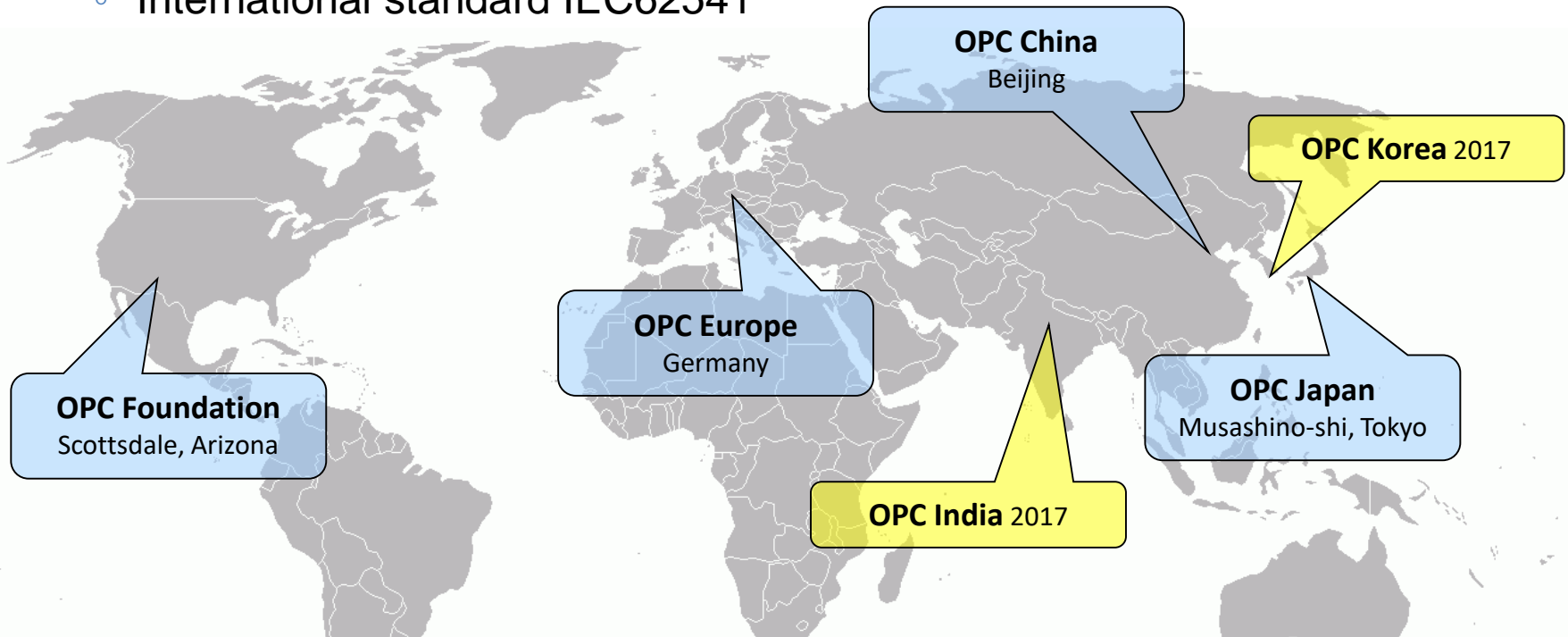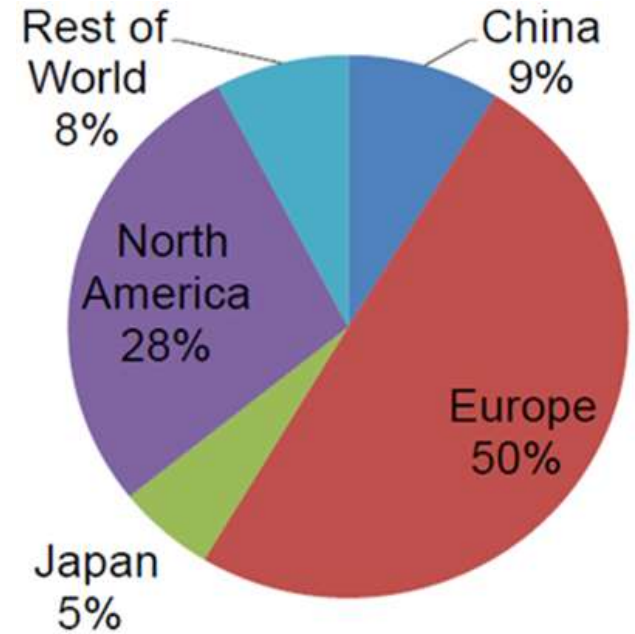# OPC Unified Architecture Adoption and Trends

Stefan Hoppe
Vice President OPC Foundation
Stefan.hoppe@opcfoundation.org

OPC Foundation

- ▸ Vision
  secure, reliable, multi-vendor,
  multi-platform, multi domain
  interoperability from sensor to enterprise

- ▸ International
  - ◦ Companies from Automation & IT
  - ◦ International standard IEC62541

Rest of World 8%
China 9%
North America 28%
Europe 50%
Japan 5%

OPC China
Beijing

OPC Korea 2017

OPC Europe
Germany

OPC Foundation
Scottsdale, Arizona

OPC Japan
Musashino-shi, Tokyo

OPC India 2017

Board of Directors Expansion

Matt Vasey
Director of IoT Business Development, Microsoft

OPC Foundation: Board of Directors

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

North America

Japan

Europe

OPC Foundation: New class A members 2016

OPC Foundation: OPC Korea

Tom Burke (OPC), Byunghun Song, Soojin Ji (KETI), Stefan Hoppe (OPC)

New OPC Certification Program

- ▶ Announce new lab "OPC Foundation Europe Certification Lab" starting Jan 2nd
- ▶ Announce the new non-member test options
  - ◦ Operated by company Allmendinger, Germany
  - ◦ Certification of products
  - ◦ Script extensions of CTT for companion specs

Tom Burke (OPC), Jörg Allmendinger

OPC UA in the world

IIC

Industrie4.0

China2025

North America: Industrial Internet Consortium Listing OPC UA and other protocols

Industrial Internet Reference Architecture

- **OPC UA listed**

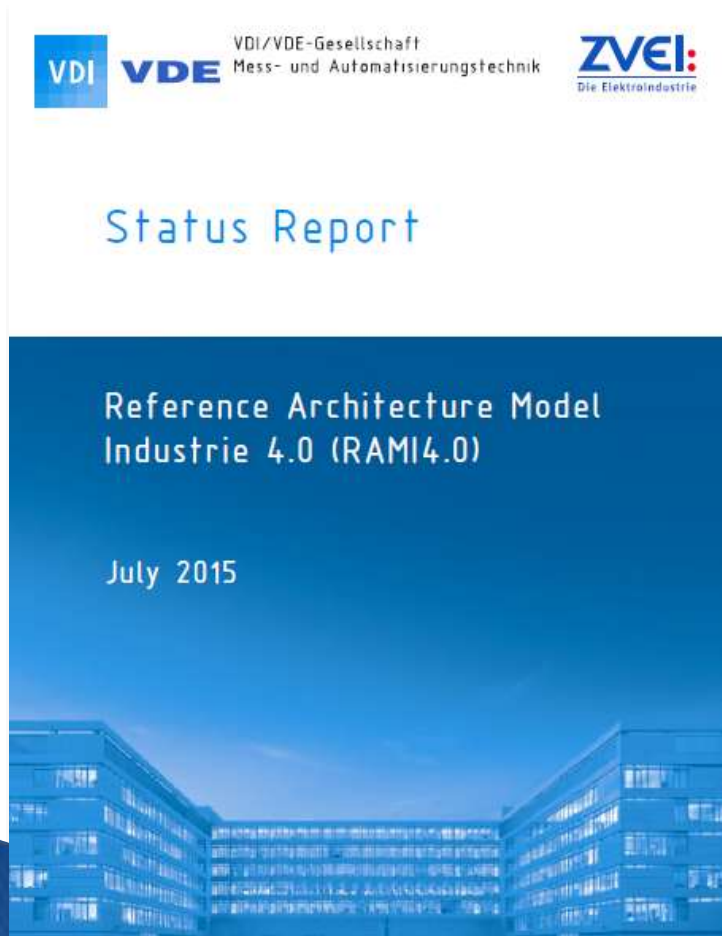9.2.2   SECURITY IN REQUEST-RESPONSE AND PUBLISH-SUBSCRIBE COMMUNICATIONS

Two common patterns in IIS communications are request-response and publish-subscribe. The request-response pattern is common in industrial systems. Examples of the implementation of this pattern include Java Remote Method Invocation (Java RMI) [6], Web Services/SOAP [7], RPC-over-DDS [8], RESTful Servers, OPC [9], Global Platform Secure Channel Protocol and Modbus [10]. As the protocols of this pattern vary in degrees of support for security, they should be independently and carefully evaluated with regard to confidentiality, integrity and availability requirements. As an example, Modbus, a popular application-level fieldbus protocol within industrial systems, lacks support for authentication and encryption, and does not provide message checksums, and lacks support for suppressing broadcast messages.

- **Today 3 testbeds with integrated OPC UA**

  - **OPC UA + TSN in Manufacturing**
  - **OPC UA Sensor in Brownfield environment**
  - **OPC UA and AutomationML for factory**

German Industrie 4.0 recommends OPC UA

http://www.zvei.org/Downloads/Automation/5305 Publikation GMA Status Report ZVEI Reference Architecture Model.pdf

VDI **VDE** VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik **ZVEI:** Die Elektroindustrie

Status Report

Reference Architecture Model Industrie 4.0 (RAMI4.0)

July 2015

- 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)

OPC UA: Security analyzed

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: German version available on BSI web and OPC web

English version available Feb 2017

Sicherheitsanalyse OPC UA

25.04.2016

Bundesamt
für Sicherheit in der
Informationstechnik

China National Standard

▸ TC124 has held first OPC UA GB certification working group meeting in October 2016

▸ The first OPC UA related standard will be released:
  ◦ 20090699-T-60   Part 1: Overview and Concepts
  ◦ 20090700-T-60   Part 2: Security Model
  ◦ 20090701-T-60   Part 3: Address Space Model
  ◦ 20090702-T-604   Part 4: Services

▸ OPC China will fully cooperate with TC124 and drive to release this standard before the end of 2016

▸ Continue with Part 5+ in 2017

OPC Adoption!

- By the Numbers!
  - Statistics as of June 1, 2016
  - Companies building OPC products 4200+
  - Number of OPC products 35,000+
  - Number of OPC installations 47 million+

Emerson supporting OPC UA

▶ **Emerson Process Management**

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

GE supporting OPC UA

GE is supporting OPC UA

The CPE400 is a multi-core platform the runs their PLC engine, PREDIX, supports OPC UA, PROFINET, and has multiple Ethernet ports for other communications.

Users can provide due applications on a core running in Linux and support containers.

Rockwell support OPC UA

▶ **Rockwell Automation Show Nov 2016**
  Compact Logix 5480 with integrated OPC UA Server
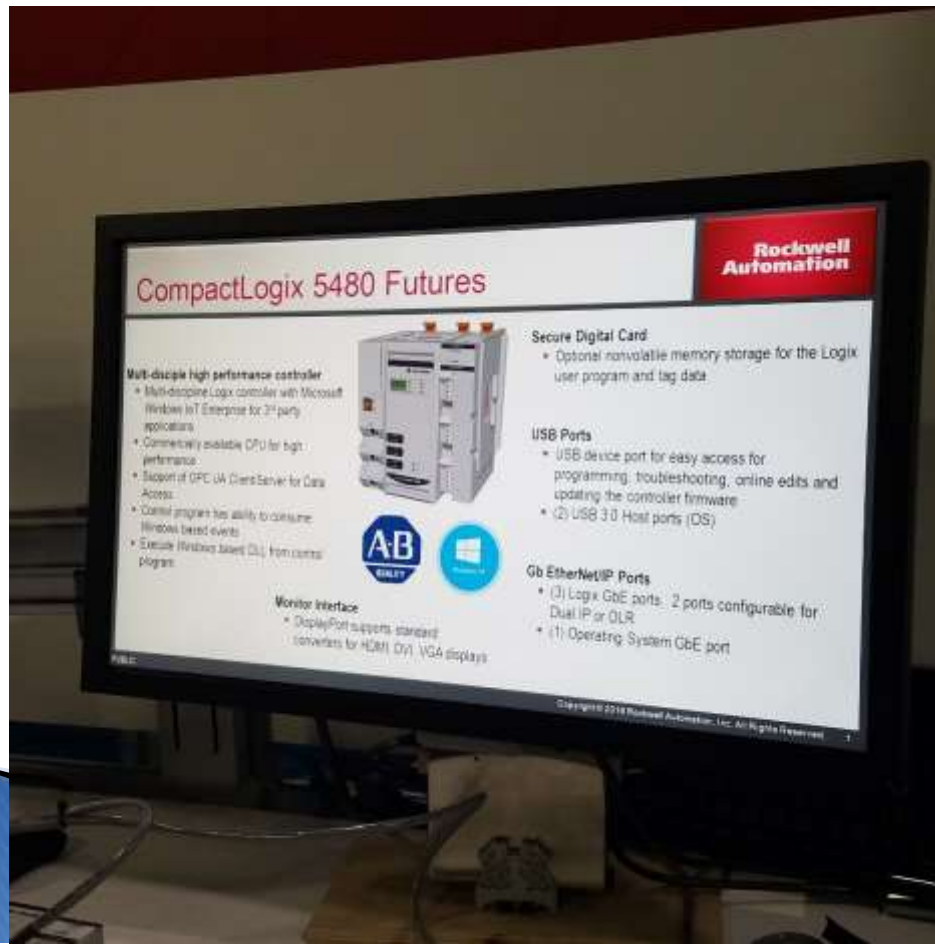
Siemens support OPC UA

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
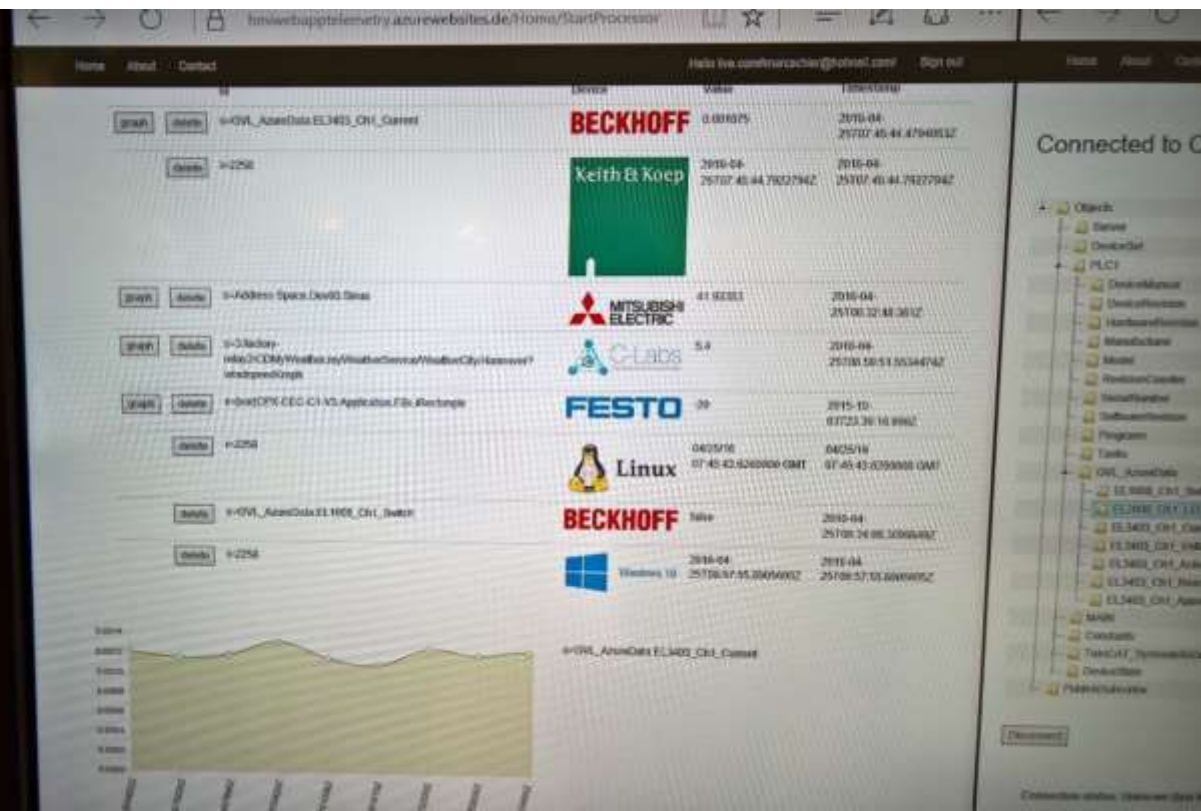
Microsoft support OPC UA

…always overcrowded…

Microsoft support OPC UA

Demo at Hannover trade show: 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

Microsoft Windows 10 listing 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
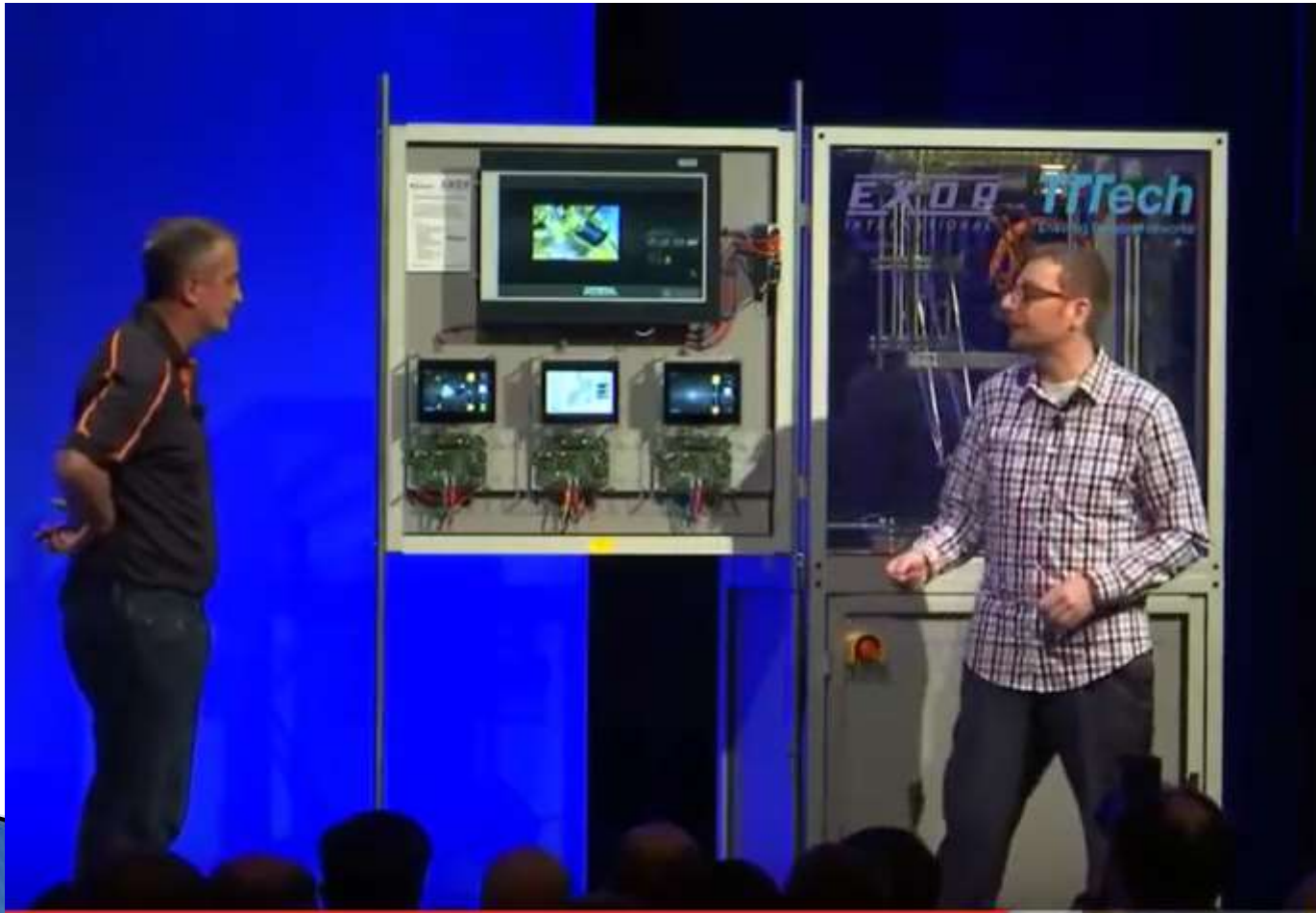- Low level BUS and hardware support

Azure Cloud Integration

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

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**

SAP: SoA Reshape Automation Pyramid Hanover Messe: Impressions

SAP Demo: The assets to make it happen
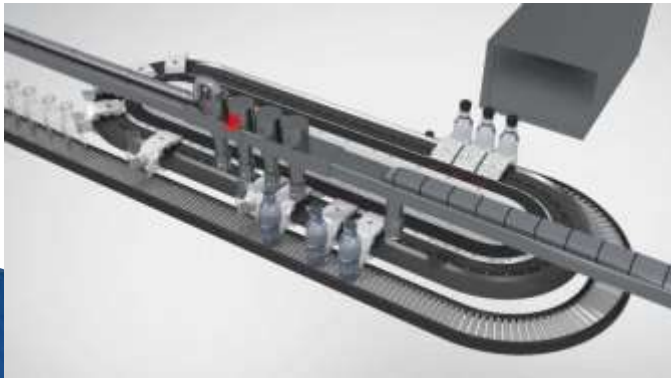
SAP HANA Cloudsystem
SAP MES

HANA

PCo (Plant Connectivity)

SAP

Cache

XTS Transport System
Beckhoff

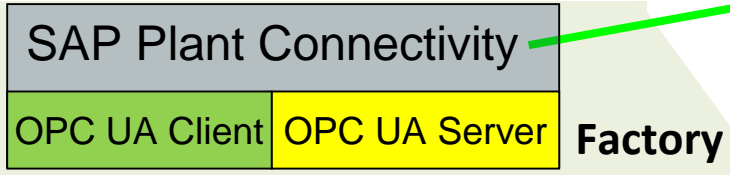Robot
Stäubli

Vision Camera
Asentics

Laser Printer
CAB

Architecture: SoA enabled by OPC UA

- Assets provide services (exposed as OPC UA Server)
- Assets can initiate actions (as OPC UA Client)
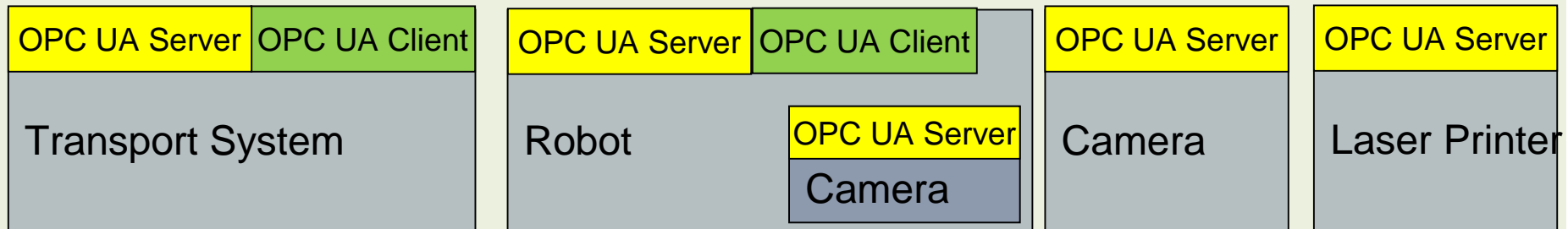   - "DoJob(OrderNr)"
    - Confirm "JobDone(OrderNr)"

SAP Data Center

SAP Plant Connectivity	
OPC UA Client	OPC UA Server

Factory

OPC UA Client / Server Communication done <u>ONLY</u> via <u>OPC UA method calls</u>

<u>(NO HANDSHAKE MECHANISM)</u>

OPC UA

Factory

OPC UA Server	OPC UA Client
Transport System	

OPC UA Server	OPC UA Client	
Robot	OPC UA Server	
	Camera	

OPC UA Server
Camera

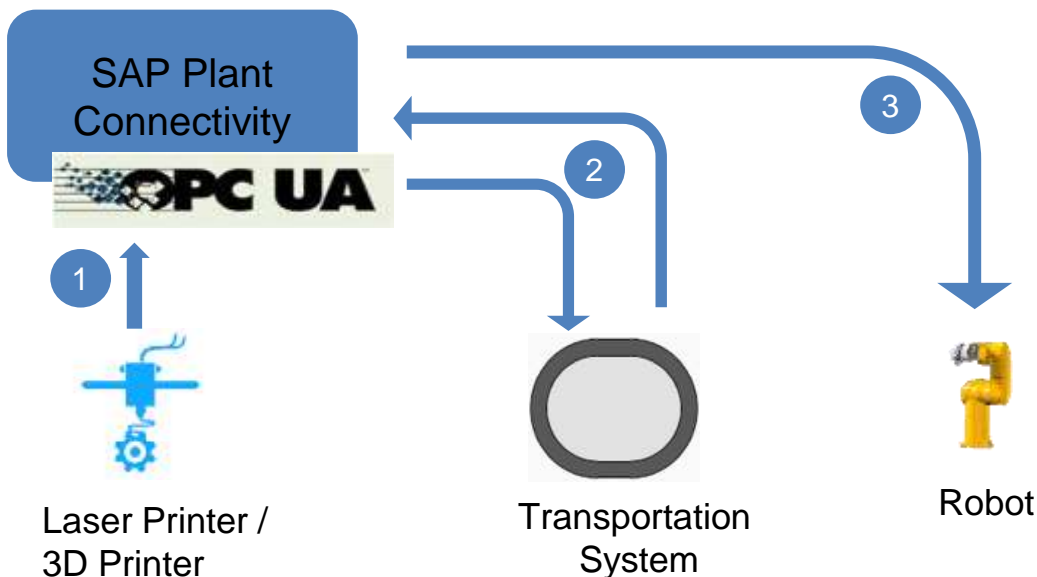| OPC UA Server |
| --- |
| Laser Printer |

SAP: SoA Reshape Automation Pyramid Orchestration & Synchronization the shop floor

Orchestration:

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

SAP Plant Connectivity

OPC UA

1

2

3

Laser Printer /
3D Printer

Transportation
System

Robot

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

OPC

FOUNDATION

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

- Asset is an intelligent device / machine providing functionality

SAP Plant Connectivity	
OPC UA Client	OPC UA Server

OPC UA Server	OPC UA Client

OPC UA Server
Camera
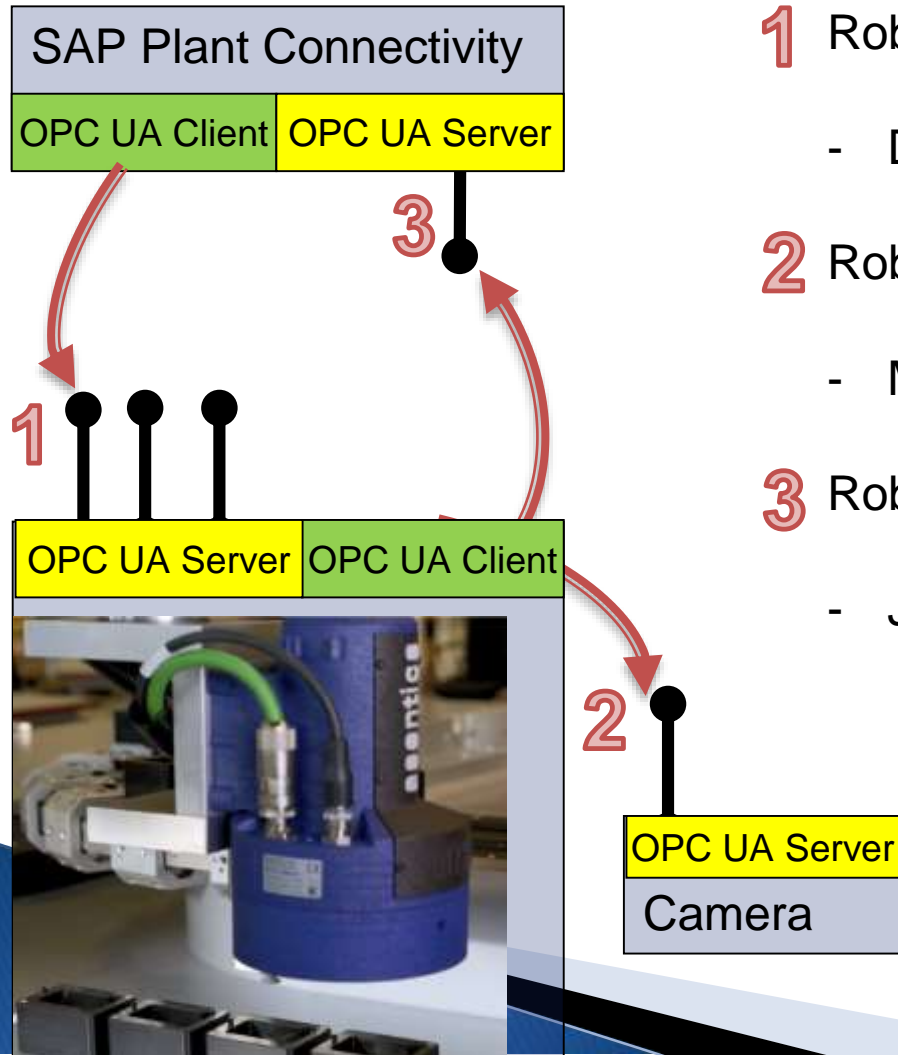
1 Robot provide functionalities:

- 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 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

Fieldbus

FOUNDATION

Member of OPC Foundation
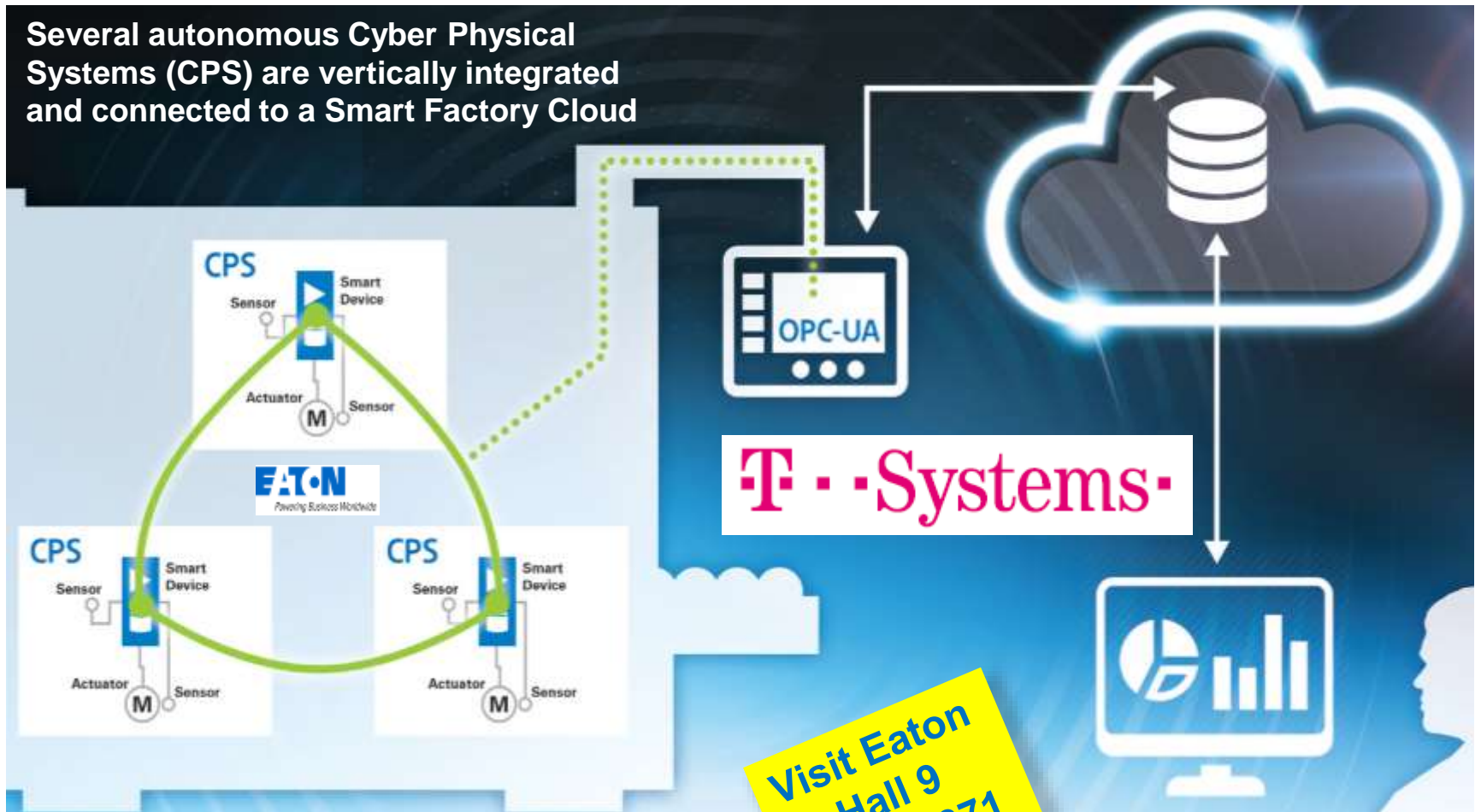
Leuze electronic member of the OPC
Foundation since September 2016

Why?
- I4.0: Exchange of data across different
  levels and in different directions

- Leuze electronic sensors provide data for
  I4.0

- Standardized model of communication is
  required

- OPC UA Key Enabler for I4.0

- OPC Foundation driving at a
  standardized communication (I4.0 context)
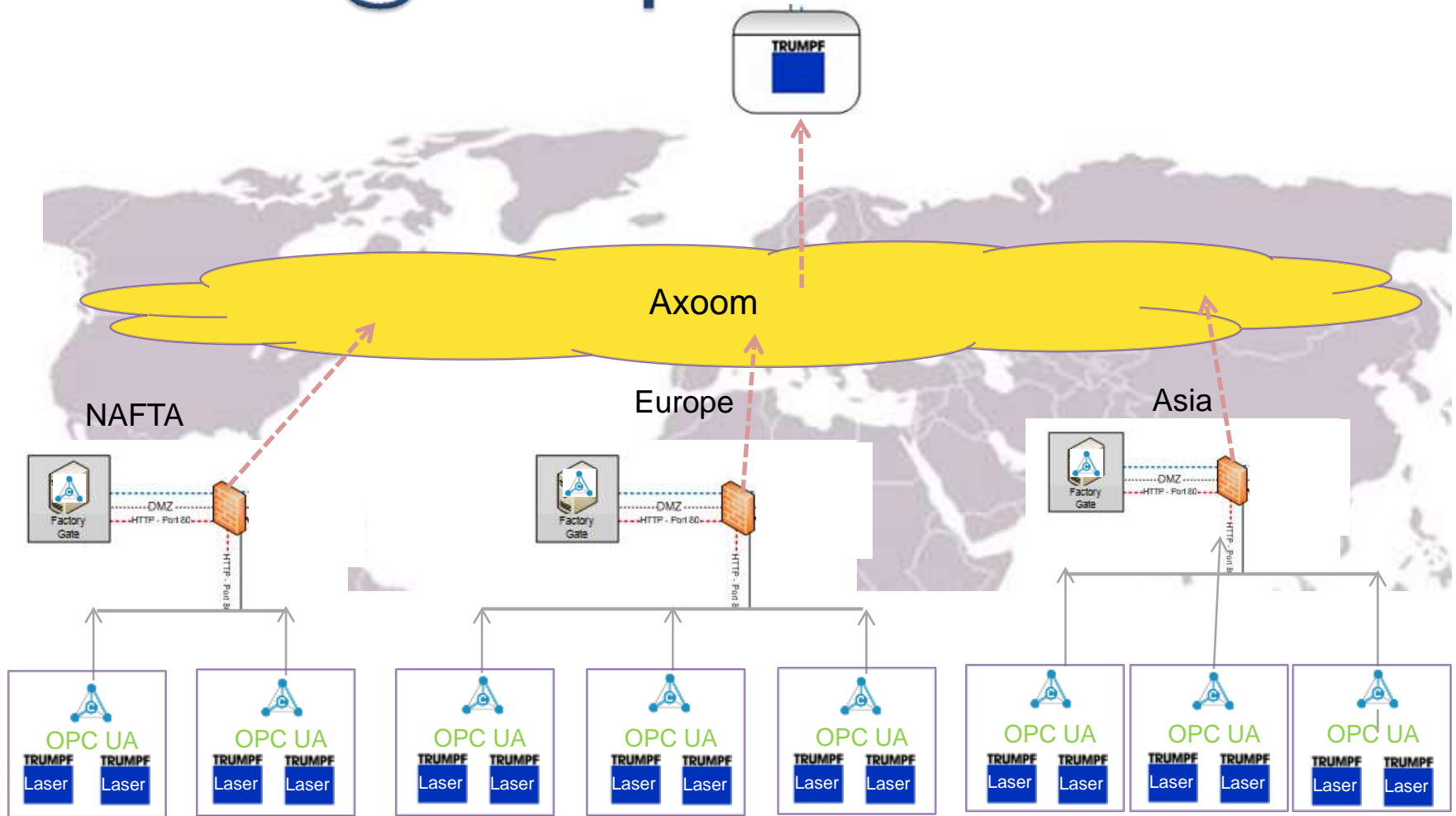
- Participation in Companion Standards

Press Conference OPC Foundation
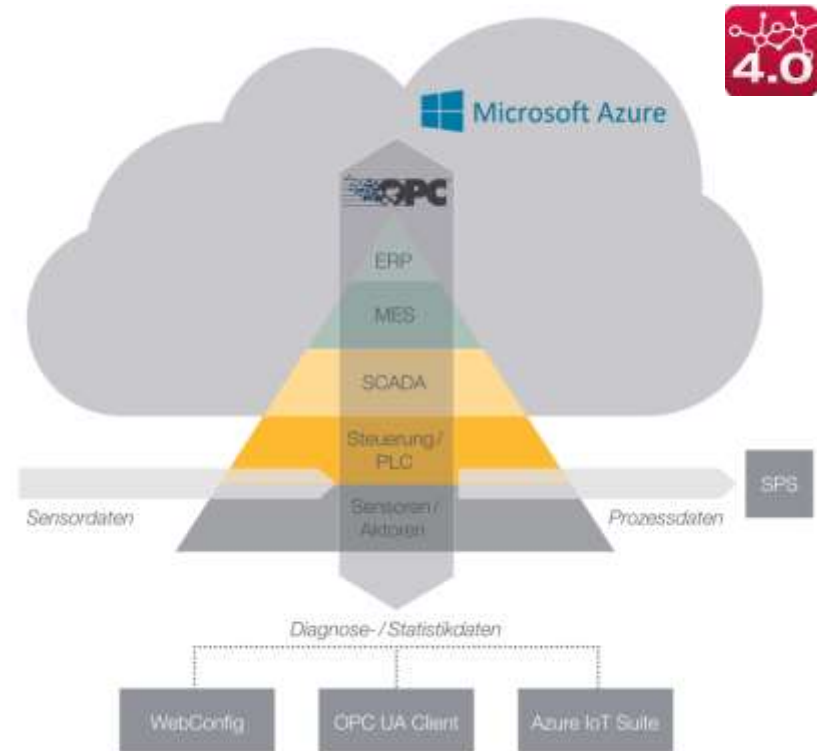
OPC UA Solution

Several autonomous Cyber Physical Systems (CPS) are vertically integrated and connected to a Smart Factory Cloud

Visit Eaton
Hall 9
Stand 371

OPC UA @ Trumpf Laser Machines

Axoom

NAFTA

Europe

Asia

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

OPC UA TRUMPF Laser TRUMPF Laser

Number of lasers just schematically

OPC UA on chip level: Hilscher

▸ **2016: Commercial product OPC UA in chip**

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.

- **Markets**

  - **Automation**
  - **Building Automation**
  - **Energy**
  - **Engineering**

  - **Measurement**
  - **Oil & Gas**
  - **Transportation**

OPC Web - „Collaborations"

Logo	Vertical market	Teaser
PLCopen *for efficiency in automation*	Automation	More… **PLCopen**, as an organization active in Industrial Control, is creating a higher efficiency in your application software development and lowering your life-cycle costs.
AIM	Automation AutoID Supply Chain	More… RFID, but also other AutoID processes, are key technologies for the implementation of the philosophy of industry 4.0. The more important it becomes to integrate these technologies as simple as possible into total solutions. Therefore **AIM-D e.V.** (Association for Automatic Data Capture, Identification and Mobility), responsible for Germany, Austria and Switzerland, defined standards on the basis of an OPC UA.
VDMA	Automation CNC	More… An OPC UA information model has been developed within the cooperation of the **German Machine Tool Builders' Association (VDW)** and the OPC Foundation, in order to interface and exchange data with CNC systems.
MTConnect	Automation	More comming soon MTConnect mapped their information modell into OPC UA and thus became portable.
EUROMAP	Automation Plastics and	More… **EUROMAP** is the European umbrellas association of plastics and rubber machinery manufacturers. It provides technical recommendations for this

OPC UA companion specifications

- OPC UA & AutomationML: released
- PLCopen OPC UA Client for IEC61131-3: released
- OPC UA for AutoID: released

- MDIS (Oil&Gas): First interoperability workshop for companion spec
- PackML: Release candidate
- (VDMA) Injection molding machine: Release candidate
- (VDMA) Machine Vision: started
- (VDMA) Robotic: under preparation

- VDMA: Preparing an „VDMA Leitfaden OPC UA"
 for Hanover Messe 2017

Benefits of OPC UA companion spec

- With OPC UA
- Without OPC UA Companion Spec

- → every device provides own modelling
- → extra effort for engineering

IT Systems

OPC UA – Vendor A

OPC UA – Vendor B

RFID
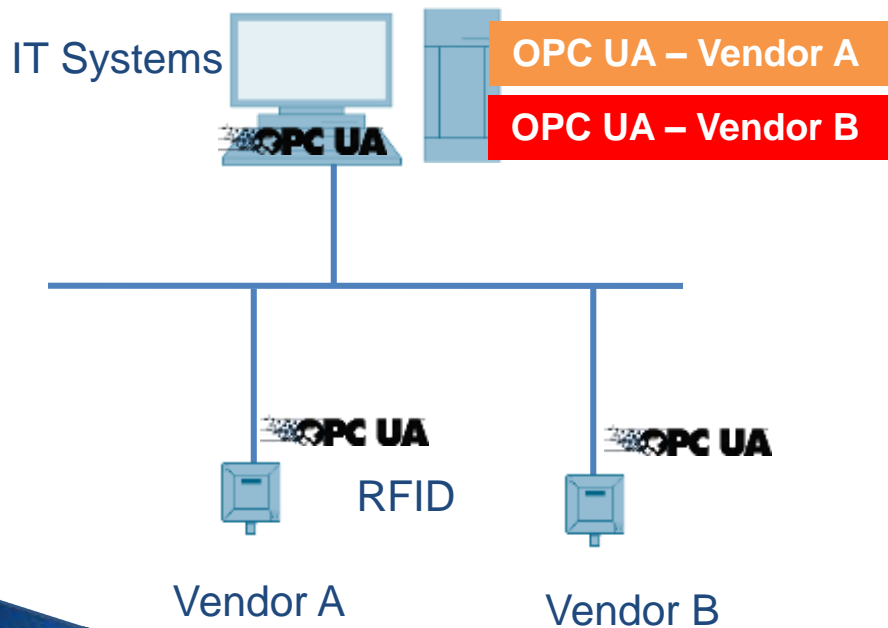
Vendor A

Vendor B

- With OPC UA
- With OPC UA AutoID Companion Spec

- → each device provides same modelling
- → reduce efforts for engineering

IT Systems

OPC UA for AutoID

RFID
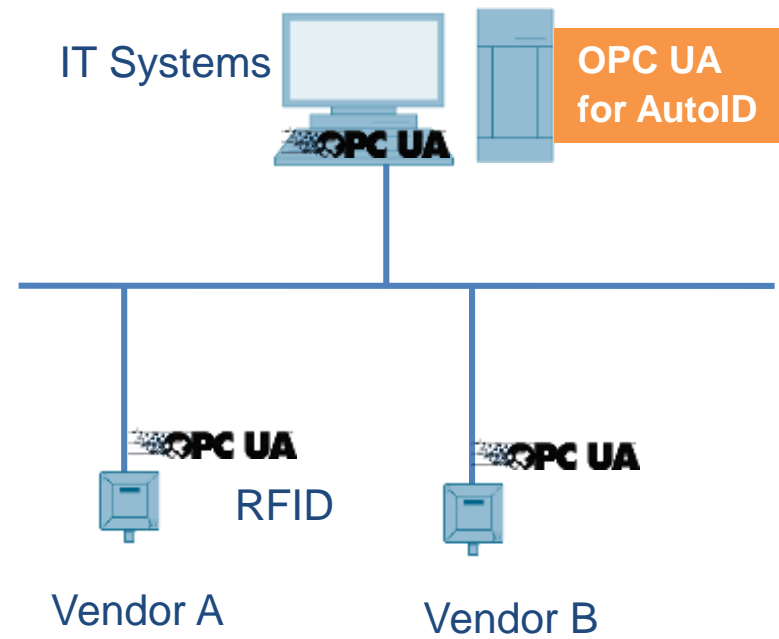
Vendor A

Vendor B

Devices / machines will differentiate by functionality

Commercial printers
- Different vendors
- Standardized connectors
  USB / Ethernet
  Support profiles "I am a printer"

Industrial devices / machines
- Different vendors
- Standardized connector: OPC UA
  Support profiles "I am an RFID reader"
- Build in security

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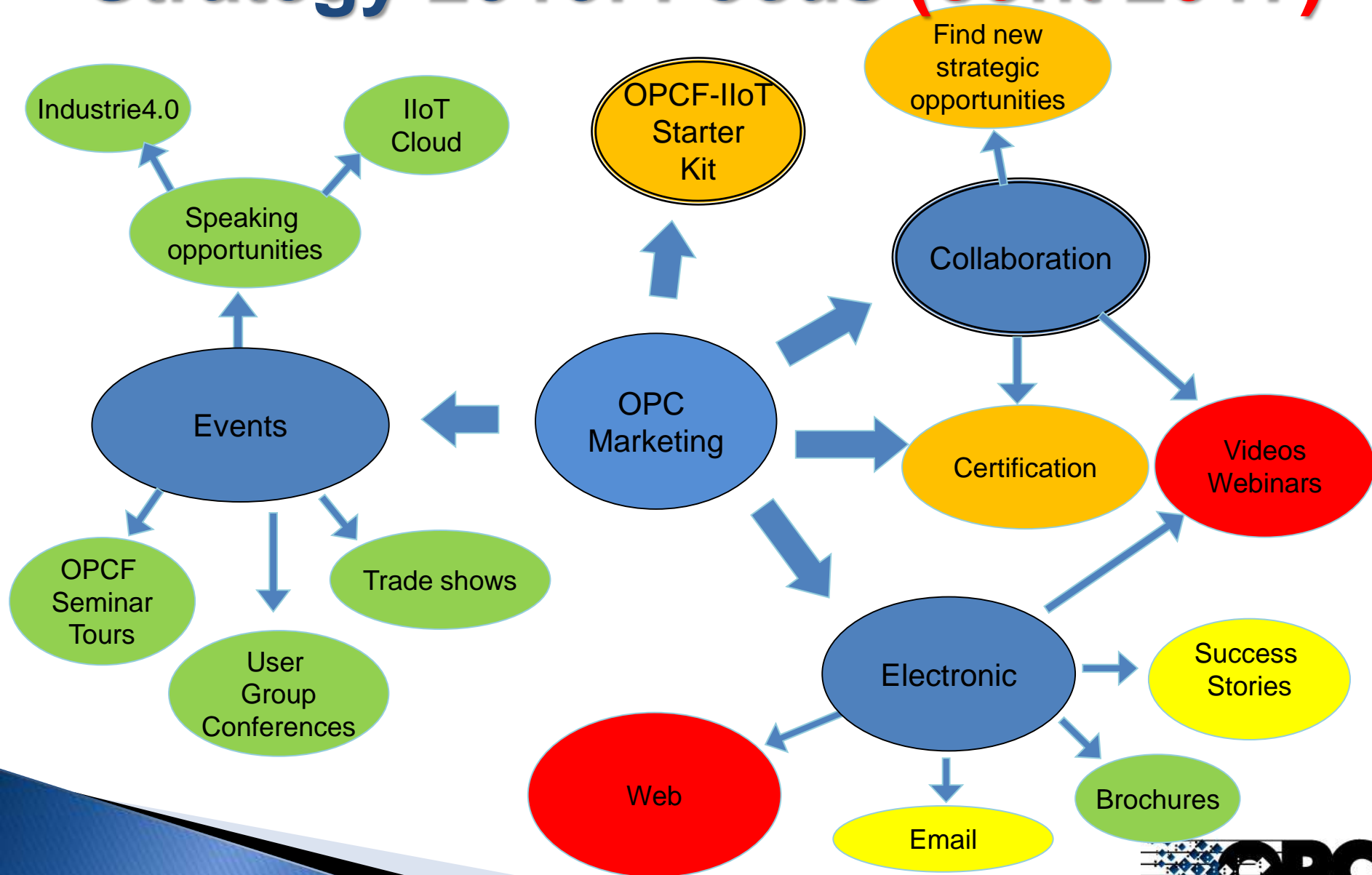   - Print costs
    - Easy to handle and interact
    - ….

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

Strategy 2016: Focus (cont 2017)

Trends

- **Trend #1**
  SoA Technology grows from IT level down into automation devices

    - **SAP Demo: Assets communicate via OPC UA method calls only**
    - **AutoID companion specs are based on method calls**

- **Trend #2**
  Integrate OPC UA into device / into machine

    - **Gateways are nice to have for period of time**
      Long term integrated OPC UA solution is key

- **Trend 3#**
  OPC UA on chip level will grow OPC UA into new markets

    - **OPC UA will grow outside automation**

OPC Foundation: Transition

The Interoperability Standard for Industrial Automation™

The Industrial Interoperability Standard™

OPC Foundation in the transition…

From   **"Interoperability Standard for Industrial Automation"**

To   **"The Industrial Interoperability Standard"**

                … on the way to additional markets

Thank you !

Stefan Hoppe
Global Vice President OPC Foundation
Stefan.hoppe@opcfoundation.org