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OPC FOUNDATION

The Industrial Interoperability Standard

OPC UA USERS AND EXPERTS – CONVEYING KNOWLEDGE AND EXPERIENCE

The OPC Foundation publishes a series of interviews with experts, market leaders and think tanks in communication, automation and industrial IT to highlight the benefits and the potential of the OPC UA technology for end users, system integrators, operators in the world of industrial IoT.

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DATA COMMUNICATION WITH OPC UA IN MECHANICAL ENGINEERING

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CONFUSION 2022 & HOPE FOR 2023

In this article about the confusion in standardization, remarkable outcomes from the SPS trade show, amazing progress on companion specifications and their harmonization and an outlook for 2023.

STEFAN HOPPE,
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Good morning, good afternoon, good evening – wherever you are in the world!

Confusion in standardization

Are you also confused by all these new technology terms? We can't keep up with them in our own everyday lives and we have a hard time assessing which are relevant. When I'm travelling, I get asked questions like: How is the management shell related to OPC UA? Is a submodel of the Management Shell the same as an OPC UA Companion Spec? The Management Shell scales over the lifecycle and collects data – why is it a digital twin now – i.e., a copy of a physical asset, that's different, right? Does the DataSpace stand above the twin – or beside it and isn't it much better? Is it still worth implementing in the management shell, or isn't lifetime data safer in the Data Space or directly in the MetaVerse? Oh, there are multiple-verses? How do they communicate with each other… and why, actually?
Certainly, very large enterprises have the resources to offer their experts to all the groups and initiatives to get a picture and, ultimately, check for relevance. But smaller and mid-sized companies are left behind, having very different concerns with supply chains that are still strained. "Wait until the picture becomes clearer" becomes the interim motto. The overabundance of terms and solutions leads to an implementation blockade.

But brighter days are approaching …

The associations AutomationML, IDTA, OPC Foundation, and VDMA have accepted the challenge and are currently working intensively together on a joint position paper. I expressly thank the small core group of participants from the 4 associations for the political will, the excellent cooperation, and the mutual explanations. We listen to each other, help and complement each other, in order to present an easily understandable joint position paper, which hasthe current working title of, "Big Picture Interoperability" in 2023.

SPS trade show highlights

There were several highlights to announce and celebrate at the SPS trade show:

1. **Field Level Communications Initiative: Release of the Specification**

Congratulations to Peter Lutz as the representative but also to the 320 active members from more than 65 companies on the public release of the UAFX specifications. As a first step, this closes a gap so that assets from different eco-systems can exchange information horizontally with each other in a standardized way.

2. **OPC UA Cloud Initiative: 18 publishers plus adoption by AWS**

Compared to 2021 with 2 companies, 2022 boasts a total of 18(!) companies who demonstrated "OPC UA over MQTT" messages sent directly from their asset.

After Microsoft Azure lead the way in 2021, another dashboard from the cloud giant, AWS, was shown at the OPC booth in 2022: Both dashboards could easily receive and display live data from the 18 participating companies via "OPC UA over MQTT" without extra software adapters. OPC UA over MQTT as "the USB connector for telemetry data to the cloud".

Cloud giant AWS supporting OPC UA PubSub over MQTT
Steve Blackwell, Tech Lead / Head of Specialists SAs, Manufacturing, AWS

Adoption will continue to grow, and it is apparent that all companies have recognized the need for a single MQTT standard: OPC UA over MQTT, as an IEC Specification with 2 different encodings – JSON and Binary – to cover all industry requirements. The working group "MQTT" bundles and coordinates these requests from the industry and derives the necessary specifications.

3. New: .NET User Group

The ".NET User Group" has been initiated by three companies represented on the OPC Foundation Board of Directors ABB, Microsoft, and SAP. This group aims to maintain and extend the existing open-source "UA-.NET standard" project, which is available on GitHub.

Information models and harmonization

Another 12(!) information models were released this year, which resulted from cooperations with our partners. In total, the OPC Foundation hosts 85 information models and the number is constantly growing. The new landing page allows an easy search with special filters. https://opcfoundation.org/about/working-groups/

I, again, understand that beside the domain specific information models, the harmonization of the models, among themselves, is particularly important. Special thanks and appreciation to the harmonization groups under the leadership of Dr. Wolfgang Mahnke.

Events 2023

I invite you to have a look at the international events 2023 in the OPC Foundation Web:
→ Call for sponsor: https://opcfoundation.org/advertising/
→ List of activities. https://opcfoundation.org/events/

UAcadmic Program

I hope you are familiar with the OPC UAcademic program: OPC Foundation provides basic content and graphics, which can be used, free of charge, to teach students (the materials may not be used for commercial purposes). The curriculum includes information about the core concepts of communication, security, and information modelling, but also important topics like telegram mapping.
The curriculum is available in English and Chinese already. Support for Japanese, French, Spanish and Arabic will be available in early 2023.
Register here https://opcfoundation.org/resources/opcuacademic/

Outlook 2023

Besides the many activities in 2023, the OPC Foundation has also set a new focus: we want to offer easy access and learning of the OPC UA technology – to learn more about the framework with technology, security, modeling, companion specifications and more, via purely "digital means – remote – virtual". But I am also convinced that OPC UA will grow further into the IT world to offer solutions for the requirements of secure interoperability.

Normal life

In December 2021, I asked myself the question, "Are we back to normal life?" at this same spot within the newsletter. I had used this opportunity to describe the lockdowns and travel restrictions due to the Covid virus, where we all hoped from one quarter to the next to make this virus manageable and return to "normal life". "But in 2022 everything will be better!" was the hope that I offered with reference to travel opportunities. And yes, many people are traveling again, industry trade shows and other user group meetings are happening again. I am lucky to again meet so many enthusiastic people in the world. And as much as I appreciate the personal exchange on site to listen to each other and to achieve mutual understanding and clarifications in conversation – I still became very reflective: While I am coordinating travels in the OPC team for 2023 or working on bringing light into the confusion of standards through inspiring meetings with other organizations – other people are, suddenly, living without electricity and running water because their critical-infrastructure is the easiest target in a war to hit and wear down a civilian population.

Has the world become more normal in 2022? Probably not.
And nevertheless, or just because of that:
Merry Christmas and a Happy New Year.
Here's my hope for a more peaceful 2023!

The technological demands on Rosendahl Nextrom, the special machine manufacturer for cable, fiber optics, and battery production, are very high.

DATA COMMUNICATION WITH OPC UA IN **MECHANICAL ENGINEERING**

ROSENDAHL KNILL GRUPPE SIEMENS OPC FOUNDATION

Future-proof Industrial Communication with OPC UA at Special Machine Manufacturer

With automation solutions from Siemens and the OPC UA communication standard, Rosendahl Nextrom flexibly connects all production steps. Orders for cable or battery machine production can be implemented more efficiently and complex operating data can be collected simultaneously.

Rosendahl Nextrom supplies machines for the automotive, telecommunications, energy, explosives and construction industries.

CABLES & BATTERY MANUFACTURING

STRANDING MACHINE
Individual cores are stranded together in a controlled process to form a robust strand.

ROSENDAHL NEXTROM

Rosendahl Nextrom develops and manufactures equipment for the global cable, fiber optics, and battery industry. The company is part of the KNILL GROUP, an Austrian group focused on industrial manufacturing. It supplies production technologies for battery machines (BM-Rosendahl), machines for the production of cable, wire and shocktubes (Rosendahl), as well as fiber optics and fiber optic cables (Nextrom). Numerous products in the brands' portfolio demonstrate global market leadership. Depending on the area, the company covers between 25 and 60 percent of the market. At just under 60 percent, the Rosendahl brand generates the largest share of total earnings.

COMPLEX MANUFACTURING PROCESSES IN CABLE PRODUCTION

Cables are produced in numerous manufacturing steps on different machines. The basis for each cable is a single wire or optical fiber. This single wire or fibre is stranded with other elements and coated with a plastic insulation in an extrusion process. In further production steps, several insulated wires are combined to form complex cables and sheathed with a protective jacket. Rosendahl Nextrom's core competencies include solutions and equipment for drawing glass fibers, extruding, stranding, welding and corrugating for producing cable types for a wide range of applications. This essentially includes cables in the fields of low, medium and high voltage, fiber optics, automotive, communications and special applications.

MANUFACTURING SOLUTIONS FOR BATTERY PRODUCTION

In principle, two technologies can be distinguished: lead-acid and lithium-ion batteries, which are used as starter, traction, and stationary batteries. The production is divided into three main processes: the production of electrodes/cells, the assembly of the battery, and the charging and testing of the finished battery. For each step, several industrial machines are needed to obtain a battery at the end of the manufacturing process. BM-Rosendahl develops and produces customized manufacturing solutions in the field of assembly of both technologies. The portfolio includes equipment for the processing of lead electrodes (sleeving, stacking, cast on strap, and the assembly to automotive, motorcycle, industrial batteries) and the assembly of lithium-ion modules and battery packs (stacking and compressing, gluing, laser welding, screwing, etc.).

SUPPORT VIA OPC UA

Rosendahl Nextrom has also made a trend-setting decision in favor of the OPC UA communication standard, with the objective of problem-free connection of the products to higher-level master computers, machines, customer and cloud systems among other standards. "OPC UA has now become one of the Industry 4.0 standards," explains Benedikt Wagner, Head of Commissioning and Programming. "Thanks to this solution, we can guarantee high security standards through integrated certificates and user management. On the other hand, the free standard can be adapted dynamically, which perfectly supports our customized approach."

FACTS

- Rosendahl Nextrom GmbH, based in Pischelsdorf, Austria and Finland was founded in 1959.
- The company is represented in 73 countries.
- Production facilities are located exclusively in Austria, Finland and Romania.
- More than 800 employees worldwide
- 10 percent of sales are reinvested in research & development.
- 60 percent of annual sales are generated by Rosendahl Cable & Wire.

The OPC UA communication standard establishes interoperability between devices from different manufacturers.

Silicone is an ideal insulating and sheathing material for cables used in fireproof applications such as elevators or alarm systems.

OPC UA AT ROSENDAHL NEXTROM

In the extrusion line for special cables, the sheathing of the core takes place.

AREAS OF APPLICATION AT ROSENDAHL NEXTROM

At Rosendahl Cable & Wire, OPC UA is used for dual operation between individual machines and the orchestration of the entire plant (M2M communication), as well as for further data collection. BM-Rosendahl additionally uses the communication standard for a vertical data transfer in the direction of MES/ERP systems, which are provided by the respective end customer. The integration of the plants into the data interface provided by the end customer, in the direction of management systems, is possible without any problems.

PREDICTIVE MAINTENANCE THANKS TO SEMANTIC INFORMATION

Based on historical data and empirical values, analyses that enable predictive maintenance are carried out for each plant. In the extruder section of the plant, for example, tensile stress, temperature, and object data are transmitted using OPC UA. Condition data is also collected to optimize the service life of the screws installed there. Unlike other protocols, semantic information is transmitted so that conversions from Celsius to Fahrenheit, for example, are no longer necessary.

INTERACTION WITH AUTOMATION

In a long-standing partnership with Siemens, Rosendahl Nextrom first develops new plants in a virtual environment. Tests and optimizations take place on the basis of digital twins in the form of simulations. The construction and use of prototypes has therefore become unnecessary. Siemens enables these processes with TeamCenter, TIA Portal, Mechatronic Concept Designer, and other tools. One of the benefits of using these automation protocols is the construction of a new machine for the production of lithium-ion batteries. It is not a linked plant, as is usually the case, but consists of individual production cells, which in turn are automated individually. This allows the production capacities of the machine to be flexibly increased or slowed down and adjusted to market requirements. Since OPC UA is an open communication standard, all existing automation systems can be connected via plug-and-play, without any loss of functionality, regardless of the operating system or manufacturer.

EXPANSION POSSIBILITIES

In the next step, Rosendahl Nextrom wants to incorporate artificial intelligence into data analysis to make farther-reaching predictions. With semantic information, AI can directly relate objects and elements during data analysis, providing a faster and more reliable analysis. OPC UA Alarms & Conditions will also be integrated to provide additional improvements to the process.

Complex and distributed plant environments and Big Data scenarios in the area of operational technology (OT) benefit significantly from a uniform communication standard.

ADVANTAGES OF **OPC UA**

OPC UA ensures the safety of equipment and employees, as seen here in lead-acid battery machine manufacturing.

UNIFORM REPRESENTATION OF PROCESS VALUES

The main task of OPC UA in the manufacturing industry is to facilitate communication, independent of platform and manufacturer, and to overcome the traditional barriers in industrial communication. All separate protocols are combined into a single secure technology. Unstructured data is contextualized to become easily understandable information. Diverse and distributed plant environments and Big Data scenarios in the area of operational technology (OT) benefit significantly from this.

FAST INTEGRATION INTO EXISTING SYSTEMS

The changeover to OPC UA took place in the course of a one-month pilot project. Extensive tests were carried out at the pilot plant in the technology center in Pischelsdorf am Kulm. Among other things, it had to be ensured that all required plant components, from a wide range of manufacturers, could be connected with OPC UA and communicate according to the plant parameters required by Rosendahl Nextrom. The implementation was fast and smooth. The rollout to the operating sites took place promptly.

REDUCTION OF DOWNTIME

“The biggest advantage is, of course, the easier connection of machines to existing systems,” says Benedikt Wagner. “By eliminating hardware adapters, we become more independent and flexible. Conversely, the standard also enables the availability of new process values and comprehensive data access, in real time.” According to Benedikt Wagner, these improvements lead to a reduction in downtime of the entire plant as well as a higher-quality end product.

A Rosendahl extruder in a factory.

OPC EXPERTS INTERVIEWS: ENERGY EFFICIENCY – BUILDING A UNIFIED MODEL WITH OPC UA

PROF. DR. KARL-HEINZ NIEMANN,
University of Applied Sciences, Hannover
karl-heinz.niemann@hs-hannover.de

In this interview, Professor Dr. Karl-Heinz Niemann of the University of Applied Sciences and Arts in Hannover, Germany, will share insights on a project he's leading on energy efficiency and how OPC UA can help when building a unified energy model. Additionally, he will discuss OT security, data formats, energy management systems, and, finally, highlight a consolidated energy model to be made available via OPC UA.

BY MICHAEL CLARK

CLARK: Professor Niemann, please introduce yourself to our readers and share your personal, and even the university's, involvement in OPC technology and the OPC Foundation.

NIEMANN: Hello, my name is Karl-Heinz Niemann and I work in Hannover, Germany at the University of Applied Sciences and Arts. I teach Industrial Informatics and Automation Technology, which has to do with integrated automation, industrial communication, and process interfaces. I teach energy efficiency in production plants and, since last semester, I also teach OT security.

Besides all this, I'm the speaker of the research cluster Industry 4.0 of our university and, within the PROFIBUS and PROFINET International organization, I'm heading up the Working Group for the installation guides.

OPC UA is quite common throughout our industry; I teach it in my lessons and we use it in many cases for integration of automation systems within different projects.

CLARK: Sounds great, and by the way, we will be going into more detail on all of these topics during the course of the interview, but let's move into our first series of topics. Karl-Heinz, please tell us about your research into IoT energy efficiency and your studies on OT/IT security.

NIEMANN: We currently have different projects running with respect to the IT security issue. I'm part of the "Future Lab for Industrial Production." where we are integrating secure data sharing between the stakeholders along the horizontal value chain of a product. This helps with providing access to the production data for the data analytics staff. This project is funded by the government of Lower Saxony. For this research project, I'm working together with a team on the data platform and the IT security.

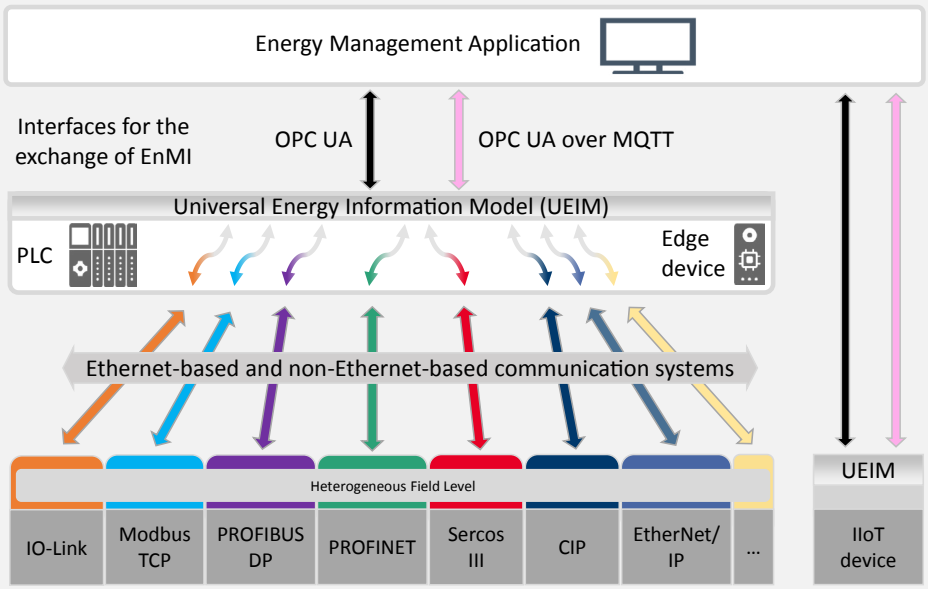
In parallel to this, we have the Digital Center for Small and Medium-sized Companies, wherein we support small and medium sized businesses with their progression toward Industry 4.0. I participate on this project with my team with whom I work on cybersecurity, especially with respect to OT security for production systems.

Another area of my research is energy efficiency, wherein we are currently running a project with the title "Development of energy management interfaces for IoT technologies" (IoT_EnRG). This is a joint research project with the Helmut Schmidt University, in Hamburg, Germany with Professor Dr. Alexander Fay. The project has a special emphasis on data acquisition from the field and the consolidation of this data in a unified mode.

IoT_EnRG

CLARK: We're going to be concentrating further on the IoT energy project but I assume that you will also leverage your knowledge and experience from your OT cybersecurity project into the IoT energy project, right?

NIEMANN: Yeah, that would be new to our scope of work, but, for sure, if we are talking about data acquisition and the transfer of data



Approach of the Universal Energy Information Model (UEIM)

from the field to the supervisory level, IT security is always a consideration because we have to take care, especially at the connection between the IT domain and the OT domain, that we have good separation of the data. OPC UA is one of the tools that we are going to use with respect to secure communication. OPC UA already has a security solution so, when using OPC UA, we will certainly be using the security functionality of OPC UA.

CLARK: Please tell us more about the IoT Energy Project. What's the story behind that?

NIEMANN: In Germany, we have many research projects that are funded by the German Government. The IoT Energy Project is funded within the Joint Industrial Research Project, which is a program of cooperation between the two universities that I mentioned earlier and the industrial sector.

The project is in a kind of pre-competitive research phase. So, this means that companies cooperate with the universities in order to solve problems that are relevant for all of the companies.

For example, within our project, we have 13 companies, with 50% of them being small to medium sized companies, all looking for ways to get energy-relevant data from the field to the supervisory level in a standardized way.

So, the main topic is acquisition of energy data, focusing on how to process it in a consolidated way because, currently, we have the challenge of quite a diverse infrastructure down at the factory floor, with different protocols or different ways to communicate the data.

The good thing is that others are benefiting from this joint research – we make the results of our project publicly available. It's not just the companies who support us who benefit; sure, they review the results, they verify our concepts, they check our work, they even provide components for demonstrators but, all in all, the German Government is very keen to make this information available to industry. As part of the project, we always maintain a publication strategy – or a transfer strategy – so that not only the 13 companies involved in the project benefit from it but also the industry can benefit through our publications.

CLARK: So, what then, specifically, are you researching within this IoT energy project?

NIEMANN: We applied for this project in 2018, so, quite a while ago. The project has been running for more than three years now, so, we are getting close to the end of the project.

The idea behind the project was that, if I want to improve my energy efficiency, I need to know my energy consumption… and if I want to know the energy consumption, I need to acquire the data from the field, to make it available to the upper levels of the automation system, especially the energy management system. What we experienced, in 2018, was that we have different ways in which automation systems acquire such energy data. For instance, we have energy profiles like PROFIenergy or CIP-Energy or sercos Energy, wherein all these standards use different terms and semantics for power consumption, so, it starts already with a naming convention.

For example, if we look, in detail, at power consumption, perhaps I want to know the power consumption of a motor or a frequency converter, and if I look into the different standards wherein PROFIenergy says "active energy import expert", CIP Energy says "supplied consumed energy odometer" and sercos Energy says, "generated consumed energy odometer", these three expressions already show the problem. We are interested in one thing, the consumption, and, if we are now going to integrate systems that use different protocols – and in practice this is always the case – we usually don't have a clean plan where only one communication protocol is ubiquitously deployed. In many cases, we find package-units or other units that are supplied, where we end up having a mix of different protocols.

With the objective of collecting the energy data, we begin realizing that the different protocols use different names for the same thing; and to make matters worse, they are not only using different naming conventions, they are also using different data formats – signed integer, float 32, float 64 – and now, the poor guy on the top level, with the energy management system, needs to handle this variety of data, including a variety of naming conventions. This costs a lot of money and effort to adapt all these messages because, at the energy management level, these data come together, where it is necessary to

have a unified approach so that you receive all data with an identical name and an identical data format.

CLARK: Perhaps I can ask you to go one step deeper into looking at these examples of the different formats – the why the who and the how?

NIEMANN: When we look at the different energy profiles, we see they have been developed independently from each other. Indeed, they are each dealing, more or less, with the same objective of acquiring energy information from the field. Some protocols deal mainly with electrical energy, while others are associated with crude oil or gas, also cooling media or heating media, and so this diversity on the protocol level creates a problem with respect to effort. What we are now striving for is to come to a harmonization of this energy information.

In our project, we started with analyzing each of the different representations of energy data. We looked to see if there was a methodology for harmonization. As a result, we are now formulating an energy model that merges the information into a format where the energy data is unified into a single data model, thus, allowing us to deliver energy information to the supervisory level in a unified format. This is done by mapping or integrating the different and diverse data into a unified model, and based on this unified model, the person who now programs the energy management application, can access all the data in a unified way, irrespective of the source of the data. So, this is the easiest way for the people sitting at the top level to access data without knowing which protocol conveyed it. We are currently working on a demonstrator, where we have a heterogeneous plant for simulation at the bottom, where we then undertake to convert the data. This is where OPC UA comes into the game. We consolidate energy information into an OPC UA server so that the energy application – in the form of an OPC UA client – accesses the data in a unified way. We are also working on a kind of semi-automatic configuration of the OPC UA server, based on the plant configuration.

CLARK: You've mentioned that you have been looking at the OPC UA architecture that brings together the energy efficiency pieces of the different protocols. Maybe you can explain, in a little more detail, how you came to consider OPC UA from the beginning.

NIEMANN: Over many, many years, I've become quite familiar with OPC; not only OPC UA but, also OPC DA; and so, the functionality of OPC technologies as a kind of integration methodology throughout industrial plants, especially with differing automation systems, is well known. So, for those of us running the project, it was quite clear that we needed something like OPC UA in order to acquire the data from the field side, and then to submit it, or to make it available, to the energy management system in a standardized way. Furthermore, as we talked about security, OPC UA also has a methodology to securely communicate such information, which is another key reason we went with OPC UA.

CLARK: According to sources, a little while ago, a Power Consumption Management Joint Working Group was established to develop the OPC UA interface standard for energy consumption data. How does this working group relate to your project?

ABOUT THE INTERVIEW PARTNER – PROF. DR.-ING. KARL-HEINZ NIEMANN:

Since 2005, Prof. Dr.-Ing. Karl-Heinz Niemann (born 1959) represents the areas of industrial informatics and automation technology at Hannover University of Applied Sciences and Arts. From 2002 to 2005, he was responsible for the area of process data processing at the University of Applied Sciences and Arts Northeast Lower Saxony (known today as Leuphana University). Prior to that, he held leading positions in the development of process control systems, at ABB, Elsag Bailey, and Hartmann & Braun.

NIEMANN: This is a really interesting story. We started considering the integration of energy data, as I said, in 2018, so, quite some time ago, and when I heard about this joint working group between ODVA, OPC Foundation, PI, and VDMA, I was really excited because, when I saw their objectives, I realized that this initiative was, more or less, similar to the objective of our research project.

I was able to join this working group on behalf of PROFIBUS and PROFINET International and, at the kick-off meeting, I recognized that there are large synergies between our research project and the joint working group. If we look at the agenda of this working group – including, analysis of the different energy protocols, proposal for a joint architecture, proposal for a joint data set model – it is, more or less, all the same compared to our project. So, we are quite happy that we will be able to provide the results of our research project directly into this working group. We are making the results of our work, especially the energy information model, available to the working group so that the participants will be able to review our results and to decide on possible re-use.

I'm quite sure there will be changes because it always happens that, when you bring external content into a working group, they will likely produce changes; but, you know, the good thing is that we are not starting from scratch – we are not starting with a blank sheet of paper – we have the chance to build on a base of three years of work donated from our project, and so I'm quite happy and I'm most enthusiastic that we can accelerate the products of this working group significantly.

If we review the guidelines of the German Government, with respect to making government funded project information available, it is setup to provide input into industrial projects. That's very helpful, from my point of view.

CLARK: And, it's also great to hear that OPC Foundation acts as the platform for bringing people and projects together. Although, perhaps, that may bring specific challenges. What do you think?

NIEMANN: Well, I have been working within international standardization for many years, so I'm used to this, quite a lot. I think, for some of my engineers, it's a little bit of a new field in which to work; however, this cooperation in developing standards is not that new to us, so, I expect this effort will be a success.

DR. WOLFGANG MAHNKE,
Chair of the OPC Foundation
Harmonization Working Group
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HARMONIZING OPC UA-BASED INFORMATION MODELS

Since 2019, and with the assistance of over 120 members, the Harmonization Working Group, under the stewardship of the OPC Foundation, has been reviewing and harmonizing information modelling that spans a broad array of OPC UA Companion Specifications. Where similarities exist, the Working Group endeavors to produce a common semantic that unifies and bridges between domain-specific information models, thus, preventing duplicate modelling.

CHALLENGES ARE ADDRESSED

The general idea of OPC UA is to provide a communication infrastructure and generic information modelling capabilities. Using the information modelling capabilities, domain-specific information models can be developed. Those can profit from the eco system of OPC UA and do not need to reinvent the basics, including the communication infrastructure. This idea has become very successful and a large variety of so-called companion specifications have been developed and released, in addition to vendor-specific information models.

The information modelling capabilities are quite powerful and provide various concepts like, defining data types, variable types, and object types, using methods, state machines, events, conditions, and alarms. This implies, that similar requirements can be modelled differently, like transferring data in a method call, using conditions with acknowledgment, or variables with structured data types.

But even, if two companion specifications implement exactly the same requirement using exactly the same modelling approach, from a client perspective, they look different as they are defined in different namespaces.

The goal is to harmonize companion specifications in a way that similar things are done in a similar way and the same things are done exactly in the same way (same types, same namespace).

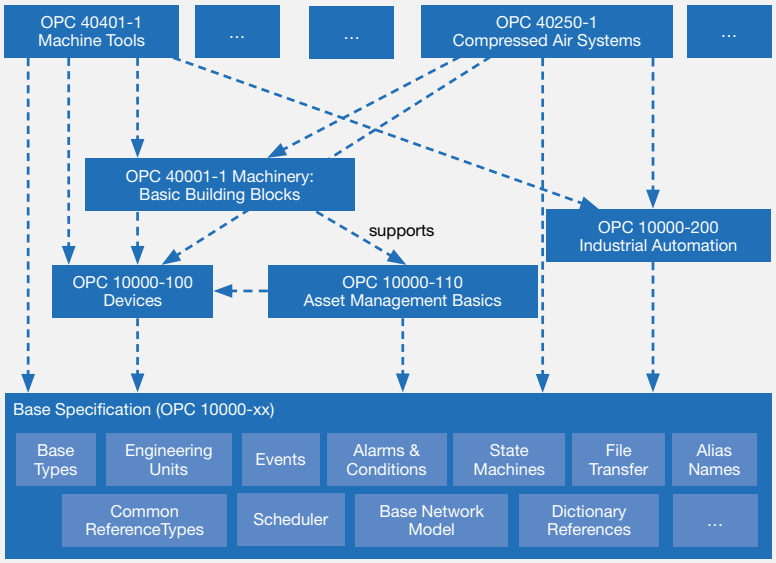
HARMONIZATION WORKING GROUP

The harmonization working group was founded in 2019 to address this problem. Over 120 members, including representatives from the working groups creating and maintaining companion specifications and generally interested information modellers, are working together. There is a regular monthly web-meeting, open for all members and various subgroups, work on specific harmonization topics.

Tasks and Results

The harmonization working group fulfils various tasks. In addition to the concrete subgroups addressing specific and larger problems, those tasks include:

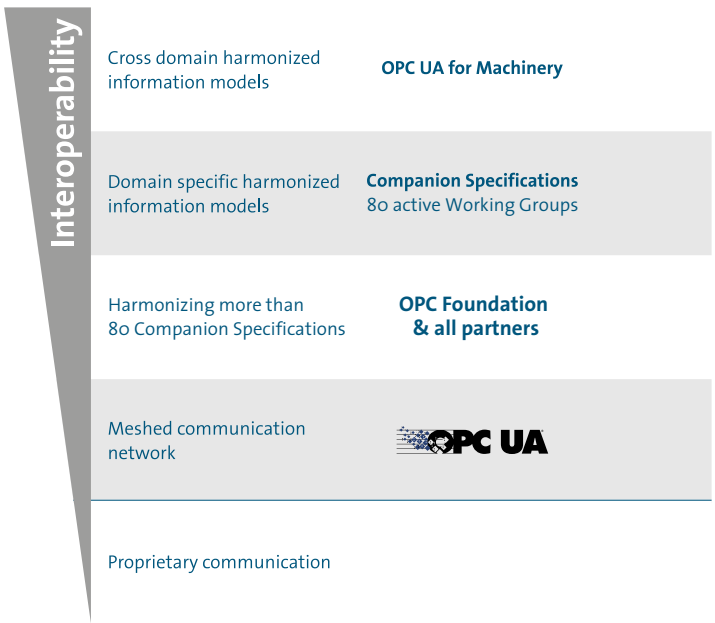
- → Reviewing companion specifications to learn from each other and potentially generalize common modelling concepts. In this activity, sometimes concepts of a companion specification are moved either into the base specification or a more common specification like OPC 10000-100: Devices or OPC 10000-200: Industrial Automation.
- → Maintaining the template for companion specifications and making sure that it fits into the tool chain of the OPC Foundation, like the validator used to check companion specifications and their consistency with the UaNodeSet-file, a machine-readable representation of the information model.



- Started 2019
- Over 120 members
- Learning from other industries
- Harmonizing common concepts and information
  - Asset Management Basic
  - Industrial Automation
  - Relative Spatial Location
  - Base Network Model
  - Base Relationships between components
  - Calibration Target Management
  - Information Model Best Practice
  - Scheduler
  - StackLights
  - XML Data Type Mapping
  - OPC UA for Machinery

→ Identifying topics for harmonization and, either, resolve them on the fly, or form specific subgroups. Several of those topics have been solved and added to into the base specification or a more common specification like OPC 10000-100: Devices or OPC 10000-200: Industrial Automation.

→ Maintaining documents created by the Harmonization working group like
- OPC 10000-110: Asset Management Basics (Specification)
- OPC 10000-200: Industrial Automation (Specification)
- OPC 10000-210: Relative Spatial Location (Specification)
- OPC 11020: Companion Specification Template (Template)
- OPC 11030: OPC UA Modelling Best Practices (Whitep.)



Subgroups of the Harmonization working group have addressed various topics, including:

→ **Application Hierarchies:** Working on a whitepaper how to deploy OPC UA applications.

→ **Asset Management Basics:** Addressed basic use cases for asset management. Defined in OPC 10000-110 how to address those use cases, sometimes by new types, sometimes referencing existing concepts of the base specification and OPC 10000-100 Devices.

→ **Base Network Model:** Created a base model on networks that was released as 10000-22: Base Network Model, which is now maintained by the core working group.

→ **Base Relationships between components:** Defined various common types of references and refinement mechanisms in OPC 10000-23: Common ReferenceTypes, which is now maintained by the core working group.

→ **Calibration Target Management:** Created a model on the management of calibration targets that was released as part of OPC 10000-200: Industrial Automation.

→ **Information Model Best Practice:** Created the whitepaper OPC 11030: OPC UA Modelling Best Practices and is actively working on updates of the whitepaper.

→ **Scheduler:** Created an information model on scheduling actions (like generating a report or turning on the heating) which is published as OPC 10000-24: Scheduler, which is now maintained by the core working group.

→ **StackLights:** Created an information model representing stack lights that was released as part of OPC 10000-200: Industrial Automation.

→ **XML Data Type Mapping:** Created a specification that maps base data types of OPC UA and XML bidirectionally which is published as OPC 10000-120: OPC UA and XML Data Type Mapping.

→ **Relative Spatial Location:** Created an information model on relative spatial location that is published as OPC 10000-210: Relative Spatial Location.

OPC UA FOR MACHINERY

In addition to the Harmonization Working Group hosted by the OPC Foundation, the VDMA addresses, in cooperation with the OPC Foundation, the harmonization of topics specific to the area of machinery. Both working groups work strongly together and move topics to the appropriate working group. As a result of this activity, several specifications have been released or are in the process of being created.

- **OPC 40001-1 Machinery – Basic Building Blocks:** Addresses use cases like, identification of a machine and the components of a machine, finding machines and their components in an OPC UA Server, and monitoring the state of machines. The identification is based on identification defined in OPC 10000-100: Devices and specialized to the domain of machinery.
- **OPC 40001-2 Machinery – Process Values:** Defines a model of how to represent process values, including the monitoring with limits. Based on OPC 30081 Process Automation Devices – PADIM and OPC 10000-100: Devices.
- **OPC 40001-101: Machinery – Result Transfer:** Provides mechanisms to transfer results that are produced by a Server or its underlying system. The characteristics of such results is to contain meta data together with the individual results.

In addition, the group is working on topics like

- **Job Management,** based on 10031-4: ISA-95-4 Job Control
- **Power Consumption Management,** as cooperation between OPC Foundation, VDMA, PNO, and ODVA

ABOUT THE INTERVIEW PARTNER – DR. WOLFGANG MAHNKE:

Dr. Mahnke consults with companies that are applying OPC UA and is also involved in the creation of various OPC UA based companion specifications. As chair of the Harmonization working group, and editor of the Machinery specifications, created in cooperation with the VDMA, he aims to harmonize the growing number of standardized information models. He has been a driver and editor of the core specifications for OPC UA information modelling. Wolfgang has 18 years of experience in the industry having worked for ABB, TE Connectivity, and ascolab in the fields of cooperate research to product development.

Information

Further information can be downloaded from the OPCF's website: **www.opcfoundation.org**