

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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2021 Year in Review
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RENAULT



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DIGITAL TRANSFORMATION AT GROUPE RENAULT

Groupe Renault's plan is to implement the use of OPC UA-enabled devices and equipment at all production sites worldwide, and to implement end-to-end data communication from the sensor to the machines to the cloud and back again using the OPC UA communication standard. Today, OPC UA is already being used in 17 of the 38 production sites with a total of 3,300 OPC UA-enabled devices.



The start of digital transformation at Groupe Renault began as early as 2016 at the Valladolid plant in Spain. Numerous digital pilot projects of an initiatory nature were launched there for the automobile production of the French automotive group. Other production sites in Turkey and Romania also began focusing on digital projects at almost the same time. In 2017, Renault had already recognized that the OPC UA communication standard offered the necessary prerequisite for

the efficient networking of data from a wide range of different machines and operating systems. The integration of OPC UA-capable components and systems has been actively pushed forward ever since.

GROUPE RENAULT ON THE PATH TOWARDS A SMART FACTORY

The control, optimization and profitability of multi-site manufacturing, based on secure real-time data, represents the future of automotive production.

OBJECTIVES ON THE PATH TO DIGITALIZATION

A group of OT, IT, equipment and software experts defined five concrete objectives for the digital transformation of automotive production for the entire Groupe Renault in 2017. These objectives included a connected workforce, real-time data-driven operations, Process 4.0, flexible supply chains and systems, and the complete traceability of components. Turning the vision of intelligent automotive production into reality was the ambitious future scenario. M2M communication, cloud applications, Big Data, and machine learning were as much a part of the vision as AI and digital twins.

HURDLES ON THE PATH TO DIGITALIZATION

Highly specialized production systems are used in the automotive industry. Groupe Renault uses different assembly systems, maintenance systems, test systems, automatic welding machines, and industrial robots, each of which has specific operating systems. Some systems have been in use as legacy systems since the 1980s. A

major challenge at the start of the digitalization initiative in 2016 and 2017 was, therefore, the lack of interoperability between systems. Networking the established plants with different operating systems could not be implemented easily. Furthermore, interoperable interfaces had to be integrated and a uniform data structure and communication protocols had to be developed so that production could access standardized data. At the beginning, the vision of the smart factory and profitability was primarily characterized by the search for the appropriate IT architecture. Groupe Renault decided to build the digitalization of production on the foundation of OPC UA technology and the OPC UA-based Companion Specifications. In addition to this, Groupe Renault has also developed its own data model for various different processes.

GLOBAL COMMUNICATION STANDARD FOR THE AUTOMOTIVE INDUSTRY

GOOGLE CLOUD PLATFORM

The advantages of a uniform data model are of significant benefit across manufacturers in the entire automotive and supplier industry.

WHAT ARE THE CAPABILITIES OF OPC UA?

The letters OPC UA stand for Open Platform Communications Unified Architecture (IEC62541). It refers to an IT architecture that can be integrated on different operating systems. Data is provided by OPC UA servers. The OPC UA client or subscriber can access this data. A system can be both the server and the client at the same time.

WHAT MAKES OPC UA SO EFFICIENT?

The architecture is platform and manufacturer independent. OPC UA is the uniform, global standard for bidirectional information exchange. This standard enables the transmission of machine data and the semantic description of the data.

WHAT IS INCLUDED IN THE OPC UA TOOLBOX?

Simple interfaces, uniform message formats, flexible expansion options, and the implementation of high security standards. OPC UA, thereby, offers an adaptable architecture that can be flexibly and quickly adjusted to innovations in industrial automation. From the sensor to the cloud and back, in real time, is OPC UA's recipe for success.

ADAPTORS PAVE THE WAY

To ensure a uniform data structure, gateways or adaptors for the machine data are used for the existing machines. The OPC UA sensor data (Publication Topics) and sensor configuration (Command Topics) are distributed via MQTT. This enables both the transmission of monitoring sensor data to the cloud, but also the controlling of machines with sensor data from the cloud. Groupe Renault uses Google Cloud Platform for data collection.

RENAULT MAKES ITS DECISION

These advantages were the deciding factor for Groupe Renault's group of experts to integrate OPC UA as a communication standard across plants. For Groupe Renault, the OPC UA interface provides

uniform access to data from divergent control types. OPC UA generates data security in communication, fast data processing, reliable and contextually accurate delivery of data, a uniform data structure specification, and high scalability. At the beginning, the decision to integrate OPC UA as a communication standard was primarily motivated by the manufacturer-independent data exchange. Today, OPC UA is one of the most important building blocks for the vision of the smart factory.



The advantages of a uniform data model are of significant benefit across manufacturers in the entire automotive and supplier industry.

OPC UA IN PRACTICE AT GROUPE RENAULT

INDUSTRIAL DATA MANAGEMENT 4.0

Groupe Renault uses the data structure descriptions (OPC UA Companion Specifications) developed by the OPC Foundation with its partners, in addition to its own data models. Own extensions for the machine level (Unified Data Collector) and the aggregator level (Data Flow Aggregator) are defined by Renault itself. As an example, the extensions affect the device identification and the location of the devices. The 'Industrial Data Management 4.0' (IDM 4.0) platform, which has been in place since 2019, enables data to be collected from a wide variety of sources. The data is contextualized, structured and aggregated, and made available as Big Data for control and analysis purposes. In mid-2020, the Renault-Google Cloud Partnership started with the transfer of Groupe Renault OPC UA data models to Google Cloud's BigQuery. Based on the OPC UA infrastructure, Groupe Renault is able to effectively monitor and control all 17 sites, factory processes, and machines worldwide – all in real-time.

HOW ARE LEGACY SYSTEMS CONNECTED?

The integration of data and protocols from different production components and legacy systems is a necessary step towards automation and digitalization. Without this step, it is virtually impossible to increase productivity. Groupe Renault solved this problem by equipping legacy components and systems with adapters, thus enabling controls, data formats and protocols from different manufacturers to achieve OPC UA capability. With partners, Renault developed an IoT Box in which the specific data protocols of each component are transformed to the OPC UA standard. Regardless of the platforms, production can now access standardized device information.

CONNECTION OF NEW COMPONENTS, TOOLS, OR SYSTEMS

New components or systems that are integrated into production are already equipped with an OPC UA interface as standard. The connection of the new devices to the existing OPC UA infrastructure is, therefore, possible, without any hurdles. Groupe Renault also encourages suppliers to deliver equipment and components with OPC UA interfaces in order to continuously increase the number of components with OPC UA interfaces.

Conclusion: The data of all OPC UA-capable devices are sent to OPC UA servers in a uniform data format. Vision: In the future, digital twins are to be created from Big Data in order to optimally control all factory processes.



DOMINIK WEE,
Managing Director Manufacturing,
Industrial and Transportation, Google Cloud



 Google Cloud

"We're honored to support the OPC Foundation and our membership underscores Google Cloud's commitment to openness and industry collaboration. OPC UA will be our way of incorporating machine data into our data analytics and AI capabilities, to ultimately drive new capability and performance within the factory. By driving AI across the value chain, our goal is to provide flexibility and choice at industrial scale."



Groupe Renault has set itself the goal of reducing the failure-rate of all components to 0.5 percent of operating time. According to Renault, significant savings were achieved in six out of ten workshops where devices with OPC UA interfaces were deployed.

INTELLIGENT TOOLS

ELECTRIC SCREWDRIVERS

Groupe Renault uses servo-controlled electric screwdrivers in automated or manual production, which use different protocols and generate data (such as process code, job number, and energy consumption) depending on the manufacturer. Renault has defined the first data model for tightening controllers. Groupe Renault's IOT Box is used to transform the specific protocol to OPC UA. Three different tightening controller brands are currently connected and Renault is preparing to add another two to the list. Over 500 tightening controllers are connected at present. The new data protocols include information such as motor number, screwdriver type, torque, and values used when tightening screws. Since 2019, Renault suppliers have also committed to producing OPC UA-enabled electric screwdrivers.

BATTERIES

In 2018, 80,000 measuring points for determining battery power were equipped with adapters and, thus, became OPC UA-capable. Result: Battery charge states of all vehicles are transmitted in real time with OPC UA.

WELDING ROBOTS

Components such as CNCs, PLCs, welding processes, robots and other industrial components become OPC UA-enabled through adapters. This applies to data types such as Boolean values, time stamps, analog values, and image and table data. OPC UA is particularly advantageous for the automated welding of components, since an exact current and voltage supply must be guaranteed. If the voltage and temperature are too low, a so-called "sticky point" occurs, which has a negative impact on the quality of the welded components. With the help of the data collected from the 2,200 connected robots in the body shop, Renault is able to efficiently monitor welding processes, detect irregularities in real time, and intervene or perform predictive maintenance on the components. Failure rates in welding processes have decreased by 20 percent.

OPC UA on its path to becoming international industry network standard for automotive manufacturers and their suppliers.

EXPANSION OF OPC UA DEPLOYMENT

Groupe Renault is steadily expanding its use of OPC UA. In machine-to-machine (M2M) communication and human-machine interfaces (HMIs), OPC UA has achieved “highly promising results with low implementation effort,” according to Groupe Renault. New process, manufacturing, and quality data will be made accessible using OPC UA-enabled devices. Groupe Renault is gaining access to an increasing amount of data as its OPC UA deployment expands. As of Q1 2021, more than 1 billion messages per day are being transferred to the Google Cloud, according to Groupe Renault. The amount of industry data available is expected to increase tenfold by the end of 2023.

OPC UA FOR CAR MANUFACTURERS

OPC UA AS AN INTERNATIONAL STANDARD FOR THE AUTOMOTIVE INDUSTRY

Groupe Renault is continuing to drive the integration of OPC UA interfaces in automotive manufacturing. In 2019, the “Connected Plant” project introduced the use of OPC UA in machining equipment, lathes, and milling machines, among others. An increasing number of suppliers are integrating OPC UA interfaces into equipment and on-board software. Groupe Renault’s vision: An international, industrial communication standard based on OPC UA for car manufacturers and their suppliers, with uniform data models.

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STATUS AND CHANGES IN THE KOREAN INDUSTRIAL MARKET

With strong requirements for digitalization throughout Korea's industrial markets, OPC UA has emerged as one of the key technologies of interest in Korea, especially throughout the manufacturing industries, including casting, molding, plastics processing, welding, surface treatments, heat treating, and so on.



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These growing digitalization requirements, especially in legacy installations, creates new challenges as these industries navigate this paradigm shift to a new era. Furthermore, Korea's root industry, centered on SMEs, has less flexibility to innovate compared with larger enterprise. The mission of the Korean industrial markets is to transform companies in the root industry, the core of the Korean manufacturing industry, into future structures, and actively respond to new challenges such as the Fourth Industrial Revolution and global supply chain reorganization.

In line with these market trends, OPC UA is expected to become a key technology for digital transformation and innovation within the Korean root industry. Korea Electronics Technology Institute (KETI), in cooperation with OPC Korea, have built a SMIC (Smart Manufacturing Innovation Center) model factory testbed to jointly develop various applications using OPC UA with various domestic suppliers in order to demonstrate various technologies such as OPC UA interoperability and plug and play. As a result, efforts are being made to strengthen the ecosystem of industrial solutions in Korea, centered on OPC UA. In terms of OPC UA's promotion, the OPC Day Seoul had been held every year up until 2019, before the Covid-19 Pandemic arrived, promoting the latest trends and technologies to the Korean manufacturing market. In addition, starting with the national standardization of IEC62541-1, Overview and Concepts in 2020, IEC62541 was designated as the K-Manufacturing Standard through KATS (Korean Agency for Technology and Standards), including the registration of part 14 pub/sub in December 2021.. The goal is to complete registration of all standards in 2022.

POC of use cases using OPC UA through SMIC model factories

As mentioned earlier, KETI established an SMIC model factory (@Ansan, South Korea) in 2016 in order to showcase smart factory technologies in various manufacturing fields. The team has demonstrated various use cases through OPC UA with various solution vendors and developers in the market. In 2021, a second model factory, focusing on the machine building industry, was newly established in Changwon, the central city of the machinery industry. In particular, the new model factory was built on a digital twin basis to service as an actual manufacturing process that enables actual production of components – not just a demonstration – with 22 suppliers, including major Korean machine tool companies. In addition, it is a test bed that supports demonstration of interworking between various IT and OT applications, such as AI-based data analysis and process optimization. These various IT solutions and OT elements are linked and demonstrated through OPC UA.



IEC62541 KS Standard



OT/IT Aggregation Server Prototyping

Recently, OPC Korea developed an Aggregation Server prototype referencing the OPC UA for Machine (OPC40001-1) information model and OPC UA for Machine Tool (OPC401-1). This was done to demonstrate interoperability and plug and play between OT level and IT levels, supporting various services on SMIC precision processing processes, each configured using machines and solutions from major domestic machine tool builders and various global vendors. In this development, the ObjectType, provided by the Standard Information Model, was maximized and a number of customized ObjectType were additionally applied to obtain data specialized in the SMIC process. The Converting function of the Aggregation Server automatically links the machine interface with reference to XML files generated by a trusted modeler and creates an aggregation server that opens data to the top IT level. In addition, the aggregation server configures Address-Space hierarchy, based on standard information models and user-defined information models, enabling users to utilize data from heterogeneous machines in the form of a common information model that

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is standardized and easy for users to understand. OPC Korea plans to promote and cooperate with those stakeholders in the machinery industry who are using machine tools, while conducting POCs (proofs of concept), to enhance the features that can be used in the actual manufacturing environment.

Prospects and plans

While looking back on our prospects and plans in recent years, COVID-19 created a major crisis across the industry and our personal daily lives, but it has also provided an opportunity to recognize and develop the importance of virtualization and interoperability technologies. In line with these alternative solutions, OPC Korea will continue to distribute and promote various media from the OPC Foundation throughout the Korean manufacturing market using online methods in the virtual world, all the while striving to strengthen a healthy and larger manufacturing ecosystem using OPC UA, centered on SMIC demo plants.



SMIC Model Factory, Changwon South Korea



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OPC EXPERTS INTERVIEWS: OPC UA MACHINE TOOL COMPANION SPECIFICATION

In this interview, we hear from Andreas Wohlfeld of Trumpf and Götz Görisch of VDW as they both describe the excellent and timely efforts that have gone into the OPC UA for Machine Tools Companion Specification. They will explain the collaborations between this working group, the harmonization working group, and the relationships with other working groups that are building on the foundation that the machine tool companion spec has produced.

CLARK: In this interview we will hear from both Andreas Wohlfeld from Trumpf and Götz Görisch from the German Machine Tools Builders Association, VDW. They will be sharing their insights on the OPC UA machine tools companion specification and describe the scope and achievements and which use-cases the companion specification addresses.

Andreas, please introduce yourself to our readers and tell us a bit about your employer, Trumpf, and your personal involvement with OPC UA technology and the OPC Foundation.

WOHLFELD: Well, I work for Trumpf Machine Tool Division as a Lead Architect with a strong focus on connectivity and data standardization.

TRUMPF is a high-tech company, which offers production solutions in the machine tool and laser sectors. The company is driving digital connectivity in the manufacturing industry through consulting, platforms, and software offerings. TRUMPF is the world technological

and market leader for machine tools used in flexible sheet metal processing and also for industrial lasers.

Trumpf has been involved with OPC UA for some years now, building deep knowledge for its utilization within the machine tool industry and providing standardized OPC UA interfaces for our machine products. These interfaces began as manufacturer-specific standards, since, at the time, the industry was not ready for cross-manufacturer standardization.

Of course, we have been a member of the OPC Foundation for quite some time now and participate in a number of working groups therein. With this history, we, of course, jumped at the opportunity when the VDW started this project to create a standardized OPC UA interface for machine tools. We are one of the most active members in this project and have been pushing for the creation of this interface from the beginning. This included taking the lead role in the modeling group, leveraging our knowledge of OPC UA modeling to help to create the standard, and putting in a lot of work together with both the



Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW) of the University of Stuttgart and VDW to create the information model for the OPC UA for Machine Tool standard.

In the course of the work, we also pushed for early harmonization with the VDMA, which led to the development of the OPC UA for Machinery Companion Specification. We provided parts of our model for generalization and integration into the Machinery standard.

Since the release of Part 1 of the OPC UA for Machine Tools Companion specification, our focus has been on harmonization and extension with further use-cases.

CLARK: Götz, I'll ask the same of you to please introduce yourself to our readers and tell us about your employer, the German Machine Tool Builders Association, VDW, and also your personal involvement with OPC technology.

GÖRISCH: Hi, I'm Götz, a consultant for digitization at the VDW, The German Machine Tool Builders Association, and we are closely partnering with the VDMA. For the last three years, I've been working with the OPC community, helping our members get OPC technology into their products. As you might imagine, I'm also working closely with Andreas on the project, started by the VDW, to create a standardized interface for the machine tool community.

I was elected Chairperson for this Joint Working Group and I'm also driving the community work, promoting practical applications of how to implement this companion specification into new products.

CLARK: Most of your activities have been seen publicly as "umati", the Universal Machine Tool Interface, through an amazing demonstration at EMO Hannover 2019. Please share some of the details of this demo as well as the released OPC UA for Machine Tools Specification.

GÖRISCH: Yes, we've heard from the OPC Foundation that this, so far, has been the biggest OPC UA public demonstration for the purpose of showing our draft work on the companion specification. We showcased 110 connected machines to 28 software solutions, with a big aggregating server in the middle. The machines and the software solutions were provided by 70 companies, from 10 countries. We certainly made our mark in the public community.

Since then, umati has been known as a standard; however, it was originally created more as a community brand, in order to market the activities of the working group even though we were already working on the machine tool companion specification.

After the demo in 2019, the visibility of our activities gained greater attention and, since 2020, we've engaged in talks with other associations, especially the VDMA.

umati has since been renamed as the Universal Machine Technology Interface in order to broaden the scope and create an umbrella for more than 40 companion specifications coming out of the machine builder communities of the VDMA and VDW.

CLARK: Andreas, do you want to add something to this question?

WOHLFELD: I would like to highlight the difference between the standardization part versus the brand. The standardization part, for us, has always been OPC UA for Machine Tools, which includes a number of other related standards, like the machinery standard of the VDMA or Part 200 of the OPC UA Base Specification. I'm sure we'll touch on this subject later on.

CLARK: So, how then do the customer brands and the technical standardization efforts, within the working groups, relate to each other?

WOHLFELD: First, addressing the technical specification, it has two parts.

The individual working groups define the domain-specific content of the companion specifications and their respective information models. And in the case of OPC UA for Machine Tools, our group defined the domain specific content for the machine tool specification and, on the other hand, in the harmonization working groups, we define common elements across multiple domains.

One example here is the Identification element defined in the machinery specification, which we, from the machine tools group, like others as well, started to define within our specification and then brought it into the discussion within the Machinery group. That way we had the advantage of being able to use this element from the machinery specification for our model from the beginning.

CLARK: Götz, do you want to add the brand perspective?

GÖRISCH: Yes, as Andreas mentioned, the companies contributing to the standardization effort told us that, in order to market these activities and to make them visible to their customers, we needed a brand in order to carry the message of how all these products inter-operate – that's why we created the umati community – to help all machine builders, and also the customers, talk amongst each other and to assure a common promise that, if you have a machine which implements one or more of the umati companion specifications, you, as a customer, are reassured that the machine works with your software solution.

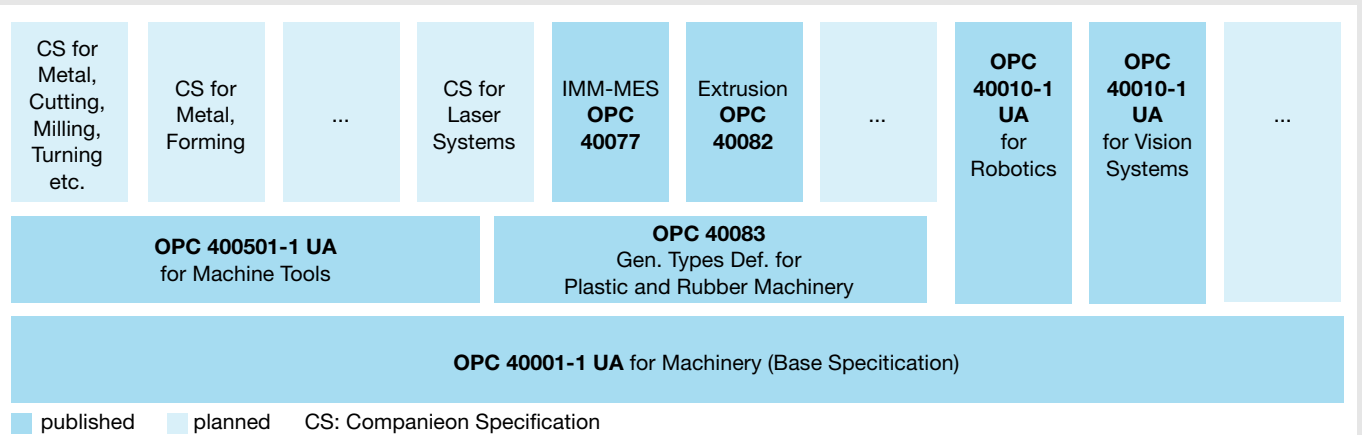
CLARK: So, what is the scope and the purpose of the Machine Tool Specification?

WOHLFELD: Well, you have to keep in mind that we are talking about Part 1 of the specification here, the part released in September 2020.

This part was always thought of as a basis for future parts of the standard. As such, it lays the foundation, in terms of types and principles. It is designed to cover all types of products classified as machine tools, in a very broad sense, from the very simple to the extremely complex.

Obvious examples, attributable to the nature of the participants in our core group, include milling centers, laser cutting machines, additive manufacturing, i.e., metal printing machines, and so on.

Planned hierarchy of specifications (exemplary)



CLARK: Let's get into the technical content and the status of the Machine Tool Companion Specification. How did your group work together to determine the content for this first version?

WOHLFELD: Well, the core group always worked on the basis of use cases; we were very use-case driven. We identified quite a large number of them in our first set of workshops and then prioritized them and started working on the first set with the highest priorities.

We ended up with nine consolidated use cases in the first part of our machine tool specification, addressing big and basic topics like Identification and different scenarios of Monitoring in a production environment.

Part 1 was released at the end of September, 2020. Since then, we have been working on further use cases in different groups, depending on the scope of the use cases.

Some of them are addressed in sub working groups of the Machine Tool Joint Working Group, while, for others, we participate in the work of the Machinery Working Group. In parallel, manufacturers have been working on implementing Part 1 of the Machine Tool Specification into their products.

CLARK: Looking back at earlier statements made at the beginning of your activities, you were quite optimistic in thinking that you would release the companion specification at EMO Hannover, 2019. Tell us the reasons why you didn't make this very ambitious deadline, but you kept your EMO promise to release it in the summer of 2020?

GÖRISCH: Well, while we were working hard with the global community, we found that there were similar things which we were addressing – Andreas already mentioned the topic of Identification – but we also found that the stack lights, which is now included in Part 200 of the OPC UA Base Specification, as well as a few other topics, needed longer discussion with a larger audience. That's why we focused our work on bringing our preliminary work, which we showed with a draft at the EMO, into these groups and tried to harmonize directly in the beginning. Since that was also the time when the Machinery companion specification took off, we introduced our knowledge and lessons learned to this group. And that's why we aligned our activities to come out with OPC UA for Machinery, Version 1.

WOHLFELD: And you were asking why we didn't deliver on target in 2019? Let's not forget, for a standardization effort of this scope, and an industry with such diverse products, we have been, and still are, quite fast.

CLARK: Andreas, you just mentioned harmonization activities. Can either of you give us an example of these activities?

WOHLFELD: Well, there are two groups we call harmonization working groups. One is within the VDMA – the group that's working on the Machinery specification – and there's a harmonization working group within the OPC Foundation.

The scope of these groups is often very simple but, what characterizes them, is their relevance for a broader spectrum of products than 'just' machine tools or 'just' one industry. Take Identification, for ex-

ample, which we've mentioned before; how do products of different manufacturers identify themselves with respect to arbitrary software systems of other manufacturers?

This question had been solved by a number of groups, in slightly different ways, when we were working on it. However, instead of creating our own individual flavor, we teamed up with the other groups and found a solution that works for all our industries and products.

This was one of the first topics of the harmonization working group within the VDMA and that model is now a part of the OPC UA for Machinery specification.

Another example is the information model for stack lights, which Götz mentioned only a moment ago. This also started within the Machine Tools Working Group and, in the end, was pivotal in creating Part 200 of the OPC UA Base Specification.

There are still more technical issues for which we found solutions that have been included, or soon will be, in respective parts of the OPC UA Base Specification.

These are only the topics that we've completed so far, pertaining to Part 1 of our specification – the Machine Tool Specification. Other topics are in the pipeline of both the harmonization working groups at the VDMA and the OPC Foundation.

CLARK: It's clear that there is a lot of effort going into the standardization and harmonization activities. How are these working groups staffed? Can other parties, like those reading this interview, join your team?

GÖRISCH: Yes, for sure.

Everyone from the OPC Foundation or the VDMA can join in the activities of the working group. At the moment, the working group consists of about 190 participants from approximately 80 companies. We have a monthly call, in which we align with each other on our respective topics, with the main work being accomplished within three individual sub working groups. We are supported by the ISW, from the University of Stuttgart, relying on their knowledge of OPC UA to assist with editing the companion specification, notwithstanding the fact that industry experts are leading the individual groups. From the overall organization, as VDW, I'm supporting the visibility and the administration staff around the joint working group but I also initiate talks with other groups to address further harmonization efforts.

As Andreas said, we just released Part 1 and are looking to release Part 2 – or perhaps include additional use cases within Part 1 – at the beginning of 2022, depending on the speed of the harmonization within the Machinery Working Group.

CLARK: Wow, that's truly amazing. To help put this in perspective – going back to what you said earlier about the EMO Demo in 2019 – if I'm correct, you mentioned 28 software applications, 70 hardware solutions, from 10 countries... and, now, you're talking about 190 experts from 80 companies. That's a huge undertaking, with so many people involved to bring a global specification to reality.

Before we conclude our interview, are there any final thoughts about developments or activities that you would like to share with our readers?

GÖRISCH: Yes, you're right, it's quite a large community working here; and it also involves companies from the USA, from Asia – from all continents of the World. Indeed, it's quite an effort to align them. We are already seeing products based on OPC UA for Machine Tools. We are no longer working on a draft specification. We see the final specifications deployed within new products to show to the world.

WOHLFELD: And just to add something about the future outlook; we're working hard on the next parts of all the OPC UA standards, not just our own, but the connected standards as well because we are practicing the principles of harmonization and building each standard, complimentary to the other, so that they work best for the end user.

Already, there are ideas and activities within other groups who are basing their standards, for their product spectrums, on OPC UA for Machine Tools. A couple of examples include the groups for wood-working machines or cutting machines using lasers and other technologies.

So, there's a very broad spectrum of activities that are related to the core activity of standardization for machine tools; and that's where our efforts are currently focused.

ABOUT THE INTERVIEW PARTNER – DR.-ING. ANDREAS WOHLFELD:

Dr.-Ing. Andreas Wohlfeld is the head of the modeling group of the Joint Working Group OPC UA for Machine Tools and represents this group in the Joint Working Group OPC UA for Machinery. Within VDMA he is the chairman of the Industrial Advisory Board on Interoperability, which initiated the working group OPC UA for Machinery.

Andreas Wohlfeld studied Engineering Cybernetics at the University of Stuttgart, where he also received his PhD at the Institute for Control Engineering (ISW).

Since 2010 he has been working for TRUMPF Werkzeugmaschinen GmbH + Co. KG in different functions centered on control and connectivity architecture. Currently he is Lead Architect Production Solutions / Smart Factories and in this role promotes the development and standardization of interfaces for Industrie4.0 with a focus on OPC UA.

He is the representative of TRUMPF to the OPC Foundation, where he is a member of a number of working groups centered around harmonization.

ABOUT THE INTERVIEW PARTNER – GÖTZ GÖRISCH:

Götz Görisch is a consultant for digitization and Industry 4.0 at the German Machine Tool Builders' Association (Verein Deutscher Werkzeugmaschinenfabriken e.V.); he has been deeply involved in OPC UA standardization at the VDW and VDMA for several years. He studied mechanical engineering and has worked as a developer in several positions at machine tool manufacturers and plant engineering companies. He is the chairperson of the OPC UA for Machine Tools Joint Working Group. At the same time, he supports the umati community in the implementation of the Companion Specifications in developer workshops, first prototypes and also in the realization of demonstrators.



OPC EXPERTS INTERVIEWS: 2021 YEAR-IN-REVIEW AND GOALS FOR 2022

This interview is with Stefan Hoppe, President and Executive Director of the OPC Foundation. He will share the successes and achievements that the OPC Foundation has had with its partners and collaborators over the past year. He will discuss plans for the coming year and share personal insights on market trends.

BY MICHAEL CLARK



STEFAN HOPPE,

OPC Foundation President and Executive Director
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CLARK: Our interview today is with Stefan Hoppe, President and Executive Director of the OPC Foundation. Thank you, Stefan, for providing the 2021 year-in-review as well as sharing OPC Foundation's plans for the New Year.

Let's begin with the recent General Assembly Meeting. Please describe the purpose of the meeting, its frequency, who attends, and so on.

HOPPE: The General Assembly Meeting (GAM) is to report to our members the status of the financials, the future road map, but also the results of the Board of Directors election.

In terms of membership growth, we count a total membership of 856 members - so in 2021 we grew very similarly to previous years with 62 new members (2020: 57). We are also growing in all regions and sectors. 13 of the 62 new member companies are major brand companies.

As an example, we are very proud to welcome Amazon Web Services (AWS) as a new member: together with GoogleCloud, IBM, Microsoft, and SAP, the who's who of IT companies are thus members of the OPC Foundation. We sometimes refer to ourselves as the "united nations of automation" because we are democratic and neutral and each company has only one vote, regardless of its worldwide turnover.

CLARK: So, you mentioned during the General Assembly that you got votes for new board members. Tell us about the composition of the recently elected board of directors.

HOPPE: Our board is made up of people from all over the world. One piece of news is that VDMA has been elected as a new board member - this is a significant change that reflects the direction of the

OPC Foundation. These changes happen all the time and are good: when the OPCF was founded and in all the earlier years, the board consisted only of automation companies (as suppliers to the OT world). In 2015, the OPC board expanded to include Microsoft and SAP because we specifically wanted to address vertical data exchange from the OT to the IT world. Today we know that 50% of all information models offered by the OPC Foundation have been developed in cooperation with VDMA, so it seemed only logical to me that VDMA, which itself has a large membership that even overlaps with OPC members, was democratically elected to the board.

CLARK: That's great; and congratulations to VDMA. So, what were your big goals for 2021 and did you reach them?

HOPPE: Well, there are always some obvious goals, like increased membership, extending certification programs, extending OPC technologies, and so on - this is always a "given" - but three years ago we started the Field Level Communication (FLC) initiative and, after three years, we sensed an importance to show tangible results. We showed that the initiative is not just an academic approach but that it's really getting down to Earth and showing results.

Another highlight for 2021 was how OPC technologies connect to the IT world.

Overall, I think we did a great job and we reached our goals.

CLARK: Let's move to another topic - certification. Are there any specific things that you can mention with respect to that topic?

HOPPE: Well, we spent a lot of money and dramatically increased the budget for certification efforts. A lot of trade shows and events

didn't happen because of the COVID pandemic, so we immediately put a lot of the money into accelerating work on the Conformance Test Tool (CTT) to address, for example, the new topics in OPC UA version 1.05, including alias names and alarm conditions. Other topics include enhancements in crypto libraries, tests for pub/sub basics but also OPC UA FX specs. However, CTT is also increasingly integrating a large number of COmpanion specs. It is important that we ensure that we test, validate and certify how information is exchanged, but also test the semantics and behavior of the data exchange.

Our infrastructure also allows us to do a lot of virtual interoperability workshops: Fortunately, we enabled remote testing years ago, so developers can sit anywhere in the world and connect their platforms to run tests.

CLARK: Another thing that we heard during the General Assembly is that you are continuously looking for volunteers. What is it that they need to do and what capabilities must they have?

HOPPE: Good question! Paul Hunker, the Director of OPC UA Certification, mentioned during the General Assembly meeting that it's not just about having a bigger budget to implement test scripts and use cases into the CTT, somebody has to define these first. Therefore, we need domain experts to help.

For example, if you want to check the semantics and the behavior of a robot, you need a person from the robotics industry to help define those test cases.

CLARK: Why did you explicitly mentioned the willing to cooperate with other standardization organizations on certification topics?

HOPPE: I'm working very diligently on this! Since OPC UA has achieved worldwide success, I believe there will be more and more of what I call "hybrid products" forthcoming. We will see products with today's established fieldbus protocols on the south port to do the deterministic cyclic part, we're now seeing the north port of the same product used to transfer data via OPC UA to IT and to cloud applications. Another example is horizontal communication from one device, horizontally, to the other. You might also integrate OPC UA Safety, and so on.

So, the big question is, "Do vendors, who are producing these hybrid products, have to send their devices to multiple certification labs – or can we work with other certification bodies to reduce the number of labs where people have to send devices for testing? I've started by initiating a dialogue with our peer SDOs like FCG, PNO, and ODVA, suggesting that we sync with one another.

CLARK: Let's move on to the topic of Field Level Communication. Please remind our readers about this huge initiative and what developments have occurred over the past year.

HOPPE: In 2015, we established an OPC UA group on Time Sensitive Networking (TSN) for horizontal deterministic data exchange. In fact, this it was one of the largest groups in the world with 85 participants. Initiated by the PNO, work was also done on "ProfiSafe over OPC UA."

Three years later, in November 2018, we combined this work and created the "Field Level Communication" initiative: The working groups are open to all members, the Steco is formed by 27 who-is-who companies who also donate extra budget. All activities related to field level exchange are brought together in this group, like the TSN topics, but also 5G. ProfiSafe over OPC UA became a more general OPC UA Safety part and this specification is already available for download.

After reaching our first milestone, which was horizontal communication - controller-to-controller (or C2C) - we added controller-to-device (C2D) communication as our next milestone. This is a huge benefit for the industry, especially since there had been no common solution to this C2C challenge, until now! Sure, there are a lot of proprietary solutions but the automation community had never before agreed on a joint effort to do horizontal, C2C communication.

CLARK: Tell us about the new Cloud initiative. Perhaps you can mention the global organizations that are involved.

HOPPE: I think our cloud initiative is a similar concept to the FLC initiative: bringing all the groups that are involved together to find a harmonized solution. The cloud is not just about communicating with the cloud but also about the concept of the digital twin and the management shell: it is about modeling information. All cloud vendors have their own modeling language and each does it a little differently. Traditionally, they look at a machine from a business perspective, whereas an engineer models a technical machine and its technical capabilities. The OPC Foundation already has other groups like UA for Cloud Library, where we load information models into a cloud-based library. People can browse this library and download the information they want for free. This is work we have done in collaboration with CESMII, our main US partner. We also have a working group with DIN, a German partner, working on Cloud Federation - the standardization of the methodology of how cloud systems exchange data with each other.

CLARK: You've mentioned some of the hyper-scalers or cloud service providers. Can you shed a little more light on these companies?

HOPPE: Very much so as a dream come true: For the first time, all cloud companies including AWS, Google Cloud Platform, IBM Cloud, Microsoft Azure, SAP, and Siemens MindSphere confirmed that they already deliver or work on ONE harmonized solution to exchange information between the shop floor and IT/cloud based on OPC UA – to be more precisely: OPC UA over MQTT.

CLARK: I think we can almost see you smiling and can sense great pride associated with these accomplishments. I have one specific and perhaps technical question that we would like to hear answered regarding OPC UA over MQTT. In the past, hasn't MQTT been misunderstood as a competitive protocol relative to OPC UA data exchange architecture?

HOPPE: Maybe this is my second-most frequently made statement. OPC has never fought against MQTT and we don't see MQTT as a competing technology; but MQTT does not describe the payload (same as modbus not does). Before each controller company is de-

fining their own mapping to MQTT and also consortia's do this we end up in a zoo of MQTT mappings – which will not be a solution for reducing engineering efforts. So we should define ONE accepted standard. International. Based on a standard like IEC. Including security.

OPC pub/sub has the benefit of being an international IEC standard, released in Feb 2018 including transport via UDP and MQTT. So, since this standardized mapping over MQTT is specified as an IEC standard, this is what matters throughout the industrial world – not just having a quick-fix, which may be defined by a specific vendor who goes around saying that their idea is the best in the world. Clearly, we see why users have already implemented the OPC UA pub/sub solution.

Beckhoff and Siemens already deliver OPC UA over UDP and MQTT out of the PLC controller – both companies are also participating together with Microsoft the “OPC UA over MQTT” plugfest. KUKA has announced to participate and so we expect many more companies supporting this ONE standard. Everybody is welcome.

CLARK: I've heard things about OPC UA Starter Kits – what is the key direction?

HOPPE: Interest in OPC technology is booming, therefore, we wanted to show how easy it is to start with OPC, to move data vertically via OPC UA over MQTT to IT systems. That's why we have an IoT Starter Kit.

This kit is available, free of charge, by downloading it from GitHub. You load it onto something as simple as a Raspberry Pi and, within minutes, you have a demo up and running; and then, in only three more steps, publishing data or subscribing to data. You can have everything running in less than of half an hour.

We also wanted to provide better educational materials so we've created OPC UAcademic for Universities and Polytechnic Institutes. Again, this is a free download for educational institutes from the OPC Foundation. It contains accurate learning materials, including graphics and descriptions that professors can use to jump-start their lesson planning easily, without starting from scratch.

I like to mention the eBooks wherein we have fantastic articles, ranging from technology to security, but also including reports of end user's OPC success stories. Recently, we included a story from Equinor about a project they've completed in the North Sea. They explain how they move over 1,000,000 data points, via OPC UA, into Microsoft Azure. The great thing about these eBooks is that you can download each of them and read these great articles offline, without the need of an internet connection.

CLARK: Let's spend a little bit of time discussing what it is that you're planning for the coming year. What are the main goals of the OPC Foundation?

HOPPE: Well, besides the fact that we are planning to attend, in-person, at some trade shows – our greatest focus is cloud, cloud, cloud. We will have plenty more news about information modeling; connecting to IT systems; asset administration shell; what kinds of information models do we need? Where and how do they scale? When should PLC controllers directly push OPC UA over MQTT to cloud system? When do you prefer gateways? So, there are a lot of topics but, in general, it will be as I mentioned, cloud focused. Secondly, we will dedicate further efforts toward improving the certification process. As I mentioned before, the certification process

needs to run in a more automated fashion. Remember, the number of OPC UA test cases are growing every day; but we have to take care that the cost of certification isn't also growing. Therefore, we would like to keep costs in check by automating more of the certification process.

CLARK: So, what if someone wants to get involved with an initiative you've spoken about or to volunteer in some way. How do they do that?

HOPPE: Number one, get in contact with us! Furthermore, it's easy to go onto our website, where there is a contact form, where you can ask questions.

I'd like to close with something non-technical, something that I believe is the most important message, and my message is that I wish for everyone to please stay healthy. Indeed, I love to travel around the world, to be in other countries, to taste their food, to connect with people, to learn how they solve their problems. To me, it's all about human connections; talking more with each other, building trust, and so on. But, right now during we do this interview in December 2021, we can't do that. We have to do things virtually. My feeling is that, unfortunately, this pandemic will likely stay for a while. So, my wish is for everyone to stay healthy and have a good and happy New Year.



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