OPC UA is The Industrial Integration Technology
Status update November 2019

OPC Day Helsinki, Nov 6th, 2019

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OPC Foundation

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

Organizational Overview

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

2019 Board of Directors

<table>
<thead>
<tr>
<th>Company</th>
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<tr>
<td>Microsoft</td>
<td>Honeywell</td>
<td>Rockwell,</td>
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<td>SAP</td>
<td>Yokogawa</td>
<td>Schneider,</td>
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<td>Siemens</td>
<td>Mitsubishi</td>
<td>ABB</td>
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<tr>
<td>Beckhoff</td>
<td>Ascolab</td>
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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!
OPC UA in the world: Industrie4.0 is the enabler across the globe

**Industry 4.0 across the globe**

Main initiatives, partnerships and influences as of March 2017

**United States**
- Industrial Internet (Consortium)
- Smart Manufacturing
- Industry 4.0

**EU / Western Europe**
- Austria: Industrie 4.0 Österreich
- Belgium: Factories of the future
- Czech Republic: Průmysl 4.0
- Denmark: MADE
- France: L’Industrie du Futur
- Germany: Industrie 4.0
- Hungary: IPAR4.0
- Italy: Industria 4.0
- Netherlands: Smart Industry
- Portugal: Industria 4.0
- Spain: Industria Conectada 4.0
- Sweden: Smart Industry / Produktion 2030
- UK: Industry 4.0 / 4IR
- EU: aligning national plans

**China**
- Made in China 2025
- "Born in Germany"

**Japan**
- Robot Revolution Initiative Society 5.0

- **Industrial Internet**: US concept (GE) but Industrial Internet Consortium global and collaborates with Industry 4.0 Platform.
- **UK**: Industry 4.0 and 4IR initiative. Post-Brexit unknown.
- **China**: Industry 4.0 the framework of "Made in China 2025"
- **Japan**: several initiatives, collaboration Industry 4.0 Platform.
German Industrie 4.0 requires OPC UA

There are 3 levels to reach:
- Industrie 4.0 Full
- Industrie 4.0 Ready
- Industrie 4.0 Basic

Industrie 4.0 Basic list 7 criteria – 2 of them are OPC UA

<table>
<thead>
<tr>
<th>2. Industrie 4.0 communication</th>
<th>T</th>
<th>M</th>
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<tbody>
<tr>
<td>Transfer of product data and data files for interpretation or simulation, for example; product data in standardised form</td>
<td>M</td>
<td>Manufacturer makes data that is relevant for the customer available/accessible online with the aid of identification, e.g. PDF via http(s)</td>
</tr>
<tr>
<td>The product can be addressed via the network, supplies and accepts data, Plug &amp; Produce via Industrie 4.0-compliant services</td>
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<table>
<thead>
<tr>
<th>5. Industrie 4.0 services and conditions</th>
<th>T</th>
<th>O</th>
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<tbody>
<tr>
<td>Definition still open (service system) General interface for loadable services and messages regarding statuses Essential basic services that an Industrie 4.0 product must support and provide</td>
<td></td>
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</tr>
<tr>
<td>Information such as statuses, error messages, warnings, etc. available via OPC-UA Information model in accordance with an Industry standard</td>
<td>O</td>
<td>Information of the device interface available digitally</td>
</tr>
</tbody>
</table>

Source: ZVEI
OPC UA fits into Industrie 4.0
Interoperability Conference - World

- Host: Hannover Messe & OPCF & VDMA & FieldComm Group
- 32 Organizations & groups presenting
- Information & registration www.opcfoundation.org/wic2019

- Agenda
  12:00 noon   Keynotes OPCF / VDMA / FCG
  13:30 h      Thematic Round 1 (short talk Vision, Mission, Discussion)
  14:15 h      Thematic Round 2 (short talk Vision, Mission, Discussion)
  15:00 h      Thematic Round 3 (short talk Vision, Mission, Discussion)
  15:30 h      End of the event

Presenting Organizations
1st Interoperability Conference - World

32 Groups

Very positive feedback

Conference No. 2: on Monday April 20th, 2020
OPC UA Day Automotive 23.05.2019

- Organizers
  - AIDA: Audi, BMW, Daimler, Porsche, Volkswagen
  - OPC Foundation
  - VDMA

- Host
  - Volkswagen in Wolfsburg
  - German speaking event
    Plan to replicate in US and India

- Notes
  - 300+ attendees expected
  - Focus is adoption (not technical developer level)
  - Free of charge

- Information & Registration
  [https://opcfoundation.org/automotive-europe](https://opcfoundation.org/automotive-europe)
306 attendees voted most valuable speakers: Uwe Steinkrauss & Alex Allmendinger
North America: Industrial Internet Consortium
Listing OPC UA + other protocols / Testbeds

- OPC UA listed

- Today 3 testbeds with integrated OPC UA
  - OPC UA + TSN in Manufacturing
  - OPC UA Sensor in Brownfield environment
  - OPC UA and AutomationML for factory
OPC Foundation in Korea: Manufacturing Renaissance

- Manufacturing Renaissance Vision Proclamation in June 19th, 2019
  - The for powers of manufacturing in the world until 2030
  - Support 8 trillion won of R&D fund for new industries

- OPC UA is Korea national Standard
  - Parts 1~6 have been completed

- Official announcement from Government: “Manufacturing Renaissance : Made in Korea”
  - OPC UA as standard of essential projects of smart factory in Korea
ITEI helps OPC Foundation convert OPC UA (IEC 62541) into Chinese National Standard GB/T 33863.

ITEI and OPC Foundation cooperate to establish OPC China Test Lab for testing compliance of products.
OPC Seminar Tour 2019

150+ July 3rd – OPC Day Shanghai hosted by Huawei, China
151: July 4th – OPC Day Nagoya hosted by Mitsubishi, Japan
119: July 5th – OPC Day Seoul, Korea
157: July 8th – OPC Day Taipei, Taiwan hosted by Microsoft
150+ July 9th – OPC Day Shenzhen hosted by Foxconn, China
115: July 10th – OPC Day Singapore sponsored by Beckhoff
VDMA represents the breadth of the manufacturing industry
VDMA has more than 3200 member companies

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)
OPC Foundation: Library of Description of Industrial Things

Future:
"The OPC Foundation will become the world library for descriptions of industrial things."

OPC UA Companion Specs

... description of data, interfaces, features, behavior,

... a description of a thing.
OPC Foundation: Information

Published

- Online reference
  [https://reference.opcfoundation.org](https://reference.opcfoundation.org)

- Listing data types, interfaces …
  - All OPC UA specifications
  - All joint Information models
SAP & OPC UA: SoA Reshape Automation Pyramid

Industrie4.0 demo at Hannover Messe SAP booth since 2016, 2017, 2018, 2019… 2020?
**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 ↔ XTS
Only vertical communication

The transport system is not aware of any other asset!
- 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)

- SAP is not aware of vision camera
- The robot appears as a “Smart Robot”
Architecture: What is an asset? (3/3)

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

SAP Plant Connectivity
SAP can handle both….what does customer need?
SAP: Asset integration in 10min
SAP Plant Connectivity (PCo)
2. orchestrate independent machine units

(1) Event occurs on Machine Unit X
(2) Machine Unit Y needs to be notified/triggered
(3) PCo can be configured to execute communication between units

PCo becomes a “SOFT PLC with Business Logic” for OPC UA Client/Server bundles
Read the 2 page article... public since February 2016

Rüdiger Fritz
Director - Product Management SAP Plant Connectivity (PCo)
Production Planning & Manufacturing
SAP SE
Ruediger.fritz@sap.com
Microsoft commitment

- See video Microsoft Azure & OPC UA here [https://youtu.be/QJ1DWTvGQxo](https://youtu.be/QJ1DWTvGQxo)

- Microsoft is the world largest open source contributor for the OPC Foundation. Contributed over 3.5 million source lines of code, more than everyone else together

- OPC UA Open Source on GitHub: [7.500 visitors per week for OPC UA .NET Standard](https://github.com/opcfoundation/opcua-net-standard)
Microsoft: OPC UA integration into Azure IoT

Microsoft Proxy Module (open source)

- "South Port"
  Act as OPC UA client to Third Party devices

  Support
  - complex data
  - method calls
  - …. Everything!

- "North Port"
  Tunnel OPC UA binary via MQTT into Azure

- Benefit
  Transparent OPC UA from Cloud to Field level
Who?
Joint Water and Wastewater Authority
Vogtland, Germany
Silvio Merz, Divisional Manager, s.merz@zwav.de

What?
• Supply water to about 240,000 people and treating their wastewater as well
• Operate almost 600 Water and Wastewater treatment plants
  • Waterworks
  • Water pumps
  • Water reservoirs
• Distributed over about 1400 Km²
M2M & IoT in decentralized, intelligent equipment

Please take over filling of elevated reservoir

Quality problems in freshwater!

Requests for process values and state changes

Due to problems at group 1 supplier of freshwater has changed to group 2

Level reached!

Stopped pumping

Requests for process values and state changes

Closed User Group

SCADA

Elevated Reservoir

Waterworks 1

Pumping Plant 1

Pumping Plant 2

Waterworks 2
M2M & IoT in decentralized, intelligent equipment

TwinCAT OPC-UA Client (PLCopen-based) and TwinCAT OPC-UA Server are integrated into one of the smallest Beckhoff controllers, a CX9020 Embedded PC.
M2M & IoT in decentralized, intelligent equipment

Cost saving effects

- Transmission of complex data structures -> there’s no configuration of every single datapoint required
- Replacement of a proprietary solution with a combined OPC-UA client/server. Standardization of data communication reduces interfaces, just the OPC-UA client and server.
- A physical interruption of the connection does not lead to a loss of information -> automatically buffered in the OPC-UA server for a time and can be retrieved as soon as the connection has been restored
- Using security mechanisms like authentication, signing and encryption integrated in OPC-UA in addition to a closed mobile radio group to ensure the integrity of the confidential data
- “The solution provided us with a saving on the initial licensing costs of more than 90 % per device.”
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
“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/
OPC UA Videos

- Landing page [https://opcfoundation.org/resources/multimedia/](https://opcfoundation.org/resources/multimedia/)
- OPC UA Vision, Thomas Burke [https://youtu.be/7mUmfq0M29U](https://youtu.be/7mUmfq0M29U)
- Learn about OPC UA technology – video series by Uwe Steinkrauss
  - 2: "OPC UA Transport" (06-2019), 17min - [https://youtu.be/VCQnLly0cDY](https://youtu.be/VCQnLly0cDY)
  - 3: "OPC UA Security" (06-2019), 11min - [https://youtu.be/z4zNgNdauLY](https://youtu.be/z4zNgNdauLY)
  - 4: "OPC UA Profiles" (06-2019), 8min - [https://youtu.be/CCvlLASACjE](https://youtu.be/CCvlLASACjE)
  - 5: "OPC UA Discovery" (06-2019), 6min - [https://youtu.be/1NlbUAIOdcA](https://youtu.be/1NlbUAIOdcA)
- Learn about certification - video by Alexander Allmendinger - [https://youtu.be/LoYLqvRlyYk](https://youtu.be/LoYLqvRlyYk)
## OPC UA Videos

- **Collaboration**
  - VDMA Overview: [3min](https://youtu.be/5roRSuNlEF0)
    - VDMA Overview in detail: [9min](https://youtu.be/LhOIC7GNcmI)
  - VDMA Plastics and rubber machinery: [6min](https://youtu.be/jSvSRjFX_RI)
    - VDMA EuroMAP: [12min](https://youtu.be/wwAI2D_fyMw)
  - VDMA Machine Vision:
    - Overview: [4min](https://youtu.be/BUywZ1oong)
    - Overview in details: [12min](https://youtu.be/zK8yhyugGNI)
  - VDMA Robotics:
    - Overview: [2min](https://youtu.be/xgFKg1hXTg)
    - Overview in details: [8min](https://youtu.be/ZdLVFI_1S54)
Thank you! - Questions?

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Stefan.hoppe@opcfoundation.org

Looking for more information?
https://opcfoundation.org/