



OPC UA

La norme d'interopérabilité sécurisée pour l'Industrie 4.0 et l'IoT

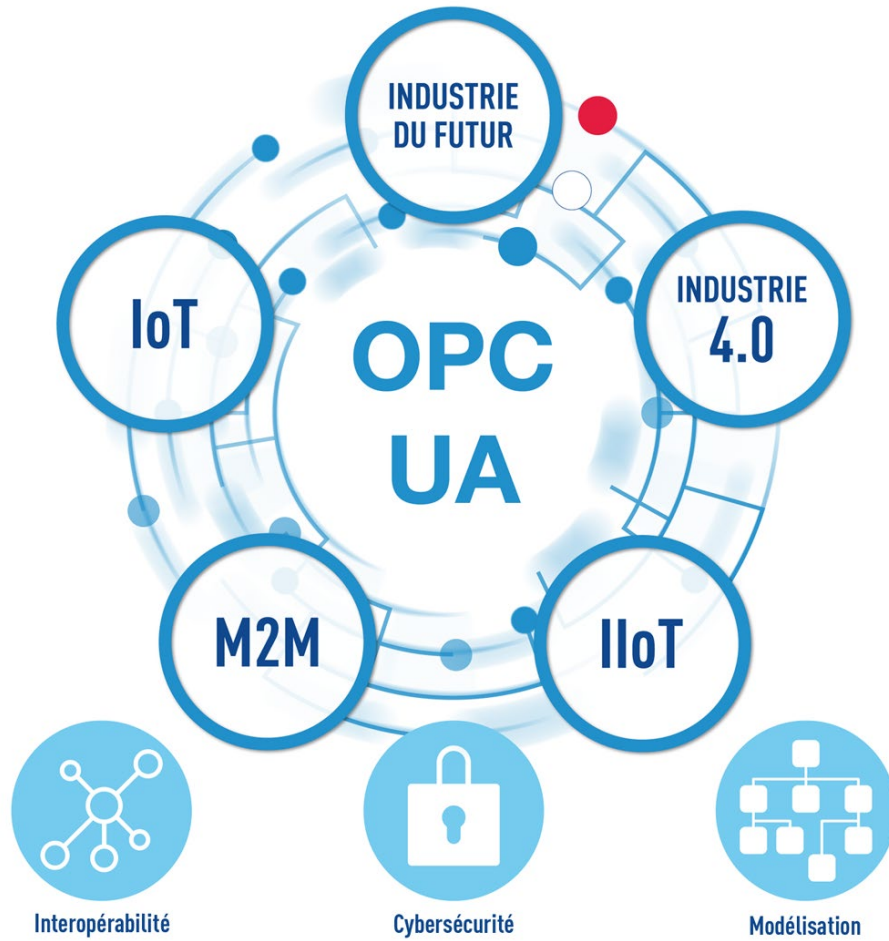
OPC Day France, Saclay

14 Juin 2023

Principaux avantages pour les utilisateurs

- ▶ Gain de temps lors de l'intégration de la machine dans les installations
- ▶ Communication standardisée multi-vendeurs
- ▶ Accès hautes performances à de grandes quantités de données
- ▶ Sécurité intégrée grâce à des mécanismes à la pointe de la technologie
- Authentification par certificats, mots de passe ou délégation d'identité (OAUTH2)

Les trois piliers de l'OPC-UA (IEC62541)



1. Interopérabilité
2. Cybersécurité
3. Structure de données
 - 3.1 : Modélisation métier (Companion Specifications)
Sémantique
Structuration des données

1 - Interopérabilité

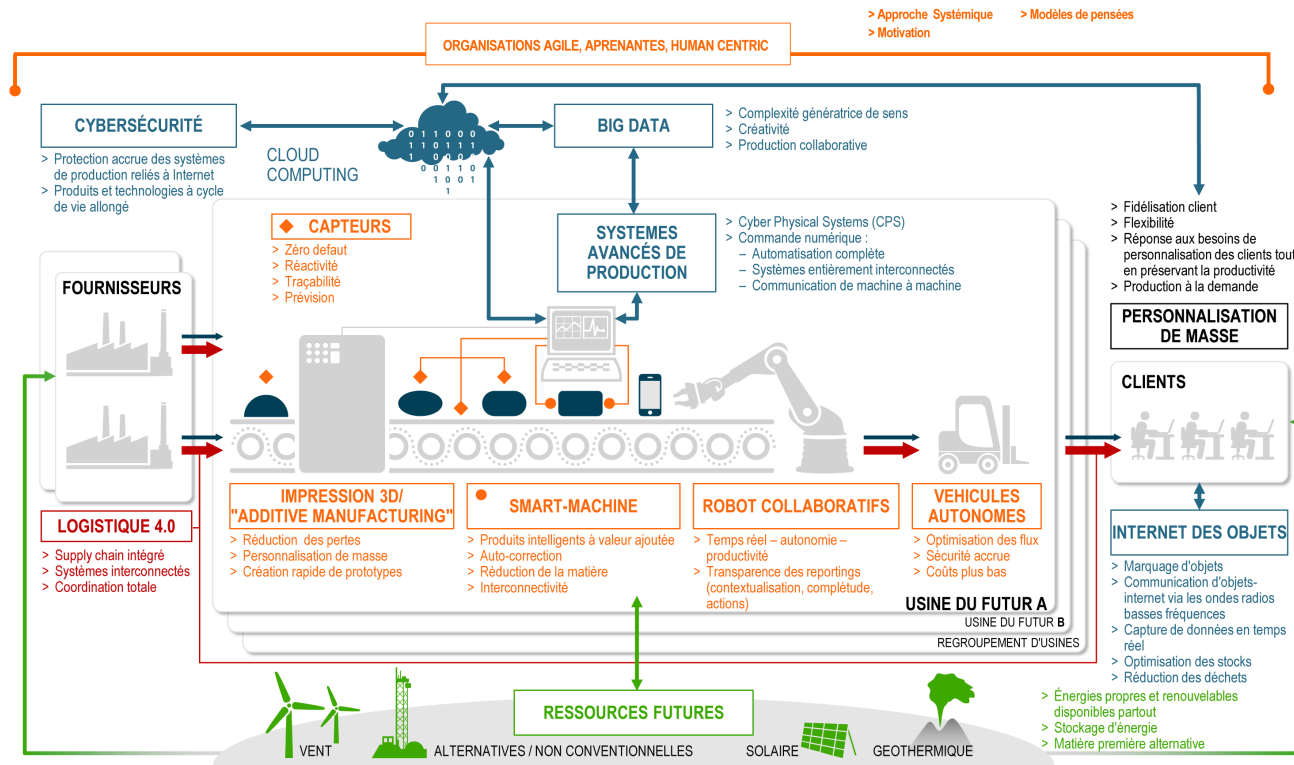
L'interopérabilité, c'est :

La capacité des systèmes cyber-physiques (c'est-à-dire les porte-pièces, les stations d'assemblage et les produits), des humains et des usines intelligentes à se connecter et à communiquer entre eux via l'Internet des objets et l'Internet des services.

► Indépendant de la plateforme matérielle et logicielle

► Interopérabilité horizontale et verticale

- Convergence OT/IT du capteur jusqu'au cloud
- Intégré par tous les constructeurs



Source : Roland Berger

2 - Sécurité

OPC UA a été conçu autour de la sécurité

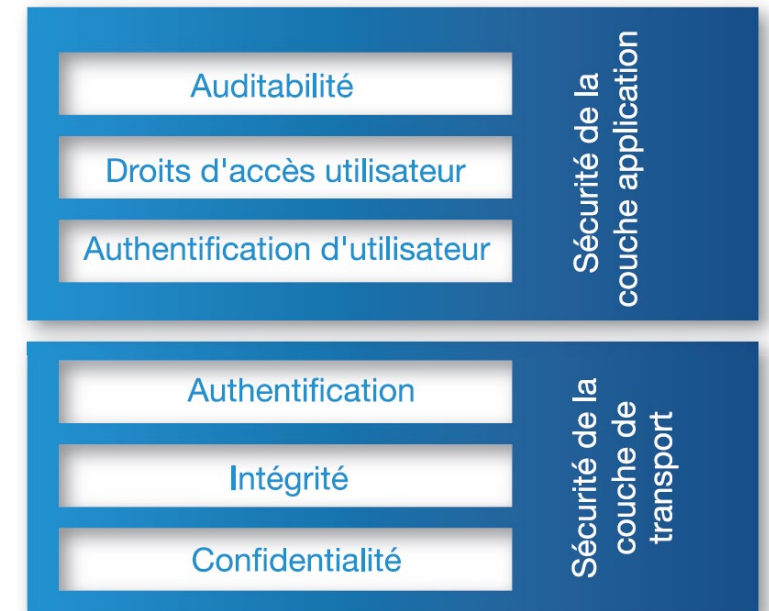
Basé sur des standards de sécurité ouverts

Authentification, chiffrement, ...

Evolutif: évolue avec les technologies de sécurité

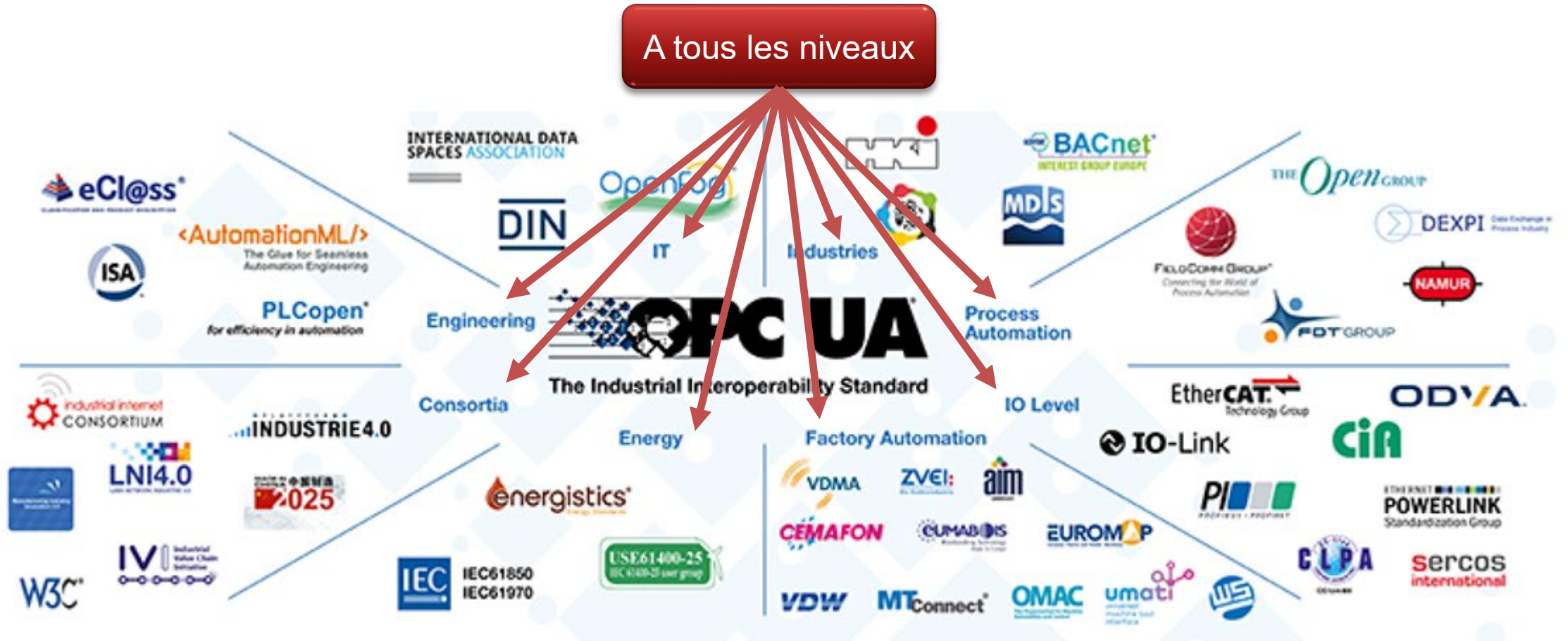
Aligné sur les exigences de l'IT

Publication par l'office fédéral de la sécurité de l'information Allemand (BSI) des résultats de l'analyse de sécurité d'OPC-UA

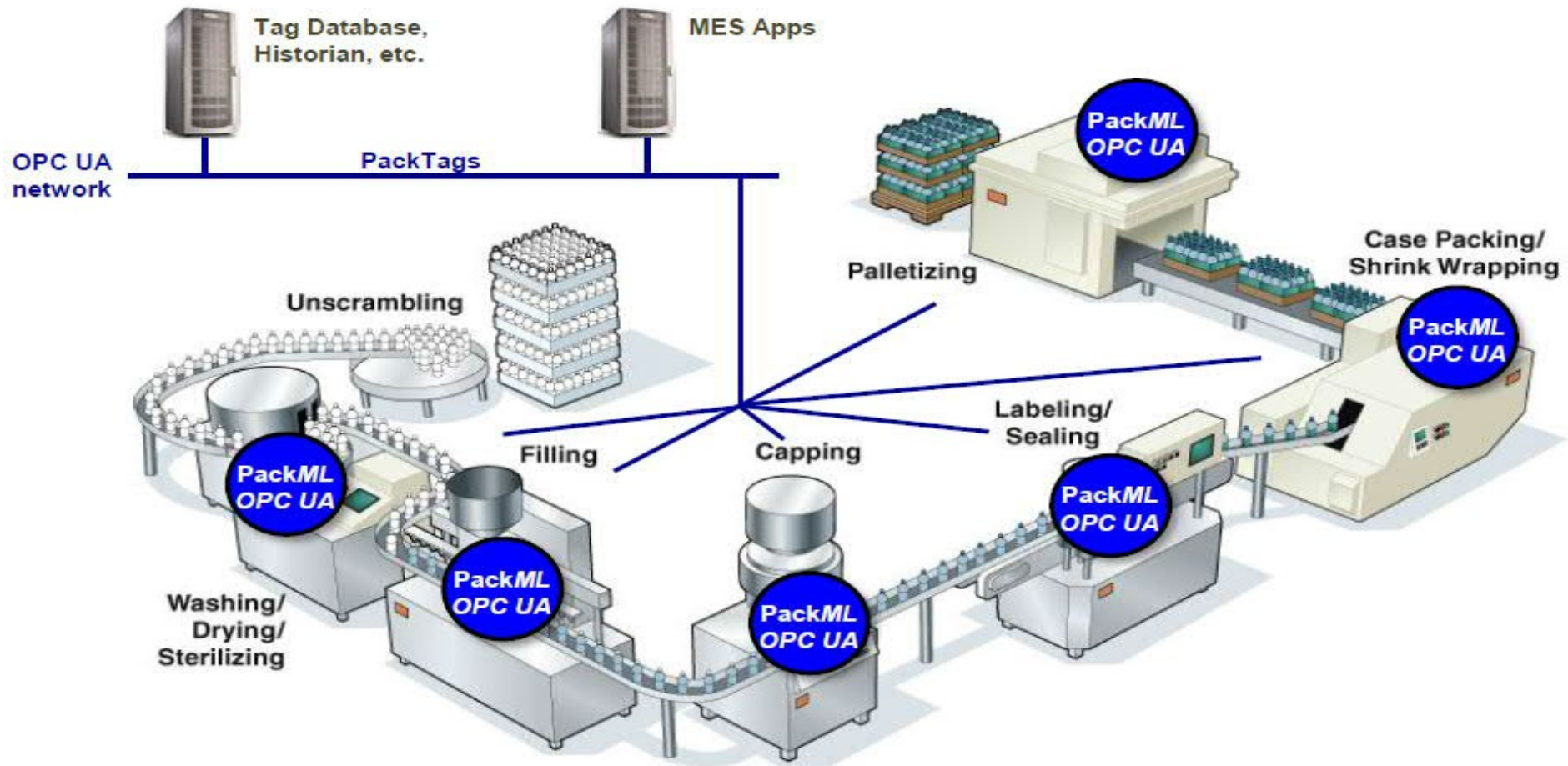


3 - Modélisation

La Fondation OPC coopère étroitement avec des organisations et des associations de différentes branches. Les modèles d'informations spécifiques à d'autres organisations de normalisation sont mappés sur OPC-UA et deviennent ainsi portables.



Exemple d'intégration – Companion Spéc PackML



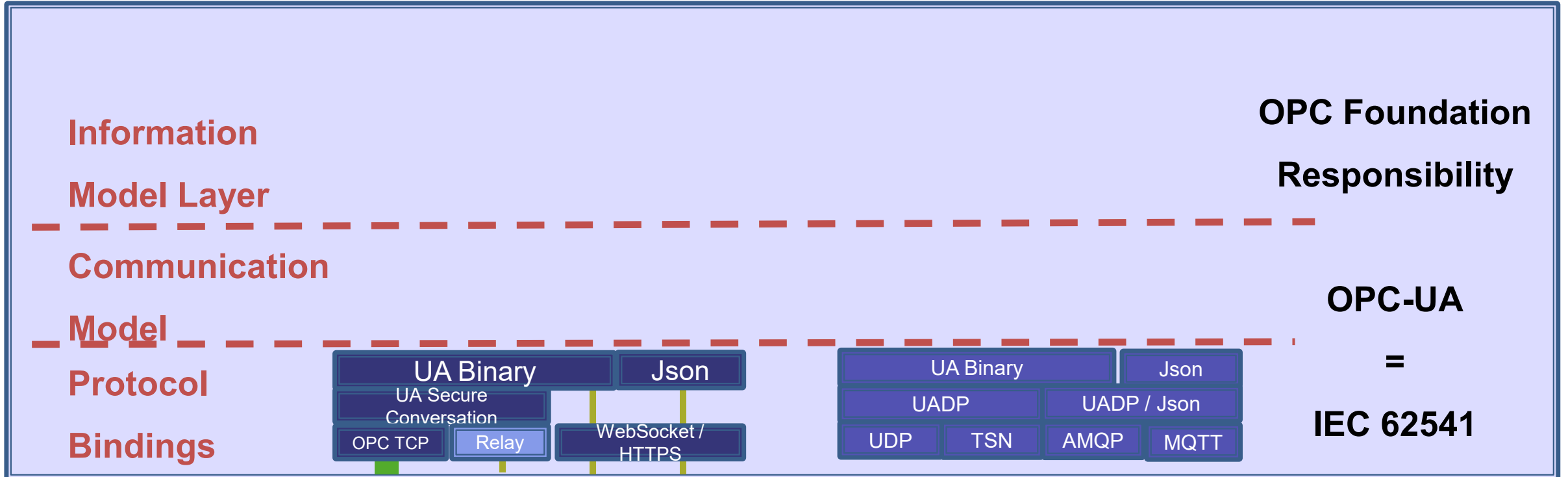
OPC-UA : du capteur au Cloud

- 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

Protocol Bindings

Couche Basse avec plusieurs protocoles définis garantissant une interopérabilité matérielle

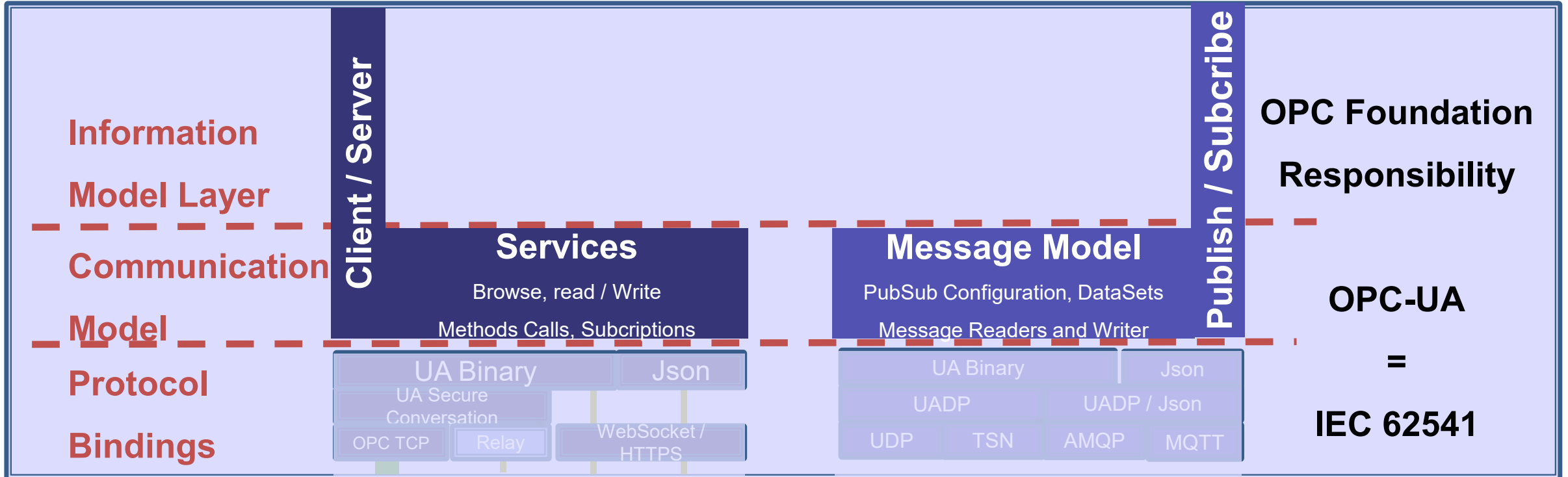
- UA-TCP - TCP/IP based, UA Binary
- UADP – UDP based, UA Binary, TSN deterministic
- UADP – MQTT based, JSON, Cloud, optional Broker



Communication Model

OPC UA intègre les deux types de communications pour offrir le maximum de flexibilité

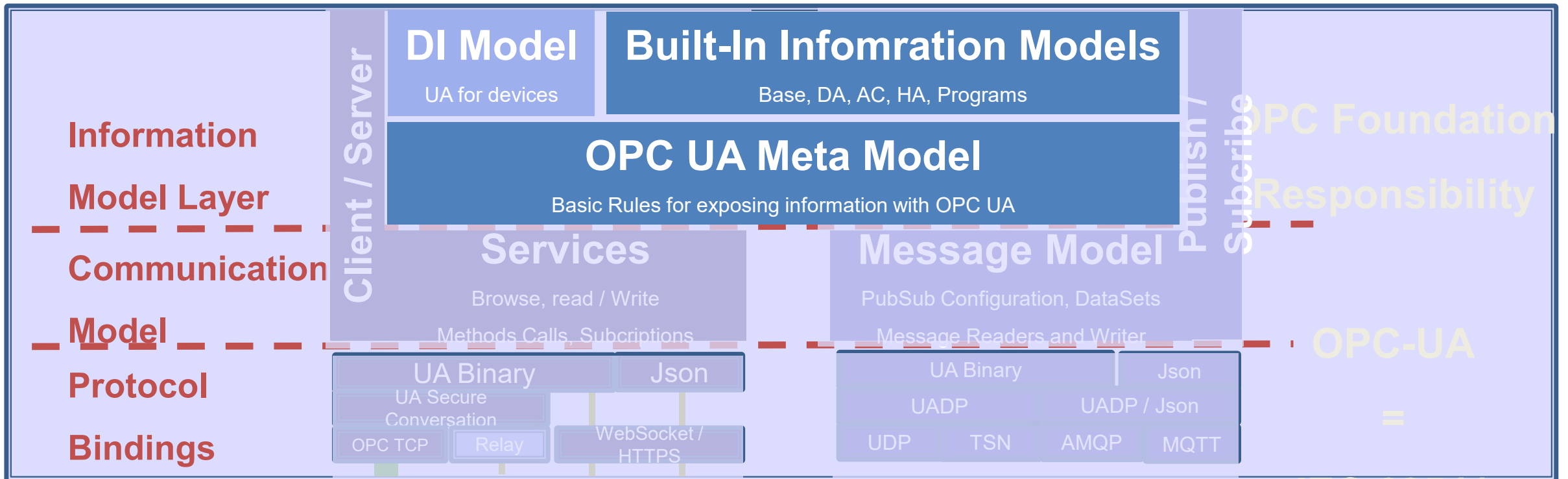
- **Client / Server** - service oriented, request / response, on demand
- **Publish / Subscribe** – message oriented - multicast, unidirectional, „cyclic“



Data Models

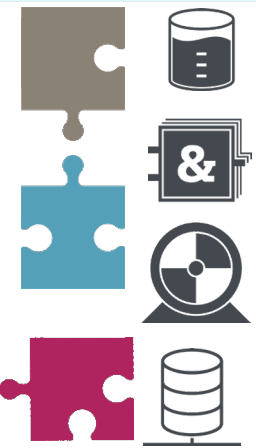
OPC UA intègre une couche haute supplémentaire , la modélisation des données

- ▶ Orienté objet
- ▶ Flexible
- ▶ évolutif







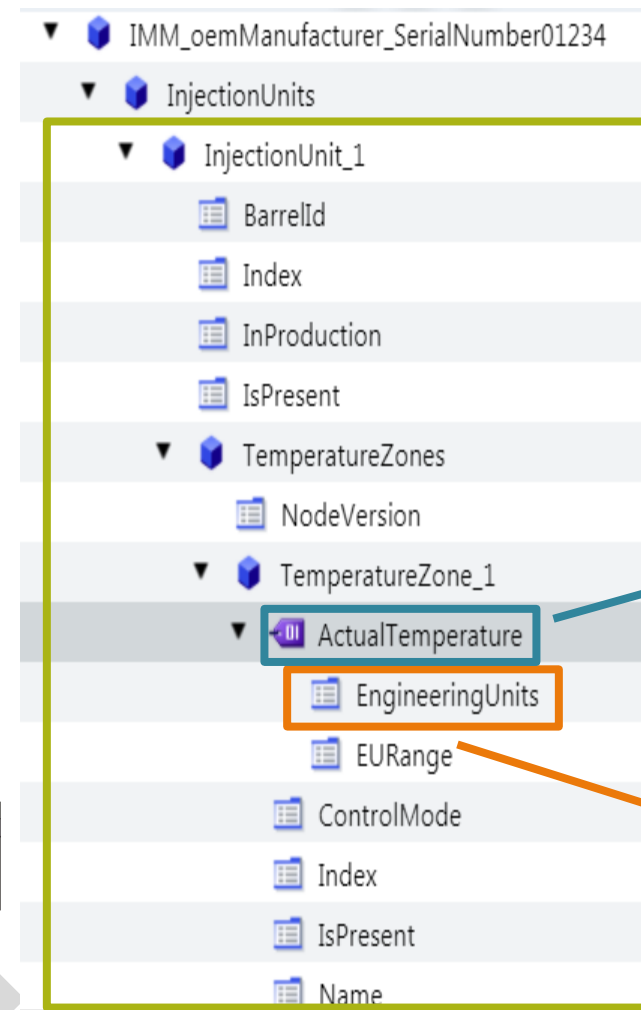
Modélisation des échanges en utilisant des éléments de base OPC-UA

PLC Data



ProductionEquipment_1			
	Name	Datentyp	Erreichbar aus HMI/OPC UA
1	Static		
2	DeviceManual	Wstring	<input checked="" type="checkbox"/>
3	DeviceRevision	Wstring	<input checked="" type="checkbox"/>
4	Diagnostics	*typeDia...	<input checked="" type="checkbox"/>
5	DeviceHealth	Dint	<input checked="" type="checkbox"/>
6	HardwareRevision	Wstring	<input checked="" type="checkbox"/>
7	IMVersion	*typeVer...	<input checked="" type="checkbox"/>
8	Major	Uint	<input checked="" type="checkbox"/>
9	Minor	Uint	<input checked="" type="checkbox"/>
10	Revision	Uint	<input checked="" type="checkbox"/>
11	ItemDesignation	Wstring	<input checked="" type="checkbox"/>
12	Manufacturer	Wstring	<input checked="" type="checkbox"/>
13	Model	Wstring	<input checked="" type="checkbox"/>
14	RevisionCounter	Dint	<input checked="" type="checkbox"/>
15	SerialNumber	Wstring	<input checked="" type="checkbox"/>
16	SerialNumberController	Wstring	<input checked="" type="checkbox"/>
17	SerialNumberHW	Wstring	<input checked="" type="checkbox"/>
18	SoftwareRevision	Wstr...	<input checked="" type="checkbox"/>

-  Object
-  Method
-  Variable
-  Property



```

    IMM_oemManufacturer_SerialNumber01234
    └─ InjectionUnits
        └─ InjectionUnit_1
            └─ BarrelId
            └─ Index
            └─ InProduction
            └─ IsPresent
            └─ TemperatureZones
                └─ NodeVersion
                └─ TemperatureZone_1
                    └─ ActualTemperature
                        └─ EngineeringUnits
                        └─ EURange
                        └─ ControlMode
                        └─ Index
                        └─ IsPresent
                        └─ Name
    
```

Technological objects include assortments of

- Tags
- Objects
- Methods

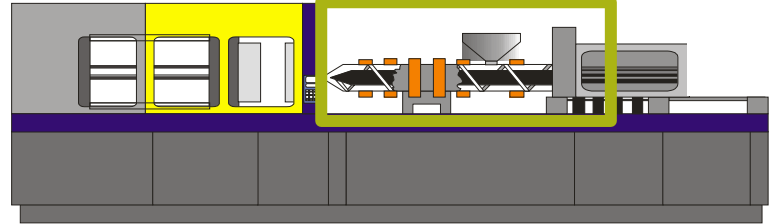
Including semantics and namespaces

Actual Value

Property (e.g. definition of technical units)

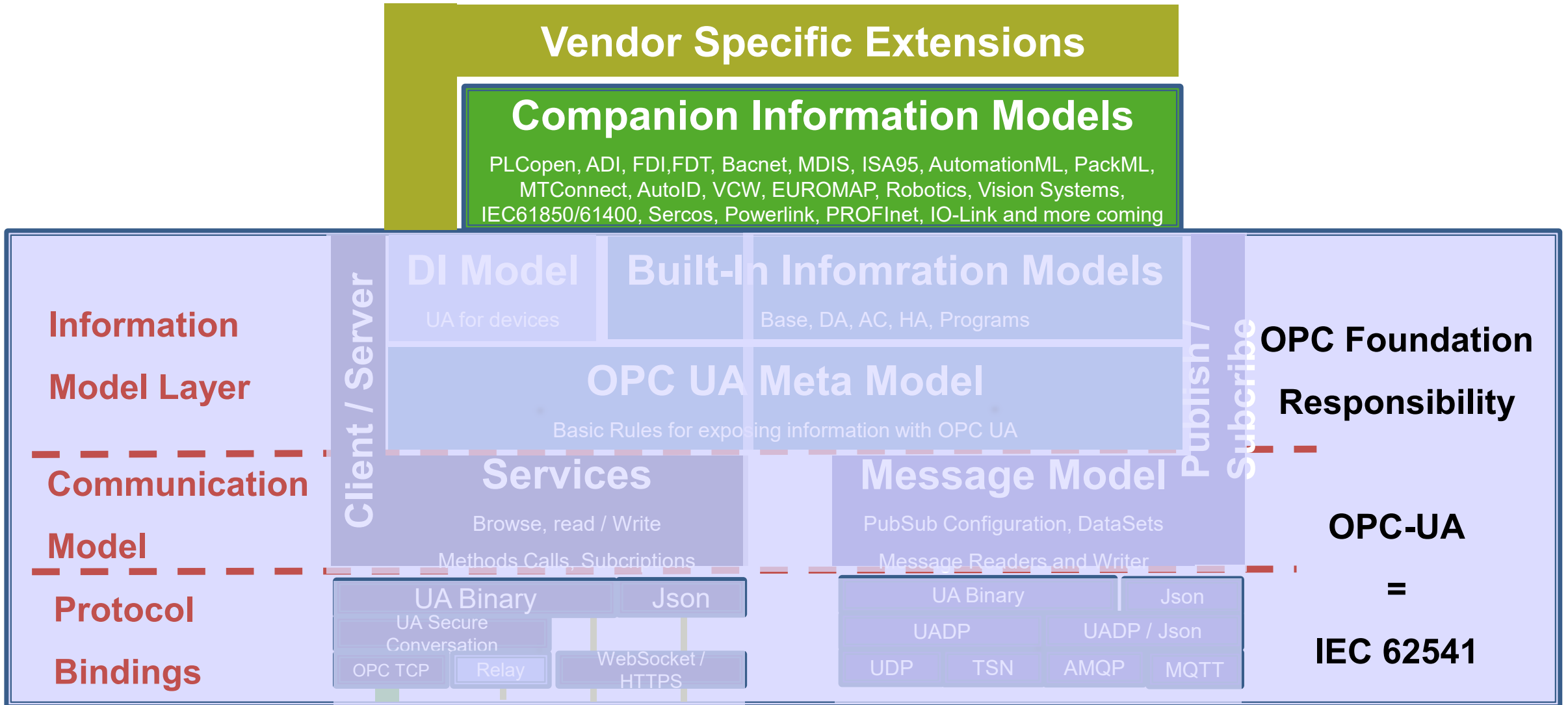


Data Model



OPC UA

Companions Spécifications



Ce qu'il faut retenir

Possibilités de développer des modèles de données par métier

**Information
Model Layer**

**Bibliothèques d'objets pour l'OT
(Modèles)**

Communication

Connexion universelle:

Model

Client / Server ou Publish / Subscribe

Protocol

Bindings

Interopérabilité Matérielle

**à tous les niveaux
Cybersécurité native**

**OPC Foundation
Responsibility**

OPC-UA

=

IEC 62541

Process de certification



- Tests sur les fonctionnalités
- Produits testés avec 5 autres
- Tests de communications
- Combine la conformité, l'int

® Properability Testing

Robustness

Efficiency

Usability

Bénéfice de la certification

- Produits (Hard et/ou Soft) vérifiée d'OPC-UA
- Démontrer l'expérience dans OPC-UA
- Montrer l'engagement pour la technologie
- Fiabilité vérifiée
- Moins d'efforts de support
- Listé sur le site des produits certifiés

de l'OPC Foundation



Experts OPC-UA France



Outils

- ▶ Web (documents , normes, events, outils, etc..) <https://opcfoundation.org>

Web



Réseaux sociaux



Youtube

<https://www.youtube.com/@TheOPCFoundation>

Certification

- ▶ Certification Portal
<https://opcfoundation.org/certification>
- ▶ Profile Reporting Tool
<http://opcfoundation-onlineapplication.org/profilereporting>
- ▶ Compliance Test Tool (CTT)
<https://opcfoundation.org/developer-tools/certification-test-tools>

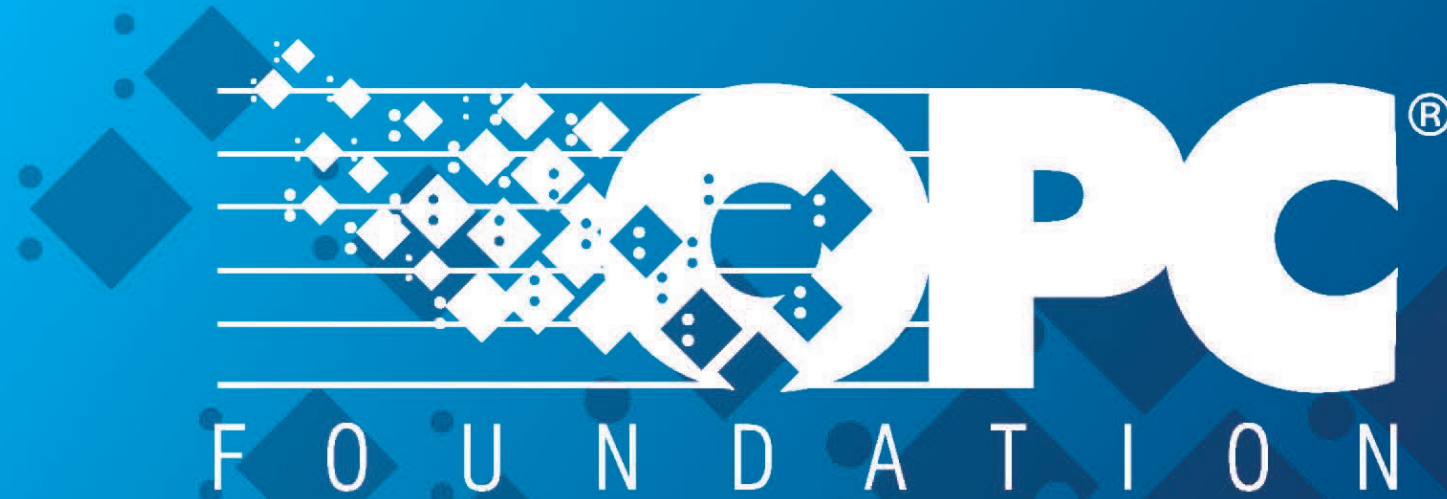
Produits Certifiés



<https://opcfoundation.org/products/?certified=yes>

Travaux en cours : Amélioration d'OPC-UA

- FX : Communication Controller To Controller, Motion , Safety
- CCloudLib: Bibliothèque de modèles (Vannes, Savoir Faire métier spécifique, etc...)
- RestAPI: Ouverture vers des applications Rest externes permettant des échanges avec un serveur OPC-UA



The Industrial Interoperability Standard

Présentation SYSTEREL

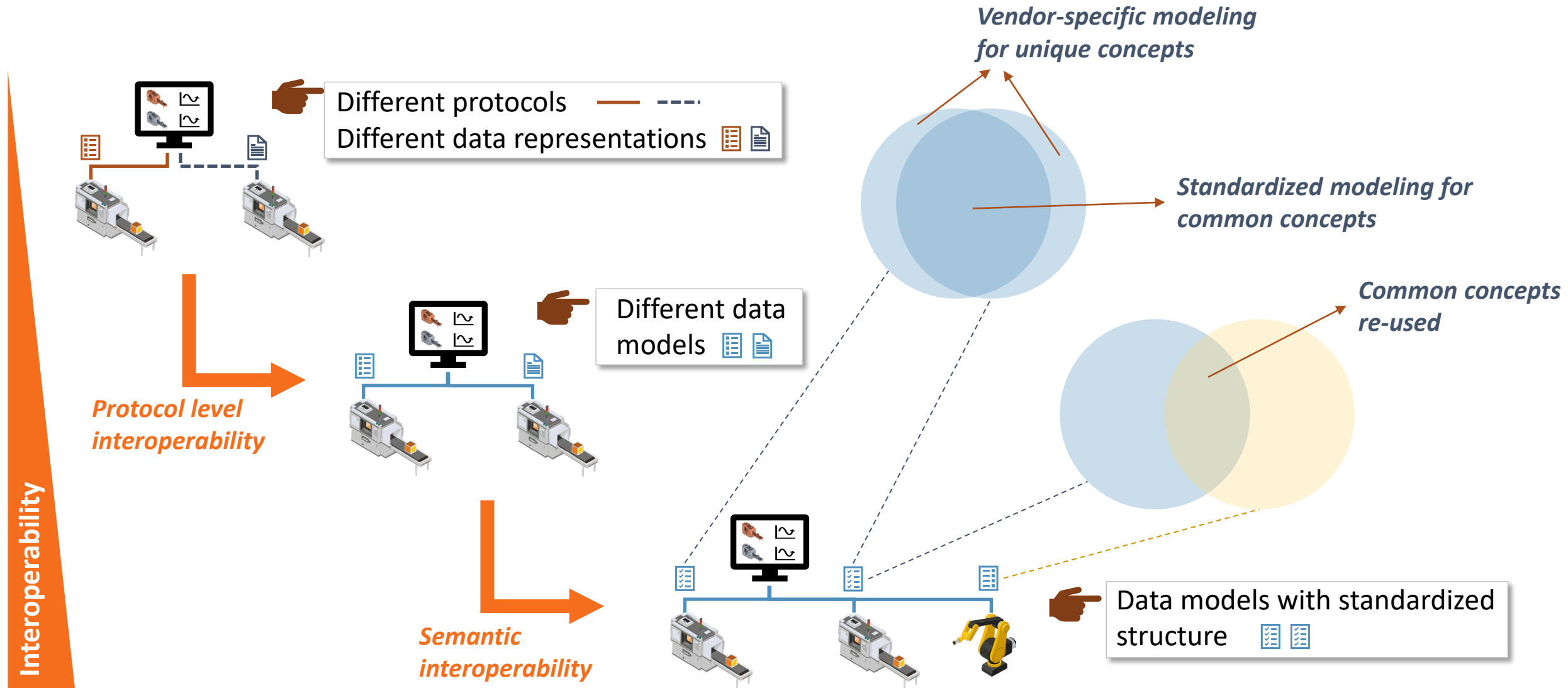


OPC UA Companion Specifications

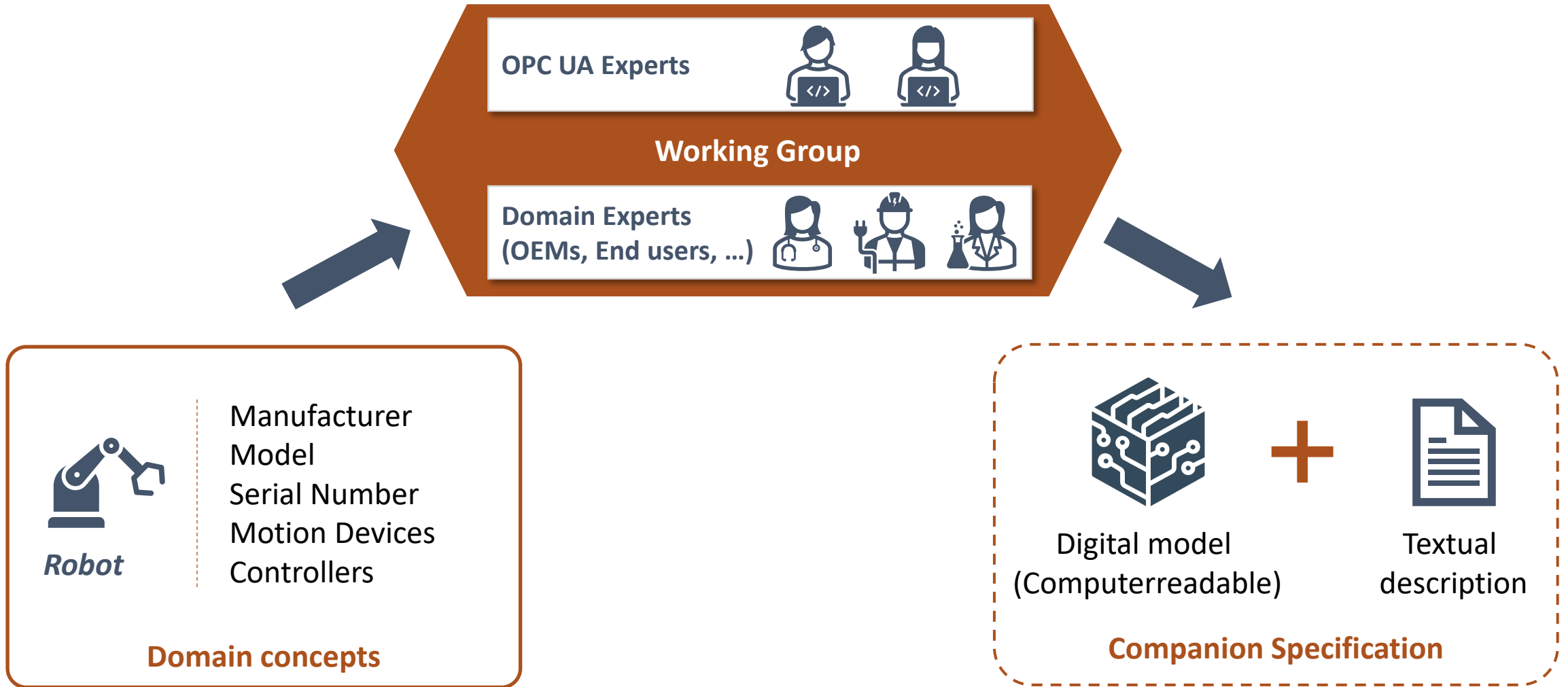
Fahad Golra, Agileo Automation



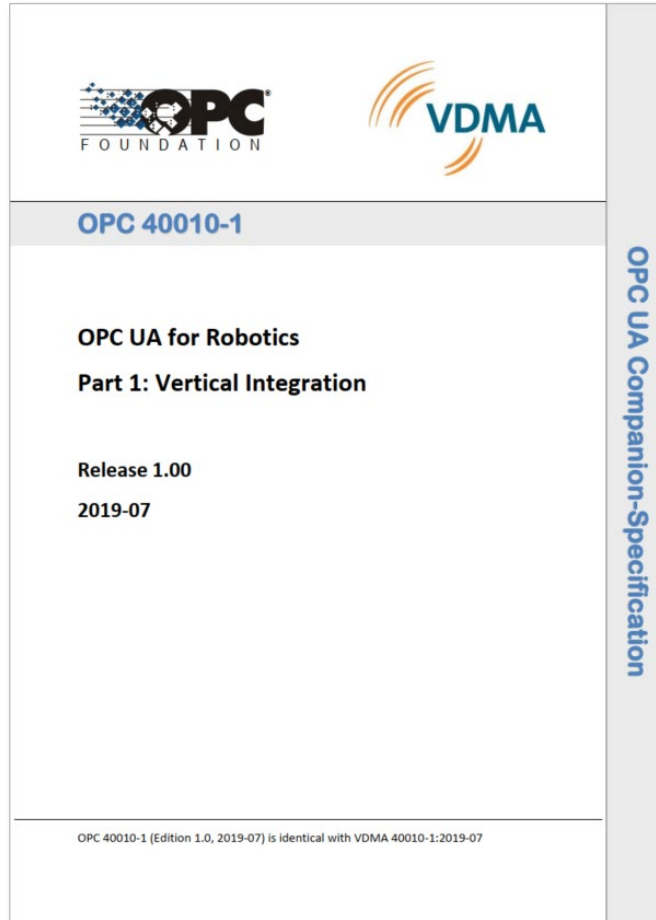
Multiple levels of interoperability



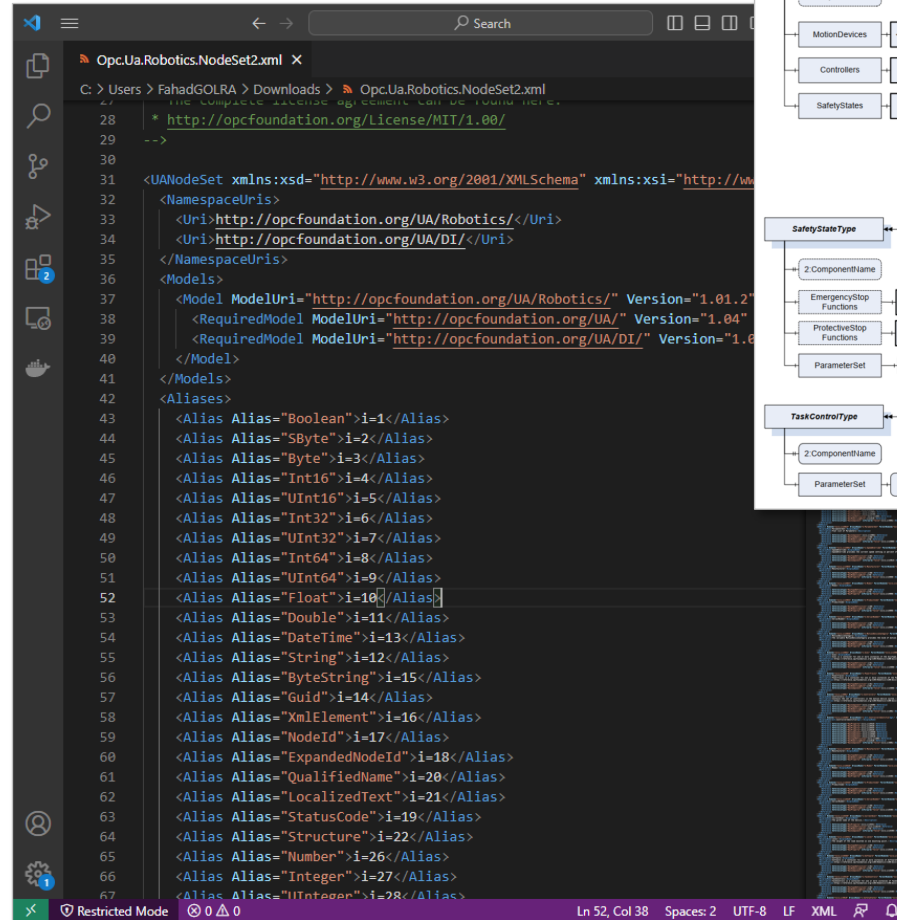
Development of a CS



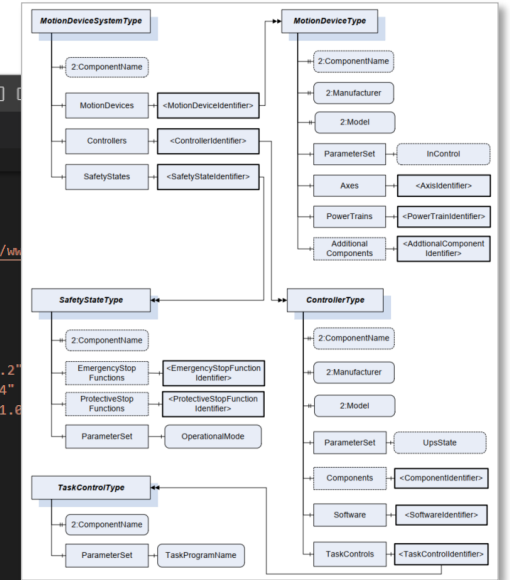
CS Example – Robotics



Textual specifications



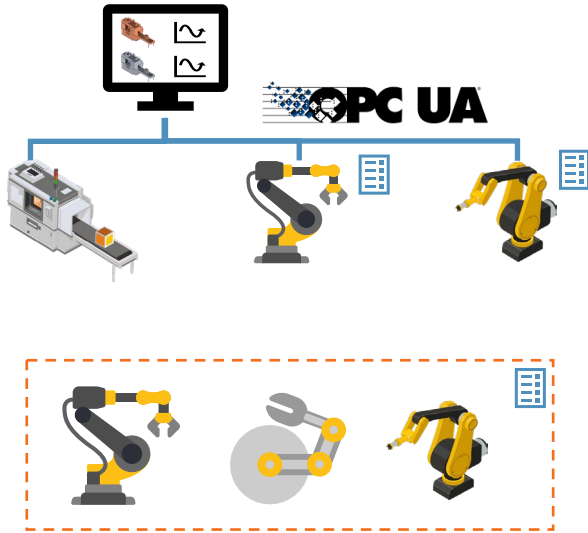
Digital model in nodeset file (XML)



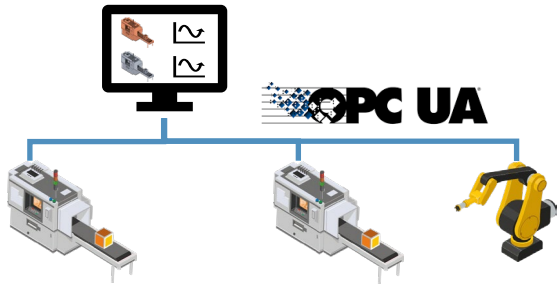
Graphical Notation

Interoperability with OPC UA

Interoperability



Companion specifications at multiple levels



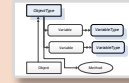
OPC UA communication network

Enterprise & Cloud

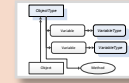
Industrial Automation

Devices, tools & Equipment

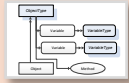
Asset Management



ISA-95 Job Control



Cloud Library API Definition



Process Automation Devices – PADIM



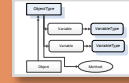
OPC UA for PackML



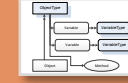
OPC UA for DEXPI P&ID



OPC UA for Robotics



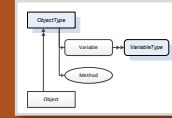
OPC UA for Weighing Tech.



OPC UA for CNC Systems



OPC Unified Architecture

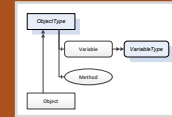


Data Access

Alarms & conditions

Information modeling (Objects/Types, Variables, ...)

OPC Unified Architecture



Data Access

Alarms & conditions

Information modeling (Objects/Types, Variables, ...)

Working Groups

- 71 different working groups
 - Joint -> 58
 - Internal -> 17
 - External -> 1

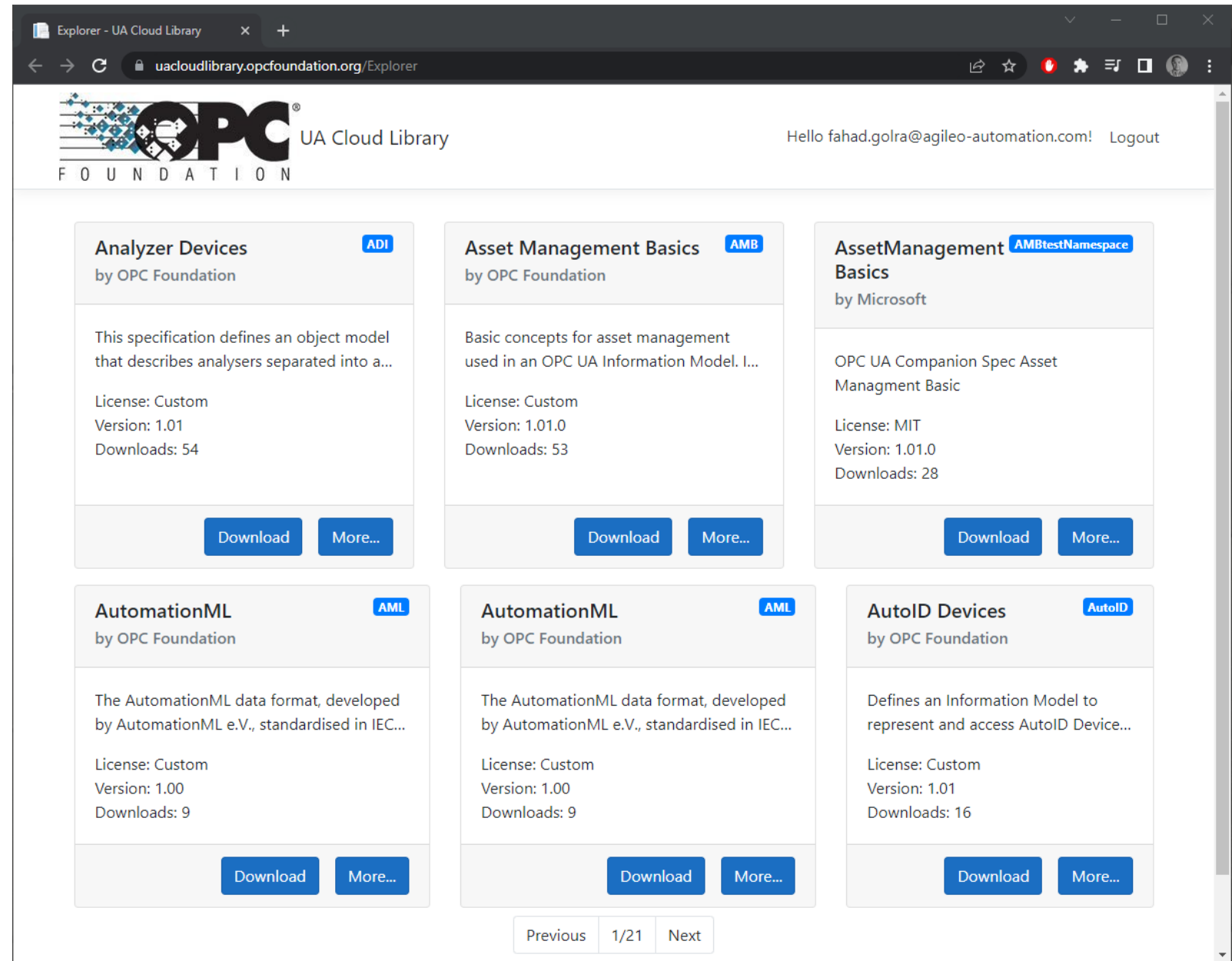
The screenshot shows the OPC Foundation website's 'List of Working Groups' page. The page has a blue header with navigation links: About, Membership, Products, Certification, Markets & Collaboration, Resources, and News & Events. Below the header is a blue banner with the title 'List of Working Groups' and a breadcrumb 'Home > Working Groups'. The main content area includes a filter section on the left with a search bar and three filter categories: Working Group Type (Internal, Joint, External), Status (Proposed, Active, Completed, Inactive), and Classification (Core UA Topics, Generic Models, Factory Automation). The right side of the page displays a table of working groups with columns for Name, Abstract, Partner Logo, Partner Org, and Chair. The table lists several working groups, including Additive Manufacturing, Analyzer Devices - ADI, Asset Management Basics, Automatic Identification Devices - AutoID, AutomationML model, BACnet, and Carbon Capture and Storage.

NAME	ABSTRACT	PARTNER LOGO	PARTNER ORG	CHAIR
Additive Manufacturing	The working group develops OPC UA Information Models for the industrial process chain of additive manufacturing ("AM") so that AM systems and other systems directly involved in the additive manufacturing process can be easily connected, configure...		VDMA	Martin Gehringer
Analyzer Devices - ADI	Develop specifications for analyzers irrespective of the underlying device protocols. Analyzer devices are comprised of one or more analyzer channels with a single address space which has its own configuration, status and control. Examples: Particle ...			Claude Lafond
Asset Management Basics	Defines common asset management models that can be used directly or as base for other companion specifications to refine those concepts for their domain specific needs.			Wolfgang Mahnke
Automatic Identification Devices - AutoID	Develop specifications for identification devices executing a scan, read or write process. Comprises barcode, OCR, 2D code, RFID, NFC, RTLS, sensors and mobile computing.		AIM – Association for Automatic Data Capture, Identification and Mobility	Bernd Wieseler
AutomationML model	Develop an OPC UA specification for AutomationML and an XML schema to describe OPC UA Servers and their communication parameters in an AutomationML file and to integrate UANodeSet address space XML files into AutomationML.	<AutomationML>	AutomationML e.v.	Miriam Schleipen
BACnet	Specify a gateway interface between the BACNET object model and OPC UA -> integration of building and industry automation.		BACnet Interest Group Europe e.v. (BIG-EU)	Frank Schubert
Carbon Capture and Storage	The OPC UA CCS Working Group will develop several OPC UA Information Models for		VDMA, CESMII, OPC	Erich Barnstedt

www.opcfoundation.org -> About -> Working Groups -> List of Working Groups

UA Cloud Library

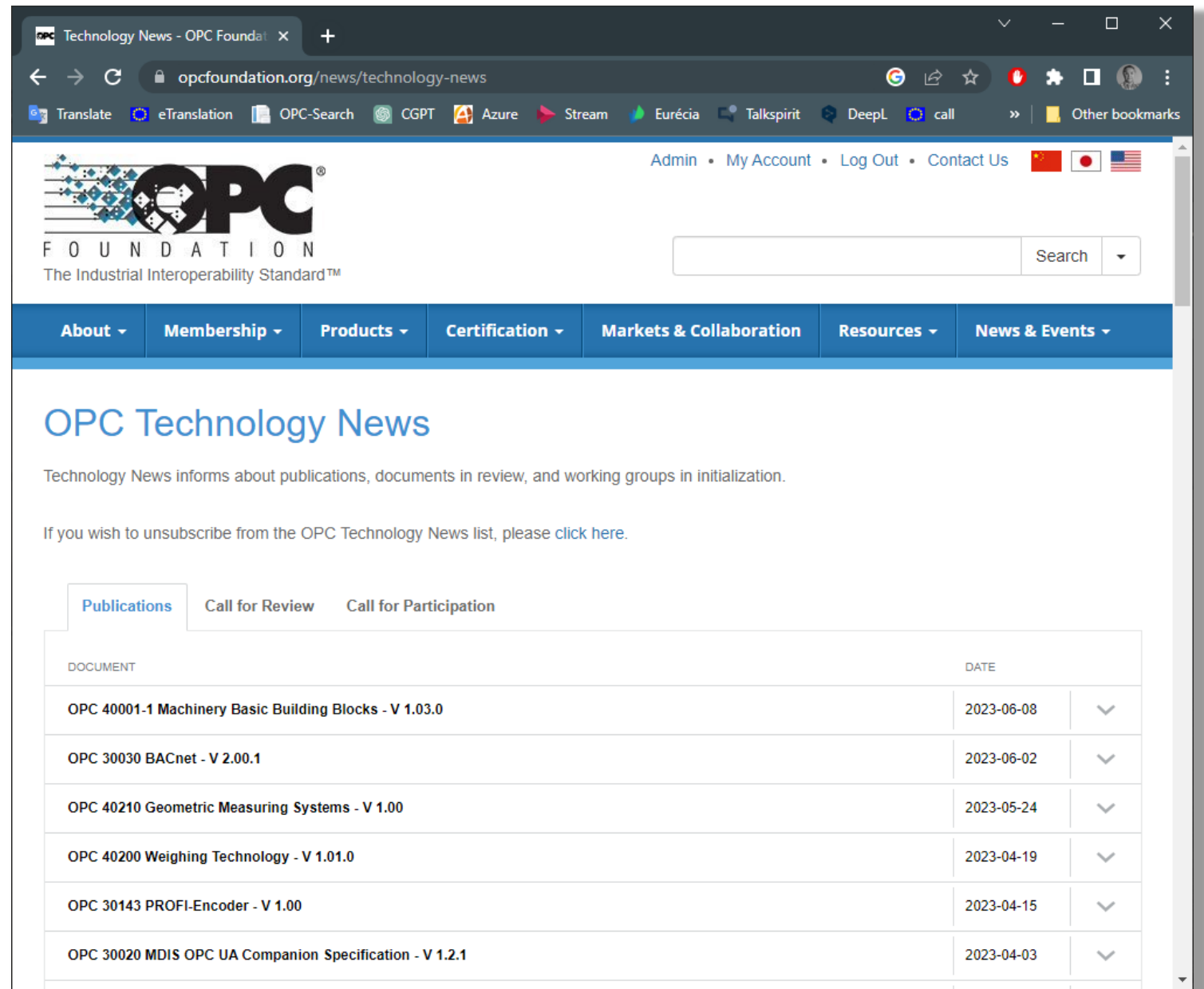
- A *query-able* online store of OPC UA CS information models.
- 126 OPC UA Information Models for the companion specifications available
- UA Cloud Library Explorer
- GraphQL Editor



<https://uacloudlibrary.opcfoundation.org>

Technology News

- Updates about the latest versions of CS
 - Subscription to the technology updates
- Call for review
 - Review the companion specifications before their release.
- Call for participation
 - Join the working groups



The screenshot shows the OPC Foundation Technology News page. The header includes the OPC Foundation logo and the tagline 'The Industrial Interoperability Standard™'. A navigation menu contains links for About, Membership, Products, Certification, Markets & Collaboration, Resources, and News & Events. The main content area is titled 'OPC Technology News' and includes a sub-header: 'Technology News informs about publications, documents in review, and working groups in initialization.' Below this, there is a link to unsubscribe. A tabbed interface shows 'Publications' selected, displaying a table of documents.

DOCUMENT	DATE
OPC 40001-1 Machinery Basic Building Blocks - V 1.03.0	2023-06-08
OPC 30030 BACnet - V 2.00.1	2023-06-02
OPC 40210 Geometric Measuring Systems - V 1.00	2023-05-24
OPC 40200 Weighing Technology - V 1.01.0	2023-04-19
OPC 30143 PROFI-Encoder - V 1.00	2023-04-15
OPC 30020 MDIS OPC UA Companion Specification - V 1.2.1	2023-04-03

Spread of OPC UA Companion Specifications

Manufacturing mechanics

40001 - Machinery
40010 - Robotics - Vertical Integration
40020 - Cranes&Hoists - MotionDevicesSystemBase
40077 - PlasticsRubber – IM Machines to MES
40079 - PlasticsRubber – IM Machines to Robot
40082 - PlasticsRubber - Peripheral Devices
40083 - PlasticsRubber - General Types
40084 - PlasticsRubber - Extrusion
40086 - PlasticsRubber - Material Supply Systems
40100 - Machine Vision
40200 - Weighing Technology
40223 - Pumps and Vacuum pumps
40250 - Compressed Air Systems
40301 - Flat Glass Processing
40400 - UA for Powertrain
40444 - Textile Testing Devices
40451 - Tightening Systems
40501 - Machine Tools
40502 - CNC Systems
40540 - UA for Additive Manufacturing
40550 - Woodworking Machinery
40740 - Process Air Extraction and Filtration

Field Device Integration

30080 - FDI Specification
30090 - Field Device Tool

Field Communication

30100 - Sercos Devices
30110 - Powerlink
30120 - IO-Link Devices and IO-Link Masters
30130 - CSP+ForMachine . CCLink
30140 - PROFINET
30141 - PROFIenergy
30142 - PROFI-RemoteIO
30143 - PROFI-Encoder

Industrial Automation

30400 - Cloud Library
10020 - Analyzer Devices
30000 - PLC Model based on IEC 61131-3
30001 - PLC Client Function Blocks
30010 - AutoID Devices
30020 - MDIS OPC UA Companion Specification
30081 - Process Automation Devices - PADIM
10000-100 - Devices
10000-110 - Asset Management Basics
10000-120 - XML DataType Mapping
10000-200 - Industrial Automation - Basics
10000-210 - IA- Relative Spatial Location

Consumer Industries

30060 - Tobacco Machinery
30200 - Commercial Kitchen Equipment

Enterprise, Asset Management, Packaging

10030 - ISA-95 Common Object Model
10031 - ISA-95-4 Job Control
30050 - PackML - Packaging Control
30260 - Open-SCS Product Serialization
30261 - Open-SCS Job Orders
40600 - Weihenstephan Standards

Engineering Data

30040 - AutomationML
30250 - DEXPI P&ID

Energy Automation

10040 - IEC 61850 - Electrical Substation Automation

Building Automation

30030 - BACnet

Oil and Gas, Mining

40561 - Mining - Extraction
40562 - Mining - LoadingEquipment
40563 - Mining - TransportAndDumping
40564 - Mining - MineralProcessing
40565 - Mining - DevSupport
40566 - Mining - MonitoringAndSupervision
40567 - Mining - PELO Services
40569 - Mining - ACandUC

JWGs with VDMA

OPC UA serves as basis for the Global Production Language



- » Additive Manufacturing
- » 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
- » 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
- » Lasers and Laser Systems for Material Processing
- » 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