OPC Foundation
Mission, Organization and Collaboration
by Stefan Hoppe, President OPC Foundation
**OPC Foundation**

[https://opcfoundation.org](https://opcfoundation.org)

- **Vision**
  - Secure & reliable
  - Vendor, platform, and domain agnostic
  - Interoperability from sensor to enterprise and beyond

- **Global Profile**
  - Non-profit organization (founded 1995)
  - Companies from Automation & IT
  - Internationally recognized: OPC UA is IEC62541

- **Deliverables**
  - Specifications: openly available
  - Tools and code examples for faster, easier adoption (AnsiC/C++, C# .NET Standard, Java)
  - Certification: OPC Labs open to everyone

- Ecosystem with toolkits and education
- Modern IPR policy

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**Organizational Overview**

**Membership:** 734 (Nov 5th, 2019)

**2019 Board of Directors**

- Microsoft
- SAP
- Siemens
- Beckhoff
- Honeywell
- Yokogawa
- Mitsubishi
- Ascolab
- Rockwell, Schneider, ABB

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**Membership Region Distribution**

- Europe Region 51%
- North America Region 25%
- Japan Region 6%
- China Region 8%
- Rest of World Region 10%
OPC Foundation: Largest Eco System for Interoperability

734 members - Status Nov 5th, 2019 - ... plus 120 Logo members
“With OPC UA at the heart of Industrie4.0, adopting the OPC UA technology and using it to its full potential in our factories is a natural progression.

Being a member of the OPC Foundation guarantees early information to upcoming key technologies like the OPC UA Companion specifications which provide secured and standardized information and interfaces for assets.”

Michael Schweiger, Volkswagen
Structure of organization

- Board of Director, Officers, Directors
- Control Boards
  - Technical Control Board (TCB)
  - Marketing Control Board (MCB)
- Technical Advisory Council (TAC)
- Markets Advisory Council (MAC)
- Local groups (countries..)
OPC Foundation: Experts Program

https://opcfoundation.org/experts/

- List of OPC UA experts willing to offer services to interested vendors or organizations
- Technical Control Board (TCB) defined criteria
- Types of skillsets clearly identified

**Experts**

<table>
<thead>
<tr>
<th>Expert Name (alphabet)</th>
<th>Contact</th>
<th>Language</th>
<th>IM</th>
<th>AD</th>
<th>SC</th>
<th>TR</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong, Randy</td>
<td><a href="mailto:randy@sparthekssoftware.com">randy@sparthekssoftware.com</a>, Phone +1 425 298 7731</td>
<td>English</td>
<td>Y</td>
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</tr>
<tr>
<td>Aro, Jouli</td>
<td><a href="mailto:jouli.ari@proxysopcom.com">jouli.ari@proxysopcom.com</a>, Phone +358 4 420 9007</td>
<td>Finnish</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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</tr>
<tr>
<td>Condemine, Michel</td>
<td><a href="mailto:michel@4-ce-industry.com">michel@4-ce-industry.com</a>, Montpellier, France, Phone +33 4 87 79 07 37</td>
<td>French</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Damm, Matthias</td>
<td><a href="mailto:info@unified-automation.com">info@unified-automation.com</a>, Kehlreuth, Germany, Phone +49 911 495 25000</td>
<td>German</td>
<td>Y</td>
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<tr>
<td>Gappmeier, Gerhard</td>
<td><a href="mailto:info@unified-automation.com">info@unified-automation.com</a>, Kehlreuth, Germany, Phone +49 911 495 25000</td>
<td>German</td>
<td>Y</td>
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<tr>
<td>Hunkar, Paul</td>
<td><a href="mailto:Paul.Hunkar@dsinteropability.com">Paul.Hunkar@dsinteropability.com</a>, Cleveland, Ohio, Phone +1 (440) 337-4161</td>
<td>English</td>
<td>Y</td>
<td>Y</td>
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<td></td>
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<tr>
<td>Mohrke, Wolfgang</td>
<td><a href="mailto:info@unified-automation.com">info@unified-automation.com</a>, Kehlreuth, Germany, Phone +49 911 495 25000</td>
<td>German</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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</tbody>
</table>

**IM = Information Modeling**  
**AD = Application Design**  
**SC = Security Consulting**  
**TR = Training**  
**IS = Implementation Support**

Registered Experts: 26 (as of Nov 5th, 2019)

Note: The OPC Foundation does not assume liability for the quality and outcome of these services.
OPC UA in the world

IIC  INDUSTRIE 4.0  Made in China 2025  Japan IVI
History – Use Case Driven

- Definition 2003 – 2006
- Verification and Implementation 2006 – 2008
- Final OPC Foundation Release 2009
- IEC 62541 Release 2010 – 2012

**OPC UA = established OPC features**
- Platform independence
- Standard internet and IP based protocols
- Built in security features
- Generic object model
- Extensible type system
- Scalability through profiles
- Migration path from Classic OPC

**Today**
- Open source and toolkits available
- No membership required to adopt OPC UA
- Certification for members and non-members
- Strong IPR policy protection also for non members
The Industrial Interoperability Standard

OPC UA: The industrial framework enabling secured, standardized data and interfaces

Interoperable
- Vendor, Platform, Market and OS Independent
- Scalable: From Sensor to Cloud
- Discoverable Services Oriented Architecture
- Independent of transport protocol
- Non-Profit (OPC Foundation)
- Widely Adopted: >50M install base
- Open Source on GitHub

Data Modelling
- **Graph Support**, preserves source context
- Vendor **extendable** data model via Companion Specifications
- Relevant: Enables domain specific information models
  - Discrete: Robotics, Machine Vision, ...
  - Process: FDI, FDT, PA-DIM, MDIS, NOA..
  - Energy: IEC61850, ..

Secure
- Secure Design from group up
- Based on open security standards
- Auditing, Authentication & Encryption
- Future Proof: Evolves with security technologies
- Vendors/Users can choose level of security
- Accepted: Aligned with IT requirements

... today 50+ initiatives!
## Vendors will differentiate on features not interfaces…

### 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?
  - Colour? Combined or separate?
  - Print speed, cost, etc.
  - Ease of use
  - ….

### Industrial devices / machines
- Different vendors
- Standardized connector: OPC UA
  - Support profiles “I am an RFID reader”
- Built in security
- Differentiate by functionality
  - Reduce engineering costs
    - Support standards
    - Easy network integration
  - Costs
  - Throughput of machine
  - ….
Brownfield integration: Gateways!

Before USB

DIN Keyboard / Centronics printer / PS2 mouse

Transition
Use adopters to connect old and new world

With USB

Market of gateways
- <$500
- Connect to PLCs or fieldbus systems
- No changes to machines required!

Benefit:
Consistent, compatible data model for all machines, plus security!
DATA TABLE 5

<table>
<thead>
<tr>
<th>WORD0</th>
<th>0x5128</th>
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<tr>
<td>WORD1</td>
<td>1111000010101001</td>
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<tr>
<td>WORD2</td>
<td></td>
</tr>
<tr>
<td>WORD3</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>WORD255</td>
<td></td>
</tr>
</tbody>
</table>

- Huge documentation efforts
- Different parameters for different vendors
- High efforts for humans to understand

Instead:
Machines should help humans in “their language”!
Self-description reduces engineering
Today: Machines help humans to easier understand the process

Who are you?

My name is R2-D2

What can you do for me?

I can navigate, lift, drill and cut

Can you lift me up to the second floor?

What is your weight?

OK, let's start

200 kg

The self-description reduces configuration effort and supports quick understanding of information.
OPC Foundation: Difference between CS and JWG

UA Companion Specifications

The Basic OPC UA Infrastructure
OPC UA has been designed for scalability and supports a wide range of application domains, ranging from field level (e.g., devices for measurement or identification, PLCs), to enterprise management support. To achieve these design goals, the OPC UA standard provides a multi-layered architecture as shown in the following figure:

OPC UA Companion Specifications

- Discovery which allows clients to find OPC UA servers, their supported protocols, security policies and other capabilities.

OPC UA is built on the following infrastructure:

1. Internal
2. Joint
3. External

CS word templates available

Joint Working Groups

- In cooperation with OPCF
- OPCF voting, review

- Definition / Criteria / How to create
- Rules for deliverables
- Levels of adoption
  - Specification
  - Adoption
  - Certification

UA Companion Specs

- Can be done by everybody
- OPCF not involved - No OPCF logo

- 3 categories
  - Internal
  - Joint
  - External

- OPCF not involved - No OPCF logo
OPCF joint working group (JWG) – Definition, Criteria, How-to

Public documentation for joint working groups [https://opcfoundation.org/about/working-groups/joint-working-groups/](https://opcfoundation.org/about/working-groups/joint-working-groups/)

- Definition
- Criteria
- How to create
- Levels of adoption (specification / adoption / certification)

A “joint companion specification” is not a technology of the OPC Foundation.

The OPC Foundation does not guarantee exclusiveness and cannot prove that the use cases of the cooperating organization are fulfilled.

Participation of OPC Foundation members is voluntary. There shall be no expectation that OPC-F provides resources for the JWG.
OPCF joint working group (JWG) – Overview groups

Public documentation for joint working groups

- List of existing groups: What / Who / Contact / Version
- Link to Release
- Traffic lamp for: Implemented / IP tested / Certified
Open Process Automation Forum

- Open Process Automation Forum (is part of The Open Group)
  www.opengroup.org

- The Open Group is a non-profit, global consortium for IT standards
- ExxonMobil selected The Open Group
- https://www.opengroup.org/open-group-open-process-automation-forum-launches-o-pas-standard

San Francisco, California – February 5th, 2019: Today at the ARC Industry Forum event in Florida, The Open Group, the vendor-neutral technology consortium, has announced the launch of its new O-PAS™ Standard, Version 1.0, a preliminary standard of The Open Group. Developed by The Open Group Open Process Automation™ Forum (OPAF), the standard will provide a vendor-neutral reference architecture to enable the construction of scalable, reliable, interoperable and secure process automation systems.

The O-PAS Standard, Version 1.0, is focused on meeting the minimum standard and specification requirements for federated process automation systems, using an open and interoperable reference architecture. A key tenet of the Standard is to adopt ‘fit-for-purpose’ industry standards that exist in the marketplace today. As a result, the Standard will incorporate a variety of functional elements that are already provided by multiple vendors, including:

- Security: ANSI/ISA 62443 (adopted by IEC as IEC 62443)
- Connectivity: OPC UA
- Systems Management: DMTF Redfish
Process Automation: OPC UA mandatory for NOA

- NAMUR is an international user association of automation technology in process industries
  [https://www.namur.net/en.html](https://www.namur.net/en.html)
- The NAMUR Open Architecture (NOA) concept offers possibilities to enable innovative solutions for new and existing plants: "**NOA Information Model OPC UA implementation mandatory**"

More information about NOA:
[https://www.namur.net/en/focus-topics/namur-open-architecture/](https://www.namur.net/en/focus-topics/namur-open-architecture/)
VDMA represents the breadth of the manufacturing industry
VDMA has more than 3200 member companies

Factory Automation

- Agricultural Machinery
- Air Conditioning and Ventilation
- Air Pollution Control
- Air-handling Technology
- Building Control and Management
- Cleaning Systems
- Compressors, Compressed Air and Vacuum Technology
- Construction Equipment and Building Material Machines
- Drying Technology
- Electrical Automation
- Electronics, Micro and Nano Technologies
- Engine Systems for Power and Heat Generation
- Engines and Systems
- Fire Fighting Equipment
- Fluid Power
- Food Processing Machinery and Packaging Machinery
- Foundry Machinery
- Gas Welding
- Hydro Power
- Integrated Assembly Solutions
- Large Industrial Plant Manufacturing
- Lifts and Escalators
- Machine Tools and Manufacturing Systems
- Machine Vision
- Materials Handling and Intralogistics
- Measuring and Testing Technology
- Metallurgical Plants and Rolling Mills
- Metallurgy
- Micro Technologies
- Mining
- Plastics and Rubber Machinery
- Power Systems
- Power Transmission Engineering
- Precision Tools
- Printing and Paper Technology
- Process Plant and Equipment
- Productronic
- Pumps + Systems
- Refrigeration and Heat Pump Technology
- Robotics
- Robotic + Automation
- Security Systems
- Software and Digitization
- Surface Treatment Technology
- Textile Care, Fabric and Leather Technology
- Textile Machinery
- Thermal Turbines and Power Plants
- Thermo Process Technology
- Valves
- Waste Treatment and Recycling
- Wind Energy
- Woodworking Machinery

VDMA (17!)
OPC UA for AutoID

One communication standard for the whole AutoID world

- Standardized, secured data and interfaces
- Different devices like HF/UHF-RFID, OCR, Optical (1D/2D barcode), RTLS

Adaption

- Harting, Siemens (4 types)
- Balluff, Leuze (2 types), Sick, Turck, (P+F 2019)
Adoption: PLC controller

Supporting “OPC UA for IEC61131-3”

- 3S
- BECKHOFF
- Bosch-Rexroth
- B&R
- Honeywell
- Phoenix Contact
- WAGO
The VDMA is Developing International Standards
VDMA OPC Machine Vision Initiative leverages its international network

Andreas Faath

Machine Vision

» 60 Involved companies world wide
» over 100 participants

OPC Vision is an accepted G3 Standard - the group of leading machine vision associations:

» AIA (USA)       EMVA (EUROPA)
» JIIA (JAPAN)    VDMA (EUROPA)
» CMVU (CHINA)

» OPC Machine Vision has been invited to chinese Machine Vision standardization meeting (CVSM) in Beijing on 26. and 27.10.2018 as OPC Machine Vision was core topic of meeting.
Agenda was also listing chinese standardization council SAC and also Prof. Zhang.
Applications of this demonstrator

» Asset management
» Condition monitoring
» Preventive Maintenance
» Vertical integration
  » Information flow from shop floor to cloud
  » ERP, MES, SCADA
Requirements – Call for Bidding

- Companion Specification
  - VDMA Robotics Specification
  - AIM RFID Specification
  - PLCopen UA Functions Blocks
- OPC UA Core Specification
  - Full Featured Profiles
  - Additional Facets
  - Security Profiles
- Quantity Measures
  - Data Volume
  - Speed

Precise functional description of OPC UA Application

Call for Bidding
Certified Information

C UC S Server

Member: TechniFMC
Product website: https://www.technifmc.com/automationcontrolproducts

This product enables TechnicalM’s UC S control system to inter-operate with OPC UA clients by acting as a Data Gateway on the UC S side, and as a UA Server for external network devices. It’s certified to support the MDS profile via...

OPC Foundation 11-2019
Future

Presentation on afternoon
OPC Foundation “Field Level Communications Initiative”:
Extending OPC UA including Deterministic, Safety & Motion down to field level

Separate presentation by
Peter Lutz, Director FLC

OPCF Press Conference SPS 2018
Overcrowded!

ABB, Beckhoff, Mitsubishi,
Rockwell, Siemens, Schneider
# OPC Foundation: Roadmap

[https://opcfoundation.org/about/opc-technologies/opc-ua/opcua-roadmap/](https://opcfoundation.org/about/opc-technologies/opc-ua/opcua-roadmap/)

<table>
<thead>
<tr>
<th>Recent innovations in v1.04</th>
<th>2019/2020 – <strong>Features worked on</strong></th>
<th>2021 and beyond – <strong>Vision</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2019: Relate with established semantic models</strong> <em>(Dictionary Reference)</em></td>
<td><strong>Deterministic UA: Mappings to TSN</strong></td>
<td>The following features are under consideration. No concrete specification work has been initiated.</td>
</tr>
<tr>
<td>- An infrastructure to reference from an OPC UA Information Model to external dictionaries like IEC Common Data Dictionary or cCIoTs.</td>
<td><strong>Transactions</strong></td>
<td><strong>Transactions</strong></td>
</tr>
<tr>
<td><strong>2019: Interfaces and AddIns</strong></td>
<td><strong>Field-Level Communication (FLC)</strong></td>
<td><strong>With the increasing popularity of OPC UA in various industries, we also see more and more scenarios where OPC UA is used for configuration. Simple configuration tasks can be solved with Methods, for more complex scenarios, transactions will be needed.</strong></td>
</tr>
<tr>
<td>- Interfaces and AddIns complement the type model and can be used when subtyping is not suitable for a required extension.</td>
<td><strong>Alias names</strong></td>
<td><strong>Metadata in the Cloud</strong></td>
</tr>
<tr>
<td><strong>PubSub</strong></td>
<td><strong>This feature will enable locating Nodes (Objects, Methods, or Variables) on a global level (e.g. in an entire system). An AliasName is an alternate well defined name. Global OPC UA discovery services maybe constructed that aggregate all AliasNames on OPC UA Servers in a system and then serve as a system-wide lookup service for Clients.</strong></td>
<td><strong>When data are published to cloud applications, most of the meta information that is in the Server’s AddressSpace is not part of these data. The “Metadata in the Cloud” project targets this deficiency.</strong></td>
</tr>
<tr>
<td>- New communication schema to enable and optimize OPC UA for one-to-many, many-to-one, or many-to-many configurations.</td>
<td><strong>Harmonization of companion standards</strong></td>
<td><strong>Cloud-Relay</strong></td>
</tr>
<tr>
<td><strong>JSON Web Token, OAuth2</strong></td>
<td><strong>Many organizations use OPC UA to model and expose their existing information. Sometimes, however, the definitions overlap or are identical. This project supports companion working groups to harmonize their models.</strong></td>
<td><strong>The cloud-relay capability allows for connectivity between UA applications even when both Client and Server are behind separate firewalls.</strong></td>
</tr>
<tr>
<td>- User identification using the authorization service well-established in modern cloud applications (Azure, Google, Facebook, ...)</td>
<td><strong>Deterministic Communication using 5G</strong></td>
<td><strong>The 5th generation wireless systems will provide better performance and determinism. Similar to the TSN mapping a mapping of PubSub to 5G protocols may be considered.</strong></td>
</tr>
<tr>
<td><strong>Reverse Connectivity</strong></td>
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</tr>
<tr>
<td>- Servers behind firewalls can use reverse connectivity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SessionLess Services</strong></td>
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</tr>
<tr>
<td>- Avoids session establishment for use cases where Servers are called infrequently.</td>
<td></td>
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</tr>
</tbody>
</table>

Next roadmap has been reviewed by TCB & MCB

Now to be publish and announced (at e.g. trade show)
OPC Foundation: United Nations for Industrial Automation

Independent / Neutral ground to work together / No company, no country can dominate OPC Foundation
Standards can only developed together
Information: Brochures Updated (v9a) -> v10 official for 2020

- “Interoperability for Industrie 4.0 and the Internet of Things”
- Edition „2020“: Extended with
  - New: OPC History
  - Updated: UA Technology article like PubSub integrated into OPC UA
  - New: FLC (2 pages)
  - New: Collaborations (released once)

- [https://opcfoundation.org/resources/brochures/](https://opcfoundation.org/resources/brochures/)
OPC UA Videos

- Landing page https://opcfoundation.org/resources/multimedia/
- OPC UA Vision, Thomas Burke https://youtu.be/7mUmfq0M29U
- Learn about OPC UA technology – video series by Uwe Steinkrauss
  - 2: "OPC UA Transport" (06-2019), 17min - https://youtu.be/VCQnLi0cDY
  - 3: "OPC UA Security" (06-2019), 11min - https://youtu.be/z4zNgNdauLY
  - 5: "OPC UA Discovery" (06-2019), 6min - https://youtu.be/1NlbUAiOdcA
# OPC UA Videos

- **Collaboration**

| VDMA Overview | VDMA Overview 3min, [https://youtu.be/5roRSuNIEF0](https://youtu.be/5roRSuNIEF0)  
VDMA Overview in detail 9min [https://youtu.be/LhOIC7GNcmI](https://youtu.be/LhOIC7GNcmI) |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------|
| VDMA Plastics and rubber machinery | VDMA Plastics and rubber machinery - 6min [https://youtu.be/jSvSRjFX_RI](https://youtu.be/jSvSRjFX_RI)  
VDMA EuroMAP 12min, [https://youtu.be/wwAl2D_fyMw](https://youtu.be/wwAl2D_fyMw) |
VDMA Machine Vision Overview in details - 12min, [https://youtu.be/zK8yhyugGNI](https://youtu.be/zK8yhyugGNI) |
| VDMA Robotics | VDMA Robotics - Overview - 2min, [https://youtu.be/-xgFKg1hXTg](https://youtu.be/-xgFKg1hXTg)  
VDMA Robotics - Overview in details - 8min, [https://youtu.be/ZdLVFI_1S54](https://youtu.be/ZdLVFI_1S54) |
Thank you! - Questions?

Stefan Hoppe
President & Executive Director OPC Foundation
Stefan.hoppe@opcfoundation.org

Looking for more information?
https://opcfoundation.org/
OPC Day Seminar: 13:00-17:30 Meeting room 203, 2nd floor