

Innovations made in NRW

OPC UA / umati

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Prof. Dr. Andreas Pinkwart
Minister of Economic Affairs,
Innovation, Digitalization
and Energy of the State of
North Rhine-Westphalia

Business leaders,
members of the business community,

The ability to innovate, technical know-how and a commitment to implementing new ideas and practices are key characteristics of successful businesses. These skills have made our industry what it is today: a driver of growth that is strong in exports, sets new standards worldwide, and leads the way in progress and advancement. And it is these strengths that give us the crucial impetus in shaping the digital transformation. In the age of Industrie 4.0, companies in North Rhine-Westphalia can build on this foundation, securing competitiveness and the ability to address the challenges of the future.

Information and internet technologies are being designed over, step by step, into products, processes and manufacturing. One of the main challenges in this process is the secure, standardized exchange of data and information that defines industrial cooperation. The communication technology OPC UA, the OPC UA interface standards developed in the mechanical and plant engineering industry and the umati label support machine-to-machine industrial communication as well as system-to-machine interaction. OPC UA, as an Open Source model and interface standard independent of manufacturers, defines the 'grammar of the universal language' of mechanical and plant engineering. This is a step towards digital sovereignty, and opens up new opportunities for businesses in global trade.

Scores of best practice examples demonstrate the involvement of North Rhine-Westphalian companies in the development of and proficiency in this machine 'language'. They may offer a motivating incentive and helpful impetus to look beyond the coronavirus pandemic that currently dominates our lives and envisage the tremendous opportunities that the digital transformation holds in store – in which North Rhine-Westphalia has been a driving force. In our capacity as the state government, we take this motivation as support for our goal of leading North Rhine-Westphalia into the digital forefront and developing it into Europe's most cutting-edge industrial location.

A handwritten signature in blue ink, appearing to read 'Andreas Pinkwart', with a large, stylized flourish above the name.

Warm regards
Prof. Dr. Andreas Pinkwart



©: Boge

Wolf D. Meier-Scheuven
Spokesman for the
ProduktionNRW
Competence Network

Dear Reader

The increasing digitalisation of products and production processes calls for a changed type of industrial communication. Manufacturing companies have an individual mix of different machines and equipment, robots and systems that are linked to one another to a greater or lesser extent. The ideal industrial or technical communication network should have an architecture that enables all components to be connected to one another – at the customer's end and in the manufacturer's production facility.

One step on the path to achieving this level of interconnectedness is the Open Platform Communications Unified Architecture technology standard OPC UA and standardised OPC UA interfaces, as well as umati, which represents the community of mechanical and plant engineering practitioners. This community has banded together to disseminate the OPC UA standards in mechanical and plant engineering.

The mechanical and plant engineering industry in North Rhine-Westphalia has a superbly positioned SME sector and the ideal conditions to be at the forefront of the digitalisation revolution. As a provider and user of Industrie 4.0 technologies, it has a pivotal role to play. But industrial interconnectedness via OPC UA is only one side of the coin. Networking with businesses and partners along the value-added chain is just as important, because innovation is very rarely a solo effort. Especially when implementing Industrie 4.0, networking within and outside traditional industry definitions – nationally and globally – is a key way to broaden your business's opportunities, and offers potential for growth.

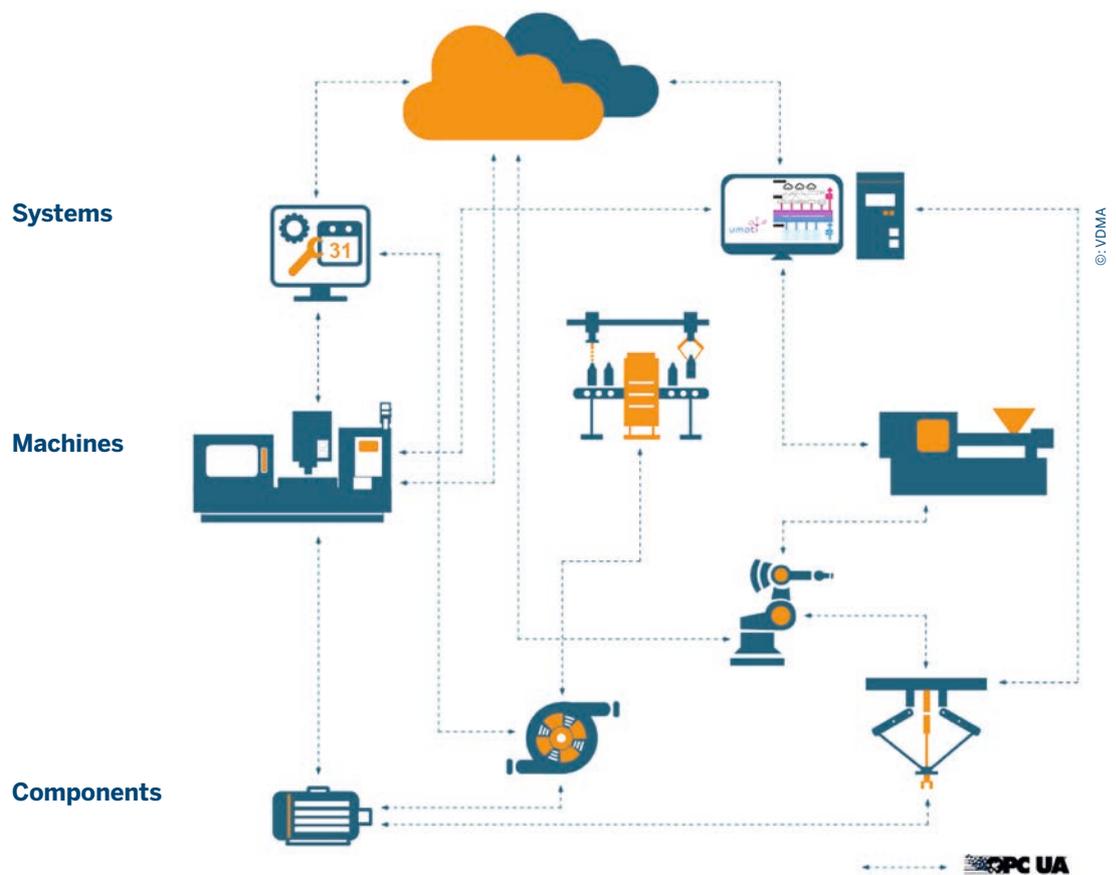
Networks such as the ProduktionNRW Competence Network are an important building block for business success. As with industrial networks, the success of this particular network is achieved through active exchange of information among its members. On that note: get involved in our network and get ready to see your business move to the next level!

A handwritten signature in blue ink, appearing to read 'W. Meier-Scheuven'. The signature is fluid and cursive, written in a professional style.

Warm regards
Wolf D. Meier-Scheuven

OPC UA – the global production language

In the world of digital production, it's essential that machines from different manufacturers can communicate with each other. That's why uniform standards are needed, and VDMA is playing a vital part in creating them: the OPC UA Companion Specifications.



OPC UA enables cross-hierarchy communication from the shop floor to the cloud.

OPC UA is the preferred Industrie 4.0 standard for the mechanical and plant engineering industry. VDMA recognised at an early stage that OPC UA can be used as the basis for Industrie 4.0 use cases. Industrie 4.0 communication using OPC UA can mainly be considered on two levels in this context: communication and information.

The communication level focuses on transmission technologies and protocols that can be used to transmit information. Components, machines and plant have to be able to exchange data and information with no impediments. Adopting OPC UA as a communication technology solution makes multivendor, secure communication achievable, from the shop floor to the cloud.

The information level focuses on the information to be transmitted via OPC UA and set down in information models, for example, technical properties. This includes descriptive detail such as the name of the manufacturer, device type and device configuration, as well as process data such as temperatures, pressures, feed rates and cycle times. Standardisation applies

only to established interface information in this case. In other words, the standards include no information relevant to market competition or copyright.

“Easy integration” required

The goal is to encourage “plug & produce” through interoperability at the communication and information levels. In the long term, efficient integration of components, machines and plant into existing production lines or systems will become reality. At the moment, however, the interface technologies and the information to be shared via these technologies differ from manufacturer to manufacturer and are developed to suit individual customers.

This is where OPC UA, used as an interface, can also be considered as an integrator in the areas of communication and information, since its broad range

of application reduces interface complexity in terms of the communication technologies.

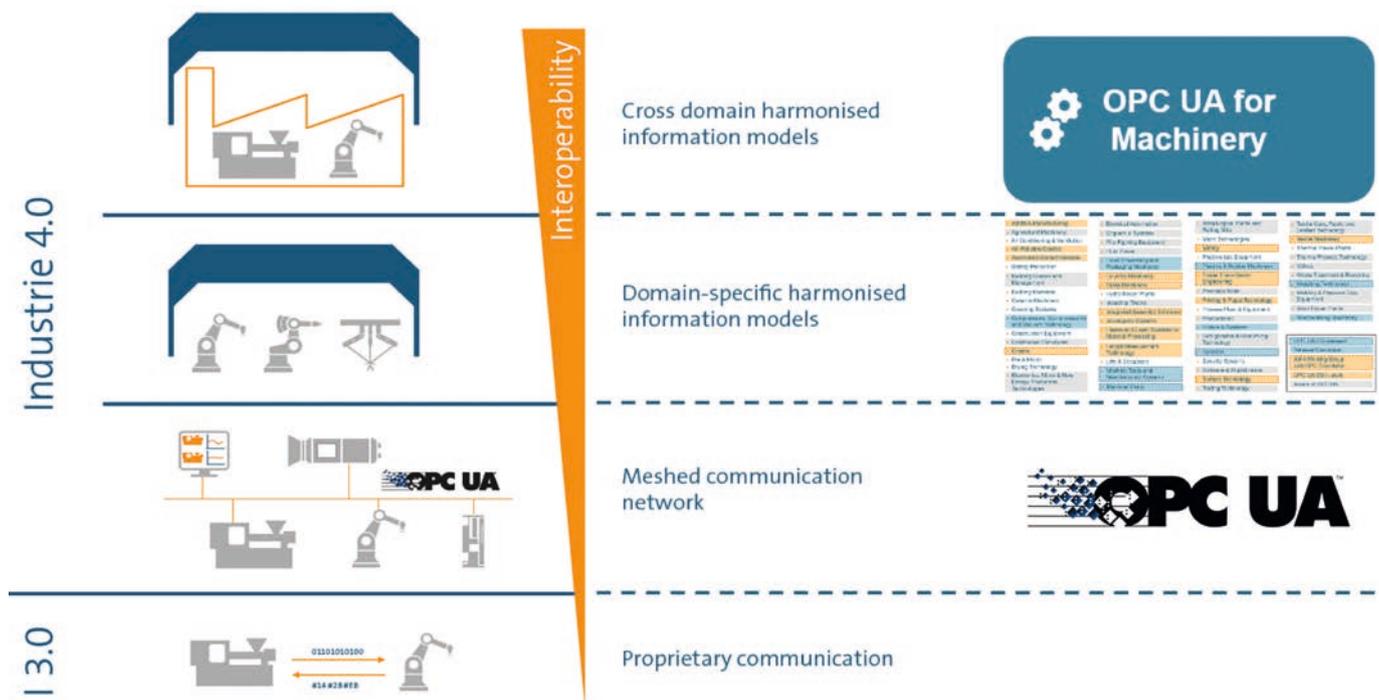
OPC UA Companion Specifications make multivendor standardisation of technical properties and information possible. It’s only with this standardised description that the structure and unique meaning of the machine type are set down via the interface. All components, machines and plant in the network understand the meaning of the shared information in the same way. As a result, they can be efficiently integrated into production and systems.

VDMA – a key player

The details of the OPC UA Companion Specifications are elaborated by the members of VDMA, as well as national and international companies. VDMA looks after the working groups in the respective professional and trade as-

sociations. The content of the OPC UA Companion Specifications can be drawn only from the professional knowledge held by these companies. In addition to companies in mechanical engineering and plant construction, integrators, system providers and users are also included in the work on the OPC UA Companion Specifications. The broad pattern of opinions and collaboration ensures acceptance and thus also utilisation of the OPC UA Companion Specifications around the world.

In addition, VDMA is working with the OPC Foundation to develop the OPC UA Companion Specifications, which in turn ensures even greater worldwide acceptance and adoption. VDMA identified the OPC UA Companion Specifications at an early stage as a core initiative for practically implementing interoperable communication and in-



Multisector interoperability with OPC UA.

incorporated it into its professional association work as a strategic and operational field of action, all of which has paid off.

VDMA has now leveraged into the global centre of gravity for the development of OPC UA Companion Specifications for the mechanical engineering and plant construction industry. In asso-

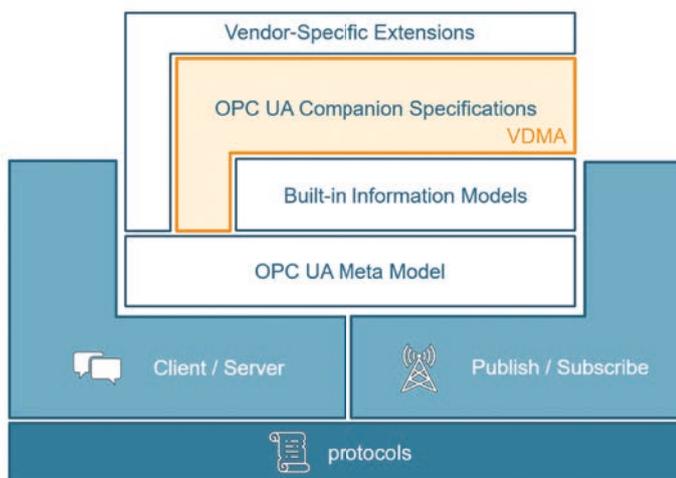
ciation with more than 600 national and international companies, about 25 sub-sectors are involved in more than 35 working groups to develop OPC UA Companion Specifications for a vast range of machine types. The activities by the working groups are generally supported by the industry and are monitored by VDMA at a professional and an organisational level. The commitment shown by the companies underlines the role of OPC UA and the Companion Specifications. The objective is to establish the Standards at a global level, which must be based on quality in addition to supply and demand.

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OPC UA at a glance

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The broad level of stakeholder acceptance is partly a consequence of the open source approach underlying OPC

“OPC UA for Machinery” – harmonising interfaces for mechanical engineering as a whole

Obviously, given the large number of OPC UA Companion Specifications, there will be instances of repeated interface details, such as information to identify machines and components, or machine condition. This information is therefore being harmonised across the entire mechanical engineering industry.

The German Ministry of Economic Affairs and Energy (BMWi) has recognised the value of this harmonisation process, and is sponsoring the relevant activities as part of the “Interoperable Interfaces for Intelligent Production (II4IP)” project. The cross-industry

Step by step towards OPC UA

In systems that are integrated into automation solutions, customers have special requirements in terms of process reliability and want to record and log the relevant process data.

Reinhardt-Technik GmbH is one of the leading providers of dosing and mixing technology for the processing of liquid plastics in the fields of bonding, sealing, casting and surface coating. The company is the global competence centre for bonding and sealing within the Wagner Group.

Extensive exchange of data with other systems and equipment is an increasingly frequent occurrence. The required interface types and the corresponding data structures usually vary from application to application at a customer's facility. Designing these interfaces therefore requires in-depth consultations and a substantial individual effort for project planning and programming. This work can account for more than 25 percent of project scope. The control technology may also have to be adapted, since interface type and data handling are so closely interlinked that implementation on a different platform requires a high level of programming work.

Integrated concepts must be found

Small and medium-sized enterprises are giving more attention to the issue of Industrie 4.0, and corresponding applications require significantly greater and more structured data exchange between different control systems. However, there is often a lack of universal, integrated concepts, which



©: Reinhardt-Technik

LSR eTwin Connect with OPC UA.

currently makes implementation very difficult and results in considerable additional costs.

Since 2015, Reinhardt-Technik has been working very closely with Arburg GmbH & Co. KG, a manufacturer of injection moulding machines for plastics processing, on the joint design of an OPC UA interface (Euromap 82.3). This largely relates to the idea of combining mixing and dosing systems with injection moulding machines for processing Liquid Silicon Rubber (LSR).

Up to now, the solution used has been a classic hardware interface between a two-component dosing system and an

injection moulding machine. This interface was purely functional and did not allow any exchange of process data. "When designing the OPC UA interface, we now had to deal with information models, methods, events etc, which at first seemed very academic and lacking in practical relevance. In the course of the project, however, the advantages became increasingly clear to us", says Thomas Gerke, Senior Manager Systems and Applications.

What is the benefit of the effort?

Reinhardt-Technik sees the greatest benefits of an OPC UA interface as the following:

Non-proprietary:

Relevant data exchange can be implemented problem-free using different platforms without having to change the control platform, a step that is costly and requires intensive development.

Standardised information models:

In cooperation with the VDMA, the OPC Foundation is developing standardised information models (Companion Specifications) for a wide variety of industries that will standardise the flow of information over the medium and long term. For example, by using the OPC UA interface OPC 40082-3 release, any LSR dosing system can interact with any injection moulding machine without the need for separate adjustment.

Largely self-explanatory:

With the option of semantic description of machine data, the interface can also provide its own description. As a result, the integrator's or customer's programmer can design his part of the interface much faster.

Full data exchange:

Not only classic numerical values can be exchanged via the interface. Complete events and methods can also be implemented, including the exchange of entire files.

What are the limits of OPC UA?

OPC UA is not real-time capable. Practitioners often refer to 'OPC UA over TSN', which guarantees real-time capability. However, the network topology with the requirements for real-time capability must be taken into account. It quickly becomes clear that mixing a normal network with a real-time network will not work without problems.

Reinhardt-Technik takes a two-pronged approach here, and separates the functional and data interfaces from one another. The fieldbus is also used to control the actual process. OPC UA is used for the exchange of process data that are not time-sensitive. According to the company, OPC UA over TSN is evolving into a fieldbus system that is not, however, currently supported by all fieldbus devices.

OPC UA balances a variety of diverse requirements

Many businesses are currently having the discussion: "What is Industrie 4.0?"

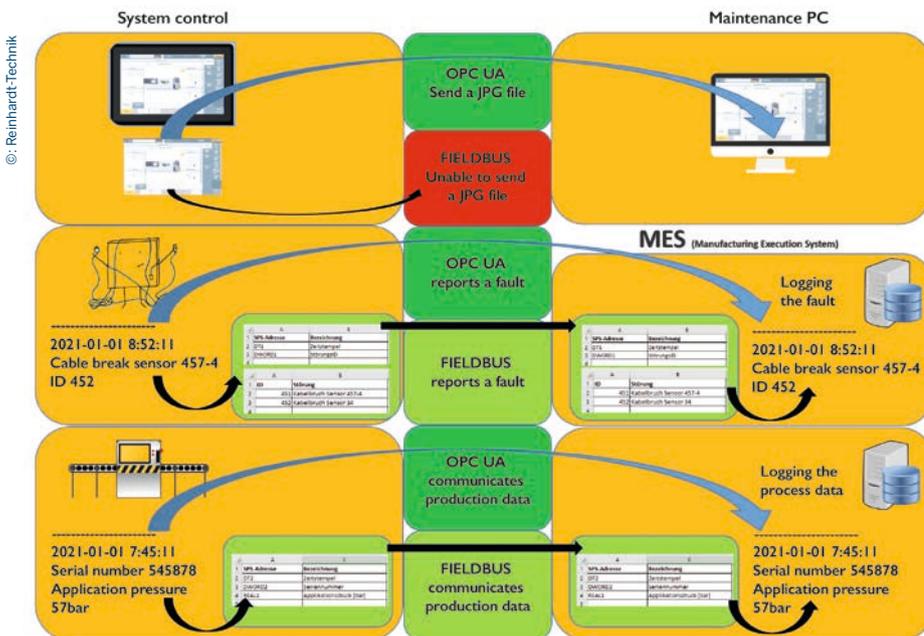
- The maintenance department wants 'predictive maintenance'.
- The production manager wants 'machine learning' for process optimisation.
- The works manager wants to be kept informed on his mobile phone, with quick and clear information, of the status of production.

- QS wants complete process documentation for each individual process step.

The list is not complete, and everyone has their legitimate requirements. The foundation for all of these analyses is data. These data need to be available, accessed and transmitted from as many sources as possible. This is precisely where the advantage of OPC UA lies: it is a standardised, non-proprietary and platform-independent interface.

"The more industry-specific knowledge is incorporated into their definition, the more user-friendly the Companion Specifications and the data models are. Operational know-how doesn't have to be divulged. It's therefore to everyone's benefit if as many machine and plant manufacturers as possible get involved in the development of the Companion Specifications", says Gerke. "Through our work on the Companion Specification for surface technology, we believe we'll be able to significantly reduce the work and costs involved in project implementation and start-up in the future."

Marcus Naber
R&D Software engineer
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Kierspe
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A comparison showing the degree of coordination and the capabilities of an OPC UA interface with a corresponding Companion Specification and a classic fieldbus, which usually has to be implemented in a customer-specific manner.

Smart Factory with IoT: Networked plastic components use OPC UA standard

In today's world, immeasurable amounts of data are generated in just seconds. And every bit as important as generating this data is making information available, and the form in which the information is output. Output via an OPC UA server is the option that probably offers the most flexibility since this technology is available for all standard providers.

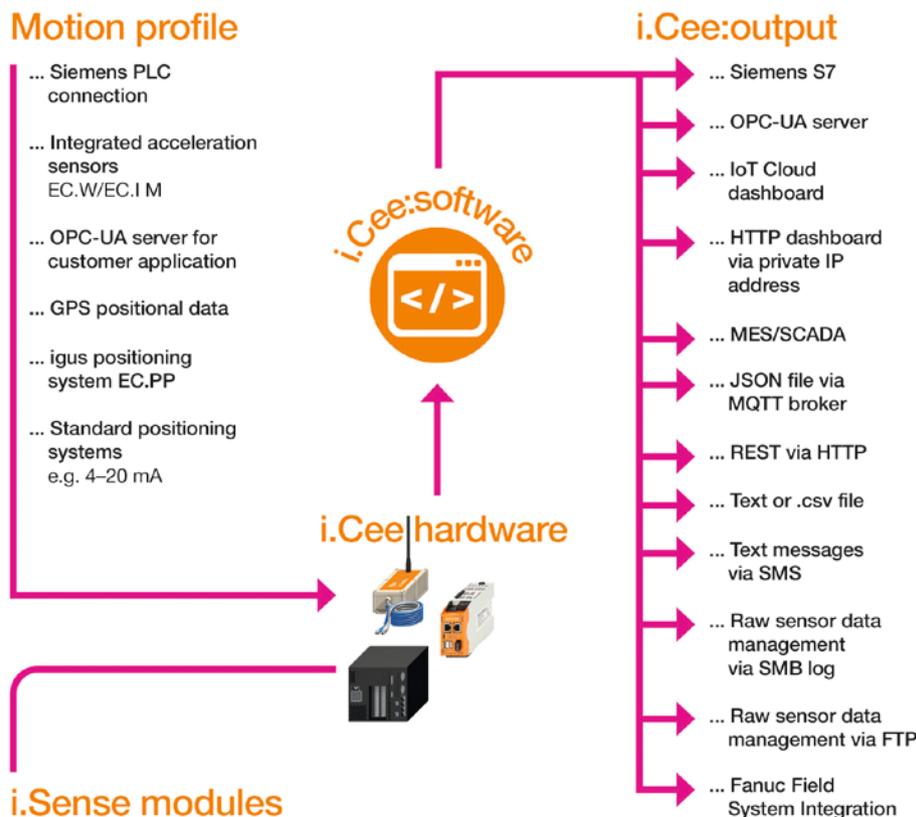
Networking is currently the key word when it comes to Predictive Maintenance and Industrie 4.0. That's why igus, a specialist in motion plastics and a manufacturer and supplier of components made of high-performance motion plastics – including energy chains, cables and friction bearings – is increasingly orienting its mechanical

products toward use in a networked, smart environment. Its objective is to make servicing and maintenance more efficient and more cost-effective.

Among the tools it needs are industrial IoT platforms based on the OPC UA standard, and automation specialist Fanuc has developed just such a plat-

form: the Fanuc Intelligent Edge Link & Drive System (FIELD) provides a way to network production machinery together. To be able to evaluate data from machines and plant at a central level, this industrial IoT platform can connect production machinery from any manufacturer via a local network topology, enabling end-to-end data analysis cov-

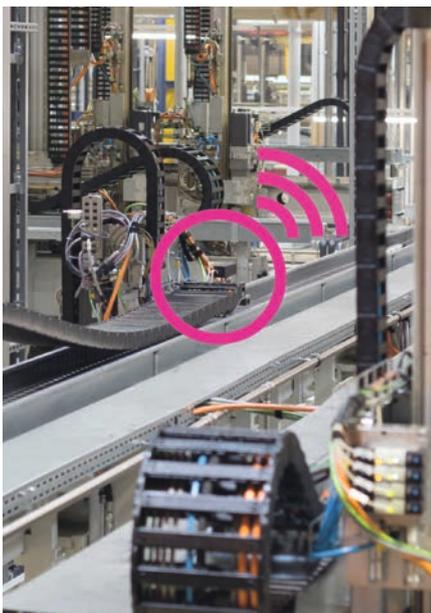
©:igus



Integration of igus smart plastics into the Fanuc FIELD system: the i.Cee:local hardware collects data from the isense sensors and transmits it via a converter to the FIELD system. Maintenance technicians can use the igus app to monitor the condition of components such as energy chains.

ering the entire process chain. In doing so, it can operate either on-premise or, in future, via a Cloud connection.

©: igus



The i.Cee hardware collects data from the i.Sense modules, for example, and outputs it in the desired format via i.Cee software.

The system collects and analyses machine data locally. That means operating data and sensor data from the machines can be centrally collected and accessed via just a single server. Efficiency is easy to monitor, production workflows can be made faster, and maintenance activities can be scheduled. And thanks to the platform's open structure, all machines can be connected to the system. Apps for the system are available from Fanuc and third-party providers. igus has also created an app for its smart plastics and made it available to the FIELD platform.

By integrating this app, users can monitor the condition of their energy chains and cables at any time, and plan maintenance activities predictively.

Connection via i.Cee in a secure environment

Therefore, for large-scale energy chain systems, it's essential to observe maintenance instructions to ensure maximum service life. For example, the i.Cee system from igus reminds customers about upcoming inspections or maintenance work, as happens with cars. These notifications are use-dependent, which means longer maintenance intervals are possible if an item is not heavily used, which can save costs.

More and more manufacturing businesses are recognising the potential savings offered by networking machines and machine components at a data and IT level – through to multi-company networking using comprehensive standards such as OPC UA. All sensor data, such as calculations of individual service life and the resulting alerts, can be forwarded to higher-level IT systems for evaluation or documentation. That applies to Manufacturing Execution Systems (MES), Zero Downtime Systems (ZDT) and software for company-wide maintenance, for example.

Predictive maintenance thanks to smart networking

Under the brand name isense, igus markets sensors of all kinds to record the condition of components and generate data. They measure component

condition, record the data at a central level, and transmit it to a smart system if required. In doing so, they prevent the worst-case scenario – system downtime and production stoppages.

The communications modules in the i.Cee:local series make the data available via an integrated OPC UA server. Lastly, an OPC UA converter in the FIELD system connects to the iCee:local module as an OPC UA client and communicates via the standardised OPC UA architecture. Integrating the existing i.Cee:local software into the FIELD system was achieved in a very short space of time using the very clearly described OPC UA syntax.

The open nature of the FIELD system gives users the opportunity to use the data and service life predictions for the igus products in a protected local network environment. The smart plastics app tells the maintenance technicians how many days are left before the next maintenance activity is due. Unscheduled system downtime can be avoided as a result. Users can download the FIELD system apps, including the igus smart plastics app, from a store that lets them select their own preferred software solutions.

Richard Habering
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Injection moulding production speaks OPC

With an OPC UA-based host interface between the injection moulding machine and an MES (EUROMAP 77), the injection moulding industry got on board with the OPC UA protocol at an early stage. The possibilities of semantic modelling were a crucial driver. Injection moulding machine manufacturer ENGEL relies on seamless communication based on the I4.0 layer model in all products.

Complex production systems comprising a host of different components need efficient interfaces internally as well. The only way to manage this complexity is a high level of modularisation, starting with the machine design and carrying on through to the software solutions. The integration of options into a series production machine or a retrofit should have no impact on PLC sequence programs or the visualisation system. This requirement is nothing new. Interfaces for the modularisation of control technology existed 20 years ago. The path up to the present day is characterised by a continual progres-

sion of new programming languages, data formats, communication models, electrical interfaces and ever more efficient and ever smaller components that make this communication possible. Enterprises have also carried out extensive development work on many levels of the ISO / OSI reference model.

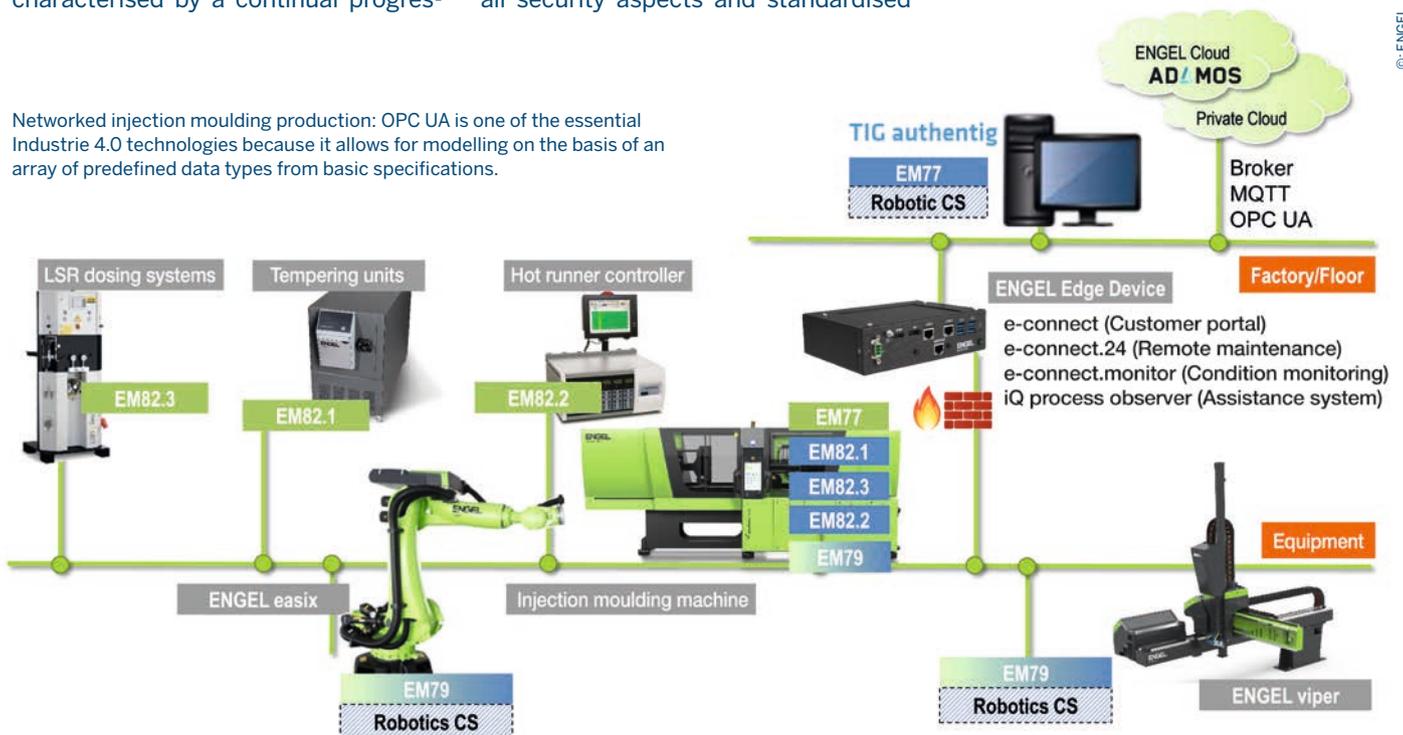
One of the key benefits of the OPC UA base specification is its scope which, in contrast to previous libraries or frameworks, covers all aspects. For the numerous communication models, as well as coding and decoding options, all security aspects and standardised

modelling are covered; a range of different programming languages and operating systems is supported. Instead of creating its own protocols or modelling, a company can now pick and choose from the OPC UA kit.

Real-time communication is the next milestone

While many technologies have been in wide use for a long time, OPC UA for machine-to-machine communication with real-time requirements is still in

Networked injection moulding production: OPC UA is one of the essential Industrie 4.0 technologies because it allows for modelling on the basis of an array of predefined data types from basic specifications.



©: ENGEL

the initial stages. This includes the EUROMAP 79 robot-machine interface from the plastics and rubber industry, which uses the pub / sub mechanism with UDP transport protocol. The challenge lies in exchanging data within milliseconds; for ten years, this has worked very well with Ethernet-based fieldbus systems, but these are mostly based on proprietary solutions with a relatively simple communication infrastructure. When implementing the OPC UA pub / sub data exchange, however, high-performance solutions with the shortest possible latency time must be adapted to the network chips used, the TCP / IP stack of the operating system used, and ultimately to the existing PLC system.

An increasingly critical advantage is the promised, and to some extent already available, communication infrastructure based on broker or cloud solutions with direct OPC UA integration. It will give a further boost to global data exchange – for uses such as asset management, condition monitoring, update management or centralised management of production systems. ENGEL is incorporating these solutions into its e-connect high-performance customer portal, and is working on other products.

A blank spot in OPC UA client implementation processes is the HTML5-based browser technologies that are increasingly finding their way into industry. Especially in the area of visualisation, this technology is becoming more and more widely accepted, and almost all control unit manufacturers are forced to come up with their own in-house solutions. The company has to use its own resources to fill in the gaps in operability.

Many peripheral devices can already be operated via OPC UA

The company is endeavouring to build on the models from the Companion Specifications. To do this, it is useful to bring our own ideas into the VDMA standardisation process. OPC UA in particular offers numerous implementation options; not all of them have the same level of efficiency and they can also differ significantly in terms of complexity. Being involved with the models at such an early stage also means that once in a while, an implementation needs to be reworked and adapted to a new version of the Specifications.

As things stand, an injection moulding machine can already interact with a whole range of peripheral devices such as tempering units, LSR dosing systems, granulate mixers or hot runners via OPC UA and conveniently integrate those devices for the user, including shared data management and visualisation on the control panel of the injection moulding machine. The interaction of the various components within the production cell, regardless of manufacturer, is considerably simplified by standardised interfaces.

ENGEL was one of the drivers behind the EUROMAP 77 and 82.1 and is now also contributing its expertise to the development of EUROMAP 79 for the operation of handling systems. As the headquarters of ENGEL Automation Technology GmbH, the Hagen site in North Rhine-Westphalia is a key plant for global automation projects. Linear and articulated arm robots in the company's own viper and easix model ranges are fully integrated into the CC300 control unit of ENGEL's injection moulding machines at the Hagen plant, offering many benefits for the

user. These include shared data record management, very fast signal transmission, the synchronisation of robot and machine movements, and combined display of robot and machine on the machine display.



© ENGEL

Communication between injection moulding machines and robots poses a particular challenge. Information on machine and robot movements needs to be transmitted in real time.

But for users of ENGEL system solutions, the new interface opens up even more possibilities. Highly integrated production cells can be constructed in a more modular way, using module connection systems based on established structured ethernet cabling. This will further simplify the configuration and adaptation of production cells to new tasks, better safeguarding investments.

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Digitalising productions in the SME sector

In the SME sector in particular, standardised machine interfaces such as umati / OPC UA can help companies to push ahead with their digitalisation journey. However, other building blocks are even more relevant today.

thyssenkrupp Materials IoT GmbH is the thyssenkrupp Group's Industrie 4.0 service provider, with its own Industrial Internet of Things (IIoT) platform, toii®. In addition to thyssenkrupp's own digitised production locations, so far numbering more than 30, the service provider also digitises manufacturing plants outside its parent company, and it's offering this service not only in the metal-working industry but also in industries that are completely unrelated to the Group's sector, such as plastics.

Often, thyssenkrupp's factories and those of its external customers are on a very similar digital transformation journey. In most cases, the goal is to increase productivity and maintain long-term competitiveness.

The necessary building blocks for digitalisation, which are reflected in profitability, are

1. the right use scenario with a clear business case
2. an understanding of the context, i.e. the production processes and the current production IT landscape
3. the selection or development and implementation of the right digitisation solution
4. a successful change management approach, to ensure all employees are brought on board
5. adjustments to shop floor management

The role of standardised machine interfaces

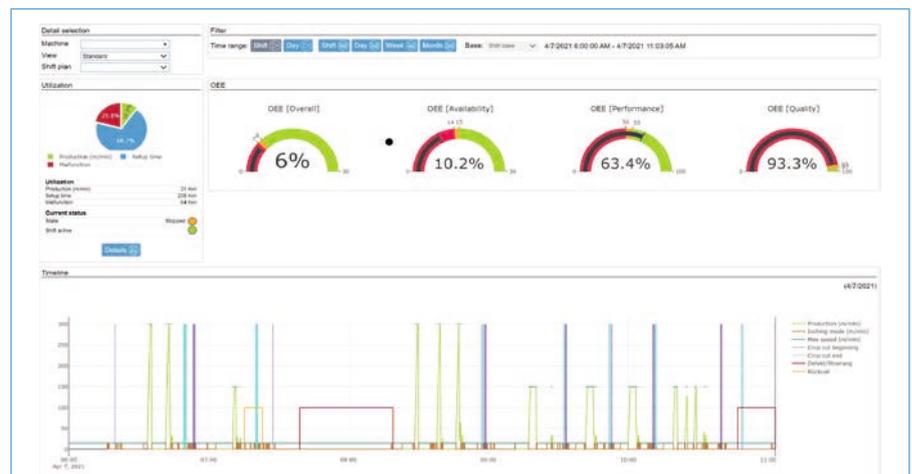
In the development and implementation of digital applications in manufacturing, standardised interfaces such as umati / OPC UA help reduce complexity, and thus costs, for the machine connection. When introducing standardised entry-level software products, the development of interfaces to machines is the single biggest cost driver.

For medium-sized companies in particular, there is a need to keep the barriers to the leap into digitisation as low as possible. Unfortunately, no one can expect overnight miracles from interface standards, as the investment cycle of a machine pool – often between 25 and 50 years – is considerably longer than that of software products. Even retrofitting of machine control systems

often is unable to keep pace with developments. That means that, for the foreseeable future, the reality for the digitiser is a raft of different machine interfaces in manufacturing plants; a 'plug & play' connectivity as on home computers is still a long way off.

A typical 'digitalisation journey'

From paper-based, non-transparent, inflexible and error-prone production systems to the smart factory, for SMEs a typical digitisation journey is similar to that of larger companies. For reasons of cost, mid-sized companies often decide against a powerful MES (Manufacturing Execution System) solution. In the following, therefore, applications in SME-type manufacturing locations using machine data acquisition are presented, albeit not exclusively.



Dashboard of a longitudinal divider in the Group's steel service centre.

These journeys usually start with a poor level of information about productivity data. These data – if they exist at all – are incomplete, and even then they’re usually available too late to effect optimisations within shifts or to enable data-driven learning from one shift to the next on shift handover. The first digitisation steps are therefore aimed at transparency in performance indicators.

stead, they use solely the operating data logged by the machine operator, combined with very simple machine data.

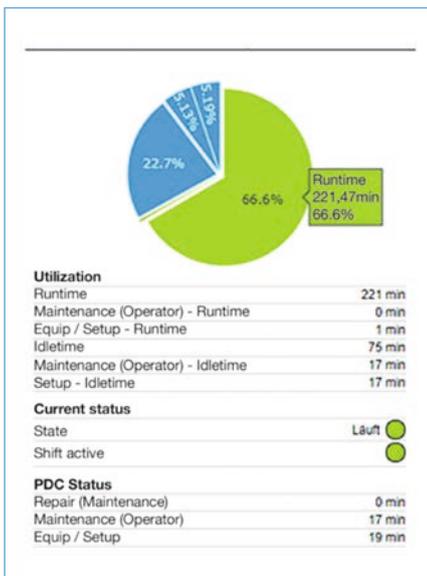
Systematic machine data acquisition

More advanced transparency products rely on systematic machine data acquisition. It’s here, and on the issue of data security, that OPC UA really comes into its own. Comprehensive dashboards with key performance indicators (KPIs) generated from machine data are possible. For example, the reasons for malfunctions can be recorded at a very detailed level and analysed later on using additional operating data acquisition.

type of automation. Bidirectional machine connections, for example via OPC UA, are of assistance here.

With comprehensive job management using machines communicating with OPC UA and connected manual or autonomous intralogistics, all products can be tracked within the production unit, whether geographically or along the manufacturing process. The systematic evaluation of processing times means further optimisation potential can be identified and utilised.

©: tMIOT



Digitised saw in prefabrication.

There are entry-level products to answer the question ‘Are the machines producing or not?’ in real time for the entire site. If the answer is no, the reasons are systematically identified and recorded: Is the machine currently being set up? Is it waiting for materials? Or is there a defect? This information can be evaluated over any period of time, thus allowing conclusions to be drawn about potential areas for optimisation.

These solutions don’t require any sophisticated machine interfaces; in-

All transparency products thus provide a basis for data-driven decisions on further optimisations and, where applicable, further digitalisation of production. Often, the next step is to digitise sub-processes – such as quality assurance. The integration of manual wireless or fully automatic measuring systems offers complete quality control.

Smart production

The next stage of expansion towards the smart factory is fully paperless production. In addition to increased flexibility, this also offers significant productivity gains, especially where there are frequent ‘recipe changes’ in manufacturing operations with a wide variety of products. Production orders are transmitted directly from the ERP (Enterprise Resource Planning) to the machine control system. Particularly where there are a large number of production parameters, this saves a considerable amount of time while also maximising the input quality.

In many cases, complex and modern machines can no longer be operated in any worthwhile capacity without this



©: tMIOT

Thickness measurement report from radiological thickness measuring.

The applications outlined above are the foundation for ensuring competitiveness in manufacturing companies, and can be supplemented by other solutions from the areas of advanced data analytics and artificial intelligence.

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OPC UA takes machine and system scalability to a new level

CONVERSATION WITH DR HORST HEINOL-HEIKKINEN

Interview with Dr Horst Heinol-Heikkinen,
Managing Partner of
ASENTICS GmbH & Co. KG, Siegen.



Dr Horst Heinol-Heikkinen

©:ASENTICS

What do Companion Specs do for your company?

Heinol-Heikkinen: The Companion Specifications let us simplify and accelerate the connectivity of Machine Vision Systems with their environment, which significantly reduces key factors such as commissioning and implementation times. These time and cost savings are important steps toward making “everyday” automation more progressive.

Where do OPC UA or the Companion Specs reach their limits?

Heinol-Heikkinen: The long-term goal is to remove the restraints currently imposed on Machine Vision by the bottom-up communication from the field level. That will make it much simpler to share information between Machine

Vision and the IT company level. In working toward this goal, however, our current information models such as the VDMA Companion Specifications reach their limits, since they generally use large-scale domain knowledge to represent the physical functional extents of individual assets in digital form. The “big picture” is still missing.

This is where the concept of the “digital twin” and its Asset Administration Shell (AAS) come into play. This deals with the whole thing on a top-down basis, with much greater scope, and more particularly working from the application out. The digital twin summarises information or partial models, ideally Companion Specifications, by complexity and depth, as part of an Asset Administration Shell in accord-

ance with the user’s own wishes. One of several benefits offered by digital twins is interoperability with any number of other assets.

How does this extend the status of Machine Vision?

Heinol-Heikkinen: For us as system manufacturers, OPC UA helps us to make the huge data and information potential contained in our products fully usable. That means we’re talking about potential strategies for adding value! This makes products simpler and more secure – and, we hope, more attractive for our customers! No other technology in the context of Industrie 4.0 has as much information power as Vision Technology. OPC UA creates the necessary accessibility for us.

Of course, Vision Technology is a big thing as a quality control tool, but vision can also be used to provide information about machine condition, whether it’s working properly or if there is wear or damage in particular areas. Cameras can also be used to monitor the factory hall. With vision technology it’s possible to achieve more, and business fields can be scaled hugely. This is where the Industrie 4.0 infrastructure is needed.

OPC UA, the Companion Specifications, and the Digital Twin with its AAS are essential factors for all these possible applications.

In other words, we're moving away from dependence on interfaces that would otherwise have a limiting effect, and the result is completely new opportunities built around information, accessible transmission and meaningful use. Taken together, these will not only consolidate the status of Machine Vision on the market, but will also help to expand it.

What does this mean for your customers?

Heinol-Heikkinen: OPC UA gives us end-to-end networking, and thanks to the Companion Specifications we have the semantic self-description of all participants in the process. That changes everything, since instead of rigidly performing an established task, the main focus is now on flexibility and changeability. That represents a paradigm shift,

and facilitates highly dynamic communication to deal with changing tasks.

Another huge benefit is the fact that the Companion Specifications only have to be implemented once. Even if the Machine Vision service provider is changed, the agreed standard will ensure problem-free integration into existing infrastructures. We're therefore moving to a completely new level in terms of machine and system scalability.

The benefits and the specific work on Industrie 4.0 outweigh these costs many times over. It's also a question of the future viability of companies.

What examples are currently available to show the impact of the Companion Specs on the integration of Vision Technology into production process automation?

Heinol-Heikkinen: To put Vision Technology to use in the production process, we first specified the generic

behaviour model; in other words, the state machine for an Machine Vision device. This resolves an issue that has been problematic for some time: the complexity, the lack of uniformity, and the recurring problems of comprehension that result between separate disciplines: the Machine Vision integrator and its customer. Having a mutually agreed understanding about how and, particularly, when the right question can be put to a Machine Vision device, is a huge relief in terms of building up stable and secure communication between this device and, for example, a PLC, Manufacturing Execution System (MES), etc. The importance of solving this problem should not be underestimated.

What are the scenarios that OPC UA will enable for your customers in future?

Heinol-Heikkinen: In future, OPC UA will be a tool that can be used to greatly simplify and automate the entire service process of our ASENTICS VARIO



ASENTICS VARIO ©
OPC UA VDMA 40100



ASENTICS RIITA ©
OPC UA VDMA 40100

Besides the OPC Companion Specifications (VDMA 40100), fully automatic inspection machine also use additional OPC UA partial models for communication, with ERP systems, for example.

Machine Vision System for robot vision applications uses the OPC UA Companion Specifications (VDMA 40100).

©:ASENTICS

systems. Our inspection machines are acquiring a kind of awareness, since they have knowledge about when specific wearing parts need to be changed, they draw attention to the fact at an early stage, communicate with the ERP system, or request the needed parts directly from us.

For example, exchanging data between an MES and the Machine Vision system to orchestrate a change of product or task for the Machine Vision system and other participants using centrally stored and managed data. The idea is to transmit data during or following every task to a different

technologies have an interest in interoperability with a range of machines and IT levels.

Examples – not only from the point of view of vision technology – are remote commissioning and remote service of systems. They provide valuable services without physically visiting the factory. I believe such scenarios will receive an unimagined boost on account of the limitations currently being imposed by the pandemic.

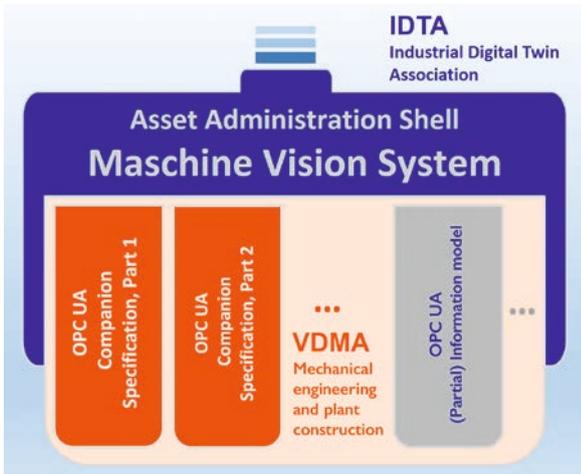
The digital twin describes ways to do. The digital twin will also make it possible to gather an incredible amount of

That means something's "opening up" for all markets and all market players!

What tips do you have for other companies?

Heinol-Heikkinen: It won't work without financial and human resources. Developing your own corporate perspectives for the age of Industrie 4.0 can hardly be kept separate from developing your own technical I4.0 skills. 'Get involved at an early stage' is my answer as the owner of a technology business that's aiming for technological leadership!

I'd like to make an appeal to those who are involved with OPC UA, or even with the creation of digital twins, but are not committed as part of the appropriate committees, and tend to work in isolation in their own way for their own products: Industrie 4.0 communication is probably the most powerful and meaningful interface that we have ventured on to date with standardisation as our goal. That can succeed only if we proceed as part of a larger community. Those of us working on these themes have to be 'interoperable' above all else – and then perhaps our machines can be too!



The interoperable digital twin 'Machine Vision System' is developed from the sum of all domain-specific partial models (e.g. OPC UA Companion Specifications) under the Asset Administration Shell.

device or another machine, and to generate understanding and possibly even interaction in this way. In the process, therefore, we are creating a further important starting point for "machines talking to each other".

Which markets will open up in the process?

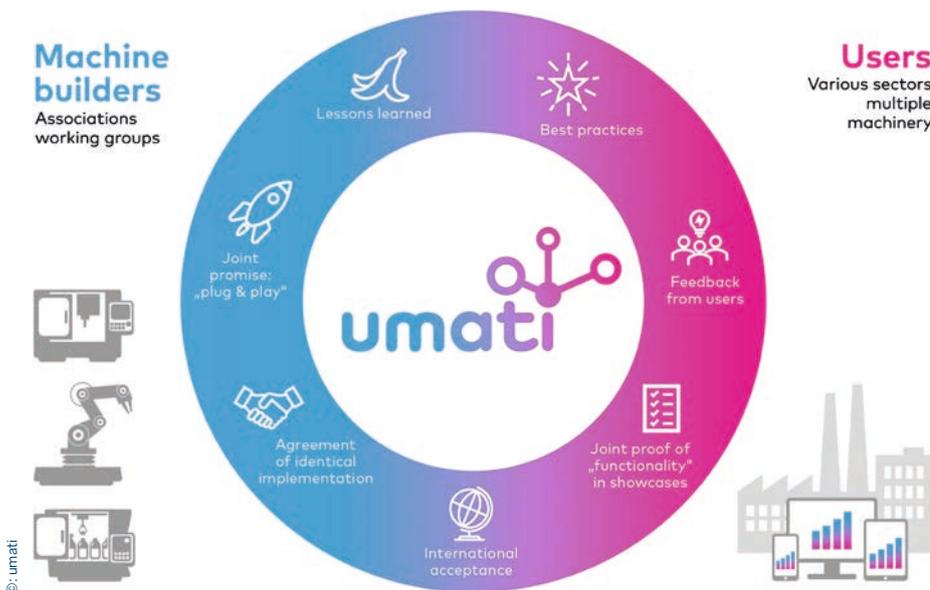
Heinol-Heikkinen: Everything will revolve around digitisation of the value chain. It must be possible to extract the essence from hardware for networking with software. All industrial sectors and

information throughout the entire life-cycle of an asset, which will bring the end customer or – in other words – the asset owner a huge benefit from a very different perspective. The great thing is that you can set the limits, and therefore the entire scope, yourself. Consider, for example, just a single machine or an entire production line, or even the whole factory. Each of these elements can collect and supply vast amounts of information, always with the aim of structuring your own value chain much more efficiently.

www.asetics.de/en

umati – bringing OPC UA into the global use in mechanical and plant engineering

The letters in umati stand for “Universal Machine Technology Interface”. It forms the framework for the worldwide distribution of interface standards based on OPC UA in mechanical and plant engineering.



umati – a strong community for manufacturers and users.

There are many different OPC UA specifications, depending on the type of machine and field of application. From a technological perspective, this makes sense, since different technologies have different needs when it comes to data sharing. But in their businesses, the users of machines and plant – manufacturing companies, in other words – use their own individual assemblage of machines, plant, components and IT systems from various manufacturers. That’s why it’s necessary to coordinate the implementation of the various OPC UA specifications and to standardise them as much as possible. That’s the only way to put in place a comprehensive “Global Pro-

duction Language”. umati is the global brand and community to spread the standards.

The goal pursued by umati is to have machines of all kinds networked in a standardised form, data that can be used to suit the customer’s wishes, and standards distributed in a way that ensures international compatibility.

Efforts in this direction go beyond just standardisation work. The partners working on umati all commit to the principle of “Connectivity – easy, secure and seamless”. Since umati is an initiative by the mechanical engineering and plant construction industry for the

benefit of the industry and its customers, the participating partners collectively commit to a practicable way of ensuring the standards are uniformly implemented in their products. The result is that customers can connect their machines to their individual IT ecosystems in the easiest way possible. In turn, this makes it easier to derive added value from the use of data.

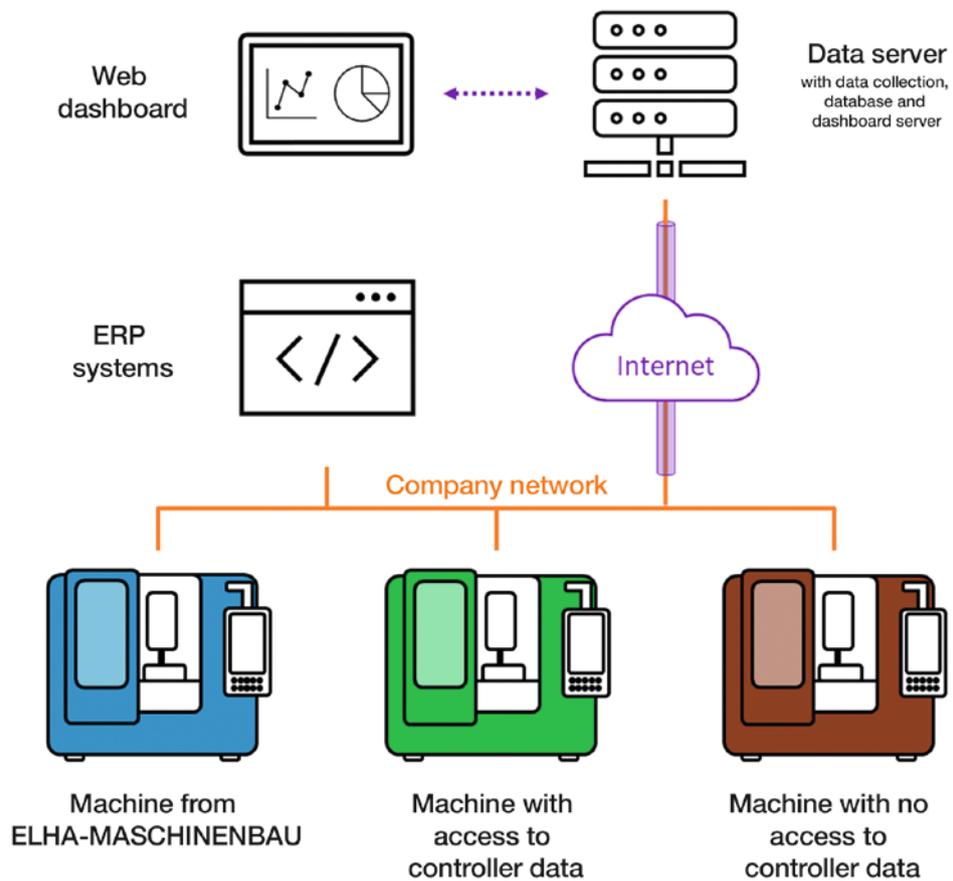
umati is jointly funded by the VDMA (the Mechanical and plant Engineering Association) and VDW (the German Machine Tool Builders’ Association). Heads of production around the world must be able to have the confidence that machines from widely differing manufacturers will speak the same language and can put the aim of umati – Connecting the World of Machinery – into practice.

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Networking machine tools in production using umati

Networking and data collection in production are important tools for identifying potentials for improvement. This is where umati helps, by providing a basis for presenting data from machine tools in production in standardised form via an OPC UA server and for accessing and evaluating it using data collection tools.

Concept for collecting data from different machine tools in production using umati.



©: ELHA-MASCHINENBAU Liemke KG

To collect data from machine tools in production, ELHA-MASCHINENBAU Liemke KG is fitting its machines with an OPC UA server which makes the data available via umati. Its fleet of machines comes in various types: some operate using controllers with no inter-

face to internal data, while others have controllers that present their data via OPC UA using manufacturer-specific information models. To enable the data from these machines to be collected in standardised form, it must be presented using the umati information model.

In addition, the machine tools constructed by ELHA-MASCHINENBAU are equipped with an umati interface, enabling them to be connected to the data collection system during the commissioning stage.

Because of the different conditions applying in different cases, three different concepts have been developed for making the umati interface available, each suitable for a specific group of machine tools.

Concept 1: umati without machine controller data

If it is not possible to read data from the machine tool controller, the production status of the machine is determined by measuring the power consumed by the machine tool. For this purpose, current transformers are installed in the feed line which are evaluated by a programmable logic controller (PLC). The PLC calculates the power taken up and uses the result to calculate the production status. Additional machine data, such as the condition of the warning light, can be collected via the digital inputs of the PLC. The data is made available in the umati information model via the OPC UA server of the PLC.

Concept 2: umati with machine controller data

If data from the machine tool controller is available via OPC UA, this will be collected via an OPC UA client. The collected data will be used to determine which data is needed to create a comprehensive interface. This data is made available in the umati information model via an OPC UA server. In addition to the production data, other data from individual channels and spindles, and alarms and warnings from the controller, can be made available via the umati information model.

Concept 3: umati interface integrated in machine controller

For machine tools manufactured by ELHA-MASCHINENBAU, the data for providing umati is determined directly in the control. The umati information model is made available on the OPC UA server of the controller in the machine tool. Production, monitoring, alarm and warning data is all made available under this concept.

The machines with umati are connected to the production network. To collect the data from umati, a cloud computer with the IIoT data collection software from ELHA-MASCHINENBAU is integrated into the network. The OPC UA client software is connected to the OPC UA servers in the individual machine tools and can access the umati data. Once the connection to the machine has been established, the software checks which data is provided via the machine's umati information model and then stores it on a cyclical basis in an SQL database. Web-based dashboards make the recorded data accessible in easy-to-follow diagram form.

Dashboards provide an overview

The three concepts described above enable all machines in the production unit to be connected to the data collection system, which means the dashboards hold extensive production information. The advantage of evaluating the power taken up is that production status can be determined even for older machines without a modern controller, and these can be fitted with an OPC UA

server containing umati information models. If a machine has access to the machine controller data, the variables in the umati information model can be presented in full. The dashboards provide a good overview of production and potentials for improvement in production orders can be identified. Improving the organisation of production orders can increase production efficiency, for example. Also during the commissioning stage of self-made machine tools, progress with commissioning can be made clearly visible via dashboards.

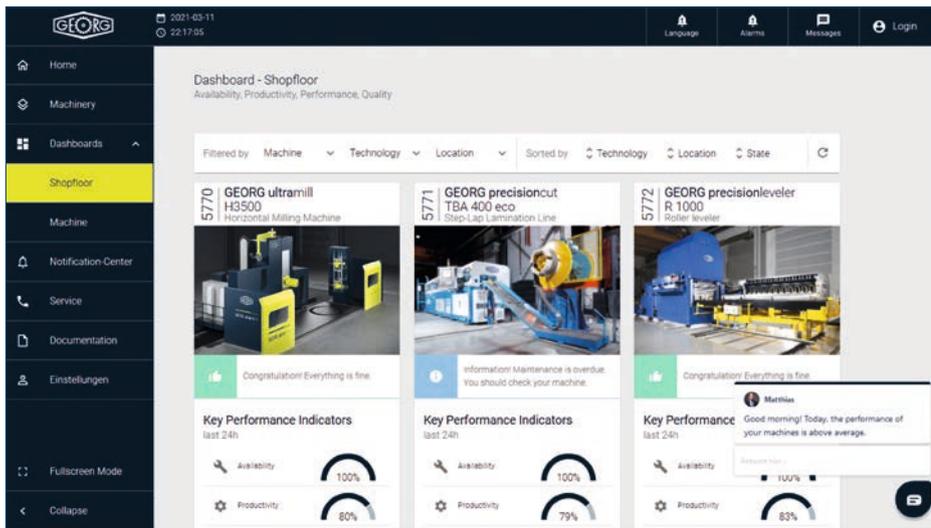
In the future, additional data-based analyses will be able to identify potentials for improvement, thus enhancing the production process as a whole. It will also be possible to connect machines to the ERP system to link order and production data using the standardised umati information models.

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OPC UA as a key success factor in new product development

Digitalisation presents a plethora of new challenges in the development of new products. The conventional mechanical engineer must step out of his familiar territory and enter uncharted waters. He has to evolve from mechanical engineer to process optimiser.

©: Heinrich Georg GmbH



In addition to current machine status, the Georg dashboard's plant overview shows the key figures and machine conditions for the last 24 hours. Users can quickly customise the display to their particular needs using filter and sorting options.

The specialist for solutions in coil processing and machine tool manufacture, Heinrich Georg GmbH Maschinenfabrik, is meeting this challenge head-on and is actively lending direction to the transformation from mechanical engineer to process optimiser. Among other things, the company is currently developing a dashboard that focuses on increasing the productivity of its own customers. In addition, the new (roll grinding machine) control equipment offers the highest degree of interconnectivity and interoperability thanks to its seamless integration into the system environment.

This is made possible through consistent use of communication standards such as OPC UA.

Fresh thinking on product development processes

The paradigm shift from product to process also leaves its mark on the development process. The perspective needs to change; innovators need to put on their 'data glasses' and use them to look at the following questions:

- What additional data would enable us to optimally structure our process?
- What systems can provide us with this data, and how do we get access to the data we need?
- How can we enhance the data with the knowledge from our process and redistribute it?

Many other considerations will follow, including the question of whether the effort and expense would actually pay off.

Speed up efficiency and time-to-market

Standards help to significantly reduce time, effort and costs. Instead of talking to customers about technical aspects of various interfaces, the focus can be placed on content. This enables efficient development.

The establishment of a communication standard that specifies not only the technology but also the content facilitates and accelerates market access. Georg is benefiting from this advantage in the development of its



Featuring the very latest OPC UA technology, the advanced Georg smartcontrol milling machine control system is set to meet the challenges of the future.

own web-based dashboard. Umati is a crucial core of the database application. The umati system provided access to a sound data framework and information model developed by experts, thereby accelerating development.

By consulting a broad base of stakeholders and modelling the resultant findings into a description of use cases and requirements, umati reduces the effort and outlay for requirements engineering. The necessary reduction and abstraction of these requirements is also achieved, with the definition of the parameters to be transmitted. Furthermore, umati's existing information model covers a certain volume of not insignificant preparatory work on system architecture, as well as its implementation. This facilitated the generation of important basics for the Georg dashboard, allowing the developers to focus more fully on the machine-specific added value.

umati's emphasis on developing a standard for all machine tools also broadens Georg's own horizon and thus enhances product quality. And customers retain their machine-specific individuality; umati forms the basis

to which extensions are then added for the specific application and the specific machine. Georg also integrates parts of this standard in product areas outside machine tool industry, creating the basis for connecting its dashboard to all Georg machines and systems. This includes, among other things, slitting, cut-to-length and multi-blanking lines, as well as machinery and equipment relating to transformer industry.

In addition, umati gives companies like Georg easy market access outside their own field of machine technology. Any umati-enabled machine can be connected to the dashboard via plug & play. Customers benefit from the straightforward and rapid integration of their umati-enabled machines.

Enabler for new business models

All too often in this day and age, new ideas or business models fail because of a lack of data access. Brownfield is the norm. Many companies have recognised this problem and have already resolved it to some extent, for their own purposes at least. The factory is fully interconnected throughout. Due to a lack of established standards, however, proprietary systems are often

used, creating the next 'brownfield'. New barriers are thrown up and this impedes straightforward market access for external data-driven solutions. Innovations are thwarted.

Georg also routinely faces the challenge of accessing data from proprietary systems, or making such data available. Often, the cost or the complexity of interface integration is so high that a project simply can't be implemented, or can only be implemented in part. Especially with small tools, the added value for the customer is devoured by the outlay for data collection and provision.

Open standards such as OPC UA and umati can significantly reduce these barriers, and thus enable customer added value.

Shaping the future together

Successful development of new products calls for collaboration, because the transformation from mechanical engineer to process optimiser involves much more than just your own machine technology. It requires active interconnecting and cooperation. Open standards form the common foundation, making a significant contribution to future innovations.

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Information models for OPC UA, ready to use at your fingertips

Klingelberg GmbH has developed the uaGet platform to facilitate the straightforward creation, use and sharing of OPC UA information models. UaGet makes it a simple task to use a range of different information models in OPC UA servers.

With the growing prevalence of OPC UA in the context of machine tools, the number of and need for relevant information models (IM) that carry the actual description of a technical domain are also increasing. Users and manufacturers rely on new Companion Specifications such as umati and its further development.

The object-oriented approach to the description of IMs is a great strength. However, it results in a multiplicity of IMs that need to be tested, managed and integrated. At Klingelberg, we asked ourselves how shared work with an IM that was available as an XML file could be managed beyond the boundaries of the company itself.

Anyone who has tried to find existing standards and make use of them has had to embark on extensive Internet research. There is no single contact point for exchanging IMs. Klingelberg has taken on this challenge, and has developed a new platform for OPC UA. This platform will be available for use by all OPC UA users and providers.

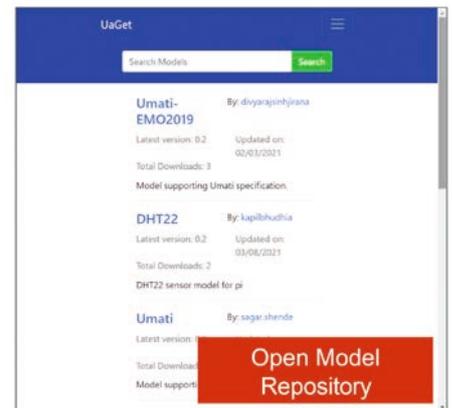
OPC UA brings new challenges for manufacturers and end customers

As a maker of machines for manufacturing gears, Klingelberg is a committed user of umati, the Companion Specification of the future for machine

tools. But the general standard covers only a portion of the world of gear manufacturing. This standard therefore needs to be expanded to incorporate the specific features of gear-cutting machines and the complex production process. In addition, every additional customer has certain requirements for the adaptation and use of OPC UA on their own shop floor.

As a consequence of these requirements, it is vital for the machine manufacturer and the customer to have the resulting IMs available at an early stage. The connection of the OPC UA server to the machine control system – and the connection to the existing IT systems on the shop floor – must be implemented. Ideally, all of this information should be available before the machine reaches the customer. Integration via OPC UA can be done in advance, and any subsequent changes can be implemented quickly.

For end users and for the machine suppliers themselves, the test requires the IM first to be run on OPC UA servers. These IMs are usually shared as XML files. For this collaborative development process involving the triad of standard, machine manufacturer and end customer, Klingelberg has now developed a platform: uaGet.



Search for existing OPC UA information models.

uaGet – a development platform for OPC UA

The web-based application uaGet can now provide robust support for this collaborative development of IMs with OPC UA. Anyone interested can register free of charge at www.uaget.org. You can then search for IMs and adapt them for in-house development, or the finished OPC UA server can be directly tested as a receiver for your in-house applications – all with just a few mouse clicks. Support spans the entire life-cycle and includes the IM development, management and sharing beyond the company's boundaries. The intended purpose of OPC UA as the standard for Industrie 4.0 can only be achieved via this type of platform. A platform for the provision and sharing of IMs significantly reduces the effort and outlay involved in OPC UA applications in distributed scenarios.

Management of information models

Like a public library, uaGet provides information models. After registering, users can browse all entries and simply download relevant models. The reverse is also possible; any registered user can make their own IMs available

through collaboration with component suppliers or with customers, necessitate continuous adaptation. An integrated editor on uaGet makes it very easy to make adjustments, apply new types of data, expand objects or modify existing data types.

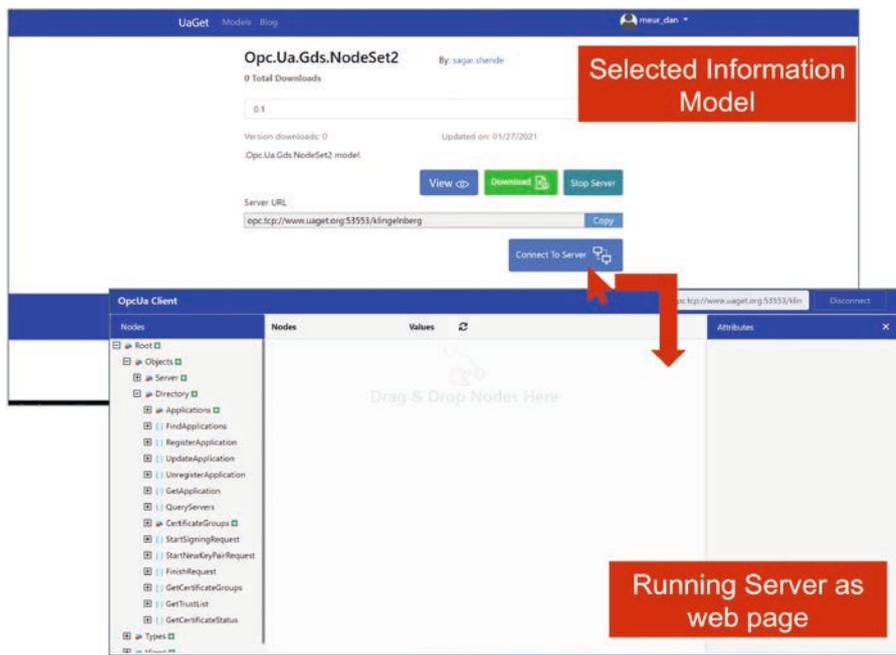
Rapid utilisation of information models

The most exciting function of uaGet is the rapid execution of IMs in OPC UA servers directly on the website. When the user has found a relevant IM in the library, with a single click he can launch an OPC UA server that makes this IM available. This means modifications to the IM can be tested very quickly directly on the website, allowing the end user to easily pre-test an OPC UA server for a particular machine. No previous knowledge is required for this. This function is very useful and speeds up development, as no specific knowledge about software development is required.

Conclusion

The uaGet development platform is a major step forward. The OPC UA platform enables the rapid exchange of OPC UA information models. End users and their in-house developers use the uaGet functions described. The aim is to radically simplify the development of user-specific information models and OPC UA applications.

©: Klingenberg



Selecting relevant models and launching of new OPC UA servers.

on the platform. The models stored can be private, or visible for all. In addition, a current version number is provided so that every user of the model can ensure they are using the most current update.

Rapid development of OPC UA servers

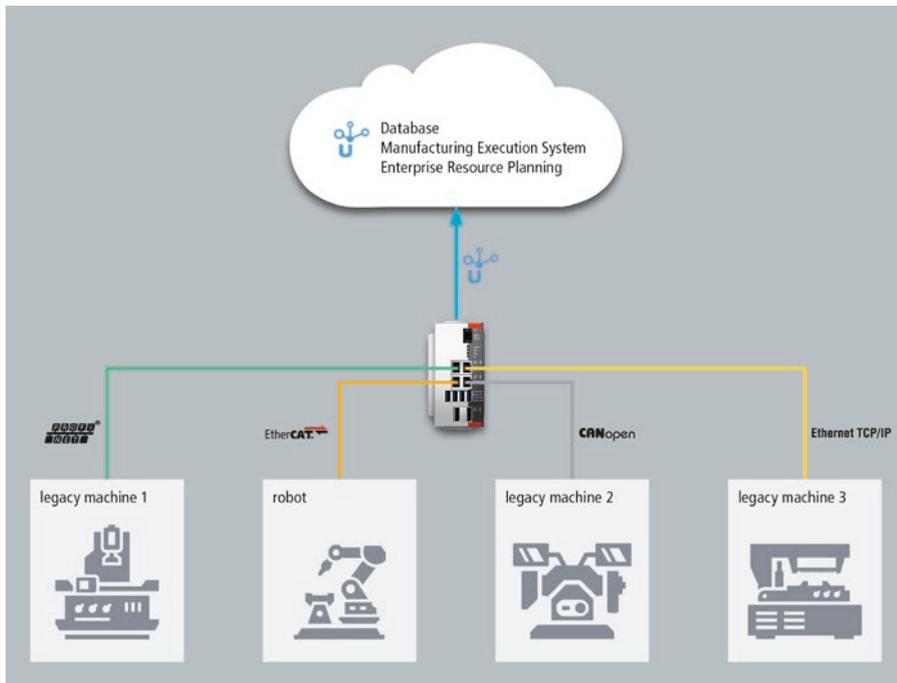
The lifecycle of an IM doesn't end with its initial deployment. Rather, modifications and enhancements, especially

No additional software is required in order to work with the IM. As the owner of an IM on uaGet, you launch the editor and make the required modifications. The new version will then be automatically saved and other users will be automatically informed of the changes. To receive this notification, you just need to set the relevant IMs as favourites on the website.

PC-based control – the umati enabler

The universal machine technology interface (umati) promises to resolve a host of familiar problems, and to exploit new potential in terms of added value. Umati is a universal, OPC UA-based interface via which machine tools and systems can exchange standardised data with a higher-level controller.

©: Beckhoff Automation GmbH & Co. KG



Older machines without an OPC server can be made umati-capable using a fieldbus and an upstream industrial PC.

The integration of diverse machines into control systems still represents a significant cost factor in the design and operation of modern production systems. Often, the main causes of this expense are the disparate range of data provided by the various control systems, as well as the lack of a universal standard with regard to structure, content and presentation of information in the industrial environment.

New applications possible

The automation specialist Beckhoff Automation sees great potential in umati as a basic orientation, not only for solving existing problems such as control system connectivity, but also for developing new applications based on PC-based control technology. Beckhoff has demonstrated a number of interesting approaches in the recent past; in the simplest case, the machine control system and OPC server run on

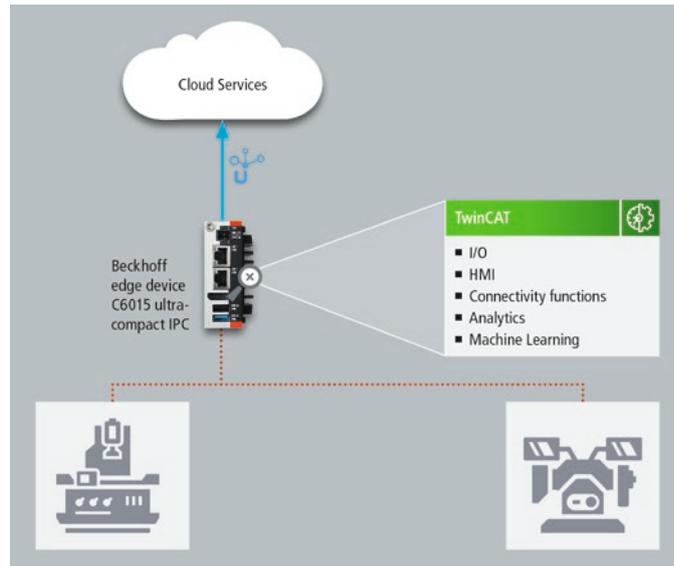
one and the same industrial computer. This strategy is highly efficient, as the interface between the controlled process and the OPC server is implemented solely using software. This is possible because the industrial PCs not only have the interfaces required for integration into IT landscapes, but are also able to control the most complex workflows in hard real-time, for example, using TwinCAT automation software. This allows the companion specification for machine tools to be made available directly from TwinCAT CNC.

But machine control and OPC server can also be implemented on separate devices. Whether as a result of a deliberate design decision or a retrofit, in both cases PC technology has proved extremely advantageous due to its openness. Industrial PCs (IPCs) can even communicate with older controllers, for example via fieldbus. The data obtained can be processed locally and made available to the outside world on an OPC server. This means existing machines can also be made umati-capable. Beckhoff has already demonstrated this scenario at EMO 2019, where the company integrated several third-party manufacturer controls in the VDW's umati showcase.

For new products and retrofits alike

Industrial PCs can also be used as umati aggregation servers for several machines, for example within a manufacturing cell. The interface to the machines can be implemented either through fieldbus connectivity or umati itself. From the point of view of the individual machines, the IPC then functions as an OPC client.

In practice, the above examples cannot always be clearly separated from one another. As is so often the case, the transition points are fluid. One charac-



Industrial PCs can not only act as OPC servers, but also take on a variety of other tasks – as edge devices, for example.

Infobox

OPC UA is becoming more prevalent even in areas outside mechanical engineering.

Beckhoff Automation has been involved in a number of successful implementations in infrastructure and buildings projects. Such projects often include many communication partners, who benefit from the standardised, yet scalable OPC UA communication model.

As in this example: the building and mobility area on the campus of the Empa interdisciplinary research institute is used to conduct energy research in an active, bustling living and working environment. To interconnect these areas, comprising an array of different elements – with all their components involved in producing, storing, transporting and converting energy – the institute relies on the OPC UA communication standard.

teristic feature, however, is that the IPC never has to be reduced to the function of purely an OPC server. The openness and scalability of this platform allow for tailor-made solutions that bring identifiable added value. For example, an aggregation server can simultaneously act as a cell control system with PLC and NC functions, and the IPC installed as part of a retrofit can provide additional condition-monitoring functions. This includes the connection of the required sensors and their evaluation in real time.

The spectrum ranges from simple statistical analyses of binary signals right up to energy measurement technology and complex frequency analysis of critical components. The state variables calculated can be incorporated directly into the umati data supplied. At the same time, this information can also serve as input data for machine learning algorithms. TwinCAT executes this task on the IPC in real time, harnessing previously unknown cause-effect

relationships. This may be done to increase efficiency, or for early detection and prevention of potential machine breakdowns. Existing machines can not only be integrated into the umati world; they can be future-proofed as well. An elegant solution can be achieved if the required PC and I/O technology with protection category IP65 or higher can be mounted directly on the machine, without the need to make changes to the existing installation set-up in the control cabinet.

The umati concept is still young but it is already apparent that, given the broad field of possible applications, PC-based control technology will be a key factor in achieving cross-industry interoperability.

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OPC UA ensures communication in the learning steelworks

Companies in the steel and non-ferrous metal industry generate huge volumes of data in their production lines, which is often available only in heterogeneous form and spread across numerous systems and databases.

Data silos have to be broken down to be able to extract the information that's vital for adding value. Only then can data be turned into information, and information into added value. But it's a time-consuming task.

The SMS DataFactory is the foundation for a 'learning steelworks', and makes the data from plant automation, sensor technology, and production-level IT systems available for design, maintenance and quality assurance applications. This makes it possible to fully work up and analyse all the plant data. This is where OPC UA acts as a key language that links sensors and smart devices from partners of all kinds di-

rectly to the SMS DataFactory or via the SMS IIOT platform.

Technological drivers of the learning steelworks

The learning steelworks has one goal: to use data to make production faster, more efficient, more robust and more sustainable. Software picks up the data from a plant, turns it into information and ultimately refines it using artificial intelligence and machine learning. This generates important insights for practical implementation, saving costs and resources in the process.

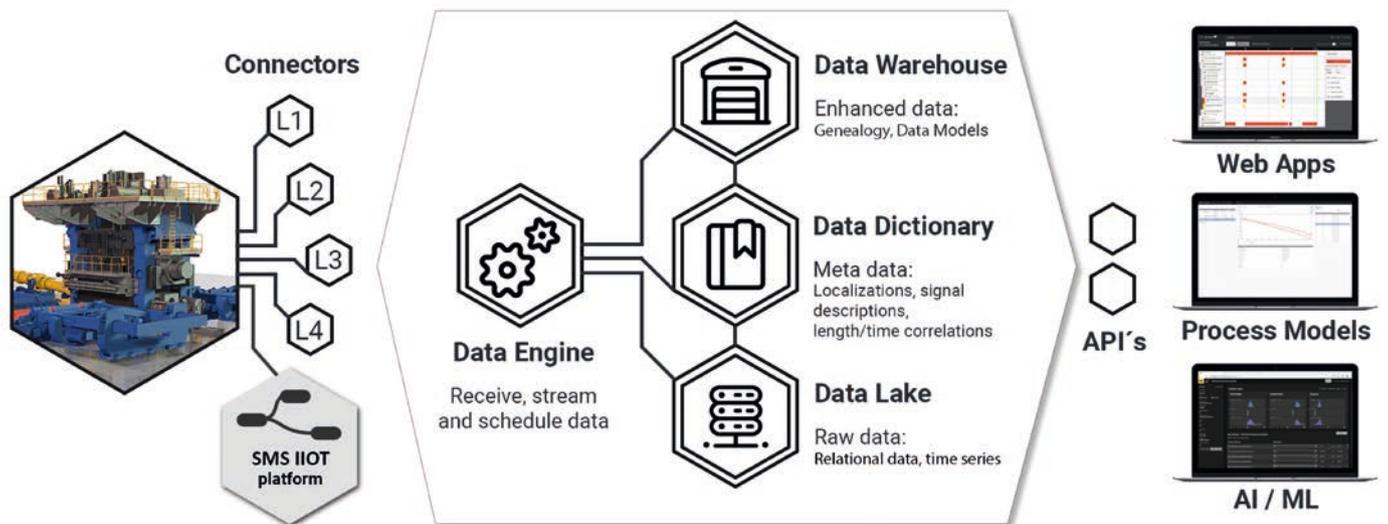
"In the age of digitisation and Industry 4.0, it's important to get maximum

performance from plant and process routes," says Dr Eike Permin, Chief Operating Officer. "That's why it's important to take the huge volumes of data coming from the plants and processes and give them an orderly structure to facilitate analysis."

The SMS DataFactory architecture

The SMS DataFactory manages the entire data lifecycle from reading the data in to cleaning it up, storing it securely and efficiently, and backing it up and providing long-term archiving. In doing so, it takes the steelworks to "digital ready" level.

©: SMS digital GmbH

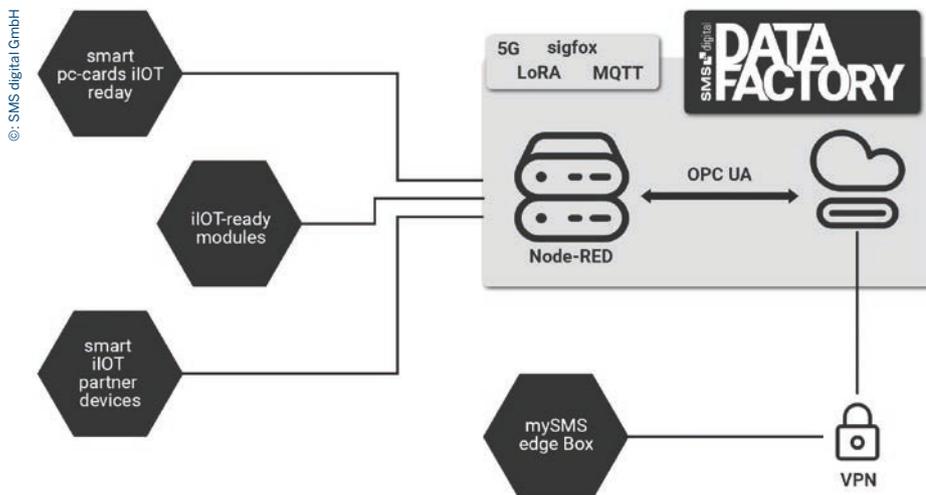


Structure of the SMS DataFactory.

It also provides a meaningful catalogue for data interpretation in addition to permanent access to the required data, for example via Data Warehouse or customised SQL views. The Edge layer

standardised, which means the variables are easy to incorporate regardless of the manufacturer. Depending on the task to be resolved, the data is made available in various formats.

tionary provides the process experts with deep insights into the available data using mutually linked data elements based on their origin, purpose and type.



mySMS IIOT platform.

organises and provides efficient support for data and signal collection from OT systems and industrial plant. The edge systems are collecting data over a range of communication protocols. The data are collected, consolidated buffered and forwarded locally.

When required, powerful, smart Edge boxes are used to perform analyses directly and process business applications using AI/ML models. This is where OPC UA forms an important bridge, and uses a companion stack such as umati to facilitate a much simpler and faster connection to applications outside the steel industry. The documentation and designation of the data sources are

Data volumes that become necessary in the future will require 5G, mySMS-edge-Box and standardised protocols such as OPC UA to enable them to be completely managed.

Technology expertise meets domain expertise

By having the data available in the appropriate form, it's possible for the learning steelworks to analyse and process it using IT systems. The data is then enriched using metadata, which makes it faster to locate and gives it meaning. The most important thing in this regard is to combine technology expertise with domain expertise. Within the SMS DataFactory, the Data Dic-

To fully network all machines and applications, SMS digital provides a state-of-the-art, flexible and scalable basis in the form of the mySMS platform. This platform can be used to integrate in-house and partner digital applications and expand the portfolio. "Implementing these processes has become possible only with the advent of a uniform language and interfaces, such as OPC UA," says Permin. "That makes OPC UA one of the many key enablers of the Industrie 4.0 revolution."

Expanding the OPC UA-umati project for the mechanical engineering and plant construction industry was an important reason for SMS digital to become a part of the VDW-VDMA Joint Working Groups. A standardised interface makes it significantly easier to share data with the SMS IIOT platform and thus with the SMS DataFactory, and facilitates the implementation of digitalisation solutions in other industries, not only the learning steelworks.

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