCADA, MES, ERP) as OPC UA servers.

The devices are connected by wireless routers; a physical interruption of the connection does not lead to a loss of information, since information is automatically buffered in the OPC UA server for a time and can be retrieved as soon as the connection has been restored – a very important property in which a great deal of proprietary engineering effort was invested beforehand. The authentication, signing, and encryption security mechanisms integrated in OPC UA were used in addition to a cloud mobile radio group to ensure the integrity of this party-sensitive data.

The vendor-independent interoperability standard OPC UA opens up the possibility for end users to subordinate the selection of a target platform for the required technology in order to avoid using proprietary products or devices that don't meet the needs of the application.

### Testimonial: Licensing Costs Reduced by 90%

The replacement of a proprietary solution with a combined OPC UA client/server solution in small, but powerful embedded controllers provided JWWA with savings in the initial licensing costs of more than 30 % per device. Among the service assignments in the field results in significant additional savings for maintaining several hundred water facilities within an area of 1,600 km<sup>2</sup>.

For the engineering part, better standardization results in:

- Efficient engineering
- Cost reductions
- Reuse of technology/equipment
- Improved transparency
- Increased availability
- Increased choice of providers
- Higher interoperability

The considerable potential for business management optimization is more than worth putting together existing and new technologies.



Steve Nitz, Chairman Manager Electrical Process Technology, Joint Water and Wastewater Authority, Vogtland  
s.nitz@jwwa.de

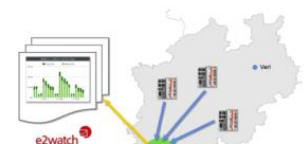
## Energy Monitoring



### Smart Metering with OPC UA Enabled Intelligent Devices

Embedded Controller with Integrated PLCopen OPC UA Client Collects and Pushes Data to the Cloud

For optimal energy management of municipal buildings, it is necessary to be as informed as possible via rapid-response energy monitoring systems to report consumption of water, electricity, and heat. The region around the city of Aachen, Germany, together with their premises management and the IT service provider, regio IT, has therefore introduced e2watch®, which is based on advanced data logging technology from Beckhoff.



The data logger collects measurement data, which is first buffered locally, and then the information is synchronized on configurable time points with a cloud-based Microsoft SQL database from which they flow into a Big Data Management (BDM) system. There it is evaluated, and various post-processings are applied. Detailed energy consumption reports are available via a convenient web portal.

Operations, owners, and even residents of those real estate properties have access to the dedicated statistical analysis results. In particular, the building users can be kept better informed in this way for more economical and environmentally-friendly use of energy resources. The building manager can also use an internal work area for detailed analysis and alarm messages and, as a result, correct errors or adjust for additional consumption faster than before. The system can also track the compliance of energy conservation requirements. With this feature-filled technology, regio IT customers are also able to recognize and respond to emergency conditions like water pipe breaks much faster.

regio IT's customer, the city of Aachen (Germany) connected as of today around 170 facilities to e2watch®. This includes schools, day care centers, office buildings, sports halls, swimming pools, sports facilities, museums and commercial spaces, and the monitoring of 11 million kWh of electricity, 237 TWh water and 53 million kWh of heat. The connected buildings represent a total of approximately 1,000 data points that are collected in (configurable) 15-minute intervals. This means the immense amount of information of about 100,000 records per day.

The customer potential for BDM solutions like e2watch from regio IT is obvious and can be applied for a wide variety of markets. The collection, buffering, and forwarding of data are everyday tasks, required in countless applications. The data logger uses the standardized PLCopen OPC UA client function blocks. This enables the intelligent device to actively initiate secure communications and push collected information into the cloud as well as retrieve configuration data, i.e. the transmission of the collected information to the cloud occurs after a configurable time. OPC UA with its standardized access and integrated security mechanisms is the perfect data transport layer for these types of applications.

### More efficiency, security, and flexibility through standards

This kind of application strongly requires standardized and secure communication because data is being transmitted through the Internet. The obvious choice was to create the application based on the international standard IEC 62541 – OPC UA. Each data logger initiates the data communication itself, so the data logger needs to act as an OPC UA client.

As the underlying programming language, IEC 61131-3 provides an approved international programming standard, enabling the development of object-oriented programs for more efficient and maintainable program code.

TwinCAT 3 software and PC-based control from Beckhoff offer not only substantial benefits during application develop-

ment via object-oriented programming, but they also provide a ready-to-use OPC UA server and client which is based on the standardized PLCopen OPC UA client function blocks.

Each data logger configuration is preset in the web portal of e2watch. This configuration is retrieved from the data loggers for self-configuration.



Peter Fischer, Product Manager der regio IT GmbH  
vertrieb@regio-it.de

# Devices / machines will differentiate by functionality

## Commercial printers

- Different vendors
- Standardized connectors  
USB / Ethernet
- Support profiles “I am a printer”



- Differentiate by functionality
  - All-in-once scan/fax/print?
  - Double side printing?
  - Color? Combined or separate?
  - Print speed
  - Print costs
  - Easy to handle and interact

## Industrial devices / machines

- Different vendors
- Standardized connector: OPC UA
- Support profiles “I am an RFID reader”
- Build in security



- Differentiate by functionality
  - Reduce engineering costs
  - Support standards
  - Easy network integration
  - Costs
  - Throughput of machine
  - ....

# Semantic Modelling

OPC Unified Architecture: enables Semantic Modelling

OPC Foundation collaborations with organizations and domain experts

- ▶ OPC UA defines HOW
- ▶ Domain experts define WHAT

## Companion Information Models

PLCopen, ADI, FDI, FDT, BACnet, MDIS, ISA95,  
AutomationML, MTConnect, AutoID, VDW,  
IEC 61850/61400, ODVA/Sercos and more coming

## Built-in Information Models

## OPC UA Meta Model

# Semantic Modelling

## Collaborations

The OPC Foundation closely cooperates with organizations and associations from various branches. Specific information models of other standardization organizations are mapped onto OPC-UA and thus become portable.

PLCopen  
for efficiency in automation

BACnet  
INTEREST GROUP EUROPE

m2m  
STANDARDS

AVM  
Network for Automation  
Value-adding, Identification and Real-time

MES  
DACH  
The International  
Manufacturing Enterprise Standard

ISA

FDI  
COOPERATION

FDI  
Group

OMAC  
The Organization for Machine  
Automation and Control

MDIS

energistics

MT  
Connect

OPC UA™

EUROMAP

VDMA

<AutomationML>

W3C

CiA

CLPA  
CONCEPTS  
FOR  
LARGE  
PLANT  
AUTOMATION

EtherCAT  
Technology Group

IO-Link

INDUSTRIAL  
DATA SPACE e.V.

ODVA

PI  
Pneumatics - Proportional

ETHERNET  
POWERLINK  
Standardization Group

SERCOS  
international

OPC  
FOUNDATION

# OPCF Collaboration with VDMA

## **“VDMA & OPC UA” brochure**

- **08.07.2016 Kick Off at Frankfurt VDMA**
- **Companies participating by invitation only**
  - **BECKHOFF / KUKA / BOSCH-Rexroth /  
SAP / FESTO / Pepperle & Fuchs / Lenze  
OPC Foundation**
- **Goal**
  - **Provide a joined „VDMA & OPCUA brochure“ till Hanover messe 2017**
  - **Meet „Language of VDMA members“**
  - **Available in German and English language – available worldwide**



# PubSub Prototyping

- ▶ Sub-Group of UA WG
- ▶ Kick-off on June 8, 2015
- ▶ Over 70 WG members
- ▶ Wireshark available
- ▶ First demo finished



## OPC UA Pub/Sub

Enhancement OPC-UA via UDP / AMQP / ...  
Optimized for Cloud and Sensor Networks

**Early adopters**

BECKHOFF, Rexroth, Honeywell, IBHsoftec, RTA, softing, SICK, Unified Automation

OPC UA Pub/Sub

OPC UA Pub/Sub is a new OPC UA specification for real-time data exchange between industrial machines and the cloud. It is optimized for cloud and sensor networks and supports various communication protocols like UDP, AMQP, MQTT, and REST.

Key features include:

- Testimonials
- Technology
- Collaboration
- Success Stories
- Getting Started

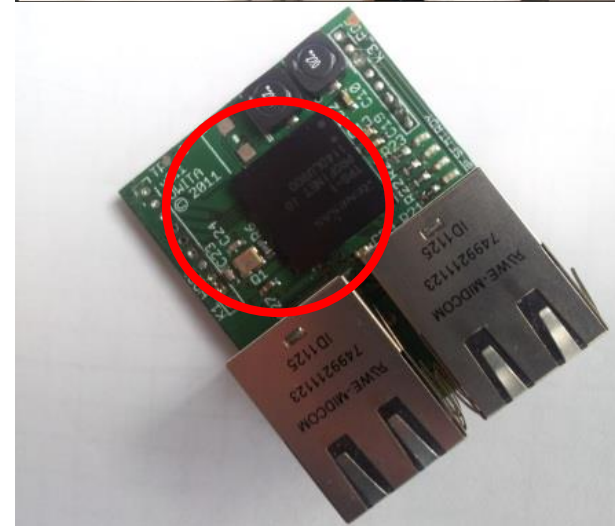
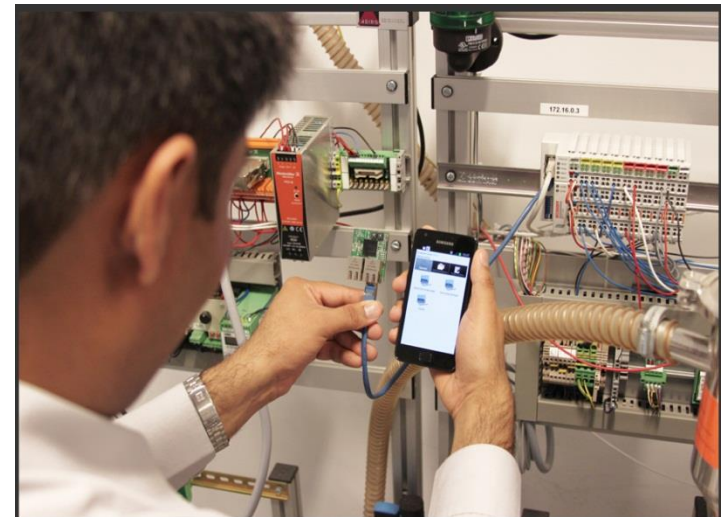
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# OPC-UA at Chip Level: Software

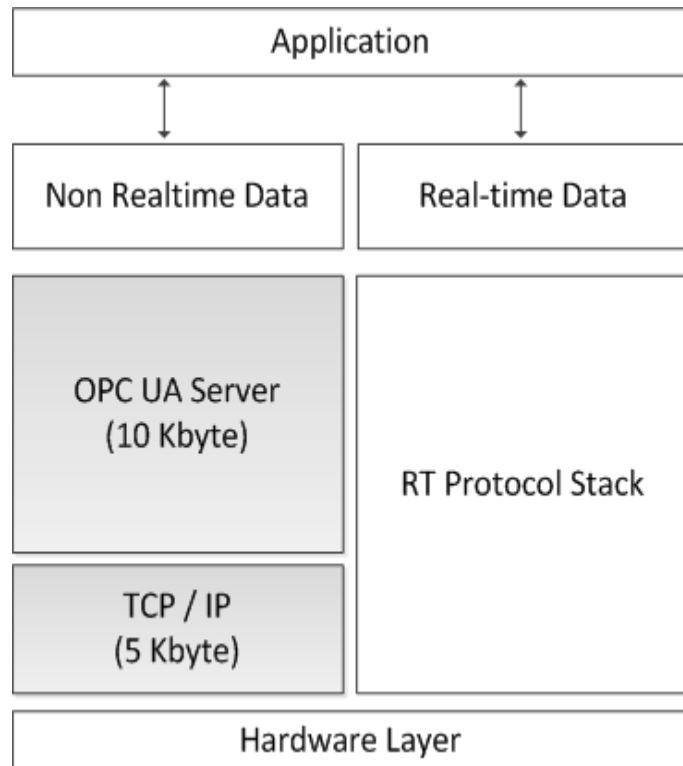
OPC-UA at Chip Level enables Internet of Things

- ▶ One of the smallest OPC-UA server that makes software integration easy for the simplest devices in the Internet of things.
- ▶ Ported into very resource limited devices such as a sensor integrated with a communication interface, and communicate directly for vertical integration.
- ▶ Platform specification:
  - TPS-1 Chip, ARM9@100MHz
  - Available memory < 64 Kb
  - Operating system: EmbOS
  - Connectivity: Ethernet (two port switch and non real-time TCP/IP channel parallel with a real-time channel)



# OPC-UA at Chip Level: Software

OPC-UA at Chip Level enables Internet of Things



- ▶ OPC UA Services
  - Nano Embedded Device Server Profile
  - Read, Browse
- ▶ OPC UA Information Model
  - Simple sensor data
  - Basic device information
- ▶ Footprint (15 Kbyte)
  - OPC UA Stack: 10 Kbyte
  - Micro TCP/IP stack: 5 Kbyte

# Trend: OPC UA on chip level

- ▶ 2016: Commercial product OPC UA in chip



Hilscher

IoT-Enable Devices  
with Hilscher's netIC  
IOT; Multiprotocol,  
Secure Boot, OPC UA,  
MQTT

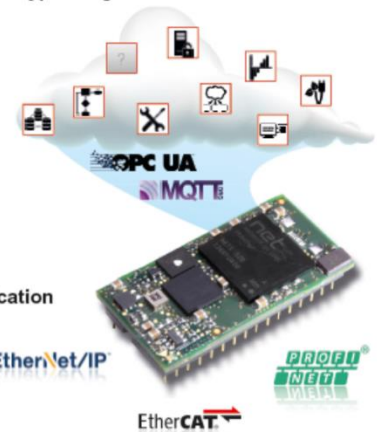
LEARN MORE



- Intelligent multiprotocol module for field devices
- IoT communication via OPC UA and MQTT bypassing the PLC

- Central „build process“ with intelligent engineering tool
- Protocol independent object interface to the application

- Customized device description file & source code for integration into the application



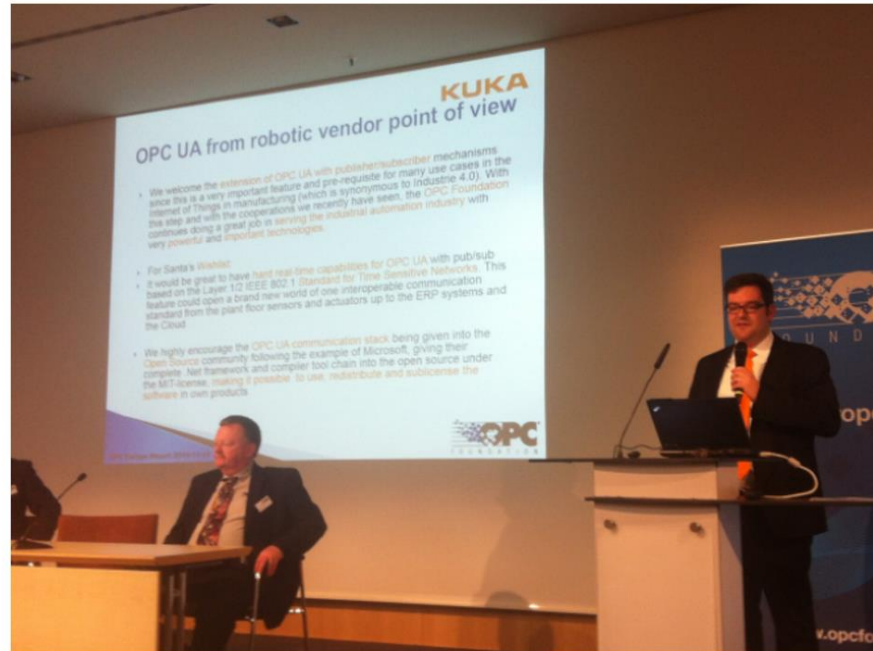


# OPC UA TSN: The starting point

- ▶ **2014 Press Conference SPS/IPC Drives**

## History & Call For Action

- ▶ **Nov. 2014:** KUKA communicates the Pub/Sub, Real-time and Open Source requirements to OPC UA on the SPS/IPC/Drives OPC F press conference
- ▶ **Jan. 2015:** KUKA joins the OPC F
- ▶ **Feb. 2015:** KUKA talks to several companies represents regarding feedback for this initiative
- ▶ **Mar. 2015:** KUKA in Augsburg hosts a kick off meeting for this initiative
  - Support of ca. 20 companies
- ▶ **May 2015:** The OPC Foundation invites their members to the pub/sub and TSN workshop kick off meeting on **June, 8th. Get involved!**



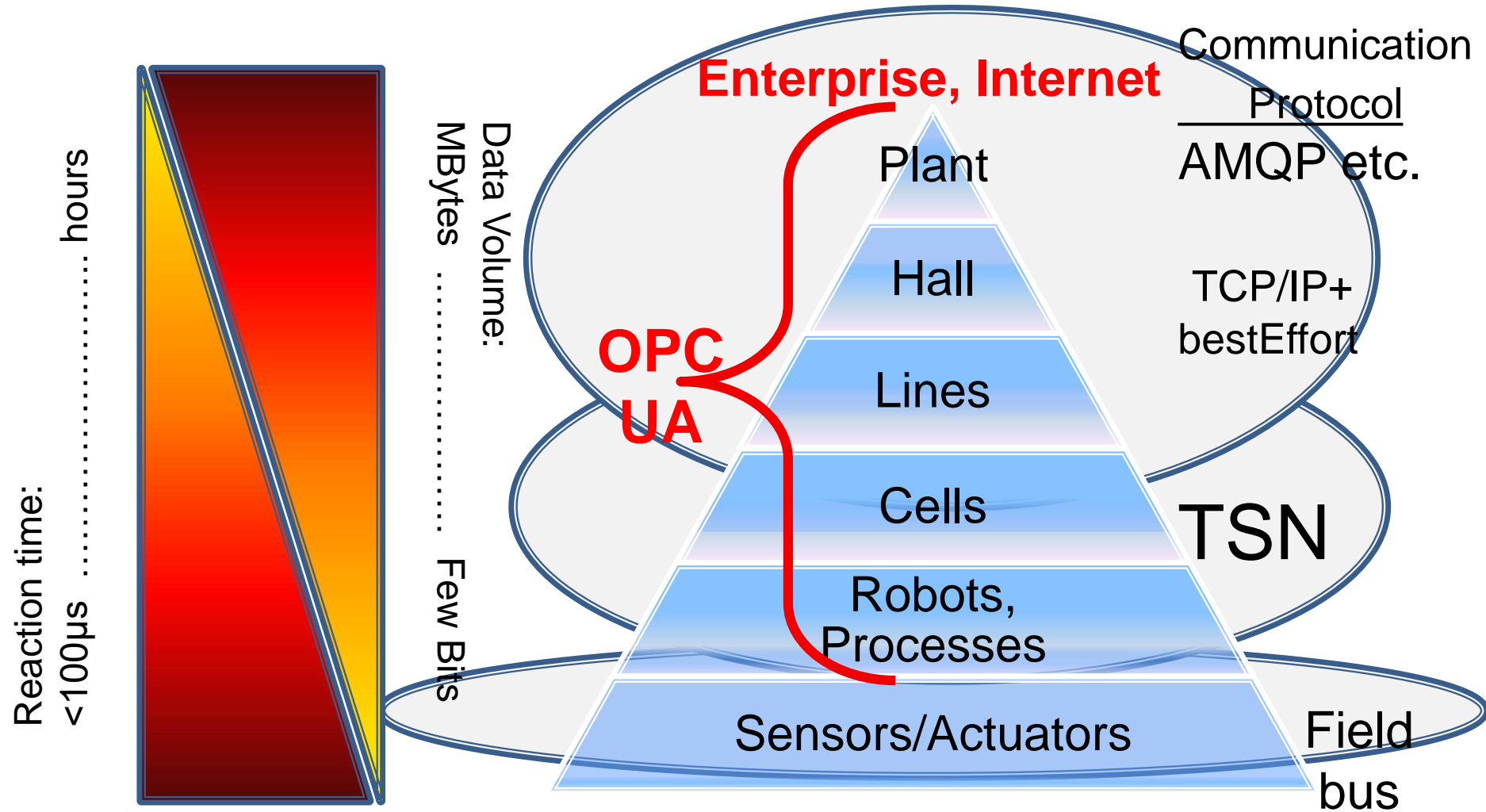


# OPC UA TSN: Workgroup Members

## ▶ 81 (!) participants from 33 companies

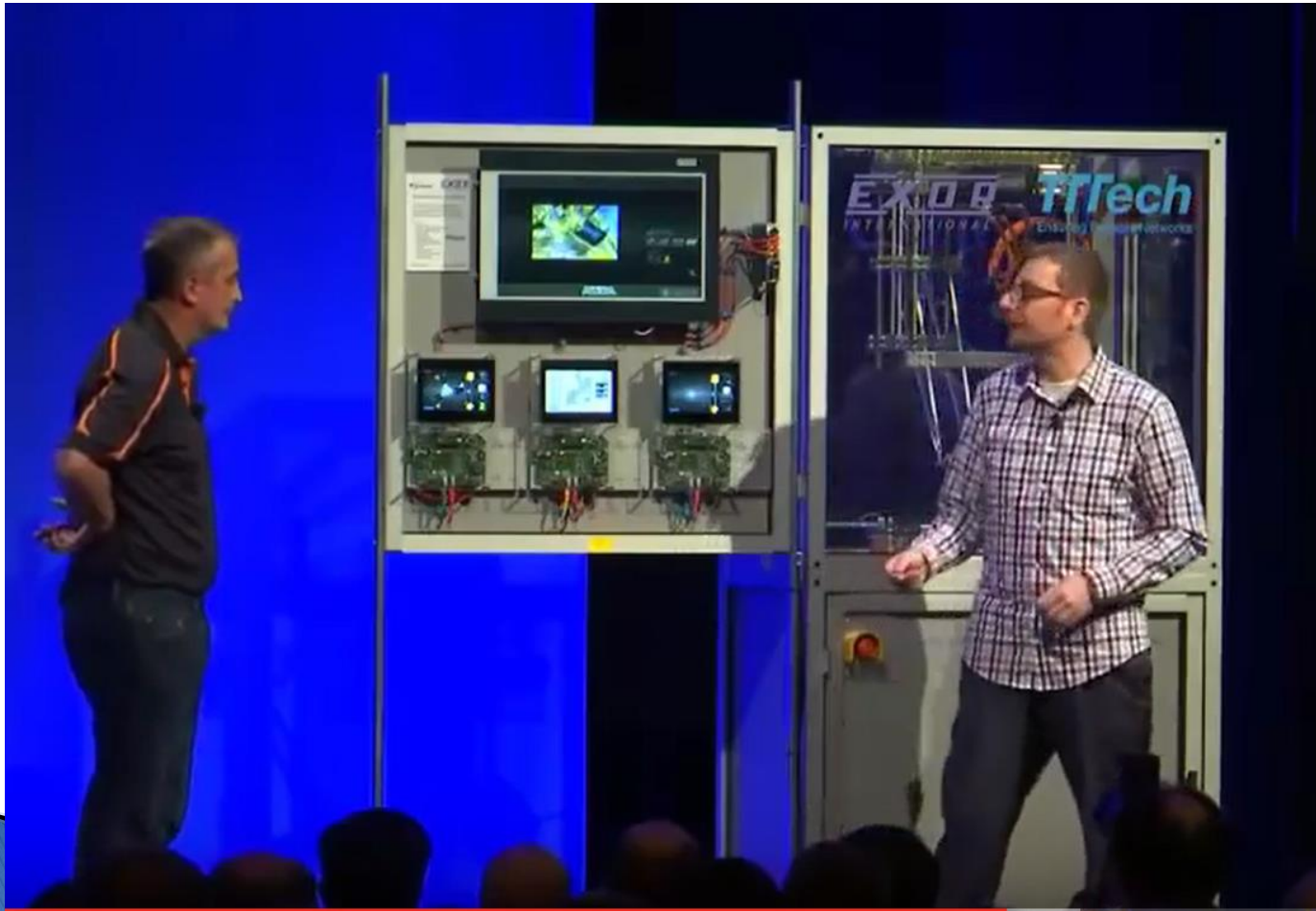
- ▶ - ABB
- ▶ - ascolab
- ▶ - Beckhoff
- ▶ - Beeond, Inc.
- ▶ - Belden
- ▶ - B&R Industrie-Elektronik
- ▶ - Bosch Rexroth
- ▶ - Cisco
- ▶ - Fraunhofer-Anwendungszentrum Industrial Automation (IOSB-INA)
- ▶ - GE Global Research
- ▶ - GE Intelligent Platforms GmbH
- ▶ - HARTING Electric GmbH & Co. KG
- ▶ - Hilscher
- HMS Networks
- Innovasic
- Institute Industrial (inIT)
- ISW Uni-Stuttgart
- KEBA AG
- KUKA Roboter
- Mitsubishi Electric
- National Instruments
- PHOENIX CONTACT Electronics GmbH
- Robert Bosch GmbH
- Schneider Electric
- SICK AG
- Siemens
- Softing
- TU Wien, Institut für Rechnergestützte Automation
- TTTech
- VTT Techn. Research Centre of Finland
- WAGO
- Yokogawa
- 4CE Industry

# TSN and OPC UA in the context of Automation



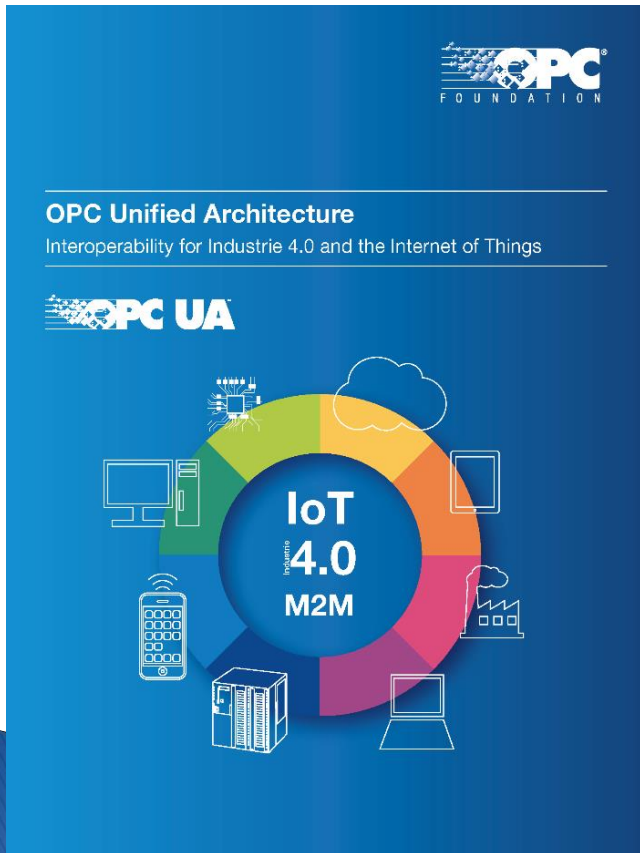
# OPC UA & TSN in Intel Key note

- ▶ IDF 2016: Intel CEO Brian Krzanich with Demo with Exor & TTTech (at 38min)
- ▶ <https://www.youtube.com/watch?v=Psd2JKu0PSw>



# OPC UA - Brochure

- ▶ Brochure: “Interoperability for Industrie 4.0 and the Internet of Things”
- ▶ Print & online version available in English / German / Chinese / Japan  
<https://opcfoundation.org/resources/brochures/>



- ▶ Testimonials
- ▶ Technology
- ▶ Collaboration, Semantic Modelling
- ▶ Success Stories
- ▶ Getting Started

# OPC Foundation: Vision



**OPC Foundation in the transition...**

**From “Interoperability Standard for Industrial Automation”**

**To “The Industrial Interoperability Standard”**

**... on the way to additional markets**





# Industrial IoT Adoption / Trends / Vision

**OPC Day Finland 18.10.2016**  
**hosted by BECKHOFF Finland**



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