

Battery Model Out-of-the-Box

New battery model accelerates
battery control unit development

Multi Cloud Broker

New cloud management solution
supports mobile operators

Process Digitization

New consulting offer from MicroNova



Digitalization Made Easy



Dear Reader,

whether it's dealing with the organizational consequences of a pandemic, optimizing supply chains, or simply running day-to-day operations without going into crisis mode: digitalization is gaining an ever greater foothold in companies and now to an increasing extent in public-sector organizations. Whether excluding or perhaps even incorporating AI capabilities in the future: digitalization is a huge opportunity for companies, institutions, etc. There's a good reason why MicroNova has been very successfully focusing on extensively mapping processes and workflows in digital form for over five years. This approach reduces workload, ensures security and transparency, and also helps to reduce costs and sustain growth.

Based on our own experience and proven successes, we have therefore decided to offer digitalization services as part of our portfolio - which is why we are introducing Enterprise Solutions in the preface this time around, as this is the business area where our digitalization services are located. You can find out more about our digitalization portfolio starting on page 34 in an introduction to the related partnership with Webcon and in an interview with my colleague on the Executive Board, Dr. Klaus Eder. Our founder, Josef W. Karl, also shares a few more thoughts on digitalization, particularly its potential for cutting red tape, in his column from the Supervisory Board on page 39. The contributions from the Enterprise Solutions division are rounded off with another ManageEngine

customer case study (p. 26) and an article on roadmapping.

From the Testing Solutions business unit, you can read our article about the new EXAM QKit for the ISO 26262 standard. Other topics: Battery models "out-of-the-box", cybersecurity, the testing of electronic systems on virtual test benches, and current events in the division.

Another collaborative venture plays a key role in the Telco Solutions division's contribution: working with Clyso GmbH, MicroNova provides mobile network operators with a powerful solution for managing cloud-based telecommunications solutions from end to end – read more on page 22. We would also like to draw your attention to our updated "Telco Compendium", which you can download from our website.

I'll finish, as always, by hoping that you enjoy reading the magazine and wishing you health and, of course, a peaceful world.

Orazio Ragonesi



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Out-of-the-Box Battery Model

The new “MicroNova Battery Model” can speed up the development of battery controllers with simple and versatile configuration options.

TEXT: Jan Steikowski, Stephan Schmidt PICTURES: © Frame Stock Footage/ Shutterstock.com

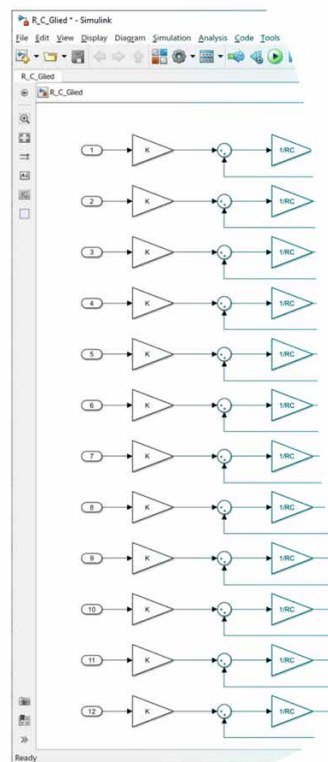
Developing and testing battery management systems (BMS) requires powerful and very accurate models. MicroNova’s new configurable simulation model accurately replicates the electrical and thermal behavior of battery cells in BMS – without requiring them to be directly connected to a battery. Thanks to its versatility and real-time capability, the MicroNova Battery Model is ideal for use in hardware-in-the-loop (HiL) systems for validating battery controllers.

MicroNova can draw on many years of experience in the field of battery modeling. After all, ever since the

launch of the first battery HiL system in the NovaCarts family more than 15 years ago, there has been a need for precise models to enable reliable testing of their controllers. While modeling used to be project-specific, automotive manufacturers and suppliers can now use the MicroNova Battery Model to create an abstracted universal battery model that also offers many detailed customization options for high-quality battery testing.

This specifically involves safety, because the legal requirements governing modern vehicle batteries are becoming increasingly stringent in this

regard. This has implications for the protection of the associated control unit. The functions in the model must precisely match those of the BMS. More and more customers therefore sought the option of incorporating their own content for an appropriately customized model. To meet these needs, MicroNova has encapsulated individual components of its battery model so that they are available as library building blocks. This allows users to make small changes themselves and thereby adapt the model for various test projects as part of its configuration options. This approach saves costs and shortens project times.



1 The "MicroNova Battery Model" accurately replicates the electrical and thermal behavior of battery cells in BMS and is ideal for use with HiL systems to validate battery control units.

Design and Operation

The main part of the model takes into account the high number of physical mechanisms that occur within individual battery cells during the charge and discharge cycles. It consists of three submodels that map these physical processes: intermediate circuit, current and battery cell model. Electrical variables such as dynamic current and voltage behavior, the state of charge of the individual cells, and passive balancing are all taken into account. Furthermore, the submodels also simulate the thermal processes in the battery, such as heat transfer by convection.

Chemical reactions within the battery cells are also factored in, as is power dissipation at the internal resistance caused by leakage current. The basis for numerous calculations within the core model is the characteristic data of the battery cell previously selected by the test engineer using a graphical interface. A number of different interpolation methods are available during test runtime in order to map the entire spectrum of the relevant characteristic curves.

The three-part master model is connected to two other submodels that are used for communication and data

processing on the simulation node. The MATLAB/Simulink blocks they contain are specifically optimized for later use in combination with NovaCarts software.

The MicroNova Battery Model is available as a configurable MATLAB/Simulink model. It should be regarded as an open model that can be extended and adapted to meet individual requirements as desired. NovaCarts-specific components are made available directly as a type of library function. The model is optimized for use on NovaCarts hardware but is equally suitable for use on other target systems.

Battery Model Generation GUI for Li_Ion cells

Temperature Sensor (NTC) Configuration		Battery Configuration Parameters		Batterie Configuration	
No of NTC in CC00:	<input type="text" value="5"/>	No of Cell Controller	<input type="text" value="17"/>	Energie Variant:	<input type="text"/>
No of NTC in CC01:	<input type="text" value="5"/>	No of Cells in CC00:	<input type="text" value="16"/>	Cell Producer:	<input type="text"/>
No of NTC in CC02:	<input type="text" value="5"/>	No of Cells in CC01:	<input type="text" value="16"/>		
No of NTC in CC03:	<input type="text" value="5"/>	No of Cells in CC02:	<input type="text" value="16"/>		
No of NTC in CC04:	<input type="text" value="5"/>	No of Cells in CC03:	<input type="text" value="16"/>		
No of NTC in CC05:	<input type="text" value="5"/>	No of Cells in CC04:	<input type="text" value="16"/>		
No of NTC in CC06:	<input type="text" value="5"/>	No of Cells in CC05:	<input type="text" value="16"/>		
No of NTC in CC07:	<input type="text" value="5"/>	No of Cells in CC06:	<input type="text" value="16"/>		
No of NTC in CC08:	<input type="text" value="5"/>	No of Cells in CC07:	<input type="text" value="16"/>		
No of NTC in CC09:	<input type="text" value="5"/>	No of Cells in CC08:	<input type="text" value="16"/>		
No of NTC in CC10:	<input type="text" value="5"/>	No of Cells in CC09:	<input type="text" value="16"/>	Cell Capacity [Ah]:	<input type="text" value="75"/>
No of NTC in CC11:	<input type="text" value="5"/>	No of Cells in CC10:	<input type="text" value="16"/>	BMS Cooling option:	<input type="text" value="FAN"/>
No of NTC in CC12:	<input type="text" value="5"/>	No of Cells in CC11:	<input type="text" value="16"/>		
No of NTC in CC13:	<input type="text" value="5"/>	No of Cells in CC12:	<input type="text" value="16"/>	<input type="button" value="Select a Cell Producer"/>	
No of NTC in CC14:	<input type="text" value="5"/>	No of Cells in CC13:	<input type="text" value="16"/>	<input type="button" value="Load Battery Parameters"/>	
No of NTC in CC15:	<input type="text" value="5"/>	No of Cells in CC14:	<input type="text" value="16"/>	<input type="button" value="Generate Model"/>	
No of NTC in CC16:	<input type="text" value="5"/>	No of Cells in CC15:	<input type="text" value="16"/>		
		No of Cells in CC16:	<input type="text" value="16"/>		
Total no of NTC: 85		Total no of cells: 204			

2 The modeling of a specific battery is done via a generator with a graphical user interface.

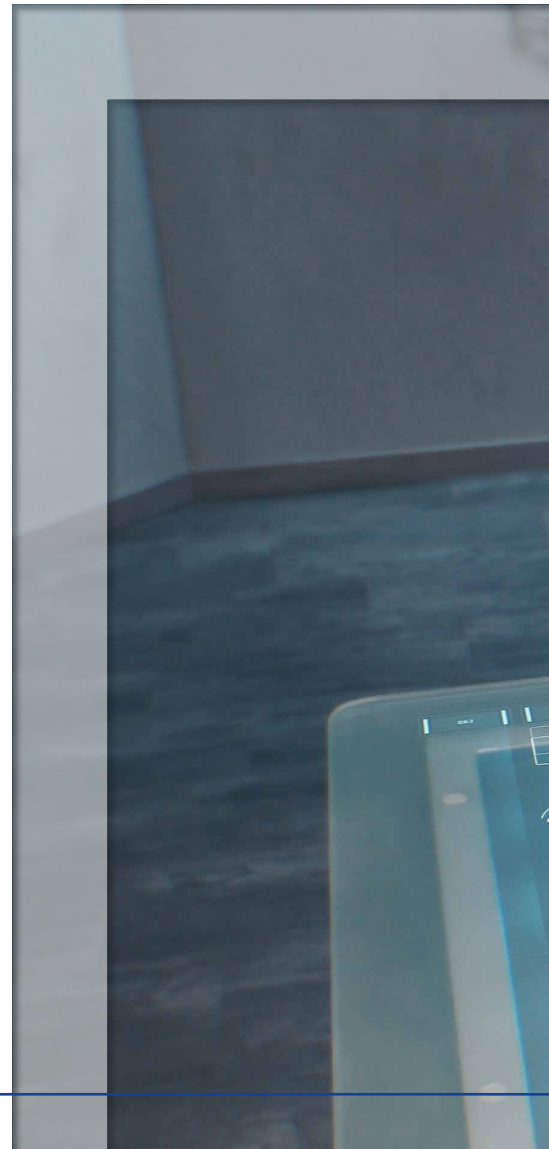
Versatile Configuration Options

The tool-supported modeling of a specific battery is accomplished using a generator with a graphical user interface. This allows a choice to be made between different battery configurations and battery cell manufacturers within MATLAB/Simulink. There is also a choice between air and water cooling. The MicroNova Battery Model generates the desired battery model with up to 17 cell controllers and 16 cells per controller based on a reference model, depending on the way the various configuration parameters are defined. This customized model contains only those blocks required for the configurations in question. This increases both the performance of the model on a simulation node and the ease of processing in MATLAB/Simulink.

The generator can be extended to include batteries of any size if required and provides MATLAB/Simulink base models that can be integrated into the overall model. These can in turn also be extended as desired and easily debugged in MATLAB/Simulink as well as modified with respect to runtime.

Continuous Development

A great deal of research is currently being undertaken in the field of high-voltage batteries due to the fact that the topic is still relatively new and the development potential high. Continuous development of the battery model is therefore a matter of course. MicroNova has assembled a team of battery experts to ensure future viability and consequently investment protection. They continuously analyze the market and the latest research to incorpo-



rate new requirements directly into new versions of the MicroNova Battery Model. This ensures that both the graphical user interface and the model itself are continuously updated to provide an even higher level of simulation detail and operation with greater convenience. Customers will benefit from these updates on an ongoing basis thanks to our flexible licensing model combined with our software maintenance service.

Summary

The MicroNova Battery Model's detailed replication of the battery's chemical and physical properties, in combination with a HiL system, makes

it possible to validate battery control units. This approach not only reduces resource requirements and costs, but also development time for BMS manufacturers. Users can make adjustments to the battery model themselves quickly and easily thanks to a wide range of configuration options and adapt it to the development status of the relevant "device under test". MicroNova's consultants will, of course, provide support for more extensive changes or specific modifications to the library modules as well as for custom developments. Our experienced staff work with the customer to ascertain specific needs and develop concrete solutions based on the requirements identified. ■

Model Consulting

MicroNova offers consulting services that go beyond the configurations that users of the MicroNova Battery Model can easily perform themselves in order to cover specific test requirements. This enables us to provide companies with optimum support based on our decades of testing and modeling experience. Please feel free to contact us on +49 8139 9300-0 or at sales-testing@micronova.de.



Easier and Faster Testing of Battery Management Systems

MicroNova expands its NovaCarts CMC simulator for the latest high-precision battery cell monitors and balancer components from Texas Instruments (TI). This helps accelerate the development of BMS prototypes.

TEXT: Editorial staff PICTURE: © MF3d / iStockPhoto.com

MicroNova has enhanced its NovaCarts Cell Module Controller (CMC) simulator to support the latest high-accuracy battery cell monitors and balancers from Texas Instruments (TI), making it easier and faster to test battery management systems (BMS). The BQ79718-Q1 device serves as a monitoring, balancing and protection unit for battery modules in high-voltage BMS.

Simulating CMCs minimizes change-over times and downtimes on hardware-in-the-loop (HiL) simulators, resulting in cost savings. The NovaCarts CMC simulator features a daisy-chain

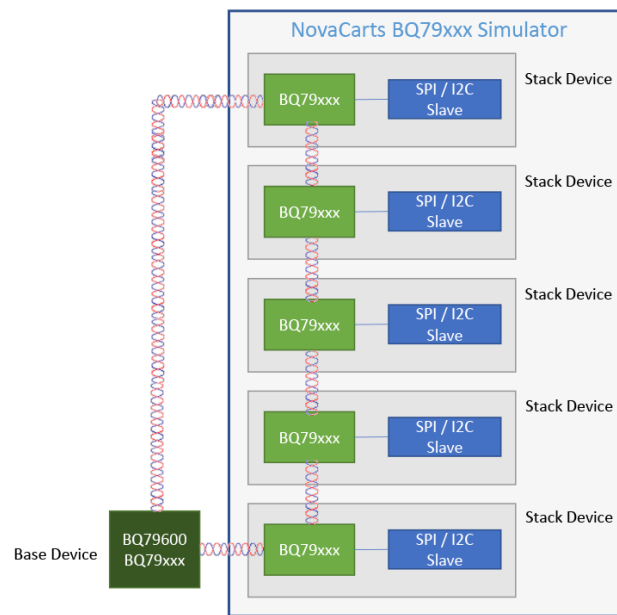
communication interface to the bridge device on the master board of the BMS or the master control unit (MCU), ensuring precise timing as well as high-performance simulation. The CMC simulator is able to simulate up to 35 CMC chips at any one time, and engineers involved in the development and testing of BMS systems can also combine several CMC simulators to simulate batteries with a very large number of cells.

“The BQ79718-Q1 battery cell monitor and balancer from TI allows auto-makers to maximize the true range of their EV with high-precision battery

cell voltage measurements down to 1 mV. Together with the NovaCarts CMC simulator, it can be a highly effective and efficient way for engineers to prototype a BMS and get to market faster,” said Sam Wong, vice president and general manager for Battery Management Solutions at TI.

Reducing Complexity and Costs

As a component of the BMS of a high-voltage storage systems for both electric vehicles and stationary energy storage systems, CMCs allow the batteries to operate safely and deliver



- 1 Block diagram of a BMS test setup with real BQ79xxx base device and simulated slave devices.



- 2 19" rackmount KIT for integration of the CMC simulator into a switch cabinet.

high performance. To achieve this, they continuously monitor the voltage and temperature of the individual cells. The NovaCarts CMC simulator provides a cost-effective and safe solution for performing tests on BMS and simplifying and accelerating their development. The fact that CMC simulation on the HiL simulator can easily be combined with actual cell module controllers also reduces the cost of the HiL system. The solution therefore constitutes an ideal extension to BMS HiLs.

"Setting up a HiL with real CMCs is complex because it requires simu-

lating the actual cell voltages of the battery and as well as the temperature sensors. High overall voltages are generated in the HiL when emulating high-voltage batteries, increasing complexity in terms of reliability and hence the costs involved. The simulation of the cell module controller chips acts as a countermeasure to this," explains Detlef Naundorf, Product Manager at MicroNova. "At the same time, the NovaCarts CMC simulator can be used as a standalone solution for software development and testing. It's also easier to recreate and test fault situations than with a real-life setup."

To date, the NovaCarts CMC simulator supported the BQ79616-Q1 and BQ79618-Q1 devices from TI. The integration of the BQ79718-Q1 expands MicroNova's CMC simulator range to include this powerful chip. ■



EXAM QKit Simplifies Tool Qualification

The new EXAM ISO 26262 QKit simplifies the qualification of toolchains according to the ISO 26262 standard for the use of the automated testing solution EXAM in automotive projects.

TEXT: Christoph Menhorn, Steven Bailey PICTURES: © AlexLMX, Photon photo, YoloStock, DStarky / Shutterstock.com

As more software and electronics are integrated into vehicles, the risk of malfunctions that could potentially endanger the health or even the lives of drivers increases. Consequently, government regulations in this area have become significantly stricter, requiring automotive manufacturers and suppliers to adhere to various requirements. Legislation is increasingly monitoring whether and how a company actively gives consideration to the safety of motor vehicle drivers and passengers.

A lot has happened on this subject, especially in 2011 and 2018, when the International Organization for Standardization (ISO) launched and extended the 26262 standard on 'Functional Safety' with a second edition.

In short, these standards contain additional requirements for all automotive systems that include electronic control units and software components, when these are responsible for the lifecycle of safety-relevant systems. The requirements have an impact on development, production,

management, and service processes, and more besides, and are designed to minimize potential hazards caused by malfunctions of the E/E safety system.

The key challenges for car manufacturers are:

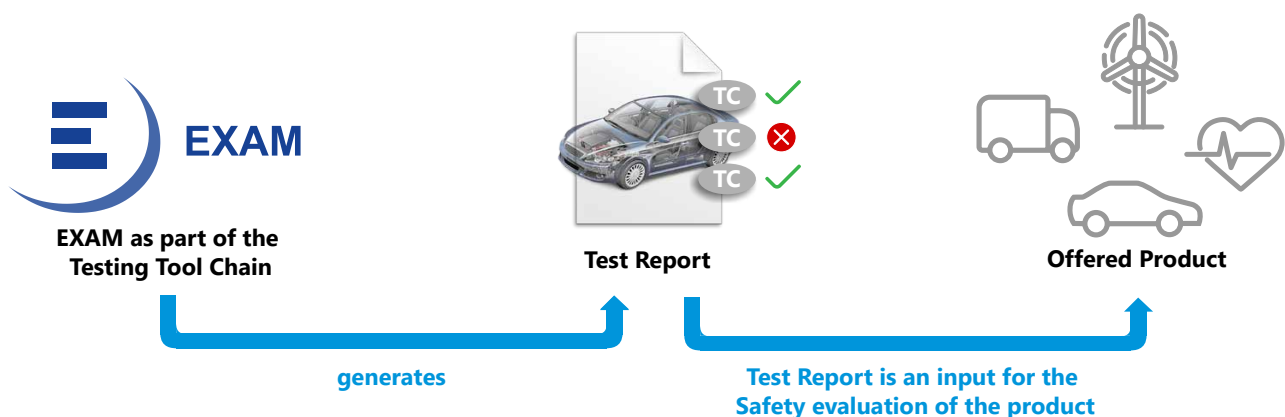
- » to keep development costs and the financial risk from liability for safety defects as low as possible
- » to comply with requirements regarding the certification of all tools according to ISO 26262, and
- » to define risk tolerance and risk management in the development process at an early stage.

In light of the above, it is hardly surprising that since the introduction of the ISO standard, car manufacturers have asked their suppliers to provide appropriate certification for the entire product or to support this process.

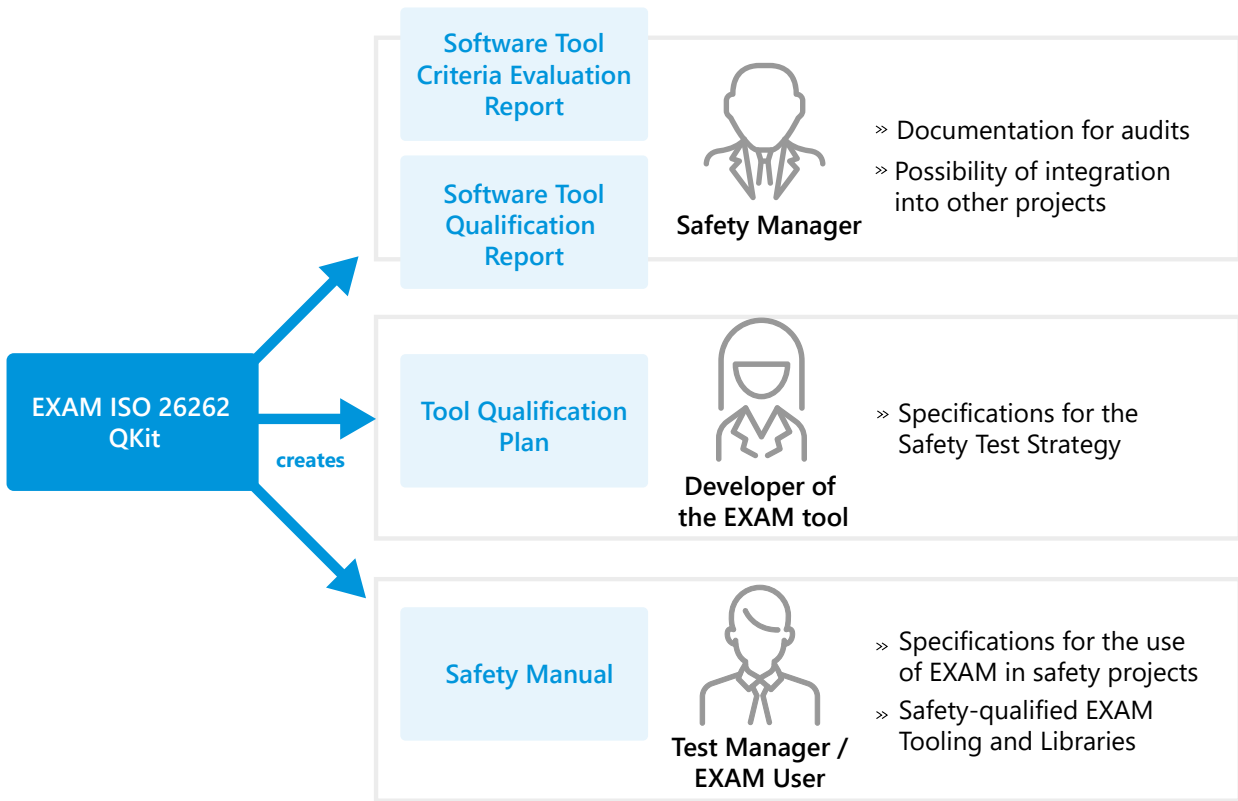
However, one point is often forgotten or not given enough priority in the discussions and measures on functional safety: When and how are tools qualified according to ISO 26262?

Consulting

Tool validation without EXAM: During a series of training courses and workshops, as well as during development, MicroNova's consultants have gained extensive experience in how the tools and processes of the EXAM ISO 26262 QKit can also be used for the validation of other tools. Using Validas' documented and TÜV-certified compliance methodology, they are able to take the necessary steps with and for customers to qualify any tool.



1 All factors with an impact on the test report are considered safety critical.



2 Components of the EXAM ISO 26262 QKit

MicroNova: Your partner for functional safety

This is where MicroNova comes in as an experienced and reliable partner: In collaboration with Validas AG, a recognized expert in library and tool qualification and a preferred partner of TÜV Süd and TÜV Nord, MicroNova has developed a plug-in for functional safety: the EXAM ISO 26262 QKit (EXAM QKit for short). This EXAM extension can be used to generate the safety documentation required for ISO 26262 for the testing automation solution. This ensures the qualification of this part of the validation chain for the electronic control unit development process of automotive manufacturers and suppliers.

Thanks to the EXAM QKit, companies can automatically generate plans, safety manuals, and verification/validation reports, all in accordance with "ISO 26262-8 Part 8: Supporting processes" and "ISO 26262-11 Part 11: Analysis and qualification of the Tool Confidence Level (TCL) and the Automotive Safety Integrity Level (ASIL) – 11.4.7, 11.4.8, 11.4.9" for the TCL, classification, and qualification of the tool.

Tool qualification with the EXAM plug-in

The EXAM ISO 26262 QKit significantly simplifies the tool qualification process when the testing automation solution is part of the toolchain used. The EXAM QKit minimizes or elimi-



nates the need for an EXAM user to qualify the testing automation for each new tool version. The relevant test cases are already created and executed automatically by MicroNova.

The delivery of a "Safety Manual" with the EXAM QKit also makes it easy to execute product-specific safety tests. The manual provides detailed instructions for test engineers on how to operate the test automation solution in accordance with ISO 26262 requirements.

Moreover, the EXAM QKit can improve the quality of product test cases, as these can be defined algorithmically and deterministically, prioritizing, and specifying how they should be created.

ISO TÜV qualification

Car manufacturers and suppliers using the EXAM ISO 26262 QKit can therefore be sure that the use of the EXAM tool is appropriately qualified and can also be certified if required. The long-standing cooperation between Validas and TÜV Süd further simplifies the certification process.

Summary

Functional safety has become an indispensable component in the automotive industry. As a solution for the requirements of functional safety, MicroNova, in collaboration with an experienced partner, offers the EXAM ISO 26262 QKit. In addition, experts from the Consulting division support companies with safety concepts, processes, and tool qualification. This allows automotive manufacturers and suppliers to maintain their operational capability while reducing complexity and costs in development. ■

Contact

For detailed information on the EXAM ISO 26262 QKit licensing model and MicroNova's consulting services, please contact us on +49 8139 9300-0 or sales-testing@micronova.de.

Hot Topic: Cyber Security

One of the most important topics in technology development right now is cyber security.

The editorial team of InNOVation interviewed MicroNova CEO Orazio Ragonesi on this subject.

TEXT: Editorial staff PICTURES: © SquareMotion / Shutterstock.com; © MicroNova

InNOVation: Mr. Ragonesi, to what extent does MicroNova tackle the issue of cyber security – and thereby also takes care of concerns of the company's customers?

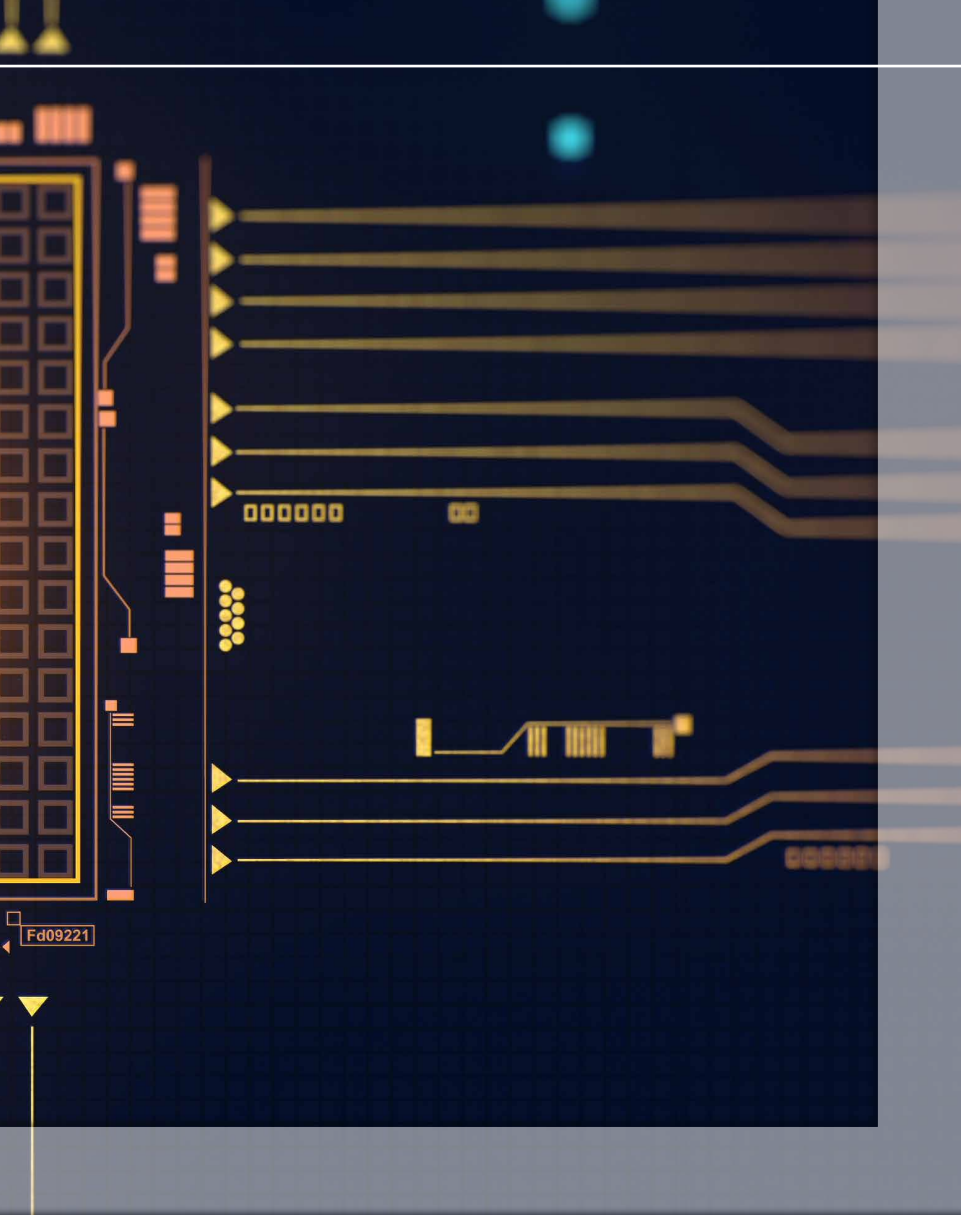
Ragonesi: First of all, cyber security has become much more important recently. As the world becomes ever more networked, so the possible attack vectors increase. This affects basically every industry, including those with which MicroNova works closely, namely automotive, enterprise software, and telecommunications. It is evident that our Enterprise Solutions division, which has a wide range of products in its portfolio, is active in this area accordingly. Due to the widespread nature of the issue, we have decided to create a dedicated competence team for cyber security.

InNOVation: What does this team do exactly?

Ragonesi: The team is a cross-sectional organizational unit, similar to the one we formed for the topic of artificial intelligence. It works across different business areas, consisting of members from all three MicroNova business units. In this way, we benefit from broad expertise, a wealth of experience, and existing tools all in one place. For our clients that have to deal with the issue of cyber security this is a very agreeable set-up, of course. They can get as much as possible from a single source. Specifically, we offer consulting services, facilitate the effective use of products from other vendors, and are currently developing our own product.

InNOVation: Let's take a closer look at the individual services – starting with consulting...

Ragonesi: ... which usually takes place at the start of a project since the analysis serves as the basis for further collaboration. It is crucial to be familiar with the relevant standards at this point. In the field of cyber security, the primary standard is ISO 21434, supplemented or further differentiated in the automotive sector by the industry-specific UN ECE WP.29. Our team has already built up a significant amount of expertise in this field and can quickly assist customers. It bears stating clearly: Compliance with the contents, processes, and so on, described in the standard is ultimately a prerequisite for a vehicle to obtain its approval.



InNOVation: What specifically do consulting services in the automotive sector involve?

Ragonesi: We can support our customers in complying with the standards relevant to their specific needs. This includes criteria in the development process, audits, etc. Ultimately, it is about putting in place a complete cyber security management system, abbreviated as CSMS. In terms of process, it is a relatively standardized workflow. However, the contents, implementation recommendations, possible tools, etc. are highly specific. Which is why relevant expertise and consulting are invaluable, particularly for automotive manufacturers and suppliers. These companies need to demonstrate that a proper CSMS has been successfully implemented and is

actually used in their organization, and we provide support in that regard.

InNOVation: Why is a cross-functional team better suited for this?

Ragonesi: As mentioned earlier, ensuring full compliance with a standard requires more than just consulting. If we consider the various network attack scenarios that have driven the concerns regarding cyber security, telecommunications expertise is naturally very helpful in this context. Additionally, to use the right tools is paramount. Our Enterprise Solutions business unit, for example, takes advantage of an established toolset provided by our partner ManageEngine that can be used in this context, ranging from a password manager to encryption and monitoring solutions. This solutions

portfolio helps us to provide a kind of end-to-end cyber security solution. There are many use cases beyond the automotive industry, including in the telecommunications sector itself.

InNOVation: Does this toolset cover all cyber security requirements for all industries in general?

Ragonesi: Special cases will require special solutions. Specialized encryption, for example, is one such case where there may not be an appropriate off-the-shelf solution. However, these are usually provided by the manufacturer. Therefore, we are indeed able to implement the described end-to-end approach from a single source. There are no specifications in terms of which tools to use - it's a question of achieving the desired results, such as password management, encryption, intrusion detection, etc. In the area of management systems, we have been working very successfully with the Webcon product from the eponymous vendor for many years. It forms the basis of our, if I may say so, extremely successful process digitalization. If needed, we can also set up a norm-compliant process chain optimized for cyber security and support other companies dealing with this task.

InNOVation: We have shed light on the consulting services and the existing toolset - what about MicroNova's own product that was mentioned?

Ragonesi: Here, our objective is the execution of cyber security tests. The basis of the product, I can reveal, will be the test automation solution EXAM, which has been in use at the Volkswagen Group for over 15 years now.



"Ultimately, it is about putting in place a complete cyber security management system, abbreviated as CSMS. In terms of process, it is a relatively standardized workflow. However, the contents, implementation recommendations, possible tools, etc. are highly specific."

– Orazio Ragonesi,
CEO, MicroNova AG

Because even in cyber security there are classical test cases, such as what happens in the automotive field in the event of a hacker attack on an electronic control unit, or how secure the onboard communication in a vehicle is. In the event of an attack against security, the control units in the vehicle must respond correctly, and this specific behavior needs to be tested in compliance with norms – a classic EXAM topic. Of course, we also focus on cyber security as well as operational safety and reliability. Our team has already passed several milestones, and I am confident that we will see an initial version by the end of the year.

InNOVation: How does MicroNova approach such projects?

Ragonesi: Primarily, MicroNova itself implements relevant ISO requirements. We address this through an integrated management system based on the good old quality standard ISO 9001, with cyber security being embedded accordingly. We rely on a framework, so additional criteria are added to our IMS allowing us to approach the topic efficiently. Our previously mentioned high level of digitalization based on the Webcon application has helped us to implement this quickly and easily. Ultimately, measures including an evaluation system, audits, and tracking are always required. We have successfully implemented all of this in Webcon and have thus built up a wealth of expertise. Accordingly, we have a well-established best-practice approach within the company that our customers can benefit from, as it is already serving as a blueprint for similar projects.

InNOVation: That's a comprehensive offering overall. Will the topic of cyber security become as big as current discussions suggest?

Ragonesi: Maybe even bigger. Ultimately, cyber security matters pertain our entire economy, for end users this is most obvious when the critical infrastructure is concerned, which is essential for the basic functioning of our state and society. Demand for solutions is already enormous and will continue to grow. Let's take the issue of over-the-air updates as an example. A successful attack at this point could potentially paralyze an entire fleet, with corresponding consequences on the manufacturer's reputation. But it is also conceivable that hospitals or large corporations would be shut down too. We are dealing with entirely new orders of magnitude here. At the same time, we see new possibilities for monitoring and early detection of attacks through the use of artificial intelligence. All of this will also make insurance more expensive and quite likely some things may even no longer be insurable in the future. Therefore, I am glad that we already have a strong portfolio, as it allows us to truly support our customers with the challenges they are facing right now.

InNOVation: Will the role of artificial intelligence increase in this context?

Ragonesi: Absolutely. Especially, I think, in the areas of fraud and intrusion detection. We are actively involved in a research project in the academic environment. AI will certainly play a role here, although not the generative

type of AI that has become widely known since the hype of ChatGPT, but rather the opposite, an AI that can help with the detection of attacks. It is important to note that we are not exclusively talking about the automotive industry, here.

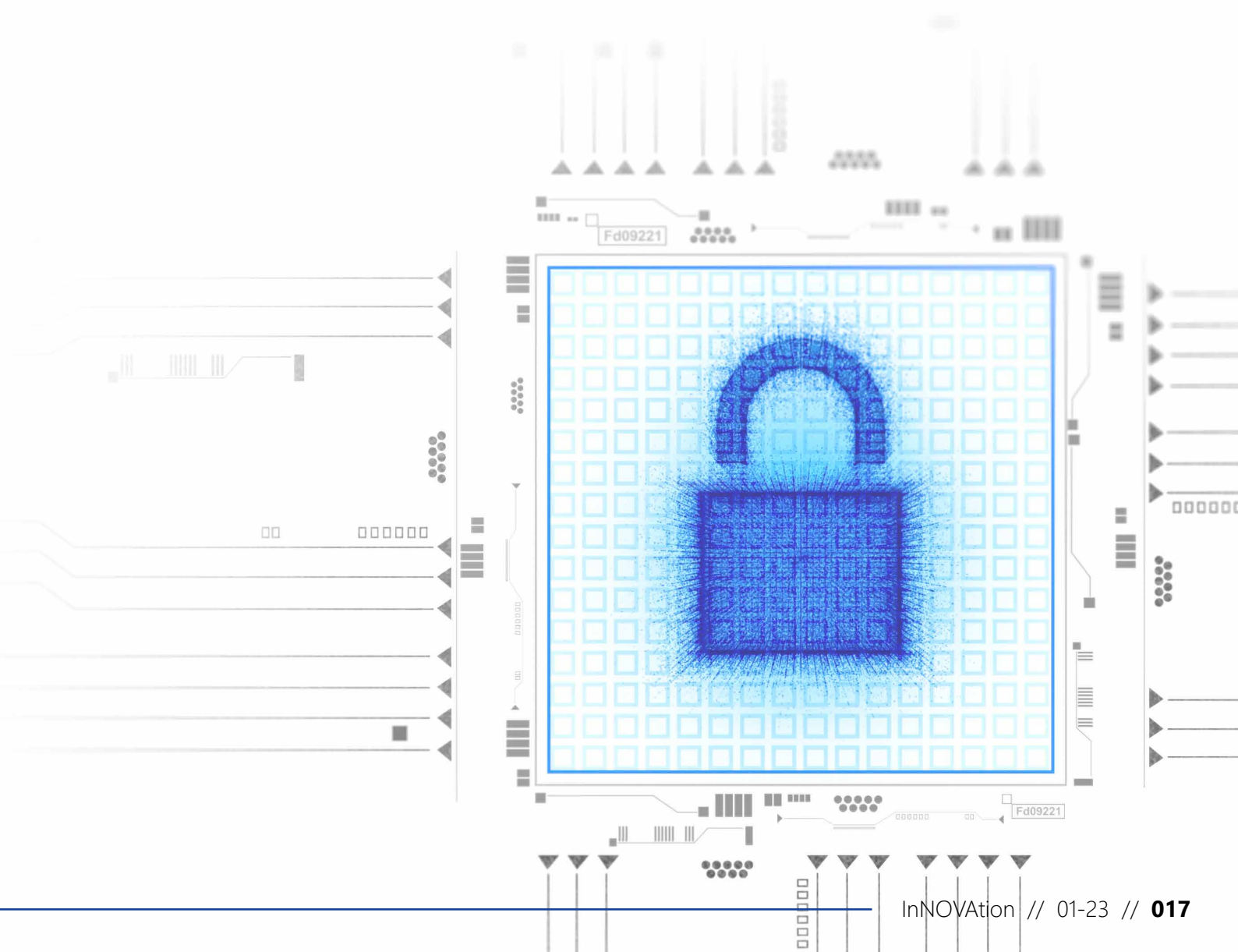
InNOVation: What are some approaches in the telecommunications sector mentioned earlier?

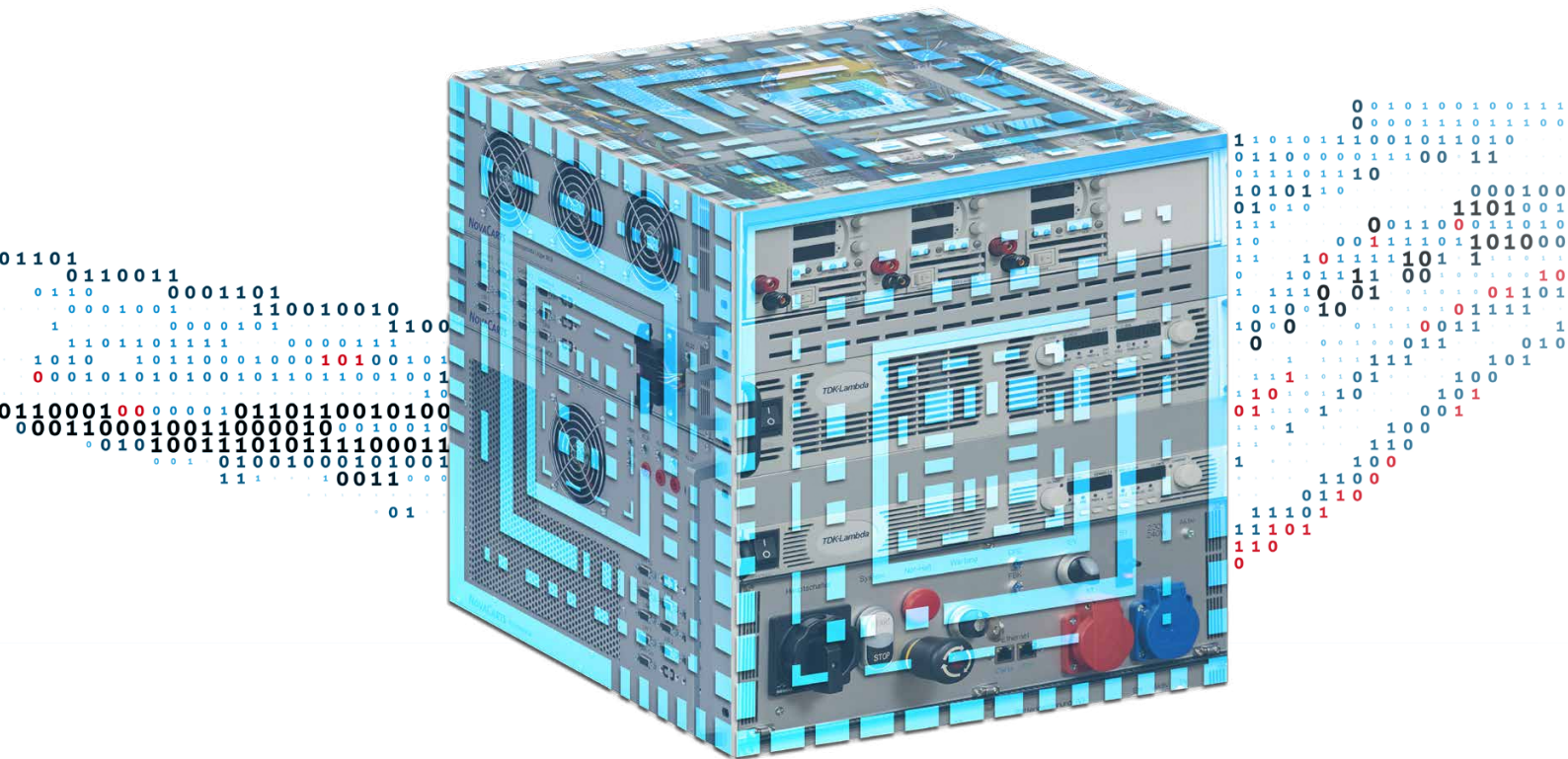
Ragonesi: The basis of ISO 21434 applies regardless of the industry. In the field of mobile networks, for example, the increasing 'cloudification' of solutions is a major topic. Today's mobile network is still a relatively closed,

proprietary system. However, the near future is moving towards the cloud, to put it simply towards an intelligent antenna with cloud connectivity. This means that the mobile network is becoming more and more like a commodity, similar to a Wi-Fi network in a large building, which does simplify many things, but on the other hand it opens up a potential entry point for cyber attacks. As a result, the mobile network itself becomes potentially vulnerable – so it is important to detect and protect against this. The same goes for other sectors, such as industrial networks that control data-based applications, from machinery pools to energy grids. This broad variety under-

scores the urgency of the issue and the contribution we can provide for our customers.

InNOVation: Mr. Ragonesi, thank you for the interview! ■





Virtual Test Bench: Testing Electronic Systems More Efficiently

The increased use of electronic control units makes many areas of life more convenient – but safety must be guaranteed at all times. This calls for innovative solutions for development and protection.

TEXT: Stephan Schmidt PICTURES: © Lidiia, Buslik / Shutterstock.com; © archy13/ Fotolia.com



Most modern products and appliances that make our everyday lives more convenient consist of hardware, electronics and software. This covers a wide spectrum and affects many areas from smart homes and vehicles to medical devices and industrial manufacturing equipment. For example, we drive home from work, and our position data combined with the current traffic situation results in exactly the right time for the heating system at home to boost the temperature in our apartment. But not too early, either, in order to make optimum use of energy. Some of these user-friendly functions can be implemented more easily or, in some cases, exclusively by software. Therefore the focus should be on the seamless interaction of hardware, electronics and software early on in the development process.

Simulating Mechanics, Electronics & Software Together

There are already fully developed tools on the market that are used during the development process to simulate individual building blocks. The mechanical workings can be viewed in 3D, and simulations can be used to check functions and strength properties. A planned circuit for the electronics can also be simulated during the design phase. Are all the connections correct and complete? Have all the rules for circuit design been followed? These questions can be answered even before a single terminal block is set.

Simulators and models also enable software to be tested and enhanced accordingly during development.

Wouldn't it therefore make a great deal of sense to combine the simulation of these three elements? The answer is, of course, YES. These solutions can be divided into different levels depending on the degree to which the simulations represent reality. Each one has its own justification. As always, the focus of the test is what matters when it comes to choosing a test bed.

Virtual Testing and Virtualization of the ECU

The terms software-in-the-loop, virtual testing, and virtual test bench are buzzwords that are often used in ECU development. The core element of any implementation in these areas is the separation of software testing from the target hardware, i.e. the electronic control unit (ECU). Tests are usually performed on PC systems, although calculations can also be outsourced to other hardware such as graphics cards or FPGAs if and when required. Such systems are operated locally or in cloud data centers.

Extending this type of virtualization to other connected peripherals – for example, actuators, sensors and the vehicle bus – creates a test bench that might also be implemented as a HiL system. Because of the demanding requirements involved in testing ECUs,

the experts at MicroNova believe that expanding the test systems used to include virtualization is the most forward-looking approach. This is why MicroNova offers virtual test procedures in the form of its Virtual ECU and NovaCarts Virtual. The method allows test cases to be executed on a virtual test bench, with only minimal adjustments compared to conventional hardware test benches. HiL systems can therefore be supplemented and test capacities significantly expanded.

Implementing a Virtual Test Bench

The virtual test bench relies on co-simulation of several software products. The focus here is on simulating an ECU at the instruction level, paving the way for the ECU software to be executed as unmodified binary code. Depending on the desired depth of simulation, the processor models used range from processor emulation to register-transfer level (RTL) simulation. This makes it possible to completely replicate the processor and other connected components of the ECU board in every detail. In this case, the simulation depth includes not only the execution of the individual processor instructions but also the implementation of all registers present as hardware together with the simulation of processor timing. The detailed representation of cache accesses and areas of memory allows test engineers to identify deep-set errors in the system.

Use Case Architecture Optimization

A virtual ECU can be used in many different ways. This procedure already shows its value when extending the development environment for the microcontroller to be used in the future electronic system. A significantly greater challenge is posed, for example, by a reproducible solution for environment simulation. A plant model, which is mostly used in HIL system, is not sufficient in this case. In contrast, a flexible, realistic environment model, such as that used in the development of autonomous driving functions, starts with the connections of the particular chip or even within the controller. Using cross-compilation and free cutting within the software, it is possible to simulate with minimum reference to the hardware. The ultimate discipline, however, is the path described above, where all ECU components are consistently simulated. MicroNova Consulting's experts in the field of virtual ECUs provide comprehensive support to companies in operating virtual ECUs.

Virtualization Cuts Down on Prototypes

Probably the greatest added value, however, is provided by the arbitrary depth of fault triggering during virtual testing. Being non-destructive, this procedure cuts down on prototypes, which also saves costs. It is possible to trigger errors and record measured values in a range that cannot be reached at all with real hardware for various reasons. For example,

the laws of physics represent an insurmountable hurdle. Taking the electric motor as an example, the speed control is electronic and the electronics are controlled by software. An error is to be triggered at a defined speed when a specific angle is reached in order to perform detailed analysis of software behavior. A breakpoint can be set in the simulation that causes not only the software to stop, but at the same time all components involved in co-simulation. This enables the software to be debugged at the command level while visualizing realistic motor currents, since the motor also continues to be simulated at suitable time intervals. The same applies to the communication module, which receives or sends messages at a slower rate depending on the particular debugging step.

The ability to cut down on physical prototypes is good, but creating fully virtual prototypes is even better. After all, once all components have been modeled in great detail, it is then possible to implement various combinations of these components in individual virtual prototypes. And investment is then only made in building an actual prototype for the variant that performed best in the simulation. This makes the selection of the compo-

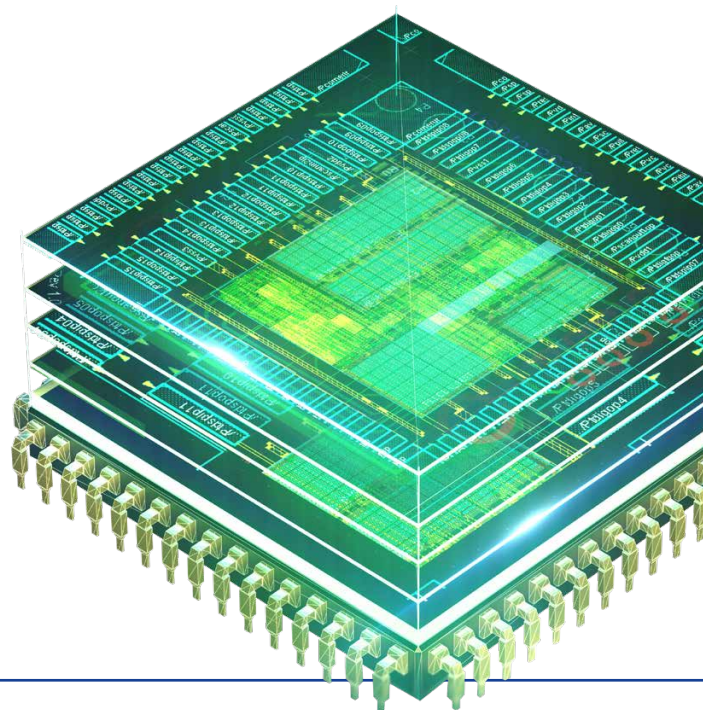
nents that are ultimately installed much more systematic, saving both costs and a great deal of time, as well as, most importantly, raising product quality to a whole new level.

Test Automation

As in every test instance, the reproducibility of test execution also plays a key role in a virtual ECU. This is most easily achieved with a test automation solution such as EXAM. The high level of detail in the approach described in the article is accompanied by a high level of development effort. This makes it highly desirable to ensure that the test system is utilized to its full capacity. A 24/7 load is feasible with the support of MicroNova's Test Consulting experts. A wide spectrum of products and services ensures the best possible solution for every project.

Summary

Virtual testing will not replace existing test instances, but rather extend them beneficially—like all test instances that have been developed previously. ECU virtualization therefore opens up new possibilities that can quantifiably enhance the innovative power of any development business. ■



MicroNova live!

Most events are finally taking place again in their old form and there are some interesting dates coming up in the Testing Solutions area in 2023. We look forward to meeting you at one or the other industry event or to welcoming you at one of our workshops!

Automotive Testing Expo Europe 2023

Messe Stuttgart, Booth 1126, Hall 10
13 - 15 June 2023

Meet our Testing Solutions team in Stuttgart at the world's largest trade fair for testing and validation technologies. We will show you solutions for your current testing challenges!

ELIV – Electronics in Vehicles

World Conference Center, Bonn, Booth 27
18 / 19 October 2023

Meet our Testing Solutions team at the VDI Congress ELIV in Bonn and find out about our extensive portfolio of innovative test systems.

23rd International Stuttgart Symposium – Automotive and Engine Technology

House of the Economy, Stuttgart
04 / 05 July 2023

In 2023, the Stuttgart Symposium will take place for the first time in summer and MicroNova will be present as an exhibitor. In addition, our experts will provide information specifically on the topics of BMS testing using electrochemical impedance spectroscopy and virtual ECU testing.

Supplier Day Automotive Industry BW

presumably at the Neckar Forum, Esslingen am Neckar
16 November 2023

The state agency e-mobil BW, together with the Ministry of Economic Affairs, Labor and Tourism Baden-Württemberg, invites to the 25th Supplier Day Automotive Industry BW. The event will focus on the topic "Digitalization as a driver of change". Meet MicroNova at the related Matching Fair.

f-cell Stuttgart – International Exhibition for Fuel Cell Technology

Messe Stuttgart, Stand 4A34, Halle 4
13 / 14 September 2023

During the international congress, MicroNova and its partner Smart Testsolutions will present their cooperation in the fields of fuel cell measurement technology, HiL test & validation for control units and control electronics, and monitoring of fuel cells and electrolyzers.

EXAM Hands-on Workshops 2023

In a free hands-on seminar, our EXAM experts will introduce you to the basic functions and benefits of the test automation solution - and you will program your own test case with EXAM directly on site. The hands-on workshops will take place in five German cities. Info, dates and registration at:

www.micronova.de/exam-workshop

Further events, webinars and presentations will be added to our schedule on an ongoing basis. Visit our website at www.micronova.de/testing-veranstaltungen.



Multi Cloud Broker

Orchestration of public and private cloud infrastructures with the Multi Cloud Broker

TEXT: Ingo Bauer PICTURES: © issaro prakalung / Shutterstock.com

Truly into the Cloud

The entire telecommunications industry is currently undergoing a process of change in order to gear up for the new requirements and make itself fit for the future. This process entails a transformation of previous on-premises architectures (on-premises is an information technology term that refers to the installation of software and systems on local servers and computers within an organization) to cloud-based or cloud-native solutions.

Familiar approaches to cloud migration such as "lift & shift" explicitly move existing systems to the cloud without making any explicit changes. However, this leaves them without the necessary customization and strategy to take advantage of a public cloud.

There are currently a large number of public cloud providers operating in the market. The best known are:

- » **Amazon Web Services (AWS)** – part of the Amazon group and currently the world's largest cloud services provider
- » **Microsoft Azure** – belongs to the Microsoft Group, offering a wide range of cloud services – including IaaS, PaaS and SaaS
- » **Google Cloud Platform (GCP)** – owned by Google, providing similar services to AWS and Azure, including computing, storage, and networking
- » **IBM Cloud** – belonging to the IBM Group and offering a wide range of cloud services – including IaaS, PaaS and SaaS
- » **Oracle Cloud** – part of Oracle and offering a variety of cloud services – including IaaS, PaaS and SaaS
- » **Alibaba Cloud** – part of the Alibaba Group and the largest cloud provider in China, currently experiencing continuous rapid growth globally

In partnership with Clyso GmbH, MicroNova offers MNOs a powerful solution for managing cloud-based telco solutions comprehensively. The offering covers the management of private and public clouds through to a combination of both, so-called hybrid clouds.

The two companies offer a joint solution in the form of their Multi Cloud Broker (MCB), which can be customized flexibly to meet customer needs, delivering:

- » **Cost optimization**
- » **Availability optimization**
- » **Data locality and protection**
- » **Capability centralization**
- » **Access management**
- » **Asset management**

Multi Cloud Broker

Multi Cloud Broker is a middleware that helps organizations manage and optimize IT infrastructure across multiple cloud computing environments. By taking a multi-vendor approach, MCB helps achieve optimum performance and flexibility. In addition to public cloud providers such as GCP, AWS, Ali Cloud and Azure, it also integrates private cloud providers and approaches such as OpenStack, VMware and Kubernetes through a unified and centralized interface.

This is how MCB provides a single point of contact that facilitates access to different cloud environments, simplifying the management of applications and their data in different clouds. It covers the entire lifecycle of individual tools, including all data management associated with migration, backup, and transformation.

It allows different cloud models to be integrated, such as Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).

SDN

SDN is a technology that telecommunications providers use to automate and centralize network control and management, and which allows providers to control and manage their networks from a central location, rather than having to do it manually for each node or switch. This centralized management approach gives providers more oversight and visibility into their network. This, in turn, allows them to use network resources more efficiently and simplify overall network management.

Telco Cloud refers to the virtualization of network functions and services in a cloud environment. This means that MNOs can deploy their networks in a virtual environment, giving them more flexibility and scalability, as well as promoting cost efficiency. Telco Cloud enables providers to roll out innovative services faster and to adapt their networks dynamically to meet new demands.

Network Slicing

A key focus of 5G technology is the deployment of radio network-based services and the quality of service policies for these services, which are called "network slices" in the mobile radio environment. These network slices allow several virtual networks to be provided over a shared physical infrastructure. Each of these networks, or 'slices', is designed to meet the specific requirements of a particular type of application or user group, such as mobile broadband, the Internet of Things (IoT), or critical communications with low latency and high failure safety. Network slicing therefore enables mobile network operators (MNOs) to offer differentiated services and allocate network resources to meet the specific requirements of each slice.

Besides a functional extension of the network hardware, network slicing also calls for a high degree of flexibility and dynamism in the mobile network, which can be delivered through the use of software-defined networks (SDN) and cloud-based technologies (Telco Cloud).

Planning and Migrating Existing Infrastructures

MCB is used to capture the current status, determine the resources required in the public cloud and create a migration plan. MicroNova and Clyso take into account and calculate the costs of the various applications and resources used in the cloud during operation, based on individual pricing quotations and models from providers, early on in the planning stage and during the rollout process in order to minimize costs and increase efficiency.

To save costs, systems can be grouped according to customer-specific requirements and features before their benefits are analyzed. An analysis of costs reveals a range of potential savings. For example, users can identify and manage the automatic shutdown of systems over weekends or when not in use directly through MCB.

Extract from a Selected Customer Project

- » Migration of 14,000 virtual machines within seven months
- » Decommissioning of 800 physical servers
- » Visualization for 1st and 2nd level support
- » Introduction of central logging management
- » Optimization of data transfer from DCs to the corresponding public cloud region
- » Ongoing cost control throughout the project regarding the use of the public cloud
- » Flexible use and provision of resources in different regions and from different providers

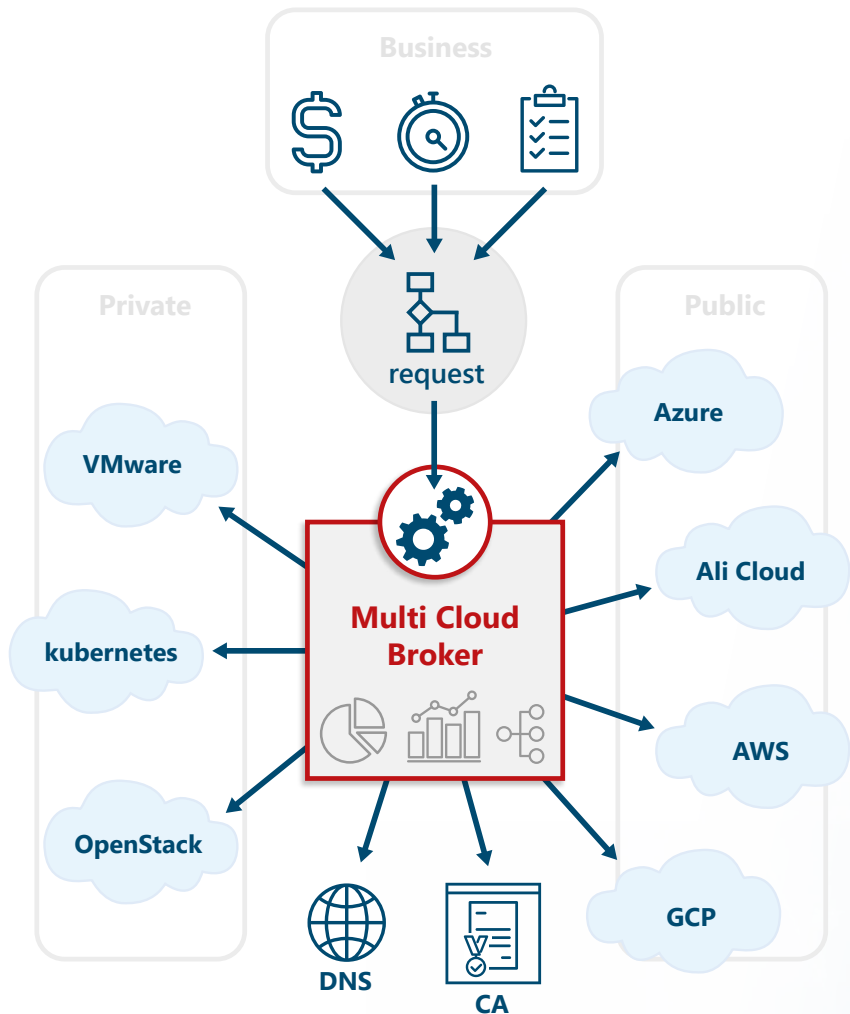
Automated Rollout and Service Support

Entire architectures, clusters, individual machines as well as a whole network can be rolled out automatically via the MCB API. MCB presents a platform for creating, scheduling, and monitoring workflows programmatically, thus offering the ability to abstract project requirements.

When IT service management (ITSM) tools are connected, services in the cloud can be deployed centrally, automatically, and under full MCB control, with support for the entire lifecycle

of a service. It includes, among other things, budgeting for a service within the cloud and provides crucial help during the planning stage in order to estimate costs in advance. This is made possible by a special forecast module within Multi Cloud Broker.

The integrated monitoring and compliance module evaluates provider stacks centrally and ensures throughout the entire rollout process that all devices and applications are deployed according to a defined standard.



1 Multi Cloud Broker

Benefits and Features of Multi Cloud Broker at a Glance:

- » Complete cost planning and tracking across multiple providers and platforms
- » Resource management across multiple providers and technology stacks
- » Support for declarative and imperative orchestration methods
- » Optimization of utilization across providers, operating systems, and applications
- » Prevention of vendor lock-in
- » Simplification of use of complex policies and provider services
- » Central monitoring platform for the cloud stack
- » Flexible use or provision of resources in different regions and from different providers

Summary

By using Multi Cloud Broker, network operators benefit from the advantages of different cloud providers without having to commit to one specific vendor. The value-added benefits range from greater flexibility and better scalability to higher availability and better data security, while ensuring that control over resources and costs remains in the hands of the MNOs at all times. In partnership with Clyso, MicroNova offers a comprehensive package consisting of several years of telco and cloud expertise as well as the powerful MCB software. Clyso and MicroNova support deployment and migration from the very beginning of the project in close coordination with the MNOs - starting with comprehensive consulting and analysis of the existing environment, to successful implementation and operational support. ■

About Clyso

Clyso GmbH was founded in Munich in 2010 and is today one of the leading CEPH Storage & Cloud Solution providers in Europe. With a team of experts, Clyso is currently managing 25 customer projects in progress and has already delivered more than 350 projects successfully. Clyso actively uses open source technologies to minimize the risks of IT security, licensing costs, vendor lock-in and technical bottlenecks. The technical focus is on building highly scalable and globally distributed cloud computing environments, both based on IaaS and PaaS as well as SaaS.

Brand new: Telco Solutions Compact

"Telco Solutions Compact" is a compendium of our most important articles and contributions for the telecommunications industry. Bundled and to the point, readers receive technical insights, analyses, and assessments as well as in-depth descriptions of solutions relating to the successful management of mobile networks. After a well over two years "in service", it was time to launch a brand new edition - and that has now happened.

You can read our compendium as an e-book at <https://www.micronova.de/TelcoCompact2023> or create a pdf download from our website. From network slicing to automation and orchestration to artificial intelligence in the context of mobile networks: We wish you an informative read!



Proactive Infrastructure Monitoring at BEKO TECHNOLOGIES

OpManager detects faults before users are affected

TEXT: Editorial staff PICTURES: © BEKO TECHNOLOGIES GmbH

BEKO TECHNOLOGIES GmbH:

- » Sector: Mechanical and plant engineering, compressed air technology
- » Employees: approx. 580 (2019)
- » Revenue: € 107.2 million (2019)
- » Headquarters: Neuss

BEKO TECHNOLOGIES GmbH develops, manufactures, and sells components and systems for the treatment and management of compressed air and compressed gas. The independent, family-owned company, which has its headquarters in Neuss, Germany, was founded in 1982 and today has an international presence with over 580 employees and 16 operating sites around the globe. The company's expertise and services range from the treatment of compressed air and compressed gas through filtration and drying to proven condensate technology and instruments for quality control and measurement. BEKO TECHNOLOGIES advises manufacturing firms regardless of their industry in order to find the optimum solution for their compressed air treatment needs and to ensure compliance with the

required process quality and energy efficiency.

The starting point – Good experience with ServiceDesk Plus and Desktop Central, but no central IT monitoring

Back when Nils Volkmer, current Team Leader Global IT, first started at BEKO TECHNOLOGIES, there was no ticket system. In order to bring structure and clarity to the daily IT routine, the IT team was initially looking for a helpdesk solution. Since Nils Volkmer had already had positive experiences with ServiceDesk Plus from Manage-Engine at his previous employer, he decided to take a closer look at the IT service management solution, along with other tools from other vendors. The



ment. Due to the much larger range of functions and the significantly lower costs, BEKO TECHNOLOGIES finally opted for Desktop Central*. An intensive trial period was arranged. When he realized a function was missing, Nils Volkmer again approached the vendor. "After only two weeks, the missing function was implemented as a feature," says Volkmer. "We are thrilled how incredibly fast ManageEngine implements new functions when they are relevant for several customers." So nothing stood in the way of implementing the unified endpoint management solution. Bit by bit other features of the solution were released, such as patch management, software deployment, and self-service functions that allow users to request software themselves. Thanks to integration into the helpdesk solution ServiceDesk Plus, the IT team can view the current installation, maintenance, and patch statuses at any time.

Wanted: Monitoring for the IT infrastructure

wide range of functions of the ManageEngine solution was then compared with the defined requirements and thoroughly tested in a test installation. The company took its time and worked closely with the vendor, as some requirements were not yet available in the solution. In dialog with ManageEngine, it was possible to incorporate the required functions into the product after only a short time. The quick response and cooperative collaboration won Nils Volkmer over and ServiceDesk Plus was introduced in 2016 once the trial was completed.

The second ManageEngine solution, Desktop Central*, followed shortly after. Again, several vendors were evaluated, including Intune from Microsoft, as initially the company was only focusing on mobile device manage-

At the beginning of 2020, BEKO TECHNOLOGIES started another project: The company wanted its entire IT infrastructure to be monitored proactively. The goal was to detect faults before they actually affect users. Alexander Palm, who had just started as IT Security Specialist at BEKO TECHNOLOGIES, was in charge of finding and introducing a network and infrastructure monitoring solution, that would allow the six-member IT team to switch from a reactive, usually very stressful, mode to a proactive one. Once again, the first step for BEKO TECHNOLOGIES was to define the requirements: The solution should be user friendly and able to integrate new devices and services with as little effort as possible. Another criterion was support and continued development

by the vendor. In all three criteria, ManageEngine OpManager scored better than the competition – including Nagios, PRTG, Icinga and Zenoss. Another advantage was the integration possibilities that OpManager offered for ManageEngine solutions already in use at the company.

ManageEngine OpManager

In the trial period that followed, OpManager scored points with its user-friendliness, clear dashboards, and ease of use. This was followed by a workshop with ManageEngine distributor MicroNova, in which the IT team gained an even more detailed overview and clarified how the individual requirements could be best implemented. Alexander Palm then first set up the infrastructure monitoring, which was expanded in several stages and finally put into operation after six months.



"With OpManager, we can easily create dashboards, store service level agreements, generate reports, and access other services. This makes it very easy for us to use."

– Nils Volkmer,
Teamleader Global IT,
BEKO TECHNOLOGIES GmbH

* Desktop Central is now called Endpoint Central



“Thanks to OpManager we can provide information about current availability of the core services.”

– Alexander Palm,
IT Security Specialist,
BEKO TECHNOLOGIES GmbH

By now all 16 branches of BEKO TECHNOLOGIES are connected to the ManageEngine solution, including six production sites with servers in Germany, China, India, and the USA. In addition to more than 130 virtual machines, HCl and SAP clusters, as well as Quorum systems, OpManager also monitors approximately 40 switches, 100 access points, 20 firewalls and 80 printers. In order to also monitor the performance of critical applications, certificates, and the sharepoint, the company uses the Applications Monitoring extension in OpManager, where, for example, the individual systems for SAP – a business-critical application – are combined into monitor groups. This allows dependencies to be visualized so the IT department can see immediately if a component is causing problems. A team specifi-

cally responsible for the business-critical service also regularly reads out the logs. OpManager monitors the complete SAP operation all the way through to document printing.

In addition, the IT team has its own SLAs and regularly prepares reports for the heads of departments. “The core services must have a correspondingly high availability,” explains Alexander Palm. “Using the SLAs and excluding maintenance windows, we can provide information about current availability at any time thanks to OpManager.” Based on this information, informed decisions can then be made about further investments. For example, BEKO TECHNOLOGIES has opted for highly available clusters over two fire compartments, which are again split virtually.

Proactive action reduces stress levels

Since the introduction of OpManager, BEKO’s IT works according to the traffic light principle when monitoring its sites: A central dashboard shows the sites with a corresponding color. If it’s green, there is no need for action. Yellow means that the services are available, but there are restrictions. If a site turns red, this means the status is critical and requires immediate action. In this case, the solution also alerts the IT team by email about the fault.

Most of the time, however, it doesn’t even get that far: “Thanks to OpManager, we can now take proactive action because we receive the appropriate messages,” says Nils Volkmer. In this way, many faults can be remedied before the users at BEKO even notice.

This not only has a positive effect on service availability, but has also helped to significantly reduce the stress level of the IT infrastructure monitoring team.

OpManager was also impressive when it came to integrating new services into the monitoring environment when BEKO employees moved to working from home during the COVID-19 pandemic: The VPN connection became a business-critical service virtually overnight and – after the initial setup by the IT team – is now simply monitored by the ManageEngine solution.



Plans to expand monitoring further

With the introduction of OpManager, the IT team at BEKO TECHNOLOGIES can now monitor the availability and performance of its network efficiently and with much less stress than before. The ease of use and the flexibility with which OpManager can be adapted to new network requirements make the work of Nils Volkmer and his team even easier.

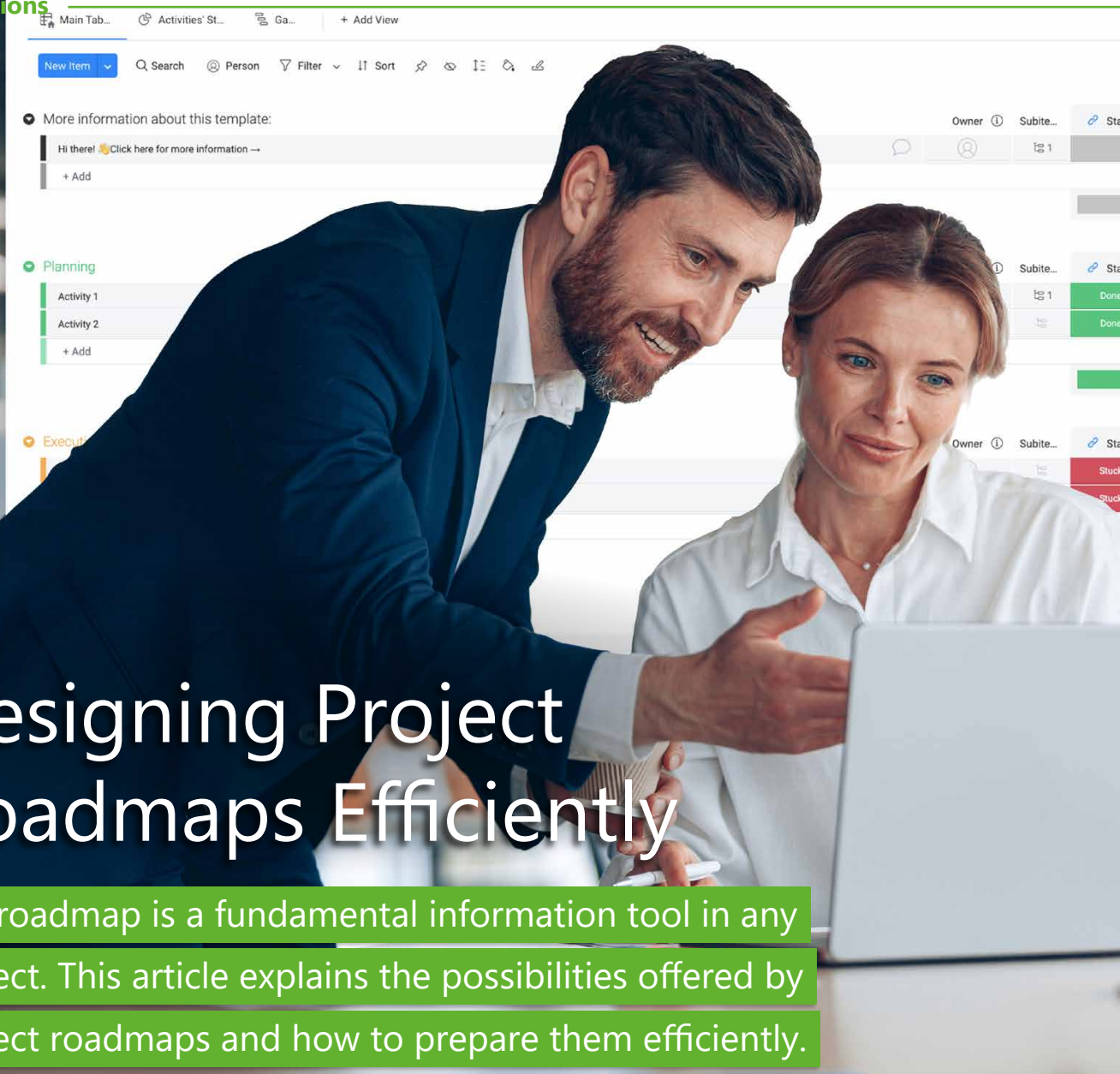
For Nils Volkmer however, the status quo is not the end of the story for.

Next, based on the recommendation of IT security expert Alexander Palm, he plans to introduce end-user monitoring in OpManager to monitor the availability and quality of cloud services for the employees' Plantronics headsets, which the company purchased during the pandemic. Subsequently, End User Experience Monitoring is to be implemented, one of the numerous extensions to OpManager. This allows monitoring the behavior of web applications, apps, and cloud services that can only be used after the user has logged in – from the user's perspective thanks to OpManager. ■

Customer benefit:

- » Simple, user-friendly operation
- » Numerous integration options
- » Clear dashboards
- » Simple device recognition
- » Seamless communication between APIs
- » Fast response from the vendor





Designing Project Roadmaps Efficiently

The roadmap is a fundamental information tool in any project. This article explains the possibilities offered by project roadmaps and how to prepare them efficiently.

TEXT: Felix Bauer PICTURES: © Yaroslav Astakhov / Shutterstock.com; © monday.com

The basic tasks of a project roadmap involve providing colleagues, stakeholders and managers with information and bringing them “on board”. Going beyond the – equally important – details, it is all about the general overview, the big picture.

A project roadmap is therefore usually a compact graphical summary that presents objectives and deliverables on a timeline. It is an extremely useful method for managing stakeholder expectations while at the same time sharing the project’s goals and plan with

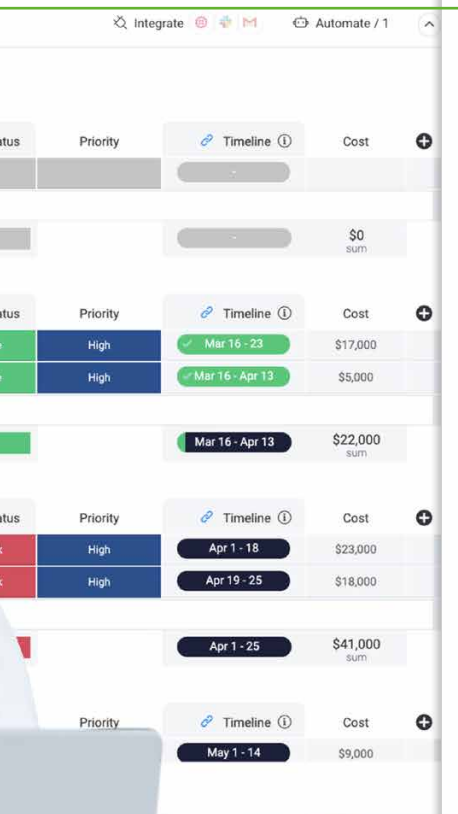
other teams. A roadmap therefore gives all parties concerned, including direct stakeholders, a better idea of the scope of the project and potential challenges.

The project roadmap must not be confused with the project plan. The main difference is the level of information. A project roadmap remains general, whereas a project plan contains specific details. A roadmap therefore explains why, who and when, while a plan describes how.

What should a project roadmap include?

A project roadmap primarily offers a strategic overview of a project’s key elements: goals, milestones, outputs or ‘deliverables’, resources as well as a timeline and path dependencies.

As explained above, project roadmap and project plan are two very dissimilar things. These differences are reflected in the templates or options in the monday.com Work OS. Important for users: both can be modeled in a simple form and comprehensive form.



Status	Priority	Timeline	Cost
			\$0 sum
High	High	Mar 16 - 23	\$17,000
High	High	Mar 16 - Apr 13	\$5,000
		Mar 16 - Apr 13	\$22,000 sum
High	High	Apr 1 - 18	\$23,000
High	High	Apr 19 - 25	\$18,000
		Apr 1 - 25	\$41,000 sum
		May 1 - 14	\$9,000

Projects Overview

Add board description

Main Table

New Item

Search / Filter Board

This Month	Person	Brief	Creative	Live?	Progress	Client	Priority
Project 1		Done	Done	Live	100%	Coca Cola	★★★★★
Project 2		Done	Working on it		34%	Whole foods	★★★★★
Project 3		Waiting for Approval			0%	Ikea	★★★★★
+ Add					45%		4 / 5
Next Month	Person	Brief	Creative	Live?	Progress	Client	Priority
Project 4		Waiting for Approval			0%	Toyota	★★★★★
Project 5		Done			34%	Samsung	★★★★★
+ Add					17%		4.5 / 5

1 Everything in view: With the project overview from monday.com

Work OS from monday.com provides appropriate templates for this purpose. Using them ensures that users can focus on key facts that are intrinsically relevant to any such document. These QR codes or links will take you to the [project roadmap template](#)¹ and the [project planning template](#)²; the latter covers the finer details that the roadmap does not contain.

In particular, these include:

- » Specific tasks
- » Approval processes (internal and external)
- » Potential issues and risks
- » Contents of each phase

Creating a successful project roadmap

Any successful project roadmap requires a certain amount of preparatory work...

1. Business Case

A project roadmap builds on all the essential information that is important to the business. What is the project about? What economic and strategic aspects play a role? What are the opportunities and threats? It is a high-level analysis that aims to first obtain the consent of the relevant people. monday.com also offers a template for this purpose, namely the [project proposal template](#)³.

2. Project Charter

Once a project has been approved, the next step is to draw up a charter. It outlines the key features of the project, such as milestones and deliverables, key stakeholders, assumptions, timeline, and resource allocation – i.e. recognizably important building blocks on the roadmap journey.

As a general rule, all the information necessary for a roadmap is most likely already available in the business case and charter. So a visual roadmap can be drawn up as soon as these two documents have been compiled.

Basic definitions

- » **Goals:** result from answers to questions such as "What is the goal of this project?" and "What does success look like?"
- » **Milestones:** are basically hypothetical dates for key events, intermediate steps, or outputs in the project, such as critical delivery dates.
- » **Deliverables:** describe all outputs – tangible or intangible – during a project at each stage.
- » **Resources:** define what and how much of it is needed for the project – including budget, team size or team members, technologies, licenses, rooms, etc.
- » **Timeline:** for a project timetable, instead of day-by-day planning, it is about a rough overview of the start and end of initiatives, often represented by a Gantt chart.
- » **Path dependencies:** indicate all relationships that impact the performance of essential outputs and activities.

¹ <https://monday.com/templates/project-roadmap>

² <https://monday.com/templates/template/122904/single-project>

³ <https://monday.com/templates/project-proposal>

3. Template

You will of course save time if you develop a project charter using a tried-and-tested template – and at the same time ensure that associated documents look consistent and professional. It is helpful to take a look at the monday.com-project roadmap template, for example; it can be tested at any time as part of a free trial.

4. Central Project Information

It is now time to populate the project roadmap with the data mentioned above. This should include:

1. The project’s goals (along with the potential risks)
2. The benefit or potential return on investment (ROI) of achieving these goals
3. A clear timeline showing the overall scope of the project and expected delivery deadlines
4. Workflows for each of the teams involved in the project (marketing, IT, sales, etc.)
5. Overarching activities that need to be completed (note: we’re talking about general weekly/monthly tasks at this point, not daily)
6. Defined project milestones (such as funding, contract conclusion, product finalization, etc.)

5. Stakeholder Involvement

Anyone creating a project roadmap should bring key stakeholders on board early in the process. They can help by closing any gaps, making suggestions, contributing different perspectives, etc. And, in the best case, they can give their approval to the particular project up front.

The distinct possibilities offered by monday.com for collaborative work are, of course, also helpful for any kind of roadmap – allowing relevant content, from product to construction project, to be easily and securely shared with others and, depending how rights are assigned, edited.

6. Updating

Projects are constantly changing. This is especially true with agile approaches. It may therefore be necessary to make frequent modifications even to an overview document such as the roadmap, for example to adjust and update timelines, resources, milestones, and dependencies. This is where monday.com’s Work OS once again comes into its own – saving both time and effort compared to a paper- or spreadsheet-based roadmap. It also reduces the risk of errors. The following features have been seamlessly integrated into monday.com:

» **Project approvals:** teams can use standardized forms to capture the exact information needed for efficient, streamlined project proposals and work specifications. All these data are added to a board, where approval processes can be speeded up with the help of automation and status messages.

» **Project planning:** team members can assign responsibilities and collaborators, set clear deadlines, and track the status of individual projects. Teams can also manage the scope of the project together with its budget, milestones, dependencies, baseline, stakeholders, and much more at every stage.

» **Portfolio management:** Teams can gain visibility by aggregating data from all projects across multiple programs into a single, high-level dashboard view. They can also instantly link in budgets, timelines, actual costs, threats, and progress in order to spot bottlenecks and trends.

» **Document creation:** monday.com “workdocs” enables users to progress even faster by creating their own documents directly in the platform – they can add text, images, boards and dashboards directly from their own workspace.

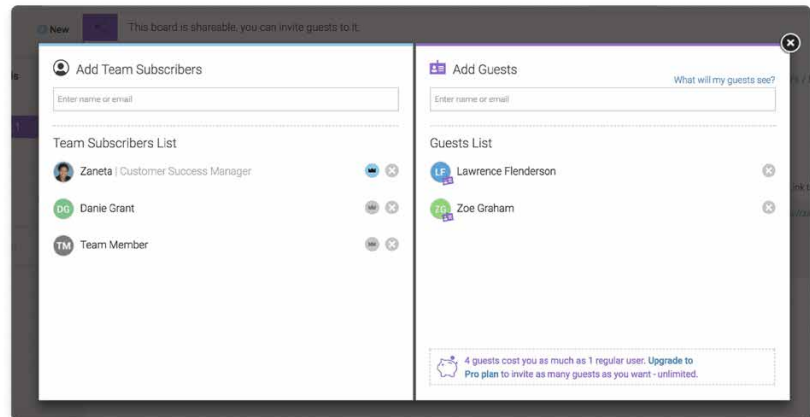
General	Action Type	Description / Performance measure	First year costs	Target date
Problem definition				
Problem statement		Since its inception, Staten Island has relied up...		
Organizational impact		The WP Project will impact Smith Consulting in...		
Technology Migration		In order to effectively migrate existing data fro...		
+ Add			SD sum	
Goals and objectives				
Business Goal/Objective Description Timely and accurate repo...		Web based tool will allow real-time and accura...		

2 Efficient problem management: The monday.com board for targeted problem identification



**Implement project roadmaps
successfully with Work OS
from monday.com**

Roadmapping can be a critical step in establishing the current status of a project and identifying the way forward. It is also a great way of bringing customers and stakeholders on board. A project roadmap must be flexible, descriptive, and easy to communicate in order to succeed. This can be achieved particularly well by using powerful project management software such as monday.com. [MicroNova's Enterprise Solutions team](#) will be happy to provide further tips and tricks. ■



3 Collaborative work made easy: Invite new users and guests to join a monday.com team



Digitization: From Compelling Application to Sales Partnership



To best support companies in their digitalization efforts, MicroNova combines its own expertise with an established product: Webcon BPS.

TEXT: Editorial staff PICTURE: © PopTika / Shutterstock.com; © Webcon

WEBCON®

Who is behind Webcon?

Founded in Krakow in 2006, Webcon develops software solutions for Business Process Management (BPM). The BPM software called Webcon BPS is used to optimize and automate business processes. Customers include both small and medium-sized enterprises (SMEs) and large corporations. The solution has established itself in a variety of industries, including banking and insurance, government agencies, and logistics companies. Numerous awards and recognitions attest to the quality and effectiveness of the BPM solution. The company is a member of the BPM network and works closely with other institutions to advance the development of BPM technologies.

The digitalization of business processes has been playing a significant role at MicroNova since 2018. Management recognized early on that digital transformation represents both an outstanding opportunity and a similar challenge. MicroNova is not alone in this assessment or fact, as today's companies are confronted with various topics such as big data, cloud computing, remote work, or the trend towards paperless offices.

In order to achieve digital transformation across all nine of MicroNova's sites, it was necessary to consider a number of parameters in addition to company-specific workflows. The number of employees had more than tripled within a decade, a strong organic growth which had resulted in increased administrative complexity. There was also the challenge of organizing teams, often according to different standards, in a way that ensures that not only do all operational activities run seamlessly, but also that everyone enthusiastically buys in to the created structures.

Digitalization as a competitive advantage

Therefore, Dr. Klaus Eder, COO of MicroNova AG, early on sought solutions for the efficient design of digital business processes. The stated goal was to analyze, digitalize, and automate workflows in order to lessen the workload on employees, simplify documentation, and make processes more efficient and more flexible. In this way, digitalization was to become a competitive advantage.

"In the end, it's about increasing our own productivity, cutting costs, and improving collaboration among colleagues, whether they are located at our headquarters in Vierkirchen, or in Braunschweig, Kassel, or Pilsen in the Czech Republic," explains Klaus Eder. Companies that embrace digital technologies are not only more competitive but also able to respond more quickly to changing market conditions.

Following an internal study that included market evaluation and initial



product testing, the choice quickly fell on the low-code platform Webcon BPS. “We wanted to standardize, automate, and digitalize our processes while maintaining a high degree of flexibility. The ability to quickly and easily adapt and expand our workflows with Webcon BPS at any time won us over,” says Eder on the choice of product.

The next step:

The partnership

Webcon BPS has been in use at MicroNova to great success since 2019. Within three years, the team has modeled 46 processes and 27 applications for various departments using the system – from requirement requests to training orders and document approvals, to risk management. The experience that the team gained with the platform was the ideal preparation for a challenge brought about by the Covid-19 pandemic: Within a short period of time, they were able to set up a process that covered the distribution of Covid-19 tests as well as proof and monitoring of vaccinations

according to legal requirements, all while taking into account data protection regulations.

Thanks to its use of Webcon BPS in-house for several years, MicroNova already had a solid wealth of experience, and there was another reason for closer collaboration with the platform’s creator: The product had been received with enthusiasm and acceptance among the workforce. In light of these impressions, MicroNova and Webcon established a partnership in November 2022. MicroNova is now the official sales partner for Webcon BPS in the German-speaking region, with a focus on small and medium-sized enterprises (SMEs) that are looking for a convincing technical solution for their digitalization and at the same time the advice of an experienced partner.

It’s the solution that counts

Because that’s what the “MicroNova digitalization team” emphasizes: Ultimately, the focus is on the solution and the benefits that can be achieved with it. This also means that, for exam-

MicroNova’s solutions for process digitalization and automation

- » Analysis, modeling, implementation, and optimization of business processes, workflows, etc.
- » Increased efficiency and reduction of manual tasks through automation
- » User-friendly interface
- » Possibilities to integrate into existing applications thanks to flexible interfaces
- » Transparent and compliance-ready

ple, additional products can be used alongside Webcon BPS where doing so makes sense. Which is why MicroNova always offers an analysis of existing processes, along with consulting on possible optimizations, product advice, and the creation of custom digitalized workflows, as well as training. ■



Digitalization is a Management Issue

Dr. Klaus Eder, Member of the Executive Board of MicroNova AG – who addressed the challenge of digitalizing processes at an early stage – outlines the digital transformation at MicroNova in this interview.

TEXT: Editorial staff **PICTURE:** © TippaPatt / Shutterstock.com;

InNOVation: How did digitalization take off at MicroNova?

Eder: It all began with a challenge that any businessman would be happy to tackle: growth. We currently have nine locations spread over a number of countries. The workflow in many overlapping processes involved printing out a document, signing it, and sending it from one location to another. These documents were then faxed, scanned, and emailed. The question we asked ourselves at the beginning was not how we could increase our level of digitalization, but rather how

we could become more efficient. And how we could minimize the sources of error? And this is actually the only real approach to thinking about digitalization: as an opportunity for greater efficiency and growth. Digitalization is not an end in itself.

InNOVation: How did MicroNova first learn about Webcon BPS?

Eder: When we started looking at digital process management back in 2018, we analyzed the market to see what tools were available that would fit our needs. We finally modeled a process

using Webcon BPS as part of a pilot project and gained initial experience with it. We were amazed at how quickly we were able to perform this process across all locations and with virtually no errors. This success motivated us to go further, working through one process after the other.

InNOVation: What was the number one challenge in digitalizing business processes?

Eder: It's important to start by fully understanding and mapping out your own processes. How does everything

actually work exactly? Naturally, there is also the opportunity at this stage to identify potential for optimization and to question the actual processes before they are modeled digitally. For example, our quotation process was already formulated in paper form in terms of ISO 9000. We thought it would be a straightforward case and we could get started right away. Things were very different in reality. The process had not been implemented in practice exactly as it had been written down. And there were exceptions to the rule. Moreover, the documentation didn't describe everything, for example how to proceed if a quotation was not approved or contained errors. Who is the person actually responsible in that case? And what's the next step at whatever point in time?

InNOVation: Was this an isolated case?

Eder: Even though our processes were basically working pretty well, it wasn't an isolated case. When we later did a similar analysis of our procurement activities, for example, we found a large number of process variants with minor, but nevertheless real, differences across the various departments. But these variants were well-established and also made sense. Modeling and digitalizing using a tool like Webcon BPS has provided positive ways for us to clearly formulate the elements and variants of our own processes based on many years of experience – including all the exceptions. It was a lot of fun and drove us forward! So, detailed analysis is always the first challenge to be addressed.

InNOVation: Were there any other pivotal challenges?

Eder: Challenge is perhaps not the right word, I'd say 'task' instead. Our second major task was to get our

employees 'on board'. That's why we made a point of communicating the introduction of Webcon BPS right from the start and decided that it would be a matter for the Executive Board. This enabled us to eliminate obstacles at an early stage, ensure that budgets had been approved, and that the procurement of the tools would run smoothly without any major difficulties. We made it very clear from the outset that we would be implementing the project together and that everyone involved would all be pulling in the same direction. This meant that everyone was always on the same page and highly motivated. Really successful implementation was, of course, another key success factor. The processes support our teams, which is why they're happy to embrace them in digital form.

InNOVation: What tips do you have for other businesses that are just starting out with digitalizing their processes?

Eder: It's essential to take a close look at your own processes either prior to or early on in the digitalization project and to work with all those involved on documenting them. I can recommend firmly anchoring the project within the company's management to ensure that process digitalization moves forward swiftly. This of course also promotes a certain level of acceptance. The enthusiasm for Webcon BPS in our company was incredible; in fact, I've never experienced anything like it with any other new tool. And I've seen so many new products come and go. When a new process emerges – and this is often the case in our organization – the standard response from our employees is now: "OK, let's get this quickly modeled with Webcon". This actually helped us a lot when it was required that companies perform mandatory testing and documentation dur-



"Modeling and digitalizing using a tool like Webcon BPS has provided positive ways for us to clearly formulate the elements and variants of our own processes based on many years of experience – including all the exceptions."

– Dr. Klaus Eder,
COO, MicroNova AG

ing the coronavirus pandemic. With several years of experience, we have been able to build up a broad portfolio of processes and applications, and we are convinced more than ever of the benefits of Webcon BPS.

InNOVation: Dr. Eder, thank you very much for the interview! ■

Impressive Sporting Performance

TSV Jetzendorf's gymnasts have been grateful for MicroNova's commitment for many years through numerous sporting highlights – also at a national level.

TEXT: Editorial staff PICTURES: © TSV Jetzendorf; © Daniela Will

Turn- und Sportverein (TSV) Jetzendorf enjoys an excellent reputation far beyond MicroNova's hometown. The female gymnasts, in particular, have proven their competitiveness time and again, showing that they can hold their own against the big gymnastics centers and Olympic training sites – thanks in part to the efforts of their sponsors, but above all to the many volunteers. And they underlined this reputation once again, with the gymnastics section providing two German youth champions in 2022. Madita Mayr and Loane Thum even took several of the coveted titles at the championships.

Madita Mayr won the title as German Youth Champion in the multi-discipline event at the German Youth Championships and qualified for three finals the following day. As the best qualifier, Madita was the last gymnast to start, but she showed nerves of steel – and after winning the multi-challenge title, she also claimed the title of German Youth Champion on vault, floor and balance beam.

National squad gymnast Loane Thum competed nationally in the age 13 category. The final day started with her turn on the balance beam, which was only ten centimeters wide. Unfortunately, the judges disallowed one element, and yet the acrobatic diffi-



1 Madita Mayr (li.) and Loane Thum (re.)

culty was enough for an impressive bronze medal. But her favorite event was the vault final. After other gymnasts had produced some very good vaults, Loane outshone them, deservedly becoming German Youth Champion on vault with a performance including two successful "Yurchenko vaults".

It was no surprise that the two gymnasts Madita and Loane were all smiles with their coaches Kerstin and Daniela Will as well as their parents. After all, the two national squad athletes train hard six times a week in order to



achieve this success and depend on the support of their families and coaches. And they still have big plans, as they both of them just love flying through the air and defying gravity. This makes Madita and Loane role models for many up-and-coming female athletes. The well-equipped gymnastics center in Jetzendorf and the commitment of the athletes, coaches and parents as well as supporters like MicroNova make all this possible.

münchen.tv has also produced a video (<https://www.youtube.com/watch?v=iNXkFvKXc0Y>) about the Jetzendorf gymnasts that is certainly worth watching.

Digitalization: A Chance for Less Bureaucracy

Dear Reader,

The foreword already contains a few lines on digitalization and, in particular, MicroNova's new offering. I would like to pick up on these thoughts and start by expressing my sincere thanks to our Executive Board member Dr. Klaus Eder! He has been instrumental in successfully digitalizing a huge number of our internal processes; please take a look at the interview with him on page 36. I would also like to thank all of our employees who have been motivated to make the transition from a acquainted path to a new one.

Although our internal processes, established some time ago and well-tried in practice, were always very useful, they had become a little "outdated" over the years. Exceptions were added, growth led to further adjustments, and so on. Consequently, it was high time to thoroughly revise and optimize everything – in order to move away from paper; approvals, checklists, etc. can be processed much more efficiently, faster and less error-prone when digital. This success and our expertise in implementation led us to launch the new service offering based around process optimization and digitalization.

However, our own experience shows one thing above all: optimizing workflows and processes is the most important part of the work; as with our development projects, the better workflows and procedures are designed, the easier it is to implement them. The bottom line for me is that good processes reduce effort – both during implementation and in the subsequent deployment of digitalization.

Process optimization, which needs to be done up front, is perhaps also the reason why some companies struggle a little with digitalization. This is often compounded by the effects of habit and a certain degree of operational blindness, as well as rigid and at the same time complex decision-making processes, especially in public agencies. The public sector in particular has enormous potential to exploit digitalization – for faster processes, greater proximity to the public, less bureaucracy and, as a result, a more effective country overall.

I can also say from my own experience with construction projects, for example, that building and energy schemes take far too long to complete due to the administrative processes involved. Approval courses involving a large number of stakeholders as well as the overarching, lengthy procedures associated with zoning and land-use plans are simply too time-consuming and too...

I wonder if this is the best way to alleviate the housing shortage or help transform our energy supply? At least, after more than six months of waiting, we were able, no, permitted, to connect our photovoltaic system with 50 kW peak output to the grid at the end of April; it supplements the supply of self-generated electricity from our hydroelectric power plant in Weichs, which we mentioned earlier – so that I can now enjoy any type of weather, be it sunshine or rain.

With warm regards,
Josef W. Karl



Josef W. Karl
Chairman of the Supervisory
Board of MicroNova

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Design:

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Printed by:

Offsetdruckerei Gebr. Betz GmbH,
Weichs

Circulation: 1,000 copies

Frequency of publication:

MicroNova's InNOVation is published two times a year. Additional special editions might be published.

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Printed on paper treated with chlorine-free bleach.

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