INFORMATION UNLIMITED

THE COPA-DATA MAGAZINE #41|2023

SPOTLIGHT

Smarter Factories

EDITORIAL

In the previous edition of IU magazine, we focused on the topic of sustainability. Clearly, technology is playing a critical role in reaching sustainability goals and keeping our planet livable for future generations. When it comes to manufacturing, only a "smart" factory can be a "green" factory. In this edition, we'll update you on where we are headed on our "Smart Factory with zenon" journey and we'll discuss the technological bridges that you can build with zenon.

First, however, let's start with a simple question: "Why do we need Smart Factories?" There are many answers to this. Firstly, increasingly intelligent production allows for more sustainable manufacturing. It also reduces the dependence on available skilled workers. Due to demographic changes, the percentage of working people is declining compared to the overall population. Automation can, therefore, be a strategic game changer for entire economies.

Businesses also gain competitive benefits by successfully implementing Smart Factory strategies: shorter time-to-market, lower production costs, greater resilience, and stronger customer loyalty. Advances in technology thus contribute directly to achieving business and financial objectives. We are delighted to be doing our part with our software platform zenon.

Modular production plays an important role in Smart Factory concepts. On page 47, you can read about how to prepare existing systems for modularity in the article "Integrating Legacy Systems."

ABInbev, the world's largest brewery group, has already achieved impressive successes in the area of digitalization. In the interview starting on page 42, Charles Tisdell, Global Director of Connected Brewery IIoT and Automation at ABInbev, provides exciting insights into his experiences with zenon.

Be inspired!

Thomas Punzenberger

THOMAS PUNZENBERGER,
CEO

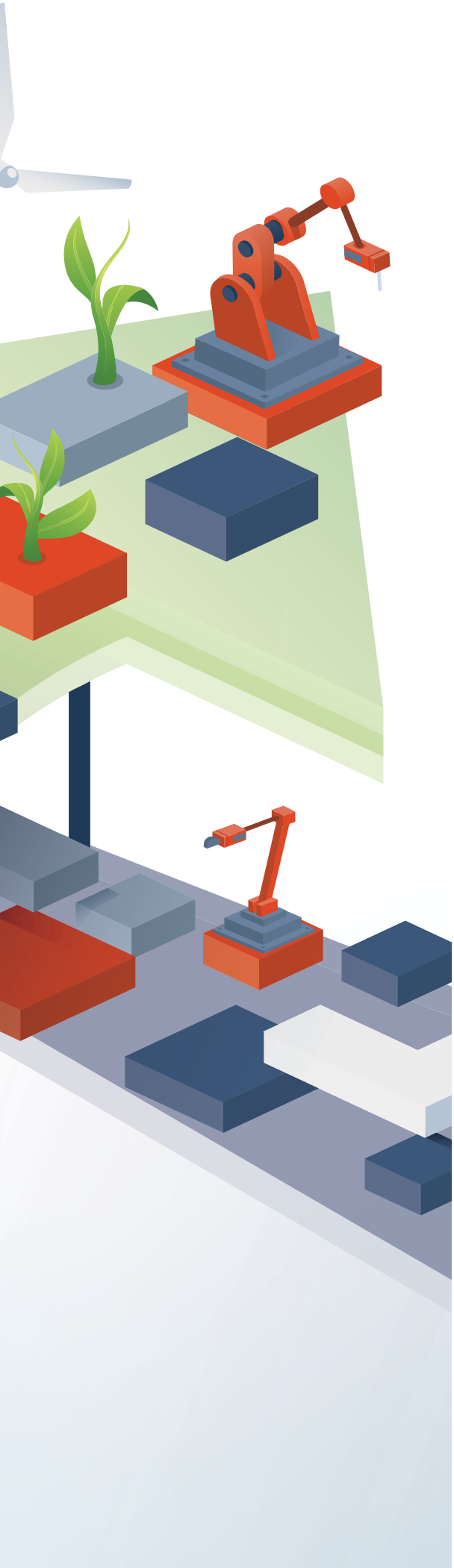
CONTENTS

SPOTLIGHT
SMARTER FACTORIES

PRODUCTS & SERVICES

INDUSTRIES & SOLUTIONS

AROUND THE WORLD



SPOTLIGHT
SMARTER FACTORIES

SMARTER FACTORIES

When the German government published its policy paper on Industry 4.0 in 2013, there was a sense of excitement about the future at COPA-DATA. Stefan Reuther was in the room when terms such as IIoT and Smart Factory were being hotly debated. In conversation with IU, the Member of the Executive Board of COPA-DATA looks back at the hype – and reflects on where the journey could lead next.

AUTHOR: ROBERT KOREC, PR & COMMUNICATIONS CONSULTANT

From the mid-2010s onwards, Industry 4.0 took off and generated considerable hype in many manufacturing industries. Concepts such as IIoT and the Smart Factory were discussed intensely in many companies. "Back then, these issues really gained momentum. Approaches such as modular automation or cyber-physical systems were not yet widespread," recalls Stefan Reuther, Chief Sales and Services Officer and member of the COPA-DATA Executive Board. At that time, COPA-DATA was already very well positioned in this area. "Many of the things that were in the papers back then, such as vertical integration, were already standard for us," says Reuther. "Other topics such as artificial intelligence are only now coming to the forefront."

INDUSTRY 4.0 FOR ALL SYSTEMS?

The hype and associated buzzwords can accelerate development by stimulating public discussion. In the 2010s, every system suddenly became an Industry 4.0 system. "Suddenly everyone jumped onboard," says Reuther. However, many companies are not even Industry-3.0-ready at present. The foundation for Industry 4.0 is missing in many places.

SOLUTIONS NOT SLIDES

When Stefan Reuther speaks to international customers, new concepts such as Manufacturing-X are sometimes bandied about. He sees only a limited usefulness for such buzzwords. "People have heard enough of these new concepts and no longer want to see colorful slide presentations. Everyone simply asks: ‚How do I solve the issue?'" This is also COPA-DATA's approach. Namely, to offer ready-made solution packages – from systems for

simple photovoltaics with battery storage applications to the automation integration layer. This makes it possible to convey your own expertise to business partners.

WEAKNESSES OF THE TECH GIANTS

Big tech companies have sometimes had difficulty understanding the challenges and needs of customers in the field of industrial automation. The fact that they were unable to gain a foothold, or have done so only slowly, is because the automation market is comparatively small. Publicly listed corporations have to show quick financial success in order to keep their investors happy. As a result, business areas that require staying power have a relatively difficult time of it. This is particularly true when the related technologies, for example Google IoT Core, are simply discontinued.

COPA-DATA is positioned differently. "We only do industrial automation. And we're really good at it. We know every bit and byte. Customers appreciate that about us. We have more in store than just buzzwords," says Reuther.

COPA-DATA has grown organically – without acquisitions, step by step, and based on a solid foundation. "The applications need a certain level of robustness," says the CSO. "Systems sometimes run for 20 years and must be maintained. Any attempt to build an industrial application from tossed together, open-source components is doomed to failure."

However, large companies are often very agile on the user side, Reuther can confirm, after participating in several meetings at the World Economic Forum in Davos at the beginning of 2023. Technology from the Fourth Industrial Revolution is being used increasingly, with industrial facilities, value chains, and business models being optimized for significant financial and operational return.

"The conventional manufacturer is not ready yet, especially when it comes to advanced manufacturing. Perhaps 20 percent of companies actually do this. The remainder use conventional automation, if anything at all." Yet advanced manufacturing or smart manufacturing concepts can now be found in more and more systems. In this regard, COPA-DATA is already well prepared.

This is true in the area of sustainability, where one often finds different requirements at large and medium-sized companies. Only a few medium-sized companies currently prepare environmental, social, and corporate governance (ESG) reports. Larger companies have more capacity for this and are therefore better prepared should this type of reporting become mandatory in the future. As part of Scope 3, an important pillar of the Greenhouse Gas (GHG) Protocol, corporations also want to include suppliers' CO_2 consumption in their environmental balance. They pass on this pressure to their suppliers in the form of additional reporting. The key, in these cases, is to act quickly in order to maintain important customer relationships.

EXPENSIVE ENERGY TRANSITION

Today, digitalization projects are often linked to sustainability goals – or „the twin transition", to use another buzzword. Conventional monitoring applications must be able to record the data from smart meters in order to bring transparency to energy consumption and correlate it with production output. Companies want to know how energy efficient their production is. In the pursuit of Net Zero and in the wake of rising energy costs, the topic has become very important. Only optimal transparency can help to meet this challenge. To improve efficiency, customers have to measure consumption.

SCOPE 3

In addition to classic energy reduction goals, companies are also navigating both the circular economy and the aforementioned Scope 3. Both influence the systems of the future. Stefan Reuther recalls a conversation with a mechanical engineer: "His company rolled out a new machine every five years, whenever there was an important trade fair. Now he wants to keep machines in operation longer to reduce the lifetime CO_2 footprint. To do this, he has to design the machines modularly and with interchangeable components – something that is already easy to do with zenon."

> "For me, selling and installing proprietary systems is simply a thing of the past. These systems are out of date. Today, it's about networking, communicating openly, moving away from silos and towards open data sharing."
>
> – Stefan Reuther

MODULAR FUTURE

In the area of modularity, zenon provides an already very advanced solution offering for module type packaging (MTP). According to Stefan Reuther, the topic is becoming increasingly established in the market. It will soon become more important in order to make industrial equipment more durable and thus part of the circular economy: "Manufacturers have to think in advance about how a machine comes back into the company. This happens of its own accord. Not only because of the idea of sustainability, but because it can create competitive advantages."

A PROPRIETARY BREW

Another topic of Industry 4.0 is interoperability. OPC-UA has established itself as a standards and

communications driver in some areas. On the other hand, Stefan Reuther still sees the tendency of large automation players to protect what's theirs and brew their own (proprietary) solution, in order to lock out the competition.

"Most of the big players still use their own protocols, although they could also use OPC-UA. This shows that many still want to protect themselves. However, I believe that as it matures MTP will increasingly end these practices."

This is another reason why COPA-DATA is delving further into the topic of open distributed control systems (Open DCS).

SHARING DATA INSTEAD OF SILO MINDSET

In proprietary systems from large providers, you are completely trapped, explains Reuther. "An existing, monolithic DCS system is difficult to replace; it has to be modernized again and again at a lot of cost before it is ultimately driven to death. But we have the chance to offer a very good alternative as soon as the next generation of systems comes along. For me, selling and installing proprietary systems is simply a thing of the past. These systems are out of date. Today, it's about networking, communicating openly, moving away from silos and towards open data sharing."

THE DATA FOUNDATION OF DIGITALIZATION

What does the future of industrial automation look like? What course should companies today chart to be prepared for the challenges ahead? For Stefan Reuther, the first important step – and a basic requirement for digitalization in the coming years – is a solid data platform. If data is not properly recorded and contextualized, there is no point in thinking about Industry 4.0 or advanced manufacturing.

It is also not necessary, in that case, to save all the data. This was promoted- for a long time in the hope that one day "AI would do the rest".

NEAR FUTURE: SELF-CONFIGURING PRODUCTION

From the COPA-DATA CSO's perspective, the interaction of artificial intelligence and modular technologies could enable completely new application scenarios at all levels. "This affects mechanics, on the one hand, and automation technology, on the other. It means that existing units can be flexibly exchanged and combined with one another. This will even go so far that systems know which different devices and assets are required for the production of a piece X, and they will autonomously find it and be able to bring it into position." According to Reuther, production lines made of modular components enable extremely short and flexible changeover times – the goal of a batch size of 1 is getting closer and closer. The modular technology for this already exists. With the help of AI, dynamic arrangement will soon become a reality. "If you think further here, AI components could configure production processes themselves and further optimize them."

This is exactly the challenge faced by industry. As an example, Reuther describes an order from a specific country that would require a quick turnaround and switching to a different production system. Currently, it takes considerable manual effort to determine the free capacities in international factories. A future solution could take on this task independently and report which assets are available at which locations and at what times.

Stefan Reuther is convinced that "all of this is not just a dream of the future, but is already within reach. The technology is already there today, albeit not good enough to work at the push of a button. We are already discussing these approaches with our early-adopting customers. For example, we are working on a prototype in the area of fast consumer goods in the F&B sector."

STEFAN REUTHER
Member of the Executive Board

Member of the Executive Board at COPA-DATA Group since 2017. Engineer Degree in Law and Economics. More than 25 years' experience in industrial automation, advanced manufacturing, and strategic management. Enthusiastic about contributing to the solutions to today's problems. COPA-DATA's vision, through its state-of-the-art software solution, is to play a decisive role in supporting its customers in achieving their strategic corporate and sustainability goals.

RETHINKING DIGITALIZATION

Robert Merz, research director at Austria's Digital Factory Vorarlberg, explores the potential that digital twins and AI offer in industrial production. In this interview with IU, he talks about the exciting opportunities arising between scientific research and productive applications – and why the possibilities are far from exhausted.

INTERVIEW: ROBERT KOREC, PR & COMMUNICATIONS CONSULTANT

IIoT and Industry 4.0 are concepts that have been around for years – and not only at COPA-DATA. They don't seem to have lost any relevance. How do you view these trends in retrospect?

Robert Merz: These ideas actually go back to the 1970s. At that time, CIM (computer-integrated manufacturing) and CAx (computer-aided x) were used to look at how computers could help to improve processes in different areas in a company. This faltered but was revived 30 years later under the slogan Industry 4.0. That was and still is a good idea. However, it's basically the same thing, just evolved. It's a slow and steady process. A lot has already been achieved in the meantime. More and more machines are communicating with each other. Nevertheless, we are still far from the desired and much-hyped vision. To be honest, what surprised me at first was that it is extremely difficult to connect machines and get usable data. Of course, like everyone else, I bought into the hype back then. Now it doesn't surprise me any longer.

The industry-wide research center Digital Factory Vorarlberg deals intensively with IIoT and digitalization in industrial production. What is Digital Factory Vorarlberg researching at the moment?

Merz: We have set ourselves three main research areas. First, data economy systems. Second, the use of AI in production. Third, the use of radio systems (wireless-X). For example, we have developed a cloud manufacturing platform and have already successfully used AI in some scenarios in production. For us, zenon is the central interface between all machines in our model factory and the HMI for visualization and operation.

To what extent can the findings of Digital Factory Vorarlberg be transferred to real companies?

Merz: Since we work on real problems, our results are directly relevant for practical applications in the real world. However, it takes time and skill to roll out and implement solutions in companies. For this reason, we often combine innovation projects with further training measures. Our research results are used in production companies, especially in the areas of quality control or forecasts. Unfortunately, I am not allowed to speak publicly about these projects. Nevertheless, as one example, I can mention our cloud platform, which is currently being tested in the training workshops of a number of Vorarlberg companies.

With increasingly networked, IT-controlled industrial production, focus is moving to the topic of security. Where do you see the current challenges?

Merz: People don't take cyber security seriously enough – until something happens. Security is extremely difficult to understand due to the complex networked systems. Good professionals are expensive. The three factors are, therefore, a lack of awareness, a lack of skills, and a high level of complexity. The complexity of the systems is likely to increase, so the logical levers for change are awareness and training.

With artificial intelligence, where do you see opportunities and risks for industrial production?

Merz: I see a lot of opportunities, but also risks. It's a matter of handling. For me, AI is like dynamite. Properly used, it is a great support that enables applications that would otherwise not be possible. In the wrong hands or misused, it's a tool that not only magnifies benefits but also magnifies problems. In the past, simple (mathematical) relationships were used to describe something or to make decisions. Today, almost infinitely complex algorithms are available with AI and are tuned using data. Due to the many parameters that are in an AI system, very complex relationships can be simulated – whether for quality control, image processing, forecasts, etc. Unfortunately, most users are not aware that an enormous amount of very well selected data is required to train a good AI system. It's like football: with a bad coach and without training for special situations, you won't become world champion.

Where do you see the biggest hurdles in the digitalization of industrial plants?

Merz: Competence, time, and money are obvious. There are two big factors. First, digitalization has to be thought of holistically. Too many isolated solutions are currently being produced to be able to quickly demonstrate ROI. Second, existing machine parks and systems are very heterogeneous, making it difficult to find a common denominator.

> "For me, AI is like dynamite."
>
> – Robert Merz,
> Research Director Digital Factory Vorarlberg

What different degrees of maturity do you see in companies at the start of their digitalization projects? What does this mean for the downstream processes?

Merz: To be honest, all projects are still relatively small but the range of projects is large. There are pioneers who have already achieved a lot and can demonstrate consistent digitalization in some areas. But they also struggle with the details or with scalability. With others, each system is a digital island and there is hardly any specialist knowledge. For us, this means that we have to meet the companies at where they are currently. For some, we need to start with skills development and basic consultations. For others, we can tackle complex technical issues. Flexibility is important.

How important is standardization?

Merz: This is one of the keys to digitalization. Without standardization, it becomes difficult to scale.

Digital twins are often cited as an important element of the Smart Factory. Is Vorarlberg researching this topic?

Merz: Yes, for example we are working on a simulation system that can predict the energy consumption of production facilities. We can then use this information to improve the use of renewables or smooth out spikes in resource consumption.

To what extent is the integration of a company's own renewable energy generation an issue in industrial production?

Merz: That depends very much on the company in question. In most manufacturing companies, self-generated electricity production is only sufficient for five percent of the required amount of energy, even if all

the available space is equipped with photovoltaic cells. In addition to the topic of energy optimization, other questions immediately arise. Namely, how can we coordinate energy producers, network operators, and the major energy consumers in such a way that we can operate the entire system optimally? The goals must be to use renewables as efficiently as possible, not to overload the grid, and to use as little fossil energy as possible. This requires sensitive data from everyone involved, which has to be processed across companies and not used for unauthorized purposes. We need data economy systems. To this end, we have just submitted a research project with a number of partners. The topic is gaining in importance in companies.

How do you foster good cooperation between research and industry?

Merz: Mutual trust and understanding of the partners' objectives are absolutely necessary. We only succeed through teamwork. For example, we have a coordination meeting at least every 14 days during all projects in which a business is participating. For companies, research can help to solve a problem that may already be scientifically irrelevant but for which the implementation is still very difficult. On the other hand, there are innovations that do not yet make a positive contribution to ROI but which are vital for the future of the companies. You can't rely on scientists developing solutions of their own accord and then making them available at low cost.

What does the Smart Factory vision look like for the coming years? What can we expect?

Merz: The vision will not change much. Networking and the use of data will be crucial. Wireless technologies will be increasingly used. We will be able to record and better detect system states. Assistants in the form of AIs will support us in making decisions. Not only simple manual work will be automated. Simple, knowledge-based work will also be performed by AI – all that takes place within the data boundary. Otherwise, it will be hard work for good specialists.

DIGITAL FACTORY VORARLBERG

An industry-wide research center, Austria's Digital Factory Vorarlberg helps companies to roll out and implement digital innovations in industry and business. Together with partners and clients, the researchers develop tailor-made solutions to solve complex tasks. zenon is the core software for the research and learning factory. COPA-DATA and the Digital Factory are linked by a long-standing cooperation. In 2021, COPA-DATA awarded Gold Partner status to the Digital Factory.
www.vactory.at

ROBERT MERZ
Research Director
Digital Factory Vorarlberg

Born in Salzburg, Robert Merz graduated in electrical engineering from the Vienna University of Technology. In the 1990s, he was involved in the development of 3D-printing processes at Carnegie Mellon and Stanford University. This was followed by positions as a systems engineer at BMW AG and department head for mechatronics at the FH Salzburg. At the Vorarlberg University of Applied Sciences, he was a university lecturer for automation and robotics, vice rector for research, and founded the Microtechnology Research Center.

> “We believe that modular orchestration is the future of automation.”
>
> – Thomas Punzenberger, Founder and CEO of COPA-DATA

ORCHESTRATING MODULAR PRODUCTION

Modular technologies at all levels enable entirely new application scenarios for industrial automation. COPA-DATA CEO and founder Thomas Punzenberger and Günther Haslauer, Vice President Software Engineering, explain why these concepts are not a future technology, but can already be implemented with zenon 12.

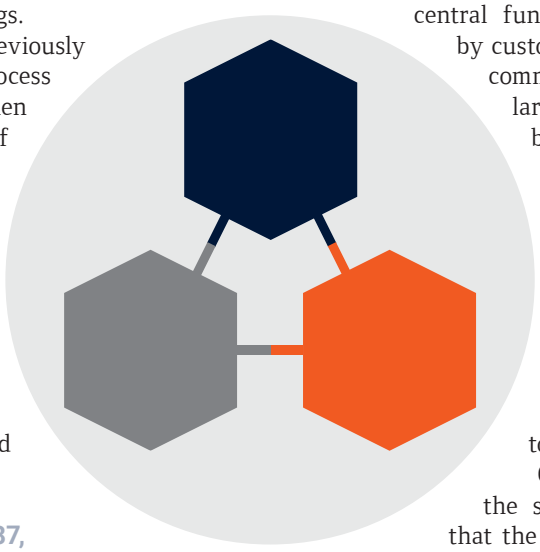
INTERVIEW: PETER KEMPTNER, FREELANCE TECHNOLOGY EDITOR IN SALZBURG

Modularization and automation are at the heart of our philosophy behind the zenon software platform. With the latest version – zenon 12 – zenon has reached a significant milestone on the path to a modular automation platform and the Smart Factory. The modularization of production systems and the automation of project creation are considered alternative solutions – not least due to the ongoing shortage of skilled workers in engineering. But how did we get here? And what steps brought us to this point?

The digitalization of industry has been happening for a while, but it has yet to be adopted fully. Will it continue to spread and become more common?

Thomas Punzenberger: There are as many definitions of what digitalization in industry means as there are companies. In Smart Factories, the production systems are connected to each other and to systems in remote locations, in addition to proprietary IT systems, via the Industrial Internet of Things.

This not only means that previously analog processes and recorded process data can be mapped digitally. When used correctly, the combination of OT and IT provides significant operational relief and enables companies to increase their efficiency, agility, and customer service by consolidating and evaluating existing data. Once on this path, companies will continue on it because this form of digitalization always has beneficial effects on their competitiveness and value creation.



You founded COPA-DATA in 1987, before terms like smart factory, IIoT, or convergence between OT and IT existed. Did you anticipate these developments?

Thomas Punzenberger: Improving value creation in companies using digital methods – which already existed – was central to the founding principles behind COPA-DATA. With zenon, we have created a solution that leverages digital technology and is designed to help people perform their tasks more easily than would be possible through conventional methods. In this regard, with our software approach, we implemented early on a lot of what is now understood under the term digitalization.

The needs of the market and the technical capacity to meet these needs have developed in parallel over the past 35 years and they have driven each other. Behind all of the buzzwords, the ultimate goal of all of COPA-DATA's development efforts today is to make the operation of equipment more secure, easier, and more transparent for users.

How do modularization and automation fit into the larger concept of digitalization?

Thomas Punzenberger: Increasingly, machines and equipment are no longer being manufactured as one-time, monolithic, complete solutions. Since many central functions are directly required by customers for all applications, it is common today to provide a modular design with standard assemblies and customer- or application-specific enhancements. Equipping these modules with control technology so that they can work together easily or even change their composition according to the principles of Industry 4.0 only became possible with reasonable effort thanks to digitalization.

Günther Haslauer: One of the secrets of zenon's success is that the software is configurable and can therefore be adapted to changing operational requirements without any real programming. In addition, zenon's universal connectivity makes it easier to use modular machines. With a global symbol library and global projects, XML import/export, wizards, Visual Basic for Applications (VBA), and add-ins, zenon opened up possibilities for reuse quite early on. This

also led to modularization and automation in engineering and a dynamic or modifiable configuration.

How did the idea for modularizing zenon come about?

Thomas Punzenberger: About 15 years ago, we thought about how we could create a way to combine individual projects into larger overall projects, in order to provide the best possible support for the changing methods in mechanical and equipment engineering. However, the options for integrating existing parts into a project in zenon were always just parts, such as the PLC program, the symbol, or the variables. There was no way to create a micro-project combining all these aspects and build a comprehensive project on this basis. That was when the idea of "Smart Objects" was born.

Fifteen years is a long time. The implementation didn't start immediately, did it?

Günther Haslauer: At first, we thought the implementation was too complicated. It wouldn't be sufficient to integrate existing projects unchanged. We faced enormous challenges that made us doubt the technical feasibility. It wasn't until 2019 that we decided to create Smart Object technology. Knowing that a great deal of our effort would be required to make it easy to use for customers, we brought on board our Content & Templates team from Professional Services to take the temperature of some of our key customers.

> "The zenon MTP Studio enables employees without in-depth software knowledge to generate a full process control system by orchestrating modular packages in the form of converted MTP files."
>
> – Günther Haslauer, Vice President Software Engineering at COPA-DATA

What is the next step towards a modular automation platform?

Thomas Punzenberger: Module Type Package (MTP), developed since 2015, has established itself as a standard solution, especially in the process industry. It uses standardized language to define the properties of technical products and provides a kind of digital business card in the form of the MTP file. It contains machine-readable information about what the component can do, what interfaces it has, and what sensors and/or actuators are available.

Günther Haslauer: Customers should be able to connect different devices from different manufactur-

ers, including but not limited to hardware. Predefined descriptions of their data models and functions make it possible to create related software modules. The individual modules are orchestrated with zenon and combined in an automation project.

Could you please explain modular orchestration? What potential do you see in it?

Thomas Punzenberger: We believe that modular orchestration is the future of automation. In the MTP component approach, the modules represent not only the hardware, but also its behavior. Anyone who knows this can design software without programming. It's a bit like a conductor in an orchestra. They must understand the music and be familiar with all the instruments involved and their qualities, but they do not have to master each one in order to make it work as a whole. Similarly, with modular orchestration, users can entrust the design of a system to people who understand a lot about production or process engineering but do not have in-depth IT knowledge.

How are modules and module packages orchestrated in zenon?

Günther Haslauer: In the higher-level Process Orchestration Layer (zenon POL), MTP files are imported and converted into Smart Object Templates. These can be treated in zenon projects similarly to native objects. The zenon MTP Studio enables employees without in-depth software knowledge to generate a complete control system by orchestrating modular packages in the form of converted MTP files. This saves a lot of time and avoids the problems that can arise when different languages are used by different experts.

Find out in PART 2 of the interview with COPA-DATA CEO Thomas Punzenberger and head of development Günther Haslauer how zenon functions as a modular automation platform. We'll also discuss the technical developments that are further driving digitalization in the industrial sector and the extent to which Linux as an operating system is now supported by zenon. See the Products and Services chapter, starting on PAGE 27.

THE SMART FACTORY – AI IN INDUSTRIAL APPLICATIONS

The year is 2010. Barack Obama is president of the United States. Smartphones are conquering the world. The financial crisis seems to be over and there is a spirit of optimism in the global economy. At the same time, something fascinating is happening, unnoticed by the public, in the development departments of innovative IT companies. A decades-old technology is beginning its meteoric rise to become one of the most important topics of our time: artificial intelligence.

The concepts on which today's AI rests can be traced back to the 1950s – and they fascinated researchers even then. However, the idea of the „general problem solver" based on neural networks which emerged then could not be implemented at that time. This was still the case when the topic was met with renewed hype in the 1990s, when Deep Blue became the first computer to win against the then world chess champion Garry Kasparov. It wasn't until around 2010 when the first commercial turning points occurred that enabled practical applications of artificial intelligence. Essentially, three things had changed:

1. With Web 2.0 there was a socio-technical transition that led to the increased use of the Internet, as well as active sharing and creation of content by everyone. Only then was a large amount of commercially interesting data available.
2. Advances in algorithms, especially deep learning, have made AI applications more powerful and robust.
3. Multi-core CPU architectures made computing power cheaper.

In the subsequent years, AI became the focus of Big Tech. The five largest tech companies – Google, Facebook, Amazon, Apple, and Microsoft – are rapidly adapting the now highly profitable technology and building completely new services and business models on it. Their areas of application range from practical utilities, such as navigation in cars, weather forecasts on smartphones, intelligent assistants at home, to complex algorithms with the purpose of predicting and influencing human behavior. With these services, AI has now reached almost every area of our daily lives without us being consciously aware of it.

Today, in 2023, we are recovering from the first big bang created by AI. A few months ago, OpenAI presented its AI ChatGPT platform to the public. The underlying language model GPT-3.5 was trained on vast amounts of text data and not only has an enormous wealth of knowledge, but also real language understanding. Does this mean the original idea of the „general problem solver" from the 1950s is within reach? The performance of these models seems so high that the first prophets are already publishing lists of jobs that will no longer exist in five years. Even if this seems somewhat exaggerated, the economic and social consequences that this new technology will bring are certainly significant. However, they remain difficult to assess today.

WHAT ROLE DID AI PLAY IN THE EARLY DAYS OF THE 4TH INDUSTRIAL REVOLUTION?

"Industry 4.0" gained traction around the same time as the commercial awakening of AI. The term was created in 2011 as part of the high-tech strategy of the German federal government. It is now used as a synonym for „digitalization" across Europe. In addition to the relevant design principles (networking, information transparency, technical assistance, and decentralization), the original guide also contains references to the use of AI. I am able to report first-hand how industrial companies have dealt with AI in the process of digitalization, because I have been at the forefront.

I started my first job as a young engineer at COPA-DATA in 2010. Coming fresh and inspired from a challenging academic program, I was equipped with unassailable self-confidence and the will to single-handedly improve the world. At COPA-DATA, I quickly became known as „the innovative one" and, in addition to other topics, starting around 2013 I was mainly responsible for the area of AI.

With a dedicated team of sales specialists and data scientists, I visited interested companies in the areas of both mechanical engineering and production to talk about AI projects. Particularly in the first few years, these conversations were very similar. They challenged me as a mediator and interpreter between the following three parties:

1. The highly motivated department head/CEO who had read in their favorite business magazine that AI was the next big thing and could solve virtually all problems overnight.

2. The responsible automation engineer, who was fundamentally suspicious of the subject of AI. Suddenly, random data pushers would solve the challenges of his department with „magic".
3. The data scientist who, from the perspective of the CEO and the engineer, seemed to be a fascinating creature from another planet and who presented things in a strange language that sounded too good to be true.

This mediation was demanding and its success depended on how open the companies were to innovation.

These first years of digitalization with AI resulted in some highly interesting projects where we implemented application-specific AI models for different tasks, such as predictive maintenance, parameter optimization of machines, and the prediction of critical process values. Even if some of the resulting models are still in operation, very few of the projects were developed beyond the prototype stage.

The reason for this was usually not to be found in the applications themselves. The AI models generally met the technical expectations. However, there were reasons for the lack of commercial success:

1. **Costs:** To implement AI projects, you need specialists and these could not be found in the German-speaking job market at that time. Daily rates and, thus, project costs were correspondingly high.
2. **Lack of trust:** For most specialist departments, the topic of AI was foreign and highly complex. In automation technology, people were used to the fact that algorithms were based on physical formulas and were therefore comprehensible. This was not the case for AI models; they were more like heuristics. Many engineers were therefore suspicious of this approach to automation.
3. **Inappropriate data and processes:** „Garbage in, garbage out" is a well-known phrase from computer science that is particularly appropriate for AI. An AI model will only ever be as good as the data it is trained on. The availability of this data and the very agile nature of the projects posed a challenge for many companies. There was no awareness of the value of data and dealing with agile software projects was new.

Looking back on those years, it still seems that the time was not ripe for AI in industry. There was a necessary discovery phase when the supply and demand sides of AI technology in industry mutually developed domain know-how and technology until expectations converged.

DIGITALIZATION AS AN ENABLER FOR AI

Things began to change in the years that followed, starting around 2017. The biggest driving force behind this change was the ongoing digitalization process itself. It meant that (almost) all the walls that had previously held back AI projects from success were leveled.

The advances started with a shift to placing higher intrinsic value on data. Many companies tried out pilot projects in the field of digitalization and readily spoke about their findings at conferences and events. Regardless of whether the projects were about AI, cloud, IoT, edge computing, or digital twins, two insights were always on the „what we learned" PowerPoint slide:

1. Data is an important part of digitalization.
2. Our data collection is not good enough, neither quantitatively nor qualitatively.

To meet the new demand for high-quality data, a lot was invested in collection and storage. In particular, the cross-technology and cross-departmental use of data calls for consistent data models, in order to make the available information transparent.

The new value placed on data has not only helped AI projects through better availability, but also through a very human change: an awareness of digitalization arose across the different lines of business. People became eager to share their new high-quality data. Little was left of the original skepticism about „exotic" AI projects.

PROFESSIONAL AGILE SOFTWARE DEVELOPMENT

The digitalization mega-trend has made many companies more open and willing to innovate. Digital services and new products are considered in forward-looking projects. This fresh wind blowing through the project landscape has not only borne fruit in terms of content but has also helped to move the work of professionals away from IT-heavy software development and into OT departments. Agile development methods, high-level languages, and modern software architectures were introduced. This professionalization of software development has also favored the progress of AI. It became clear that AI projects ultimately work just like other software projects.

The awareness that these systems have to be developed by specialist staff, maintained over the long term, and created on the basis of defined requirements has cleared away the unrealistic expectations of the 2010s.

AI HAS ARRIVED IN THE INDUSTRIAL WORKDAY

The hype about the individual building blocks of digitalization has now subsided and has given way to more realistic expectations and a hands-on mentality when implementing these solutions. I myself earn a good part of my living with projects in this area and can say from my own experience that, today, AI is a tool that, if used selectively and with moderation, delivers fascinating results.

The requisite specialists are still rare, but constantly improving no-code/low-code analytic platforms continue to democratize the field.

WHAT DOES THE FUTURE HOLD?

So far, I've used the term AI in this article in the sense of small models trained to solve a specific problem with the relevant data from the industrial process.

The counter-concept to this is the large language models (LLMs) such as GPT-4, which have been attracting public attention in recent months. These models are massive not only because of their immense number of parameters, but also because they were sometimes created at enormous cost – the training costs for GPT-4 are assumed to be more than USD 100 million.

We've all heard about their amazing abilities by now and I'm sure we can all agree that this technology will have considerable impact on the world. This already applies in my day-to-day work: AI helps me write code, corrects my emails, and even suggested wording and images for this article. It creates a well-formulated, customer-ready summary from handwritten scribbled meeting notes and conjures a usable slideshow from a few keywords.

But to what extent will these AI models change industrial digitalization? Will it be possible to generate an HMI automatically in the future?

We've seen tremendous advances in the capabilities of the large language models in just the past few months. Larger context lengths, plugins, and the ability to precisely follow instructions are just a few of the innovations. It's only a matter of time before we in the industry use these capabilities for our applications. In fact, some of us have already started...

PHILIPP SCHMIDT
Industrial Digitalization Solution Architect and Developer

Philipp Schmidt has worked in the area of industrial digitalization for more than ten years and has helped to shape these innovative changes from the very beginning. As part of our Product Management team, he supported companies with implementing new technologies and developed the zenon software platform for the future. Today, he assists organizations as a freelancer in the creation and implementation of their digitalization strategies.

philipp.schmidt@ps-it-solutions.com

CYBER SECURITY RESEARCH FOR INDUSTRIAL AUTOMATION

Cyber security for industrial control systems has been largely neglected for many years. It received little attention from industry and research alike. The rise of elaborate cyber attacks and the associated financial impact has slowly turned the situation around. However, security methods established in information technology (IT) can often not be simply applied to industrial systems. Instead, adequate and dedicated methods for operational technology (OT) are required.

AUTHORS: STEFAN HUBER, THOMAS ROSENSTATTER, OLAF SASSNICK, JOSEF RESSEL CENTRE ISIA

COPA-DATA and the Salzburg University of Applied Sciences (SUAS) have cherished their strong partnership over the past two decades. A prominent result of this collaboration is the Josef Ressel Centre on Intelligent and Secure Industrial Automation (JRC ISIA). The 2.50M research center was launched in July 2022. COPA-DATA is one of three cooperative partners and industrial cyber security is one of three research fields.

CYBER SECURITY FOR INDUSTRY

Industrial systems have long been spared from cyber attacks, mainly due to their isolation from other networks, such as the Internet, and the proprietary nature of the computational systems. A key aspect of IoT and Industry 4.0, however, is the permeability of data, requiring devices and systems to be interconnected. Consequently, the number of connected IoT devices doubled from eight billion to 16.7 billion devices[1] within the last five years (from 2018 to 2023). This continuing trend makes cyber security a pressing issue, because the number of potential points malicious actors could use to attack the system (the attack surface) has vastly increased.

Cyber attacks vary depending on the attackers' motivation. The most common motives in 2022 were espionage and monetization[2]. The goal of espionage is to gain access

[1] State of IoT 2023: Number of connected IoT devices growing 16% to 16.7 billion globally. en-US. May 2023. url: https: //iot-analytics.com/number-connected-iot-devices/ (visited on 07/10/2023).

[2] ENISA threat landscape 2022: July 2021 to July 2022. eng. OCLC: 1370608603. Heraklion: ENISA, 2022. isbn: 9789292045883

to sensitive data (e.g., intellectual property) and to remain undetected by the victim. Monetization, on the other hand, is more visible to the victim as it may target the availability of infrastructure, causing harmful production downtime. Often, a ransom is demanded in exchange for the restoration of infrastructure availability or data. These attacks are known as ransomware attacks. Monetization through data theft to sell valuable information on the dark web can be another source of financial gain. A common ambition of the attacker is to launch a successful advanced persistent threat (APT), allowing the attacker to maintain undetected access to the system.

In 2022, the European Union Agency for Cyber Security (ENISA) reported[3] that the industrial sector was the prevalent target of ransomware attacks (27.8% of all 623 studied incidents). One reason might be that traditional information technology (IT) systems are better protected against attacks through the deployment of effective methods established over past decades of dealing with cyber security threats. Production systems often lack these security methods and are, therefore, more financially viable targets to the rational attacker. On top of that, general-purpose systems (e.g. Linux and common computer hardware) are increasingly adopted by the formerly isolated industrial field.

To summarize, cyber security challenges previously only known in the traditional IT world are now becoming relevant in production environments. Unfortunately, the solutions and methodologies designed for IT cannot be directly transferred to production environments. It requires new or adapted methods and tools. These two worlds are inherently different. While, in IT, the typical device is a managed desktop PC, in production environments it is operational technology (OT) - mainly machines that are part of the production line. Desktop PCs can be considered independent devices; updates can be installed with reboots at most times if necessary. In contrast, operational technology cannot be maintained this way; the whole production line would come to a halt. OT is more comparable to critical network infrastructure equipment in traditional IT environments, where an outage affects a larger number of connected devices and has significant business impact.

OT SECURITY IS HARD

The changing threat landscape requires us to improve OT security. We need to develop solutions that fit the nature of OT and are ready for the coming shift towards smart, flexible, and highly autonomous manufacturing. The US National Institute of Standards and Technology (NIST) is monitoring this evolution. It is working on a guidance for establishing secure OT systems in the form of NIST SP 800-82. This effort together with the ISA/IEC 62443 standardization underlines the fast-growing importance of OT security. In comparison to more traditional IT security practices, OT security is characterized by the constraints discussed below, which result in particular challenges.

Downtimes are costly. Production lines are complex systems that involve programmable logic controllers (PLCs), actuators, and sensors from different vendors interacting with each other. Performing immediate installations of security updates is not possible (or would involve high costs) because system shutdowns are not trivial and need to properly follow a predefined procedure. We need methods that include long-term planning of security updates (like deploying new certificates), without leaving the system vulnerable. We also need corresponding technical solutions that ensure the security of OT throughout entire equipment life cycles, including the commissioning and maintenance stages.

→ Updating security is hard.

Safety needs to be guaranteed. Once a security vulnerability is discovered, updated software should, ideally, be released promptly, to fix the vulnerability. However, given the need to act swiftly and the complexity of the update, the risk that the fix might introduce malfunctions increases. As industrial machinery manipulates the physical world, potentially hazardous situations can occur for the operating personnel. To minimize the risk, functional safety standards (like ISO 13849) are followed and require certification by an external authority. The certification process is not limited to the machinery itself; it also includes the control software. Substantial changes to the control software require a recertification, which consumes additional time and monetary resources. As a result, security cannot be fixed as quickly as in traditional IT environments.

→ Fixing security is hard.

Computational power is limited. Operational technologies encompass a wide range of hardware platforms, ranging from the X86-64 architecture down to custom microcontroller designs. A common requirement across these platforms is the need for hard real-time capabilities, ensuring adequate manufacturing process control. Therefore, implementing security algorithms in such systems can potentially cause performance issues. In the worst-case scenario, security mechanisms cannot be adequately provided via a software update, instead requiring a redesign of the entire hardware platform. However, even with sufficient computational resources being available, well-maintained cryptography libraries are not necessarily available for the platform in use, resulting in additional development and porting efforts being required. Given the nature of such endeavors, it often results in a lower-quality implementation, which is more likely to contain dangerous bugs.

→ Implementing security is hard.

[3]ENISA threat landscape for ransomware attacks. eng. OCLC: 1347439621. Heraklion: ENISA, 2022. isbn: 9789292045807

Production lines are purpose-built. Lines are unique, designed for the specific requirements of the produced goods. The industrial machinery installed on a production line is typically built by different specialist vendors, resulting in a diverse assembly of hardware and software components. For instance, a printed circuit board (PCB) assembly line consists of pick-and-place machines for placing electronic components, an oven to remove moisture, a solder paste printing machine, a reflow machine carrying out the actual soldering, and multiple PCB loaders for transfer purposes. The resulting industrial control systems (ICSs) are typically complex, incorporating different physical interfaces and protocols, sometimes also requiring additional adapters to enable the required interoperability. This extensive system heterogeneity makes it hard to build a universal solution for detecting malicious activities.
→ Detecting cyber attacks is hard.

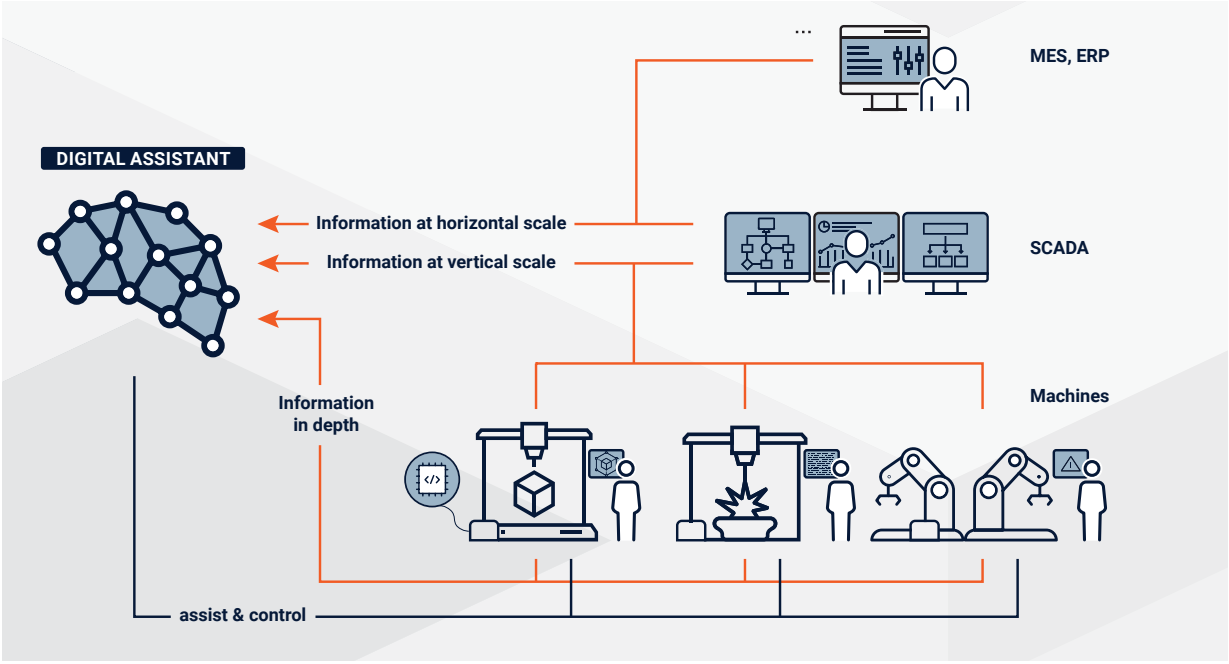
Cyber attacks need to be mitigated. In IT security, techniques have been developed that automatically mitigate cyber attacks. This includes, for example, preventing the execution of malicious code (malware detection) and protecting the network against denial-of-service attacks. Yet, in OT, there is currently no space for making autonomous decisions because this would affect the operation of the machines and functional safety. The ability to make these decisions autonomously to guard against cyber attacks must evolve together with future intelligent factories, in a kind of co-evolution.
→ Reacting to cyber attacks automatically is hard.

New methods and techniques are required. The Reference Architectural Model Industrie 4.0 (RAMI 4.0) model serves as an architecture reference for Industry 4.0 systems, including the product. Although the necessity of security is emphasized in the corresponding standard (DIN SPEC 91345), there are no recommendations for methods to secure OT architectures to address challenges such as the level of required security, how to implement a public key infrastructure (PKI), or how to handle certificate renewals.
→ Designing a secure OT architecture is hard.

RESEARCH AT JRC ISIA

Modern and future factories tend to be more adaptable, flexible, autonomous, and intelligent. This unleashes the potential for advanced optimization and analytics, enables lot-size-one production, lowers time to market, and allows for production in regions of high unit wage costs despite challenging demographic transformations.
However, the time-scales at which scientific results evolve into product development are long, so we need to develop the underlying methods and mechanisms for future factories early.
The JRC ISIA is working on the prerequisites for a more autonomous, intelligent factory in three research fields over five years: system architectures, artificial intelligence, and cyber security. More precisely, it is working on a digital assistant to industrial machines – such as injection molding machines or numerical control (NC) machines – that would perform tasks like anomaly detection or process parametrization to support human operators and to increase the level of autonomy.

For a research center like the JRC ISIA, it is important to select research topics wisely and to lever-



The digital assistant receives information from the entire automation pyramid to draw conclusion for anomaly detection and controlling machines.

age synergies between the fields. Below, we briefly describe two main cyber security topics the JRC ISIA addresses.

Testbed and security architecture. A major tactical advantage of the JRC ISIA is the interdisciplinary expertise of researchers – covering cyber security, machine learning, industrial automation, systems engineering, and control theory. We are currently finishing our work on a common testbed for all three research fields, featuring a hardware-in-the-loop (HiL) simulated production line employing robots and injection molding machines. A base technology for our research is the Open Platform Communications Unified Architecture (OPC UA). This not only gives us interoperability and semantically enriched information modeling, it also outlines requirements for an adequate security architecture.Nevertheless, current best practice still does not fully address the challenges of establishing an OT-aware PKI infrastructure and certificate management. A well-designed security architecture starts with threat modeling, like STRIDE. However, it doesn't account for the life cycles of entities. In OT, this is an important aspect and is actually an axis of the RAMI 4.0 reference model. Adequately combining cyber security methodology with model-based approaches from OT should result in well-suited methods for OT.

Intrusion detection and honey pots. In past decades, generations of intrusion detection systems essentially grew upwards in the Open Systems Interconnection (OSI) 7-layer model. We extrapolate this evolution in the form of behavioral intrusion detection. That is, we observe the behavioral patterns of industrial machines in order to detect anomalies that may be rooted in a security incident.

More precisely, we trace the state of industrial machines in a high-dimensional state space that is spanned by the OPC UA address spaces and which is modeled by semantic information models, like the European Plastics and Rubber Machinery (EUROMAP) companion specifications in the case of injection molding machines. These state space trajectories (in an adequate subspace) are cyclical in discrete automation due to (largely) repetitive behavior. This provides the foundation to train machine learning models to capture the subspace of benign trajectories and, in principle, enables anomaly detection.

One concrete machine learning model would be deep belief networks. They can also be employed as a generative model. That is, we can create artificial trajectories that behave realistically. These could then be used to fuel honey pots that provide operationally realistic behavior when observing its OPC UA address space.

PARTNERS IN RESEARCH

Research is an essential condition for the long-term success of a company in a high-tech industry. Our company partners benefit from our work and its transfer – whether through research results, alumni, or by the unfolding impact within and beyond the university.

The Josef Ressel Centre shall strive to undertake foundation-oriented applied research. The gap between methods originating from foundational research and industrial applications is often significant. In this regard, trusted long-term partnerships with company partners like COPA-DATA enable us to align our research topics to be of industrial relevance, yet at the same time to tackle research challenges of international competitiveness.

Through this commitment, COPA-DATA contributes to a vivid research ecosystem around industrial informatics in Salzburg.

STEFAN HUBER

Stefan Huber is the head of the JRC ISIA and the head of research in the department of information technologies and digitalization at the SUAS. He is a computer scientist and mathematician, for which he obtained a PhD in 2011. He was a Senior Scientist at the University of Salzburg, a PostDoc at IST Austria, and led a team and project in R&D at B&R Industrial Automation before joining SUAS in 2019.

THOMAS ROSENSTATTER

Thomas Rosenstatter is a researcher at the JRC ISIA focusing on cyber security and is a senior lecturer at the SUAS. He was a researcher at RISE Research Institutes of Sweden and received a PhD in Computer Science and Engineering at the Chalmers University of Technology in Sweden. His research focuses on designing secure and resilient cyber-physical systems.

OLAF SASSNICK

Olaf Saßnick is a researcher at the JRC ISIA focussing on cyber security and is a lecturer at the SUAS with a focus on sensors, automation, and embedded systems. He received his Master's degree in 2015 and worked as an embedded software engineer in industry until 2020, when he joined the SUAS.

PRODUCTS & SERVICES

ON THE ROAD TO THE SMART FACTORY WITH ZENON

View production figures, regardless of when or where? Always be informed about current activities or upcoming orders? Read how zenon and zenon IIoT Services enable meaningful analysis of data from widely distributed equipment and locations.

In the Smart Factory, machines are connected to each other to manufacture products and goods in perfect harmony with each other. The equipment provides detailed insights into the manufacturing process to enable companies to optimize and improve the efficiency of individual processes.

To offer this overview, monitoring using simple visualization plays an important role, allowing for quick intervention in the event of a problem. Therefore, an intuitive user interface is an absolute necessity. It should ideally be available on-the-go via smartphone or laptop. Corresponding security precautions and user management are essential.

To achieve this, first and foremost, extensive networking is required between the equipment in use. This not only affects new acquisitions but also, to a large extent, existing systems. With this retrofitting, in particular, it is necessary to use flexible and adaptable automation solutions that support a large number of communication protocols. This provides an ideal basis for connecting machines and synchronizing processes with each other.

THE SMART FACTORY AS A NETWORKED INTELLIGENT PRODUCTION FACILITY

Communication with higher-level software systems is just as important for a Smart Factory as the connectivity to the controllers and machines. MES systems that provide different order data are the first to be mentioned here. If you move further in the direction of IT, cross-plant mathematical models and machine learning components may also become necessary. These accompany the production steps and determine valuable key figures. By using them, the process can be optimized, for example, by fully automatically adapting machine parameters – such as cycle times, production quantities, or recipe parameters – to the current circumstances.

WHAT CAN ZENON ADD TO A SMART FACTORY?

If you set your sights initially on the goal of equipment networking, the strength of zenon's flexible connectivity quickly becomes clear, with its more than 300 supported communication drivers. They can be used both with established and distributed controllers as well as with more modern communication standards such as OPC UA. For data exchange with higher-level MES or other IT systems, zenon has integrations designed for this purpose, such as with Werum PAS-X MSI. Furthermore, it also enables tailored, programmable extensions.

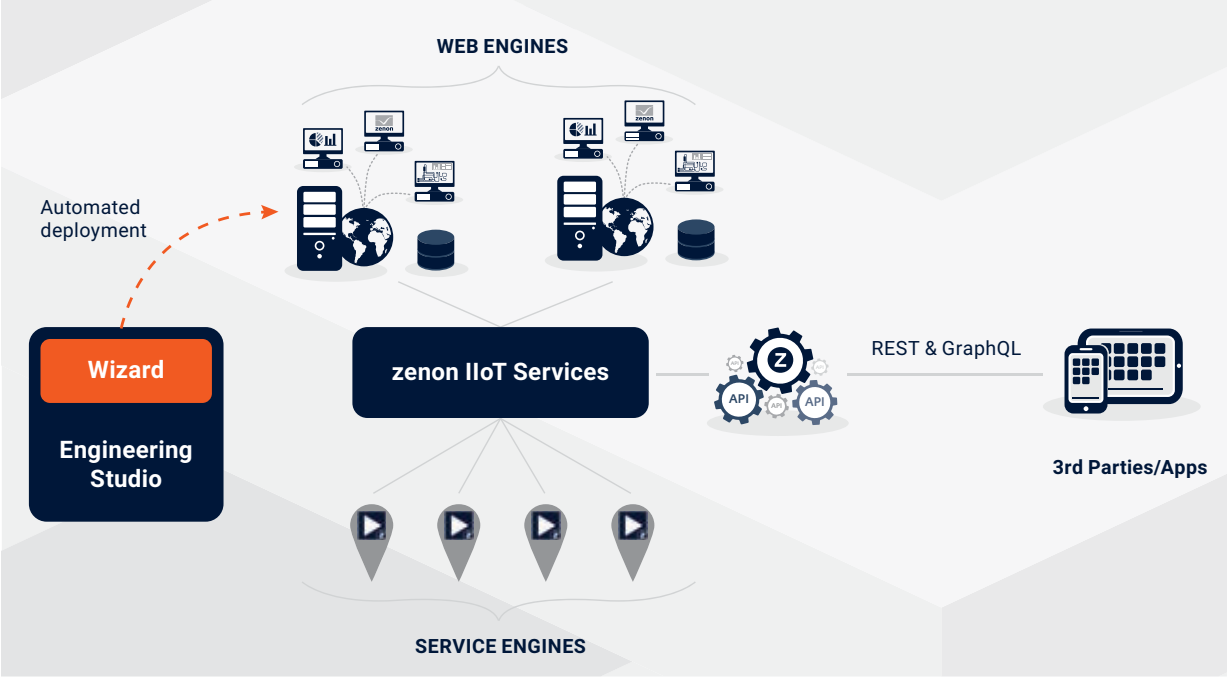
If data exchange with systems via a REST interface or GraphQL interface is required, zenon IIoT Services (formerly zenon Service Grid) can be used to serve as an integration layer for several zenon Service Engines. If necessary, this can also be performed across locations. Encrypted connections in only the outgoing direction ensure information security. In addition, the IIoT Services are an ideal integration point for cross-plant optimization algorithms, which can be used to fully automatically adjust selected production parameters, as needed.

Production and machine visualization has always been one of the central strengths of zenon. In this regard, the original local visualization continues to expand to remote monitoring solutions thanks to ongoing digitalization.

In this context, zenon Web Engine plays an important role, as it provides lean visualization with HTML5 technology. Originally, the accessibility of Web Engine installations was limited to local networks. This is adequate for local visualizations in the same production facility, but restricts remote access via the Internet.

With the introduction of zenon IIoT Services, the range of applications with HTML Web Engine has been expanded considerably. Since the data flow between Service Engine and Web Engine can now be realized via IIoT Services, it is possible to run a Web Engine in a central data center while the Service Engine remains in the secure production network. The outgoing-only network connections and the applied TLS encryption secure this scenario against unauthorized access and data manipulation.

In this scenario, Web Engine can provide lean equipment visualization and display the most important figures in a preconfigured dashboard. This gives users a "window" into production, which is provided securely via zenon IIoT Services. Restrictions to the absolutely essential data and read-only access are some of the recommended configuration principles.



zenon Web Engine, Engineering Studio and zenon IIoT Services enable the development of remote monitoring solutions and the integration with third-party applications.

CONFIGURE MORE EFFICIENTLY WITH SMART OBJECTS AND AUTOMATION

Visualizations using the HTML Web Engine are, therefore, ideal for use in monitoring. The reusability of configured visualizations also means that they can be implemented more efficiently.

If you also use Smart Objects in your solutions, you can use them to design reusable individual components that can be conveniently combined to form user-friendly dashboards. This enables time-saving project planning and supports the creation of a reusable component library. This is of benefit to both machine manufacturers and end customers.

One of the foundational principles of zenon is the automation of configuration tasks. This "automated engineering" can also be extended to IIoT Services and HTML Web Engine. With the appropriate programming knowledge and expertise in the field of containerization and cloud technologies, for example, the installation and configuration of Web Engine can be automated as a Linux container. For example, a customized wizard would be able to compile the zenon project for Web Engine and start a new Web Engine instance in the data center. This wizard could also take care of uploading the zenon project and connecting Web Engine to an existing installation of zenon IIoT Services.

In summary, it can be said that zenon offers valuable options for implementing a Smart Factory. With regard to connectivity with different systems, ideal conditions are in place. With the use of zenon IIoT Services and HTML Web Engine, secure web-based remote monitoring solutions can be implemented. This can be accessed externally, if necessary, and the visualization can also be tailored to mobile devices.

In addition, the installation and configuration steps can be automated, reducing the time needed to configure a web visualization.

Be inspired by the possibilities of zenon and use it to create your own Smart Factory!

MORE INFORMATION:

IIoT Services:
Seamlessly implement IIoT projects with zenon IIoT Services

Success Story:
Stadtwerke Feldkirch: Secure Power Supply via IIoT

MATTHIAS SCHNÖLL
Product Manager

Matthias Schnöll joined COPA-DATA in 2015. He has been part of the Product Management team since 2018. As a product owner, he works on developing the zenon software platform. His main focus is on zenon IIoT Services and all cloud-related issues. He considers bridging the gap between OT and IT as one of today's most important challenges.

matthias.schnoell@copadata.com

CLEMENS CONNECTED

THE SHIFTING VISION OF A SMART FACTORY

Today, our understanding of the "Smart Factory" is unequivocally linked with deep learning and AI. This is very different to our understanding of the concept fifteen years ago, when the first visions of the Smart Factory of the future emerged. What became of these early visions? And where are we today?

MARK CLEMENS
Connectivity Architect & Security Strategist

Mark Clemens has been part of the COPA-DATA HQ customer services team since 2002. In his role he is also a product owner for connectivity topics. As an expert for cybersecurity, he helps connecting IT, OT, and IIoT, while keeping security in check. As a frequent IU author, he shares his views on the buzzwords of our time.

markc@copadata.com

We lack a globally accepted definition of "Smart Factory". Further, what we label as "the factory of the future" today is likely to be different to the concept 10 years from now. And this shifting definition is but one complication.

The term also implies an end state which, once reached, provides no further room for improvement. Surely the Smart Factory built 10 years ago has become smarter since? Likely, it's seen improvements due to further investment and by making better use of available information. I, therefore, prefer the term "Smarter Factory", since it describes a factory that is smarter than its previous incarnation yet has the potential to become smarter still.

The goal of a Smarter Factory is achievable in small steps, with the chance to learn while doing. A Smarter Factory approach can also be applied to existing factories – whether there is already technology, automation, and data collection in place or not. While one can debate the argument, I think that making an existing factory smarter is much more easily achievable than building a new Smart(er) Factory from the ground up.

A SMARTER FACTORY DEMANDS A STRATEGY

For many industries, making production smarter is a no-brainer of a goal. Yet, in some industries, you might argue that production doesn't need to become smarter than it is today. I think that today's reality – an aging workforce, the changing climate, the need to drive sustainability while maintaining competitiveness – creates challenges and opportunities for every company.

BUT WHERE TO BEGIN?

It definitely makes sense to define a Smarter Factory strategy from which small achievable goals can be derived. This allows for an iterative, agile approach. Many topics can be worked on in parallel, rather than starting one big project for which the benefits may be hidden from the business for a long time. It is key to get people involved from different domains from the very beginning, especially when improvements could make some job roles superfluous. The involvement and outlook of different roles in an agile process provides future perspective and reduces the risk of efforts being sabotaged.

Let's take one example where there are quick wins to be had: a company thinking about net zero and how to move from fossil fuels to electrification. One challenge is the grid connection which cannot quickly be upgraded to the necessary capacity by the electricity provider. Not doing anything is not an option. Local generation, in combination with storage,

could be a viable option if you know what your energy consumption looks like and where peaks can be shaved. Such an effort fits into a Smarter Factory strategy and it starts with information that may not be readily available from everywhere.

> “With zenon as your edge computing engine, it’s easy to provide qualified, time-stamped, harmonized, aggregated, consistent, and context-related data.”

MAKE SMARTER USE OF EXISTING INFORMATION

Rather than installing energy meters at every piece of equipment, interrupting production processes, the energy consumption of a piece of equipment may, for example, be derived from an existing sensor that is used for some other purpose in its PLC program. Other equipment energy consumption may be measured once so that subsequent consumption can be extrapolated from the operating hours of the equipment as provided by daily manual recordings.

Experienced shop floor workers probably know the conditions when equipment is running but could be idle. When existing intelligence is used smartly a lot can be gained. Nevertheless, at some point, it will be necessary to implement automated data collection. Maintenance staff and system integrators with networking experience are perhaps best equipped to help define where the installation of new measuring devices would be most efficient and most easily achieved. IT can provide the necessary data repositories and backups while ensuring cyber security.

GET THE DATA STRUCTURED AND HARMONIZED

Warning: buzzword alert! While I have tried to avoid using buzzwords so far, it’s hard to do when writing about a topic that is often only a conglomeration of buzzwords. I would like to introduce a paradigm that some may consider a buzzword: edge computing. Data can be collected from many energy meters and other devices as fast as 100 milliseconds, generating large amounts of data.

While I can agree that data is the new gold, this idea does need to be put into perspective. It’s gold when you have the right kind of data to answer a pressing question. Of course, the price of gold fluctuates with the trends in the worldwide economy, interest rates, and the nervousness of investors. Similarly, the value of data also fluctuates.

Energy consumption data has less value when energy prices are low. It’s worth more during an energy crisis. And having huge amounts of consumption data without context related to other sensory and production information, may even prove to be as valuable as fool’s gold.

DERIVING REAL VALUE

Many energy meters provide their information through the Modbus protocol. It has no mechanism for conveying timestamp information or quality information.

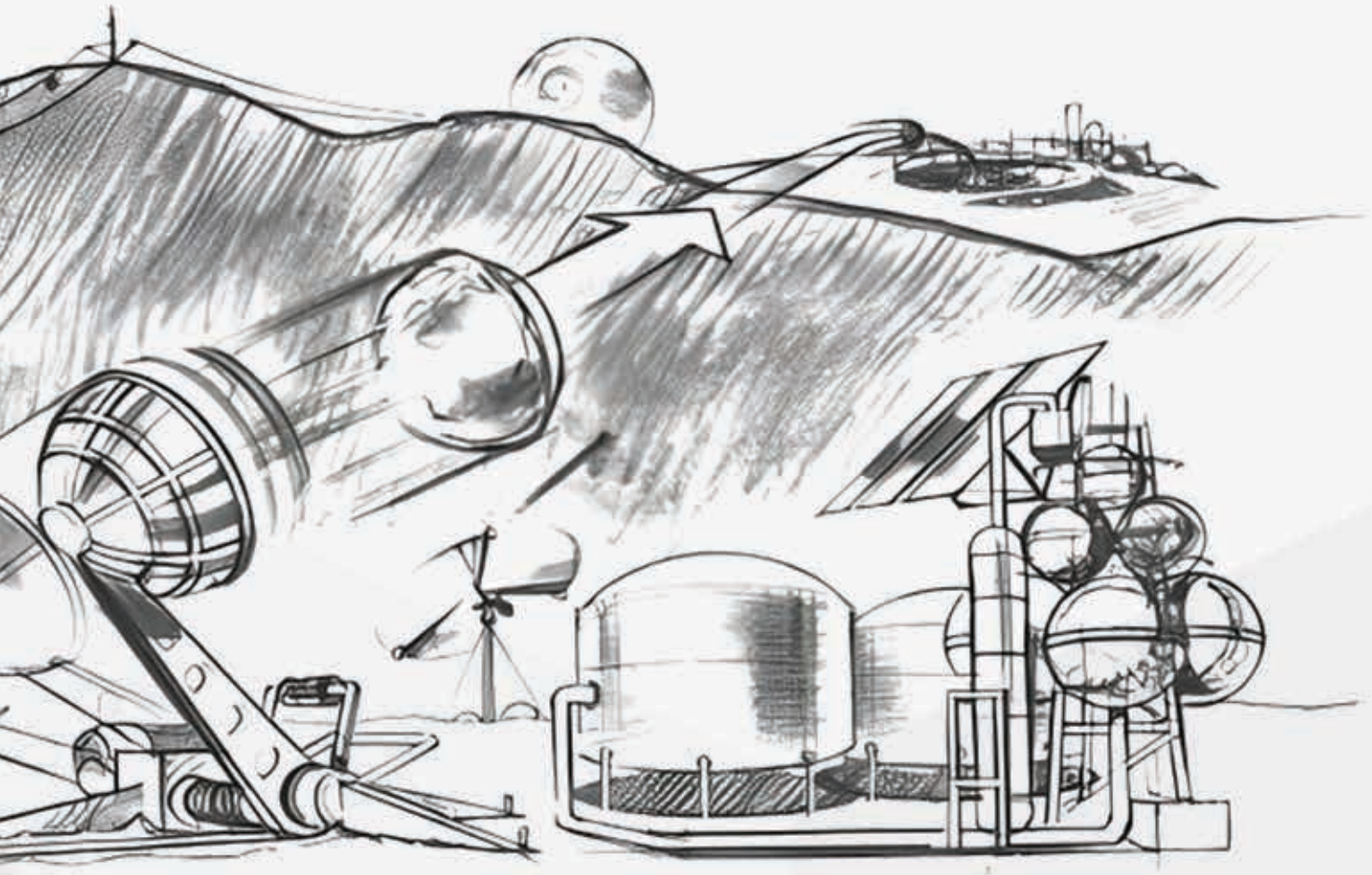
Challenges around data consistency must also be considered. When an energy meter needs to be replaced, a sudden change in the energy consumption reading can throw off downstream logic, algorithms, and reporting. While standards are emerging for unifying information over Modbus – such as Sunspec – not all meters support this. Other data used as virtual

energy consumption data needs some transformation and harmonization in order to be useful.

Ideally, data should be reduced to only what is needed downstream for visualization, reporting, and decision making. All these tasks can be performed or computed locally, close to production, i.e. at "the edge". With zenon as your edge computing engine, it's easy to provide qualified, time-stamped, harmonized, aggregated, consistent, and context-related data. With zenon version 12 available on Linux for selected communication protocols and functionality, it's even easier.

THE FUTURE'S SMARTER FACTORIES

A fully autonomous, self-optimizing, self-maintaining, self-healing, perpetual process factory may today be science fiction. But, in future, we will be needing factories that are smarter still... think of facilities operating on the ocean floor in the deep sea or on the moon to produce oxygen or hydrogen. These Smart Factories of the future will be an even bigger challenge!



Multiple approaches for the extraction of oxygen from regolith (lunar soil) exist. For industrial scale deployments, some method is needed to transport the upper few meters of regolith, containing sharp, glass like particles, to the processing plant. With minimal equipment wear and low maintenance requirements, one approach for transport is based on on ballistic conveying. Imagine a smarter factory like this!

Image: Schrunk, D. G.: The Moon: Resources, future development, and settlement. 2nd ed. Berlin, Chichester, UK: Springer; Published in association with Praxis Pub; 2008.
Höber, D., Taschner, A. & Fimbinger, E. Excavation and Conveying Technologies for Space Applications. Berg Huettenmaenn Monatsh 166, 95–103 (2021). https://doi.org/10.1007/s00501-020-01073-z

PROFESSIONAL SERVICES, TAKE CHARGE!

When system integrators roll out the zenon software platform in a business, they strive to implement customer-specific solutions in the best way possible. Three examples from different core industries illustrate how the COPA-DATA Professional Services team works with integrators and customers to leap over all hurdles.

Increasingly complex tasks require the support of specialists. For this reason, the Professional Services (PS) team consists of two sub-teams, each with its own focus. The PS Content & Templates team, led by Felix Punzenberger, specializes in optimizing graphical user interfaces and user experience. How this can be implemented was presented in the last IU issue using the example of Romaco.[1] The PS Development Team, led by Christian Bauer, mainly develops wizards to automate time-consuming manual work and thus make it more traceable and less prone to errors.

During the more than 10 years that the Professional Services team has existed, the team has consistently expanded. It currently comprises 15 people.

IIOT AND SMART FACTORY – TURNING AN IDEA INTO REALITY

Wizards created by the PS Development Team support the transformation from a manufacturing operation to an intelligent, self-directed production site or, in short, a Smart Factory. When IIoT is put into practice, many new possibilities open up. The reliable recording and evaluation of relevant data provides information about all of the processes taking place in the production facility. Inventories can be queried as easily as current consumption information for resources or figures for business calculations. Processes can be accessed both on site and remotely. In addition to DNP3 and OPC UA, zenon provides more than 300 drivers for connecting machines.

Before any solution is implemented, the starting point is always a business problem or a customer request. Examples from a variety of core industries provide a glimpse into projects that have already been implemented successfully.

[1] IU 40 2023, 34-36.

Instance Wizard

LIFE SCIENCES & PHARMACEUTICAL: GSK (FORMERLY GLAXOSMITHKLINE)

GSK has recently demonstrated Smart Factory benefits by implementing the zenon based solution in its fully automated production plant in Barnard Castle (UK). The system is used to integrate data from pharmaceutical manufacturing equipment to IT systems using a standard approach.

The Professional Services Development Team advanced the digitalization of the plant by developing and implementing the Template Wizard and Instance Wizard for the zenon software platform. Equipment of the same type can now be defined with real time, batch operations, and statistical data requirements as a standard and all requirements are configured via Excel files. The settings are saved in an Excel file that serves as the basis for a wizard to create standard Smart Object Templates for each equipment type.

From the Smart Object Templates, with the equipment type configurations, another wizard is used to create instances that link the specific equipment variables to the equipment type variables.

The advantages of the approach described are obvious: the file created for one equipment type is used as a configuration template with the desired specifications for all further equipment instances of this type. Thus, the equipment data is always imported into the target system in the same format.

Automation engineers and Integrators can now easily create further instances and adapt them to the respective projects with little effort driving data standardization and lowering integration effort and costs.

AUTOMOTIVE: VOLKSWAGEN (VW)

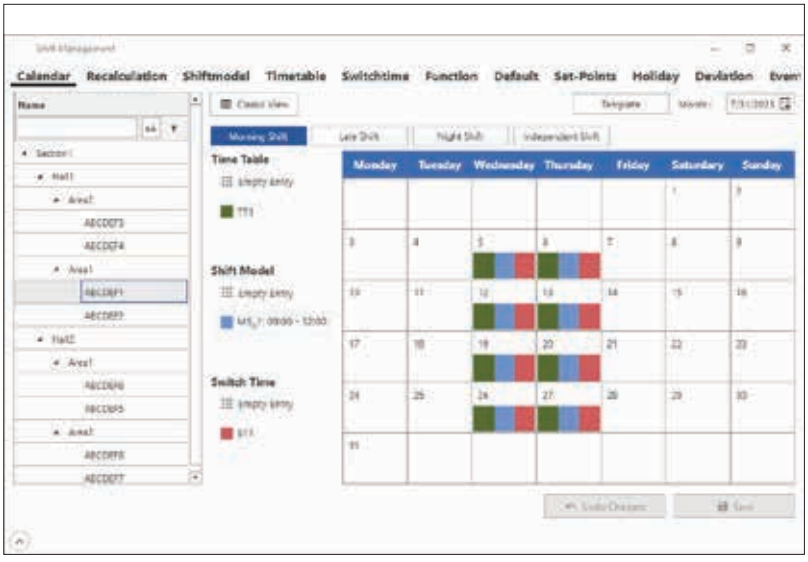
To support employees in their daily work and make the best possible use of the machines deployed, a method to link data from shift models, schedules, and switching times was sought.

Based on these requirements, a software solution was developed that comprises a wizard and a service application. The Service Engine wizard enables users to configure the shifts and all related settings, which are stored in a database. The Service Engine accesses the configurations in the database. The settings are imported into the zenon Service Engine. At the defined times, the service writes values to variables and runs functions.

The overall package uses models to connect data and machines with specific shifts and specific settings, creating the most efficient working conditions possible. In this way, machines can, for example, be brought automatically to operating temperature before the planned start of work or turned down before break times.

ENERGY & INFRASTRUCTURE: TRANSGRID

When digitalizing substations, Transgrid questioned how it could standardize and automate as many of the engineering work steps as possible. The work to manually create Substation HMI and SCADA Gateway projects is typically very time-consuming and error-prone. This was remedied by the development of a wizard that reads the project specific device and substation configuration from a set of template-based files to auto-generate a zenon project design. The wizard currently supports configurations for IEC 61850, DNP3 and

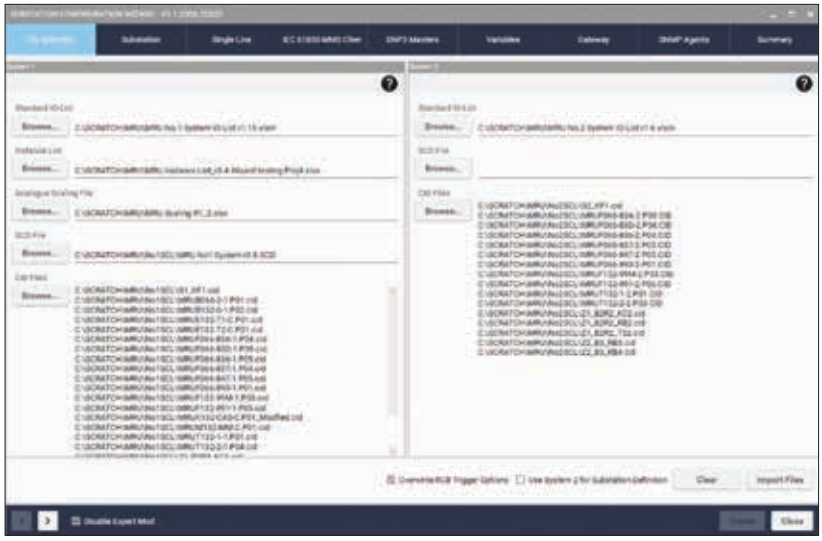


Shift Management Wizard

SNMP devices with the IEC 61850 System Configuration Files (SCL) being used to auto-configure the electrical single line diagram of the Substation HMI based on standard bay symbols defined in the zenon template project. The wizard reduces the time required to create project designs in zenon and testing the project, it also ensures smoother operation of the plant through standardization.

CONCLUSION

Individual tasks require customized software enhancements. The Professional Services team takes care of your concerns and finds solutions where others see problems. Expand the application scope of the zenon software platform with developments tailored precisely to your area of application, whet¬her for project design or customer specific Add-Ins. Benefit from the COPA-DATA team's wealth of experience in a variety of industries and save in-house developer resources.



Substation Configuration Wizard

> "We hired the software platform experts to develop the interface instead of trying to learn and develop everything ourselves."
>
> – Rustam Harzenko, Transgrid, Principal Automation Engineer

JOSEF RIES
Technical Editor

After completing electrical engineering training and working for several years in this area, Josef Ries turned to software documentation. As a technical editor, he has been involved in creating and expanding the online Help for the zenon software platform at COPA-DATA since 2016.

josef.ries@copadata.com

ZENON AS A MODULAR AUTOMATION PLATFORM

In the second part of the interview with COPA-DATA founder and CEO Thomas Punzenberger and Vice President Software Engineering Günther Haslauer, the thought leaders provide insights into the future of equipment configuration with zenon. The latest zenon version – zenon 12 – represents an important milestone in the continued development of our software platform.

INTERVIEW: PETER KEMPTNER, FREELANCE TECHNOLOGY EDITOR IN SALZBURG

The combination of modular production and Module Type Package (MTP) offers a promising solution that is revolutionizing manufacturing workflows in the process industry. Other sectors share the demand for flexibility and fast time to market. Does MTP also make sense as an approach in these cases?

MTP comes from the process industry. How can other industries benefit from MTP and a modular automation platform?

Thomas Punzenberger: MTP can help users address the urgent shortage of skilled workers everywhere by enabling flexible and modular automation in heterogeneous production landscapes. Of course, the individualization provided by these modules does not go quite as far as custom programming. However, the effort is significantly reduced not only for creation, but also particularly for testing, software maintenance, and subsequent adjustments. That's why we will make the MTP concept available to other industries, as we did, for example, with recipe management. Originally created for chemical and pharmaceutical production, recipe management is now also proving its worth in energy generation and discrete manufacturing. Something similar to the MTP concept has been around in the energy industry for 15 years, i.e. IEC 61850. This includes functional descriptions for individual devices as well as entire device groups and it is reproduced fully in zenon in the form of libraries.

How can devices without existing MTP files be integrated into zenon?

Günther Haslauer: Because there are still many devices without suitable MTP files, we created an MTP gateway to integrate them. This option and a library of ready-made components for the process area allow zenon to be used as a distributed control system (DCS).

Thomas Punzenberger: Speaking of DCS, the intelligence in machines and equipment is becoming more widely distributed and fragmented.

It doesn't always make sense to equip machine or equipment modules with their own PLC. With the IEC 61131-3-compliant SoftPLC zenon Logic, which comes as standard in zenon, the functionality required can be mapped directly. This creates a DCS based on fully configured, pre-validated MTP files. It was a short step from there to our idea to build a modular automation platform.

What other developments at zenon contribute to the creation of the modular automation platform aside from MTP?

Günther Haslauer: Another recent development is the ability to run zenon with an HTML5-based front end. In order to make this resource-efficient, we decided on a rich client solution. Relatively extensive JavaScript code runs on the browser, which renders the UI completely. This keeps the amount of data being transferred low, because only delta information travels in the form of raw data attributes. This makes users relatively independent of the type of line used for data communication.

How extensively has HTML5 technology already been implemented in zenon?

Thomas Punzenberger: The HTML5 implementation has not yet been fully completed. We'll continue to work on this for some time to come. Most projects can already be implemented in zenon 12. New additions include, for example, the Recipe Group Manager, commands, additional image elements, and filters.

Günther Haslauer: Video images, Worldview and some other functions are still missing. In addition, there are some things that cannot be converted 1:1 to HTML, such as Windows Presentation Foundation (WPF) or Active-X files. One such example is the current Report Viewer image. For such things, equivalent replacement solutions must be created using other technologies, such as backend code in dot.net Core and frontend code in Javascript. This already works in theory but needs to be implemented.

Why is switching to HTML5 technology important for operators of equipment?

Thomas Punzenberger: Systems built using zenon are usually very durable; they often remain in the field for 15 to 20 years. During this time, a lot can change. Customers need to be able to incorporate these changes into existing projects without having to replace large parts of them. HTML5 technology ensures greater independence from hardware and IT structures and often enables a reduction in the number of computers required.

A lot can also happen to the operating systems over the long period that a zenon implementation is in use. The application must have the necessary resilience to enable users to benefit from operating system updates without fear of losses due to new incompatibility. In addition, our customers need the option to virtualize their computers.

Why is computer virtualization important?

Thomas Punzenberger: In the first step, virtualization means moving many tasks to a server room with virtual machines; these are easier to maintain professionally than hardware directly in the production facilities. This virtualization has been possible

> "As a modular software that can be adapted to individual, changing needs, zenon gives users a great deal of freedom when it comes to making decisions about technology."
>
> – Günther Haslauer, Vice President Software Engineering at COPA-DATA

with zenon for some time now using Docker containers. However, until a few years ago, zenon was available only for Windows, so a Windows server was required. However, many companies use Linux servers with Linux Docker containers. These require native Linux applications. That's why we've been porting everything to Linux for the past five years. With zenon 12, a Linux implementation is now available for the first time.

What hurdles did you have to overcome when porting zenon to Linux?

Günther Haslauer: For easy maintainability, you need to have one standard source code. To do this, we had to replace all operating system-dependent code with an abstraction layer and recreate some Windows functions for Linux. This is also ideal for the customer because they can rely on consistent behavior regard-

> “The company’s philosophy behind zenon has been guided for almost 40 years by the motto ‘There is always an easier way.’”
>
> – Thomas Punzenberger, Founder and CEO of COPA-DATA

less of the operating system.

How far does this independence extend and how great are the possibilities for virtualizing zenon projects?

Thomas Punzenberger: Virtualization can, of course, also mean outsourcing to the cloud. We are in the process of creating the scope for this. It must become irrelevant whether it is a private or a public cloud. Due to the costs for cloud services and telecommunications, I don’t believe that public clouds will play a particularly big role in this, but the option will exist in zenon.

Günther Haslauer: At some point there may also be a PLC as a service. The SoftPLC zenon Logic, which comes standard in zenon, will play a role here. In fact, it has already played a role, out of necessity, when supply chains interrupted during the pandemic made hardware unavailable.

This brings us to the outlook. What can the readers of IU look forward to and what can they count on?

Thomas Punzenberger: The company’s philosophy behind zenon has been guided for almost 40 years by the motto “There is always an easier way.” We take functionalities from application areas in specific industries and make them accessible to other industries, provided they also deliver benefits in the new industry. One of zenon’s strengths is its modularity, or the low-code/no-code approach that enables standardized configuration. This avoids special solutions. The modularity is expanded through Smart Objects and the MTP files and similar constructs derived from them. And there’s more to come. We will continue to make good solutions from one industry available to other industries.

Günther Haslauer: A Modular software that can be adapted to individual, changing needs gives users a great deal of freedom when it comes to making decisions about technology. It also ensures that users are less dependent on technology trends affecting hardware and operating systems.

What about cyber security?

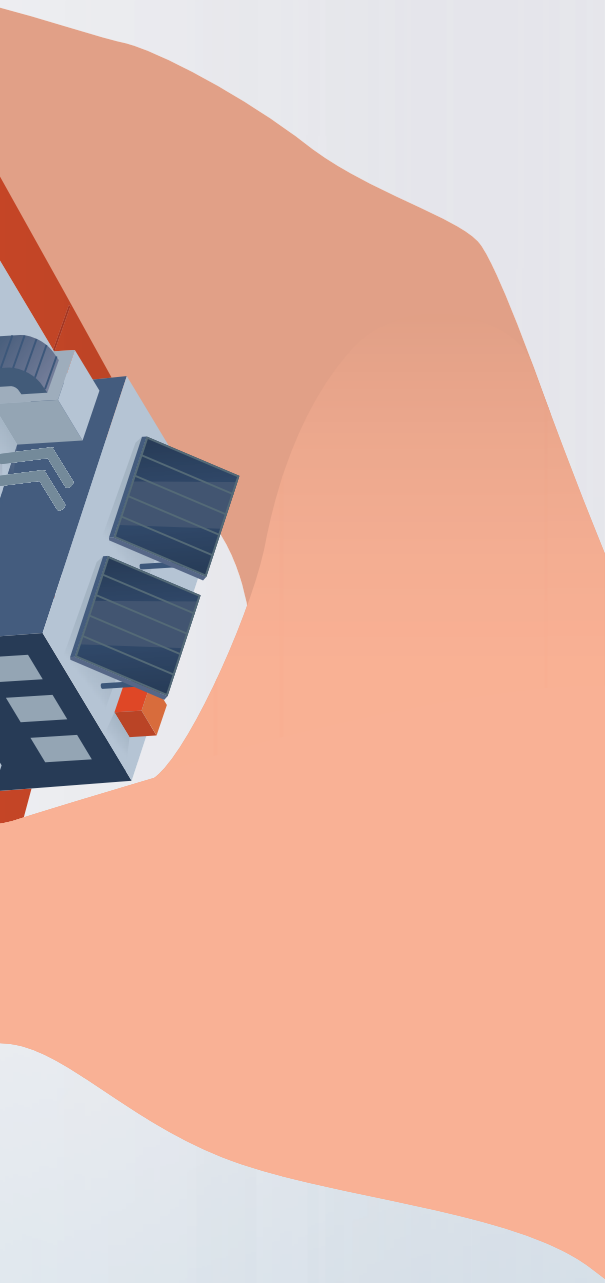
Günther Haslauer: The virtualization options doesn’t only make it easier for our customers to port the software and adapt it to their changing needs. A virtualized system in which the visualization runs in an HTML5 environment, for example, is also easier to defend against cyber-attacks. Users and implementation partners in the COPA-DATA partner network provide this protection. We deliver a system architecture tailored for resilience with the relevant mechanisms and support.

Does artificial intelligence also play a role at COPA-DATA?

Günther Haslauer: We are currently looking at ways to use artificial intelligence (AI) to relieve engineering teams of repetitive, less rewarding work. This includes, for example, contextualized preparation of the search feature in the online help, but also the creation of test plans.

Thomas Punzenberger: Our AI-supported Engineering Assistant is currently available for testing by zenon heavy users as part of a trial period, which means we also plan to use machine learning to directly improve the quality of search results.

Thank you very much for these insights and perspectives about the future.



INDUSTRIES & SOLUTIONS

> “Unlike 20 years ago, the digital transformation is now mostly people and process transformation.”

– Charles Tisdell,
Global Director Connected Brewery IIoT & Automation at AB Inbev

STEERING INTO DIGITALIZATION

Charles Tisdell plays a critical leadership role in the digitalization agendas of AB InBev, the world's largest brewing company, as global director of connected brewery IIoT and automation. No one knows better about the global and local challenges facing the brewing industry. In an exclusive interview, Emilian Axinia of COPA-DATA talked with Charles to explore his many years of experience of digital transformation strategies, technologies, and opportunities.

INTERVIEW: EMILIAN AXINIA, DIRECTOR INDUSTRY MANAGEMENT FOOD & BEVERAGE

Emilian Axinia: Hi Charles, when we first met, you were leading a dynamic „digitalization train" at AB InBev. What do you remember about the early days?

Charles Tisdell: First, thanks for the opportunity to share my many years of experience leading digital transformation. Let's start with a quick definition to set the stage; a definition that I am 100 percent aligned with.

Digital transformation is the integration of digital technology with various aspects of an organization's operations, resulting in fundamental changes to how it operates and delivers value to its customers. Based on this definition, my journey started some 20+ years ago when I was part of delivering the first TCP/IP networks, PLCs, VFDs, HMIs, and WIFI in our facilitates across North America to transform our business. Back then, this was truly transformational.

Inspiring memories! Tell us more about the impact this had on the company's business.

Tisdell: Those transformations helped make Anheuser-Busch the world's biggest brewer with over 68 percent market share in North America. Over the last 10 to 15 years, our focus has turned to technologies such as cloud computing, big data, AI, and the IoT. The goals remain the same: to optimize business processes, improve efficiency, enhance customer experiences, and drive innovation. Then, as now, my favorite aspect of transformation is working closely with plant management, technicians, and operators to solve a specific problem. I love to give people the opportunity to fully participate in the transformation journey as opposed to taking a top-down approach.

What was the key motivation to drive digitalization?

Tisdell: The key motivation or expectation over the years continues to be increased operational efficiency to drive productivity across the supply chain. To deliver on this, front-line workers must be empowered with tools that provide data-driven insights to make decisions in real time, tools to improve collaborative teamwork and to break down silos, and to enable seamless communication across departments, teams, and stakeholders.

Some may imagine digitalization in a global company as not being easy to move or steer. How would you suggest coping with this mission?

Tisdell: Unlike 20 years ago, digital transformation is now mostly about people and process transformation. Machines, servers, and networks today are very efficient and are more of a commodity. Using digital technology to drive people and process changes creates several challenges and hurdles that must be removed. Successfully addressing these hurdles requires a holistic approach that involves strong leadership, collaboration across departments and between OT and IT, effective change management, investment in talent and skills, and a long-term commitment to the transformation journey.

What are the hurdles?

Tisdell: Quickly listed, I would mention the following hurdles that must be dealt with to get the tanker turning: the resistance to change, legacy systems and infrastructure, a lack of digital skills and talent, data privacy and security concerns, siloed departments and a lack of collaboration, as well as scalability and infrastructure challenges, return on investment, uncertainty, regulatory and compliance factors, and managing cultural and organizational change.

Can you give us an example?

Tisdell: Given that most global companies like ours grow through acquisitions, a common example of a hurdle would be legacy systems and infrastructure. This adds to the complexity of delivering digital transformation at scale.

Legacy systems may require upgrades or replacements to enable a smooth digital transformation which can be very expensive to mitigate. This is where partnering with a company like COPA-DATA can help you build that IIoT and data layer while maintaining or migrating away from legacy infrastructure. It enables the use of other niche systems to deliver targeted solutions like predictive maintenance and advance process controls.

CHARLES TIDSELL'S TEN-STEP ADVICE FOR COMPANIES (RE)STARTING THEIR DIGITAL TRANSFORMATION JOURNEY

1. DEFINE CLEAR OBJECTIVES: Start by defining clear objectives and goals for your digital transformation journey. Identify the specific business challenges you aim to address, the outcomes you want to achieve, and the areas of your organization that can benefit most from digitalization. This will provide a roadmap and guide your decision-making process.

2. DEVELOP A STRATEGY AND ROADMAP: Create a comprehensive digital transformation strategy and roadmap that outlines the steps, timelines, and milestones for your journey. This roadmap should align with your business objectives and consider factors such as budget, resources, technology infrastructure, and organizational readiness. It will serve as a guide and help you to stay focused throughout the process.

3. FOSTER A DIGITAL CULTURE: Digital transformation goes beyond technology; it requires a shift in mindset and culture. Foster a digital culture by encouraging innovation, collaboration, and a willingness to embrace change. Empower your employees to explore new ideas. Provide training to enhance digital skills. Create an environment that supports experimentation and continuous learning.

4. ENGAGE LEADERSHIP AND STAKEHOLDERS: Gain support from top leadership and ensure their active involvement in driving the transformation initiative. Establish a governance structure and engage key stakeholders across departments to foster collaboration and alignment. Encourage open communication and address any concerns early on to build consensus and drive adoption.

5. START SMALL AND ITERATE: Begin your digital transformation journey by starting small and focusing on quick wins. Identify pilot projects or use cases that demonstrate the value and feasibility of digital technologies within your organization. Learn from these initial experiences, iterate, and scale up gradually. This approach helps manage risk, builds confidence, and allows you to refine your strategy based on real-world insights.

6. PRIORITIZE USER EXPERIENCE: Keep the end users in mind throughout the transformation process. Focus on delivering a superior user experience, whether it's for employees, customers, or partners. Understand their needs and pains. Design digital solutions that are intuitive, user-friendly, and add value. Regularly seek feedback based on user input to ensure continuous improvement.

7. EMBRACE DATA-DRIVEN DECISION MAKING: Leverage data and analytics to drive decision making across your organization. Invest in data collection, storage, and analysis capabilities to gain valuable insights into customer behavior, operational efficiency, and market trends. Use them to inform strategic decisions, optimize processes, and identify opportunities for innovation and growth.

8. BUILD PARTNERSHIPS: Consider partnering with technology vendors, consultants, or industry experts who can provide guidance, expertise, and support along your digital transformation journey. Collaborating with external partners can help accelerate your transformation efforts, provide access to specialized knowledge, and stay up to date with the latest trends and best practices.

9. DON'T OVERLOOK CYBERSECURITY: As you embark on digital transformation, prioritize cybersecurity from the outset. Implement robust security measures, conduct regular assessments, and ensure compliance with relevant regulations. Protecting your data, systems, and customer information is critical in the digital age.

10. MONITOR AND MEASURE PROGRESS: Continuously monitor and measure the progress of your digital transformation initiatives. Establish key performance indicators (KPIs) aligned with your objectives and regularly evaluate progress. Regularly assess the impact of implemented changes, solicit feedback, and make adjustments as needed to stay on track. Finally, remember, digital transformation is a journey. It requires commitment, adaptability, and a long-term perspective. Stay agile, learn from both successes and failures, and be prepared to adjust your course as you progress. Let people, performance, and process improvement expectations drive the technology.

You have succeeded in aligning the journey of so many different participants. How?

Tisdell: Balancing global and local initiatives is an important consideration when delivering digital transformation, especially for organizations with a global presence or multiple business units operating in different regions. There are various strategic approaches you need to achieve and maintain balance.

Can you highlight key ones?

Tisdell: Firstly, make sure the overall organizational goal is adopted with highest priority. This means that you implement governance processes which balance global standards with regional needs and market dynamics. Secondly, encourage local ownership and empowerment. We can leverage local expertise when the stakeholders participate with a sense of ownership aligned with the broader global transformation strategy. Thirdly, foster collaboration and knowledge sharing among different regions and business units. Promote the cross-pollination of ideas and ensure that successful practices are replicated globally where applicable.

How did digitalization influence the way you implement projects today?

Tisdell: Overall, digital transformation changed how traditional manufacturing projects, like a new packaging line, are implemented. I will highlight a very important influence; probably the most important. Projects now need to be imple-

Creating a future with more cheers: Charles Tisdell (2nd from left) and Jedediah Brady, Bernhard Ebert, Ferat Bulakli from COPA-DATA's key account management team (from left).

mented with a "data first" mindset: what information is required to ensure data-driven decision making by frontline employees? This requires network connectivity across assets and a solid IIoT and data strategy. Partnering with a company like COPA-DATA enables this data-first mindset across the organization and is key when building a digital transformation strategy. The wide adoption of analytics in manufacturing makes OT/IT collaboration and OT cyber security additional concerns – something all digital transformation projects need to consider.

We would like to learn a bit more from your great experience, Charles. What are the major decisions when shaping your goals?

Tisdell: In my experience, there are several significant decisions that can shape the direction and success of a digital transformation strategy. Let me enumerate five of my favorites:

One, choose the right technologies in an objective way, based on clear factors, such as scalability, security, and compatibility.

Two, define your data management and analytics concepts – including the need for real-time or predictive analytics.

Three, shape your cloud adoption strategy grounded on benefits and risks assessments.

Four, select your vendors and partners so they support your transformation initiatives.

Five, select projects in terms of both tangible and intangible benefits, risk mitigation, and strategic focus. These decisions are critical and require careful consideration, collaboration with stakeholders, and alignment with all other strategic aspects.

When considering the status quo of the installed technologies landscape versus new technologies, how do you decide where to invest?

Tisdell: This is very simple; you don't want to invest in the status quo – only maintain it. Instead, you need to integrate the status quo of installed technology with new technologies. This is mostly achieved through data or IIoT connectivity. Again, this is where a company like COPA-DATA is very strong in enabling both data and IIoT connectivity so that you can blend your existing technology landscape so that it works in harmony with new tech.

Always think about scalability and future-proofing. This will ensure that your new technology investments remain relevant and effective in the long run.

In the context of our collaboration, how would you characterize this journey together?

Tisdell: Our partnership with COPA-DATA started several years ago and continues to be the anchor of our data-first mindset. zenon's strength is connectivity and integration. This enables data exchange and interoperability between different components of our legacy infrastructure and our new technologies. It allows us to deliver new capabilities while extending the life of our existing technology base.

How do you leverage zenon?

Tisdell: We have used zenon to build an extract, transform and load (ETL) data integration layer that allows seamless integration with

> When dealing with technology hypes it's important to prioritize and align them with the real pragmatic needs of your organization.
>
> – Charles Tisdell

various systems, equipment, and devices to extract and transform plant floor data. COPA-DATA's zenon software platform also prioritizes security and compliance with industry standards which fits nicely with our OT cyber security strategy. COPA-DATA continues to innovate and invest in the zenon software platform.

Today, the platform is cloud-ready which ties into our "cloud-first" product development and technology selection strategy. We are also looking at zenon to help with solving the problem of HMI/SCADA obsolescence and to build an energy consumption monitoring system.

Tell us a bit about the benefits of digitalization that your company already enjoys.

Tisdell: AB InBev, like many global companies, does not use a "one size fits all" approach. Therefore, deploying digital technologies yields different results in different regions or even different sites within the same region. Over the years we have seen some very tangible benefits. The biggest one is improvement in operational efficiency, delivered by capabilities such as predictive maintenance, line balance optimization, and advanced process controls.

It is all about leveraging plant floor data to transform our business by reducing manual effort, minimizing error, and optimizing resource allocation. We have also deployed digital technology linked to spare parts optimization across multiple regions and that is driving a core working capital reduction.

The "digitalization train" is not stopping. What is the driving force?

Tisdell: Not at all. The train continues to move along. But it must follow a process and have some clarity about what the destination will be in 5-10 years. The driving force remains improving the end-to-end supply chain innovation by delivering digital technologies/strategies that will improve operational efficiencies across the supply chain. The key to maintaining this focus is to determine the areas within your supply chain where the transformation will have the most significant impact and drive the most value.

Is it challenging to deal with technology hypes?

Tisdell: When dealing with technology hypes, it's important to prioritize and align any technology with the real, pragmatic needs of your organization. At AB InBev, it's not technology first; it's process and people transformation enabled by technology. This means we determine the key areas within our organization where digital transformation will have the most significant impact. If we focus on those areas that align with our strategic objectives, new technologies can drive the most value. Through our governance processes, we determine the right technology to deploy. We also maintain a results-driven mindset focusing on achieving tangible results and outcomes rather than chasing particular technologies.

Looking to AB InBev's business and digital transformation, what will be the next big leaps?

Tisdell: A big leap will be leveraging cloud-based technology such as Artificial Intelligence (AI), Machine Learning (ML), and generative AI, such as ChatGPT, to improve performance and optimize our end-to-end supply chain.

What advice would you offer our readers who feel like they are just beginning their digitalization journeys?

Tisdell: Based on my experience, I would suggest ten key steps which I am happy to share with companies that are just (re)starting their digital transformation journey. In a nutshell, you need all the ingredients to help you to set the right direction, to mobilize people's transformational power, and, not least, to avoid security risks. It is all about driving change towards the future with purpose, fulfillment, and enthusiasm.

CHARLES TISDELL
Global Director Connected Brewery IIoT & Automation at AB InBev

Charles Tisdell is one of the leading forces responsible for the global digitization strategy of AB InBev. This includes building a digital supply chain through standardized controls and automation complemented with IIoT data and analytics secured by OT Cyber Security. The computer science graduate has worked for the global company for more than 30 years.

www.ab-inbev.com

Figure 3: P&ID of the ÄKTA ready™ 450 Chromatography System in the zenon POL.

INTEGRATION OF LEGACY EQUIPMENT WITH ZENON AND MTP

Module Type Package (MTP) is a concept to modularize today's automation systems. It contains a manufacturer-neutral, functional description of the automation of process modules for integration into orchestration systems, such as conventional process control systems. As not every existing asset is ready for MTP yet, it requires a simple solution for end users and equipment suppliers to upgrade existing equipment to support the MTP standard.

MODULE TYPE PACKAGE (MTP)

An increase in the flexibility of production plants is one of the answers to rapidly changing market requirements in the chemical and pharmaceutical sectors. In order to achieve the flexibility required for this, the modularization of today's production systems on a procedural, mechanical, and automation level is absolutely necessary.

To address this challenge, PNO (PROFIBUS users organization), together with NAMUR (an international association of user companies in the process industry for automation technology) and the German association ZVEI, are supporting just such a plug-and-play approach by defining the Module Type Package (MTP) concept (VDI/VDE/NAMUR 2658).1. This model allows for more flexibility by enabling the quick assembly and disassembly of systems from different vendors in an architecture.

The basic requirement for consistent modularization in production is a uniform description of the information about the individual modules. Which data objects are present? Which services are to be executed? According to MTP terminology, a module like a bioreactor or a filter skid is known as a Process

Equipment Assembly (PEA).

Each PEA presents its properties, such as the services it can offer (for example, a reactor will offer a filling or stirring service), configuration parameters, alarms, and the HMI pages for monitoring. All of this information is described in an XML file with a format defined by MTP.

All PEAs provide information in a standardized format no matter what control system they use. This facilitates integration with a superordinate Process Orchestration Layer (POL), as you can see in figure 2. By importing the various modules and interconnecting them via process orchestration, the POL layer is now able to represent and monitor all modules and create batch recipes according to the ISA 88 standard using the services offered by the various modules or PEAs. Once production has finished, it is possible to rearrange the modules to produce another batch through a different sequence. OPC UA, a widely accepted standard, was chosen for the communication layer between the PEA and POL levels.

HOW ZENON SUPPORTS EQUIPMENT SUPPLIERS

How can a manufacturer provide an MTP-ready process equipment assembly? First, with each machine, the manufacturer must deliver a file (MTP file) describing its functionality and features using the semantics defined by MTP. Also, the PLC program itself has to follow the MTP standard by providing an implementation of a state model for each involved service. All signals then must be exposed to an OPC UA server which provides the interface to a POL.

For this purpose, zenon provides the MTP Editor tool to produce an MTP file according to the specification. zenon Logic provides an integrated soft-PLC engine according to IEC 61131 including an OPC UA Server. Together with provided function blocks for the MTP logic, you can use zenon to build your process module in line with MTP and get existing process modules (e.g. package units, skids, etc.) ready for MTP.

HOW CAN YOU INTEGRATE EXISTING EQUIPMENT VIA MTP GATEWAY?

There might be skids in use which work well but unfortunately are not ready for MTP. How can these modules be integrated? Using the zenon MTP Gateway module, it is possible to integrate modules with legacy automation systems, providing them with OPC UA connectivity, the MTP logic, and a corresponding MTP file describing their characteristics. As zenon is an open system and provides more than 300 native connectors for PLC or fieldbus devices, the legacy protocols are easily connected and mapped to comply to the OPC UA structure defined in the MTP standard.

With zenon, existing assets are given a new lease of life and can be upgraded to the MTP standard, as per figure 1.

To summarize, the required components are:

- MTP Manifest: a file describing the module capabilities, like the services it can offer and the HMI layout.
- A software application called "MTP Gateway" capable of speaking with the legacy control system on one side and exposing the information in an MTP-compliant way on the other side. This application can run on any device having a Linux or Windows operating system (e.g. embedded device, PC, virtual machine, ...)

Therefore, the MTP Gateway is composed of these parts:

- Connection to legacy controllers like PLCs, IOs, serial communication, or Digital Twins.
- IEC 61131-3 logic for variables conversion, aggregation, and mapping.
- This application can run on any device with a Linux or Windows operating system (e.g. embedded device, PC, virtual machine, etc.).

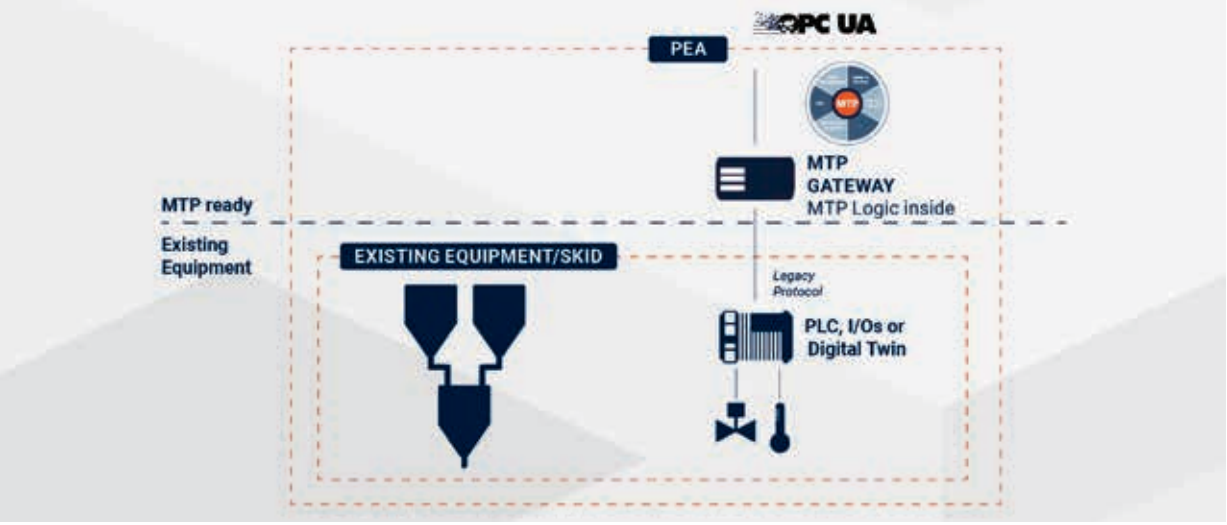


Figure 1: MTP Gateway for connecting existing equipment with MTP.

Figure 2: Integration of MG2 machines into POL via MTP.

– OPC UA Process Gateway capable of exposing the PEA variables according to the MTP manifest.

This enables you to retain your own developed software or validated PLC code and simply run the COPA-DATA's MTP Gateway on top to be ready for the demands of modular process automation with MTP.

FULL FLEXIBILITY

The MTP Gateway can run on Windows or Linux operating systems. It is up to you whether you choose to run it on a dedicated Linux device or integrated on a POL Server.

AUTOMATIC MTP CODE GENERATION: A NEW SERVICE FROM COPA-DATA

As an equipment supplier, there might be a large installation base of existing equipment. It would be a lot of work to manually create the required pieces for the MTP connection (MTP file, logic code). Therefore, an automatic generation of the MTP file and the corresponding zenon logic code for the MTP Gateway is required, dedicated to certain devices.

The MTP Studio provides the option to create MTP files by using the MTP Editor. This is not limited to the MTP Editor itself – this generation can also be performed automatically. If a device configuration, including tag structure, P&ID, etc., is available electronically, those configuration files can be read and the MTP file is created automatically. Thus, having an MTP file available is the basis for generating the zenon Logic code of the MTP Gateway in one mouse click.

The automatic generation of the MTP file and the MTP Gateway zenon Logic code is offered as a paid service by COPA-DATA. If this is of interest to you, please get in touch with us at: mtp@copadata.com

WHICH EQUIPMENT CAN BE CONNECTED VIA MTP?

So far, so good. But will it be feasible in practice? In fact, it's already been achieved. Let's have a look at the following success stories.

CAPSULE FILLING MACHINE BY MG2

Founded in 1966, the Italian business MG2 is a leader in the design and manufacture of processing and packaging machines for the pharmaceutical, nutraceutical, cosmetic, and food industries.

For many years, MG2 machines have had the capability to connect to company-wide networks through standardized modules such as OPC UA Servers, domain authentication, time server synchronization, automatic SQL Server database batch transfer, automatic network database backup, and centralized batch report generation.

Now, a new module joins the connectivity family to make MG2 machines even more PLUG & PRODUCE ready. With this proof of concept (PoC) presented at the most recent Interpack fair in Dusseldorf, MG2 applied MTP to prepare an existing capsule filling machine for MTP architectures.

MTP readiness enables our customers to easily integrate MG2 machines into their IT environment MG2 announced.

The MTP file describes the machine IT interface as outlined below.

– Services:
  • Batch interface: Receiving parameters of the batch to be produced.
  • Batch load: receiving batch information from POL (e.g. BatchID, ProductName, RecipeName, etc.)
  • Batch result: sending the production data to POL at the end of the batch (e.g. pieces produced, pieces rejected, SPC information, etc.).
– Real-time values.

Figure 4: The Cytiva ÄKTA ready™ 450.

• Alarms/GMP exceptions.
• Graphical representation of the machine on the POL level.
• The definition of services offered by the machine (ISA 88 batch phases) is freely configurable within the MTP file/MTP Editor.

CHROMATOGRAPHY SYSTEM BY CYTIVA

Cytiva (previously GE Healthcare Life Sciences), formed in 2020, is a global provider of technologies and services that help advance and accelerate the development of novel therapeutics. Cytiva started its first MTP PoC together with COPA-DATA to explore how easily an existing module can be upgraded ready for MTP.

Within this PoC, the new ÄKTA ready™ 450 Chromatography System was equipped with MTP functionality using the zenon MTP Gateway with the following goals:

- Maintain the locally validated configuration as it is.
- Avoid the need to replace or modify existing developed code or software.
- Connect the MTP Gateway to the local OPC UA Server of Cytiva's Unicorn software.
- Start local methods (recipes) via POL.
- Show status information of services and tag values in POL.

Through the use of MTP, a complex device like the ÄKTA ready™ is included in a POL at the click of a mouse. All status information and the P&ID is available after automatic generation, see figure 3.

LIVE PRESENTATION

At the zenonize23 event, COPA-DATA and Cytiva's Mikael Björling, Principal Automation Engineer, and Olivier Friker, Senior Product Manager, UNICORN, together presented a live integration of this equipment using zenon and MTP with the zenon MTP Gateway. You can watch the linked recording by following the QR code below.

R&D LAB DEVICES AT ISPE HACKATHON

Together with the ISPE Pharma 4.0 Community of Practice, COPA-DATA was part of an Emerging Leaders Hackathon with the goal of "Discovering the MTP standard by integrating R&D Lab devices".

HACKATHON SETUP

The goal of this PoC was to make the perfect cup of coffee using the listed equipment. Perfect meant the coffee cup was assessed in real time for quality, temperature, and coffee and milk concentration. Each cup of coffee was made to order. The process was monitored holistically; all data was logged and time aligned. All PEAs were orchestrated using the zenon MTP Studio. All modules were connected to a central POL, see figure 5.

The following equipment was connected using the zenon MTP Gateway:

- Peristaltic pump, Watson-Marlow 323 (RS232)
- Temperature controller, Julabo MAGIO MS-1000F (RS232)
- Temperature sensor (OPC UA)

The MTP POL application generation with zenon included the following steps:

- Import PEA MTP files incl. PEA instance generation
- Process orchestration
- POL application generation
- ISA-88 batch recipe generation and execution

MTP SUCCESS STORY AT MERCK

Merck introduces modular automation for laboratories – a first for the chemical industry. In the chemical and pharmaceutical industry, product life cycles are becoming shorter and shorter. Merck KGaA was looking for a new solution that would make it easy to create and update system configurations and rapidly upscale from the laboratory to production. With zenon, the technology company was able to roll out modularization according to MTP standards in a higher-level Process Orchestration Layer (POL). This flexible application of modules is accelerating time to market considerably. One of the key enablers for realizing this project is the zenon MTP Gateway because the project connects existing devices that were previously not ready for MTP.

At the zenonIZE23 event, participants had the opportunity to learn about the strategy of Dr. Andreas Bamberg, Executive Director at Merck. He used this modular engineering approach to develop 60 different POLs using zenon at the Merck plant in Darmstadt. The proj-

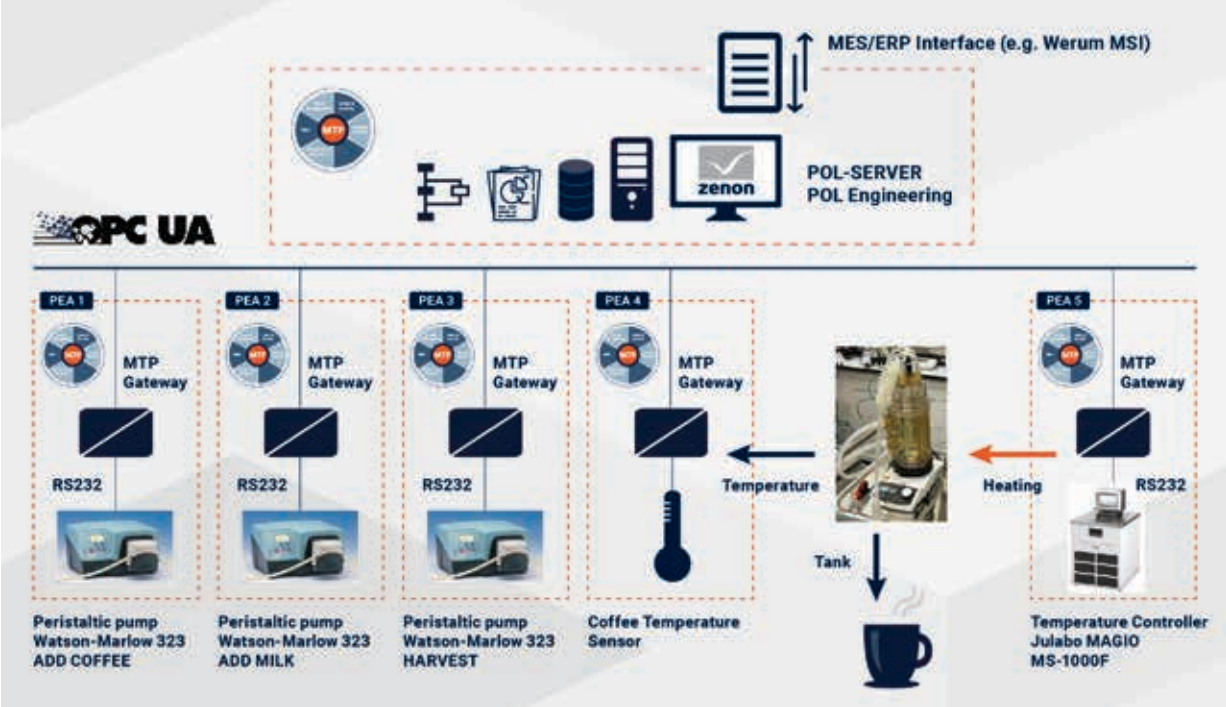


Figure 5: Hackathon MTP Architecture.

ect started in 2019 and has already delivered impressive results. To find out more, please review the linked COPA-DATA Success Story using the QR codes below.

THE FUTURE FOR MTP WITH THE ZENON SOFTWARE PLATFORM

Thanks to the experience gained in these projects, COPA-DATA has decided to extend the support of MTP in zenon. With zenon 12, it will be even easier to realize modular projects in accordance with the MTP standard.

Is modular engineering in biotech just a dream or reality? With the integration of MTP within the zenon software platform, the realization of open and interoperable DCS systems is a proven reality.

Learn more about the zenon MTP Suite: go.copadata.com/mtp

MEHR INFORMATION:

Merck Press Release

Dr. Bamberg at zenonize23 recording

Brochures MG2

Success Story Merck KGaA

BERNHARD KORTEN
Director Life Sciences & Process Industry

Since 2008, Bernhard Korten has been a member of the COPA-DATA team in Salzburg, Austria. As a volunteer paramedic, Bernhard always has the right remedy at hand, especially for software solutions in the life sciences industry.

CENTRALIZED DECENTRALIZATION

In today's world, the need for sustainable energy sources has become more critical than ever before. Every solution that we develop at COPA-DATA is designed to serve the needs of customers and make their lives easier. There are a variety of use cases in the field of renewables which utilize zenon's Industrial Internet of Things (IIoT) Services to present innovative approaches that will revolutionize the renewable energy sector.

THE DATA PRODUCERS

To better understand the potential of the IIoT in renewables, we must first understand the data: where it comes from; where it is relevant; who is going to consume it and how.

By their very nature, each renewable energy asset must be designed to its own specific criteria, meaning every project, asset, and role has its various challenges. As the industry evolves, more unique and exciting opportunities arise.

Take solar PV, for example. A solar PV plant differs from a wind farm not only by the differing types of field devices, but also in the type of data generated. A pyranometer is a device which measures solar irradiance on a planar surface. A key metric required in performance analysis is the solar irradiance that the plant is exposed to over a certain period of time. The performance ratio (PR) describes the relationship between the actual energy the plant has produced and the theoretical value that could be produced based on the solar irradiance metric.

A windfarm, on the other hand, prioritizes other metrics – such as wind speed and direction. These are then used to plot the power curves for each turbine. This is particularly important when aging assets are increasingly causing problems and maintenance of blades and gearboxes is more challenging.

Local asset performance calculations and monitoring is nothing new. It is a staple requirement found in nearly all specifications. But what if the requirement is to be able to compare the performance of multiple, decentralized assets? Having one unified central platform where real-time and historical process and maintenance data is available from within the same ecosystem is extremely beneficial. This is where zenon IIoT Services come into play…

CENTRALIZING INFORMATION FROM DECENTRALIZED ENERGY RESOURCES

zenon IIoT Services enable the remote monitoring and control of renewable energy systems, regardless of their location. This is particularly beneficial for managing remote or offshore renewable energy installations, such as solar PV plants, hydroelectric plants, wind farms, and battery energy storage systems.

IIoT systems can adjust their operations based on real-time data and feedback, optimizing performance. IIoT-enabled smart grids allow for efficient management and integration of renewable energy sources with the existing power grid. Real-time data from IIoT devices can help balance supply and demand, optimize energy distribution, and enable better load forecasting. This can lead to improved grid stability, reduced energy wastage, and increased reliability of renewable energy sources.

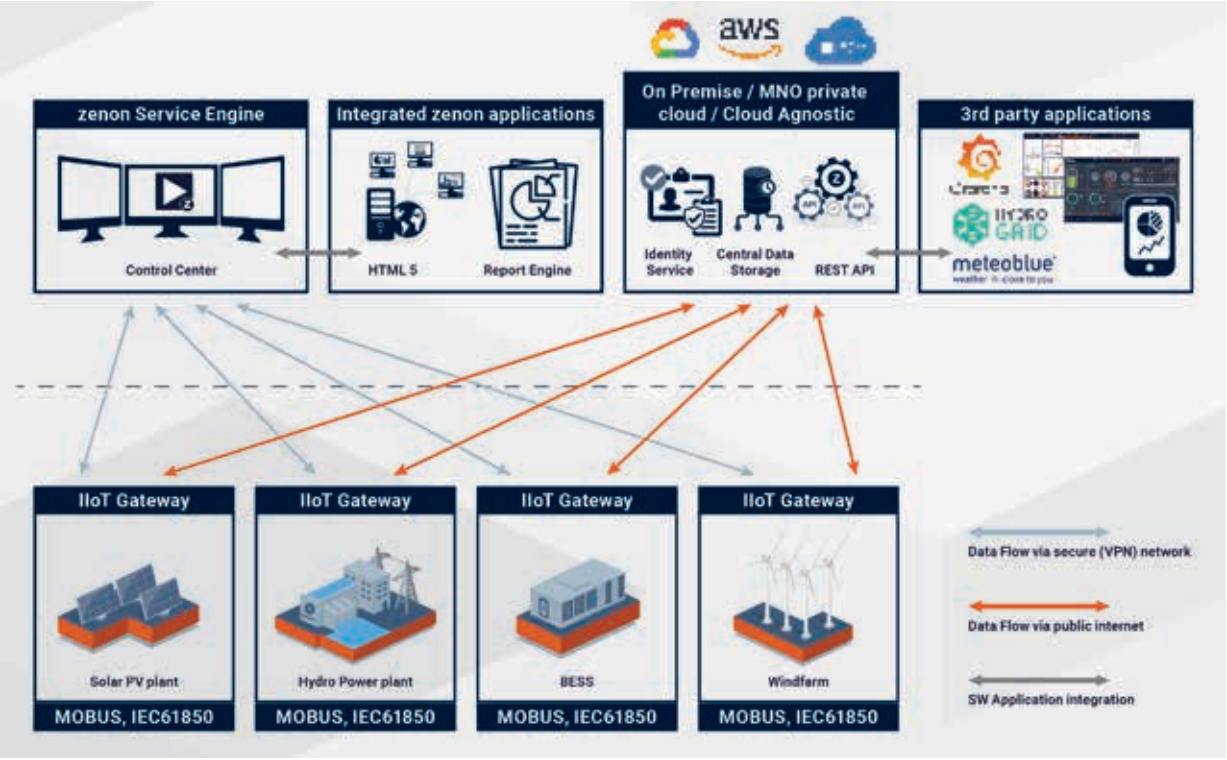
To make the onboarding of renewable assets to the IIoT platform easier, we should first define a set of metrics required from each resource. Real-time values such as P, Q, I, U, alarm counters, asset status, and server status can be defined in a data model. The data model can be integrated with the zenon application at a local site using zenon's Smart Object technology.

The same data model can then be used in the zenon IIoT software platform, thereby populating it with a standardized set of data. This helps to alleviate the need for complicated IIoT integration for brownfield projects and ensures rapid deployment of "IIoT ready" greenfield projects.

Understanding how a plant is performing under all conditions is vital. The key metrics for the individual sites can be monitored and displayed using dashboards. A geographic information system (GIS) allows for each asset in the portfolio to be displayed based on its geographical coordinates. Not only can this be used to improve the energy production of individual plants, it helps in prioritizing maintenance tasks – allowing you to dispatch maintenance resources effectively and efficiently.

FULFILLING REQUIREMENTS FOR CONNECTIVITY

zenon comes with a rich set of connectivity options. Operation and maintenance (O&M) companies need to connect to a variety of equipment, including inverters, weather stations, battery storage systems, and software such as solar forecasting and market pricing applications. zenon has more than 300 drivers and a custom driver development option to fulfill any kind of connectivity requirements.



In addition, zenon IIoT Services includes a REST API service, enabling IT applications that need data from the asset to combine this information in dashboards, data analytics, and predictive maintenance applications. With zenon, O&M companies can offer a mobile-device application to site owners utilizing zenon IIoT Services, so that owners can see the sites are up and running at full efficiency and monitor how much energy and revenue they are generating.

OPERATIONAL EFFICIENCY WITH DATA MANAGEMENT

Renewable applications typically produce vast amounts of data, thus requiring large amounts of historical data to be stored. zenon IIoT Services allows for centralized data storage possibilities.

A benefit of local data storage is the quick and reliable availability of process data. Cloud services may not be available all the time; for example, due to loss of connectivity or provider-related issues. Local data storage enables O&M companies to record and access data locally all the time. A maintenance team facing an unexpected decrease in energy generation from a specific section of a plant can check the inverter and environmental data around the time of the failure or view an extended trend analysis based on the data stored locally.

zenon IIoT Services data storage also allows for all historical data relating to each plant to be stored seamlessly in one central location. This is useful, for example, when power purchasing agreements (PPA) include data storage and retention requirements. Using central data storage for this is a much more feasible option than maintaining servers across each different site – which would be even more challenging over a long period of time.

Furthermore, advanced, cloud-based technologies usually work with larger datasets and consume data from different sites. Such use cases also create a need for central data storage. For example, an artificial intelligence algorithm needs the patterns from all sites to generate optimization recommendations.

NEW REVENUE CHANNELS WITH IIOT SERVICES

There are many different stakeholders and business models in the renewables sector. Renewables are often owned by investors who have time-bound agreements with O&M companies to ensure that they maximize profit from their sites.

When thinking about reporting and intelligence, the first step is to identify and group the various stakeholders. The next step is to determine the key interests for each of the stakeholders. Which data are you required to convey to the various stakeholders? In which format do they need the data to be presented? At what time intervals do they require the data to be available?

A single plant can serve multiple stakeholders. With zenon IIoT Services, data from different sources within an asset can be separated and grouped. The relevant KPI, ROI, or revenue reports can then be calculated and dispatched to the relevant stakeholder.

As markets develop, the stakeholders of a particular asset can change multiple times through its lifetime. Therefore, an important requirement for any asset management solution is the ability to change, remove, or add stakeholders as and when necessary while

ensuring stable and consistent access to the relevant data for the right parties.

This makes user management another critical topic for O&M companies, which often serve multiple clients which have ownership of multiple sites. In a dynamic market for investors, this feature becomes even more important. zenon Identity Service provides clear separation between zenon projects, third-party applications, and system users. As an example, when a new site owner buys into the portfolio, the O&M company is able to provide the former owner with the data and reports to date, revoke their access, and configure permissions for the new company. More broadly, zenon Identity Service can – and should – be configured so that every stakeholder is authorized to see only their data on the shared infrastructure.

REPORTING

O&M companies are responsible for the ongoing operation, monitoring, and maintenance of the assets, e.g. solar PV farms. They ensure that the system operates optimally and efficiently. O&M tasks might include regular inspections, the cleaning of solar panels, repairing or replacing faulty equipment, and ensuring compliance with regulations. To manage these tasks, O&M companies need suitable software to ensure that the panels and their operations work at maximum efficiency.

O&M companies can deliver automated reports utilizing zenon Report Engine integrated with IIoT services. With central data storage, they can also generate reports when the sites are offline. This way, O&M companies can offer site owners automated reports with different frequencies and granularity. For example, a "basic" package might include the total energy generation of a site over a one-week period, delivered every week to only one person in the controlling company. On the other hand, an "advanced" report package could consist of multiple reports, including performance ratio reports, revenue reports etc., sent on a daily basis to multiple recipients.

This intelligence could also be offered to customers as part of a consultancy service. Understanding trends over the long term across similar installations will help O&M companies to define the benchmarks that will help their customers and facilitate improvement and optimization recommendations.

THE FUTURE IS NOW

zenon IIoT Services offers the whole feature set required for an IIoT project. Customers have an end-to-end infrastructure provided with state-of-the-art security. It is a solution which bridges the point at which IT and OT converge. Further, zenon IIoT Services is updated quarterly with bug fixes, security patches, and new features. The latest feature is zenon Device Management, which enables users to remotely deploy zenon projects to any site. Users can also define when they want to run the installation, for example, during a maintenance period.

Dashboards are another important element in IIoT projects. zenon IIoT Services can be easily integrated with any dashboard. In the next issue of IU Magazine, we will be discussing the capabilities of the zenon Dashboard Service. It offers another alternative for zenon users so you can have a live snapshot of your system and keep track of your asset performance.

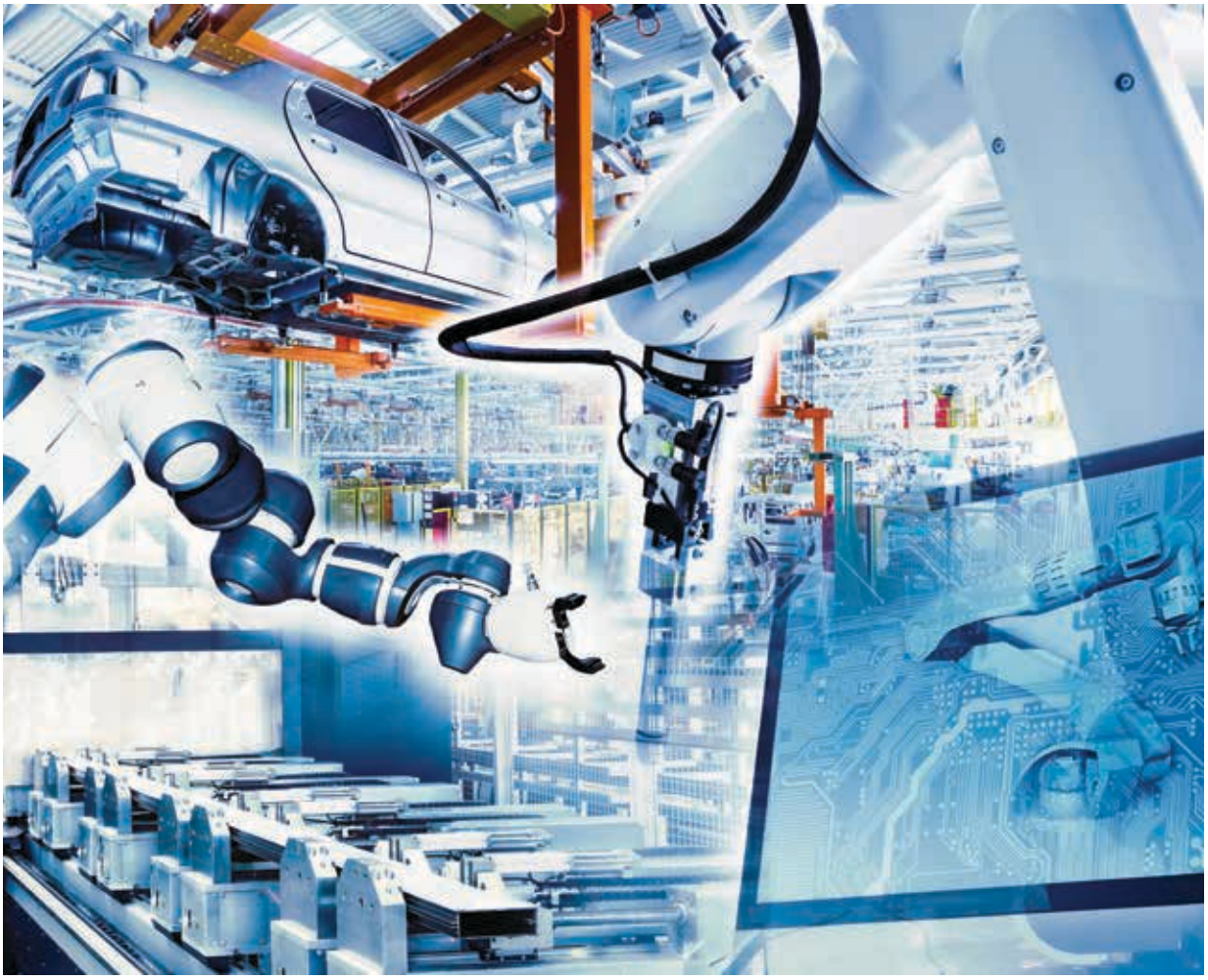
Overall, zenon IIoT Services' ability to collect, analyze, and act upon real-time data brings numerous advantages to the renewable energy sector. It improves energy generation efficiency, enhances grid integration, optimizes energy consumption, and enables proactive maintenance, thereby contributing to a more sustainable and reliable renewable energy infrastructure.

CAGDAS BASOGLU
Business Development Manager | IIoT Solutions

With a remarkable 15-year career in sales, Cagdas Basoglu has established himself as a seasoned professional in the field. Over the past 7 years, he has channeled his expertise into the IoT, making significant contributions across various sectors including smart homes, the manufacturing industry, and renewable energy. He supports customers to drive successful IoT investments, with his experience and understanding of the intersection between sales and technology.

LEWIS WILLIAMS
Industry Specialist Energy | Product & Application

As a member of the Industry management team for energy at COPA-DATA, Lewis Williams is responsible for ensuring that the zenon software platform is equipped with the key features and solutions for the various applications within the energy sector. His main interests are in the renewable energy sector, where he actively researches the latest innovations and technologies helping to contribute to a sustainable future.



EFFICIENT CAR BODY CONSTRUCTION

With its cross-technology concept, the zenon software platform is a powerful solution for production monitoring in automotive manufacturing. In this article, we show how zenon brings transparency to production and creates conditions for greater efficiency.

A car body production line consists of many production cells, each of which produces a part of the body. Although all equipment has the same basic technology components, the individual equipment is optimized for the body components it produces in order to enable a significantly higher production volume and automation. A floor group system, for example, cannot produce side parts.

Downtime in one section can delay the completion of a full car body. For this reason, the control and monitoring of both the individual equipment and the network of all systems is essential to the effectiveness of production.

The zenon software platform is ideal for production monitoring that integrates all technologies. Thanks to the comprehensive standardization of software components and interfaces, production data becomes transparent. One factor here is the option for supra-production monitoring, for optimal utilization of the available systems and transport routes. The energy required for production can also be taken into account. Corresponding analysis enables the intelligent direction of further optimization. When changing the vehicle model, process experts can

define the required zenon standard modules before the start of production (SOP), which greatly shortens the engineering and commissioning periods. During ongoing production operations, these modules ensure smooth operation and support the staff with standardized functionalities in the event of a fault or maintenance. In addition, work orders can be moved flexibly between equipment or production sites. Clocked flow production is linked to the concept of flexible workstations.

When changing models or expanding these modules, only the relevant capsule needs to be expanded functionally.

The high scalability of zenon allows it to be used at all levels of production monitoring and control. Depending on the task, users are provided with information tailored to their needs.

Data is exchanged internally using standardized and encrypted messages. A connection to a production control system or a quality system is possible with OPC UA, SQL, or proprietary interfaces.

CYCLE TIME IS THE HEARTBEAT OF PRODUCTION

The individual production cells in the car body construction process produce the different modules of the vehicle body. The cycle time defines the production time of the individual components and the transport between equipment units. The cycle time sets the pace of production in body construction and it is one of the most important variables in production control. As a result, it has to be monitored. If the cycle time of an equipment unit is not observed over time, the linked equipment upstream and downstream in the production line can be affected negatively.

When cycle time violations occur, zenon can respond automatically and notify equipment stages upstream and downstream via large screen displays or ANDON boards. Measures to stabilize the cycle time are initiated. For example, set values can be modified or new cycle times specified for the systems affected.

Subsequent evaluations of the recorded cycle times and cross-equipment comparisons using the corresponding zenon reports enable a „weak point analysis“ of the systems and make it possible to identify potential for improvement.

REDUCED DOWNTIME WITH ZENON ALARM MANAGEMENT

zenon alarm processing is used to process faults and messages. This lists all messages, alarms, and faults in a sorted list. Multiple filter options enable searches for specific online alarms, historical alarms, unacknowledged alarms, pending alarms, area, group, cause, tag name, identifier, limit text, and time filters.

The contents of the list and the filter options can be predefined for specific tasks. Extensive filter options are available for an optimal analysis of the faults and messages classified. These filters can be saved in user-specific profiles and reused.

All messages can be divided into different categories. Alarm classes and alarm groups enable the logical grouping of alarms and support prioritization and classification. zenon alarm groups are used to differentiate between production areas. Alert classification assigns priorities for customized responses based on the severity or urgency of the alert. For example, the classes “Technology”, “Logistics”, and “Production” are used.

Each group or class can be assigned a name, number, color, and function. These classifications make it easier to filter and quickly find the alarm reference. The class color is used as text or background color to better organize the alarm lists.

Each message in the alarm list has a limit text. This can be switched online to a desired user language. A dynamic limit text allows users to insert current values or texts in the limit text.

ALARM TRACKING

Alarm tracking allows alarms that have occurred to be tracked from the overview screens to the equipment area screens. If an alarm occurs in an equipment area, for example, in a production cell, the corresponding screen element is highlighted in color. When the operator selects this item on the screen, the system switches to the related detail screen. In this way, the system graphically navigates the operator through the screens. It constantly increases the level of detail

Focus on production key figures.

Transparent control of the production cells.

of the display: from the overview screen to the equipment screen, to the alarm message list with plain text display.

STATISTICAL EVALUATIONS OF FAULTS AND MESSAGES

With statistical evaluations of the alarm data, weak points in the equipment or locations can be localized, displayed, and permanently removed.

Various analytic and filter options are available for analyzing the alarms, for example, the summary list and the statistics list. The summary list contains area, group, and cause-related faults as well as individual faults. The statistics list provides information about alarms, including the most frequent, the last, the longest, and the shortest alarms in relation to the downtime and the total fault duration of a system. The number N of the listed alarms is freely selectable.

BODY AND COMPONENT TRACKING

In car body construction, the bodies and body parts are transported to the individual production cells using conveyor technology. To properly carry out the work steps at the different stations and optimize overall efficiency, the individual positions in the production flow have to be identified through car body tracking.

This is performed using identification modules (RFID, barcode, etc.) on the car bodies. These are carried along with the car body throughout the entire production process to allow for identification at automatic reading stations at any time. The data from this process is stored in a database, evaluated by zenon, and can be displayed in the factory layout or in a detail screen.

With an integrated search function, the current positions of car bodies can be determined quickly and reliably. As a result, you can easily track history and progress within the material transport process.

The seamless integration of car body tracking enables the linking of the stored production information and master data with the faults, messages, and process values that have occurred for further evaluations. In this way, availability, cycle time of the production stations, and throughput times can be calculated. For example, it is possible to determine the shift-related cycle times of the respective production stations, the required processing and transport times, as well as the shift-related downtime with production run losses.

In a conveyor system, decisions have to be made at multiple points on the route along which a car body could potentially be transported. As a rule, these decisions are made automatically by stored timetables.

In some cases – for example, quality control or post-processing – it is necessary to change the targets of the bodies through manual input. A manual target control of the bodies can therefore be set up at defined points. With zenon, the positions of the car bodies and the status of the manufacturing progress within production can be clearly determined.

DISPLAY IN FACTORY LAYOUT

The conveyor system layout is shown in detail in overview screens with current statuses and data. The zenon Worldview function offers the operator different zoom levels with the corresponding level of detail. To help with orientation, the conveyor technology elements are listed in a station list.

CONTINUOUS MONITORING OF PRODUCTION FIGURES

An important task in car body construction is recording production data and calculating the key figures for production monitoring from it. zenon calculates key figures using various needs-based methods, including the integrated IEC 61131-3 programming system zenon Logic. The calculation algorithms are part of the libraries and are connected to the corresponding input and output variables.

OEE METRICS (OVERALL EQUIPMENT EFFECTIVENESS)

The data recorded and calculated by the system, such as alarms, counter values, process values, calculated values, and shift information, are used to determine the OEE parameters. Formulas are stored in the system for calculating the key figures. A needs-based adaptation to specific requirements is possible.

A typical definition of a formula for calculation is:

$$OEE = \underbrace{\frac{\text{Run Time}}{\text{Operating Time}}}_{\text{Availability Factor (A)}} \times \underbrace{\frac{\text{Actual Quantity (Gross)}}{\text{planned Quantity}}}_{\text{Performance Factor (P)}} \times \underbrace{\frac{\text{Good Quantity}}{\text{Actual Quantity (Net)}}}_{\text{Quality Factor (Q)}}$$

The availability factor (A) is a measure of losses due to unplanned equipment downtime. The performance factor (P) is a measure of losses due to deviations from the planned number of pieces due to downtime that was not used to determine the availability factor. Quality Factor (Q) is a measure of loses due to defective or reworked parts.

This allows statements to be made about system availability or production capacity utilization. The zenon reports are carried out in different forms, for example, shift related to a specific shift, comparison between different shifts, availability related to individual equipment units, and availability related to entire production groups.

On the basis of the downtime-relevant alarms, the number of pieces lost can be determined, i.e. zenon calculates how many vehicles could not be produced due to downtime. The calculation is based on cycle time and downtime. The technology-wide evaluation of body losses in production is called up via a filter for equipment, time, and shift schedule.

ENERGY AND MEDIA CONSUMPTION

The monitoring of utility and energy consumption for process-relevant equipment and systems serves as a variable for low-emission and efficient production. zenon supports the recording, data processing, visualization, and evaluation of different utilities such as electricity, gas, compressed air, the amount of water supplied, as well as hot or cold water used.

A detailed breakdown of the data is supported by the interdisciplinary use of different technologies and the equipment and areas contained therein. In addition, zenon allows users to assign energy costs to cost centers.

Displaying consumption values transparently provides a basis for reducing costs over the long term. The Energy Management System (EMS) can be used to optimize the energy consumption of manufacturing operations. All recorded consumption values can be displayed online in equipment screens, in table formats, in reports, or as trend curves.

SUMMARY

The requirements in car body construction in automotive manufacturing are manifold. zenon provides the ideal basis for sustainable integration in production. The flow of information through the simple data distribution system in zenon is a key success factor for consistent control of production.

BERND WIMMER
Industry Specialist Automotive

Bernd Wimmer has been Automotive Industry Manager at COPA-DATA Germany since 2002. He lives with his wife, two children, and their cat in beautiful Bavaria.

bernd.wimmer@copadata.de

AROUND THE WORLD

COMING TOGETHER ON THE STAGE OF DIGITALIZATION

In June 2023, COPA-DATA invited customers and partners from across the world to visit Salzburg, either in person or virtually, to attend zenonIZE 23. The event provided a forum for discussing the latest challenges and opportunities arising in the worlds of industrial and energy automation. We also discussed methods for working together to achieve the goal of net zero.

The event opened its doors both literally and virtually on June 14 and 15, when around 200 visitors descended on Salzburg and more than 600 participants entered the app built to accompany the proceedings. These figures made zenonIZE 23 our largest customer event to date. The format allowed us to finally return to in-person discussions with customers and partners after several years of solely virtual interaction. The in-person event took place in Salzburg's Schauspielhaus theater. Its two stages provided a platform for more than 30 presenters to deliver inspiring and captivating talks to the attendees.

ROADMAP TO NET ZERO

With "The Stage of Digitalization" being the slogan for the event, the discussions and topics that were presented centered on strategic approaches for industrial digitalization and improved sustainability in production, plus customer use cases. In the ten years or so since Industry 4.0 emerged as a watchword, our environment and our assumptions have changed in many ways. Numerous companies are now pursuing sustainability projects. The examples from practice that were presented illustrated the contribution that the zenon software platform is already able to make on the road to net zero. A range of scenarios drawn from different industries outlined a roadmap to achieving more sustainability in production. They illustrated ways in which companies can bridge the gap between societal concerns and technology both now and in the future.

Seamless digitalization from laboratory to production

In his keynote speech, Andreas Bamberg from Merck KGaA demonstrated how zenon and Module Type Package (MTP) technology enable significant reductions in time to market. The guest speaker stated that modularity has been key to creating an edge over the competition. The introduction of digital technology has revolutionized the world of production, making it possible for every stakeholder in the industry to achieve a seamless transition from laboratory experiments to commercial production on a large scale. The advent of modular production systems, he added, has created a flexible environment and gives companies the scalability needed to increase or reduce production levels smoothly in line with demand.

ZENON 12

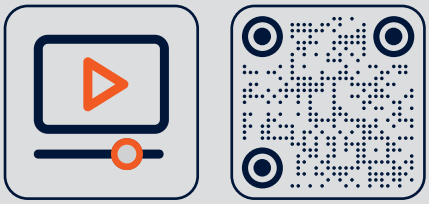
Yet another highlight was the unveiling of zenon 12 – the latest version of our software platform, launched shortly after the event. Participants were given an exclusive sneak preview of the key new features and enjoyed the chance to see the expanded options and functions for themselves. There were also in-depth presentations about the new zenon Historian 360 and the wide variety of possible applications in which our zenon IIoT Services can be used.

TO BE CONTINUED IN 2025

We received valuable feedback from participants, who showed an overwhelmingly positive response – whether they had attended in person or through the live streams. Hearing this has reinforced our commitment to stage more zenonIZE events in the future, providing a platform for sharing expertise, discussing personal insights with fellow attendees, and engaging in valuable networking between our customers, partners, and many friends.

Stay tuned for zenonIZE 25!

WATCH THE VIDEOS FROM ZENONIZE 23 AND GET INSPIRED!




zenonIZE 23


We've come a long way together –
now off to new horizons
Stefan Reuther


zenonIZE 23
Inspiration Days for COPA-DATA Customers, Partners & Friends


13 CLIMATE ACTION


zenonIZE 23

ABOUT US

In every issue, Information Unlimited places the spotlight on selected employees to help our readers get to know our company better. Our employees featured here talk about their professional workday and personal interests.

GARRY FORFAR

Sales Director, COPA-DATA UK
At COPA-DATA since 2019

I grew up in the electrical industry and have been involved in substation projects for over 15 years. Colleagues can come to me for anything related to the electrical industry, renewable generation, transmission, distribution, or private networks. In my job, I like the variety and how involved I get to be in major infrastructure projects. I switch between technical meetings about securely controlling 150 substations, large offshore wind farms, and negotiating framework contracts with transmission operators.
In my free time, hill running is my main love but I also compete in triathlons, surf, and sail. I enjoy anything active that lets me spend time out in nature. I'm particularly drawn to sports that involve a mix of engineering and nature for propulsion, like sailing, paragliding, and surfing. I work from home in Edinburgh, I'm lucky to have my own office in the house. My desk is covered in things for me to fidget with, I have photos of colleagues and myself from our international meetings and large framed prints of my three sporting idols (Sergey Bubka, Paula Radcliffe, and Michael Johnson) on the walls along with a big map of the world to plan adventures.

garry.forfar@copadata.co.uk

MICHELLE KURZ

Junior Sales Manager,
COPA-DATA Germany
At COPA-DATA since 2019

What I particularly like about my job is that I have a lot of creative freedom and can develop and evolve freely. As a Junior Sales Manager, I am always in direct contact with my customers and partners. Since I'm on the road a lot, I mainly work digitally. That's why my desk is very tidy and well organized. There is a calendar on the wall with pictures of my godchild. A cup of coffee is my most important everyday accessory at work.
These three words describe me best: ambitious, dynamic and good-looking ;-)

michelle.kurz@copadata.de

SEBASTIAN BÄSKEN

Team Lead Marketing Communications,
COPA-DATA Headquarters
At COPA-DATA since 2015

I create content about aspects of zenon and COPA-DATA for marketing and communications. This ranges from short promotional texts to long, detailed descriptions of visual concepts and video productions.
Our teamwork and cooperation are unique and exciting. The shared progress that occurs when different minds and personalities look at a topic from different perspectives and then negotiate it with each other is fascinating. The job is very diverse and I get to play with ideas. Even if we don't manage to implement them all, it's fun and it challenges my imagination.
I really enjoy spending my free time with my wonderful Austrian-German family. In the summer, mostly with red sand on tennis socks. In the winter I prefer to carve on skis or, even better, to dive into fresh powder snow with my nose.

sebastian.baesken@copadata.com

DANIEL KIENINGER

Technical Account Specialist,
COPA-DATA Headquarters
At COPA-DATA since 2013

What I particularly like about my job is working together closely with customers to find a solution tailored to their needs. Our colleagues and customers can always turn to me; I am well versed in licensing, zenon Historian, general system architecture, zenon networks, and pharmaceutical-specific topics such as the validation process.
Personally, the three words that best describe me are: spontaneous, helpful, and solution-oriented.

daniel.kieninger@copadata.com

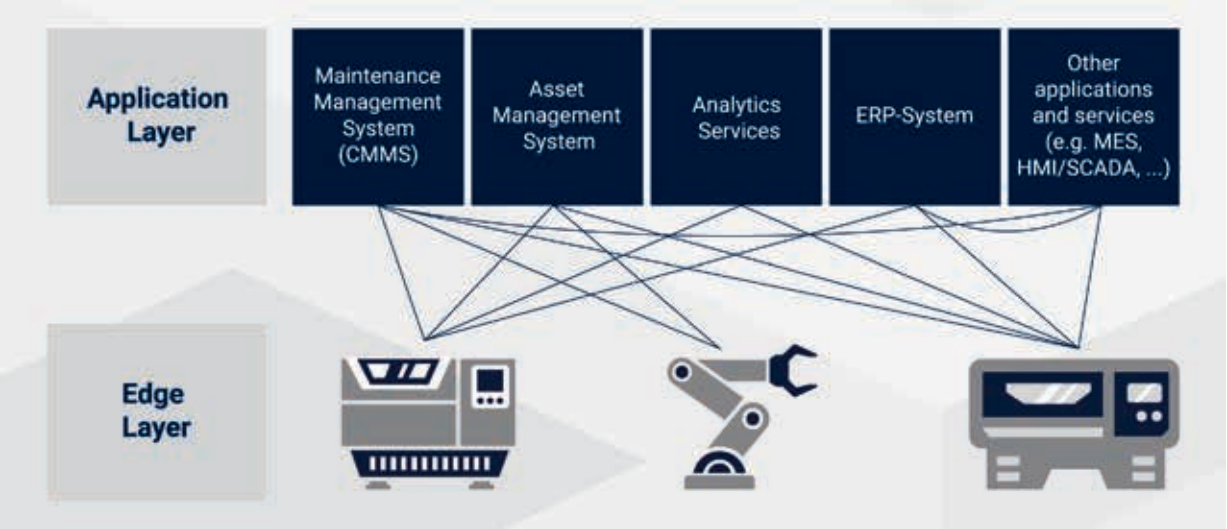


Figure 1: Direct communication of machines and applications – © Salzburg Research.

INFORMATION HUB DIGITAL TWIN

Digitalization increases the complexity of communication in networked production systems. Salzburg Research and COPA-DATA are working on a revolutionary concept: Semantic Integration Patterns are designed to facilitate integration and create secure and standardized communication channels.

DATA INTEGRATION AS A CHALLENGE FOR DIGITALIZATION

In recent years, digitalization has developed into a key driver for optimizing industrial productivity, equipment availability, sustainability, and resource efficiency. The boundary between OT and IT has become blurred and there has been extensive networking of production and IT systems. Industry 4.0 transformed every new machine and component into an intelligent, networked asset. This trend continues through the digital retrofitting of existing equipment. When data is exchanged between every machine and every application, a production network arises as illustrated in Figure 1. The classic automation pyramid[1] is dissolved, because the equipment (edge layer) continuously supplies data to all those IT systems (application layer) that need this data for monitoring, surveillance, analysis, and control processes. The heterogeneity and multiplicity of conventional protocols and standards place complex demands on data integration.

COMPLEX COMMUNICATION

Connected production networks place complex requirements on digital communication and the interoperability of the systems involved. The manual or automatic processes deployed differ fundamentally, in several important ways:

- in the openness and access to relevant messages or control units,
- in the communication protocols used,
- in the adaptability to different receiver systems.

It is not uncommon for "vendor lock-in effect" to occur. Further, high integration effort and cost can result because the devices that generate the messages have to know the recipient systems and their programming interfaces exactly and map the information provided to the information model of the recipient. For example, when error messages are generated by different equipment but all need to be forwarded to a maintenance planning system or AI software via an HMI/SCADA system.

DIGITAL TWINS AS INFORMATION HUB

In state-of-the-art manufacturing networks, the concept of digital twins – or digital replica of physical assets – has established itself as an important tool in the digital transformation of automation and production processes.

[1]Åkerman, M. (2018). Implementing Shop Floor IT for Industry 4.0. https://www.researchgate.net/publication/326224890_Implementing_Shop_Floor_IT_for_Industry_40

Digital twins exchange information with all connected applications in the operational manufacturing systems (see Figure 4). As a result, digital twins and their associated information models are naturally the focus of interoperability considerations. Solutions for providing open, standards-based, self-descriptive (semantic) interfaces between the participants in a manufacturing ecosystem can significantly reduce integration effort.

As an information hub, digital twins have to meet a wide range of communication requirements, and several information models have recently been developed for this purpose.

The asset administration shell (AAS[2]) is one of the newer information models developed for Industry 4.0. It was created as a specification as part of the Reference Architecture Model Industrie 4.0 (RAMI4.0) by "Plattform Industrie 4.0" and it provides a standardized information model for the description of industrial equipment and its components (DIN SPEC 91345). It offers conditions for the implementation of digital twins.

Figure 2: Asset Administration Shell.

SEMANTIC APPLICATION INTEGRATION

Data integration and interoperability in networked production systems mean increasing complexity. This is the starting point for the i-Twin[3] research project. The project, which started in 2022, examines interoperability concepts for digital twins of industrial equipment. Salzburg Research and COPA-DATA are working together with software companies and industrial companies to implement advanced communication patterns.

In contrast to the situation shown in Figure 1, i-Twin has a data integration layer that serves as a link between the edge layer and the application layer. The interfaces to the applications are application connectors and those connecting to equipment are asset connectors. Both types of interface components use the asset administration shell as the central information model. In this way, the data integration layer enables standardized data exchange. Figure 3 shows the general architecture of the proposed solution.

The data integration layer, combined with the generic connectors, forms the basis for the Semantic Integration Patterns. This covers the standardized communication patterns for integration of equipment and IT systems.

The benefit of Semantic Integration Patterns is that they drastically reduce the effort involved in integrating new machine types and applications. All that a system integrator has to do is implement the relevant connector. In addition, Semantic Integration Patterns also support bidirectional communication. For example, changes in the status of fault handling can be reported back to the system. Figure 4 shows the concept of connecting different IT systems with the digital twin as the central communication hub via Semantic Integration Patterns.

SUMMARY

With Semantic Integration Patterns, the i-Twin project is developing a revolutionary concept for the semantic data integration of equipment and IT systems, a process geared towards significantly reducing integration effort.

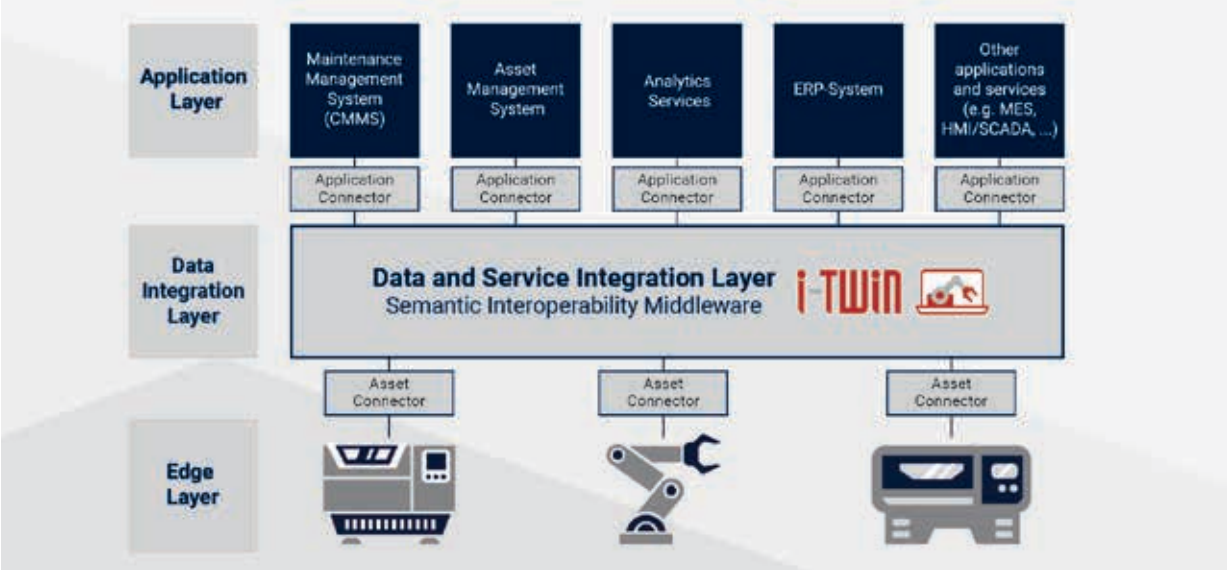


Figure 3: Industrial communication via the Data Integration Layer (i-Twin) – © Salzburg Research.

[2]Details of the Asset Administration Shell - Part 1. https://www.plattform-i40.de/IP/Redaktion/EN/Downloads/Publikation/Details_of_the_Asset_Administration_Shell_Part1_V3.html

[3]i-Twin: Semantic Integration Patterns for Data-driven Digital Twins in the Manufacturing Industry. https://srfg.at/i-twin

Thanks to the focus on standardized information models and, in particular, the asset administration shell, companies are successfully future-proofing their communication channel setups and protecting their investments in integrating applications for the long term.

The project, led by Salzburg Research, will develop a series of Semantic Integration Patterns for industrial communication by March 2024 and will make these available in open-source form. As one of the project partners, COPA-DATA is planning to integrate the asset administration shell into its zenon software platform, thereby offering an Industry 4.0-compatible interface for equipment. The project is running in cooperation with H&H Systems Software, IcoSense, Innio Jenbacher, and the University of Salzburg.

The project is funded by the BMK and the FFG with funds from the ICT of the Future program.

For more information about the i-Twin project and Semantic Integration Patterns, visit srfg.at/i-twin and github.com/i-asset.

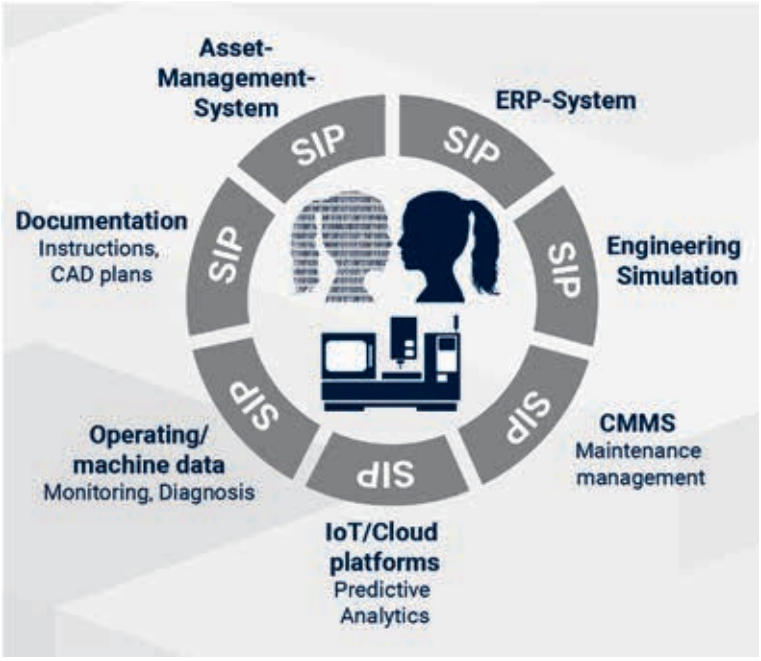


Figure 4: Semantic Integration Patterns create standardized communication channels. © Salzburg Research.

SALZBURG RESEARCH

As an independent research and technology institute, Salzburg Research provides sustainable solutions and know-how for overcoming digital innovation challenges, as well as for complex challenges in the Internet of Things. Salzburg Research is a think tank for innovative companies from a wide range of industries. The team develops software prototypes, conducts field studies, and evaluates technologies for the future digital business of cooperation partners.

www.salzburgresearch.at

ASSET ADMINISTRATION SHELL (AAS)

The AAS is a standardized information model of an asset (one unit of equipment or its components) and describes its digital twin. The AAS consists of a number of sub-models in which all information and functionality of the asset can be described, including characteristics, properties, states, parameters, metrics, and capabilities.

GEORG GÜNTNER

Georg Güntner is a senior researcher and key account manager at Salzburg Research. He works as a senior consultant in the dankl+partner consulting network. His research focuses on the conception of digital twins and data strategies for asset management. He is the i-Twin project manager and coordinates the Maintenance Competence Center.

georg.guentner@salzburgresearch.at

THE RIGHT DESTINATION: USING ZENON TO GUIDE PLANES AND BAGGAGE

With 16 million passengers passing through it in 2019, Budapest Airport is the biggest international airport in Hungary and a central hub for Southeastern Europe. However, the airport's control and SCADA systems for operating critical infrastructure were aging and not standardized. In an attempt to simplify engineering, the control systems department decided to unify systems using the zenon software platform. This has enhanced reliability and ensures the airport's autonomy.

Lao Tzu said, "The journey of a thousand miles begins with a single step." For airline passengers, the first step takes them to an airport. Airports are intermodal traffic hubs linking land and air traffic. Their tasks include processing arrivals, departures, and transit for passengers and freight as well as guiding airplane movements in the air and on the ground.

Airports are often very large and certainly complex – not least because of the elevated security requirements. In direct contact with the control tower, each airplane is guided step by step to its gate or starting position. This is supported by an extensive, sophisticated air-ground light system (AGLS).

Passenger handling is similarly complex – from issuing all transport documents at the check-in counter all the way to clearance at the security checks and at the gates. In addition, the checked baggage needs to be registered, inspected, and transported to the correct airplanes and retrieval stations. Within airport buildings, these tasks are usually taken care of by an automated baggage handling system (BHS).

MAJOR AIRPORT WITH A WIDE VARIETY OF TASKS

Budapest Liszt Ferenc Airport (BUD) is the international airport of Hungary's capital city, colloquially known as "Ferihegy". It is only 16 kilometers (ten miles) away from central Budapest. Before COVID, in 2019 over 16 million passengers used the airport for business or recreational trips.

Operated by a private consortium, BUD is also an important freight airport. BUD Cargo City is the country's central air freight hub. Because Hungary is a NATO member, its largest international airport also

The tasks of airports include guiding airplane movements both in the air and on the ground. © Csuha Péter, HungaroControl Zrt.

The baggage handling system at Budapest Liszt Ferenc International Airport (BUD) has more than 1,000 conveyors. © Róbert Baranyi, Budapest Airport.

serves military purposes so BUD must be operational around the clock all year round.

A HETEROGENEOUS SYSTEM LANDSCAPE

Since it opened for business as a passenger airport in 1950, BUD has been frequently extended, redesigned, and modernized. Many of these upgrades left some of the existing installations and systems unchanged. The various remodeling or extension contracts were often years apart and awarded to different contractors. All this resulted in a very heterogeneous system landscape for the airport's AGLS and BHS.

This heterogeneity extended to the various control systems. "For operation and monitoring, we had a total of six SCADA systems," says Géza Kulcsár, control systems group leader at Budapest Liszt Ferenc International Airport. "No less than four were in use for the BHS alone."

A DESIRE TO SIMPLIFY OPERATIONS AND MAINTENANCE

The incumbent systems had been implemented by different systems integrators for individual installations. Consequently, they had only the specific interfaces required for their defined, narrow purposes. Each system had its own, individual visualization. During operation, the different look and feel of the human-machine interfaces (HMI) was a nuisance. It also brought with it an added and unnecessary risk of misinterpretation.

The lack of consistency also meant that maintenance staff needed to be trained on all of the isolated applications. For modifications, they had to fall back on the systems integrators. However, support was often difficult to come by because some of these companies had gone out of business or employees familiar with the airport installations had left.

"Comparably simple tasks such as operating system updates frequently turned out to be formidable challenges," Géza Kulcsár recalls. "Breakdowns of partial systems occurred regularly."

STANDARDIZATION USING ZENON

Quite understandably, these challenges spurred the desire to standardize systems. The aim was not full integration of all systems, but system unification within the AGLS and BHS.

To prepare for the system selection process, the control system experts at Budapest airport conducted a study to compare the advantages and drawbacks of all adequate control and visualization systems. They took experiences from real operations into consideration. The SICAM-230, which had been in use since 2010, showed the best stability and the least inclination to crash. However, the original supplier no longer provides technical support for the software and proposed an alternative software product. This turned out to be unsuitable for the specific requirements of the airport, so it was dismissed early on.

At the core of SICAM-230 is the zenon software platform from COPA-DATA, a hardware-independent and non-consolidated software manufacturer based in Salzburg, Austria. So it was to COPA-DATA that Géza Kulcsár turned.

LOW-RISK SOFTWARE CHANGE

As the first step, the BUD experts transformed the AGLS control systems. They replaced all of the control technology, including twelve redundant control units (PLCs) and the associated peripherals. Only the power electronics remained untouched. The system had 30,000 datapoints. Above this, they established a superordinate control system using zenon. This also features a gateway to the airfield radar system (ARS).

"We only had six hours for the entire AGLS switchover and go-live and we performed it without external help," explains Géza Kulcsár. "Thanks to zenon's openness and easy handling, it was no hassle at all."

The experience acquired using SICAM-230 also proved valuable during later modifications. "We only need 16 minutes from importing the datapoint list to system commissioning, which leaves a lot of time for in-

tensive testing," says Géza Kulcsár. He stresses the fact that zenon's hot reload ability yields a substantial benefit, particularly in case of the AGLS: "As we can test modifications using simulation, implementing changes takes no more than three seconds."

Full recording of all system parameters in zenon makes it possible to return to the previous state within two minutes. These system properties facilitate stress-free annual upgrades to the control systems at Budapest airport.

FLEXIBILITY AND SPEED

Budapest Airport control system engineers benefitted from zenon's great flexibility. Native drivers and interfaces to more than 400 third-party systems and components ease the task of integrating PLCs, drives, and sensors from an unparalleled range of manufacturers.

The options for designing zenon projects provide a similarly high flexibility. The zenon principle is "parameter setting, not programming". There are libraries with Smart Objects that can be used to create pictures, functionalities, and combinations thereof. They can be reused anywhere in the system and adapted for the individual purpose by setting parameters. It is, therefore, sufficient to store and maintain them centrally. Changes need be made only once. They automatically become effective in all relevant sub-projects without any further action.

Budapest Airport's control system department used the zenon software platform to create a high-level operating system for the air-ground lighting system including twelve redundant PLCs.

The visualization for the baggage handling system with more than 1,000 conveyors was created in two weeks purely by parameter setting.

> "Using zenon, we were able to create the visualization for the BHS, incorporating more than 1,000 conveyors, in only two weeks and with only six hours for the entire AGLS go-live."
>
> Géza Kulcsár,
> Control Systems Group Leader
> at Budapest Liszt Ferenc
> International Airport

A UNIFIED VISUALIZATION CONCEPT

These zenon properties considerably accelerate engineering work, at the same time as eliminating some notorious sources of error. To refurbish the BHS, most of the work went into creating the datapoint list because some of the information found in the control system documentation did not correlate with reality.

"Using zenon, we were able to create the visualization for the BHS with its more than 1,000 conveyors in only two weeks," Géza Kulcsár reports. "For its configuration, we used standard zenon as is and did not need to write a single line of code."

DESIGNING THE FUTURE WITH ZENON

The zenon based solutions proved effective and efficient in everyday operation. System stability has risen to a level hitherto unknown. Likewise, the effort required for adaptations and modifications has been greatly reduced. The airport team no longer needs to lean into third-party support. Moreover, the standardized screens have considerably improved the system's ease of operation.

Encouraged by these improvements, Géza Kulcsár now plans to use zenon to integrate the airport's building automation and power supply systems. "I consider it a major benefit of zenon that our team of seven now has all the technology in its own hands," he says. "This made it easier for us to ensure operational readiness in spite of access restrictions for non-company personnel during the COVID-19 pandemic."

COPA-DATA PARTNERS

The COPA-DATA Partner Community (CDPC) is a global network of specialists in the fields of industry and energy automation. It is based on long-term and sustainable business partnerships, two of them here:

PROTASIS

Greece

SILVER

ABOUT US

We, at PROTASIS Engineering & Consulting have 20+ years of expertise and innovation in delivering expert design and planning, engineering, technical consulting, and customized solutions for advanced protection, automation, and control. We work in more than 20 countries across Europe, Africa, the Middle East, and Asia.

OUR SOLUTIONS WITH ZENON

We provide turnkey solutions for the energy market and RES installations and use zenon Energy Edition to control and monitor industrial systems, including:

- Power management systems
- Substation automation systems
- PV SCADA applications
- BESS SCADA applications

OUR CUSTOMER PROMISE

PROTASIS provides the most reliable SCADA solutions, especially for power and energy management and substation automation systems. We choose to work with zenon because it is not affiliated with any intelligent electronic device (IED) vendors. This means we can keep our promise to supply customized solutions which are tailored to our customers' needs.

PROTASIS engineering & consulting *with power, we perform*

WWW.PROTASIS.NET.GR

COGNIZANT

Ireland

GOLD

ABOUT US

Cognizant's Life Sciences Manufacturing group delivers digital solutions to support our clients' Manufacturing 4.0 initiatives. We work across batch automation, data infrastructure & intelligence, MES, lab automation, CSV, and digital technologies with deep life sciences expertise. Our 30,000+ skilled professionals in 37 countries work across the entire manufacturing life cycle from project conception to completion – for better connected IT and OT systems and more informed, data-driven decision making while adhering to Good Manufacturing Practices (GMP).

OUR SOLUTIONS WITH ZENON

We work with clients to implement zenon as an integration layer across the shopfloor, providing a single point of interface. zenon Smart Objects, MTP software, and numerous drivers allow for the easy integration of shopfloor equipment and zenon tools, such as the SAP connector, make it easy to interface with manufacturing business systems.

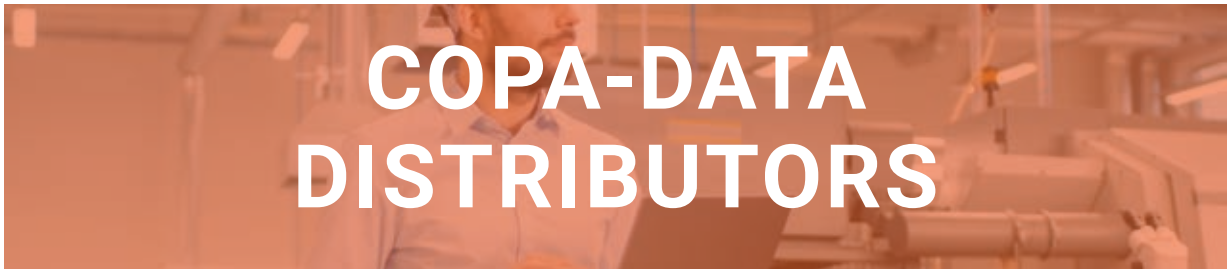
OUR CUSTOMER PROMISE

We support our customers in the digital transformation of their facilities. Data flow is key to digital transformation and we help our customers achieve the necessary connectivity. With zenon, we enable our customers to achieve our shared goals of advancing science, optimizing manufacturing, and improving outcomes for patients.

cognizant intuition engineered

WWW.COGNIZANT.COM

COPA-DATA Partner Community
440+ members worldwide in 70+ countries



COPA-DATA DISTRIBUTORS

zenon is a globetrotter. The COPA-DATA sales network spans all continents, from North America to Australia and consists of subsidiaries and distributors. We introduce two distributors here:

LINX SOUTHEAST ASIA

Singapore

ABOUT US

LINX Southeast Asia is the leading distributor of automation equipment in this region, with the headquarters in Singapore and offices in Malaysia and Thailand. We collaborate with partners who develop quality, cutting-edge technology products and who share our vision of delivering innovative technology solutions for our customers. We have a strong focus on advanced manufacturing, robotics, and the IIoT.

OUR SOLUTIONS WITH ZENON

LINX SEA (Southeast Asia) is thrilled to spearhead our IIoT and SCADA automation work with the formidable capabilities of zenon. By integrating the robust software platform into our portfolio, we are primed to revolutionize the industrial and infrastructure sectors. With zenon as our chosen automation software, we will lead sustainable technology adoption across the region.

OUR CUSTOMER PROMISE:

We forge loyalty by consistently advancing our customers' businesses. We empower our customers, providing them with streamlined solutions to implement their strategies effortlessly, swiftly, and with purpose.

LINX

WWW.LINX-SG.COM

International sales network
14 COPA-DATA locations & 18 zenon distributors

D.T. PARTNERS

Brisbane, Australia

ABOUT US

As exclusive Australian and New Zealand distributor of zenon, we provide local product & engineering support and training, working closely with COPA-DATA to ensure that local needs are addressed.
Our team of experts is passionate about delivering innovative automation and engineering solutions that meet our clients' needs. Our values center on technical competency and customer-focused service, delivered under global quality standards. We continually strive to exceed the expectations of our customers and build lasting, high-value relationships.

OUR SOLUTIONS WITH ZENON

We have already successfully developed and delivered many customer solutions within the utility industries, including electricity transmission and distribution, renewable generation, and gas infrastructure. With our template-based zenon solutions, our energy customers are able to auto-generate project designs in zenon.
And, we also have an established record in delivering zenon development and support services in other industries, including infrastructure, pharma, life science, and food & beverage.

OUR CUSTOMER PROMISE

Together with our partners, we can facilitate the modernization of your automation and control systems, integrating with other digital systems. Our staff is providing our customers with local training, coaching, and support to achieve project and business success.

DT Partners

WWW.DTPARTNERS.COM.AU

ISSUE #41

IU INFORMATION UNLIMITED by COPA-DATA

PRESIDENT AND PUBLISHER: Thomas Punzenberger; Ing. Punzenberger COPA-DATA GmbH
Karolingerstrasse 7b; 5020 Salzburg, Austria
Commercial Register Number: FN56922i
T +43 (0)662 43 10 02-0
F +43 (0)662 43 10 02-33
www.copadata.com

EDITORS-IN-CHIEF: Robert Korec, Christina Andexer, Sebastian Bäsken, Stefan Eder

EDITORIAL TEAM: Eva Oberauer-Dum, Esther Rutter

ART DIRECTOR: Kathrin Machmer

ILLUSTRATIONS: VerVieVas, www.vervievas.com

COPY EDITING: Supertext Deutschland GmbH, Berlin, Germany

AUTHORS/CONTRIBUTORS: Emilian Axinia, Sebastian Bäsken, Cagdas Basoglu, Mark Clemens, Garry Forfar, Georg Güntner (guest author), Günther Haslauer, Stefan Huber (guest author), Peter Kemptner (guest author), Daniel Kieninger, Bernhard Korten, Michelle Kurz, Robert Merz (guest author), Thomas Punzenberger, Barbara Rameseder, Stefan Reuther, Josef Ries, Stefan Robl, Thomas Rostenstatter (guest author), Olaf Saßnick (guest author), Philipp Schmidt (guest author), Matthias Schnöll, Charles Tisdell (guest author), Phillip Werr, Lewis Williams, Bernd Wimmer

PRINT OFFICE: Offset 5020 Druckerei & Verlag Ges.m.b.H.,
Bayernstraße 27, 5072 Siezenheim, Austria

LETTERSHOP: Pro mente Job Training Center, Siezenheim,
Angerstraße 10, 5071 Wals-Siezenheim

PRINT RUN: 5,100 copies

CONTACT/ FREE SUBSCRIPTION: IU@COPADATA.COM
WWW.COPADATA.COM/IU

linkedin.com/company/copa-data-headquarters
facebook.com/COPADATAHeadquarters
xing.com/companies/copa-data
youtube.com/copadatavideos
instagram: @copadata_insights

Validate your MTP files **ONLINE!**

Plug & Produce with zenon MTP Suite

Manage PEA Instances
Configure your equipment

Process Orchestration (POL)
Connect your equipment

Validation of MTP files
Based on VDI/VDE/ NAMUR 2658

PEA Software Suite
Visualize and control your skids

MTP Editor
Edit or create MTP files

MTP Gateway
Integrate existing equipment

go.copadata.com/mtp

zenon
by COPA-DATA