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INCREASE PRODUCTIVITY EASILY AND EFFICIENTLY

By using open-source software and data containers, companies can quickly gain a deeper and practical understanding of their production processes. WAGO offers suitable technologies in their open automation solutions.

Recent studies show that the average system efficiency in German companies lies only in the range of 40 to 60 percent. This implies that they produce far less efficiently than they could; which means they have a significant potential for increasing their competitiveness. This is where WAGO comes in: WAGO has future-oriented technology solutions to help companies to quickly and easily improve their productivity.

Complete Freedom for Customers: In order to increase potentials for optimization, companies need to aggregate their data at higher levels and correlate the data points with one another, explains Benjamin Böhm, Global Industry Manager Mechanical Engineering at WAGO. "One very efficient path follows along a combination made of flexible open-source software and the use of data containers, instead of using proprietary systems, as was previously common." Wago promotes real-time openness to the greatest extent, and offers customers complete freedom in its open, transparent and interoperable automation solutions.

Nimble in Co-Creation: WAGO strikes a chord with its solutions. K-Businesscom is a company that develops digitization projects, which it nimbly implements in co-creation with international customers using open WAGO technology and container solutions. The user group is broadly diversified from vendors to end customers. "Equipment manufacturers approach us because they wish to digitize their products so that they can provide their customers with new services and new business models. Production companies from the various process industries are also launching projects with us," states Roland Ambrosch, Head of the Digital Factory sector at K-Businesscom.

Sustainable, Future-Oriented Innovation: WAGO is the backbone of a smart, connected world and is committed to continuous innovation. The best example for this is the WAGO Compact Controller 100 with a real-time Linux® operating system. It records machine data and loss information in real-time and offers maximum engineering flexibility in the software. This means that projects can be generated using CODESYS V3, the manufacturer-independent IEC 61131 automation software, or existing open-source services can also be accessed via Docker® – the user can decide. Additional products, offering scalable solutions for every application, include the Edge Controller and Edge Computer, among others. Both enable optimal data use in the field.

Get more from your processes!

Many optimization approaches in industry are only possible when data is aggregated at a higher level and the data points are correlated with one another. Most companies prefer solutions for this that allow them to quickly and easily optimize their productivity. One very efficient path follows along a combination made of flexible open-source software and the use of data containers, instead of using proprietary systems, as was previously common. WAGO believes in maximum possible real-time openness and offers precisely this opportunity with future-oriented technology solutions.

Take the WAGO Compact Controller 100 as an example: you decide whether to generate your projects using the well-known CODESYS V3 software engineering environment (IEC 61131), or to use microservices and container visualization, for example, by accessing existing open-source services via Docker®. An example of the latter is Node-RED, an efficient and flexible programming tool that offers openness to various interfaces.

WAGO is your partner in digitalization! This is demonstrated by our first joint project with inray. The software manufacturer offers OPC routers as central communication hubs for Industry 4.0. In order to avoid the need for a separate server, inray relies on WAGO's Edge Computer, with the OPC router running there as a Docker® container – this saves on costs, and allows the control functions to be united in one device. Would you also like to optimize your process? Let us inspire you with our solutions!

Benjamin Böhm

CONTAINERIZATION

GET MORE INFORMATION FROM OPERATIONAL PROCESSES

An increasing number of enterprises are using open-source software to gain a better overview of their systems and facilities. Automation experts, like those from Wago, work as co-creators with system integrators to combine sensor systems, gateways, container applications and cloud computing.

Many optimization approaches in the process industry are only possible when data is aggregated at a higher level and the data points are correlated with one another. Status data from processes, parameters for pumps and compressors, or energy consumption for different assets open the floodgates for identifying potential savings. The measured values function to lower operating and maintenance costs.

The Move Away from Proprietary Solutions: Troy Sensing and Kurt Braun of WAGO USA work closely with providers in the process industry in the eastern US. Both are experts in moving data from the field level to the cloud, and from there to the monitors used by management. They have observed that companies are looking for fast and pragmatic ways to get more information from their processes, while at the same time shying away from proprietary solutions. They have gained good experience with open-source technology in a number of projects.

"We have many customers who wish to expand their existing control systems with additional functions. Therefore, we began to examine containerization solutions some time ago as a means to resolve this problem", explains Braun. According to him and based on his experience, a new automation environment has

been developed, in which it is expected that PLCs are connected to the internet and compatible with basic technologies in IoT, such as MQTT.

This approach does, however, require a different framework than the one provided by a typical industrial fieldbus protocol. Consequently, as he has observed, more and more solutions and practices are being adapted from the IT world in the USA. A number of additional security layers are applied to enable them to communicate securely outside the firewall. Programmable logic controllers are used to manage secure log-in data and encryption, and also for isolating less secure protocols, such as Modbus or Ethernet/IP™.

"IIoT solutions are strongly driven by the MQTT protocol on the US market due to the fact that it is secure, easy to use and is well understood by most destinations and endpoints. Software such as Docker® offers the isolation that IT groups require, while Node-RED helps manage life cycles, for example. Working together, these tools form a very powerful and highly functional system," relates Sensing, based on his experience.

This trend is backed up by the fact that each one of these technologies is an open-source solution, meaning that they can be used without any license

fees and that they can be continuously upgraded to meet and keep pace with industrial and safety requirements. "This presents a unique opportunity for WAGO to host these programs on our hardware," adds Sensing.

Generational Change Accelerates Transition: The use of open-source applications in the process industry can be attributed to a generation change in the IT world. Automation in the US is thus reacting to new capabilities and working methods coming from IT developers. Node-RED is a good example of this. Using this platform, it is extremely easy to create a JavaScript-based application layer and use it on corresponding hardware.

Until all controller technology companies are familiar with Node-RED and containerization, opportunity will continue to knock for those integrators who can implement digitization projects most agilely and cooperatively. They are the intermediaries between gateway providers such as WAGO, cloud providers and end users. K-Businesscom AG is one such integrator. The Austrian company creates digitalization concepts and jointly implements them with their international customers. This involves the connectivity and orchestration of machines and systems, smart sensing and inline quality assurance, along with upgrading and improving machines.

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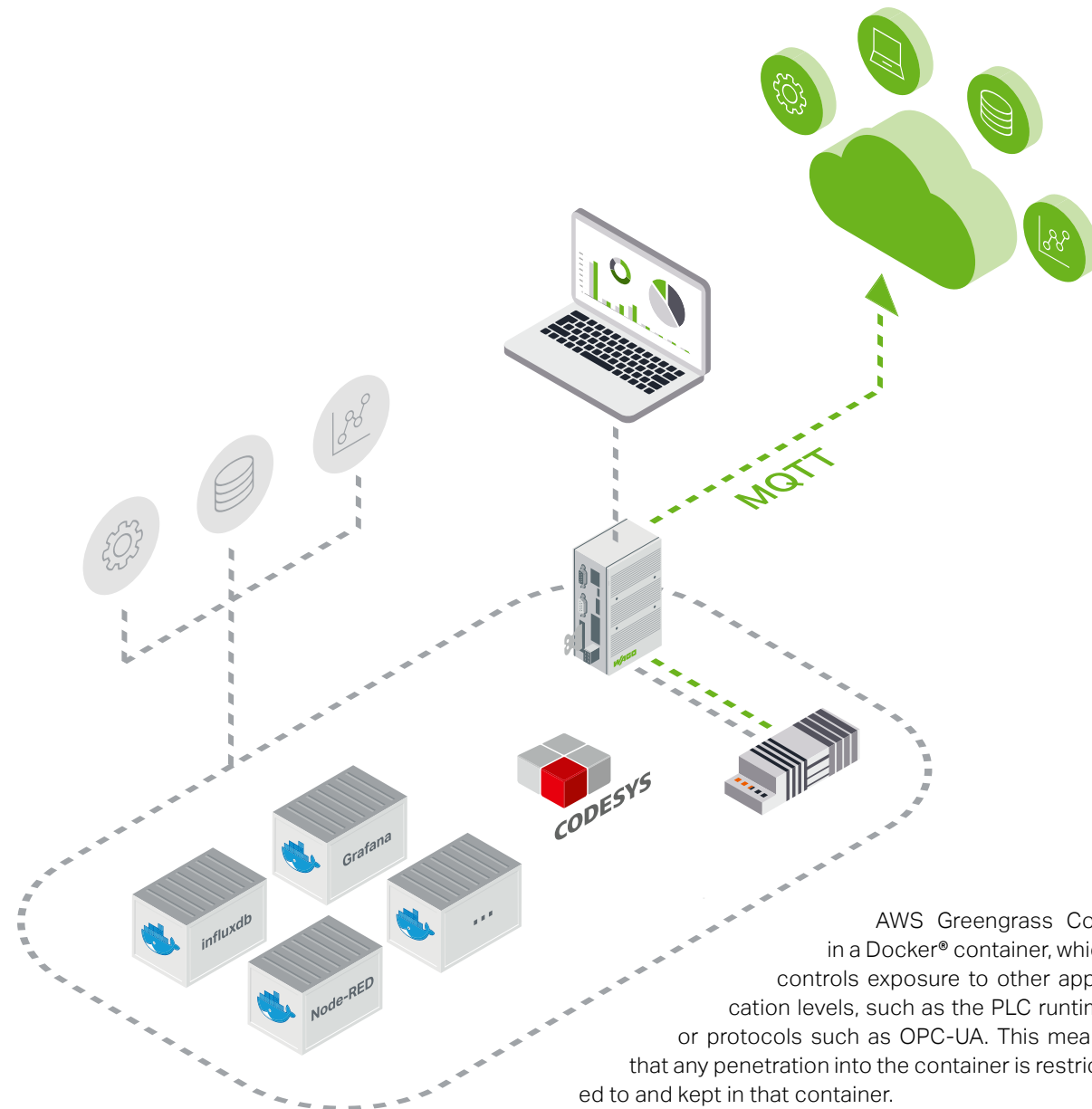
AWS Greengrass Core in a Docker® container, which controls exposure to other application levels, such as the PLC runtime or protocols such as OPC-UA. This means that any penetration into the container is restricted to and kept in that container.

Roland Ambrosch heads the Digital Factory sector at K-Businesscom and has a wealth of experience with containerization: "We can use this method to achieve excellent standardization and modularization – in a wide range of applications and at any time. For example, if computing power may need to be increased at a later date, containerization offers a good solution. Microservice architectures are also good targets for subsequent expansions," declares Ambrosch.

Broad Use of Container Solutions: This user group includes both suppliers and end users alike: "Machine manufacturers approach us because they wish to digitize their products, so that they can provide their customers with new services and new business models. Production companies from different process industries are also launching projects aimed at increasing 'Overall Equipment Efficiency' (OEE), improving energy management or enhancing efficiency," states Ambrosch. He continues, by declaring that this would work very efficiently as a combination of open-source software and the use of data containers.

In his view, the trend toward containerization is primarily based on technology, "It is more manageable when a central unit does not have to be worked into a distributed structure, but rather when a central unit retrieves distributed data," Ambrosch explains. Security would also be enhanced when work is conducted based on a single production line or plant. A further benefit would be that, once a standardized container has been generated, it can be copied whenever needed so that managing the new information landscape remains simple, even during the operations phase.

The unanimous view of the experts is that containerization knowledge has become a basic prerequisite for anyone working in IT. Docker®, for example, was developed specifically as an abstraction and isolation tool to keep application elements in a sandbox. The WAGO Edge Controller, as another example, can execute

Another argument in favor of Docker® and similar software is that a containerized solution offers a possibility for using standard systems to provide and maintain different software. This also applies to IT cyber security applications. This allows users to update the operating system and every individual container to the current standard, and to quickly close any gaps that may arise.

All in all, this yields several overall benefits, above and beyond the functionality of the programs. Costs are reduced and become more predictable. In general, open-source programs are well maintained. Should contributions from specific users for development of the software become necessary over the course of the project, this can be viewed as additional work; however, it also functions as a modern form of marketing. By heightening awareness within the community, new contacts and network links are created. "If you can select the right tool for the specific task at hand, instead of having to adapt the tool to the task, you will always get better and better results," is how Sensing sums up his motivation for efforts toward greater containerization in a nutshell.

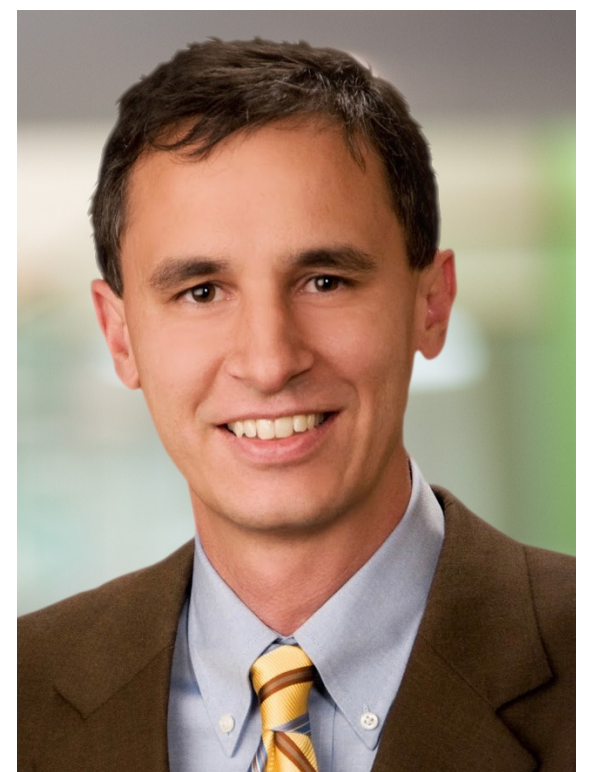See more about how "Containerization Enables IoT" in our video.

»WE DON'T USE THESE TOOLS BECAUSE THEY ARE INTERESTING, BUT BECAUSE THEY SOLVE PROBLEMS.«

Troy Sensing
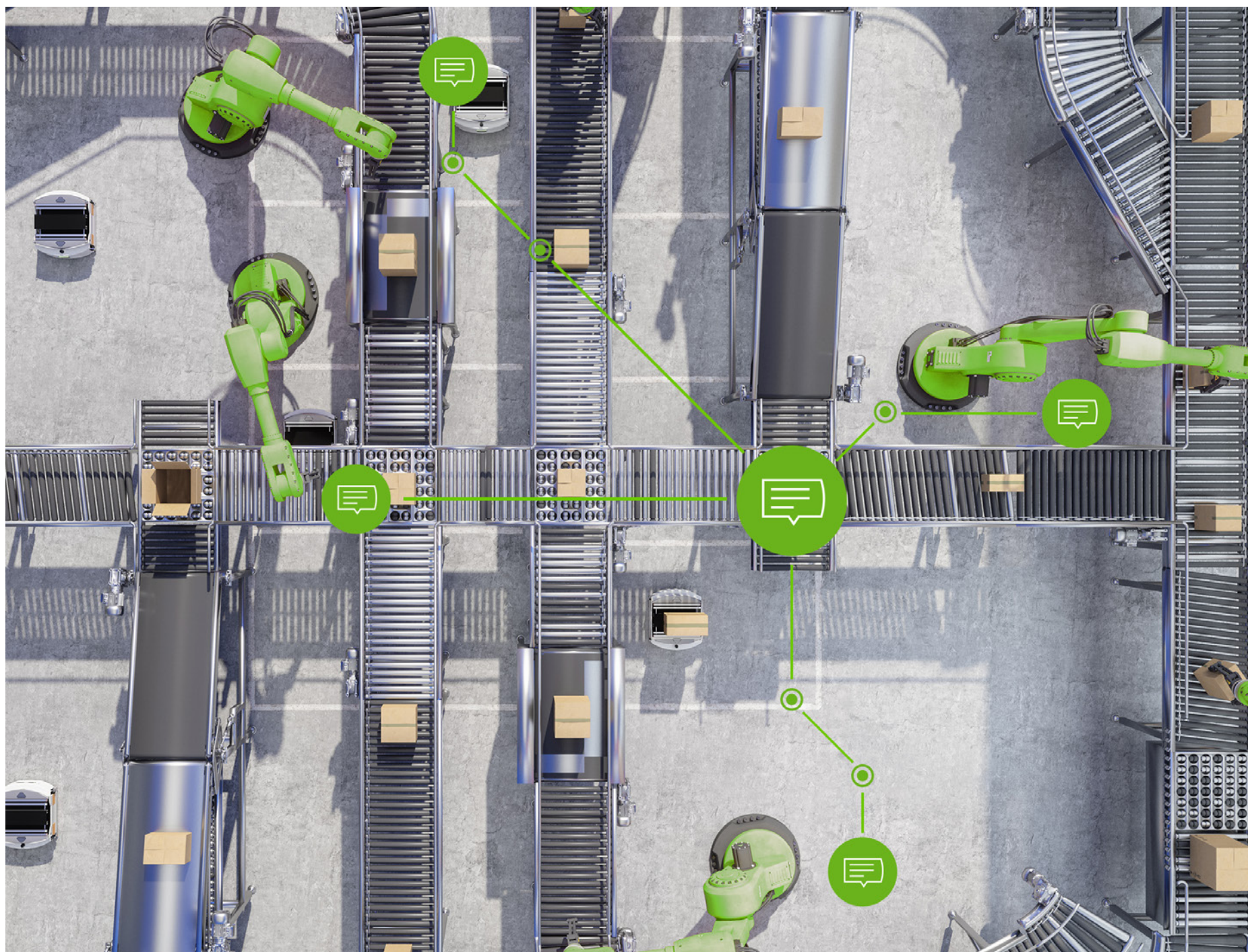Director of Strategic Sales and Industry at WAGO USA

»IN NORTH AMERICA, THERE IS A CLEAR TREND TOWARD OPEN-SOURCE SOLUTIONS.«

Kurt Braun
Applications Engineer and IIoT Market Specialist at WAGO USA

EDGE COMPUTERS REPLACE SEPARATE SERVERS.

EXPLOIT THE ADVANTAGES OF DOCKER® MORE EASILY
WITH EDGE COMPUTING

As one of the communication standards in the Industry 4.0 environment, OPC will play an important role for future development. An OPC router, like those offered by inray Industriesoftware GmbH, can act as classic middleware and provide a central communication hub. It is true that installation of a separate server plus maintenance can be costly; therefore, inray now relies on WAGO's Edge Computer, with the OPC router running there as a Docker® container.

As a software manufacturer, inray has been developing solutions for industrial communication for over 25 years, and specializes in data communication between software systems and components. One of the company's central products is the OPC router, which serves as a communication platform for Industry 4.0 projects. By working with standard interfaces, it allows data

exchange across all levels. The OPC router connects systems both vertically and horizontally: from sensors and controllers to ERP and cloud platforms, and from printers and scales to MES or SCADA systems. This provides the basis for comprehensive data exchange and for optimizing production processes.

Configuration of the OPC router uses a simple graphical interface – just drag and drop elements to establish connections between individual systems and devices. The data transfer is then initiated by triggers, which can be either time-controlled or event-controlled. There are many different applications. Examples include: providing data from an ERP system to a production machine, and labeling solutions that can be implemented by

connecting printers. "We've also implemented connections to different messaging platforms like Microsoft Teams, Telegram and WhatsApp; production processes could then use these to send messages to the specific messaging system automatically," explains Mike Elsen, director of the Sales Division at inray.
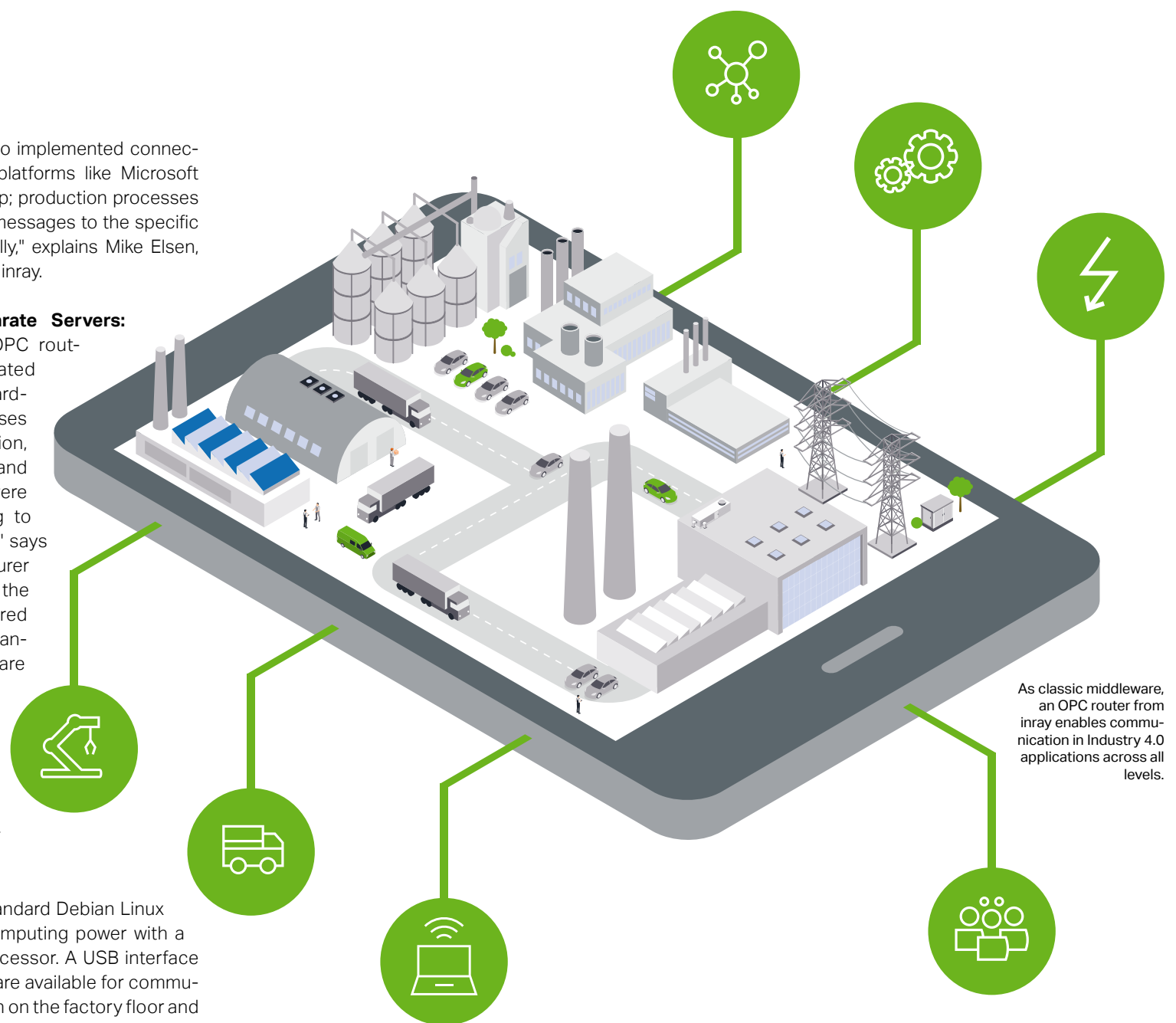
Solutions without Separate Servers: In the past, installation of OPC routers usually required a dedicated server. In addition to the hardware costs, significant expenses were incurred during installation, maintenance, and updates, and to ensure security needs were met. "So, we've been looking to add something for some time," says Elsen. The software manufacturer has now found just the thing: the WAGO Edge Computer. Compared to dedicated servers, the advantages for hardware and software are obvious. In the control cabinets usually found in production environments, DIN-rail mounting and the 24 VDC power supply not only save time and money, but also eliminate the need for a separate power supply unit.

As classic middleware, an OPC router from inray enables communication in Industry 4.0 applications across all levels.

The Edge Computer runs a standard Debian Linux OS and provides sufficient computing power with a 1.91 GHz quad-core Atom processor. A USB interface and a Gigabit ETHERNET port are available for communication. Communication – both on the factory floor and with the cloud – is available through all standard protocols. With 4 GB of RAM (8 GB optionally available) and 64 GB of flash memory, even more complex projects can be implemented. If very large data volumes need to be processed, such as arise in large-scale database applications, the Edge Computer can be expanded with an SSD card, using the 2.5 inch SSD mounting provided inside the housing. As the Edge Computer does not require a fan, despite its extended temperature range from −20°C to +60°C, it is very compact and is thus easy to mount within a control cabinet on the DIN rail.

OPC Router as a Docker® Container: One especially important feature for inray is that the Edge Computer supports so-called container virtualization via Docker®. This allows different applications to be installed in parallel, but prevents them from interfering with each other. The resources that the individual containers use are strictly separated from each other. This approach not only offers a high level of security for the individual applications, but also makes it easier to deploy applications on the Edge Computer. Instead of a laborious installation process, the applications can simply be transported and installed as files. "This is also the principle inray uses for its OPC router," explains Jürgen Pfeifer, IoT and Cloud Partner Manager at WAGO Kontakttechnik. "It no longer needs to be installed on its own dedicated server in the network – it's simply deployed as a Docker® container on the Edge Computer and is immediately executable."

The Docker® containers with the OPC router can be easily deployed via cloud platforms such as Docker® Hub. The configuration of an OPC router is also very easy to manage, as Elsen explains, "The entire configuration can be performed as either a manual or an automatic setup process involving just a few mouse clicks. By using the redesigned configuration interface, even different Dockers® can be centrally managed. If an Edge Computer then needs to be replaced, for example, the user simply loads the Docker® container onto the new Edge Device and loads the configuration that was previously exported – the application can then be immediately executed again." This solution not only eliminates the need for a separate server, but is also very flexible, secure and easy to maintain. "Redundant installations of OPC routers on two separate Edge Computers within a system is also a possibility, if the MES supports this," says Elsen, explaining another option that also increases protection against failures.

Controller and OPC Router on one Edge Device: Container virtualization via Docker® lets users run the machine or system controller, together with the OPC router, on a single Edge Computer. Docker® technology eliminates the risk of interference between them. This approach allows control functions and Industry 4.0 functionality to be combined in one powerful device.

Since the WAGO Edge Computer supports container virtualization via Docker®, the OPC router can be installed as a Docker® container in addition to the actual control program.

EASILY INCREASE
SYSTEM EFFICIENCY

"OT meets IT" – the WAGO Compact Controller 100 is the new IoT controller for production in the future. It offers users complete freedom, and records machine data and loss information in real-time. It thus offers the best possible conditions for identifying potentials and expanding on them.

Recent studies show that the average system efficiency in German companies lies only in the range of 40 to 60 percent. This implies that they produce far less efficiently than they could; which means they have a significant potential for increasing their competitiveness. The WAGO Compact Controller 100 with real-time Linux® operating system offers a solution that operators can use to quickly and easily optimize their productivity. It provides data for analyses that can be subsequently used for optimization.
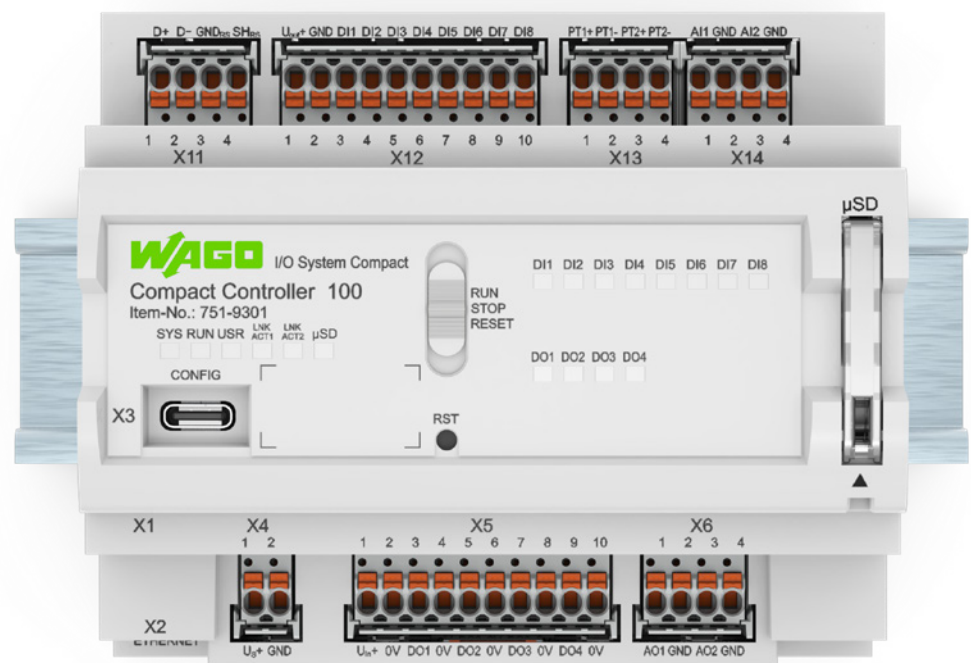
## Quick and Easy Implementation of IoT Applications

WAGO's new Compact Controller 100 provides maximum engineering flexibility. The new Compact Controller 100, with a real-time Linux® operating system, gives users maximum freedom. This compact device is freely programmable with CODESYS V3, but can also be used with IEC 61131-independent software, for example, Node-RED, Python or C++. Later installation of Docker® as a virtualization environment is also straightforward. This addition makes the Compact Controller 100 a full-fledged IIoT device with gateway functionality. In this way, WAGO combines the requirements of two different domains within one device in the best possible way, bringing its expertise to bear where "automation meets IT." Another advantage of the Compact Controller 100: it can also be mounted in small distribution boards due to its design as a DIN-rail built-in installation device per DIN 43880. The I/O unit is located with the controller in a compact housing, so it requires no additional space for extra control components. The wiring interface is removable, which provides advantages for installation and commissioning.

The Benefits for You

- Quick, easy, flexible software engineering
- Controller with a real-time Linux® operating system
- Compact controller with I/Os in a DIN-rail mountable device housing

More about the WAGO Compact Controller 100
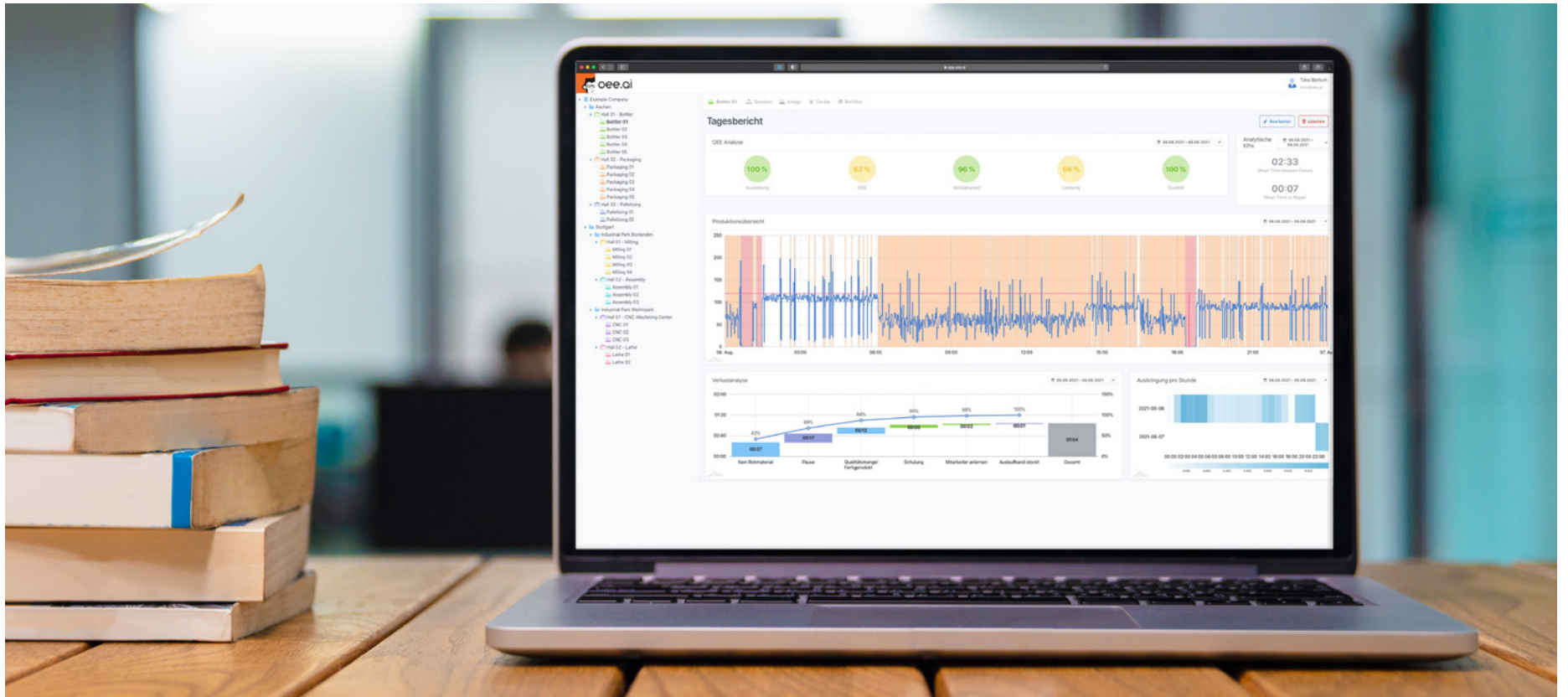
The captured data are processed in oee.ai and graphically provided in an internet browser window. The reporting system is completely widget-based, and can be individually configured. This provides users with the option of selecting and displaying the data according to various criteria.

Exploit the Benefits of Containers: The device also offers maximum flexibility in software engineering. "The user decides whether to develop projects using CODESYS V3, the well-known engineering environment (IEC 61131), and to generate applications with the aid of established libraries, or to strike out on a new path," explains Lukas Dökel, Head of Industry & Key Account Management Digital Plant at WAGO.

Thus, it is also possible to use microservices and container visualization, for example, by accessing existing open-source serves via Docker®.

As an example, Node-RED offers very efficient and flexible engineering software and is open to a wide variety of interfaces (nodes). "By using nodes (CC100), users can like the inputs/outputs from the WAGO Compact Controller 100 directly into their Node-RED Flow," explains Dökel. The device therefore offers all of the characteristics of a fully-fledged IoT device with gateway functionality. "Those who engage with the new world offered by containers and would also like to apply the benefits of IT solutions in automation have the best options in this case."

Analyze Data Using Artificial Intelligence: Working together with oee.ai, software specialists from Aachen, WAGO demonstrates how users can exhaust the potentials found in their machine data. The controller transfers all relevant information into the oee.ai software, which analyzes it and proposes improvements for operators and management. "Artificial intelligence recognizes patterns and anomalies in the time series and guides humans in optimization. AI libraries offer simple access to fast solutions," explains Jörn Steinbeck from oee.ai.

This allows customers to observe and optimize their productions processes easily, cost-efficiently and sustainably. And this is only one example of how they, together with WAGO and other partners, can make your production more efficient and productive, based on currently-available solutions.

OUR
EXPERTS

Lukas Dökel
Head of Industry & Key Account Management
Digital Plant

WAGO IoT Partner: ifp Software GmbH

oee.ai Manufacturing Intelligence – MES as an App
oee.ai processes system data and supplemental employee inputs to increase shop floor productivity through intelligent evaluations. To achieve this, data are visualized in real time and analyzed using the most up-to-date technologies and algorithms.

oee.ai is one of many partners in the WAGO IoT Partner Network. Our goal – to combine different capabilities into one ecosystem and jointly create end-to-end customer solutions.

Our WAGO IoT Partners complement our WAGO Cloud, cloud connectivity, IoT gateways and controllers. This compatibility ensures that we can always provide tailored solutions to meet your needs.

WAGO | IoT Partner

Learn more about which solutions other WAGO IoT Partners are jointly implementing with us.

CYBERSECURITY

»WE PROACTIVELY PUSH SECURITY FORWARD«

Cyber attacks on industrial sites have seen significant increases. Jens Sparmann, Security System Specialist, explains how WAGO protects itself and its clients from them.

How dangerous is this situation for companies?

Jens Sparmann: The Federal Office for Information Security (BSI) has evaluated the current situation in the status report from 2021 as ranging from serious to critical. The number of security-related attacks has practically doubled over the previous year. Our WAGO "Product Security Incident Response Team" (PSIRT) has also observed this trend. In 2021, we processed a total of 18 incidents – this number had already been exceeded in Spring of 2022.

How does PSIRT handle the topic?

Sparmann: We deal with security vulnerabilities, which we find in our WAGO products, or which our customers report to us. Last year, we published information about a total of nine vulnerabilities, for example, in CODESUS V2.3 Runtime or in the OpenSSL library. From here, we in the company can also introduce the necessary steps to tackle the incident. Employees from Development, Product Management, Sales and Support work together in the team. This means we have all corporate areas working together to quickly evaluate the vulnerabilities and to derive further alleviation measures in a targeted way. PSIRT doesn't just react; we proactively push security topics. One example for this is the introduction and implementation of the IEC 62443 standard at WAGO, an international series of standards that defines cybersecurity levels in automation systems.

Why is the IEC 62443 so significant?

Sparmann: The IEC 62443 standard is the undisputed security standard in the world of operational technology (OT). We at WAGO are currently engaged with implementing 62443-4-1 and 62443-4-2, and becoming certified in both. The schedule is somewhat casual: we would like to complete certification for our automation products by the middle of 2023.

WAGO's automation solutions follow from the company's approach to expertise #openandeasy. How does openness support security?

Sparmann: The systematic use of open-source software on WAGO controllers and Edge devices supports product security. Due to the publication of the source code in open-source software, errors are quickly found and alleviated, because the open-source community is enormous and committed. An autonomous communication encryption in the configuration interface can be activated both openly, and also easily with MAC security switches. This encryption is based on a pre-shared key authentication method, which works using symmetrical keys that have been previously exchanged, and functions directly in the switch's system on a chip (SoC). For example, this allows even public cable runs on company property to be quickly and easily secured.

What happens when WAGO products are affected by security vulnerabilities?

Sparmann: In that case, defined processes are initiated by the PSIRT, and we have also brought a strong partner on board for this. We have a cooperation agreement with the Computer Emergency Response Team (CERT) in the VDE (Association of German Electrical Engineers). The CERT assists with communicating about and publicizing of vulnerabilities, and also with communication with government agencies, like the BSI. It is extremely important for production security in Germany that we speak with one another across company boundaries. It helps no one to keep silent about security vulnerabilities.

Open communication is good, but it is not the only thing. Who helps in a case of acute risk?

Sparmann: We at WAGO have established an IoT Partner Network for very complex projects. It currently includes more than 20 companies specializing in various sectors.

This allows us to ensure that we can solve any problem to the complete satisfaction of our customers, and that projects can be continued without any problems.

OUR **EXPERTS**

Jens Sparmann,
Security System Specialist

More about our cybersecurity solutions.

LEGAL INFORMATION