OPC DAY FINLAND 2020

4.11.2020, 1.00-4.30 PM (EET)

#OPCUA #OPCDAY #OPCDAYFINLAND #AUTOMAATIO

OPC Foundation & Partners: The world largest ecosystem for interoperability

- OPC UA: Promise for Industrial Interoperability
- Technology bricks – collection of bricks for markets
- Overview OPC Foundation
- Information modeling: 55+ industry domain specific standardizations
- Validation & Certification
- Future bricks: Into FLC Initiative & Harmonization

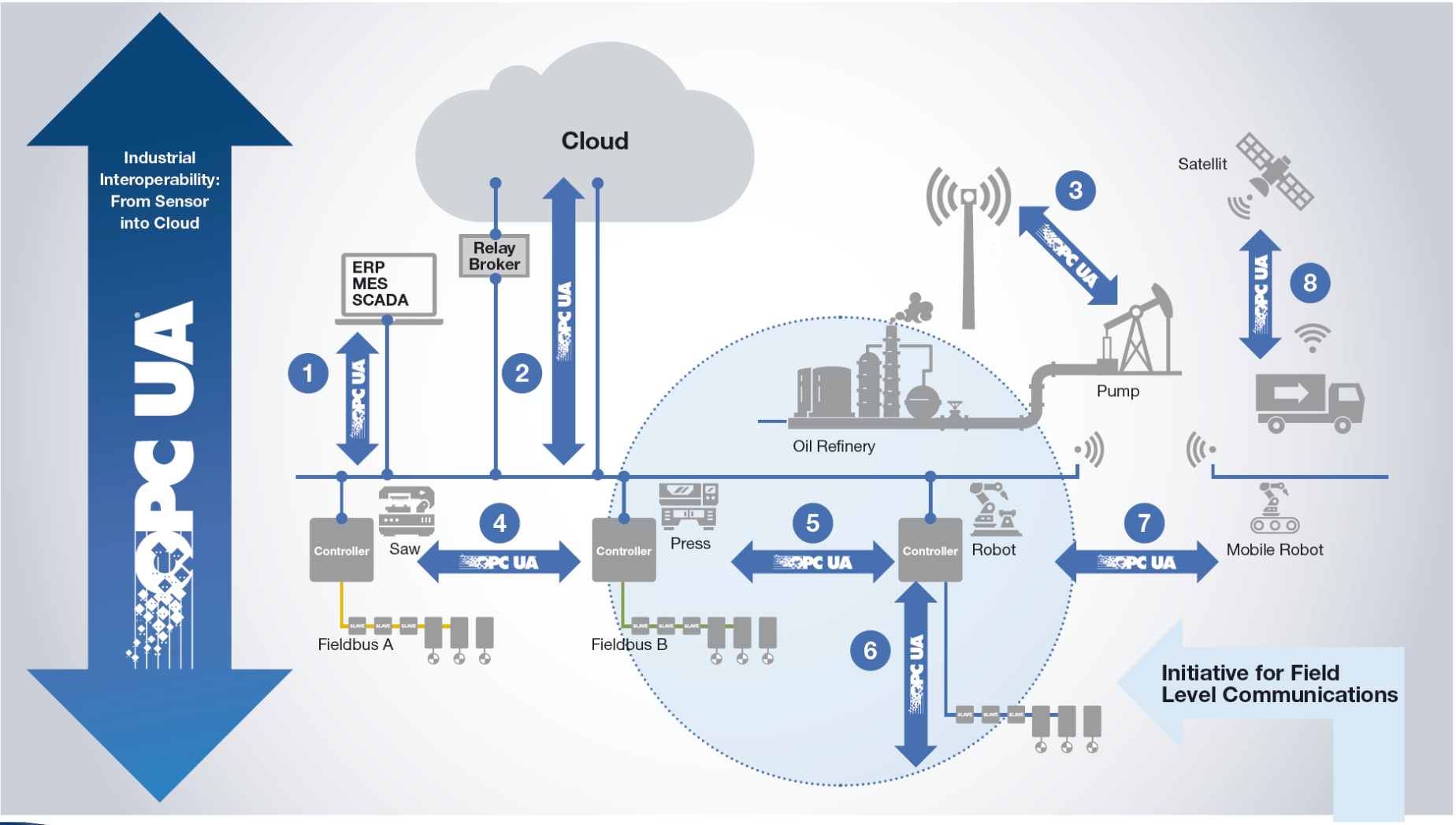
Stefan Hoppe
President & Executive Director OPC Foundation
stefan.hoppe@opcfoundation.org

FINNISH SOCIETY OF AUTOMATION
SUOMEN AUTOMAATIOSEURA RY

SPONSORS:

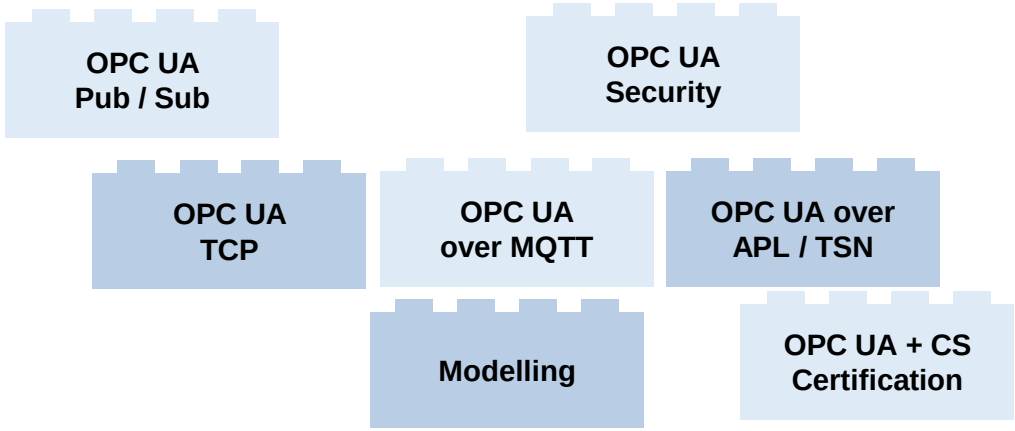
ABB BECKHOFF NAPCON NOVOTEK PROSYS OPC OPC FOUNDATION Valmet FORWARD Wapice

OPC Unified Architecture:
Enabler for consistent information model from sensor to cloud



1. IT / OT Communication
2. Cloud Integration
3. Secure Remote Access
4. Local OT Communication
5. Controller to Controller
6. Controller to Field Device
7. Wireless Integration (5G)
8. Future Ready

OPC UA: Promize for Interoperability
Collection of technology bricks



- **OPC UA: Collection of technology bricks**
  - Connectivity, different protocols
  - Security
  - Information modeling capabilities

- **Companion Specifications: Collection of bricks for different markets**
  - Information modelling to describe specific market
  - Field devices need TCP, UDP, Safety, Motion, real-time, ...
  - Gateway & Cloud services need UA over MQTT, 5G

- **OPC UA + Companion Spec guarantee 100% Interoperability**
  - Mandatory bricks guarantee interoperability
  - Optional bricks allow flexibility
  - OPCF: Tools and infrastructure for certification

OPC Foundation https://opcfoundation.org

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

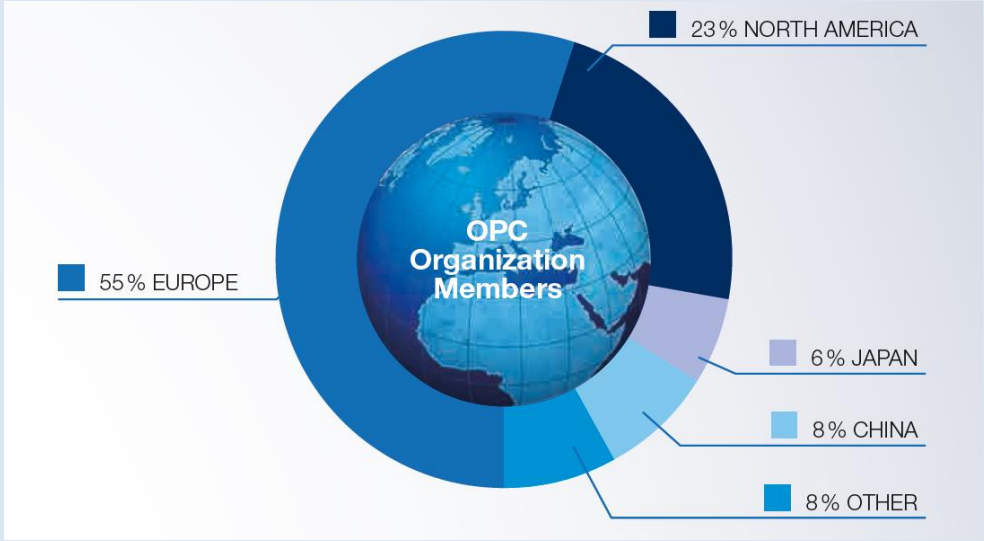
- Global Profile
  - Non-profit organization (founded 1995)
  - Companies from Automation & IT
  - Internationally recognized: OPC UA is IEC62541

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

- Ecosystem with toolkits and education
- Modern IPR policy

Organizational Overview

Membership: 795 (Status: Nov 4th, 2020)



Since 2019: Board of Directors

Microsoft	Honeywell	Rockwell
SAP	Yokogawa	Schneider
Siemens	Mitsubishi	ABB
Beckhoff	Ascolab	Emerson (since 2020)

OPC Foundation

- OPCF nominated Emerson (NYSE: EMR) to BoD
  Peter Zornio, CTO for Emerson Automation Solutions is representative
- Emerson Process Automation joint OPCF FLC Initiative
- PR https://opcfoundation.org/news/press-releases/opc-foundation-welcomes-emerson-to-its-board-of-directors/

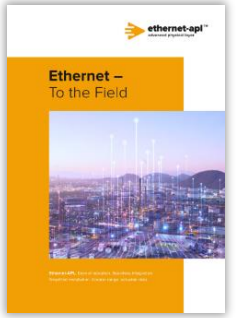
News OPC Foundation

- **Google Cloud joint OPC Foundation as member**
  Will offer OPC UA as a part of commitment to openness and industry collaboration

- **Emerson Process Automation joint the OPCF FLC initiative**

- **OPC Foundation FLC Initiative startet OPC UA Motion group**
  OPC Foundation Cooperates with ODVA and Sercos International to Develop OPC UA Motion

- **OPC Foundation joins APL Project Group**
  APL critical important for OPC UA field level strategy in Process Automation
  Download new brochure: www.opcfoundation.org/apl



- **OPC UA Certification: Guarantee of Interoperability**
  UACTT extended for Companion Spec validation: Now offering validation for PA-DIM, PLCopen & MDIS

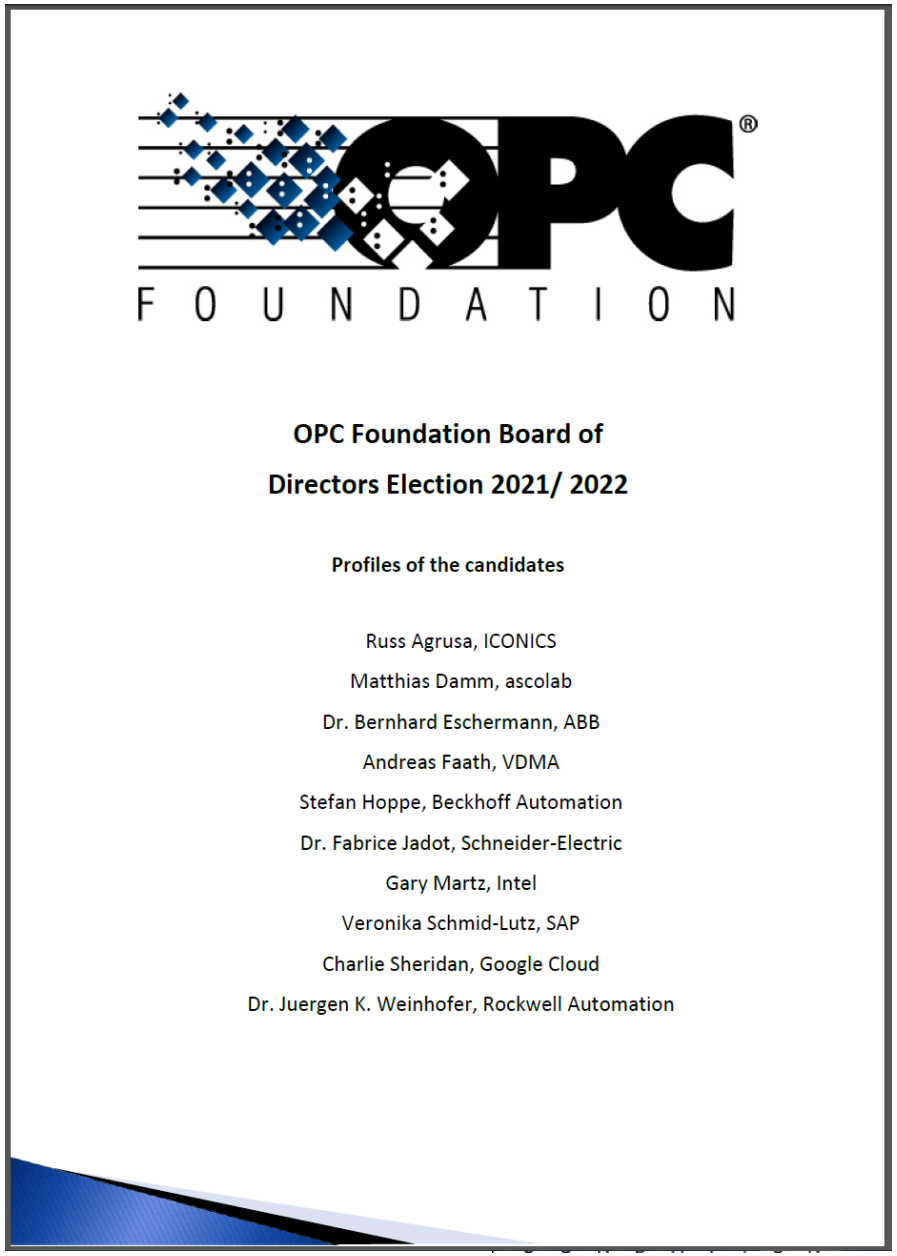
OPC Foundation – Election 2021/2022

- 12 BoD seats in total, democratic elected my representatives
  - Nov 2020: 7 seats to be re-elected for period 2021/2022
  - Nov 2021: 5 seats to be re-elected for period 2022/2023

- 10 candidates
  - 7 existing BoD members
  - 3 new candidates from VDMA, Intel, GoogleCloud

- Election started November 2nd

- Announcement at “Global Assembly Meeting” on Dec 9th, at 4pm CET (registration opening soon)



OPC Foundation: Promise for OPC UA based Industrial Interoperability

Interoperability Robustness & Security

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

Security Design from Ground up

OPC UA

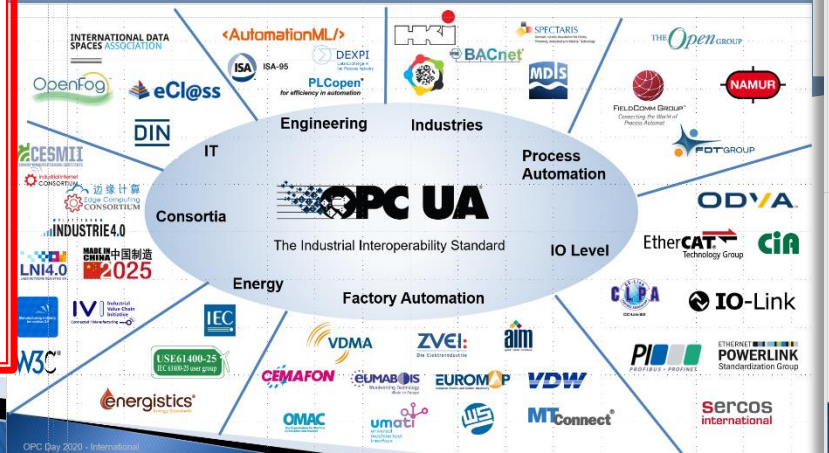
55+ Joint Working Groups Data Modelling/Harmonization

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, ..

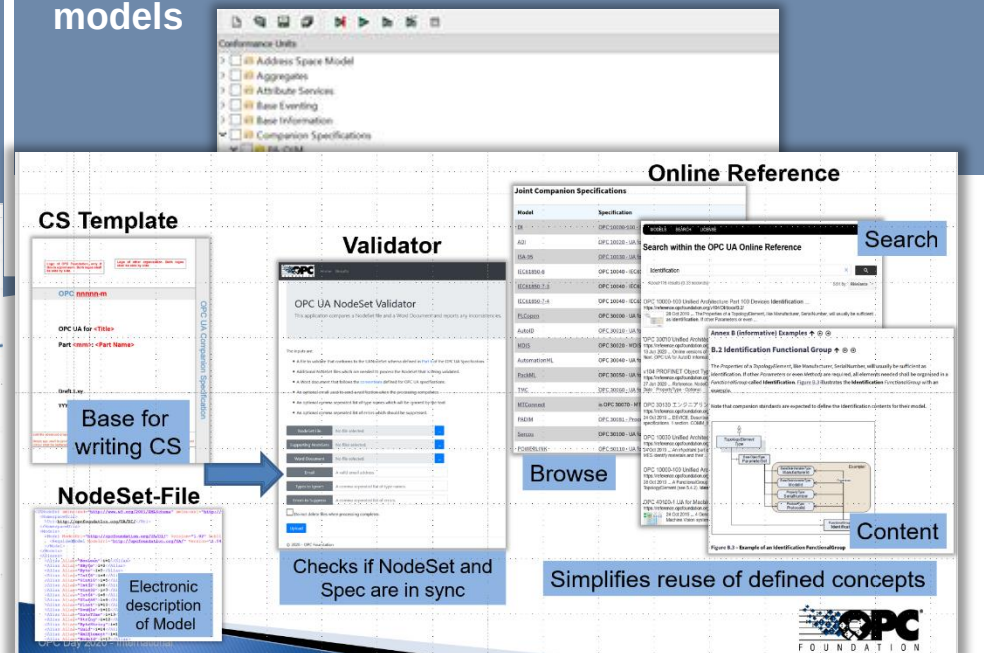


Validating / Certification Online Reference

Validation of Companion Specs

Compliance Test Tool (CTT): Open available 1800 test scripts for the OPC UA core functionality and for the Companion Specifications available now for PA-DIM / PLCopen / MDIS

Online Reference: Public reference with all models



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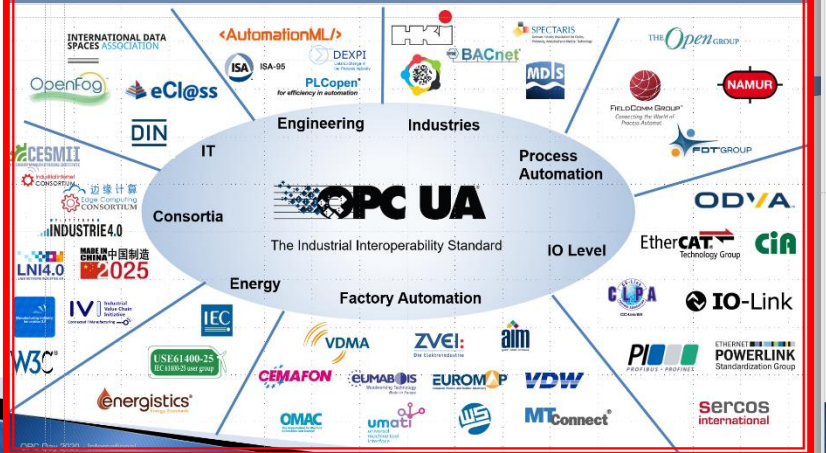

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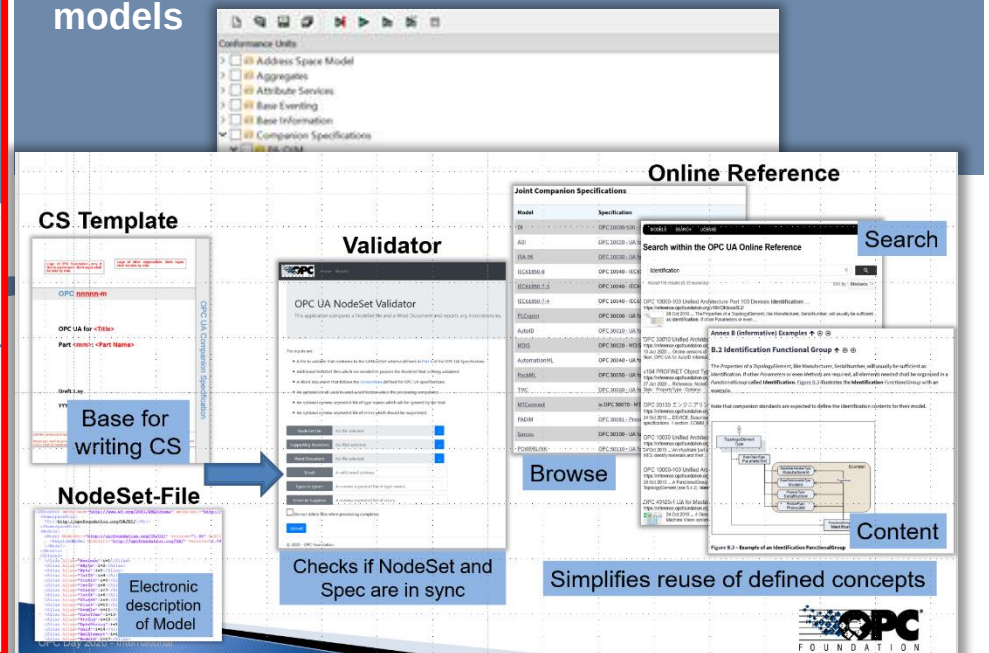


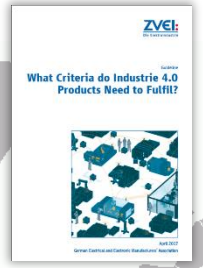
OPC UA in the world

CESMII

Industrie4.0

Made in China2025
National Standard
OPC UA GB/T 33863

Japan IVI



Criterias “Industrie 4.0 Basic”
→ OPC UA mandatory

smart manufacturing korea 4.0

Manufacturing Renaissance
‘Made in Korea’

OPC UA National Standard

OPCF joint working group (JWG) – Definition, Criteria, How-to

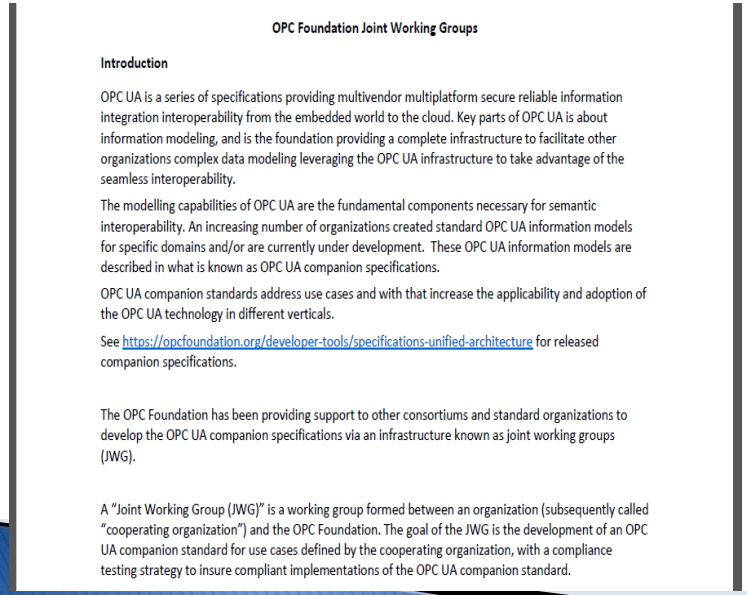
55+ joint groups defined semantics

Public documentation for joint working groups
https://opcfoundation.org/about/working-groups/joint-working-groups/

- Definition / Criteria / How to create

- List of existing groups: What / Who / Contact / Version
- Link to Release

A "joint companion specification" is not a technology of the OPC Foundation. It's joint efforts – jointly owned !



OPC Foundation Joint Working Groups

Introduction

OPC UA is a series of specifications providing multivendor multiplatform secure reliable information integration interoperability from the embedded world to the cloud. Key parts of OPC UA is about information modeling, and is the foundation providing a complete infrastructure to facilitate other organizations complex data modeling leveraging the OPC UA infrastructure to take advantage of the seamless interoperability.

The modelling capabilities of OPC UA are the fundamental components necessary for semantic interoperability. An increasing number of organizations created standard OPC UA information models for specific domains and/or are currently under development. These OPC UA information models are described in what is known as OPC UA companion specifications.

OPC UA companion standards address use cases and with that increase the applicability and adoption of the OPC UA technology in different verticals.

See https://opcfoundation.org/developer-tools/specifications-unified-architecture for released companion specifications.

The OPC Foundation has been providing support to other consortiums and standard organizations to develop the OPC UA companion specifications via an infrastructure known as joint working groups (JWG).

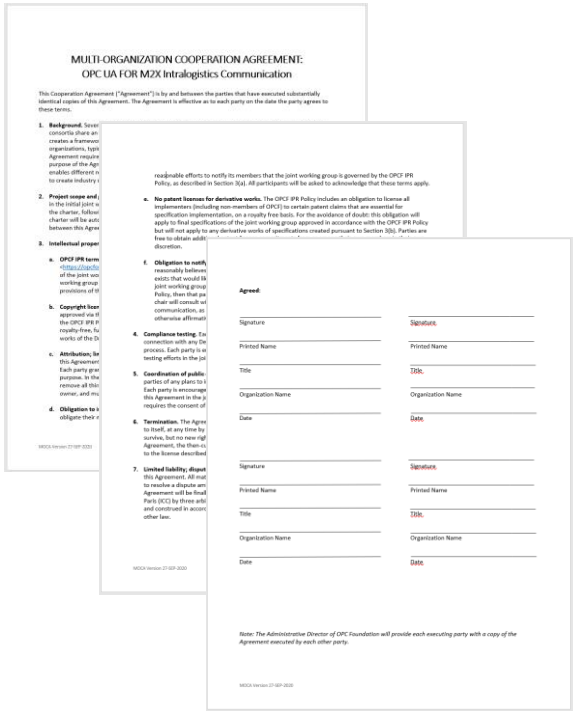
A "Joint Working Group (JWG)" is a working group formed between an organization (subsequently called "cooperating organization") and the OPC Foundation. The goal of the JWG is the development of an OPC UA companion standard for use cases defined by the cooperating organization, with a compliance testing strategy to insure compliant implementations of the OPC UA companion standard.

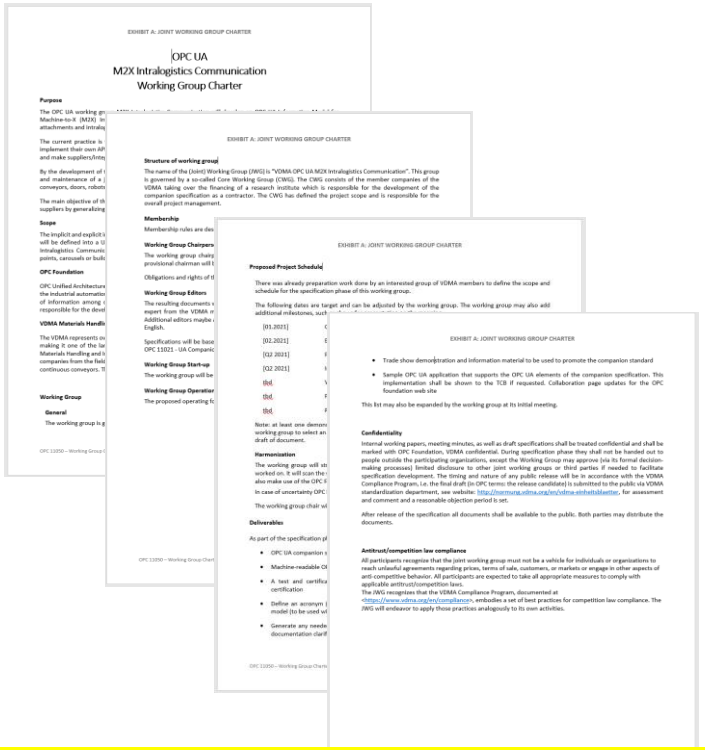
Version 2019-02-11

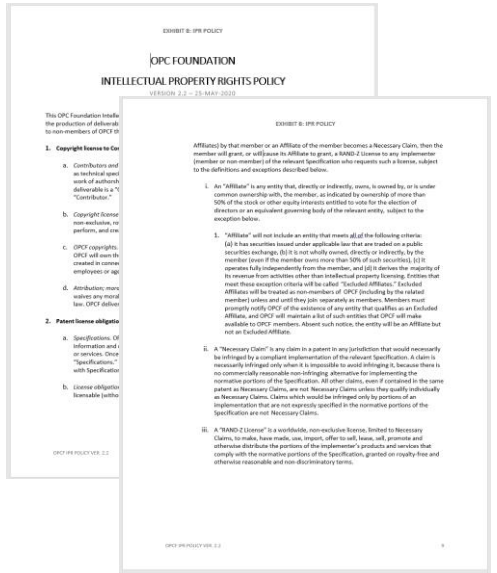
Title	Active	Abstract	Contacts	Version	Status	Status Date	Implemented	IOP tested	Certification	Key Words
Generic Device Models (Controller, Field Device, Process Device)										
OPC Foundation: UA for Devices (DI)	Y	generic representation of devices, e.g. Field devices, controllers, robots, machine tools	Matthias Damm, chair	V1.00	Released	Dec-09				physical device,software component, functional grouping
				V1.01	Released	Jul-12				
				V1.02	Release Candidate	Jan-19				
OPC Foundation: Analyzer Devices (ADI)		A unified view of analysers irrespective of the underlying device protocols. Analyzer devices are comprised of one or more analyser channels with a single address space which has its own configuration, status and control. Examples: Particle Size Monitor, Acoustic Spectrometer, Gas Chromatograph	<AskOPC>	V1.00	Released	Oct-09				
				V1.00	Released	Jan-15				
UA for 61131-3 (PLCopen)	Y	Control program, tasks, controller variables, structured data, function blocks	Stefan Hoppe, chair	V1.00	Released	March-10				PLC, Controller, Automation
				V1.01	In work					
UA Client FunctionBlocks (PLCopen)	Y	PLC controller initiates UA communication. Controller-Controller, Controller-MES, ...		V1.00	Released	Apr-14				
				V1.01	Released	Sep-16				
UA for Autoid Devices (Autoid)		Identificaton device executing a scan, read or write process. Comprises barcode, OCR, 2D code, RFID,	info@AIM-D.de	V1.00	Released	Apr-16				

OPCF MOCA Multi-Oganization Collaboration Agreement

- MOCA:
  - Including the Charter and the OPCF IPR as appendix
  - MOCA template and 1-page MOCA-business explanation here https://opcfoundation.org/Guidelines-And-Templates/





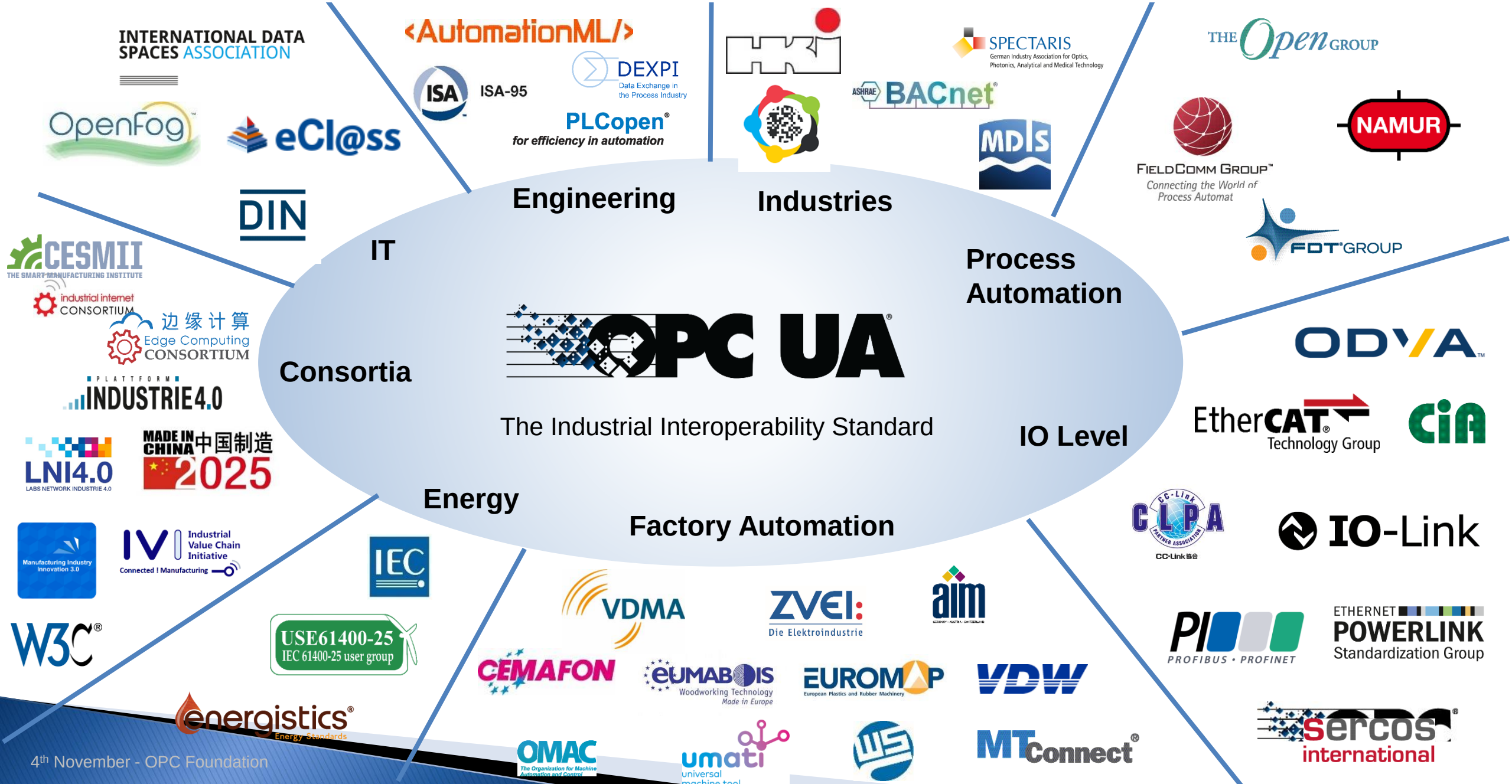


2 page MOCA
1 page signature

3-4 pages Charter for JWG
Scope, rules and timeline

2 page OPCF IPR

Overview and details : https://opcfoundation.org/markets-collaboration/

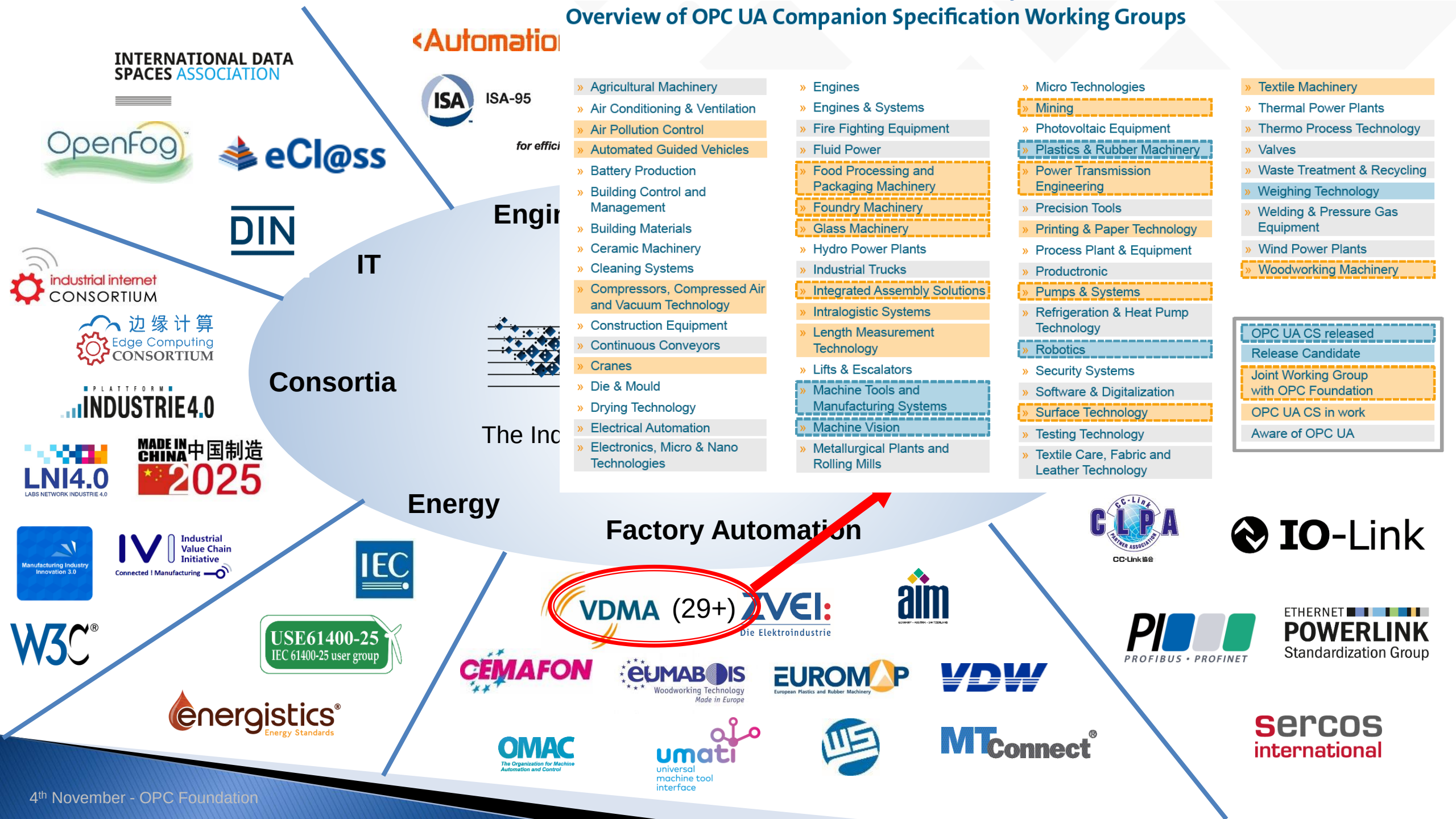


Potential Collaboration Partners

Manufacturing USA

AFFOA Advanced Functional Fabrics of America	**AIM Photonics** American Institute for Manufacturing Integrated Photonics	**America Makes**
ARM Advanced Robotics for Manufacturing	**BioFab USA**	**CESMII** Clean Energy Smart Manufacturing Innovation Institute
IACMI Institute for Advanced Composites Manufacturing Innovation	**Lift** Lightweight Innovations for Tomorrow	**MxD** Manufacturing times Digital
NextFlex	**NIIMBL** National Institute for Innovation in Manufacturing Biopharmaceuticals	**Power America**
RAPID Rapid Advancement in Process Intensification Deployment Institute	**REMADE** Reducing Embodied-energy And Decreasing Emissions	

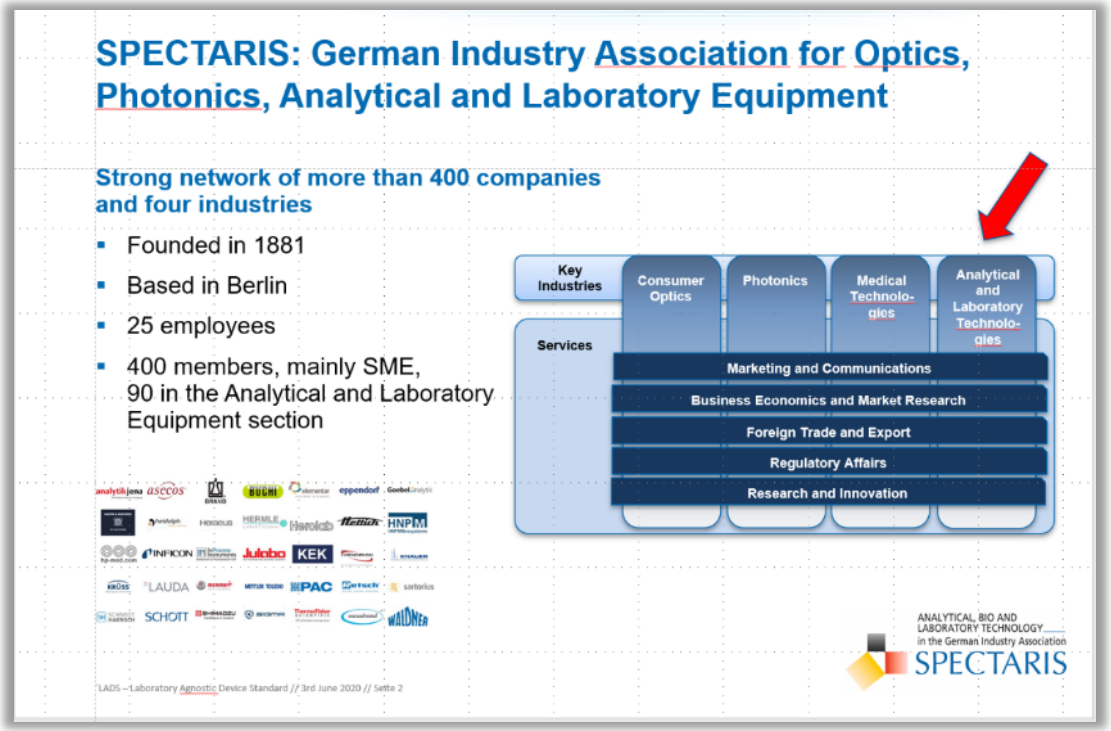
Overview of OPC UA Companion Specification Working Groups

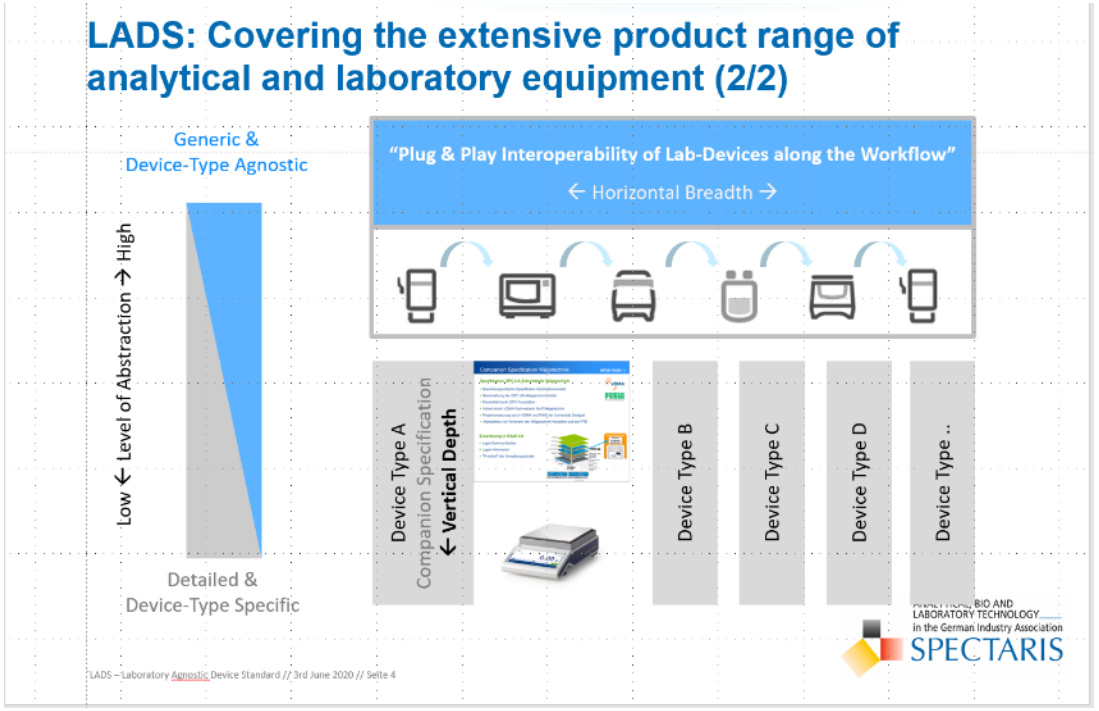


- Agricultural Machinery
- Air Conditioning & Ventilation
- Air Pollution Control
- Automated Guided Vehicles
- Battery Production
- Building Control and Management
- Building Materials
- Ceramic Machinery
- Cleaning Systems
- Compressors, Compressed Air and Vacuum Technology
- Construction Equipment
- Continuous Conveyors
- Cranes
- Die & Mould
- Drying Technology
- Electrical Automation
- Electronics, Micro & Nano Technologies
- Engines
- Engines & Systems
- Fire Fighting Equipment
- Fluid Power
- Food Processing and Packaging Machinery
- Foundry Machinery
- Glass Machinery
- Hydro Power Plants
- Industrial Trucks
- Integrated Assembly Solutions
- Intralogistic Systems
- Length Measurement Technology
- Lifts & Escalators
- Machine Tools and Manufacturing Systems
- Machine Vision
- Metallurgical Plants and Rolling Mills
- Micro Technologies
- Mining
- Photovoltaic Equipment
- Plastics & Rubber Machinery
- Power Transmission Engineering
- Precision Tools
- Printing & Paper Technology
- Process Plant & Equipment
- Productronic
- Pumps & Systems
- Refrigeration & Heat Pump Technology
- Robotics
- Security Systems
- Software & Digitalization
- Surface Technology
- Testing Technology
- Textile Care, Fabric and Leather Technology
- Textile Machinery
- Thermal Power Plants
- Thermo Process Technology
- Valves
- Waste Treatment & Recycling
- Weighing Technology
- Welding & Pressure Gas Equipment
- Wind Power Plants
- Woodworking Machinery

OPC UA CS released
Release Candidate
Joint Working Group with OPC Foundation
OPC UA CS in work
Aware of OPC UA

Announcement: LADS Joint Working Group





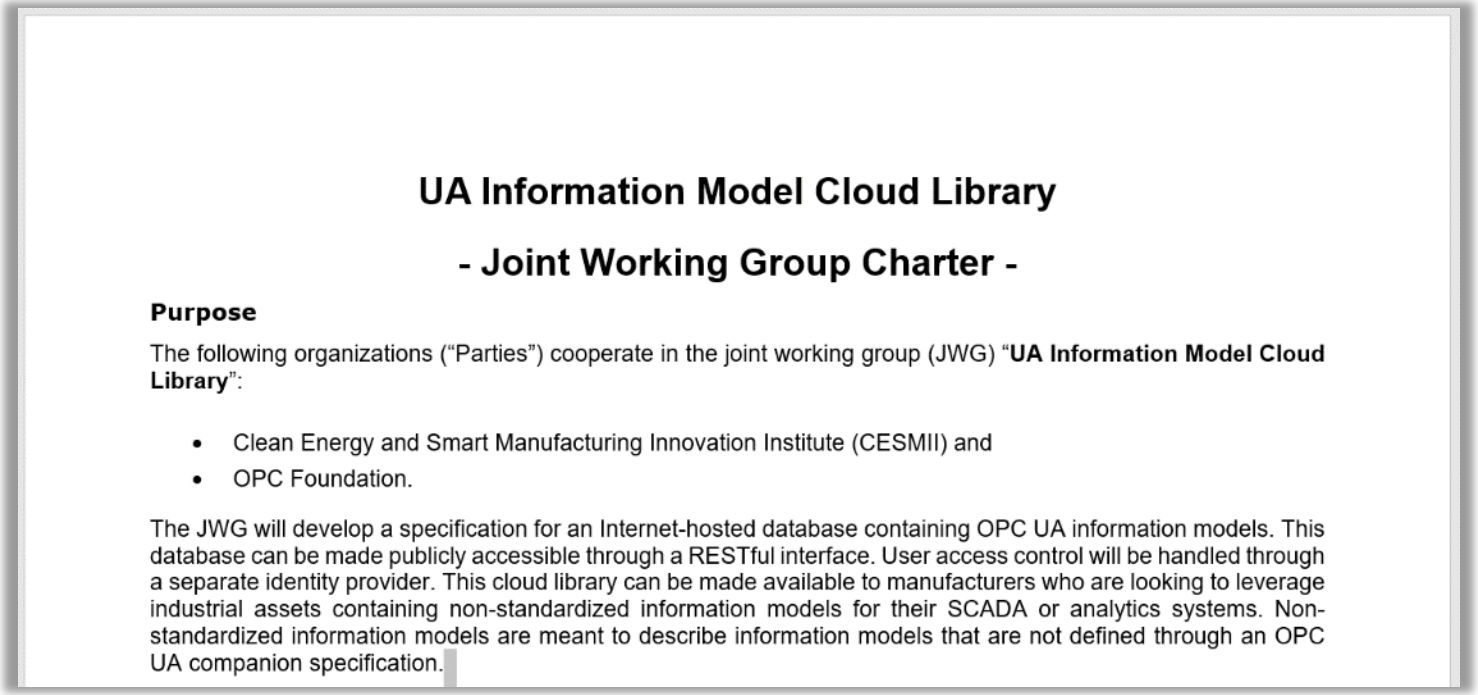
The joint SPECTARIS, VDMA and OPC Foundation LADS OPC UA Working Group will develop an OPC UA Information Model for analytical and laboratory equipment.

August 2020: Call for participation
October 2020: Kick off

White Paper

https://www.spectaris.de/en/association/thespectarisindustries/networked-laboratory-equipment/

Announcement: “UA for Cloud Library” Joint Working Group



UA Information Model Cloud Library

- Joint Working Group Charter -

Purpose

The following organizations (“Parties”) cooperate in the joint working group (JWG) “**UA Information Model Cloud Library**”:

- Clean Energy and Smart Manufacturing Innovation Institute (CESMII) and
- OPC Foundation.

The JWG will develop a specification for an Internet-hosted database containing OPC UA information models. This database can be made publicly accessible through a RESTful interface. User access control will be handled through a separate identity provider. This cloud library can be made available to manufacturers who are looking to leverage industrial assets containing non-standardized information models for their SCADA or analytics systems. Non-standardized information models are meant to describe information models that are not defined through an OPC UA companion specification.

CESMII IS LEVERAGING OPC UA

In an effort to identify common data in machines and processes to accelerate innovation in data science and application development, CESMII is leveraging OPC UA as an industry standard interface. Through the development of an OPC UA Companion Specification, CESMII members identify and articulate important data elements for both new and brown field manufacturing systems.

CESMII
THE SMART MANUFACTURING INSTITUTE

New Joint Working Group CESMII & OPCF
“UA for Cloud Library”

OPC FOUNDATION

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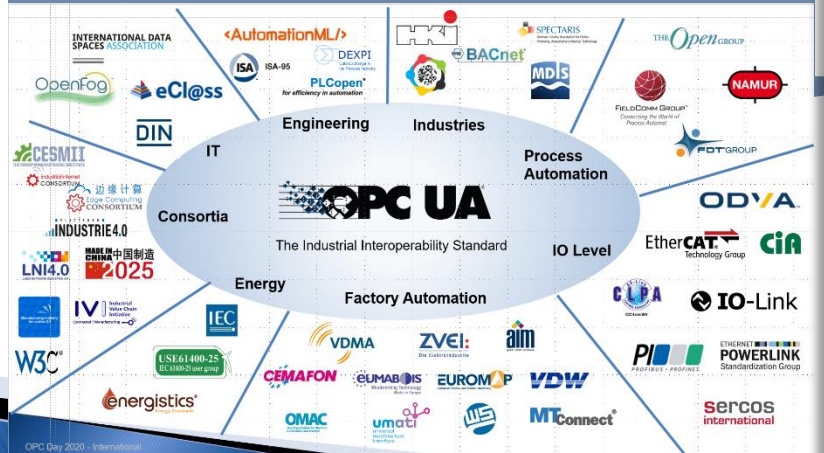

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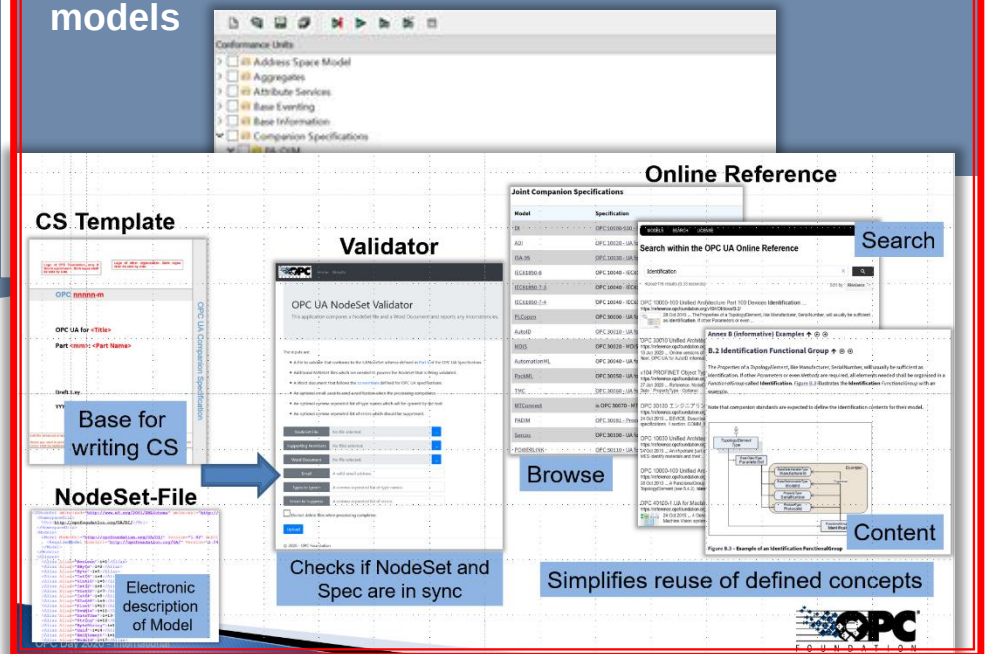


End Users to request Certified Information

Today:

- **OPCF offer "one-stop-shop" certification**
  OPC Labs able to certify package
  - **OPC UA**
  - **Information models like MDIS, kitchen equipment, ..**

  - **Future:**
    - **OPC UA Safety, OPC UA Motion**
    - **OPC UA over APL, TSN, 5G, ..**

- **Two OPC Labs:**
  - **Europe (Stuttgart, Germany)**
  - **China, ITEI**

Grouping set of functionalities

https://www.opcfoundation.org/profilereporting

OPC UA Profiles

Following are the currently defined profiles, arranged according to their application category.

- Server Category
  - Facets
    - Core Characteristics
    - Data Access
    - Event Access
    - Alarm & Condition
    - Generic Features
    - Redundancy
    - Historical Access
    - Aggregates
    - Programs Model
    - Query
  - FullFeatured
    - Nano Embedded Device 2017 Server Profile
    - Micro Embedded Device 2017 Server Profile
    - Embedded 2017 UA Server Profile
    - **Standard 2017 UA Server Profile**
      - Enhanced DataChange Subscription 201
      - User Token – X509 Certificate Server Fac
      - Embedded 2017 UA Server Profile
    - Global Discovery Server 2017 Profile
    - Global Discovery and Certificate Mgmt 2017
- Client Category
  - Facets
    - Core Characteristics
    - Data Access

"Standard 2017 UA Server Profile" Profile

Description	This Profile is a FullFeatured Profile that defines a minimum set of functionality required for PC based OPC UA servers. Compared to the embedded profiles, the Profile requires higher limits for Sessions, Subscriptions and Monitored Items. It also requires support of diagnostic information. This profile supersedes the "Standard UA Server Profile".
URI	http://opcfoundation.org/UA-Profile/Server/StandardUA2017

This page lists the conformance units of the selected profile with their name and description.
Conformance units that are inherited via included Profiles are not listed by default. Use the following radio buttons to change this default behaviour.

- ○ Show only explicitly included conformance units
- ◉ Show also conformance units from included profiles
- ○ Show all existing conformance units
- ○ Show relationship of Conformance Units with Units and Profiles for Clients / Servers

Address Space Model

Include	Name	Opt.	Description	From Profile	Test Cases
☑	Address Space Base	☐	Support the NodeClasses with their Attributes and References as defined in Part 3. This includes for instance: Object, ObjectType, Variable, VariableType, References and DataType.	Core 2017 Server Facet	Open
☑	Address Space Dictionary Entries	☑	Support external dictionaries by relating OPC UA Nodes to dictionary entries using the HasDictionaryEntry ReferenceType.	Core 2017 Server Facet	Open
☑	Address Space Atomicity	☐	Support setting the NonatomicRead and NonatomicWrite flags in the AccessLevelEx Attribute for Variable Nodes to indicate whether Read or Write operations can be performed in atomic manner. If the flags are set to '1', atomicity cannot be assured.	Core 2017 Server Facet	Open
☑	Address Space Full Array Only	☐	Support setting the WriteFullArrayOnly flag in the AccessLevelEx Attribute for Variable Nodes of non-scalar data types to indicate whether write operations for an array can be performed with an IndexRange	Core 2017 Server Facet	Open

OPC Foundation: Library of Description of Industrial Things

- Description of a thing
  data, interfaces, features, behavior, …

  OPC UA Companion Spec
  .. has 2 components
  - Human readable spec
  - Machine readable spec

- Collection of OPC UA Companion Specifications:

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

- Online ***Searchable*** specification reference
  https://reference.opcfoundation.org

- Type dictionary
  - All OPC UA specifications
  - All joint Information models

Published Information Models

OPC UA Specifications

Model	Specification
Core	OPC 10000-1 - Part 1: Overview and Concepts
Core	OPC 10000-2 - Part 2: Security Model
Core	
Core	
Core	

Joint Companion Specifications

Model	Specification
DI	OPC 10000-100 - Part 100: Device Information Mod
ADI	OPC 10020 - UA for Analyzer Devices
ISA-95	OPC 10030 - UA for ISA-S95
PLCopen	OPC 30000 - UA for Programmable Logic Controller
AutoID	OPC 30010 - UA for AutoId Devices
AutomationML	OPC 30040 - UA for AutomationML
PackML	OPC 30050 - UA for PackML (OMAC)
TMC	OPC 30060 - UA for Tobacco machinery (TMC)

Future

OPC Foundation: Roadmap

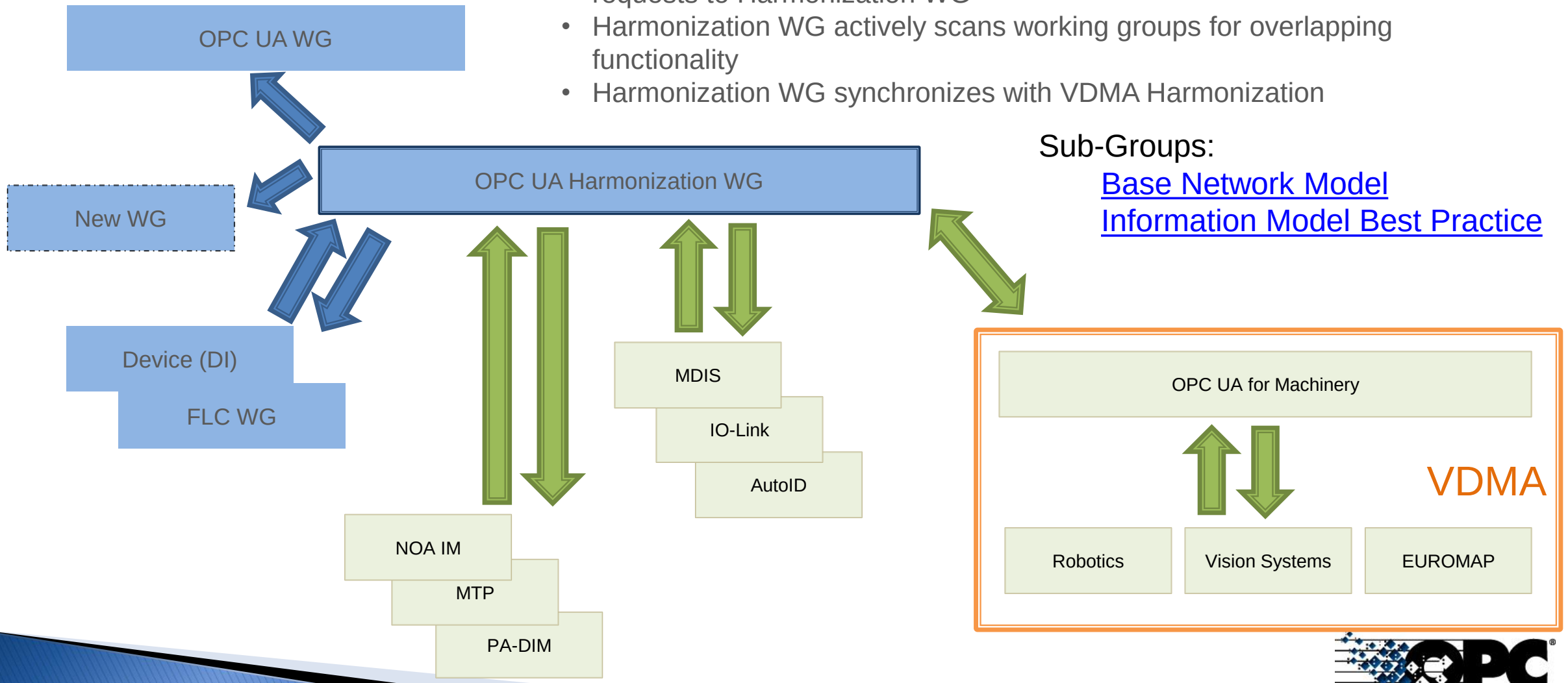
https://opcfoundation.org/about/opc-technologies/opc-ua/opcua-roadmap/

Recent innovations in v1.04	2019/2020 – Features worked on	2021 and beyond – Vision
2019: Relate with established semantic models (Dictionary Reference) ▪ An infrastructure to reference from an OPC UA Information Model to external dictionaries like IEC Common Data Dictionary or eCl@ss. **2019: Interfaces and AddIns** ▪ *Interfaces* and *AddIns* complement the type model and can be used when subtyping is not suitable for a required extension. **PubSub** ▪ New communication schema to enable and optimize OPC UA for one-to-many, many-to-one, or many-to-many configurations. **JSON Web Token, OAuth2** ▪ User identification using the authorization service well-established in modern cloud applications (Azure, Google, Facebook, …) **Reverse Connectivity** ▪ Servers behind firewalls can use reverse connectivity. **SessionLess Services** ▪ Avoids session establishment for use cases where Servers are called infrequently. **Security**	**Deterministic UA: Mappings to TSN** ▪ This project will add a transport mapping of OPC UA PubSub to Time Sensitive Networking (TSN). Based on this mapping, deterministic data exchange between UA applications is possible. **Field-Level Communication (FLC)** ▪ The goal of this initiative is to extend OPC UA to the field by addressing all relevant use-cases for Process- and Factory Automation including for instance determinism, safety and motion. **Alias names** ▪ 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*. **Harmonization of companion standards** ▪ 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	The following features are under consideration. No concrete specification work has been initiated. **Transactions** ▪ 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. **MetaData in the Cloud** ▪ 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. **Cloud-Relay** ▪ The cloud-relay capability allows for connectivity between UA applications even when both Client and Server are behind separate firewalls. **Deterministic communication using 5G** ▪ The 5th generation wireless systems will provide better performance and determinism. Similar to the TSN mapping a mapping of PubSub to 5G protocols

OPC FOUNDATION

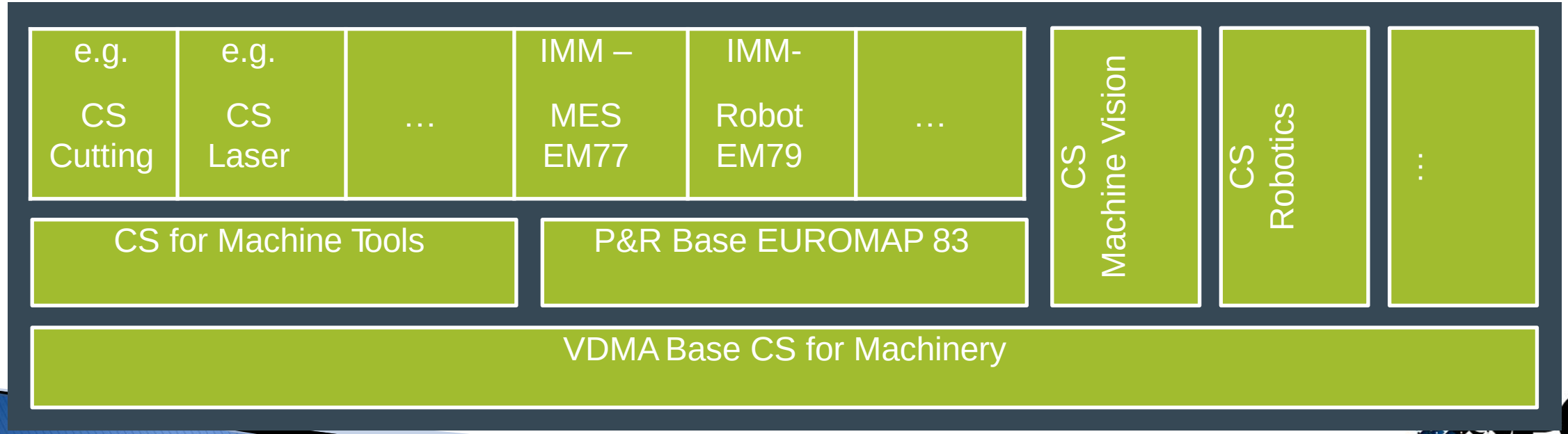
OPC UA Harmonization Working Group

- Companion Working Groups (OPC F and JOINT) report common feature requests to Harmonization WG
- Harmonization WG actively scans working groups for overlapping functionality
- Harmonization WG synchronizes with VDMA Harmonization

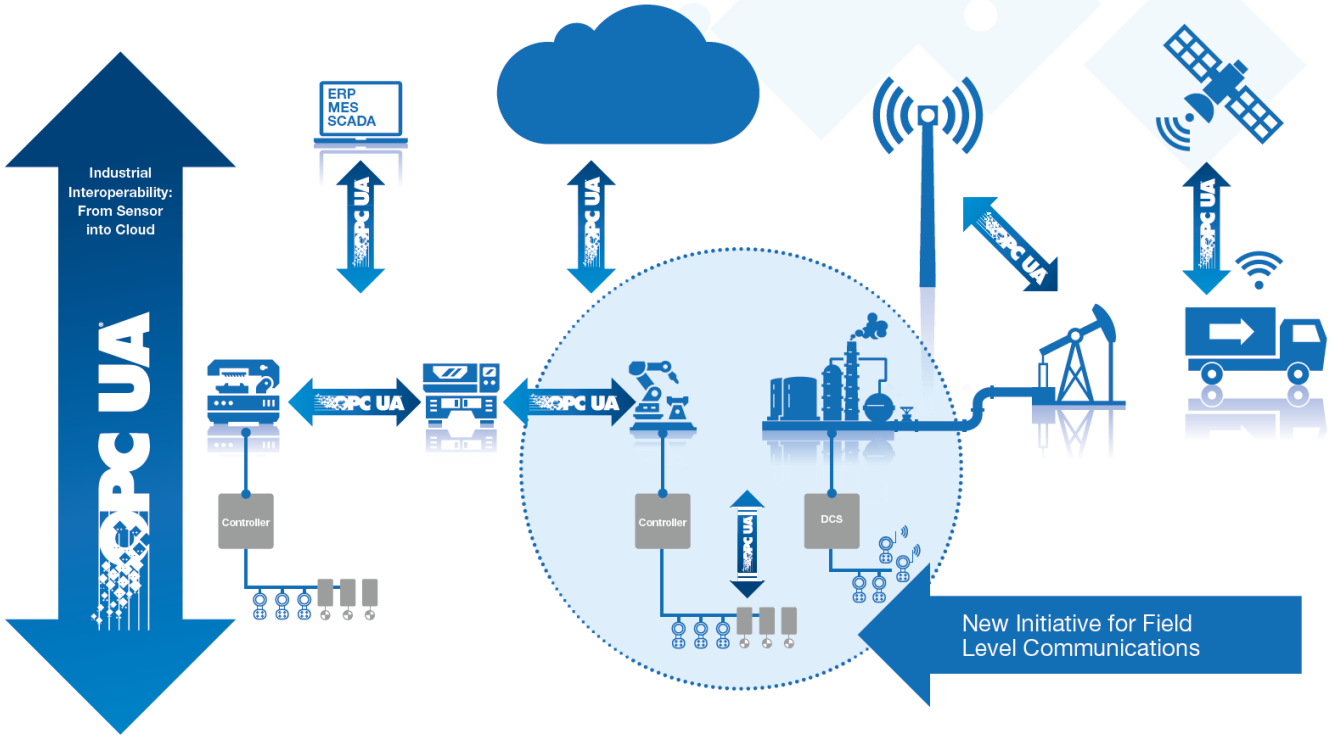


Base Building Blocks

- **OPC UA for Machinery** defines building blocks for the whole engineering industry
  - Use-Case specific Building Blocks for base-functionality
  - Companion Specs use Building Blocks required



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



Milestones

- 2018: Started at OPCF Press Conference SPS Overcrowded!

- 2020: First result!

OPCF FLC Initiative with 27 supporting Industry Players

- extra contribution for steering
- working groups open to all OPC members
- Overall, more than 200 technical experts from more than 50 member companies of the OPC Foundation are active in the FLC Technical Working Groups

Field Level Communications Initiative

Information Models
Semantic
Security
IT Connectivity

OPC UA

IEEE 802 TSN

Converged, real-time capable Ethernet networks

ethernet-apl™ advanced physical layer

OPC UA

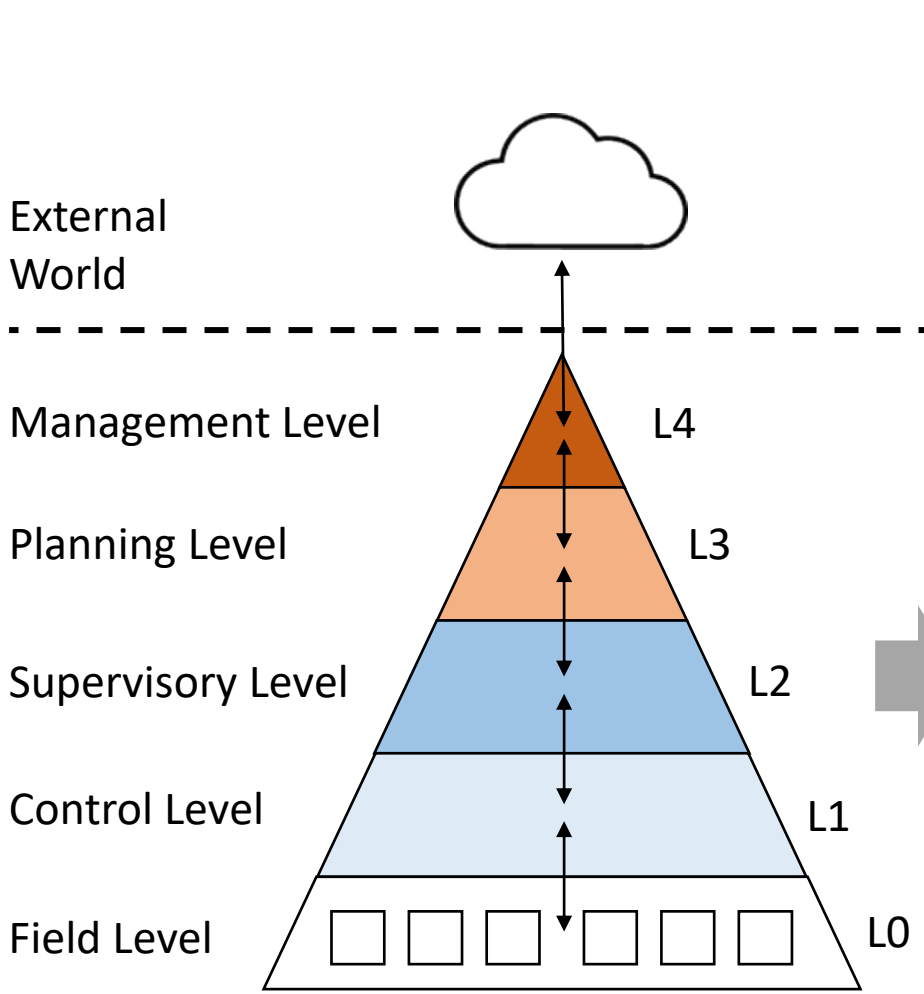
Combine Strength

OPC FOUNDATION MEMBER

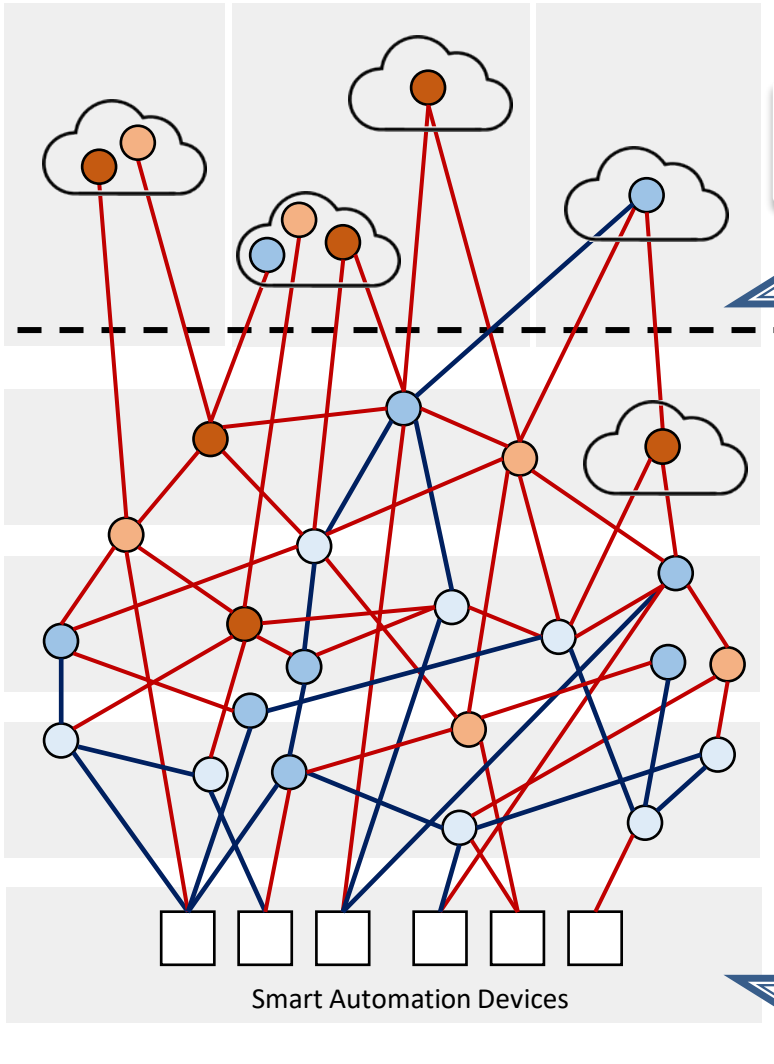
Major automation vendors in the initiative add their long time field level communications know-how

OPC FOUNDATION

From Automation Pyramid to Automation Network



Source: VDI (2013), MDPI (2019)



Universal Industrial Network

OPC UA

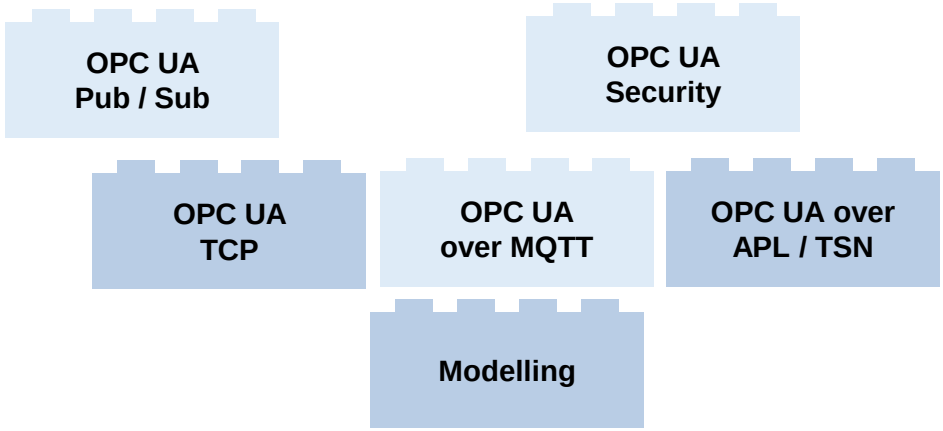
The Field Level Communications Initiative of the OPC Foundation is extending OPC UA to cover all requirements of industrial automation including Ethernet APL/SPE, Ethernet TSN (and in future 5G, Wi-Fi 6, etc.)

OPC FLC: Information

New brochure available soon

OPC FLC Webinar: Dec 1st – registration opening Nov 6th

Call for action

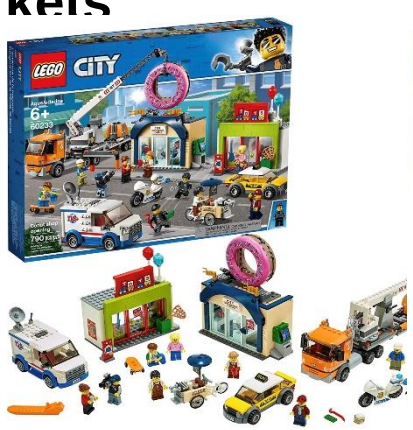


- **Summary: OPC UA + Companion Spec**
  → Promize of 100% Industrial Interoperability
  → Validation and Certification available

Call for action:

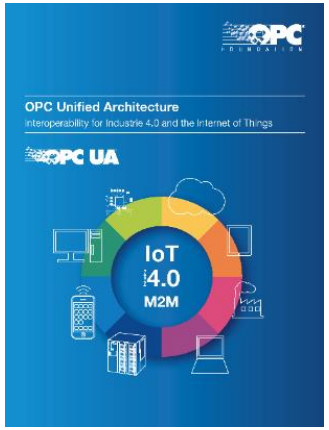
- **OPC UA: Collection of technology bricks**
  - Learn more about OPC UA!
  - Join upcoming webinars (FLC, Security,..)
  - Brochure https://opcfoundation.org/opcua-en.pdf

- **Companion Specifications: Set of features for different markets**
  - Is a standardization group existing for your market?
  - Get in contact with OPC Foundation!



OPC Foundation: Information

https://opcfoundation.org/opcua-en.pdf



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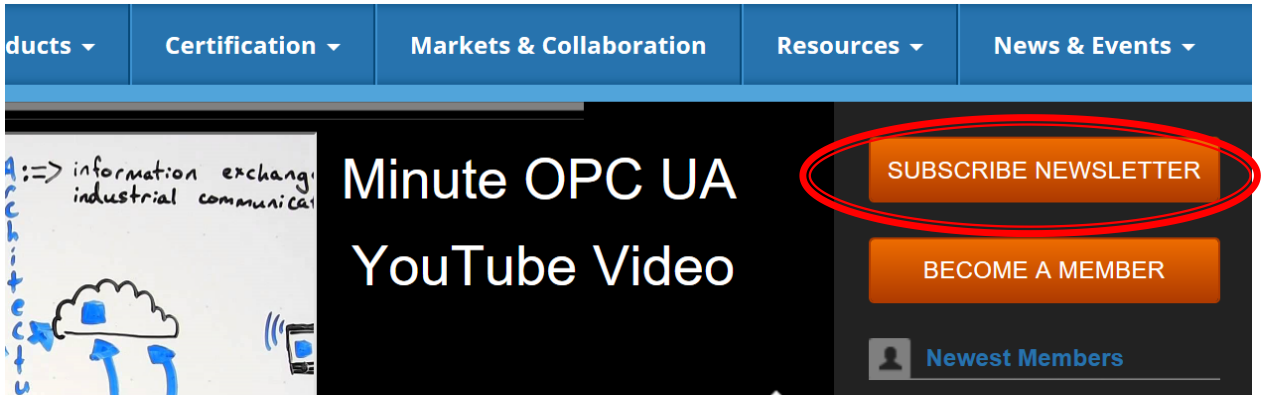

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Google: http://bit.ly/2PKsY7O

OPC Foundation: The United Nations for Industrial Automation

Thank you! - Questions?

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