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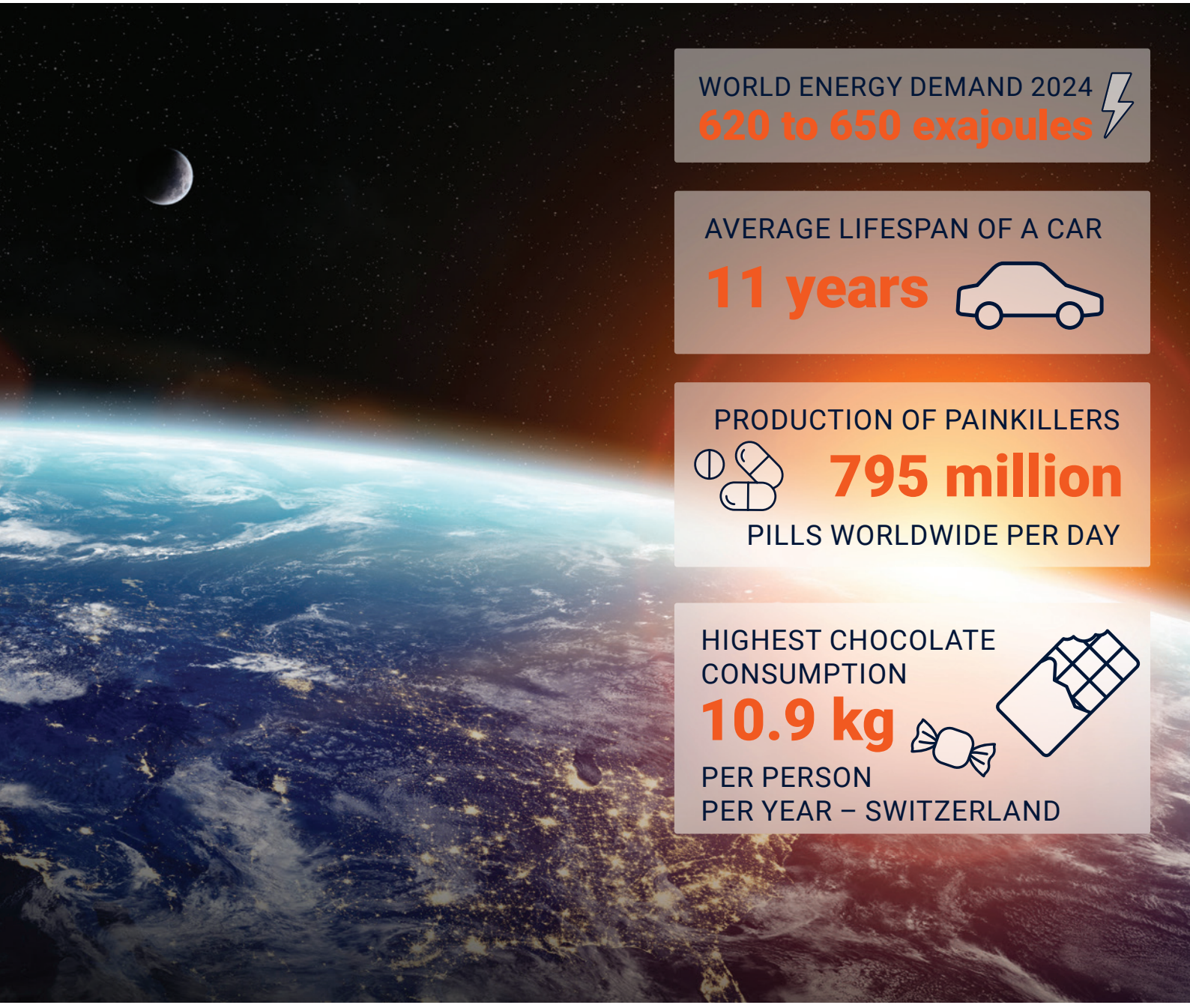
THE COPA-DATA MAGAZINE #43|2025



SPOTLIGHT

The World of Data

EDITORIAL

When it comes to gaining insights from data, discovering new potential, and generating innovative ideas, algorithms are currently in the spotlight – and with good reason. Yet in addition to algorithms and their related computing power, another star has come into the spotlight: the underlying data itself. In this edition, we focus on the importance of data and how we can make the most of our treasure troves of data. They are a foundation for further work – whether for simple evaluations, statistical analyses, or in AI algorithms. This edition is also inspired by data's practical applications: insights that enable us to work better are often found directly in the data. Let's discover these treasures together. Good places to find inspiration are the practical tips and testimonials in the articles starting on pages 20, 33, and 47.

Other key topics for the further development of our zenon software platform are virtualization and Control as a Service. For many years we have offered customers a virtual PLC solution integrated in our software platform. In recent years, the rapid convergence of IT and OT has brought these topics into focus among early adopters in the industry and the energy sector. At COPA-DATA, this trend is welcome because, as a software company, software-defined architectures are particularly important to us. For more information, please read the articles starting on pages 24 and 28.

Sustainability is always a hot topic at COPA-DATA. zenon users and our in-house experts, specifically Emilian Axinia, have long recognized that sustainability and commercial success can be two sides of the same coin. And zenon is the ideal tool to promote sustained commercial success – check out our new column on sustainability starting on page 40 of this edition.

Be inspired!

Thomas Punzenberger

THOMAS PUNZENBERGER,
CEO

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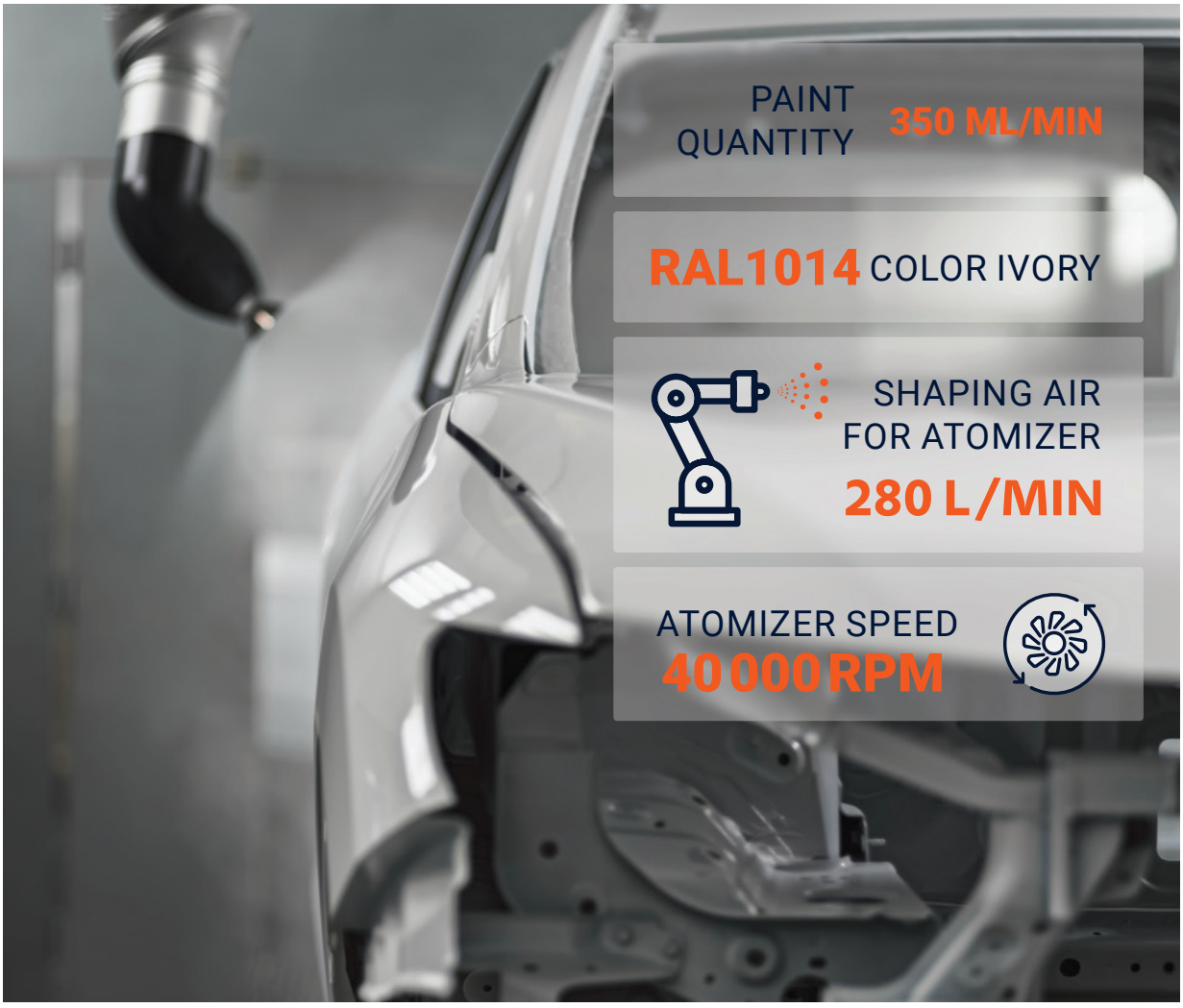
AROUND THE WORLD

Data on cover based on estimates. The graphs on pages 6, 8, 12, 15, 18, 38, 56 show data that can be collected using our software platform zenon. These are examples.


OUTFEED BELT SPEED 50%
PROCESSED VIALS
5623
REJECTED VIALS 56
FINAL WEIGHT TARGET
1100 g

SPOTLIGHT

THE WORLD OF DATA



BETTER GOOD AND RELIABLE DATA THAN BIG DATA

Much attention is currently given to the algorithms embedded in the tool sets that are being developed in the rather exciting and overlapping fields of data science, statistics, and artificial intelligence (AI). But what basic data are needed? The good, the big, the unexpected?

AUTHORS: ARNE C. BATHKE, WOLFGANG TRUTSCHNIG

Undoubtedly it is very useful to have an understanding of the algorithms and of the models on which these algorithms are based, as this proves highly informative regarding their potential, their robustness, their sensitivity, and their limitations. Depending on the complexity of the algorithms, their understanding often requires somewhat advanced mathematical reasoning at a level not accessible to everyone.

MAKING SENSE OF DATA

However, we find that the importance of the underlying data and their quality is often being neglected, even though basic data quality checks can be done by pretty much anyone, even without much formal mathematical training, often simply by applying sharp common sense. And data are the basis for any prediction. No AI can run without data, either by being pre-trained or by observing the environment and thus harnessing live data.

Data are indeed at the center of data science, and also in the field of statistics, the key slogan has been "making sense of data" for decades now. Adding to this, the consequences of suboptimal data quality can be quite dramatic and lead to wrong conclusions/decisions, including when viewed in comparison with the consequences that can arise from suboptimal algorithmic tools. Arguably, the potentials and limitations of AI can only be appreciated if users of AI tools have at least a basic understanding of the role of data and the importance of data quality, and of the most common mistakes and pitfalls that are generated, among others, by biases and seemingly paradoxical situations. Therefore, in this contribution, we focus on data and their central importance for data science, statistics, and AI, and for applications in IT and OT.

WHAT'S NEEDED TO DECIDE PROPERLY?

To this end, let us first review the essential workflow for gaining insights and making decisions based on available quantitative information. For other goals such as optimized automation or machine control, the workflow needs to be adapted somewhat, but for simplicity, we'll focus here on the goal of decision making which we all need to do on a daily basis anyway. When trying to structure this workflow from a data science point of view, the following six-step procedure that can be abbreviated as ADD-PIC may be helpful:

(A) ASKING SENSIBLE, RELEVANT QUESTIONS

(D) DATA ACQUISITION/EXTRACTION

(D) DESCRIPTION AND QUALITY CHECK

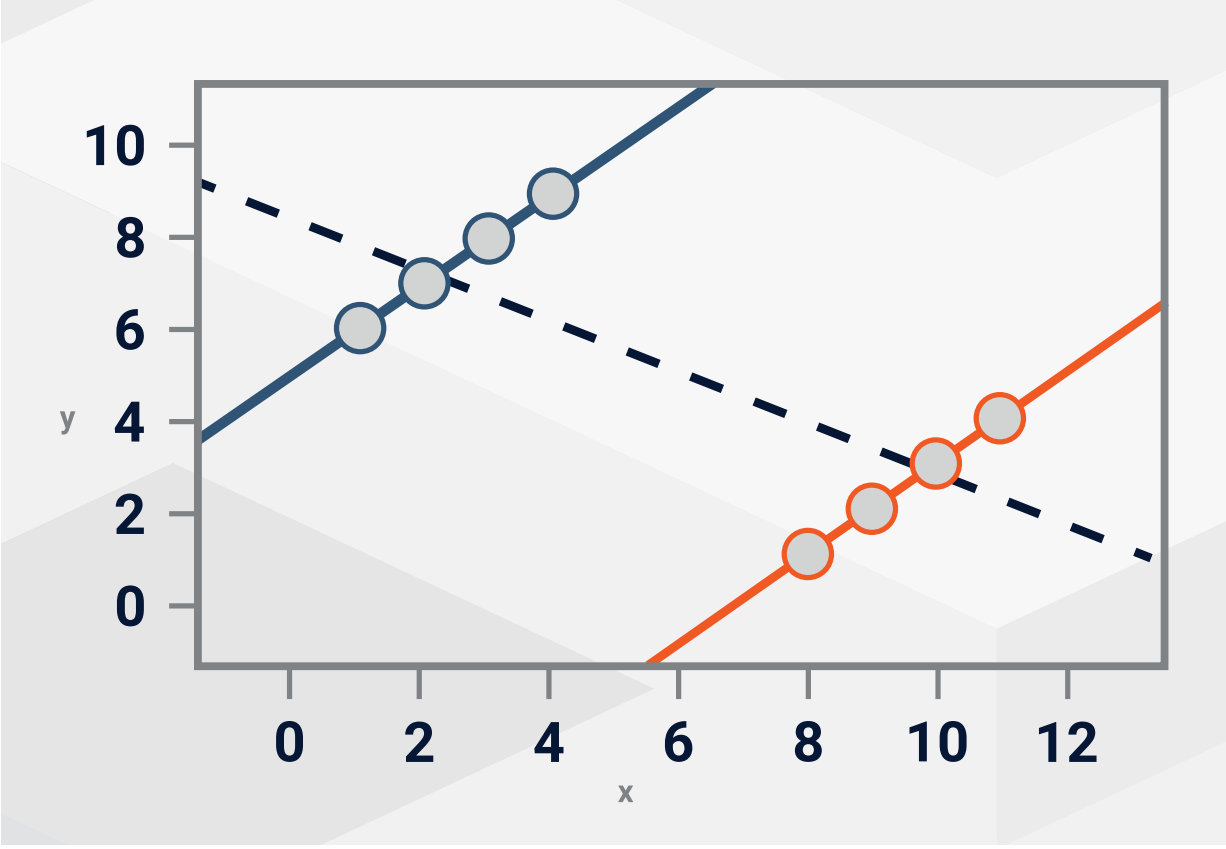
(P) PREDICTION AND GENERALIZATION

(I) INTERPRETATION

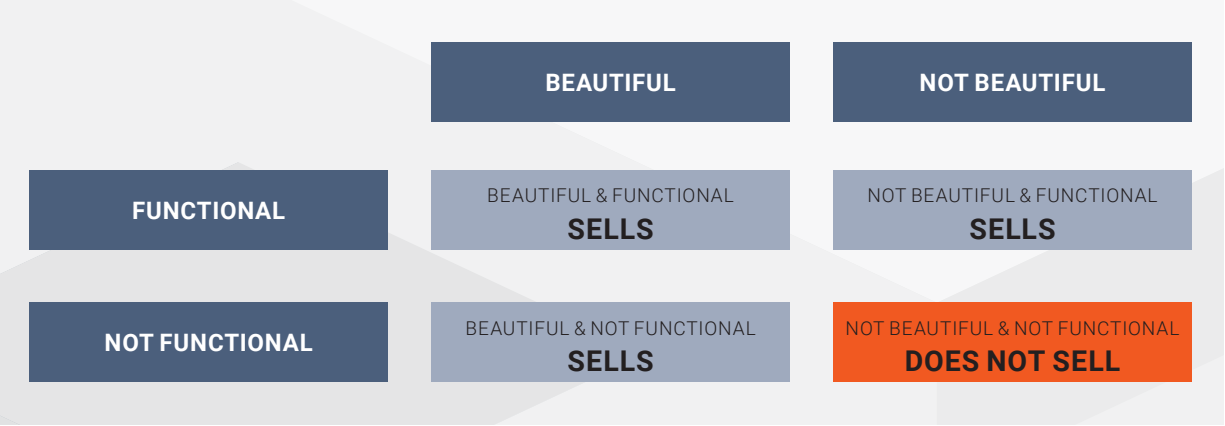
(C) COMMUNICATION

QUESTION YOUR DATA ACQUISITION

It may seem unusual at first that the workflow starts with the explicit point of asking questions. But firstly, you can always find something in data – and if you don't know what you have been searching for, what you find could likely be artifacts, outliers reflecting natural



Simpson's paradox for quantitative data: a positive trend (—— , ——) appears for two separate groups, whereas a negative trend (– – – –) appears when the groups are combined.



Berkson's paradox in a simplified way: It seems that functionality and beauty are negatively related. But it might be an issue of sampling bias that created a wrong conclusion.

variability, or findings that are not reproducible. Consequently, in the context of clinical trials, fixing (and in some sense sticking to) the right questions has been formalized in the last decades, in order to reduce opportunities for manipulation and to render medical research more reproducible. And secondly, the relevant question that has been formulated at the outset often determines which data will be appropriate or even optimal in order to provide the grounds for meaningful insights. Asking even only slightly different questions may sometimes require a different data structure or indeed totally different data for obtaining the corresponding maximal insights.

And now – the data acquisition. Which data source(s) can or shall be used? Which variables are needed? Measured on which experimental units or devices? At what spatial or temporal resolution? At which stages in a production process? Often convenience and data accessibility (and size) are the decision drivers here, but in our experience, astonishingly good results can often be achieved with only a few carefully chosen features/variables, measured on a set of experimental units. In fact, often a problem that appears to be overwhelmingly high-dimensional is essentially driven by just a few input variables, measured at an optimal resolution. Finding the perfect set of variables (a.k.a. feature selection) is not a trivial task, however. Here, the data scientist or statistician and the domain experts for the respective situation (e.g. the production engineer or the sales manager) need to work closely in tandem and benefit from each other's experience. Numerous projects have shown that teaming up in the aforementioned sense leads to optimal outcomes.

JUDGING WITH COMMON SENSE TO AVOID BIASES

A key non-mathematical criterion for "good data" is the representativity of the acquired data for the descriptions and predictions that are to be made. And a surprisingly good judge of whether a data acquisition method will be appropriate for the actual needs and the underlying question is provided by our common sense and life experience, ideally sharpened by the knowledge of some key data concepts (such as bias), and the awareness of common mistakes to look out for. Let us dive into some of these.

Bias: In general, bias stands for a systematic deviation. Selection bias happens if experimental units are systematically excluded from the data acquisition. For example, if only data from machines in location A and B are obtained, but based on these data, also decisions on adjusting controls on machines from locations C and D are to be made, it is easily conceivable that problems could occur if, say, locations A and B are warmer or at a higher altitude than C and D. Nonresponse bias happens if you try to obtain measurements from a unit, but you don't succeed, due to circumstances that may have a bearing on your decisions. For example, consider the situation where whenever it is too humid, a particular measurement device does not produce data. Clearly the resulting data set is biased as it systematically excludes measurements under certain conditions. It could also lead to a situation of Berkson's paradox (see below). And if, for example, a temperature sensor yields measurements that are consistently lower than the actual temperature, this is called measurement bias. No sensor or measurement device is perfect, therefore it is important to gauge and calibrate each device whose data will be used at the onset and regularly. This type of bias can go undetected for a long time and have lasting effects on your (then biased) analyses.

Investigating potential sources of bias is one useful step towards data quality, data integrity, and reproducibility – and one that can be performed with mostly common sense and domain knowledge. This process also involves agreeing on a clear and consistent definition of the variables, and the relevant meta-data. Is a particular variable measured in the same units and using the same definition at every important location and on each device? And does this definition follow industry stan-

dards and norms, facilitating future comparisons and scalability of the data collection?

Simpson's paradox: Deciding on which variables to use for the data acquisition is vitally important because the omission of an important variable can lead to decisions that are exactly wrong and opposite to what should have been decided. For example, it may seem that whenever you increase input X, you achieve a higher output Y, but when you take the measurements on the important variable Z into account, you notice that the trend is reversed (therefore it is referred to as a paradox). The best way to protect yourself from this mistake is to build on the collective experience of all involved domain experts to make sure that all the important variables are indeed included.

CHOOSING RELEVANT DATA FOR BEST-POSSIBLE INTERPRETATION

Multicollinearity or Overfitting: Based on the previous point, one could think for a moment that data from all available variables should be included into the analysis, in order to avoid Simpson's paradox. However, that is not the case. Redundant variables actually reduce the quality of predictions and lead to numerical instability (going so far as to erroneously indicate a positive influence of some features). Including more variables only makes sense when they provide independent information. Think of placing temperature sensors in a production environment. Common sense already tells us that it does not provide additional information if we place an additional sensor very close to one that is already installed. Perhaps surprisingly though, it can even make predictions worse. An adequately performed feature selection process will then try to filter out the most important variables bearing in mind the main questions initially asked.

Thus, more variables are not necessarily better! Neither are more data points necessarily advantageous. The key is to have high-quality data fit for purpose. But let's look at one final paradox that is known in the literature as Berkson's paradox: Changing the classical example into an industrial application, assume the very simplified situation where a product sells beyond the threshold T if it is either functional or beautiful. Certainly, the real world is a bit more complex, but for illustrating the paradox, this shall suffice. Now you look at all the products that have sold beyond the threshold T. Your analysis yields that every non-beautiful product is functional, and every non-functional product is beautiful (otherwise, they would not have sold beyond T). What would you conclude? Of course, that functionality is negatively related to beauty. But this conclusion may be totally off; in fact it may be that the relation between these attributes is positive! What went wrong? We ignored those products that did not sell beyond T, and this sampling bias alone allowed for the wrong conclusion.

Having suboptimal data will lead to suboptimal decisions, or to suboptimal performance of your data science, statistics, or AI algorithms. In this contribution, we have highlighted a few things to look out for. Most of these can be spotted without advanced technical training, just using common sense and subject matter expertise. And we definitely advise to go for high-quality data that fits the question you are trying to answer. It may not only give you better answers, but often at reduced cost, compared to a "big data" approach.

IDA LAB
INTELLIGENT DATA ANALYTICS SALZBURG

WOLFGANG TRUTSCHNIG, ARNE C. BATHKE

Both authors are statistics professors at the Paris Lodron University of Salzburg (PLUS), in the Department of Artificial Intelligence and Human Interfaces (AIHI). Their research, both basic and applied, focuses on nonparametric statistics and dependence modeling. Nine years ago, they started the first Data Science Master's program at an Austrian university. As a consequence of this, as well as through through the mandatory industry internships of their students and the many Master's theses written in collaboration with industry partners, both have worked with a wide range of Austrian and international companies. Since spring 2020 the industry and interdisciplinary collaborations have been structured in the Lab for Intelligence Data Analytics Salzburg (IDA Lab), and COPA-DATA has been one of the premier partners, actually right from the start. Their Master's program is international, and it accepts competitive student applications from around the world.

Website:
www.plus.ac.at/aihi/der-fachbereich/ida-lab/about

IDA Lab on LinkedIn:
at.linkedin.com/company/ida-lab-salzburg

Data Science Master's program:
datascience.plus.ac.at

DATA FLOWS AND COMPLIANCE LEVELS

Gold, salt, and crude oil – data has been compared to many valuable commodities. It has been called the currency of the 21st century. That might sound trite, but there is no doubt that data's importance today is huge. Yet what are the basic conditions for using data? Information Unlimited set out to find the technical and legal answers.

AUTHOR: MICHAELA HASSLACHER, PUBLIC RELATIONS MANAGER

What is data? The question is simple but by no means trivial – because the answer is not as clear as you might think. Linguists consider data to be the plural form of "datum". However, computer science, philosophy, economics, and law each look at the term from a different perspective. In general, data is something "given" (Latin "datum" = "an item given"): an entity that records something. This can, for example, be an observation at a specific time and place. In computer science, data is recorded and stored in binary form. If these data points can be interpreted, they become information. Today, in the digital age, massive volumes of data are being generated – and they need to be managed. Online shopping, the smart refrigerator, video clips on Instagram, emails, payment by credit card: our everyday lives are filled with digital data. What began in the early days with basic records has transformed since then into "big data". Together with artificial intelligence (AI), this requires huge storage to prepare data, capture training models, and produce results.

FROM A STREAM TO A RIVER

Data has also found its place in production – and not just since Industry 4.0. "90 percent of our work revolves around data," says Thomas Lehrer, Product Manager at COPA-DATA. "It 'floods' production by setting out on a long journey. It changes from a stream to a river." For example, metadata – such as data quality or batch information – enhances sensor values from field level. This may be followed by switching to another system. How quickly data becomes available can be crucial – and not just on the stock exchange. The following rule also applies: the more usable data there is, the more valuable it is. "Knowledge comes from data. It helps to provide clarity," says Mark Clemens, Product Manager for Connectivity at COPA-DATA. For example, data insights could make it possible to identify a waste of resources or to reduce the use of materials. However, data analysis can be time-consuming, especially in production. A good data landscape is characterized by both high-quality data and data on quality.

> "Data is transforming from a stream to a river."
>
> Thomas Lehrer on the powerful impact of data

PROTECTING AGAINST CYBERATTACK

It is helpful if data points speak the same language or, in other words, share the same format. The zenon software platform enables users to standardize data from virtually all sources, regardless of manufacturer. However, with older machines and equipment, it is typically difficult to generate extensive data because the interface is missing. Mark Clemens explains, "When facility A and facility B cannot be compared, opportunities get lost." At least from a data perspective, it can be beneficial to start from scratch. Another topic is the European Directive on Network and Information Security 2 (NIS 2). In contrast to the General Data Protection Regulation (GDPR), this directive has less to do with the data itself than with protecting the data from cyberattack. NIS 2 requires equipment operators to safeguard their systems. Of course, this is not the only legal aspect surrounding data – more about this in the following interview.

INTERVIEW

INTERVIEW WITH ÁRPÁD GERÉD

Árpád Geréd is a specialist in data law. After practicing law as an attorney for many years, he recently switched to "the other side". As a compliance expert, the Vienna native joined the team at the security company Genetec (read more in the infobox). Information Unlimited asked him about the much-discussed topic of data.

Mr. Geréd, we all deal with data, both in our private and professional lives. But what is data from a legal perspective?

Árpád Geréd: This is a frequently asked question, but not all data are the same. When we speak about data in general we often mean personal data. That is, information covered by the General Data Protection Regulation (GDPR). In information technology, however, we also have to deal with research data, source code, or financial data, for example. This also requires security measures. It is where the rules of the NIS 2 directive come into play. In theory, it would seem like a simple solution to treat all data as personal – but in practice this only creates problems.

Protecting personal data is also a complex topic, right?

Árpád Geréd: First, I have to know what my objective is: what data do I want to process and for what purpose? There are a lot of misunderstandings around this topic – for example, that transferring data from Europe to the United States is prohibited. However, the GDPR does not prohibit anything. The question is simply: how high is the "compliance level" that I need to

meet in order to comply with data privacy regulations? It can sometimes be overwhelming, or at least it can feel that way. For this reason, I recommend looking critically at the data flow: where can I be more efficient so that I have fewer legal hurdles to overcome?

> “The question is simply: How high is the compliance level?”
>
> Árpád Geréd on what is permitted in data privacy

Assuming I have free rein because I am starting from scratch, what do you recommend?

Árpád Geréd: First, it is important to think carefully. For example, ask yourself the following: what type of data do I want to use? How do I want to use the data? What is the IT architecture? Who is permitted to do what? How do I separate personal data from other data? How do I protect the vulnerable interfaces between operational and information technology? Then I would definitely recommend a data processing directory. This type of overview can help you to better understand your own data relationships. This is important, because there is no one-size-fits-all solution in the data universe. However, a pure greenfield approach is rarely used in practice.

Let’s switch topics and talk about process control software. What legal aspects come into play here?

Árpád Geréd: In this case, as mentioned, entirely different rules apply compared to personal data. In some cases, the basic conditions also differ from industry to industry. A bank, for example, has different legal requirements to businesses in the automotive sector. Another new challenge for many companies is the aforementioned NIS 2 directive. What is particularly exciting here is the supply chain, the security of which has to be guaranteed. Further, a new dynamic can arise when subcontractors at home and abroad are involved. This also impacts the software, which has to be adaptable to meet all of these requirements.

We are hearing more and more about artificial intelligence (AI) in connection with data. What are your thoughts on this?

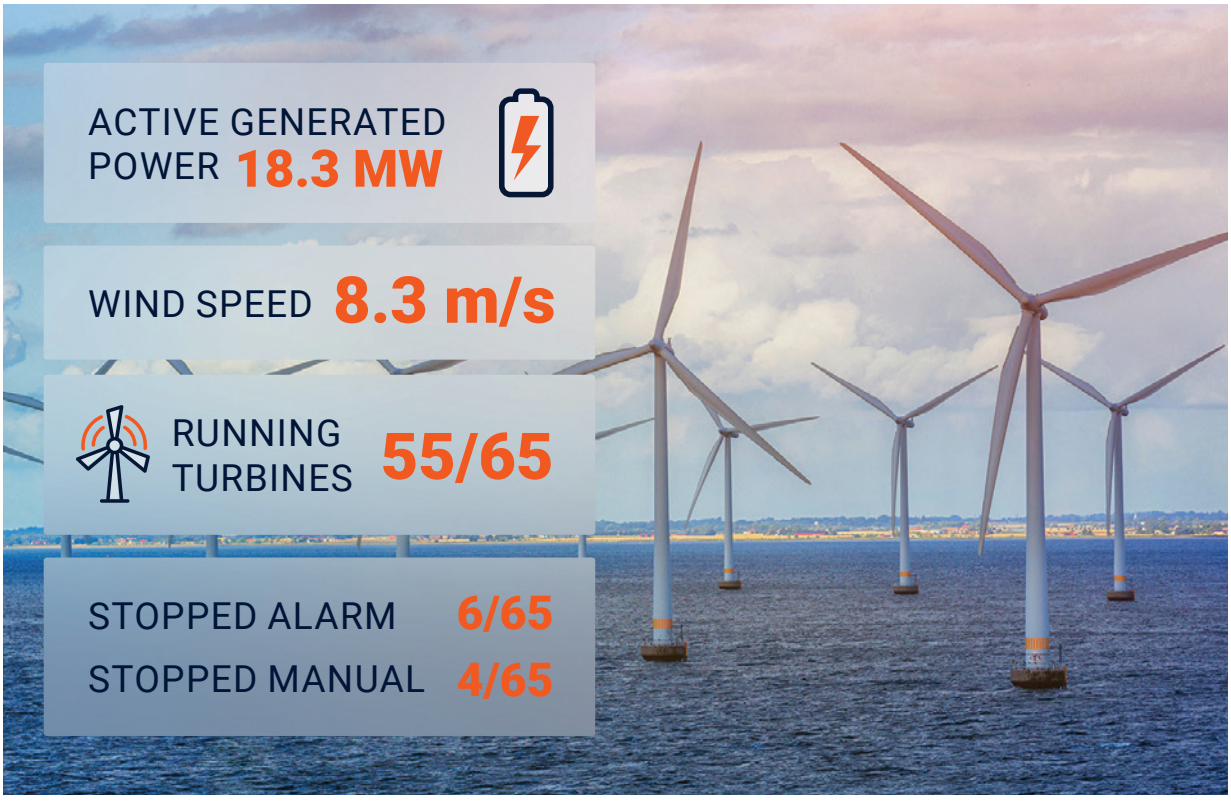
Árpád Geréd: One opportunity is that AI can self-learn to process and analyze data on a large scale. This has the potential to make threat patterns easier to detect. The media usually focuses on controversial issues, such as the transparent citizen, but AI could also avert damage to critical infrastructure. Of course, it also entails risks. This makes it important to handle AI responsibly. For example, the European Union has passed the EU AI Act, which sets standards for the use of artificial intelligence.

Finally, let’s look to the future – where is the world headed in terms of data security?

Árpád Geréd: We already mentioned that the EU is regulation-friendly. A lot will happen here in the future; security measures will continue to be rolled out. NIS 2, for example, came quicker than expected. NIS 3 will come at some point, too. Other things are happening in the background as well. For example, consumer protection for Internet of Things devices. The industry is going to be challenged on many levels.

Thank you for this interview, Mr. Geréd.

Compliance expert **ÁRPÁD GERÉD (45)** joined Genetec in February 2025 as Global Privacy Manager. The Canadian company, with 2,000 employees worldwide, develops solutions for physical and public security (more at www.genetec.com). The lawyer from Vienna worked for many years as an attorney specializing in cyber and information security, data privacy, and IT law. He has been fascinated with the law and information technology since his youth – an interest sparked by a love of video games.



DATA IS THE COMMODITY OF THE FUTURE

Consistent data is the backbone of the industry. But only when data is processed does its true value unfold. Software solutions such as zenon act as data refineries, where raw data is transformed into useful information that supports informed decision making and process improvements.

Building the capability to collect and manage, selectively use, and meaningfully interpret data is one of today's biggest challenges. Let's take a look at the recent past: Clive Humby is a visiting professor of computer and information science at the University of Sheffield. He is known for his work applying mathematical methods and computer science to consumer data, as well as for his phrase "data is the new oil" (2006). Even though the UN Sustainable Development Goals and numerous sustainability initiatives mean that many countries today put a focus on expanding renewable energy sources, the extraction and processing of crude oil into various end products remains a huge economic factor.

INTELLIGENT USE OF RAW MATERIALS

Data is rapidly catching up with oil in terms of its importance for the economy. Both "commodities" drive all kinds of trade and business activities, both directly and indirectly. Besides the subsequent negative effects released or created by humans, crude oil contains impurities after extraction and cannot be used directly. It must be processed first. Software solutions and data analysis tools play a key role in the processing of data – they act as a "data refinery" that extract useful insights from raw data.

Further processing of the raw material plays a critical role in turning oil into a valuable entity that drives profitable activities. This also applies to data processing. There are very limited applications for the pure raw material. In oil refineries, various processes such as distillation, conversion, and blending – depending on the planned use of the basic product – change oil into usable products. As with oil, the availability of large quantities of data can be worthless in itself. Data requires context. This context is created by using mostly

[1]Source: www.sheffield.ac.uk/cs/people/academic-visitors/clive-humby

Processing of oil

software-based data analysis tools. The biggest difference between oil and data is arguably their respective availability. As a finite natural resource, oil is in limited supply, whereas data appears to be infinite. It is, therefore, important to confine your activities to the relevant data.

CHALLENGES IN HANDLING (RAW) DATA

One of the foundations for using data effectively in industry is the consistent and seamless recording of process data. To manage this flood of data, state-of-the-art industrial automation software is essential. Advanced archiving features, combined with accurate time stamping and data precalculations, enable forward-looking management. They ensure the integrity and reliability of stored information, which is particularly important in regulated industries such as the pharmaceutical industry. It's about much more than simply capturing data.

The purpose of a robust software solution is to provide versatile tools for contextualizing data at both the automation and business levels. This capability enables companies to capture data in a homogeneous manner and transform it into valuable insights. Only with comparable data can contexts be identified and informed decisions made. Contextualizing and organizing data are the order of the day. Another essential factor is seamless communication across system boundaries. Depending on their requirements, data processing experts will need different options to get the most out of the "raw data" resource. Extensive interfaces allow data to be easily exchanged between systems, improving the flexibility and scalability of automation solutions.

Moreover, data is used in processes with different latency requirements. On the one hand, it has to be possible for developers to implement complex algorithms directly into the automation environment, which has to operate with low latency. On the other hand, data needs to be prepared for slower processes in easy-to-understand visualization tools, such as a clear dashboard or a simple Excel spreadsheet. These enable users to effectively interpret and communicate data to support decision making at all levels of the business. By collecting and analyzing operating data, industrial decision-makers can optimize the maintenance cycles, energy consumption, and downtime of their facilities. Combining this with AI technologies opens up new possibilities for predictive analytics and autonomous decision making.

HOW CAN ZENON SUPPORT YOU?

As mentioned already, one of the biggest challenges with the seemingly inexhaustible amount of data is capturing it in a form that is useful for analysis. This enables relevant information and insights about the process to be extracted from a massive amount of data. Recording data is one thing, but doing so in a consistent format is another challenge. This is exactly the challenge that needs to be met. With inconsistent data, it is hard to establish any good context at all. Or, as the saying goes, "garbage in, garbage out".

In the area of data recording and analysis, the zenon software platform provides the option to freely choose from over 300 different drivers. zenon provides a homogeneous data storage solution for a largely heterogeneous industrial landscape. This ensures that data is initially recorded in a homogeneous format and with a timestamp, regardless of its source.

Data has one major advantage over oil: it is compressible. Using the right methods, such as swinging door, data can be compressed and stored losslessly. And the question here should always be: what additional information does a recently recorded value provide? Can it be extrapolated from other measured

values with sufficient accuracy without becoming "garbage"? Even the most compact storage is only secondary to information retrieval, because data's added value only develops when the information it provides is processed properly.

Thanks to its numerous interfaces with other software applications, zenon offers a wide range of options for extracting information from data. Whether through statistical analysis, pattern recognition, forecasting using neural networks or the simple presentation of KPIs in a clear dashboard, a solution that is open and easily modifiable is ideal for meeting the growing number of use cases. zenon is one such solution.

Customizable solutions can be easily connected using time-equidistant processing via GraphQL or the Python API. This allows highly specialized analytics tools to work with a homogeneous database. In addition, the virtual PLC (programmable logic controller), zenon Logic, offers the option to integrate Python code directly in the IEC 61131-3 runtime environment. This enables direct interaction with process-related applications. The zenon Dashboard Service offers the option of creating suitable overviews on the fly to present the most relevant information in a clear and concise manner using preconfigured widgets. No matter what the path may look like for a specific use case, they all have one thing in common: the ability to access and build on the collected and homogenized data to get the most value from the information recorded. Thus, with all its versatility, zenon avoids the "garbage in, garbage out" trap.

WHERE DOES THIS ALL LEAD?

The countless possibilities for data collection make central and, moreover, homogeneous data storage essential. IT/OT convergence is in full swing, connecting the two previously discrete worlds. Both will remain separate, but their boundaries will shift, and their separation will become less sharply defined. The benefits of technology convergence toward one efficient entity are plain to see: increasing productivity, minimized errors, reduced costs, optimized workflows, and secure competitive advantage. However, the challenges of bringing together these two previously disparate worlds can only be overcome with a platform that speaks the languages of both worlds and purposefully drives unification. This is precisely why we continue to develop zenon based on the following equation: OT = IT with physics.

Source: xkcd.com/1838/

STEFAN EDER
Industry Marketing Manager

LUKAS PUNZENBERGER
Director Product Management

Lukas Punzenberger, in his role as Director of Product Management, leads a team of technical specialists to drive the central roadmap and strategy for zenon development.
As an Industry Marketing Manager, Stefan Eder is responsible for a wide range of solutions across various manufacturing industries – from Life Sciences and Food & Beverage to cross-disciplinary applications for greater sustainability with zenon.

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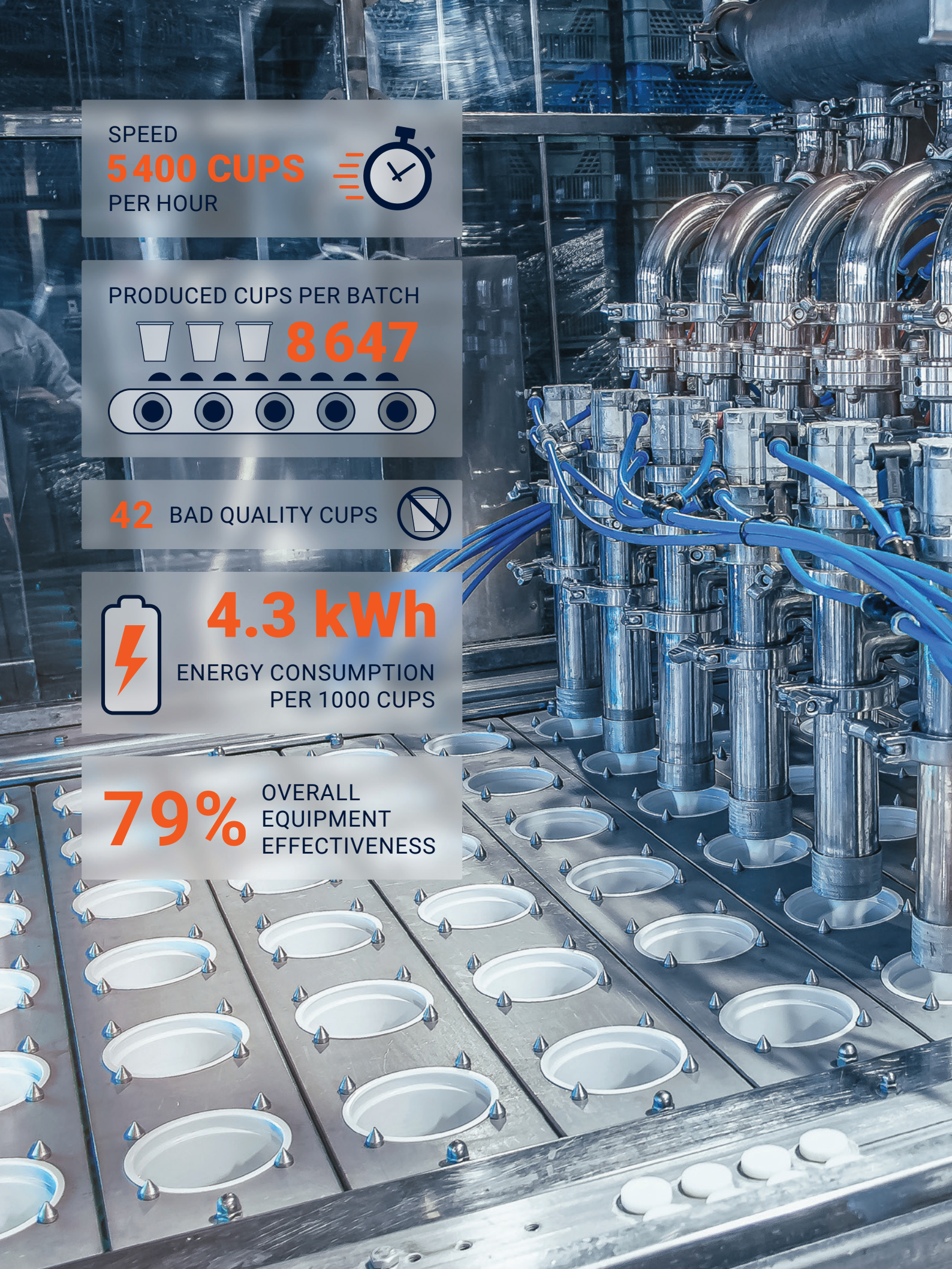
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PER HOUR
PRODUCED CUPS PER BATCH
8 647
42 BAD QUALITY CUPS
4.3 kWh
ENERGY CONSUMPTION
PER 1000 CUPS
79%
OVERALL
EQUIPMENT
EFFECTIVENESS

PRODUCTS & SERVICES

AI IN PRODUCTION: FOUR FALLACIES THAT CAN DERAIL YOUR DATA

Do you know the path your data takes? It takes precise knowledge to efficiently use data for analysis and forecasting, as well as making the right decisions. The interaction of automation (OT), historian archives, and AI is becoming increasingly important in this context. First, remember to take your foot off the brakes and avoid the following fallacies.

FALLACY 1: AI SYSTEMS WORK OFF THE SHELF

The idea of a magical black box that transforms raw data into intelligent analytics is tempting but unrealistic. In reality, integrating AI systems requires significant customization and manual effort.

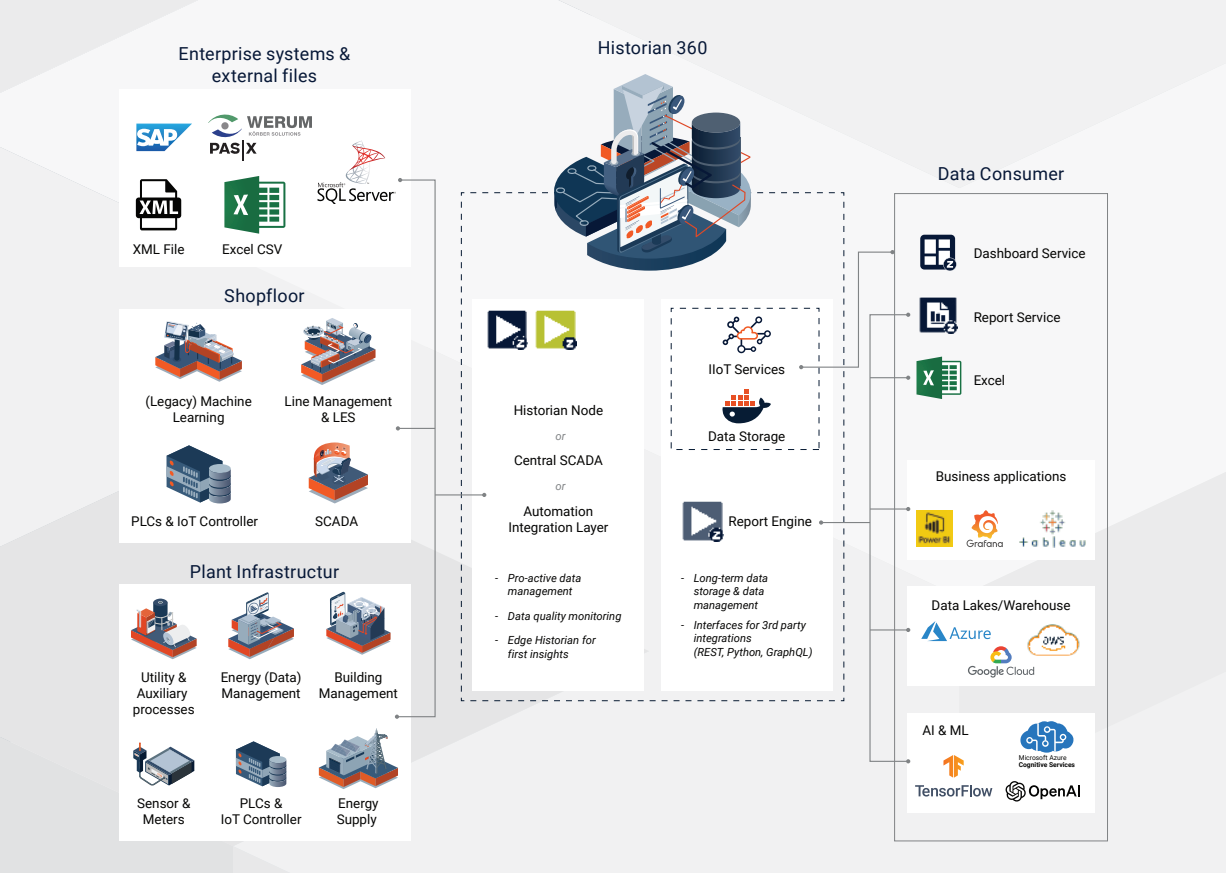
As early as the data collection step, connecting to legacy systems can be a challenge. Older machines and sensors are often not sufficiently digital. Regulated environments do not allow changes to equipment. SCADA and HMI applications use different communication protocols and store data in different formats. These factors lead to data silos and affect data quality, but more on that later. According to the Advanced Manufacturing Report[1], 36 percent of survey respondents struggle to integrate external data, while 35 percent struggle with internal data silos. How can you bring together the various sources, from sensors and controllers to SCADAs, energy data management systems, and building management systems?

zenon can do this thanks to more than 300 drivers, the add-in framework, and connectors such as the SAP interface. This means you can connect a wide variety of systems to the Historian 360 solution. In a regulated environment, you can use a Service Engine as a Historian Node to collect data without needing to intervene in validated systems. Data can then be stored in zenon IIoT Services, so that it serves as the "hub" for your production data. From here, AI systems can access the data via the IIoT Services API or the GraphQL interface.

FALLACY 2: DATA HAS TO BE PERFECT

It is often assumed that all production data has to be complete, flawless, and organized before you can use AI systems. What if you cannot access all sensors and actuators in a building management system but energy meters are accessible already? Or, are meters in production, delivery, and even PV systems also providing information already? The available data can help you to develop a solution in increments.

[1] Via Smart Industry, "Survey: Almost all manufacturers struggle with making use of data"; https://www.smartindustry.com/tools-of-transformation/data-analytics/article/33038304/survey-almost-all-manufacturers-struggle-with-making-use-of-data; accessed December 23, 2024



With Historian 360, your system can grow flexibly: begin with a Historian Node to collect the initial data without needing to intervene in a legacy system. Perhaps you are already using a Service Engine solution, for example, as an HMI or SCADA. In this case, you can also use it to collect and store data. Unstructured data can be organized basically during the acquisition step. With features such as measuring unit or the linear value adjustment, you can easily convert the measured values. In addition, the integrated virtual PLC zenon Logic enables more comprehensive formatting and standardization without losing raw data.

With each further development stage for your solution, you can implement additional Historian Nodes, as well as scaling up existing projects. This can help you to gain valuable information early on, but be sure not to trust blindly in analytics and predictions.

FALLACY 3: AI MODELS FOR OT DATA ARE COMPLETELY UNBIASED

AI systems require extensive training data. Low quality data can lead to bias, as explained in detail in the "Spotlight" section. The best way to minimize bias is to rely on common sense and the practical experience of domain experts, with whom you should work closely.

A balanced database containing relevant real-time and long-term data with meaningful context can also reduce the impact of bias. Historian 360 helps by ensuring that real-time data is read efficiently and collected without interruption, in a way that will be familiar to you from other zenon solutions. Long-term data is effectively compressed thanks to aggregation archives and the swinging door algorithm, making even large amounts of data manageable and easily accessible. Contextual information can be linked using alarm priorities, alarm groups, and alarm causes, and assigned to different areas based on equipment groups. Additionally, the asset modeling of IIoT Services enables you to link freely definable metadata, such as the year of construction or geodata, which can help to deliver further insights.

Contextualization and availability of data are essential aspects of good data quality, but there are other criteria you should keep in mind.

FALLACY 4: AI WILL AUTOMATICALLY FIX YOUR DATA QUALITY ISSUES

Breaking down data silos and contextualization are often not enough to obtain high-quality training data. Data scientists spend up to 80 percent of their time cleaning data. Improving quality not only means tedious work for analysts but it also costs a lot of money. According to consulting firm Gartner, poor data quality costs companies an average of USD 15 million. To ensure good data quality, proactive data management is essential as early as the data collection stage.

Data must be recorded fully, accurately, and without any errors in order to reduce the effort required for cleanup. If the sensor data is inaccurate due to vi-

[2] Harvard Business Review, "What Data Scientists Really Do, According to 35 Data Scientists"; https://hbr.org/2018/08/what-data-scientists-really-do-according-to-35-data-scientists; accessed December 23, 2024

[3] Gartner, "How to Create Business Case for Data Quality Improvement", https://www.gartner.com/smarterwithgartner/how-to-create-a-business-case-for-data-quality-improvement; accessed December 23, 20244

brations, for example, the value noise can be ignored during recording, similar to hysteresis in zenon.

All available data is not always relevant, as discussed by Wolfgang Trutschnig and Arne C. Bathke (pp. 8-11). If uninteresting data is generated, for example, during cleaning or maintenance, the Historian Node can pause the recording, add appropriate context, or filter it. This is made possible by event-driven archive recording or by temporarily deactivating alarms. Quality and data volume can be improved through aggregation and compression, such as the swinging door algorithm.

Valid and plausible data sets are also important. Are operator inputs correct? Were sensors calibrated correctly and values correctly stored? You can check this automatically, either using limits or input restrictions. Of course, your data can be made safe from attempts at manipulation, whether through interlocking, flexible user rights management, or the four-eyes principle of eSignature.

Proactive data management also includes automated quality checks and monitoring solutions during data acquisition. User-selected KPIs can be calculated in real time, such as deviations from tolerance ranges or reference values. Seamless data collection and retrieval can be monitored using audit trails, system events, and system driver variables. The Dashboard Service in IIoT Services enables location-independent and browser-based monitoring on a range of devices.

Overcoming these misconceptions is critical to getting the most from your solution. Historian 360 forms a reliable bridge between OT and AI systems. This enables you to unleash your data potential instead of slowing it down.

Here are some ideas for better data quality that can help you get the most out of the interaction between OT, historian archives, and AI.

Create a data catalog

Document master data, properties (metadata), and formatting of data. This facilitates traceability and consistent data management, especially when different departments use different units of measurement or naming conventions, for example.

Collect relevant and valid data

The purpose determines the selection of data points. Too much data can make predictions worse. Record the selection of relevant data in the catalog. Automate records based on production status or commissioning phases to capture only essential information. This reduces memory requirements and improves analysis speed.

Ensure data quality right from the start – and do so as automatically as possible

Historian 360 can perform real-time plausibility checks, highlight values outside defined limits, and support you with automated notifications. In addition, user interactions are logged in event lists to improve traceability. Continuous quality monitoring, for example, with the browser-based Dashboard Service, helps to detect errors early and maintain data integrity. This not only saves a lot of time and effort in terms of data cleaning, but also enables you to take steps proactively to prevent data from becoming "dirty" in the first place.

Use common sense and domain experience

It might sound obvious, but this often gets overlooked: it is important to draw on knowledge and experience from different departments to improve data quality and ensure accurate analytics.

ANITA PERCHERMEIER
Customer Experience Manager

Anita Perchermeier joined COPA-DATA in 2014 as a Screen and Interaction Designer. After five years as Project Leader for a Professional Services team, she now works as a Customer Experience Manager to ensure that our products and services not only provide impressive technology but also that their overall application delights our customers.

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USING PLC VIRTUALIZATION TO IMPLEMENT MODULARIZED CONTROL CONCEPTS

For almost 70 years, programmable logic controllers (PLCs) have been at the heart of machines, equipment, and factory automation systems. PLCs are increasingly being built in a modular manner. At the same time, demands on data processing and data communication are growing. In this interview, Lukas Punzenberger, Director Product Management at COPA-DATA, explains how zenon Logic provides a virtual PLC solution that enables machine and equipment developers to take a decentralized approach to process control technology – and why PLC virtualization is the future.

INTERVIEW: PETER KEMPTNER, FREELANCE TECHNOLOGY EDITOR IN SALZBURG

Digitalization and modularization are success factors for automated production and packaging systems. For this reason, the conventional, centralized structure of industrial control systems has long since given way to decentralized architectures. Data processing and communication no longer take place only on a central control computer. This computer shares tasks with specialized units, for example, for image processing, with controllers in the increasingly autonomously operating subsystems or machine modules, with edge devices, with external services in the company's own data center or in the cloud, and with higher-level process control systems.

The variety of decentralized solutions can be confusing and raises some questions. We asked Lukas Punzenberger, Director Product Management at COPA-DATA, to answer several of these questions in an interview.

Several control system manufacturers have recently introduced virtual PLCs. What do you think about this development?

Lukas Punzenberger: Virtual PLCs are not new. For several decades, many suppliers have been providing strictly software-based control systems that are independent of the hardware and are known as "soft PLCs" or software-based programmable logic controllers. As long as both the PLC logic and the application program are available only as software, a soft PLC solution can be run on almost any hardware. We call this a virtual PLC.

Does COPA-DATA have a virtual PLC offering?

Lukas Punzenberger: In fact, COPA-DATA has marketed a soft PLC solution in conformance with the IEC 61131-3 standard as part of its product offering for more than 20 years under the name zenon Logic. This solution is hardware independent and can be used as a virtual PLC. You can run programs and functions at any level. Our main focus is always on flexibility for users. So, there are no restrictions when it comes to choosing the best possible solution.

How extensive are the virtualization options in zenon Logic?

Lukas Punzenberger: Depending on where it makes more operational sense, zenon Logic can run on a PLC or an industrial PC directly in the machine, on an edge device in a control cabinet close to the machine, in the company's internal server room, in the corporate data center, or even on infrastructure as a service (IaaS) solutions from a cloud provider. To simplify the provision of PLC functionality regardless of the platform, we provide zenon Logic packaged in Docker containers. These can be easily transported and installed as files, thus ensuring the separation and management of the resources used on a computer. This makes the possibilities for virtualizing zenon Logic, and also for merging OT and IT, truly limitless.

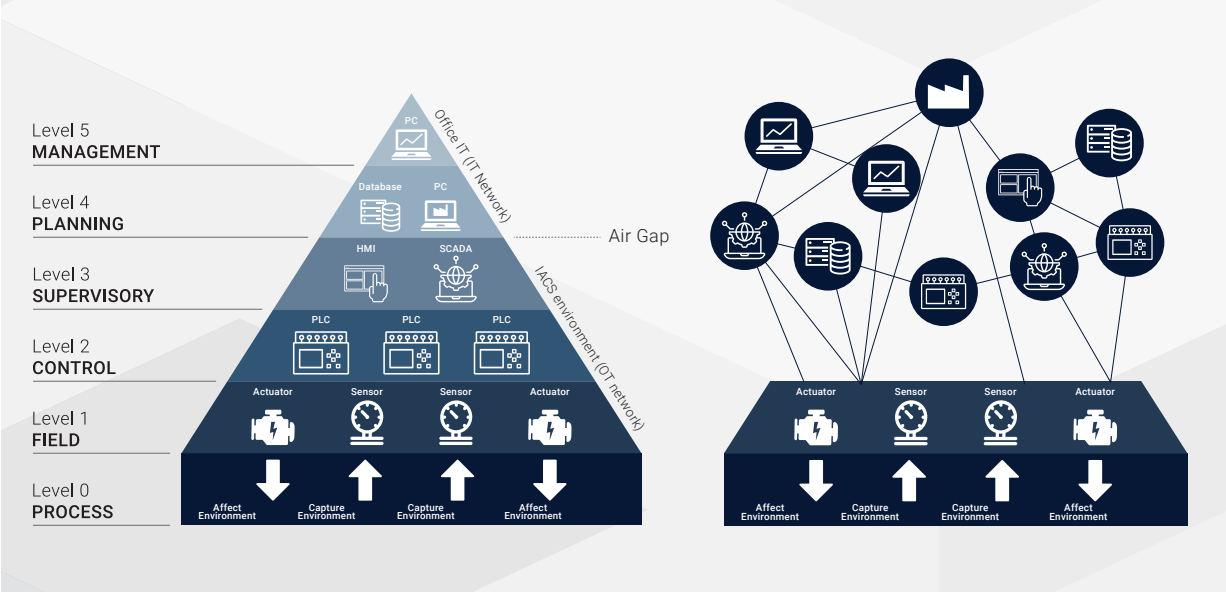
What sets apart zenon Logic from other virtual PLCs?

Lukas Punzenberger: zenon Logic is an integrated component of our zenon software platform for end-to-end equipment automation. As a result, the virtual PLC can also be integrated in larger projects without additional configuration activities.

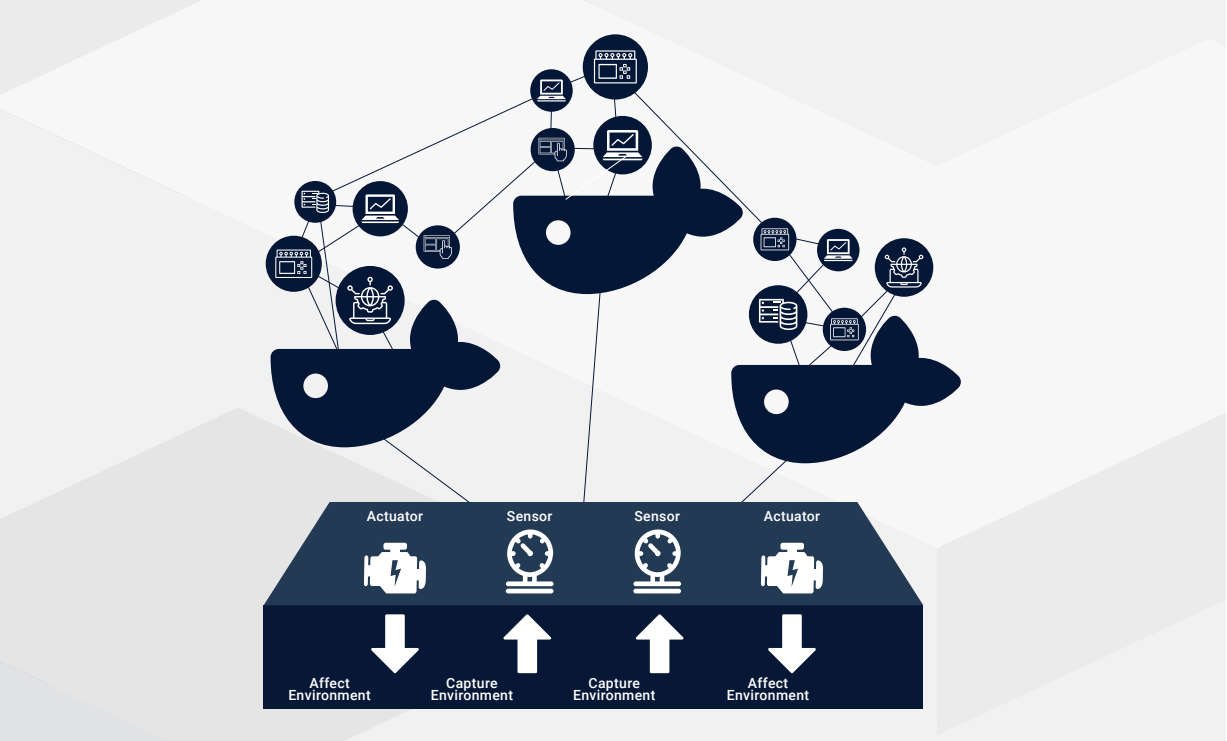
What is the benefit of embedding PLC functionality in an end-to-end zenon project?

Lukas Punzenberger: The purpose and function of the zenon software platform is to exploit the full potential of digitalization and automation by connecting machines and equipment, and monitoring, analyzing, and controlling them as a complete system. Using zenon IIoT Services, projects can also include machines and equipment at remote locations, as well as building management systems or energy systems and the connection to IT.

In addition to industry and hardware independence, zenon's strengths also include interoperability at all levels. The software platform is compatible with all commercially available industrial controllers, fieldbuses and variants of Industrial Ethernet as well as OPC UA. In addition, it meets industry-specific standards, such as those for power generation and distribution or those applicable in the life sciences and pharmaceutical sectors. In these settings, zenon Logic is a kind of silver bullet, because it makes it possible to implement PLC functionality anywhere in the overall system without installing hardware or intervening in existing subsystems.



In view of flexible, modular machines and systems, the classic automation pyramid is no longer valid.



The next step in virtualization is containerization. The full potential of this technology can be exploited by using containers.

Could you provide us with a use case?

Lukas Punzenberger: Although the zenon software platform already provides native interfaces as drivers for more than 300 different devices and systems, an intermediate step can be useful. The virtual PLC solution serves as a process-related component for addressing the sensors, for preprocessing the data provided by the sensors, and for directly controlling actuators that need to respond in real time. You can carry out engineering in the full, higher-level system. Programs run apart from the actual machine control system and therefore do not place any load on equipment.

When can this be useful?

Lukas Punzenberger: This makes it possible to manage additional sensors and actuators, particularly during retrofitting activities. In order to upgrade existing systems for Industry 4.0, it is often necessary to install additional sensors in and between machines. Integrating these in existing controllers is often impractical. In addition, in many cases this would not be possible without undergoing certification procedures again. If the sensors are connected to zenon directly or via zenon Logic, the existing CPUs and the programs running on them usually do not need to be modified at all.

Do you have to set up a complex zenon project to benefit from the advantages of a virtual PLC?

Lukas Punzenberger: By no means. With zenon Logic, users can start small. For example, they can make their systems more efficient or sustainable with a handful of additional sensors and actuators or achieve OT/IT convergence. You could also replace the existing PLC in a machine or module with a bus coupler and install the central CPU on a virtual machine, for example. This would bring some cost savings. Plus, removing specific control hardware and eliminating the related maintenance effort would have benefits in terms of reducing maintenance activities.

What does this mean for the design of modular machines and equipment?

Lukas Punzenberger: One of the biggest changes compared to classic PLC technology is the ability to distribute tasks in a highly granular way. Since there is no longer any need for hardware, instead of one PLC with many tasks, you can have many instances of zenon Logic, which in extreme cases only perform one task each. This allows the overall activity to be divided into manageable parts. And it enables users to modularize control activities.

This not only supports the modularization of machines and equipment but also their dynamic reconfiguration during operation to adjust to changing requirements. Only in this way can the actual goal of adaptive production facilities be achieved, based on the principles of Industry 4.0.

Peter Kemptner conducted the interview with Lukas Punzenberger.

> “Thanks in large part to the virtual PLC zenon Logic, no other system enables customers to implement plans so easily for an open, software-defined distributed control system, or Open DCS, the way zenon does.”
>
> Lukas Punzenberger,
> Director Product Management
> at COPA-DATA

Does this also support the scalability of machines and equipment?

Lukas Punzenberger: Of course. One advantage is not needing to know in advance what hardware will be needed later. In addition, the individual instances of the virtual PLC can be ported to different hardware depending on the requirements, for example, with regard to real-time data transmission. To simplify this process further for users, we use existing IT technology (cloud standards, data center standards) and package the logic blocks in Docker containers. As long as the hardware supports this approach, it is the simplest way, and it makes it much easier to scale, for example, if a subprocess needs more computing power.

Don’t machine or equipment manufacturers need expensive, in-demand IT specialists for this?

Lukas Punzenberger: People who are familiar with classic PLC technology are now much harder to find than software developers who are familiar with technologies common outside of industrial automation. For this reason, we have expanded the high-level language support for our virtual PLC solution. In addition to the option of programming in accordance with IEC 61131-3, this also includes Python integration. In general, the principle of “configuring instead of programming” applies to zenon, but this cannot be applied entirely to PLC functionality.

For you, what are the main benefits of virtual PLCs?

Lukas Punzenberger: In addition to the savings from eliminating the need for dedicated control hardware, this primarily means there is a much greater degree of freedom when designing machines or equipment. You can place the system boundaries where the user benefit lies. Development activities can be divvied up much more easily across many shoulders. In addition, product developers can more easily use contemporary methods, such as digital twins for simulation and testing all the way to virtual commissioning. All this helps to shorten implementation times and avoid errors and rework.

In addition, virtualization in general and containerization specifically opens up the possibility of operating and maintaining central parts of industrial control and automation technology using established IT resources. Different instances of the virtual PLC solution can run and collaborate across existing system boundaries at distributed installation locations, whether locally, on an edge device, or in the cloud. No other system enables customers to implement plans so easily for an open, software-defined distributed control system, or Open DCS, the way zenon does.

LUKAS PUNZENBERGER

After studying computer science at the Vienna University of Technology, Lukas worked at COPA-DATA Gold Partner ControlTech Engineering AG in Liestal near Basel. Since the end of 2023, he has headed Product Management at COPA-DATA.

INDUSTRIAL CONTROL AS A SERVICE

Industrial Control as a Service (ICaaS) has the potential to bring the IT and OT worlds closer together. It promises a shorter time to market and less complexity for plant owners/operators, while enabling easy integration of advanced technologies such as AI. This article presents proof-of-concepts for different ICaaS aspects. In addition, future research and development opportunities are outlined.

Process plant owners/operators are faced with the challenge of commissioning, maintaining, and managing increasingly complex automation systems. Depending on the use case, these automation systems must fulfil a growing list of requirements – from real-time communication, architectural flexibility, cross-vendor compatibility to AI integration, OT-security, compliance to NIS 2 regulation, and more. At the same time, the desire to react faster and more precisely to market trends is driving the reduction of complexity, time-to-market, reconfiguration, and update time of automation systems. In short: future automation systems should be more capable, but at the same time less complicated to commission and maintain than current approaches.[1]

The preceding article[2] showed how the concept of "Industrial Control as a Service" (ICaaS) can support the achievement of the above objectives. Now we look at proof-of-concept implementations of ICaaS-enabled the lessons learned from implementing various aspects of the ICaaS concept.

ICAAS REQUIREMENTS AND CONCEPT

Many classic Programmable Logic Controller (PLC) or soft-PLC approaches are primarily optimized to be as reliable as possible. The resulting architectures often make it difficult to adapt, scale, or integrate new technologies into automation systems.[1] As a result, more and more companies are looking for systems that allow them to quickly commission, update, and scale their systems in modern to respond faster to market trends through a shorter time to market.[3]

In particular, the current inhomogeneous software and hardware structures for IT and OT make it difficult to manage automation systems end-to-end from the field level to the Enterprise Resource Planning (ERP) level.[4] At the same time, the desire to use advanced functions such as Model Predictive Control (MPC) or AI on a large scale requires a significant increase in the storage and computing resources of automation systems.[5] Nevertheless, the core requirements of classic PLC systems, such as high system

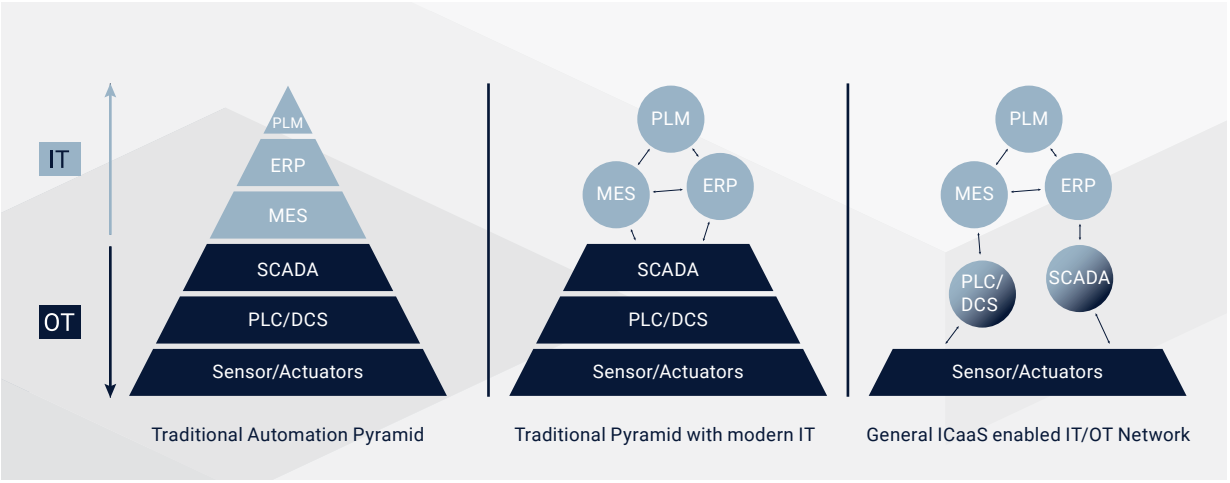


Figure 1: Shifting of the IT/OT boundary within different general architectures[6].

reliability and real-time capability, must still be met.

The ICaaS approach dissolves the classic automation pyramid in favor of a completely containerized structure (see Figure 1). This approach revolutionizes the concept of the PLC by moving the central functions and capabilities of the PLC to a cloud or server-based environment. The IEC 61131-3-compliant PLC runtime, human-machine interface (HMI) systems, databases, and cloud connectors, are fully containerized. The server infrastructure can be located both on the company premises (on-premises) and off-site (off-premises). Within this cloud, the automation elements do not necessarily have to be arranged in the rigid layering of the pyramid. Instead, the logical arrangement and interactions between the automation components can be optimized depending on the specific application.[6]

In technical terms, ICaaS works by setting up a protected, virtual network. This can be implemented on-prem or off-prem via cloud-native approaches. In this network, the necessary software components are activated as required and can exchange data using standardized communication protocols. For the end user, this results in a clear, tabular display of all active or inactive instances of PLCs, SCADA, or DCS systems, which can be managed individually or in groups. The biggest difference between ICaaS and classic control systems lies in the connection of sensors and actuators. Instead of connecting these directly or via a Remote I/O to a physical device, in the simplest scenario the connection is made via an Ethernet cable, which in an off-premises scenario can also use the Internet, for example via secure VPN connections, or secure OPC UA Pub/Sub over MQTT (TLS)[7]. In an industrial environment, however, a more complex communication setup is usually required to meet the various requirements of a real system. Other communication channels such as 5G are also conceivable. The only limiting factor here is the maximum tolerable latency time, which is usually high in the process industry with typical cycle times of 30ms-500ms.[6]

Furthermore, the ICaaS concept is compatible with already established concepts such as modular plants that are automated with Module Type Package (MTP).[8] Standards currently under development, such as Time-Sensitive Networking[9], can also be integrated. Consequently, there are several academic and industry-derived approaches to implementing an ICaaS system.[7]

Despite the various research publications and projects, ICaaS has not yet gained widespread adoption in the industry. One central issue is the lack of trust in approaches such as containerization or "X-as-a-Service", which are not so familiar to the process industry. Another problem is the perceived Technology Readiness Level (TRL)[10] of the technologies used, which gives the impression that such an ICaaS approach cannot be implemented today in a way that meets the industry's reliability and performance standards.

USE CASE: ICAAS

In order to investigate the real-world benefits and limitations of the ICaaS concept presented above, we have selected an ICaaS use case.

The use case aims to develop a modular process automation system that is controlled completely from the cloud. A vertical farming module was chosen to demonstrate that (see Figure 2). To make the deployment of this ICaaS system as easy as possible, almost all intelligent devices were removed from the plant. Only sensors, actuators, a screen for the HMI, and a remote-I/O (RIO) are left, which means that the module can be delivered pre-wired, and the user just needs to connect it to the internet. The RIO connects itself automatically to an MQTT-Broker hosted in the cloud, which is in turn connected to a cloud-server running a soft-PLC. In each control cycle, the RIO gathers information from the sensors and communicates it via OPC UA Pub/Sub over MQTT messages to the soft-PLC in the cloud. With this data, the PLC

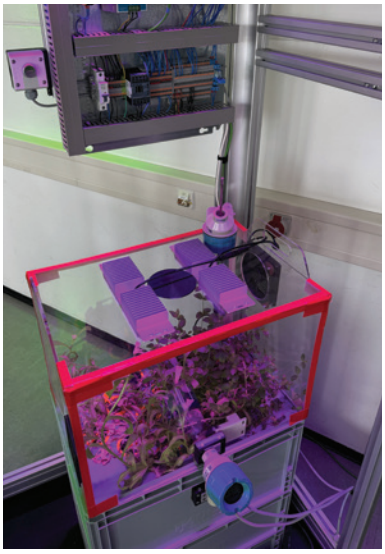


Figure 2: Vertical farming module

executes the associated control logic and sends control signals back to the RIO, which distributes them to the actuators.

But why was OPC UA Pub/Sub chosen in the first place? One intention was to reduce the complexity of the control systems. One can see from Figure 1, that the different components of the automation pyramid (Control, SCADA, MES, etc.) shall work together more closely and more seamlessly. Thus, it is favorable to communicate via one common protocol[11]. The IT world has agreed on Ethernet together with the TCP/IP protocol as one common standard for many of its components.[11,12] Conveniently, the traditional control technology can communicate over various technologies, i.e. Ethernet as well.[13,14] One protocol for this message exchange is OPC UA, which features an information model allowing for a hierarchical representation of complete systems and the required security demands for communication over public internet.

The publisher/subscriber architecture using MQTT on top of OPC UA grants additional advantages. With the MQTT broker, there is a central communication hub. This way the data access handling with authentication and authorization doesn't have to take place on (constrained) field devices, but on the broker itself.[15] Not only that, it features superior transmission performance to a client/server approach[16]. Thus, OPC UA PubSub on top of MQTT combines sovereign information modelling[17] with lightweight communication performance.[16]

The RIO includes a compact Beckhoff edge-device as an IoT coupler additionally enabling the implementation of critical logic such as interlocks locally. This means that the critical control logic is not strictly dependent on external resources but can continue to work using local computing resources in the event of a communication failure.

The HMI can be displayed and operated using any browser on the local panel of the RIO station. The responsive design of the HMI also makes it possible to display it on a browser-enabled device such as a smartphone or tablet. This use case therefore offers a very flexible solution that can be easily installed and expanded.

As seen in Figure 3, this architecture can also be utilized to implement an MTP-enabled control environment. By making the RIO available via the MQTT-Broker, its functionalities and services can be utilized by following the MTP-standard so that they are abstracted from the hardware. The module instances can be created dynamically and subsequently integrated into a Process Orchestration Layer (POL) allowing a vendor-independent combination of modules.

Furthermore, a containerized solution could be realized as well, making the deployment process even less complicated. This dynam-

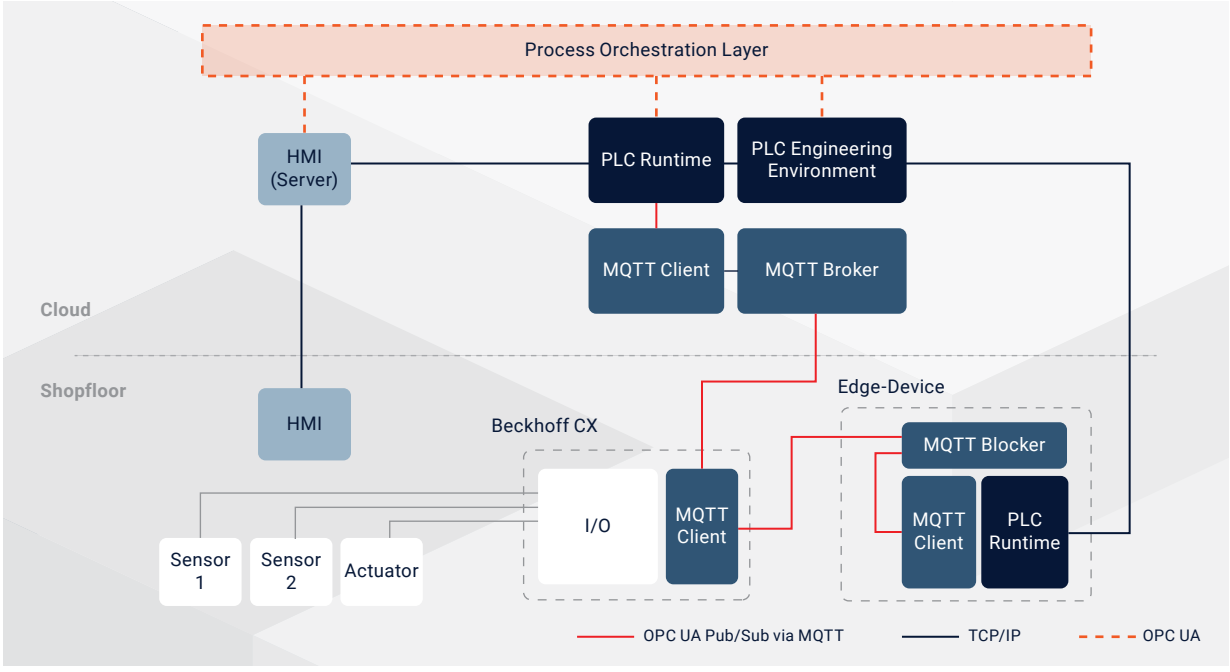


Figure 3: General ICaaS use case overview

ic approach ensures that the usage of the available computing power can be optimized while still making the modules available to the POL independently. Unused modules could be shut down and restarted when needed.

LESSONS LEARNED

The case study showed that in the near future it will be possible to control a process industry plant completely from the cloud. The devices on-site don't need to execute control logic, but only forward inputs and outputs. All they need to function is a connection to the cloud-native technology stack. Nevertheless, the vertical farming module presented in the study has very low latency requirements. Other systems in the process industry have stricter cycle times typically between 30-500ms.[6]

It also became clear that the use cases can be implemented with a combination of standard products and products that have an ever-increasing TRL. Additionally, the implemented systems were able to fulfil a wide range of the requirements that were mentioned above. Nevertheless, there are still opportunities for improvement regarding the reliability of these systems as well as the inclusion of more advanced CI/CD capabilities.

SUMMARY & OUTLOOK

The previous sections have highlighted how the ICaaS approach can be implemented right now with a constantly increasing TRL (currently roughly TRL 4-5) and what latencies are currently realistic. These findings permit the deployment of such systems in certain areas only with lower latency requirements.[18,19] Future contributions may also inquire about the latency requirements of different applications outside of the process industry. Subsequently, a comprehensive overview of possible applications could be given.

Further research is required concerning the operational stability of ICaaS systems, as they rely heavily on the availability and reliability of the local conditions given. Concepts can already be found in IT, like PACE[20] or even market-ready applications.[21] But further work is needed to examine the integration into the ICaaS concept.

The unabridged version of this article with more details about the use cases was originally published in **atp magazine 11-12/2024** (https://atpinfo.de/ausgabe/atp-magazin-11-122024/).

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REFERENCES

[1]Mirani, A., Velasco-Hernandez, G., Awasthi, A., Walsh, J. (2022). 'Key Challenges and Emerging Technologies in Industrial IoT Architectures: A Review'. Sensors, 22(15), 5836. doi:10.3390/s22155836.

[2]Information Unlimited Magazine issue #42/2024.

[3]Napoleone, A., Pozzetti, A., Macchi, M., Andersen, R. (2023). Time to be responsive in the process industry: a literature-based analysis of trends of change, solutions and challenges. Production Planning & Control, 34(6), 572-586. doi: 10.1080/09537287.2021.1942282.

[4]Vogt, L., Klose, A., Khaydarov, V., Vockeroth, C., Endres, C., Urbas, L. (2023). Towards cloud-based Control-as-a-Service for modular Process Plants. In 2023 IEEE 28th International Conference on Emerging Technologies and Factory Automation (ETFA) (pp. 1-4). IEEE. Retrieved from: https://ieeexplore.ieee.org/document/10275544/

[5]Merhi, M. I., Harfouche, A. (2024). Enablers of artificial intelligence adoption and implementation in production systems. International journal of production research, 62(15), 5457-5471. doi: 10.1080/00207543.2023.2167014.

[6]Vogt, L., Honold, F., Punzenberger, L., Greising, S., Jilg, M., Maurer, F., Barth, M., & Urbas, L. (2024). Industrial Control as a Service: Potenziale für die Prozessindustrie. atp Magazin 66(5), pp. 44–46.

[7]Lyu, M., Benfenatki, H., Biennier, F., Ghodous, P. (2019). Control as a service architecture to support context-aware control application develop ment. IFAC-PapersOnLine, 52(13), 1085-1090. Retrieved from: https://doi.org/10.1016/j.ifacol.2019.11.340.

[8]VDI/VDE/NAMUR 2658 Blatt 1. (2019). Automatisierungstechnisches Engineering modularer Anlagen in der Prozessindustrie – Allgemeines Konzept und Schnittstellen. VDI: www.vdi.de.

[9]IEE 802.1 Working Group. (2024). Time-Sensitive Networking (TSN) Task Group. Accessed: Jun. 19, 2024. Retrieved from: https://1.ieee802.org/tsn/.

[10]ISO 16290 (2013). Space Systems - Definition of the Technology Readiness Levels (TRLs) and their criteria of assessment. ISO: www.iso.org.

[11]Profanter, S., Tekat, A., Dorofeev, K., Rickert, M., Knoll, A. (2019). OPC UA versus ROS, DDS, and MQTT: performance evaluation of industry 4.0 protocols. In 2019 IEEE International Conference on Industrial Technology (ICIT) (pp. 955-962). IEEE. doi: 10.1109/ICIT.2019.8755050.

[12]D. Hercog. (2020). Communication protocols: principles, methods and specifications. Cham: Springer Nature Switzerland.

[13]Siemens. (2024). IT-/OT-Netzwerke. Accessed: Jun. 28, 2024. Retrieved from: https://www.siemens.com/de/de/produkte/automatisierung/industrielle-kommunikation/industrial-network-solutions/ot-it-netzwerke.html

[14]Ethernet Alliance. (2024). Ethernet's Role in the Operational Technology (OT) Evolution. Accessed: Jun. 28,2024. Retrieved from: https://ethernetalliance.org/ethernets-role-in-the-operational-technology-ot-evolution/

[15]OPC Foundation. (2024). UA Part 1: Overview and Concepts - 6.5 Pub Publish-Subscribe. Accessed: Jul. 18, 2024. Retrieved from: https://reference.opcfoundation.org/Core/Part1/v104/docs/6.5

[16]Reddy, G. P., Kumar, Y. P., Reddy, Y. J., Maddireddy, S. R., Prabhudesai, S., Reddy, C. P. (2023). OPC UA Implementation for Industrial Automation-Part 2: Integrating PubSub Model with TSN. In 2023 1st International Conference on Circuits, Power and Intelligent Systems (CCPIS) (pp. 1-6). IEEE. doi: 10.1109/CCPIS59145.2023.10291862.

[17]Mersch, H, Aro, J, Tahvanainen, H, Pagnozzi, D, Usländer, T, Pfrommer, J, Henßen, R, Scandelli, N, Bajorat, J. (2019). Praxishandbuch OPC UA: Grundlagen – Implementierung – Nachrüstung – Praxisbeispiele, Vogel Buchverlag, Würzburg. Retrieved from: ProQuest Ebook Central. [18 July 2024].

[18]Cesen, F. E. R., Csikor, L., Recalde, C., Rothenberg, C. E., Pongrácz, G. (2020). Towards low latency industrial robot control in programmable data planes. In 2020 6th IEEE Conference on Network Softwarization (NetSoft) (pp. 165-169). IEEE. Doi: 10.1109/NetSoft48620.2020.9165531.

[19]Stefanović, Č. (2018, November). Industry 4.0 from 5G perspective: Use-cases, requirements, challenges and approaches. In 2018 11th CMI International Conference: Prospects and Challenges Towards Developing a Digital Economy within the EU (pp. 44-48). IEEE. doi: 10.1109/PCTD-DE.2018.8624728.

[20]Cybersecurity & Infrastructure Security Agency (CISA). (2024). Leveraging the pace Plan into the emergency communications Ecosystem. Accessed: Jul. 18, 2024. Retrieved from: https://www.cisa.gov/sites/default/files/2023-05/23_0426_ncswic_PACE-Plan_508.pdf

[21]Expereo. (2024). Internet Redundancy For Business Continuity Factories. Accessed: Jul. 22, 2024. Retrieved from: https://www.expereo.com/resource/internet-redundancy-factory-business-continuity/.

CLEMENS CONNECTED

FORMAT ME

You don't often realize it but travelling by public transport involves a lot of data: departure time, destination, track number, seat number, bus number – to name just a few.

MARK CLEMENS
Product Manager
Connectivity

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

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The way that transport works globally doesn't require us to attend classes before being able to make use of public transport in a different country, save perhaps knowing the translations for some odd words. The essential information that is needed to get from point A to point B is kept simple and to a minimum.

To fly from Amsterdam to Salzburg, I may need to know the flight number (not a number really; it also includes a designation for the airline – but I don't even need to know this), the departure gate, the departure time, and the boarding time. After boarding the plane, my seat number guides me to my seat in the allocated row and the rest is taken care of. There are plenty more essential data and procedures involved, of course, for me to reach my destination safely. However, they do not directly concern me. I don't need to convert my seat number from metric to imperial when flying to the United States – although pilots and ground crew may need proper procedures for converting kg to lbs or liters into US gallons for calculating the amount of fuel required for the flight.

Without a mutual understanding, harmonized data, and proper meta information for data handling, public transport would be chaotic, dangerous, or even impossible. For those without flight anxiety, look up "Gimli Glider" for an interesting read about the consequences when data is not harmonized!

AN AWRY BUSINESS TRIP

Imagine for a moment, you are arriving at a transportation hub in a foreign country. Planes, trains, buses, metro all come together and, through a crowd of people, you try to find your way to your onward journey. But something is odd. The signs for the trains point in two different directions. You take a glance at a map of the metro lines but none of the stops are labeled and all the lines seem to have the same color. Through the window, you can see a bus terminal down below. None of the buses appear to have any kind of number or destination to differentiate them. You regret not having researched and prepared your journey better. Somehow, you don't have Internet access, making on-the-fly checks impossible.

When you finally arrive at a train station, with tracks on multiple levels and trains departing and arriving, none of the platforms have a designation or number. There is no departure information, map, or timetables to be seen. People pushing small carts loaded with filing cabinets try to sell you data interpretation services. Not trusting them, you are determined to find out more for yourself. Entering a yellow train, you find a display showing what may be travel information but it appears to be base64 encoded. In a blue train, you find a display showing a stream of hexadecimal numbers. In another, longer blue train, you find two displays with streams of hexadecimal data, separated in different formats. In a red train, a display finally shows you something that is at least more recognizable. However, what looks like a departure time may be a UNIX timestamp. And the destination is in coordinates that do not appear to be in Latitude Longitude or UTM but some other format. Reluctantly, you hand over your credit card to the smiling person patiently waiting next to a well-used filing cab-

inet and wonder whether the people driving the trains know where to go…

TRAVELLING DATA

Let's leave this slightly dystopian travel scenario, which I hope you will never have to face in the real world!

However, in the world of industrial data, we face situations like this on a daily basis. We must deal with unorderly, improperly formatted, inconsistent, and sometimes incomprehensible data, where the format of the data – or, rather, the lack of it – may change with a new generation or version of the system that produces it.

Our transport analogy illustrates that an effective system requires relevant, timely, accurate, and harmonized data. And to optimize efficiency, we need to make more use of that data.

In an industrial setting, we want to compare data from different machines and sites to find correlations. We want to make use of generative AI and train models on our own data. We want to have an excellent quality of data and ensure no data is lost, even when connectivity is interrupted. And we want to communicate our data to a central location under our control, away from the production environment. All this does not sound impossible.

Many devices support MQTT. You can set up an MQTT broker in Docker with support for secure communication in half a day. Configuring each system to communicate with the MQTT broker is a bit more work but, when that is done, an MQTT client can subscribe to the topics and receive the data.

GETTING DATA FROM A TO B DOES NOT APPEAR TO BE THE ISSUE

The real challenge comes with the format of the payload in the published MQTT messages and the designation of the message.

Like the train signs at the airport pointing in two different directions, devices may not support configuring unique MQTT topics to publish the data. Like the map of the metro lines that all had the same color and where no stop was labeled, devices may publish an MQTT payload without any meta information about what the data represents. Like the differently colored trains at the train station, devices may publish data that you need to transform first.

Devices from the same vendor with different configurations or versions may publish data differently. Each may require a proprietary data interpretation algorithm to extract the relevant information. And, like the displays in the trains, you will have to look inside each message first, parse the whole message, interpret the whole message, discard any irrelevant data, extract the relevant data, perform the necessary transformations, and add missing information to get to a state of common understanding, harmonized data, and proper meta information in order to avoid chaos.

SOLUTION ANYONE?

Just as in modern public transport systems, by agreeing on common definitions, the chaos and potential danger of incorrectly formatted or interpreted data can be avoided.

Sparkplug© B provides both the formatting and simplicity to reach a mutual understanding.

OPC UA Pub/Sub over MQTT has a similar goal and generally more capabilities. With these capabilities, the complexity rises and the plethora of different payload configurations with optional fields does increase the risk of interoperability issues.

However, we're starting to see wider adoption of both OPC UA Pub/Sub and Sparkplug B in devices. Of course, there are pros and cons to each – and I'm always interested to discuss these with you!

MQTT: FORMAT ME

There is no doubt that we need data which is formatted and eligible so we can make sense of it without any need for data interpretation services.

For COPA-DATA, both OPC UA Pub/Sub and Sparkplug B warrant our continued attention and likely both will have their own place in future. While parsing individual payloads is always possible, it will simply not hit the mark in the long run.

What are your feelings about this? I would love to hear your opinion – please drop me a line.

TCT: ONE FOR ALL AND ALL FOR THE USER

The powerful zenon software platform provides users with easy-to-use documentation thanks to our Technical Content and Translation (TCT) team. As the name suggests, the team has two areas of responsibility, each of which calls for specialized tools and processes.

As the link between the technical experts and users, the TCT team has the challenging task of taking information from the developer documentation, refining it for the user documentation, and making it available to users. The technical editors are concerned primarily with expanding and keeping the zenon help content up to date. The translation coordinators are responsible for ensuring the content is translated promptly and accurately into the languages needed. The team also includes an in-house translator, who ensures that source texts and translations are updated and improved on an ongoing basis by checking the help texts directly against the graphical user interface and the behavior of zenon. As a result, users of zenon can feel confident that the documentation they get is always top-notch.

TCT TEAM IMPROVES USER EXPERIENCE

As a zenon user, you are no doubt familiar with the property help embedded in the graphical user interface and the online help. What both help formats have in common is that the texts come from technical editors. Interface texts in zenon go through a review phase in which the English and German versions are checked for user-friendliness and consistency with the existing entries and, if necessary, updated. When creating documentation, a separate terminology database with

preferred spellings is used. This helps to ensure that authors, translators, and editors use the preferred terms consistently; in case of questions, the glossary function can be used to display a corresponding definition. zenon help is authored, translated, and updated using standard writing guidelines in order to ensure it is written in a completely clear and comprehensible manner. The clarity of terms and spellings used makes it much easier to find and understand the information you need. This makes your workday easier. Active instructions play just as much of a role as datasheets play for drivers or descriptions of function blocks.

TRANSLATION IN A TEAM

After the text has been created, it is translated into the languages required so that the knowledge is easily accessible. As part of this process, translation coordinators create translation orders for the language pairs required. They also ensure that the translations are reviewed again and are ready on schedule for the latest new release.

ENGINEERING ASSISTANT AND TCT – A SUCCESS STORY

Time does not stand still. Chatbots, machine translations, and artificial intelligence are increasingly finding their way into a wide variety of workspaces. COPA-DATA is taking full advantage of these new opportunities and has launched the Engineering Assistant, a helpful AI assistant designed for zenon engineers. The Engineering Assistant makes it easier for you to find the information you need and, thus, supports you directly with the implementation of your projects. At any time, whenever you need support.

YOUR FEEDBACK IS WELCOME

How the TCT team contributes to the success of the Engineering Assistant is not readily detectable at first glance. In order to have as much data as possible available as a basis for queries, various source media are accessed. One of the largest collections of information on the zenon software platform is, of course, the online help, which is created and kept up to date by TCT team members; this is one of the team's main tasks. In addition to generating prompts, you have the opportunity to evaluate the Engineering Assistant's answers and thus provide helpful feedback. The TCT team evaluates the feedback in conjunction with technical experts in order to continuously improve the quality of the answers. As a user of the Engineering Assistant, you benefit not only from the query results but also from contributing directly to further improvements.

TECHNICAL CONTENT AND TRANSLATION

Use the help content provided by the TCT team to clarify your questions at any time and without red tape. You can use the property help embedded in zenon, check the online help, or write a prompt for the Engineering Assistant – there are many ways to reach your goal. Choose the solution that is right for you and enjoy the biggest benefit while you meet the challenges ahead.

Your benefits:

- online help available fully in four languages
- embedded property help window in additional languages
- clear terminology and a helpful glossary
- update help option
- Engineering Assistant support
- option to improve documentation via feedback button

JOSEF RIES
Senior Technical Editor

After completing electrical engineering training and working for several years in this field, Josef Ries turned to software documentation. He has been creating and expanding the online help for the zenon software platform at COPA-DATA since 2016.

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ACTIVE POWER
124.08 MW
MWh TODAY
4.84 MWh
MWh YESTERDAY
75.19 MWh
PCC SETPOINT
40.00 MW
PCC EXPORT
13.10 MW
BATTERY STORAGE SYSTEM
TOTAL CAPACITY
23 MWh
STATE OF CHARGE
70.21 %

INDUSTRIES & SOLUTIONS

SUSTAINABILITY COLUMN

EMBRACING CHANGE

The life of future generations depends on how effectively we manage the world's transition towards Net Zero. In this article, I'd like to consider the critical success factors for achieving this, including passionately engaging with change, setting new expectations for software technology, and better understanding human nature.

THE CHALLENGE OF CHANGE

One day last summer, I travelled by train to Zurich. The trip revealed beautiful scenery through the Alps. Stony peaks, verdant forests, sparkling azure rivers, and peaceful lakes – the view was seducing. A few passengers took a seat in my carriage. As our train reached a narrow valley, the weather suddenly became stormy. The wind bent trees to the ground, rain battered our windows – and we greatly appreciated the comfort of the train car.

"This looks like climate change!" one passenger exclaimed.

It was the start of a conversation to which no one was indifferent. I heard worries about the recent catastrophic weather events, both close to and far from home as well as critics of "egotistical humans". I heard resignation too: *"There is nothing I can do about the climate crisis!"* and *"I cannot hear about it anymore!"* – in a rejection of the notion that *"everyone can connect, learn, and contribute"*.

Diverse opinions are obviously normal but the conversation became more than this; a kind of unexpected polarization. Emotions were rising in the train car… Until, after a while, the weather changed again. Under a few gently warming rays of sunshine, the mountain edges became sharp and colorful again, the sky blue – encouraging us, once again, to further reflection.

It is logically obvious that we all need to join our efforts and skills to create a better world, for now and for future generations. We need to drastically cut greenhouse gas emissions from human activities. Why is it so challenging to drive this change together?

The perspective of neuroscientists is helpful. In his recent book, Prof. Stefan Kölsch explains how the subconscious-driven behavior of humans has developed over an evolution of hundreds of thousands years. This is impacted by recent history and childhood experience. Despite the fact that they evolved to take control, especially in life-threatening moments, survival mechanisms influence our behavior more often than we imagine. Unconsciously, the fear of losing the status quo can trigger rapid, emotional, and illogical reactions. For too many people, our continuous exposure to this crisis hampers our perception of reality, blocks creativity, and drives negative thinking.

How should we cope with such a truly "dark side" of our brains? Neuroscientists have demonstrated that, more than ever, we need greater empathy, reflection, and intention in our daily lives. We must be more conscious in our behavior. We must make sure that we are not leaving anyone behind. Not easy, for sure!

It is time to meet a role model for leading the change towards Net Zero.

EMILIAN AXINIA
Director Industry Management, Sustainability Solutions

Since 2007, Emilian has been part of the COPA-DATA Headquarters team. His enthusiastic focus is to support the agile transformation journeys of manufacturing companies towards their sustainability goals by innovatively applying automation and digitalization technologies, especially the zenon software platform.

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A PASSION FOR CHANGE

Last autumn I participated in "climate week" events in New York City. It is always an amazing experience meeting so many people impassioned by climate action from all sectors of society around the globe – from

private companies to public institutions and politics. One morning, at an event hosted at Jacob Javits Convention Center, I met Mary, a sustainability manager at a manufacturing company. You could easily feel her enthusiasm as she spoke about her role. We realized that we had the same route to walk to the World Economic Forum's offices. Our way was easy to find on Manhattan's grid map with its rectangular geometries. As we walked, I was curious to know more about the ongoing transformation Mary was leading.

Mary explained to me the journey on which her company has engaged. One decisive milestone is about to happen: its public commitment to decarbonization on the Science Based Targets initiative (SBTi) platform. From now on, everything should run smoothly.

"Why are you so optimistic?" I asked her.

"We achieved good alignment with our stakeholders. As we master digital transformation, we will master the green transition, too."

Mary's recipe for success? At every organizational level we must build on many ideas to reduce carbon emissions. With a green mindset, we aim to innovate products and processes, gaining flexibility across the entire value chain. We must continue to maximize production efficiency continuously. And we must take full ownership of energy flows through the entire plant, electrify processes, invest in renewable resources, and see reality with different eyes.

When it comes to leadership, a key challenge is to understand and mitigate objections of your team. These are not always based on logic but, rather, based on emotions and "fear of change". Her comments reminded me of my stormy trip to Zürich.

"We are getting better every day," Mary continued with confidence. *"We want to reach Net Zero earlier than 2050, so we defined milestones on the way which we believe are feasible. Significative reductions in our carbon footprint will happen in the next few years!"*

"How well can you predict the next 20 years?" I asked.

"You cannot have absolute control," Mary acknowledged. *"But you leverage the experiences of your team and learn from other companies. As your plans get clearer, you also figure out the company's capabilities and the tools you need to strengthen."*

Mary and I arrived at Bryant Park, a beautiful green oasis in the middle of Manhattan. We took a seat on a bench for a moment to admire the gracious architecture of the Grace Building.

"Mary, because you mentioned the digital transition at the same time as the green transition, it seems to me that your company adopted a 'twin transition' approach?"

She quickly answered, *"In my opinion, investing in digitalization makes sense only with a sustainability mindset. Emilian, I think this is your company's business, isn't it?"*

I was eager to confirm; I couldn't hide my enthusiasm for creating automation and digitalization technologies which serve people on their transformation journey.

"What is your twin transition experience, Mary?"

A beautiful green oasis in Manhattan, Bryant Park is an appropriate place to reflect on sustainable development.

She remained thoughtful and quiet for a few moments.

"You know, due to my past roles in manufacturing, I feel lucky to understand the challenges our automation and IT specialists are facing. When we discuss our green initiatives, they say that with the right budget we will solve those hurdles on the way. Then I see them fighting with all kinds of legacy systems, not designed with the twin transition in mind."

Mary was generous in the examples she offered: too much rigidity – not only when you want to produce something new, replace packaging, or adapt processes, but even when you want to fix your existing machines. It takes too much time to integrate production equipment with other digital systems and acquire good data for improved awareness and public reporting. There are too few people available to program solutions for new ways to decarbonize and reduce the consumed energy. It's too complicated to give more colleagues the access to the information they need. There are too many interdependencies in the bundles of hardware and software to easily modernize, if one element is outdated. Cybersecurity should also become more straightforward.

Mary concluded: *"I think we must keep in mind our agile journey towards Net Zero when we implement technologies and solution concepts, rather than simply budgeting generously for any possible effort."*

SOFTWARE FOR CHANGE

On this park bench in New York, I felt thankful to be party to Mary's reflections about the heart of her company's ongoing transition towards Net Zero. It is a journey of both pain and enlightenment.

For the remainder of our walk, we continued to muse on the idea of mastering change in a manufacturing plant. People are always essential. As neuroscientists explain, it helps to understand the nature of our brains, with their systemic components and functions. Leading a team means being sensitive to purpose, hopes, fears, frustrations, personalities… and more. As we become increasingly conscious in our behavior, we will more easily understand how to collaborate with greater impact to reach our common goals. At the same time, we must evolve our thinking about the manufacturing infrastructure, machines, equipment, and their components and functions. How can we cope with their human-like "immaturities": stubbornness, communication issues, missing growth mindset, or wastefulness?

Mary and I alighted on the obvious answer that industrial software is not only critical but should play an even more impactful role.

From the programmed code of a machine to larger plant solutions running on premises or in cloud, software "gives life", "writes the brain", and even "educates the character" of the various production systems. In the context of the twin transition, we need to view industrial software in a new light.

As we reached our destination, Mary insisted: *"It's vital to define the principles of development which can make an OT/IT software truly transformative!"*.

Are you curious about our conclusions?

Here is a short summary which outlines the three key principles of OT/IT software which can streamline our collective twin transition.

1. Empower people to deliver their decarbonization plan. This requires tools and superior experience for: situational awareness in real-time; operating and adapting processes; creating new products; generating renewable energy and materials; holistically managing energy flows; enabling innovation when optimizing production efficiency and material consumption; leveraging the power of data in analysis, reporting, and further technologies.
2. Provide extensive support for the lean implementation of industrial solutions, such as: flexible automation; robust data infrastructure; reduced engineering time and skillset; agility from proof of concept to roll-out; interdisciplinary solution scopes; easy integration within the digital ecosystem.
3. Ensure a future-oriented technology foundation – by design. This should include aspects such as: product and solution lifecycle; interoperability; standardization; modularity; integrated OT/IT architectures; cybersecurity.

Does this sound familiar to you? Now, it is your turn to contribute your feedback. What are your thoughts on the important moves towards the necessary twin transition?

To find out more about how the zenon software platform can support these goals, please reach out and together we can take the next step forward.

TOGETHER TOWARDS SUSTAINABILITY WITH CARLSBERG SRBIJA

The brewery in Čelarevo was founded in 1892 by the influential landowner Lazar Dunđerski. In 2003, it became part of the Carlsberg Group. Throughout its history, the brewery has always kept up with the latest technologies, improving its processes without compromising the quality of its products or services. This tradition continues today. A desire to optimize energy and resource consumption has led to the implementation of a detailed utility management system for energy analysis and cost control.

Lazar Dunđerski dedicated special attention to the building of the Čelarevo brewery. He wanted to use the site to try out the new techniques and technologies that he had seen in breweries in large European cities. The initial capacity of the brewery was 10,000 hectoliters (hl) per year. Today, it has a production capacity of more than 2,000,000 hl of beer per year. One of the priorities of Carlsberg Srbija – and, indeed, of the wider Carlsberg Group – is continuous improvement in reducing environmental impact. This includes the preservation of natural resources such as water, electrical energy, natural gas, and other resources. Given the current capacity, the need to improve the brewery's energy management system had become a priority.

Overview of the water/steam/gas consumption based on more than 100 data points.

The consumption diagrams can be filtered in a simple manner.

HISTORY OF DEVELOPMENT

The first automation introduced to the brewery dates back to 1970, when the automatic brew house and the new bottle-filling unit were completed and put into operation. To meet increased demand, a new bottle-filling unit was built in 1978 with equipment ordered from Germany. A new bottle-washing machine and laboratory were subsequently added. At the end of the 1980s and the beginning of the 1990s, production was expanded again with another new bottle-filling line, an entirely new brewing line, and eight large tanks and fermenters. Over the next 20 years, the factory was fully modernized and the latest standards and certificates were introduced to underwrite the quality of Čelarevo beers.

STEPS TOWARDS ENERGY MANAGEMENT

Until a couple of years ago, the capture of energy consumption data was undertaken manually. The sites on which the meters were located were accessed on foot. Some metering was not available or hard to access, so a full picture of consumption was never successfully completed. Data was entered manually into various tables so it could be used for reporting. The reports, which were also created manually, were inevitably imprecise and incomplete.

It took an hour and a half to gather all the data. This was done on a daily basis from 6 a.m. when the meter values measured in the previous 24 hours were recorded. This process offered no possibility to monitor consumption by shift or use any other more detailed analysis. Plus, without continuous monitoring, responding to issues in a timely fashion was all but impossible. Action could only be taken after the manual system had recorded deviations in consumption or when the equipment or infrastructure suffered overloading.

A PATH TOWARDS OPTIMIZATION AND EFFICIENCY

With no systematic monitoring of energy consumption or data analysis that could enable a rapid response to issues, the brewery decided to implement an energy management system. Carlsberg Srbija d.o.o. found a partner in URAM system d.o.o. from Gložan. Its USW 4 EnMS solution is based on zenon by COPA-DATA.

The team at Carlsberg Srbija identified the main tasks as:

- defining measuring points,
- adding any missing meters or sensors for gathering the data in the various production units,
- establishing a network which included the various monitoring technologies,
- creating a software control and monitoring system in accordance with user demands,
- validation of the gathered data,
- launching the system.

One of the key objectives of the brewery is to preserve the environment through the implementation of the group's global "Together Towards ZERO" strategy. This defines clear ambitions, including "ZERO Carbon Footprint" and "ZERO Water Waste". These sustainability goals are also closely aligned with the company's long-term financial goals. To assist on this journey, the system has been implemented so that it monitors the consumption of renewable energy sources, including biogas and wood chips.

> “By introducing the energy management system based on the zenon software platform, we are one step closer to the ISO 50001 implementation and working towards zero environmental impact.”

Željko Bačkulić, Maintenance, Infrastructure and Investment Manager, Carlsberg Srbija d.o.o.

PATH TOWARDS THE IMPLEMENTATION OF ISO 50001 STANDARD

The new, automated solution now gathers, processes, and presents data from 100 data points for electrical energy, water, steam, gas, air, and CO_2. The system is located in the control room where surveillance and data analysis can be performed at any moment by the operator. By analyzing the data through trend diagrams, alarm and event lists, in-depth graphical reports, and key performance indicators (KPI), it is now possible to directly influence and take action to optimize the consumption of energy resources and, as a result, to optimize total production costs.

Monitoring the consumption of energy resources in real time over defined periods results in better detection of peaks and irregularities during production. The flexibility of the zenon software platform is particularly appreciated because the solution meets all the specific demands of the users. What’s more, it does this in full compliance with the requirements of the energy efficiency standard ISO 50001. The system also offers the opportunity for data exchange with other databases, including SAP or other ERP systems. Carlsberg Srbija plans to take advantage of this capability when it implements its new ERP system.

USER EXPERIENCE AS A PRIORITY

One of the main advantages of the new energy management system is the improved user experience. Screens can be visually adapted to each operator that monitors the processes. This ensures a fast and safe reaction to any unwanted changes identified by the system, such as increased consumption or other anomalies. The user moves very simply through various consumption overviews. They can filter the data depending on their needs: by relative or absolute time intervals; by standard daily, weekly, or monthly overviews; or by production activity, such as energy resource consumption for a particular series of products.

PREPARATION OF WATER FOR BETTER BEER QUALITY

Following the success of the energy management system (EMS) implementation, Carlsberg Srbija wanted to expand the supervision and management system to enable further analysis. The natural next step was to include monitoring of the chemical preparation of water

(CPW) process. The control and monitoring of the CPW process was previously completed using three different elements: the pump station, carbon filters, and reverse osmosis. By implementing the system based on the same zenon software used in the EMS, everything has been integrated in a unique project with three controllers. The system now provides centralized supervision with management of the CPW process for the entire plant. The water production capacity is 165 m³/h and the operator can review this against the utilities of the entire plant through the intuitive graphical interface.

COOLING PLANT ENSURES THE STABILITY OF ALL PROCESSES

Subsequently, zenon was used in another project. The brewery decided to replace and upgrade an existing but dated system in the cooling plant. This consisted of six ammonia compressors, five evaporating condensers, and primary and secondary glycol pumps. The cooling plant cools the water used in the beer brewing line and cools the yeast and wort used in the fermentation processes. The new system is much more intuitive. The interface is more graphically pleasing and, therefore, easier for the user. The system ensures the surveillance and management of the entire cooling system with much better alarm monitoring. Detailed insights into potential dangers caused by changes to cooling system process parameters can now be quickly identified. This includes pressure or temperature increases or changes to the level of ammonia in the receivers (collector tanks). Action can be taken much faster now, for example in response to the load of the ammonia compressors in the cooling. The response can be immediate.

A MORE EFFICIENT SYSTEM DELIVERS BIGGER SAVINGS

The system had not been in operation for long when Carlsberg Srbija started to reduce its consumption of several key energy resources, even as production continued to increase. The reported savings include savings in steam, water, electricity, and CO_2 emissions. To date, steam savings of 5.9 % (kWh per hl of beer) and water savings of 4.5 % (hl per hl of beer) have been achieved. In addition, the company saw electrical energy savings of 2.5 % (kWh per hl) and CO_2 emissions reductions of 9.6 % (kg per hl). These numbers might seem small, but the savings are significant and represent a big step towards the group's zero waste water goal. The switch to automated data collection, reporting, and analysis has also delivered significant efficiencies. The time saved on walking the site and crunching the numbers can now be used more productively to take action that drives further improvement.

ENERGY MANAGEMENT WITH ZENON:

- Simple, fast and flexible engineering
- Out-of-the-box solution
- Flexibility in designing the user interface and meeting user demands
- System in accordance with the requirements of the ISO 50001 standard
- Independent choice of hardware equipment
- Reduced time for testing and rolling out the system
- Great availability and efficiency of COPA-DATA technical support
- Expert certified system integrator: Uram System d.o.o. Gložan

PHOTOVOLTAICS: TWO COMPANIES, ONE VISION

Solar energy is a key technology for a sustainable energy future. However, photovoltaic systems need to be used more efficiently in practice in order to improve the economic viability of solar energy. This article looks at the collaboration between COPA-DATA and IFESCA: how it came about, the technical hurdles we overcame in the process, and the benefits that our solution provides to customers and the sector.

Our two companies – COPA-DATA, the developer of the zenon software platform designed to manage photovoltaic (PV) systems, and IFESCA, a provider of a powerful cloud platform for forecasting services – have together created a solution that helps customers optimize the way they run their systems.

On the road to the solution, we had to overcome challenges. These included developing an innovative interface and balancing technical and operational requirements.

THE COPA-DATA PERSPECTIVE: "THE MARKET SPOKE – WE HAD TO ACT"

Jürgen Resch, COPA-DATA, explains that our zenon software platform is a proven solution for PV system operators worldwide. It enables monitoring, analysis, and control of system performance in real time. Yet the requirements of our customers have evolved.

In the past few years, the demand for predictive data has risen sharply. Operators wanted to know: how much energy will my system generate in the next few days? This information is crucial for optimizing operational processes. It means, for example, that maintenance work can be scheduled on days with less sunlight to minimize yield

losses. The coordination of feed-in contracts with grid operators also benefits from accurate forecasts. The problem was that the zenon platform could not provide this functionality. Setting up an in-house forecasting system would not only have been expensive and time consuming, it would have also have fallen outside the core business. For this reason, COPA-DATA decided to look for a partner with this expertise.

> “Our customers did not want complicated new tools, rather an easy upgrade of the existing platform.”

THE IFESCA PERSPECTIVE: “PARTNERSHIP IS AN ENGINE FOR GROWTH”

Lars Hoffmann, IFESCA, explains that, as a provider of a state-of-the-art cloud platform with a focus on renewable energies, IFESCA recognized early on how important predictions are for efficient control of equipment. Our cloud platform uses advanced algorithms to create accurate forecasts based on weather data, historical asset values, and other influencing factors.

When COPA-DATA approached us, it quickly became clear to us that this could be a win-win for both companies. They brought an established platform and a large customer base to the collaboration, while we brought the technology required and many years of forecasting expertise in the energy and industrial sectors. But integration did not occur automatically. It took intensive collaboration to ensure that the two systems could communicate smoothly.

CHALLENGE 1: TECHNICAL INTEGRATION BASED ON DATA FLOW AND SECURITY

The basis of our partnership is the seamless exchange of data between the COPA-DATA platform and the ifesca.ENERGY cloud. The process is as follows:

1. Data transfer:
The COPA-DATA platform sends historical operating data, such as generation values, location information, and technical parameters, to the IFESCA cloud.
2. Analysis:
Our AI algorithms process this data in combination with current weather forecasts and location conditions.
3. Forecasting:
The result is an accurate prediction of power generation for the coming days. Users can freely configure the number of days.
4. Data return flow:
This forecast is sent back to the COPA-DATA platform and visualized in the user interface.

TECHNICAL DETAILS

One of the biggest challenges was ensuring data security and minimizing latency. Our customers expect the exchange to work in real time without putting sensitive operational data at risk. For this purpose, we have implemented encryption mechanisms that apply both during transmission and during storage.

CHALLENGE 2: USER-CENTRIC DEVELOPMENT

A key part of the collaboration was to understand the needs of end users. While COPA-DATA brought customer proximity, IFESCA brought technical options. Together, we organized workshops with solar park operators and technical experts to understand the requirements for the forecasting function.

Jürgen Resch says, “Our customers did not want complicated new tools, rather an easy upgrade

of the existing platform. The forecasts had to be displayed clearly, accurately, and in an easy-to-understand format."

Lars Hoffmann agrees, "We have learned that user-friendly design is as important as accurate predictions. Only solutions that are automated and easy to operate will be used on a day-to-day basis."

BENEFITS FOR CUSTOMERS

More efficiency, less cost

The results of our partnership are not only technically impressive, but also provide users with tangible benefits:

1. More efficient operations:
Operators can plan maintenance and cleaning work specifically to take advantage of days with low solar radiation. This reduces downtime and increases the overall efficiency of the system.

2. Optimized resource scheduling:
Through better predictions, operators can optimize their operating characteristics in order to achieve better prices on the electricity exchange, for example.

3. Flexibility:
Flexible and seamless integration with COPA-DATA's existing platform means no additional training or systems are required.

A WIN-WIN SITUATION

For COPA-DATA:

- New functionalities without any development costs.
- Stronger customer loyalty through the added value of forecasts.
-

For IFESCA:

- Development of new markets and sales potential.
- Leveraging COPA-DATA's established customer base to scale its own technology.

BUILDING THE FUTURE TOGETHER

The partnership between our two companies shows how synergies can spark innovation. But our journey is not over yet.

Jürgen Resch states, "We see great potential to expand our collaboration further. IFESCA has experience in other areas of energy automation that fits very well with our offering."

Lars Hoffmann concludes, "Our specialization continues to develop alongside our AI-based forecasts designed for predictions for solar power systems. We provide, for example, predictions for residual load, conventional peak shaving in production, and even predictions of electricity consumption. We then use the knowledge to optimize all of the energy producers and consumers across the board. We also provide support with dimensioning questions, for example, for a PV storage combination participating actively in the spot market. There is virtually no limit to the possibilities."

OUR VISION IS CLEAR

By combining our strengths, we aim to revolutionize solar energy – not just for today but for decades to come.

LARS HOFFMANN
Partner Business Manager
bei IFESCA

JÜRGEN RESCH
Director Industry Management
Energy

Jürgen Resch heads the Energy & Infrastructure sector team at COPA-DATA and Lars Hoffmann is Partner Business Manager at IFESCA. Both authors have worked closely from the start on the solution described and share a passion for a sustainable energy future.

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IS THE FUTURE OF PHARMACEUTICAL MANUFACTURING MODULAR?

A discussion between members of ISPE Pharma 4.0 and the GAMP Community of Practice about the life science industry's adoption of modular plant automation.

In today's fast-paced pharmaceutical manufacturing environment, companies are constantly striving for increased process efficiency, greater flexibility, and faster time to market. Enabling a faster and smoother integration of automated shopfloor equipment is critical to achieving these goals. Here, a modular automation approach, known as Module Type Package (MTP), can support this process.

While standardization bodies like NAMUR and Profibus Profinet International User Group (PI) continue to play an important role in this area, numerous industry groups are actively exploring how MTP technology can be applied in life sciences. Their focus? On streamlining and accelerating the qualification and validation process.

I spoke with two of my teammates at the ISPE Pharma 4.0 Plug & Produce Working Group, Rod Hoffman and Thomas Makait, to discuss how modular automation can revolutionize the future of pharmaceutical manufacturing.

ROD HOFFMAN

Based in Wilmington, Delaware, Rod Hoffman has been with AstraZeneca for nearly 20 years, where he has held key roles across manufacturing, operations, and IT. Currently an IT Engineering Capability Director, Rod specializes in IT/OT integration, focusing on aligning technology with business needs to drive operational efficiency.

Giuseppe Menin: Rod, what are the main benefits that modular automation can bring to pharmaceutical manufacturers like AstraZeneca?

Rod Hoffman: The advantages of a modular approach became clear to me when I took on the responsibility of implementing an MES platform at AstraZeneca. This was part of an initiative to promote standardization when the company was transitioning from paper batch records to electronic batch records (EBR). Many stakeholders across the business were excited about the benefits of integrating equipment on the shopfloor (ISA 95 Lev. 2) into an MES environment (ISA 95 Lev. 3) and some of our sites were fully onboard with that approach. However, I soon realized that standardization was lacking. This meant every site integrated its equipment differently, often using legacy technology like OPC DA or HDA. In other words, our engineers had to design each interface from scratch, requiring extensive validation documentation which could rarely be reused because of the lack of interface standardization.

It was at that point that our MES supplier started looking at ways to simplify integration with a message-based approach, which is how my modular automation journey began. The benefits of integrating shopfloor equipment were already clear to me. Now, I also understood that without standardization this integration process would be costly to maintain in the long term. I saw MTP as a promising technology that could support standardization and reduce integration costs over time while enabling companies like AstraZeneca to fully realize the benefits of integration. In essence, it's all about connecting equipment seamlessly, so that we can access the data we need easily and drive value.

Giuseppe Menin: In which areas of the pharmaceutical industry is MTP proving particularly effective? Are there any new or emerging applications where MTP could help solve integration challenges?

Rod Hoffman: There are multiple areas where we see real opportunities – such as the new cell and gene therapy plant we recently built. Greenfield applications of this kind are perfect candidates for MTP. While most of our equipment suppliers have not adopted MTP yet, I am confident that, once they realize how beneficial this approach can be to them, they will fully embrace it.

Another area where MTP can help is manufacturing environments with complex production lines made up of equipment from multiple vendors. By applying a Process Orchestration Layer (POL), we can minimize that complexity. POL plays an important role in modular automation, functioning as a control center that oversees and coordinates multiple tasks, systems, and workflows to ensure smooth end-to-end operations. Positioned above individual task automations, the orchestration layer serves as a smart connector, integrating various systems and applications.

Thomas Makait: I agree. MTP can easily adapt to multiple use cases, whether it's continuous manufacturing, batch production, or flexible campaign-oriented manufacturing on multi-product production platforms with mobile, interchangeable modules.

Giuseppe Menin: Thomas, as a senior computerized system validation (CSV) consultant, would you say demand for modular automation is growing in your sector? Are pharmaceutical companies and machine builders showing interest in this approach?

Thomas Makait: Interest in modular automation is certainly growing across the pharmaceutical industry. My clients have high expectations of MTP. They see this as a promising approach to standardization that can help to reduce the effort that qualification and validation currently entail. This field of engineering, commissioning, and qualification is undergoing a generational and technological shift. Young engineers are entering the profession and new technologies are emerging. Old qualification and validation methods and procedures are no longer fit for purpose – which is where MTP comes in.

From a technological standpoint, standardization means moving away from a traditional mindset, i.e. "vendor lock-in" and a pharmaceutical-company-specific interpretation of regulations. Instead, we must move to a standardized approach which is vendor-neutral and pharma-company-neutral. This will enable end users to easily connect automated equipment to a process orchestration layer in a compliant manner. When it comes to qualification and validation specifically, Good Automated Manufacturing Practice (GAMP) 5 is all about enabling modularization with intelligent, automated

modules allowing closer integration between automated equipment and the control layer.

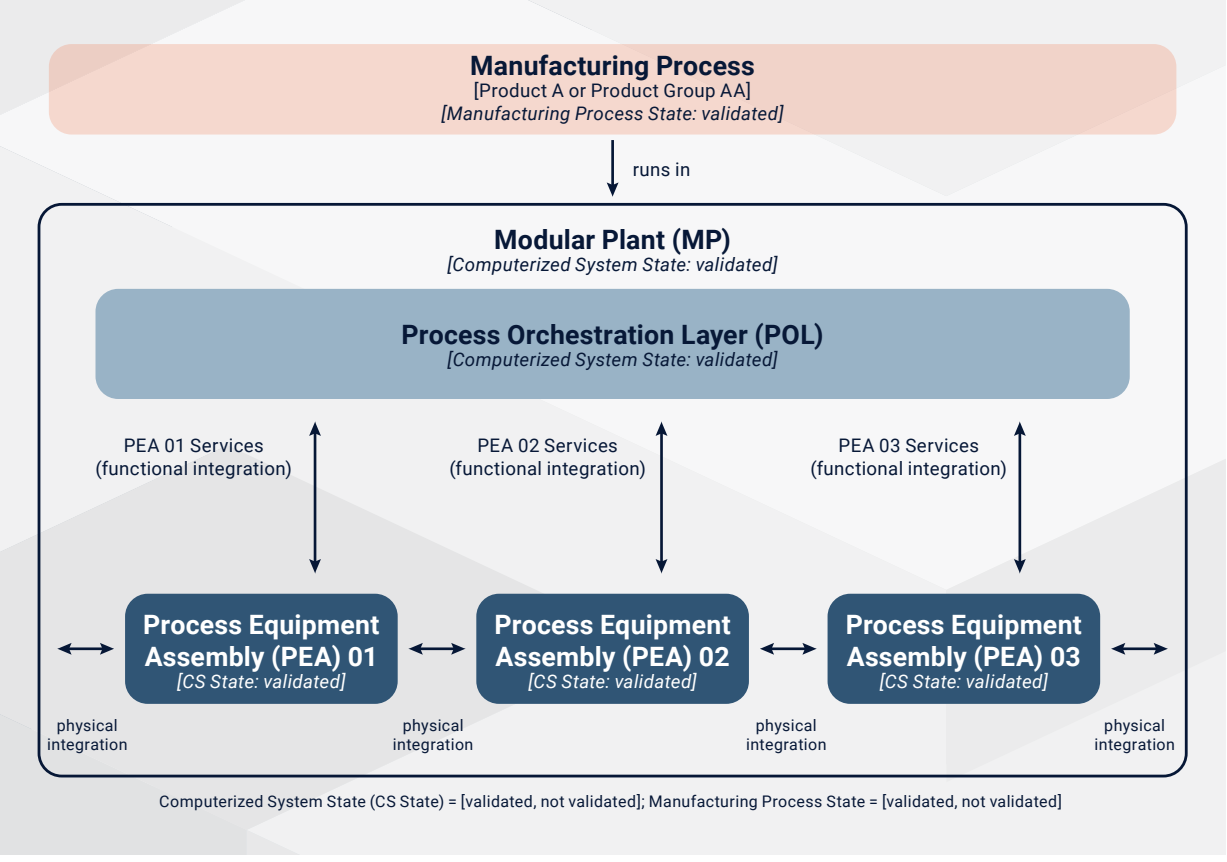
The biggest challenge is applying a holistically integrated approach for equipment qualification and validation of the overall computerized system, ensuring that multiple departments and organizations work in unison. We also need to convince equipment vendors to embrace MTP and get to a point where equipment is prequalified and validated to speed up the integration process into entirely modular plants.

Giuseppe Menin: Rod, you are a member of the ISPE Pharma 4.0 Community of Practice (CoP). Can you tell us what Pharma 4.0 is? And can you tell us more about the MTP workstream you lead within the Plug & Produce working group?

Rod Hoffman: In essence, Pharma 4.0 means applying the principles of Industry 4.0 to the pharmaceutical sector. The goal is to enable manufacturers to realize the benefits of connectivity and interoperability that underpin the Industrial IoT. There are several sub-streams of Pharma 4.0 – one of which is Plug & Produce. Here, the "Plug and Play" concept is applied to a manufacturing environment. It's inspired by the same concept that revolutionized how you plug a printer into your computer. Instead of complex technical setup tasks being required, we now use USB cables or wireless technologies – thanks to plug and play.

The main goal of the Plug & Produce working group is to ensure that any automated equipment in a pharmaceutical manufacturing environment can be seamlessly integrated. This means prevalidating the equipment's ability to integrate with other systems, thus dramatically reducing the extended lead times associated with the qualification and validation process.

Typically, engineers spend a significant amount of time writing specifications in advance of the equipment's arrival. Once the equipment hits the shopfloor, they often end up spending more time rectifying that original work. This is where ensuring seamless integration with the upper-level system is essential. Our working group focuses on addressing the gaps in the existing standards that may prevent us from achieving this level of seamless integration and interoperability. For example, we looked at the gaps in alarms and audit trails within an OPC-UA architecture which prevent us from addressing some key pharmaceutical requirements. We produced a paper to propose a potential solution, introducing new data structures within OPC-UA and we've now progressed into an MTP guide for pharmaceuticals. Ultimately, we really see promise in the MTP standard and think it could represent a paradigm change.



Operating environment of a modular plant (MTP)

THOMAS MAKAIT

With over 25 years of experience in the pharmaceutical industry, Thomas Makait is a seasoned consultant in computerized systems validation. He specializes in validation strategy and interim quality management. His career spans roles from Technical Compliance Manager at Sanofi to Quality Assurance Manager and, for the past five years, he has been deeply involved in the Modular Plant Engineering and MTP field. As one of the primary contributors to the NAMUR standard NE 185, Thomas helped shape the foundational guidelines for MTP in the pharmaceutical industry, which continue to be developed by the active working group.

Giuseppe Menin: Who is involved in the working group and what are your deliverables? Do you see any obstacles to the large-scale adoption of MTP in the pharmaceutical industry?

Rod Hoffman: The team is a very diverse group composed of industry experts like me as well as representatives of vendors, including machine builders and automation software and hardware companies. Our primary goal is to develop guidelines to help pharmaceutical companies adopt and implement MTP across their production lines or even in their developmental laboratory environments.

As a group, we want to ensure that all stakeholders understand the value of MTP. Pharmaceutical companies need to understand the value proposition of MTP and demand that vendors support this approach. Vendors must also understand it and how it benefits them. The struggle right now is that some stakeholders still don't understand what this technology can deliver for them or, worse still, they see it as a threat to their business model.

The group is creating an Implementation Guide for MTP in the pharmaceutical industry. Through this guide, we intend to offer engineers an overview of possible implementations of MTP within life sciences manufacturing, including practical use cases where MTP has already been applied. This should facilitate the preparation of User Requirement Specifications (URS) demanding MTP adoption.

Thomas Makait: One aspect that's often overlooked is the pharmaceutical industry's diversity. It ranges from Process Industry applications, such as for the manufacturing of Active Pharmaceutical Ingredients (APIs), to discrete manufacturing applications, such as vials and tablet packets. The MTP standard originated in the process industry and is still relatively new to the discrete domain, where it can entail some additional hurdles. This is something to consider when implementing MTP in the pharmaceutical sector. However, this gap will soon be closed with the MTP Version 2.0 (IEC 63280) standard which will be available in 2025.

Giuseppe Menin: Thomas, you are a senior member of GAMP DACH and GAMP International. Can you tell us more about GAMP and the role this organization has played in promoting MTP?

Thomas Makait: Back in 2002, I was one of the founding members of the GAMP DACH forum in Germany. While the GAMP 4 guide was already available at the time, applying it to specific applications in the pharmaceutical industry was a challenge. Service providers, together with equipment and DCS vendors, all joined the discussion on new and innovative approaches to computerized systems validation in close alignment with regulators.

In 2020, I was tasked with drafting the NAMUR papers on the qualification of modular plants, NAMUR NE 185. When I was sitting in the GAMP DACH forum in 2022, modular plants were not yet a popular topic in the pharmaceutical industry. However, we realized that international demand for modular plant solutions was on the rise, so we created a local German Special Interest Group (SIG) to address this emerging need in the market. The SIG comprises of industry experts from pharmaceutical companies, equipment and system vendors, systems integrators, and specialized consultants.

Giuseppe Menin: You are leading the international GAMP special interest group (SIG) "Module Type Package in Pharma" focusing on the validation of modular plants together with Markus Fink from SIEMENS as co-lead. Can you tell us more about this initiative?

Thomas Makait: In 2023, when the demand for Modular Plants based on MTP technology gained momentum in the pharmaceutical industry, the SIG was elevated to international level to standardize the approach to modular plant qualification and validation globally. These activities were welcomed and supported by early adopters of MTP-based modular plant implementations in the pharmaceutical industry.

Giuseppe Menin: Without a consistent validation framework, the modular plant concept is difficult to apply in a GAMP-regulated environment. How is your SIG addressing this challenge?

Thomas Makait: We're living through exciting times. I've been working in the automation industry

GIUSEPPE MENIN

An Industry 4.0 and IIoT enthusiast, Giuseppe Menin has extensive technical experience in mechatronics, automation, software development, and system integration. Giuseppe joined COPA-DATA in 2004 and he's currently working as Director of Life Sciences and Process Industry. Since 2014, he has been a member of the International Society for Pharmaceutical Engineering (ISPE). He's also a member of ISPE Pharma 4.0 CoP and GAMP Italy Steering Committee.

for nearly 35 years and this is the first time we have a standard to connect and integrate automated equipment with higher-level automation systems seamlessly. It is only natural that this degree of standardization must now also apply to the qualification and validation process. The goal is to develop standardized approaches based on standardized terminology and technology, minimizing ambiguity in qualifying and validating modular plants compliantly.

One promising approach is to define standards which allow for the leveraging of vendor module qualification to speed up onsite qualification and validation in a compliant manner. We need to bridge the gap between existing engineering data and the manual transfer of such data into the information required for the qualification and validation of modular plants. The major challenge for all organizations involved in the equipment and modular plant lifecycle is that there are multiple departments, stakeholders, and organizations involved. Ultimately, we're aiming for a situation where vendors are providing prequalified and prevalidated automated modules (PEAs) compliantly. This is at the heart of the "ISPE GAMP Guide Modular Plant Validation and Qualification ", a companion guide to the MTP Implementation Guide developed by Rod's team within the Pharma 4.0 Plug & Produce Working Group. Both guides shall be available in 2025.

Giuseppe Menin: What are the main areas of modular plant validation where MTP can be successfully applied?

Thomas Makait: Modular plant arrangements have already been successful across research laboratories, process development, and scale-up facilities. The next step is extending the concepts to the production environment, meaning a qualified modular and non-modular infrastructure with matching interfaces for fixed and mobile modular process units (PEAs). In other words, we need to get to a situation where, once clinical studies are completed, the same modules can be transferred seamlessly to the production environment, making room for the next product to be developed.

The validation strategies for automation platforms must be capable of integrating conventionally automated equipment alongside MTP-enabled automation, as we know that most automated equipment vendors are not MTP-ready yet. As first movers, pharmaceutical companies are at the forefront of developing this new market, supporting module vendors to develop the required capabilities to supply the life science industry with prequalified and prevalidated modules.

EFFECTIVE STANDARDS WILL ACCELERATE THE MOVE TO MODULARITY

As of today, modular plant designs for the process industry are not only discussed in academia but also tested in industrial applications. These innovative smart manufacturing plants are designed to provide the necessary flexibility to enable producers to quickly react to changing market conditions compliantly.

MTP has proven to be a standard that can support the concept of modular manufacturing. There is now a need to transfer the concept into best practice across the industry. We also need to consider smart manufacturing integration and the request for prequalification and prevalidation as integral parts of the requirements when purchasing automated equipment.

In this area, the MTP4 ISPE working group of ISPE Pharma 4.0, through its document currently under development, aims to support engineers in the drafting phase of URS. Similarly, GAMP's MTP in Pharma SIG, through the document "ISPE GAMP Guide Modular Plant Validation and Qualification " seeks to support engineers engaged in equipment qualification and computerized systems validation activities. These efforts will be crucial steps toward smart manufacturing based on modular and interoperable manufacturing plants and platforms.

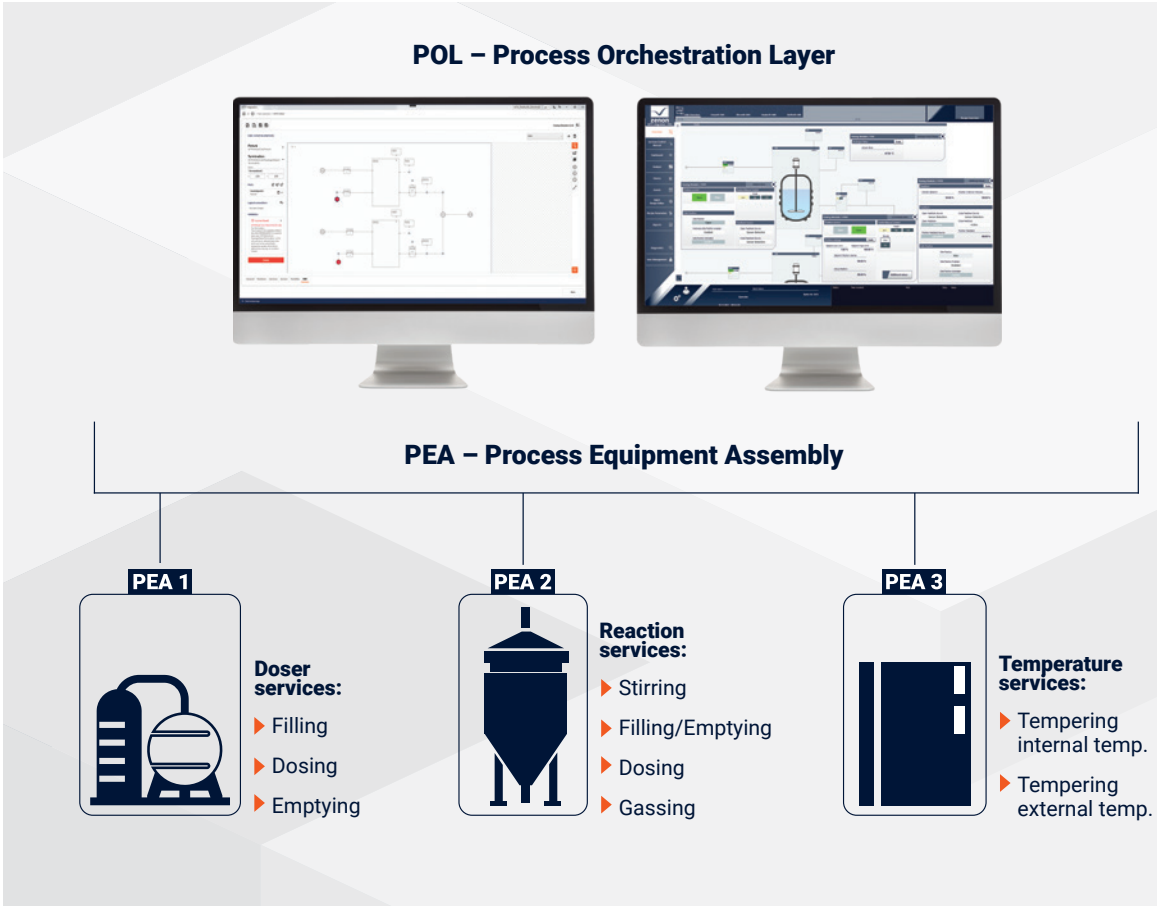
REFERENCES

ISPE 2025 Agenda 2025 Europe Annual Conference

PI International

NAMUR

ISPE® Pharma 4.0™



CO_2 CONCENTRATION

633 ppm

PV PRODUCTION

72.5 kW

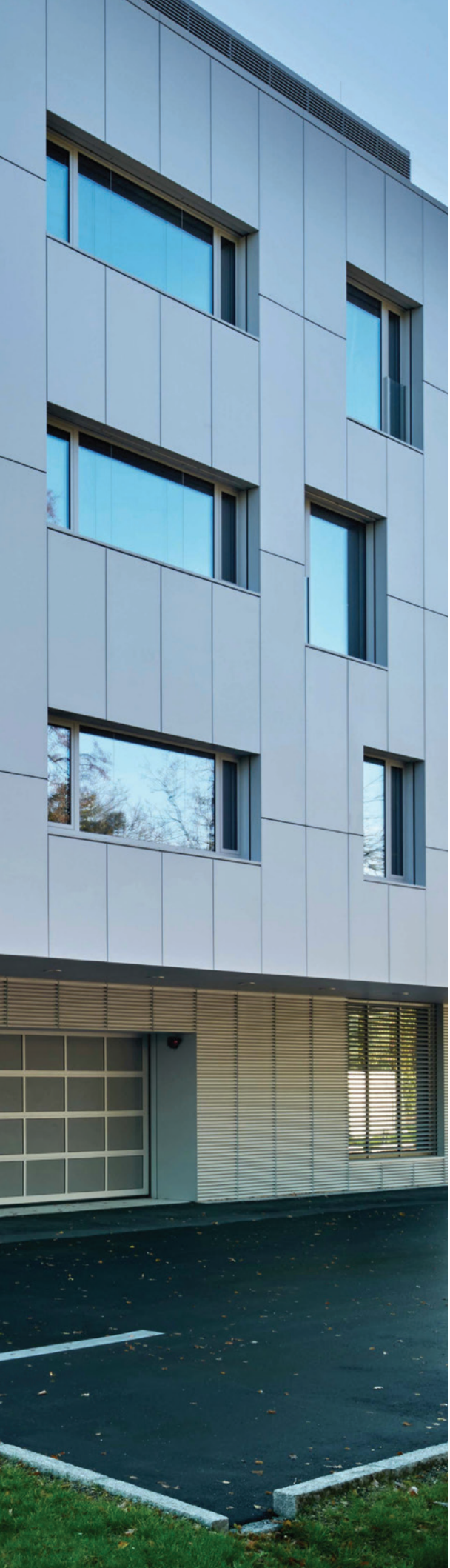
ROOM TEMPERATURE

TARGET **22°C** ACTUAL **22.8°C**

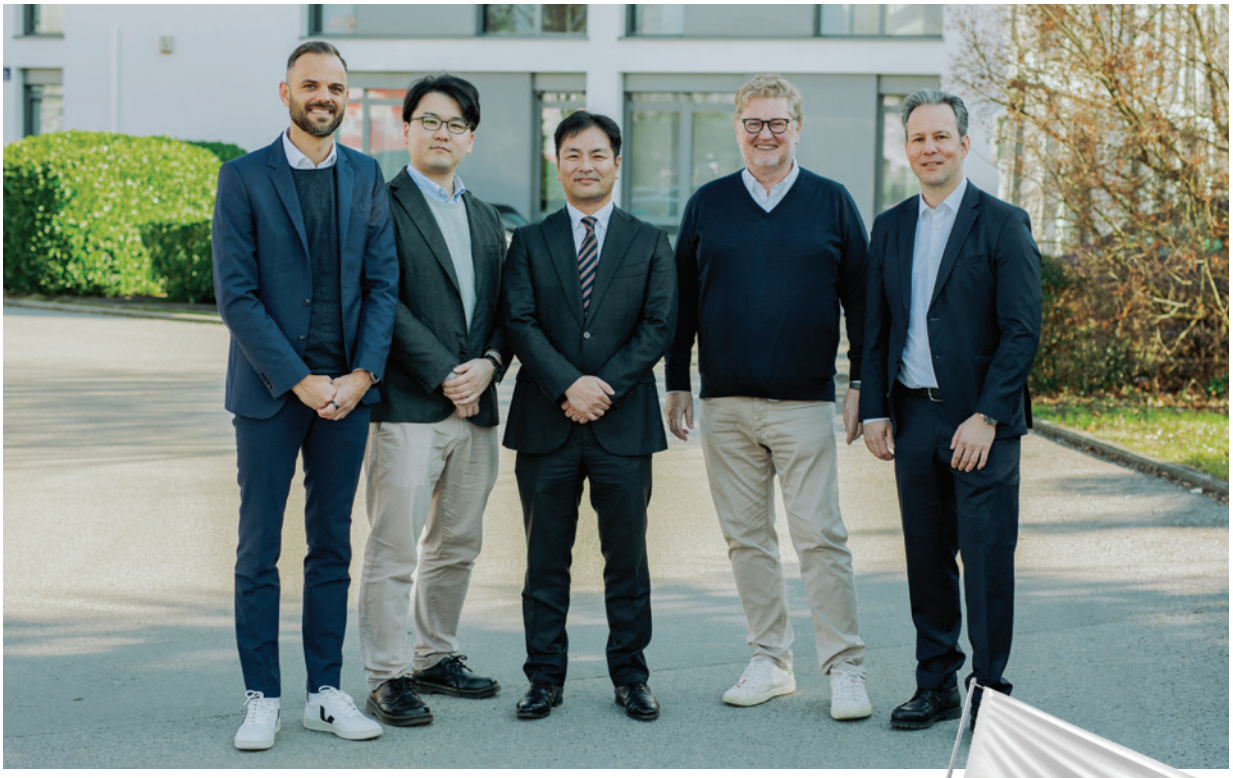
CHARGING STATIONS OCCUPIED **7/10**

WALLBOX CONSUMPTION

67.41 kW



AROUND THE WORLD



From left to right: Christoph Dorigatti, VP Global Business Development; Naoki Mayazaki, Technical Sales Manger CD Japan; Tadataka Une, Managing Director CD Japan; Thomas Punzenberger, CEO; Phillip Werr, Member of the Executive Board

IRASSHAIMASE, COPA-DATA JAPAN!

With the opening of our new COPA-DATA branch office in Tokyo, we have reached another milestone in the international market. Japan is one of the most innovative economies in the world and there is a major need for automation and forward-looking solutions in manufacturing. Managing Director of COPA-DATA Japan Tadataka Une and his team provide strong local support for COPA-DATA customers and partners.

A MARKET FULL OF INNOVATION AND BIG CHALLENGES

As the fourth largest economy in the world, Japan stands for ongoing innovation and industrial change. But there are also major challenges. Due to the ever-aging population and shortages of workers, the need for automation and modern manufacturing solutions is increasing rapidly across all sectors.

These are challenges that the zenon software platform is well-suited to meet. Our platform promotes efficient work, compliance with legal regulations, and, thus, sustainable growth opportunities for both end customers and system integrators. One area of focus that Tadataka Une has set is the pharmaceutical sector: "We will continue to focus on building relationships with end customers and system integrators in the life sciences sector. We are also very interested in pharmaceutical equipment manufacturers, who will benefit from zenon's globally proven capabilities in this area."

NEW SOLUTIONS FOR JAPAN'S ENERGY SECTOR

The Japanese energy sector is also facing a wide range of challenges. Both the necessary modernization of the grid and the trend towards renewable resources will demand flexible and innovative solutions. This situa-

COPA-DATA JAPAN AT A GLANCE

TADATAKA UNE
Managing Director

NAOKI MIYAZAKI
Technical Sales Manager

MASATAKA TAKIZAWA
Technical Consulting Engineer

TOMOMITSU YAMAGUCHI
Technical Consulting Engineer

MAKI ENDO
Sales & Marketing Administration

tion aligns with the objectives of COPA-DATA. "Japan's energy and industrial sectors are at a turning point," says Christoph Dorigatti, Vice President Global Business Development at COPA-DATA Headquarters. "Our solutions are perfectly designed to meet the challenges of the energy sector. In addition, zenon's versatility will help to meet the modern digital automation needs of the pharmaceutical, food, and automotive sectors."

EXPANDING AND STRENGTHENING CONNECTIONS

COPA-DATA has been present in the Japanese market since 2017. Through cooperation with a sales partner, we have built a strong customer base that includes global companies, such as Otsuka Pharmaceutical Factory, Kyowa Kirin, Suntory, Toyota Motors, and Panasonic. By establishing COPA-DATA Japan, our team can provide even greater support to existing customers and build new relationships with system integrators, equipment manufacturers, and end customers.

Stefan Reuther, Member of the Executive Board at COPA-DATA Headquarters, explains the strategic importance of the new subsidiary: "This expansion fits nicely with our global growth strategy. By building local teams, we get closer to our customers and their challenges. Japan is not only an important market but also an opportunity to demonstrate zenon's scalability and adaptability to modern industrial requirements."

THE THIRD COPA-DATA BRANCH IN ASIA

Following our successful entry into the South Korean and Indian markets, COPA-DATA Japan is our third office in Asia, bringing local expertise to one of the most dynamic markets in the world. The address of the new branch office is also strategically important. Shinagawa Grand Central Tower in Tokyo is a prime location strategically, thanks to excellent connections to the rest of Japan via Shinkansen bullet trains and air travel. This means COPA-DATA Japan is easily accessible to customers and partners for even closer cooperation and more innovation.

The main goal of the local team initially is to better meet the needs of the Japanese market. Tadataka Une adds: "We want to strengthen partnerships, bring the COPA-DATA Partner Community to Japan, and expand our market presence, especially in the pharmaceutical and energy sectors. Digitalization is critical to addressing the expected worker shortages in companies in the near future and supporting Japan's transition to global standards."

Irasshaimase, COPA-DATA Japan! We look forward to a successful future together.

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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.

MANON MATHIEU

Marketing Manager
STRATON AUTOMATION
At STRATON since: 2019

I am always available to answer questions about how to showcase new product features and client projects. I organize international events and trade shows and create visual content to highlight our solutions.
In our market, each expertise matters: energy experts, pioneering developers – everyone brings theirunique value. Working together is essential to create solutions tailored to market needs and stay at the forefront of innovation.
I would describe myself as creative, curious, and positive.

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THOMAS RECHBERGER

Team Lead Development
COPA-DATA Headquarters
At COPA-DATA since: 2012

What I like about my job is that I can have an impact. It's fun to create the conditions for my team members to contribute and develop to the best of their abilities – and enjoy their work.
In working with my team, it is particularly important that we get along. Respect for each other, always being open to fun, and not taking ourselves too seriously contribute to the good environment here.
In my free time, I like to be outdoors in nature – with my family, my friends, and sometimes by myself. I spend a lot of time in the mountains. In summer, I hike or ride my mountain bike. In winter, ski touring is my sport. In my day-to-day, I also prefer biking over driving.

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STEFAN PICHLER

Software Developer
COPA-DATA Headquarters
At COPA-DATA since: 2019

Customers and colleagues can contact me about all sorts of topics related to zenon. My specialties are: zenon Add-In Wizards and Services, third-party applications, custom solutions in C#, SQL in various dialects, Typescript, and web frameworks.
Every project has different requirements, which adds a lot of variety to my work, and I particularly like that. I get to focus on new topics with each project, from the zenon module to frameworks and new technologies.
In my free time, I like cycling and going for walks. I'm a hobby photographer and I play Dungeons & Dragons. I also like to code, read, write, and meet up with friends.

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CONSTANTIN VON PANDER

Senior Expert Digital Strategy & Solutions
COPA-DATA Headquarters
At COPA-DATA since: 2017

My main responsibilities are in the area of technological and strategic consulting for our Digital Tools & Touchpoints landscape. In addition to a wide variety of digital projects, I also serve as an in-house go-between for different teams and departments, as well as a contact for outside marketing service providers. One of my specialties is HubSpot, the powerful marketing, sales, and CRM tool we use.
Team spirit, a healthy dose of humor, and a good atmosphere at work are very important to me. I use my experience and expertise to find long-term solutions and I help colleagues answer questions and solve any issues they are having. It's my way of motivating colleagues and boosting team spirit.
My job provides me with a lot of unique, exciting ways to make a mark and it enables me to use my strengths to the best of my abilities. I also really enjoy the international focus, the related opportunities, and the positive work environment.
A few words I would use to describe myself are: athletic, tenacious, quiet, analytical & thoughtful, creative, and solutions-oriented.

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“IT REALLY WORKS GREAT”

“Growing together” is the motto of the COPA-DATA Partner Community (CDPC): The global community of integrators supports end customers with everything they need to know about the zenon software platform. Why is it worth becoming part of the community or reaching a higher partner level? Information Unlimited asked those who know best: the partners.

“The close partnership with COPA-DATA helps us to provide our customers with first-class advice and support,” says Andreas Langer, Chief Operating Officer (COO) at ControlTech Engineering (CTE). The Swiss company, a specialist in automation and industrial information technology, is one of about 20 Gold partners in the COPA-DATA Partner Community (CDPC): Companies that have reached this status have in-depth knowledge of the zenon platform and have already implemented complex and innovative projects using the software. This goes hand in hand with an intensive, often years-long collaboration with COPA-DATA, which benefits both the system integrator and the end customer.

FROM LISTED MEMBER TO GOLD STATUS

Gold partner status is the premier class of CDPC – and it usually includes partnering with COPA-DATA on zenon development. But how can partners reach this level? “To attain a higher membership level, you must meet specific criteria. It takes both theoretical and practical knowledge,” explains Manuela Rettenbacher, Global Partner Manager at COPA-DATA: “We support our partners in this process.” While no certification is required for listed members, higher partner levels include Bronze, Silver, and Gold.

HIGHLY VERSATILE SOFTWARE

What all partner levels have in common is the bridge to zenon: an innovative software platform that provides a powerful tool for end customers. Relatively easy to learn and use, it has a variety of licensing models. Another key benefit is the platform’s versatility, which allows users to develop individual customer solutions. Typically, it starts with a smaller project, and as the system integrator gains experience, their CDPC

membership level usually increases: large end customers usually require a higher partner level. Anyone who is a member of the Partner Community positions themselves as a trustworthy zenon expert and opens sales opportunities: the certification helps to open doors in sales, with both existing customers and new customers. As a software manufacturer, COPA-DATA does not compete with integrators.

COLLABORATIVE PARTNERSHIP

For many partners, the collaborative approach to working with COPA-DATA is what sets the Partner Community apart: "The team is helpful, open, and friendly. The partnership really works great," states Andrew Stephens, Director Sales & Marketing at Industrial Technology Systems (ITS). His company is a CDPC Silver partner just like Appliant, which relies exclusively on zenon: "I feel privileged to be part of this community. It is incredibly valuable to be able to count on this support in our day-to-day business," states Marc Ramoneda, Chief Executive Officer (CEO). Such strong support is by no means a given. For Noah Haas, Project Manager at Gold partner Actemium, the quick, reliable response to service tickets is also a big plus.

> "I feel privileged to be part of this community."
>
> Marc Ramoneda,
> CEO Appliant

VALUABLE NETWORKING OPPORTUNITIES

CDPC members have a reliable partner at their side with COPA-DATA. For example, marketing opportunities are part of the CDPC portfolio. This includes a presence on online channels such as social media or YouTube and, if possible, also at trade shows. In addition, free online training and exclusive product information are part of the CDPC. The integrators pass on this know-how – and confidence in the technology – to their customers.

GROWING TOGETHER

Last but not least, the CDPC is known for its commitment to growth. "We keep up to date with our Partner Community," says Global Partner Manager Manuela Rettenbacher. "We are pleased to continue this journey with our partners and develop the network further." It's a sentiment that sums up perfectly the motto of the COPA-DATA Partner Community: growing together.

COPA-DATA
Partner Community

THE COPA-DATA PARTNER COMMUNITY

The COPA-DATA Partner Community (CDPC) is an international community with over 500 members. It drives digital transformation and supports companies in integrating the zenon software platform. Partners are mainly system integrators but also include machine manufacturers, original equipment manufacturers (OEMs), and research or educational institutions.

CDPC on Youtube

THE PARTNER LEVELS – ALL ABOUT ZENON

Listed Member
do not need any certification to join.

Bronze Partner
have basic knowledge and initial experience with projects.

Silver Partner
possess in-depth practical and theoretical knowledge.

Gold Partner
have implemented major projects already.

Would you like to join the **COPA-DATA Partner Community?** Any questions?

Write us at
PARTNER@COPADATA.COM
For more information, visit
WWW.COPADATA.COM/PARTNER

Join our community

POWERTEAMS: SMART COLLABORATION FOR THE ENERGY FUTURE

How can we meet the global challenges of the energy transition more efficiently? The PowerTeams project between COPA-DATA and several Austrian research partners relies on an innovative digital collaboration platform inspired by established communication tools. It enables project members distributed around the world to work together on the development and testing of new smart grid applications. AUTHOR: SAMUEL INWINKL, PUBLIC RELATIONS CONSULTANT

The energy transition calls for innovations at an unprecedented pace. With the growing number of decentralized energy producers, companies are facing increasingly complex challenges, particularly with regard to smoothly connecting different systems and safeguarding digital processes. At the same time, the demands are increasing for implementing the new technologies quickly and effectively. This is where PowerTeams comes in: it is a new, service-centric collaboration platform that brings together globally distributed teams and supports seamless, digital development processes.

ONE PLATFORM CONNECTING SYSTEMS AND EXPERTS

At the heart of the project is the Integration Hub, a digital hub that connects tools, technologies, and expertise. This architecture makes it possible to exchange data and information from different development steps securely and

efficiently. PowerTeams brings together concepts for collaboration from software engineering and the traditional IT sector. On the platform itself, users can form teams to work together collaboratively. In addition to services for developing and validating an application, users can also access tools that support collaboration. "Users can access, for example, shared file storage, a notification center, workflow management, error documentation, comment functions, milestones, and web-based editors for working on files as a team," explains Christof Brandauer, senior researcher at Salzburg Research and a partner in the PowerTeams project, as he describes the possibilities offered by the platform. The zenon software platform can also be integrated here as a service. Standardized interfaces, such as those implemented in the Integration Hub, enable developers to efficiently use the relevant tools from different providers. This not only avoids expensive vendor lock-in but also promotes innovation, as the best solutions can be combined flexibly.

COLLABORATE EFFICIENTLY WITHOUT BORDERS

The project opens up completely new opportunities for cooperation in the energy community. "Globally distributed teams of development and test engineers can work together on a consistent model – without the hassle of sending project files back and forth. The teams use centrally provided services to automatically generate target configurations and conduct validation tests from the same engineering environment in remote laboratories with special test equipment," explains Filip Pröstl Andren, Senior Scientist at the AIT Austrian Institute of Technology and a partner in the PowerTeams project. This end-to-end digital collaboration minimizes sources of error and significantly shortens development times. The design of PowerTeams is similar to well-known collaboration platforms used on a daily basis in the office, which connect teams regardless of location and foster efficient teamwork.

CHRISTOF BRANDAUER
Senior Researcher at
Salzburg Research

FROM IDEA TO HANDS-ON SOLUTION

PowerTeams was developed by COPA-DATA in collaboration with the project partners Salzburg Research, AIT Austrian Institute of Technology, and the FH Oberösterreich, Campus Hagenberg. The goal is to reimagine how we engineer and validate smart grid applications because the energy market is currently experiencing one of its biggest periods of change. Jürgen Resch, Director Industry Management Energy at COPA-DATA Headquarters explains: "We need to build more and more energy producers and transmission facilities – in a shorter and shorter amount of time. As a result, we have to rapidly recruit new workers. Many planning and implementation stages can be performed online. This search for solutions gave birth to PowerTeams, which is designed to meet these challenges."

In the following interview, project partners Jürgen Resch (COPA-DATA), Christof Brandauer (Salzburg Research), Filip Pröstl Andren (AIT Austrian Institute of Technology), and Armin Veichtlbauer (FH Oberösterreich, Campus Hagenberg) offer insights into the challenges, objectives, and future outlook of PowerTeams.

FILIP PRÖSTL ANDREN
Senior Scientist at AIT Austrian
Institute of Technology

PowerTeams relies on a digital platform that efficiently connects distributed development teams in the energy industry. What is behind it exactly?

Jürgen Resch: In the PowerTeams research project, we are developing and testing a concept for a digital collaboration platform that supports the engineering and validation of smart grid applications. The idea emerged during the COVID-19 pandemic when we were increasingly collaborating digitally. We realized that a tool for coordinated collaboration in the energy industry would have a huge upside. Our concept was particularly inspired by digital tools that were widely used to collaborate during the pandemic.

Filip Pröstl Andren: Exactly. Due to the increasing decentralization of power generation and the growing complexity of systems, we need new ways to make development processes more efficient and flexible. PowerTeams enables globally distributed teams to work together on a model without having to manually share files.

Christof Brandauer: One important aspect, of course, is that PowerTeams is not only a technology platform but also sets new standards in collaboration. It combines methods from software de-

JÜRGEN RESCH
Director Industry Management Energy at COPA-DATA

velopment with requirements from the energy sector, making it easier to develop and validate new applications.

Supporting flexible teamwork regardless of location is important. But why is PowerTeams so critical right now for the energy sector?

Jürgen Resch: The energy sector is undergoing tremendous change. We need to integrate more energy producers and grid elements in a shorter and shorter amount of time. However, there is a shortage of skilled workers. PowerTeams helps to make processes more efficient and enables teams to collaborate easily, regardless of their location.

Filip Pröstl Andren: Another important topic is interoperability.

Armin Veichtlbauer: Add to this smart grids, or intelligent networks, capable of adapting dynamically. It all requires powerful development and testing tools.

Christof Brandauer: PowerTeams supports this transition by using state-of-the-art technologies, such as service-centric architectures and virtualization, specifically for smart grid engineering.

A core element of PowerTeams is the Integration Hub. What is its purpose?

Christof Brandauer: The architecture of the PowerTeams platform is based on the concepts of (micro)service-centric architectures, formalized service descriptions, virtualization, and orchestration tools. The central component is the Integration Hub, which allows users to sign up for any services on the platform and then find and use them.

Jürgen Resch: The Integration Hub is, thus, the heart of PowerTeams.

Christof Brandauer: Yes. Services are provided via containers or virtual equipment. That said, it is also possible to use the services via a web interface and without an API. COPA-DATA uses zenon to connect its powerful SCADA IDE, or integrated development environment, to the PowerTeams platform.

Armin Veichtlbauer: You can also think of the Integration Hub as a digital marketplace. Where providers and consumers of services that are helpful in engineering can meet.

What is the current status of the project? Are there still challenges in development and testing? What are the long-term plans for the project?

Armin Veichtlbauer: We have completed the design phase. Currently, we are concentrating on launching the prototype.

Christof Brandauer: And we'll continue to expand the prototype. Only project members are currently using the platform and we are testing it primarily for correctness. In the final validation phase, people outside the project will also be able to use the platform. We are looking forward to their assessments.

Jürgen Resch: However, currently we are encountering challenges related to hardware-in-the-loop (HIL) testing. We want to test different components of the zenon software platform, for example, in a HIL environment, using the Integration Hub as a central hub.

Filip Pröstl Andren: Of course, the development of a scalable authentication and authorization concept for different users and services is currently still considered a challenge.

Christof Brandauer: In the longer term, we want to create an ecosystem with a variety of integrated services. You can think of it as an app store. The services can be used in education and research and PowerTeams can serve as a reference platform for development and validation of new methods and approaches. Startups can validate their ideas faster but also offer new services, such as AI-based validation methods, via the PowerTeams platform.

What does this mean specifically for the energy sector?

Christof Brandauer: For energy suppliers and system integrators, it can be useful to have access to special simulation and test components provided via a PowerTeams service. The platform's integral collaboration options also make it easier to manage projects.

What benefits does COPA-DATA bring to the project as an industrial partner?

Filip Pröstl Andren: COPA-DATA brings its valuable expertise on SCADA and HMI systems to the partnership. This helps to link the developed platform directly with industrial applications.

Armin Veichtlbauer: COPA-DATA's hands-on experience and technical know-how give the project a clear direction and make the results more relevant for the market.

Christof Brandauer: The collaboration between Salzburg Research and COPA-DATA began in 2012. After an initial project, several more followed, and we have been partnering now for 13 years.

What makes the partnership special for COPA-DATA?

Jürgen Resch: As mentioned, we have completed some successful projects together in the past. PowerTeams is the next install-

ARMIN VEICHTLBAUER
Researching and Lecturing at
FH Upper Austria,
Campus Hagenberg

ment. The collaboration has always been very collegial and enriching. The nice thing is that, as an industry partner, we are not forced into an academic role. Instead, the industry perspective, which often includes the customer perspective, is sought outright.

What insights have you gained personally from the project and what do you see as the future of PowerTeams?

Jürgen Resch: I have learned a lot about collaborative technologies and the requirements for modern energy projects. I believe PowerTeams will set long-lasting standards that reach beyond the energy sector. Think, for example, about our other industrial sectors: manufacturing, life sciences, and pharmaceuticals. At the end of our project, we will look at ways that we can apply the PowerTeams concept to sectors other than energy.

Filip Pröstl Andren: Once we complete the prototype, our next goal is to make the platform available to selected users in the energy community. I am especially looking forward to valuable feedback from them.

Armin Veichtlbauer: Testing in specific application scenarios will certainly be exciting. As a research institution, presenting the project academically in various publications is, of course, also important to us.

Christof Brandauer: Absolutely. And the innovation pursued could be subsumed under the concept of engineering as a service. The service can then be offered to universities, start-ups, and, of course, established companies.

Salzburg Research Forschungsgesellschaft

Salzburg Research is an independent research organization with a focus on information and communication technologies (ICT). With sound scientific expertise, Salzburg Research develops and explores innovative solutions for digital networking in business and society. Special focus areas for the organization include intelligent data processing, networked mobility, Industry 4.0, and smart grids. Placing a priority on application-driven research, Salzburg Research combines academic insights with business practices and supports companies in their digital transformation.
www.salzburgresearch.at

AIT Austrian Institute of Technology

The AIT Austrian Institute of Technology is Austria's largest non-university research and technology organization and a leading player in applied research for future technologies. With a strong focus on sustainable energy, digital security, and intelligent systems, AIT develops innovative solutions to meet the challenges of tomorrow. In the field of energy, the institute focuses on the digitalization of energy systems, smart grids, and renewable energy management solutions.
www.ait.ac.at

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FH Oberösterreich is one of the leading universities for applied sciences in Austria. The Hagenberg campus focuses on computer science, communications, and media. Research and instruction are practice-oriented and closely tied to industry.
fh-ooe.at/campus-hagenberg

MEET OUR ZENONEERS

From software development to project management - Thomas has been working with zenon every day for over 10 years. With our zenon Academy learning platform, he always stays up to date and expands his know-how. The zenon Academy team works hard every day to create engaging content and produce high-quality videos for our clients. That's why we're always thrilled when we get the chance to capture our users' enthusiasm in an interview.

ABOUT YOU

Tell us a little bit about yourself:

Thomas Adem: I am 40 years old, I'm married, and I have a 9-year-old daughter. We live in Bad Vilbel, Hesse.

After training as an office administrator in the German Bundeswehr and working for a few years as an air freight export administrator at Frankfurt Airport, I decided to complete my university entry qualification and return to college.

I studied computer science and earned a Bachelor of Engineering degree from Frankfurt University of Applied Sciences.

After finishing my studies over six semesters, I started working as a software developer at my current employer in 2014. In my very first project, I began working with zenon visualization (HMI/SCADA) alongside high-level programming with C#, which I still enjoy doing on a daily basis some 10 years later, in addition to project management.

COMPANY

What is the name of your company? What industries/sectors do you cover?
SPIE AUTOMATION provides comprehensive and customized solutions for automation processes for businesses across a wide range of industries, from mechanical and equipment engineering to manufacturing.

With our divisions for engineering, software development, technical documentation, and translation, we are able to meet our customers' diverse requirements in a targeted and comprehensive manner. This offering includes a wide range of consulting services that enable us to provide customers with our expertise in IT security, risk assessment, and equipment safety, as well as knowledge management, project management, and research funding.

PERSONAL

What do you like to do in your free time?
Cycling, meeting with friends and family, and inline skating with my daughter.

zenon rocks! When you rock out, what music do you listen to?
It's a mix but I mainly listen to electronic music.

Our motto is "there must be an easier way." What feature would you add so that zenon could simplify your personal life?
zenon as a fully web-based application.

What is your specialty? What are you best at?
I create personalized solutions for customers using zenon's onboard tools, mostly with the help of the Add-In Framework.

Which of your personal skills also help you in your professional life?
I'm ambitious and a quick study. I like working independently and taking the initiative. I'm also reliable and resilient – so, all the usual.

ZENON

How long have you been working with zenon?
For more than 10 years.

What is your favorite feature in zenon?
The zenon Add-In Framework.

Which type of applications do you implement with zenon?
Mainly HMI and SCADA systems.

Which feature in zenon do you find most useful?
The zenon Add-In Framework.

ZENON ACADEMY

Which courses from the zenon Academy would you recommend and why?
zenon Basic Training provides insights into implementation options with zenon and, of course, the zenon Add-In Framework. It offers almost unlimited possibilities for meeting customer requests and requirements, no matter how "special".

How do you benefit from the zenon Academy in your daily business?
The update courses keep you up to date with each new version, allowing you to offer and implement for customers the best possible solutions that are always up to date.

zenon academy

The zenon Academy is COPA-DATA's learning platform and can be accessed with your COPA-DATA user login. Come and learn more at www.zenon-academy.com

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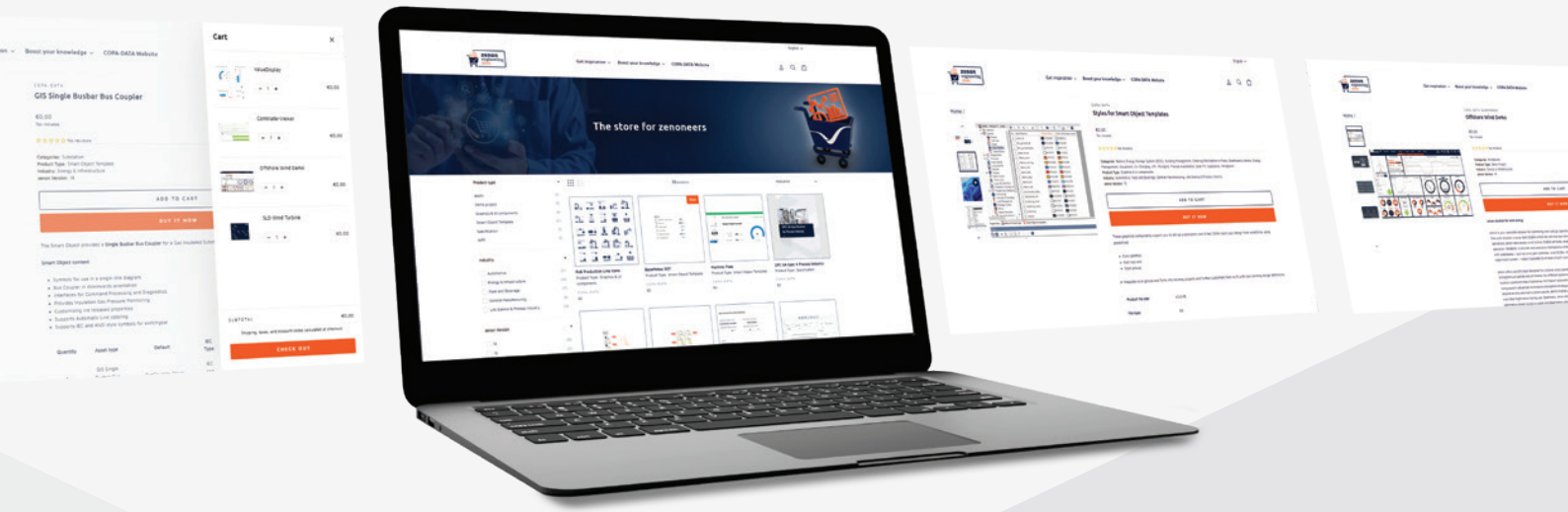

- **DEMO PROJECTS:**
  Hack the development with pre-configured solutions.
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  Cut engineering time by 50% with plug-and-play logic.
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