



HiL Testing in Integrated Networks

Simulation models simplify connected HiL systems design

RAN Intelligent Controller

Intelligent controllers for future-proof 5G networks

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Cooperation Based on Partnership



Dear Reader,

The range of technologies available to you and to all of us has now reached an impressive level in terms of depth and breadth, and for virtually an infinite number of applications; please also refer to the comments by our Supervisory Board Chairman Josef W. Karl (page 35). High-tech and innovation are opening up numerous opportunities. And yet, ultimately, it is people who make the difference. This is especially true in turbulent times.

Whether it's the banks, the economy, the automotive industry, Covid, supply chains, the recent tragic geopolitical events or once again the general economy and inflation, one thing is clear – we are in a permanent cycle of crisis. And then there are not just some ecological issues that need to be dealt with calling in the background... Which makes me all the happier to be surrounded by so many outstanding people. This applies both to the MicroNova team – now 400 strong (see p. 34) – and to our numerous customers, most of whom have been with us for many years.

We all know that good, long-term and successful collaboration has the best prospects if it is based on the spirit of partnership. If partners are able to shift perspectives. If the other party is recognized, listened to and understood. You and we, dear readers, have formed a kind of symbiosis – a fact that is more important than any technology and that strengthens us all in challenging times.

So, those involved are able to continue to tackle impressive projects with great results. This is shown right at the beginning in an article about modeling, one of the many collaborative projects with Audi. The benefits of virtual electronic control units for software development and the EXAM test automation solution, which is now at version 5.2, are further automotive highlights in this issue.

They are followed on page 14 by an article from the medical engineering sector, which, like many other industries, also has a need for testing. Consulting is also part of the telco business, and it only adds value through extensive technological expertise, as the article on the next-generation 5G network underscores.

We are also celebrating a premiere in this issue of InNOVation, as it contains the first ever MicroNova customer success story on the project management solution monday.com (starting on page 26), followed by a technical article on successful project tracking, also using monday.com. Both are preceded by another ManageEngine Success Story.

Now once again I hope that you enjoy reading the magazine and I wish you health and, of course, a peaceful future.

Ihr Orazio Ragonesi

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Simulation Models Simplify HiL Testing in an Integrated Network

Models can help when information or components are not yet available when setting up a networked HiL system.

TEXT: Matthias Lorenz PICTURES: © Frame Stock Footage, MiniStocker / Shutterstock.com

A previous issue of MicroNova's customer magazine [<https://www.micronova.de/article-modular-environment-simulation>] discussed the topic of modeling – specifically, the dilemma when not all the required information or prototypes are available when the planned hardware-in-the-loop (HiL) test benches are being set up. In such cases, it is very helpful to use models to reduce the complexity of planning and implementing such systems. This article presents a concrete use case for this: MicroNova uses its many years of experience to support AUDI AG in integrating the latter's existing models into the NovaCarts HiL test technology.

The Complexity of Networked Systems

Automotive manufacturers usually employ so-called whole-vehicle HiL test benches (G-HiLs) to perform networking tests on ECUs (electronic control units). These replicate the complete vehicle. As many original, i.e. real ECUs as possible are used to simulate the sequence of operations in the vehicle.

As a result, a large number of specialist departments as well as external partners are involved in such a project, making it extremely challenging to plan and implement it within the agreed schedule. This is because orders often have to be specified and placed with manufacturers of HiL systems, such as MicroNova, as part of this process, without any reliable information being available. After all, ideally the test systems should be available as soon as the ECU being validated is ready for testing – a classic chicken-and-egg problem.

Model Toolkit for Control Units

In order to overcome these challenges, the simulation department responsible for virtual function integration and testing at AUDI AG in Ingolstadt decided a few years ago to build up a model kit with behavioral models for almost all ECUs used in the car. Since vehicle development today is cross-brand, the simulation toolkit was elevated to the corporate level. This modular system – currently called VTD (Virtual Test Drive) – is used and developed throughout the Group.

Models can replace ECUs or HiL set-ups that do not yet exist within the test, allowing components that are already available to be integrated into the overall system, commissioned, and tested at an early stage, meaning that initial test series can start earlier and reducing time pressures during development. In addition, this gives testing departments the opportunity to have set-ups created exactly when the required quality of information is available.

This approach was used for the first time at Audi in Ingolstadt using NovaCarts testing technology on a networked HiL system for the MEB platform. The project team had decided to pursue this new path because test readiness needed to be brought forward. What's more, certain components needed to be completely replaced by simulations – namely those that would not deliver any decisive added value, especially in networked tests, but which are very complex and expensive in terms of mechanical or electrical design. It is important to mention here that these components had already been extensively tested in advance, e.g. on component HiL systems.

Porting Models

The biggest challenge in this project was to adapt the existing structure of models from the aforementioned toolkit and to integrate them into the NovaCarts testing technology. Models are available at Audi as complete offline models for the vehicle to be simulated in Matlab/Simulink. The following steps were required for purpose of integration.

The advantages of the modular design of the NovaCarts test systems become apparent when the test systems for each control unit are split into individual models. This process also requires the interfaces for the inputs and outputs of the models to be defined. The split models later represent the units that can be swapped between the real part and the behavioral model. This can be done flexibly and even, under certain conditions, on a live test bench.

Model Mapping

The next step involves replacing the models in Simulink with NovaCarts input and output blocks to establish the connection to the NovaCarts test system. These Simulink blocks, together with the corresponding compiler, are provided by the NovaCarts toolkit and are available for all current versions of Matlab Simulink.

A few modifications are sufficient to enable mapping between the imported networking data and the bus interfaces of the individual models. Once the results are assembled, a NovaCarts workspace is ready, composed entirely of behavioral models. Unlike the offline general model mentioned above, this workspace no longer runs in the Matlab Simulink modeling environment, but rather already runs on MicroNova's target hardware.

Such a workspace formed the basis for the commissioning of the networked HiL system for the MEB plat-

form in the specific project. Various teams at MicroNova successively enhanced it with the hardware modules until the final desired real-part state was achieved. This allowed Audi to make optimum use of the NovaCarts testing system to successfully validate the control units of the MEB platform.

Flexible Extension

The newly gained flexibility had a direct impact on this project and was able to demonstrate the significant advantages of using simulation models: It became apparent while the HiL was being set up that the test depth in the area of the battery needed to be increased, since a behavioral model was not sufficient to model the battery. An additional 19-inch cabinet was installed to ensure the integration of the battery controller and replace the behavioral model.

However it was still possible to run all other tests on the overall HiL system without any restrictions during the three months until the new component could be delivered. The test department would have had to shut down the networked HiL system and wait for the new setup without the intermediate step provided by the behavioral model.

HiL Upgrade for MEB Successor Platform

A further upgrade of the overall system from the MEB UNECE platform to

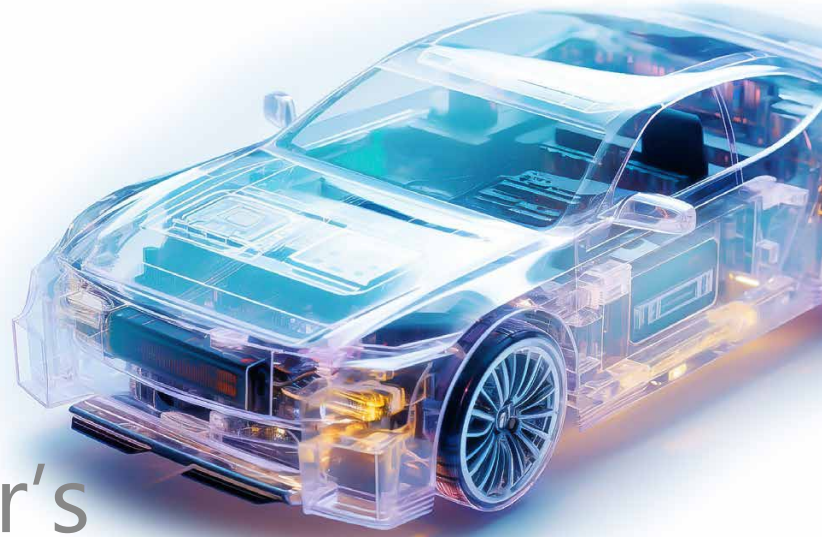
the successor platform began at the end of the third quarter of 2023. Since this only requires the replacement of a few control units, while the networking structure remains unchanged, the adapted solution is also ideally suited for the use of behavioral models. This will allow MicroNova's engineers to replace ECUs with behavioral models and start networked testing at a very early stage and before the ECU prototypes and testing setup are available.

As a result of the close and successful cooperation in model porting in several projects within the Volkswagen Group, MicroNova is now involved in modifications to the model toolkit at an early stage. This fact, together with the knowledge gained from porting models in the past, has resulted in a continuous improvement in tooling, correspondingly faster testing capabilities, as well as shorter go-to-market times for customers.

Conclusion

Thanks to the simulation models, automotive manufacturers can benefit from a stable and responsive tool chain to transfer approved offline complete models to a functional NovaCarts workspace without time-consuming, error-prone manual activities. This leaves the doors wide open for the inclusion of the model concept in a chain following the continuous integration (CI) or continuous development (CD) approach. ■





The Developer's Friend: The Virtual ECU

Virtual ECUs have long since found their way into software development for powertrains, central control units or steering. Combining real and virtual test benches optimizes the performance of software integration and system tests. This provides developers with a flexible and efficient testing and analysis option.

TEXT: Robert Evert PICTURES: © MicroNova

The validation of ECU software is subject to constant innovative pressure. Virtual ECUs (vECU) can improve efficiency in software validation and simplify the development of complex functions.

Software developers are familiar with the module test as the lowest test level in the V-model: A completed functional unit is provided with suitable input data, executed, and the output data checked against an expected value. In the software-in-the-loop context in ECU development, this check can be understood as a test on a very simple

virtual ECU, with a high degree of abstraction compared to the ECU's hardware platform. Reducing the degree of abstraction, together with the validation of one or more software components, opens the door to integration tests. For these and higher levels, a uniform test environment for HiL and SiL test benches is desirable, as it massively reduces the effort for creating and maintaining test cases and creates a high degree of flexibility in the testing process.

The possibilities and benefits offered by a uniform test bench for integration

and system tests are explained below, taking the implementation of a software function as an example. Special attention is paid to the advantages for developers.

The Challenge: Development on Different Hardware

One special characteristic of embedded ECU development is that the development hardware and target hardware are different. This applies both to the environment in which the software is executed and to the interfaces that are available. Developers can use cus-

tom hardware on a developer board at this point. This does not have to be completely identical to the target hardware and may have a different configuration, as well as preliminary versions of the respective ECU processor. Alternatively, a custom prototype hardware can be used, which for example offers an additional interface for debugging. However, such prototypes are usually expensive, have a lead time and need to be adapted again and again as development progresses.

Rethinking Virtualization

Virtualization can help mitigate delays and overcome challenges caused by a lack of hardware in all project phases in an iterative and cost-saving way, while also increasing the degree of automation. The approach with advanced virtualization is therefore a step out of the area of implementation in the lower part of the V-model (Figure 1) and complements software integration in the first step. This is often

not automated because real HiL systems are usually too expensive and too busy, and integration tests can therefore only be carried out in a complete HiL environment at great cost.

In a second step, such a virtual prototype can be enhanced with existing environmental, physical or communication models. These are often already in use on productive HiL systems. Consequently, the virtual ECU becomes part of the system test.

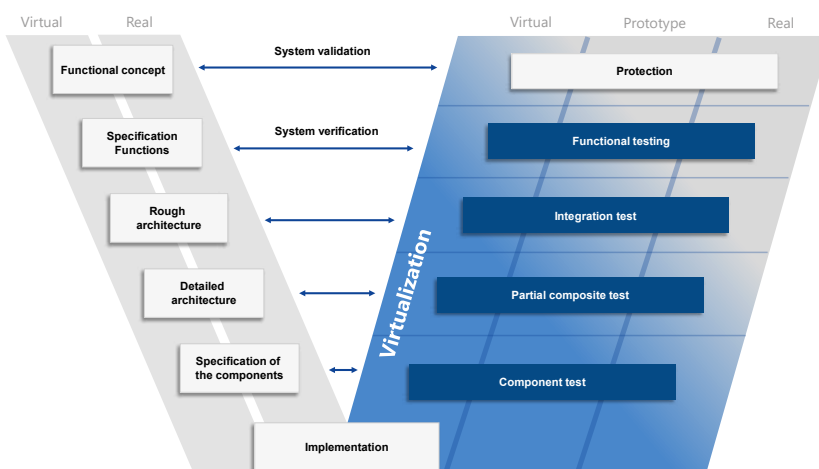
Spotlight on Software Components

For the implementation of a virtual ECU, it is advantageous if the structure of the ECU software follows a standardized architecture, for example AutoSAR. This often consists of an application layer, middleware for coordinating data exchange, and an operating system with further abstraction layers for hardware control, communication components, or cryptographic operations. Figure 2 shows the basic

structure of this type of control unit software. While the two lower layers, i.e. middleware and operating system, are usually bought from third parties, the focus of development is often on the software components themselves, as these implement the functionality of the ECU.

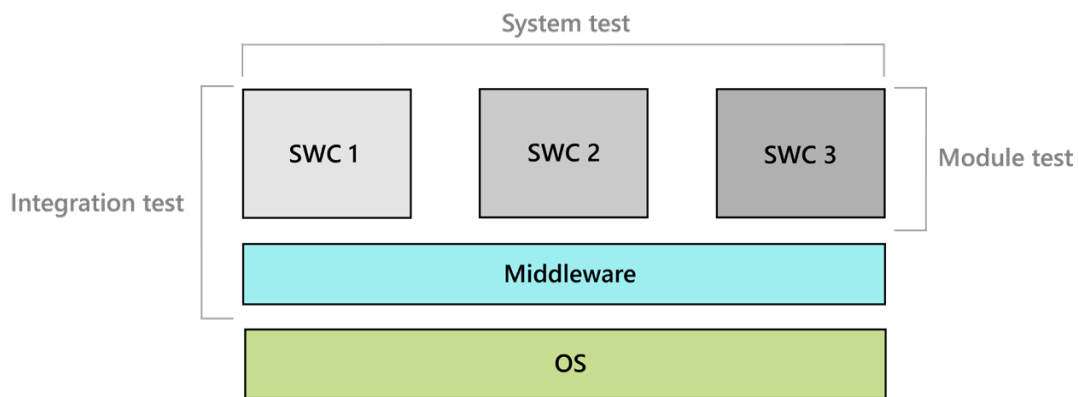
In a typical structure, one developer is responsible for each component. Each of these developers is first faced with the challenge of being able to validate "their" component in the module test with suitable data. The next requirement is to check whether the component also performs correctly when interacting with possible other software components and also with the middleware and the operating system. The common method here is the integration test.

This point in the development process is where the strengths of increasing virtualization come into play: A functionally identical prototype of the hardware can be made available at an early stage and continuously adapted to changing requirements. New hardware modules can be activated or deactivated, interfaces quickly swapped and combined with different physical models. The virtual environment forms a configurable package that is put together according to requirements. This package is distributed from one central location, so that developers and testers have access to the same environment. Standardized interchange formats also ensure simple collaboration across company boundaries and allow further forms of collaboration.



1 Categorization of virtual software tests in the V-model [following NI]¹.

¹ <https://www.ni.com/de/solutions/transportation/adas-and-autonomous-driving-validation/shifting-left-the-evolution-of-automotive-validation-test.html>



2 Module test and integration test in the context of a software component (SWC) and test scope indicated as a bracket.

Levels of Virtualization

In order to better distinguish the possible uses of a vECU, it is helpful to classify it according to levels. A distinction is made between Level 0, Level 1-3 and Level 4 (a,b), which should not be confused with the levels of automated driving [prostep]².

A Level 0 vECU is also referred to as a model-in-the-loop. In this case, a functional model (but not yet based on the later source code) is executed within a development or modeling environment (e.g. algorithms or behavioral models). The second level refers to models that are already based on a version of the later source code, but where placeholders still represent some parts of the ECU software. At this level, the compiled source code is not yet translated for the target hardware, but for the system on which the later test cases are to run. This is usually a developer computer or a cloud environment. By using placeholders and making the parts that correspond to the real software more flexible, this approach can be implemented very early on during development. The definition of placeholders here distinguishes Levels 1, 2 and 3. This type of model

can be executed in a wide range from faster to slower than real time and are therefore ideal for the developer and integration test stages.

In the highest vECU level, the source code has already been compiled for the target hardware and is executed on a processor simulator. In this case, depending on the complexity of the processor, the execution speed is usually far below real time. The high degree of proximity to the hardware simplifies handling as a real test bench, as there are fewer restrictions on the execution of the ECU software on this system. This in turn enables the qualification of such a vECU according to ISO 26262, analogous to conventional existing real test benches, in accordance with the specifications for functional safety.

Advantages

The advantages of virtualization are obvious: Time-consuming and potentially error-prone flashing of the hardware is no longer necessary. Commissioning is done centrally through the provided environment, so that time-consuming steps such as initial commissioning or parametrization are also eliminated, saving time and cutting

costs. The execution environment is clearly defined and all developers work in the same local or cloud structure. Through a simple upgrade or downgrade process, different versions and variants can be tested. Furthermore, integration tests can be executed on a regular basis. This means developers receive direct feedback on current code changes.

Test Setup with Virtual ECU

Figure 3 shows a typical test setup with a virtual ECU. Coordination of the tests, i.e. distributing and launching the test cases, and merging the test results, can typically be done by CI/CD or test management software. The test bench is controlled from the respective test automation solution (e.g. EXAM), which is also responsible for correct initialization. External dependencies on other software tools arise, for example, through calibration tools that are used for parametrization in the automotive sector. The test bench is connected to the test automation software via proprietary interfaces or, preferably, standardized interfaces such as the XiL standard.

² https://www.prostep.org/fileadmin/downloads/WhitePaper_V-ECU_2020_05_04-EN.pdf

By choosing a suitable abstraction within test automation, it is possible to decouple the executed test cases from the test bench. As a result, test cases can run on a variety of different systems. This abstraction can be achieved by adhering to a common standard (FMU/FMI, SILVI, DCP etc.), but also within the implementation through suitable interfaces. The range of possible expansion stages for test benches extends from the simple bench test station to the fully developed HiL system or the virtual test bench and the virtual ECUs integrated therein. The tools used are the same at all levels of testing. This means that the component developer can access the same calibration tool as the system tester or an automated test case.

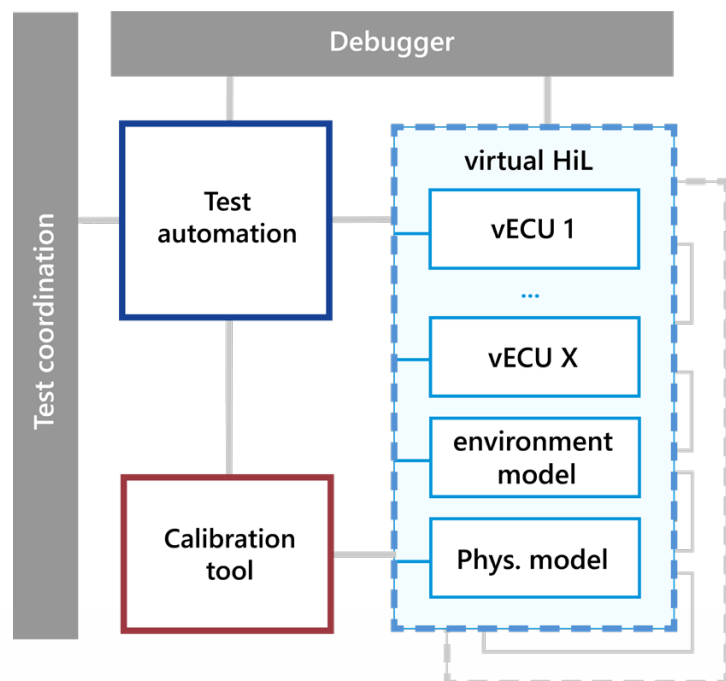
For developers, there are significant advantages within this type of structure in terms of the identification and correction of errors. By using a virtual ECU, debugging can take place in an environment that is equivalent to the one in which the error occurred. Expensive HiL time then only has to be spent on time-consuming troubleshooting in exceptional cases.

Conclusion

Progressing virtualization offers new approaches to the uniform design of test landscapes for manufacturers of electronic systems. So, what will the test landscape of the future look like? The requirements for functional safety and cyber security – some of which are prescribed by law – are also becoming increasingly significant in projects for the development of ECUs. They make it necessary to start testing earlier and more often. The specific nature of this approach is

that different hardware architectures must be taken into account both in development and in the subsequent ECU hardware. In large areas on the right-hand side of the V-model, simulations can help to execute this multitude of tests efficiently. When testing an algorithm, a function, a software component through to the complete software, it is possible to execute the

code in a suitable environment and thereby create real conditions for the respective DuT. The resulting test system can be used by the developer, tester and even supplier to perform tests. This holistic approach creates real added value for companies in product development, saves costs and can shorten the time-to-market for new models. ■



3 Typical simplified test setup with vECU



Preview of EXAM 5.2

MicroNova will be releasing the new 5.2 version of its EXAM test automation software in Q1 2024. The free tool will include all previous features as well as numerous additional innovations focusing on Diff & Merge functions.

TEXT: Rainer Moosburger PICTURES: © Comaniciu Dan / Shutterstock.com; © MicroNova

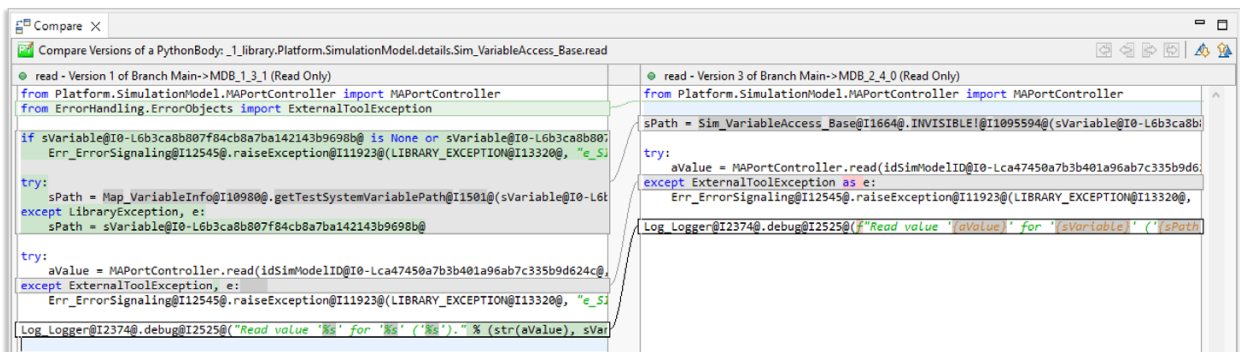
While the last major release, EXAM 5.0, focused primarily on improvements in the area of user-friendliness and a new concept for parameters, users can now look forward to the expansion of the Diff & Merge concept in the new version. This concept was first introduced in EXAM 5.1 and allows the content of individual model elements as well as entire model structures to be compared.

This provides a clear overview of which elements of a model area have been modified, deleted or added in the currently loaded configuration compared to another version. The differences between various states can be displayed in detail, particularly for sequence diagrams and PythonBodies. From EXAM 5.1 onwards, PythonBodies can also be used to merge changes or content line by line. In the new ver-

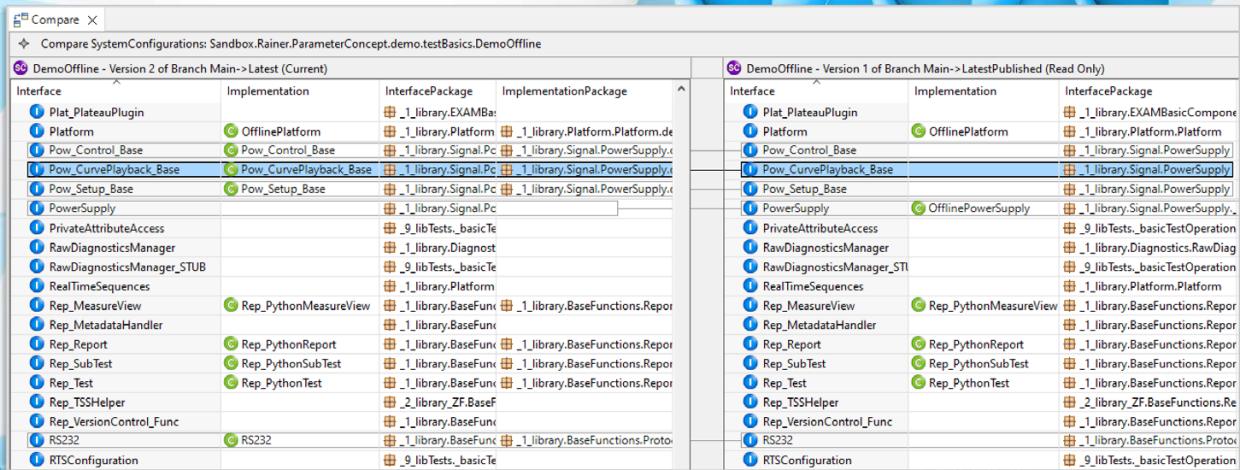
sion 5.2, Diff & Merge has now been expanded to include functions specifically for VariableMappings and SystemConfigurations.

Enhanced Diff & Merge Concept

A VariableMapping is a representation component used to assign internal EXAM mapping objects to test



1 Compare view for PythonBodies



2 Compare view for SystemConfigurations

bench or simulation variables. In simplified terms, this allows a variable in EXAM to be linked to a HIL or ECU variable.

SystemConfigurations are used in EXAM to assign an implementation class to interfaces. This assignment within SystemConfigurations describes the technical and functional characteristics of a test system. The interface concept means that generic test cases can be modeled. The technical details and the hardware used are only finalized when the test is executed by selecting the appropriate system configuration. This makes it possible to execute test cases on different test systems and therefore reuse them – without having to make any changes beforehand.

The introduction of Diff & Merge for VariableMappings and SystemConfigurations greatly simplifies day-to-day work with EXAM. This makes it pos-

sible, for example, to quickly visualize and understand which simulation variables have changed in Variable-Mappings over several versions. The Diff function also provides an excellent overview of the different test station descriptions in the SystemConfigurations. Merge also provides the option of easily merging the content of both model elements.

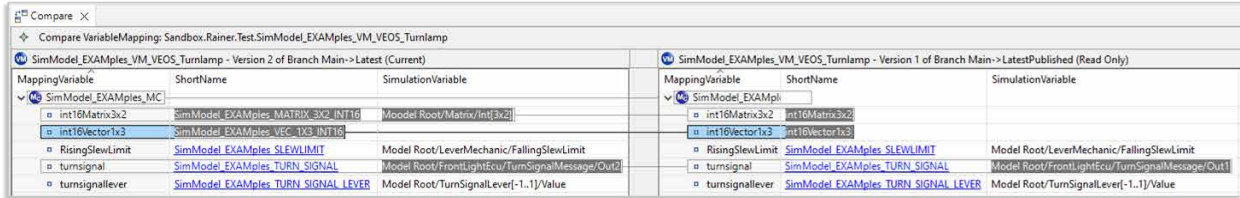
A Merge for individual steps can now be initiated from version 5.2 onwards in addition to the existing Diff function for sequence diagrams. Users can merge the content in both directions when comparing two different diagrams. The navigation functions of the Compare editors “Previous Diff” and “Next Diff” as well as the actual “Merge” can now be conveniently executed using keyboard shortcuts.

Furthermore, the developers have extended and improved the Diff and Compare functions in numerous places

in the EXAM client. For example, the History View allows you to compare any two versions with each other. What is more, the important “Publish” and “Discard” versioning functions can now also be used when comparing the structure of “Latest” and “LatestPublished” in the Diff browser.

Other Innovations

In addition to the extensive expansion of the Diff & Merge concept, the ModelerPerspective in EXAM 5.2 has undergone numerous improvements. The ParameterTable Editor can now be used to maintain Tag-Values and static detail attributes for each parameter variant, for example, in the same way as for the higher-level test case. This extension provides the basis for structured and comprehensive management of the metadata for different test case variants.

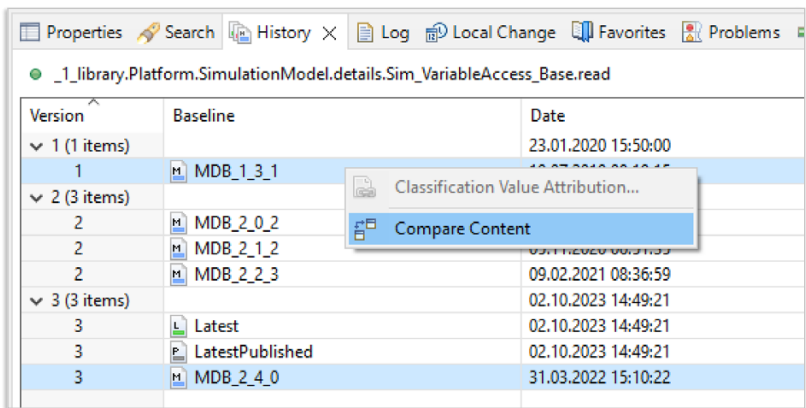


3 Compare view for VariableMappings

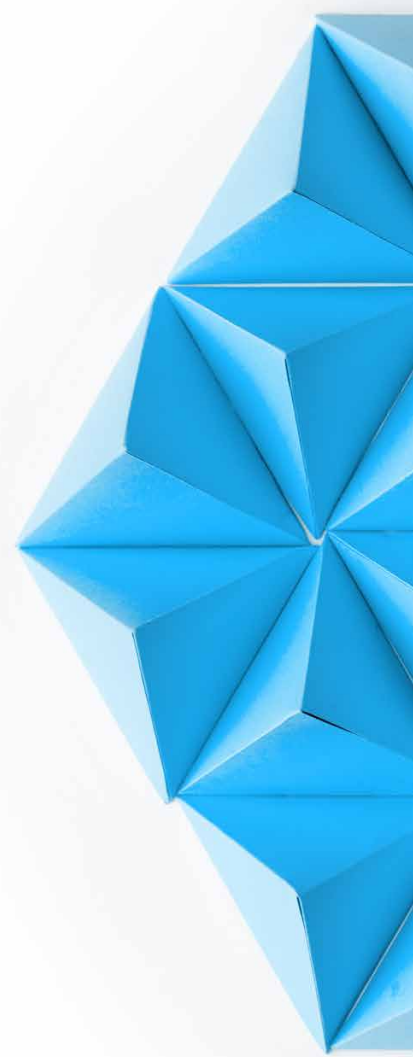
All EXAM users who already use the new ReportService from EX.E will also benefit from new features in version 5.2. Once a test has been executed, you can now navigate straight from the Testrunner console to the EX.E ReportService report using a link. In addition, the parameters of the old and new ReportService in EXAM have been clearly differentiated in the preferences and are therefore much easier to distinguish. In addition, hyperlinks contained in the descriptions of EXAM elements can be opened directly from version 5.2

onwards. External sources referenced in function descriptions of interfaces and methods, for example, can be accessed with a single click.

In the area of user management, the toolbox has also been adapted to make it easier for users to manage groups and user groups. Users who are already members of user groups or circles are no longer listed in the toolbox. This restriction of available users simplifies rights management for model administrators.



4 Compare view for SystemConfigurations



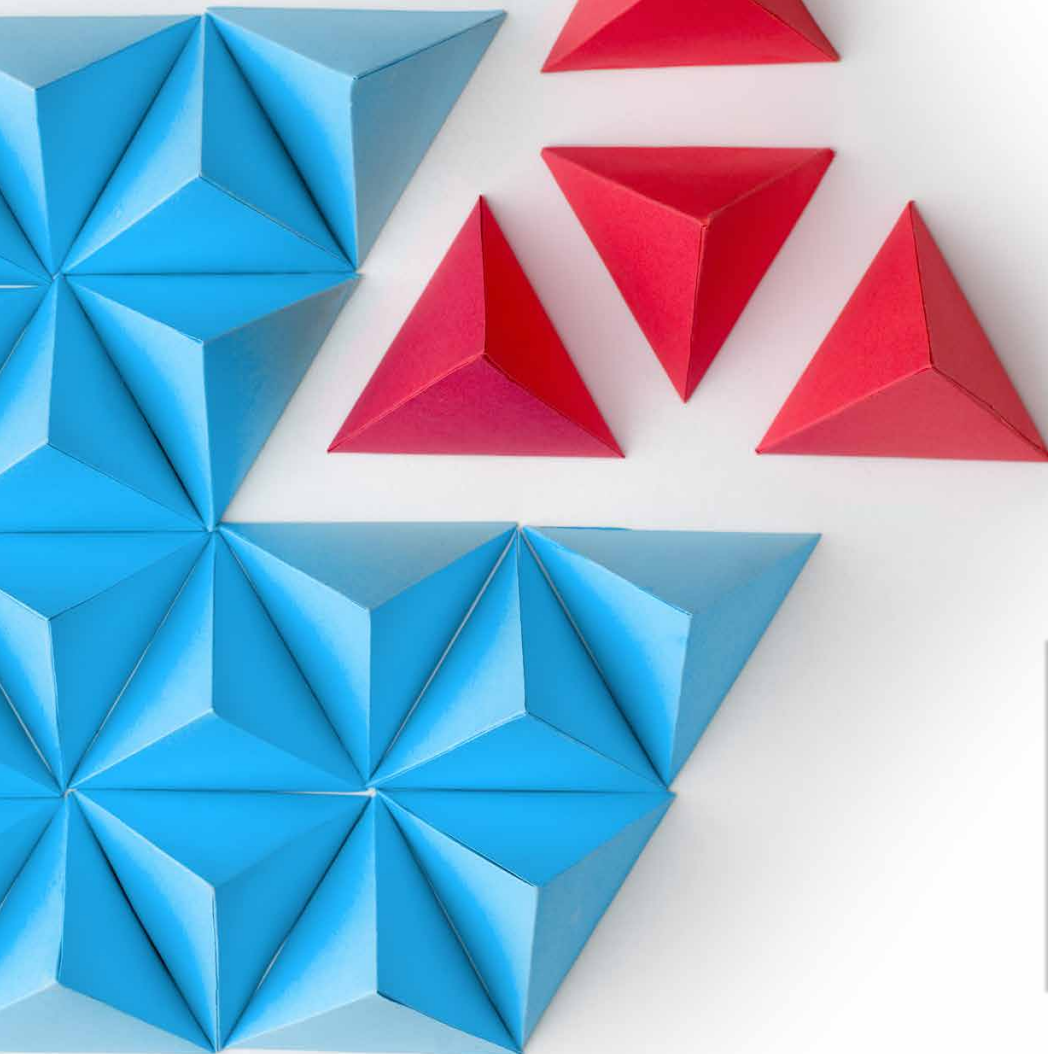
Conclusion

With EXAM 5.2, MicroNova will be releasing a new version of its test automation solution offering users significant added value in many respects in their day-to-day work. From a technological standpoint, EXAM 5.2 has also seen an important update to its runtime environment and now uses Java 17 to run the client and server components. ■

Certification as EXAM Test Designer

The EXAM "Test Designer" training course is the ideal preparation for users wishing to complete the EXAM Test Designer qualification.

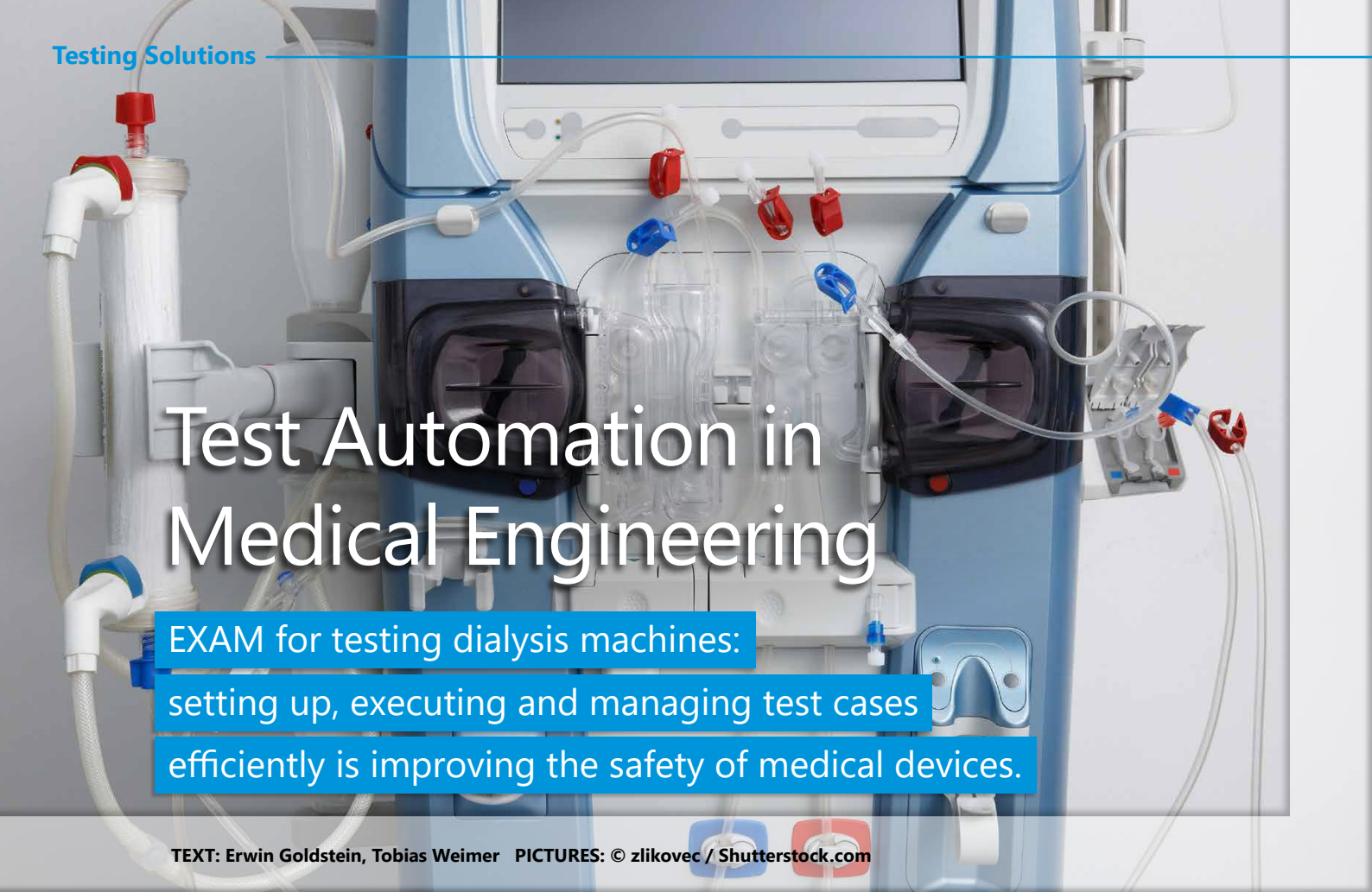
Certification as an EXAM Test Designer involves a location-independent, digital test procedure with proof of identity. Proof of achievement of the learning objectives is documented on a web-based examination platform. The corresponding certificate is seen as proof of quality for EXAM users and forms the basis for a standardized working method for projects in the productive application area of EXAM. Participation in the examination is also possible without previously taking the course.



Contact

Detailed information about EXAM is available at www.micronova.de/en/exam. MicroNova also offers extensive training and support for the current EXAM expansion stage.

Contact: info@exam-ta.de or +49 8139 9300-46.



Test Automation in Medical Engineering

EXAM for testing dialysis machines: setting up, executing and managing test cases efficiently is improving the safety of medical devices.

TEXT: Erwin Goldstein, Tobias Weimer PICTURES: © zlikovec / Shutterstock.com

Medical engineering – similar to the automotive sector – has strict safety standards designed to minimize the risk to patients from any potential malfunctions. These requirements for medical devices together with the complexity of dialysis machines mean that a great deal of effort is involved in testing during the development of the devices. For this reason, test automation software solutions are increasingly being used in this area as well in order to ensure the highest levels of reliability.

A leading vendor of products and services for people with kidney disease has adopted EXAM as a key automation tool for testing its dialysis machines. The software, which has been developed by MicroNova together with the VW Group over many years, allows test cases to be efficiently set up, executed and managed.

How a Dialysis Machine

Works

Dialysis is a life-sustaining treatment for people with chronic renal insufficiency. Globally, around 3.7 million people require this type of blood purification on a regular basis, which can be performed using hemodialysis machines. In this process, blood is continuously collected from the patient during the approximately four-hour treatment and filtered in an artificial kidney, the dialyzer. The purified blood is then returned to the patient's body. This process can also be used to transfer substances from the dialysis fluid into the patient's blood. In this way, the blood is cleansed of pathogenic substances and enriched with electrolytes, for example. The dialysis machine controls and monitors this complex process.

The two essential components of a dialysis machine are a hydraulic unit, e.g. for treating water, and an ex-

tracorporeal treatment module for pumping blood (see figure). A touch-screen monitor serves as the operating interface. During dialysis, several ECUs (electronic control units) communicate with each other to control and monitor all the processes.

EXAM – Test Automation for Dialysis Machines

A thorough verification strategy is essential given the high demands placed on the safety and effectiveness of these control units. The medical engineering company has deployed the EXAM test automation solution in its development process in order to handle the high level of testing required for dialysis machines. This is because several test levels are necessary both for testing individual control units and for the dialysis machine as an overall system. This is where EXAM comes in. Whether testing the entire system or HiL tests of individual ECUs, the test automation solution is de-

signed to combine everything in one tool across all products, thereby enabling test cases to be used across all products and projects at different test levels and in different test environments in order to meet the customer company's requirements.

Workflow and Integration of EXAM

MicroNova's experts developed a comprehensive tool chain for testing dialysis machines at various test levels (component, integration and system tests) on a number of HiL systems. By using EXAM as a central component of all test automation activities, the intention is not only to improve the sharing of expertise regarding automation, but also of specific test cases across different projects and products. The abstract modeling of test cases against interfaces is a key factor in this, as it allows them to be reused. Thus, extensive and complex test sequences can be automated, which saves time and resources in the projects.

The test automation workflow comprises several steps (see figure): The test cases are specified in an application lifecycle management (ALM) tool (e.g. Polarion) using keywords coordinated across all departments. The libraries required for these keywords are implemented in EXAM. The EXAM ALM Synchronizer then transfers the test specifications to the automation solution, where they are set up as test case implementations. These clearly structured specifications later allow

the EXAM Test Case Generator (TCG) to be used to fully automate the creation of the test cases.

A further source for the implementation are the bus matrices imported into the EXAM model as mapping classes by the bus importer. A Groovy script then generates shortnames and corresponding VariableMappings on the basis of the mapping classes.

In addition to the bus importer, MicroNova has also developed an A2L importer, which reads A2L files, allowing the necessary variable mappings, MappingClasses and shortnames to be created automatically. When the test cases are executed on a HiL test bench, the software and model variables are accessed via the XCP and XiL interfaces using the existing EXAM core libraries.

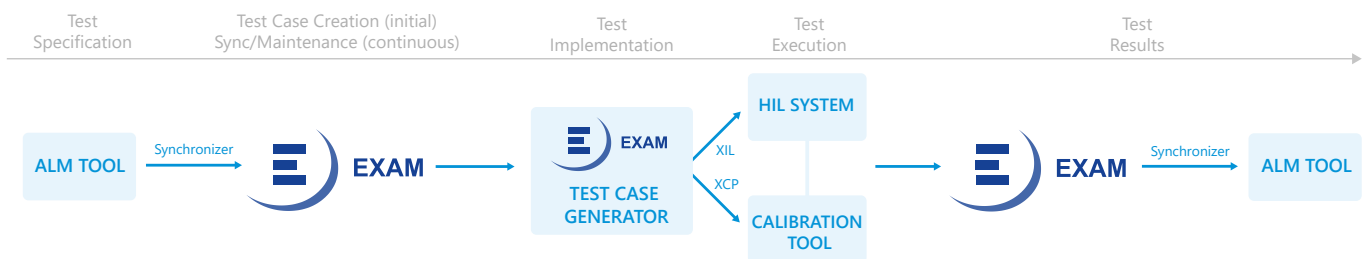
The ALM synchronizer, bus and A2L imports provide the basis for the TCG to convert the specifications into executable test cases. These are then executed in the EXAM Test Runner. The test case subsequently controls the HiL test bench via the ASAM XiL API and generates a test report. These outputs can be transferred back to the ALM tool, using the ALM Synchronizer for further processing.

As a result, the integration of EXAM into the development process has led to a significant increase in efficiency by automating repeatable tests and minimizing manual intervention.

Benefits of EXAM in Medical Engineering

The introduction of EXAM as a test automation tool offers numerous advantages for a medical device manufacturer. First, it speeds up the time to market for dialysis machines, as test cycles can be completed in less time. Second, EXAM ensures higher product quality and safety by automating extensive and complex testing – even overnight and at the weekend. Third, it improves the traceability of test coverage and simplifies the management of test cases.

The tool chain described allows a safety-critical system to be validated at multiple test levels. This demonstrates the potential of using proven technologies across different industries. Test methods for embedded systems that were originally developed for the automotive sector are also suitable for ensuring the safety of such systems in other industries with greater efficiency. These include not only the EXAM test automation solution but also, for instance, HiL systems, the ASAM standards XiL-API and MCD-2, as well as bus technologies. Whether testing control units or other areas, it is worth taking a broader look to discover tried and tested applications and proven technologies for use across different sectors. ■



1 Workflow using EXAM

MicroNova Sponsors Two Formula Student Teams

Support for young motorsports talents:
 Herkules Racing Team Kassel and Rennschmiede Pforzheim e. V. are developing their own racing cars for the student design competition.

TEXT: Editorial staff PICTURES: © Rennschmiede Pforzheim; © Herkules Racing Team

The "Formula Student" competition has been attracting students from all over the world to take on a unique challenge for a number of years. These teams compete against each other with racing cars they have designed themselves, demonstrating their skills and creativity. As a dedicated sponsor, MicroNova supports two teams on their path to racing success.

Herkules Racing Team Kassel – Electrical Innovation on the Track

MicroNova has been a proud sponsor of Herkules Racing Team Kassel since the 2020 season. The ambitious team competed in Formula Student for the first time in 2019 with a 100% electrically powered race car and has continued to work on innovative solutions ever since. The students from the University of Kassel, who come from a wide variety of disciplines, form a close-knit team working together towards a common goal: the development and construction of a high-performance racing car prototype that will give them a top placing in Formula Student.

MicroNova supports the team in this ambitious undertaking. In addition to financial resources, our sponsorship mainly provides technology and expertise that will benefit Herkules Racing Team Kassel in implementing its ideas.

Rennschmiede Pforzheim e. V. – Focusing on Electromobility

Rennschmiede Pforzheim e. V. is the second team supported by MicroNova.

These students have also been participating in Formula Student for a number of years, emphasizing forward-looking technologies in motorsports. The focus of Rennschmiede Pforzheim has therefore also been exclusively on electric racing cars since 2019.

However, the development of an all-electric race car comes with special challenges, particularly with regard to the battery management system. This control unit must function not only



1 Herkules Racing Team Kassel



reliably, but also efficiently and safely. This is where MicroNova comes in with its support in the form of a Nova-Carts Hardware-in-the-Loop (HiL) system for the racing workshop. The test bench enables the students to rack up virtual test kilometers and put the battery management systems through their paces before the racing car actually hits the track. The ability to test electronic systems under realistic conditions at an early stage not only saves time and money, but also increases

the safety and reliability of the vehicles later on.

Commitment to the Future of Motorsports

Formula Student is a unique platform that offers students the opportunity to gain hands-on experience in designing and developing vehicles. Besides technical skills, the program also cultivates teamwork, project management and a spirit of innovation – skills that are

in high demand in the industry. The international design competition for students has been organized every year since 2006 by Formula Student Germany e. V. under the auspices of the Verein Deutscher Ingenieure e. V. (Association of German Engineers) with rules similar to those of Formula SAE.

MicroNova wishes to actively promote the future of motorsports through its commitment to Herkules Racing Team Kassel and Rennschmiede Pforzheim. By supporting these ambitious teams, MicroNova is helping to ensure that young people develop innovative ideas and help shape the mobility of tomorrow.

The company follows the development of both teams with great enthusiasm and wishes the students continued success in their future races and projects. ■



2

Rennschmiede Pforzheim e. V.

RAN Intelligent Controllers as the Key to Next-Level 5G

Mobile network operators need innovative solutions for the infrastructure required to deliver a reliable and service-oriented 5G network. Intelligent controllers are a central component of a radio access network (RAN).

TEXT: Ingo Bauer PICTURES: © sirastock, Andrey Suslov / Shutterstock.com

The roll-out of 5G networks is in full swing. As availability in the commercial public environment increases, so does the level of maturity. Mobile network operators are evermore focusing on one of the key principles of 5G technology, namely the introduction of network services and network slices. This is the starting signal for a service-oriented and orchestrated system, using service management and orchestration (SMO).

While the automation of the various provisioning processes was and is the main focus during the initial phases of integration, secured services and network slices will take on an increasingly important role in the future. These primarily include services from the uRLLC (ultra reliable low latency communication) class. They are characterized by a high degree of reliability with low signal delay and ultimately improved network quality.

Radio networks per se are not qualitatively reliable and signal transmission cannot overcome the physical limits of propagation speed, which is why they require intelligent approaches to be able to deliver and ensure the agreed quality. Topics such as the mobile edge cloud (MEC), digital twins and RAN intelligent controllers (RICs) are key components of such future mobile communications architectures.

RIC: Managing and Optimizing Mobile Networks more Effectively

The concept of a RIC as a key element of 5G architecture has been very much shaped by the 3GPP standardization committee and the O-RAN Alliance. The idea is based on the principle of making the management and optimization functions in a mobile network more flexible, efficient and powerful. This development is

being primarily driven by mobile communications providers and telecommunications companies, but also by public and private research institutions.

The main tasks of a RAN intelligent controller are the following:

- » **Resource allocation and optimization:** Allocating and optimizing the limited resources in a RAN efficiently is one of the main tasks of a RIC. This includes the assignment of frequency bands, the management of transmission power and the control of antenna directions in order to maximize network efficiency.
- » **Traffic management and load balancing:** A RIC monitors data traffic in a RAN and redirects mobile devices to other base stations as required as part of load balancing. This serves to avoid bottlenecks.

- » **Interference management:** RICs can also detect and minimize interference between base stations. They also coordinate transmission power in order to ensure better overall network performance.
- » **Energy efficiency:** A RIC can, for example, switch off base stations when they are not needed in order to increase energy efficiency in a RAN. For the same reason, it can also reduce transmission power if the signal is sufficiently strong.
- » **Dynamic adaptation:** The RIC will also dynamically adapt the configuration of a RAN to different network conditions in order to ensure optimum overall performance and quality of service (QoS).

Structure and Architecture of a RIC

A key feature of RIC is its intelligence. It can, for example, use data analysis and AI to make decisions. This allows dynamic adaptation to changing network conditions and a rapid response to any faults or peak loads. What is particularly important for efficient operation is that a RIC can automate many of these tasks, thereby reducing operating costs; for example, it can independently adjust parameters to optimize network performance.

It is important to note that a RIC is not a monolithic application, but a combi-

nation of two independent platforms or frameworks: the "Non Real Time RIC" (Non-RT RIC) and the "Near Real-Time RIC" (Near-RT RIC), which communicate via the O1 interface specified in Open RAN.

Non-RT RIC

A non-RT RIC is usually directly connected to or embedded in the RAN domain orchestrator. As the name suggests, it does not work in real time and has less strict time requirements – because its tasks can also be completed with a slight time lag. This makes it suitable for large-scale, non-time-critical network optimization decisions,



similar to previous self-organizing network systems (SONs). The Non-RT RIC has a powerful RAN analytics engine that can be adapted and expanded in the form of algorithms or so-called rApps.

AI and machine learning (ML) modules enable it to perform complex data analysis and prepare or make long-term decisions to plan and improve the networks. This range of tasks is very diverse and extends from increasing the efficiency of individual network resources and base stations to optimizing network segments and predicting traffic patterns. Forecasting capabilities in particular are crucial for proactively adapting a mobile network.

The non-RT RIC obtains its data from a directly connected data lake, which is a central repository for a huge amount of network and environment data, from classic fault/performance figures and anonymized connection and movement information to weather, events, etc.

Near-RT RIC

In contrast to a non-RT RIC, a near-RT RIC focuses on processing network information and corresponding optimization functions in near real time. This means it can react very quickly to changes in circumstances to ensure optimum network and service performance. The near-RT RIC is directly integrated into the physical network and very close to the physical locations. For example, it can be operated within a mobile edge cloud. Its range is generally limited to a few base stations or RAN components.

It is mainly used for time-critical applications where low latency and a rapid response to network situations are of crucial importance. Frequently cited use cases are autonomous driving and virtual or augmented reality. Global, complex data models can be used for local optimization thanks to a direct connection to a non-RT RIC.

Like its non-real-time capable counterpart, it too has AI and ML modules. Customization and expansion can be performed using “xApps”. As with rApps, these are algorithms or applications that are active in the runtime environment of the near-RT RIC. xApps (like rApps) are typically developed by third-party providers and are made available to mobile network providers and network operators via app stores.

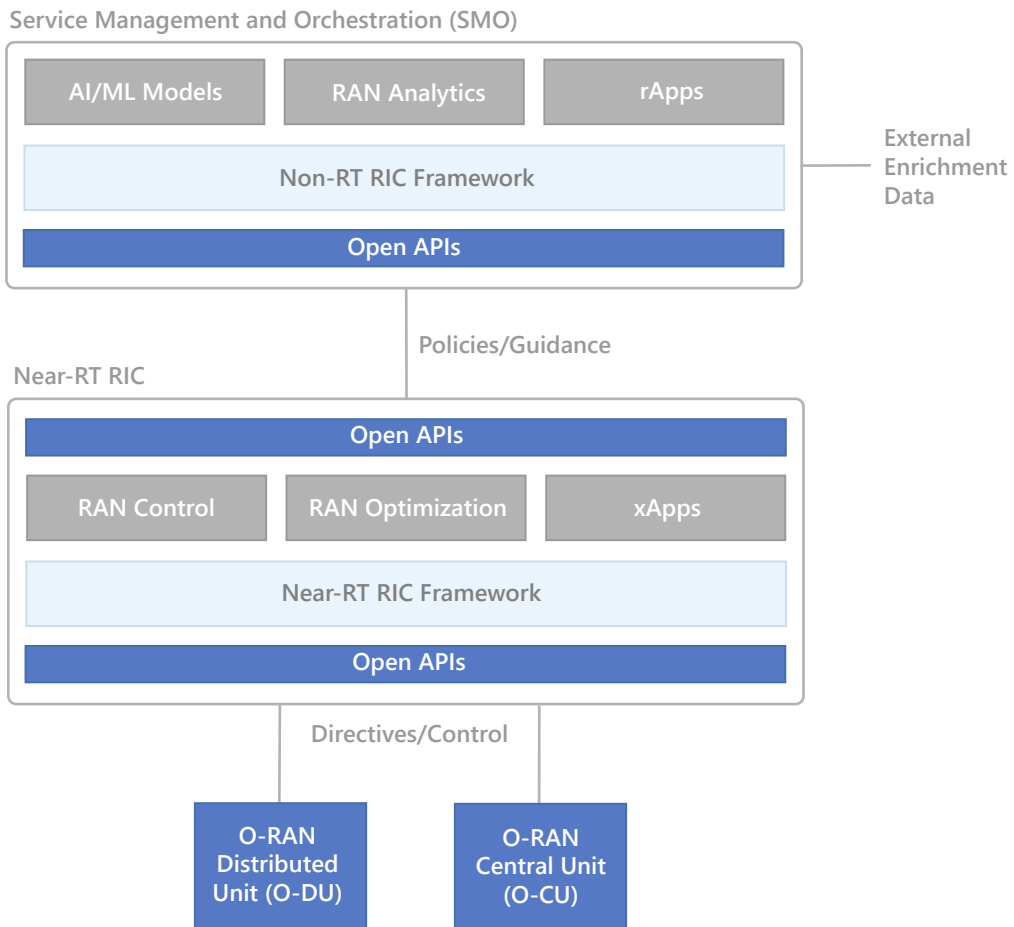
RICs as the Mainstay of High-Performance Networks

In summary, a RIC makes a major contribution to significantly improving the performance and efficiency of mobile networks while enabling support for a wide range of applications and services in 5G environments. This is crucial in order to meet the increasing demands placed on connectivity and communication and the resulting business models in today’s networked world. However, the advantages and functionalities of a RIC only come into play if a fully automated, high-performance provisioning solution is available for the RAN; this must be embedded within the SMO architecture.

With its COM5.Mobile product, MicroNova has a very powerful, automated RAN provisioning solution that fits seamlessly into an intelligent SMO

architecture. It already supports all necessary applications, from integration and optimization to fully-fledged service/slice provisioning – for all manufacturers including Nokia, Ericsson, Huawei and Open RAN. In addition to COM5.Mobile, MicroNova also offers consulting and related services for the implementation of an SMO architecture – including consulting and the development of specific rApps – thanks to two decades of experience and expertise in the RAN field. ■

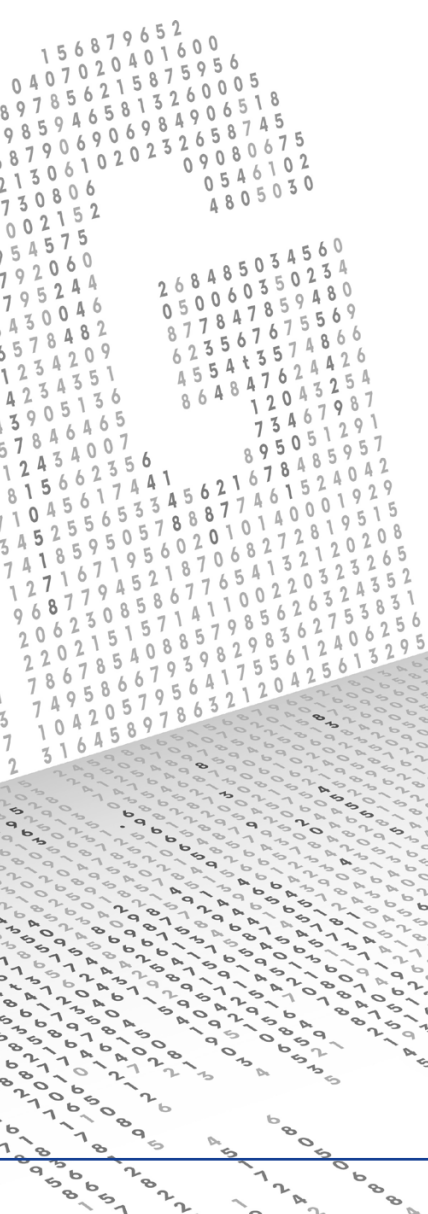




1 RIC Architecture

Network Slicing

Network slicing allows relatively rigid radio networks to be expanded for different applications, and customized to the specific use case. This allows mobile network operators (MNOs) to support a variety of business models, especially for their B2B customers, while maximizing their ROI on existing investments. You can find more information in issue 1-22 of InNOVation.



IT Service Management: Fast Solution Times at Hawa Sliding Solutions AG

ServiceDesk Plus secures business operations

TEXT: Editorial Staff PICTURES: © Hawa Sliding Solutions AG

Hawa Sliding Solutions AG:

- » Sector: Metal processing industry
- » Employees: approx. 230
- » Turnover: EUR 70 million (2020)
- » Headquarters: Mettmensetten, Switzerland

Hawa Sliding Solutions AG is the technological and market leader for sliding hardware in construction, buildings and furniture. With over 230 employees, the company develops, produces and markets sliding hardware at two production sites in Switzerland. Its solutions are sold all over the world. Based in Mettmensetten near Zurich, Switzerland, the company has been owned by the Haab family since its founding over 50 years ago.

IT Increasingly Critical

Hawa Sliding Solutions AG realized the key role that the accessibility of IT services plays in business continuity

more than ten years ago. Since employees were increasingly requiring more IT resources to perform their tasks, the IT department started thinking about how to eliminate disruptions and outages in IT services as swiftly as possible – and with the lowest possible consequential costs – at an early stage.

Chris Bregenzer, now Team Leader IT Services, first created a concept for communication in incident management in order to provide a suitable solution to meet the company's requirements. The company was looking for a tool that could simplify administrative processes in the event of disruption.



tions and offer greater transparency. The goal was to minimize productivity downtime through rapid service recovery.

The plan also aimed at reducing helpdesk costs by offering self-service functionality. This would enable users to resolve a subset of their queries (about 20 percent) themselves. At the same time, the company hoped that the new processes would reduce resolution times for users, allow all messages to be collected in one place, and simplify service requests by storing all documentation and forms centrally.

ManageEngine ServiceDesk Plus

Chris Bregenzer found a suitable solution in 2008 in the shape of ServiceDesk Plus from ManageEngine. The detailed documentation and online demonstration gave him and his team a brief overview and enabled them to get up and running quickly, meaning that it took just two months from implementation to live operation. Following software evaluation, a pilot team from different departments was set up to put ServiceDesk Plus through its paces.

The insights gained in this process were instrumental in establishing a solid basis for the management's decision. A key factor in the successful rollout of the solution was management support, but also clear communication with users, which highlighted the benefits associated with handling IT requests in a new way.

The pilot phase concluded after three weeks, with the lessons learned being implemented the following week. This was followed immediately by staff training, and ServiceDesk Plus could be swiftly switched over to live operation. The IT department enlisted the support of German ManageEngine partner MicroNova for the initial company-wide configuration of the system. The solution's ease of use and low maintenance requirements meant that the IT specialists were then able to undertake all further modifications without any external support.

Since the introduction of ServiceDesk Plus, users have been able to post new tickets either using the web interface or by email. The latter are automatically converted into a ticket by the integrated email conversion routine and assigned appropriately by a dispatcher. "The balance between



"A key task for us is to ensure that our employees are able to perform their work to the best of their ability. Providing users with optimum support in the event of fault reports or service requests is particularly important for us – and ServiceDesk Plus provides us with the best possible support in this regard."

– Chris Bregenzer,
Team Leader IT Services,
Hawa Sliding Solutions AG

web and email requests is now very even,” explains Chris Bregenzer. Regardless of how tickets are created, the IT Services team leader attaches great importance to the integrity of the data in the tickets: “As soon as a ticket is closed, our support staff checks that the categories were selected correctly. This is the only way we can ensure that reporting is based on accurate data.”

To this end, a report is generated automatically every week as a csv file and analyzed in graph form. The report contains information on how many tickets are open, closed or “on hold” in addition to the total number of tickets. Furthermore, service requests and incidents are set in relation to each other and the time required on each ticket is determined. These reports enable Chris Bregenzer and his team to take appropriate action at an early stage, allowing them to continuously improve their service: “For instance, we were able to see that we had a relatively large number of tickets relating to Outlook. We then provided appropriate training to help employees become more familiar with the new version.”

Service Level Agreements (SLA) are also an integral part of first-class IT service management for Chris Bregenzer: “We issued SLAs for prioritizing tickets, so we could assign priority based on urgency and impact. This automatically sets an appropriate deadline for processing.”

Hawa Sliding Solutions has continued to introduce new features to ServiceDesk Plus over time, such as “User Feedback”. This allows Chris Bregenzer to easily monitor how satisfied users were with the way their requests were resolved: “User feedback is very important for us. We keep a very close eye on it. If a user has given us a ‘poor’ rating – for example, one or two stars out of ten – we will proactively contact them to ask what we should have done to earn ten stars.”

In addition to Chris Bregenzer’s IT services team, which is responsible for the entire infrastructure, services, network and clients, other areas in the company also use ServiceDesk Plus. For example, Customer Support creates tickets when customers experience problems with the configurator on the website. These are then assigned to the appropriate web application specialist. Developers who have issues with their CAD application can also create tickets that are automatically assigned to the CAD expert, and tickets relating to ERP go to the IT specialists in the Business Applications team.

**Greater Efficiency
Through Self-Service
and Documentation**

At the time ServiceDesk Plus was introduced in 2008, the IT department was supporting around 80 users; by the beginning of 2022, this figure had risen to 230. ServiceDesk

Plus’ self-service capabilities mean employees can search for solutions themselves without having to create a ticket, which significantly reduces the IT department’s workload. Extensive documentation of processes and solutions also helps the IT services team save time when resolving requests and provide optimum service quality.



Short Solution Times and Satisfied Users

ServiceDesk Plus has been supporting Hawa Sliding Solutions for a number of years. The solution quickly established itself as the central tool when it comes to reporting incidents or submitting service requests.

Even after all these years, Chris Brengener is glad he chose ServiceDesk

Plus, especially since employees today need IT-supported tools more than ever: "A key task for us is to ensure that our employees are able to perform their work to the best of their ability. Providing users with optimum support in the event of fault reports or service requests is particularly important for us – and ServiceDesk Plus provides us with the best possible support in this regard." ■

Customer Benefits:

- » Easy operation for users
- » Email to ticket conversion
- » Simple ticket dispatching
- » Comprehensive reporting for analysis
- » Workload reduction for IT



More Efficient Project Management at Almdudler

monday.com supports HR management & digital transformation

TEXT: Felix Bauer, Moritz Bauer PICTURES: © Almdudler Limonade A. & S. Klein GmbH & Co KG

Almdudler Limonade A. & S. Klein GmbH & Co KG:

- » Industry: Food
- » Employees: approx. 75
- » Head office: Vienna
- » Established: 1957

Almdudler is the Austrian soft drink par excellence. Since its launch in 1957, it has developed over the years into one of the most popular and well-known drinks in Austria and beyond. The associated family business of the same name is owned by Michaela and Thomas Klein.

The Starting Point – Escaping the Project Management Jungle

Almdudler attaches great importance to ensuring that its team has the best possible working conditions – including when it comes to processes and software tools. The “Organizational Development & Digital Transformation” team was set up specifically to meet this requirement. It aims to support employees with a structured, tool-based approach in order to further develop their individual potential and provide the necessary resources – ultimately making the entire company more successful.

With this in mind, Almdudler set out in February 2022 in search of a solution to further professionalize its project management. The intention was to facilitate a standardized approach to this subject for the entire company. Previously, each team and department had organized and managed planning and processes in their own way – using everything from Excel to scratch pads. This did not fit in with the generally rising level of digitalization or Almdudler’s focus on quality.

While searching online for a suitable solution, Christina Eberling and her Organizational Development & Digitalization team came across the project management solution monday.com. It



was quickly shortlisted because both the functions and the “look & feel” of the “Work OS” made a positive impression right from the start. monday.com also left a strong mark in the further evaluation process: “Other important factors in our decision to use monday.com were its intuitive handling, the fact that users can be trained quickly and – as quickly became apparent – that it perfectly maps our processes,” explains Christina Eberling.

The Solution – A Centralized, Collaborative Tool

The clear result of the evaluation led to a swift decision in favor of monday.com. Almdudler formed a four-person

project team responsible for the introduction of the Work OS – because ultimately monday.com is a solution for operational work. Their first task was to compile a detailed list of all the requirements regarding the processes etc. to be mapped and then to coordinate the results with senior management and divisional heads. Even before acquisition, employees were closely involved in order to achieve high levels of user acceptance from the outset – a critical success factor for the introduction of any new tool.

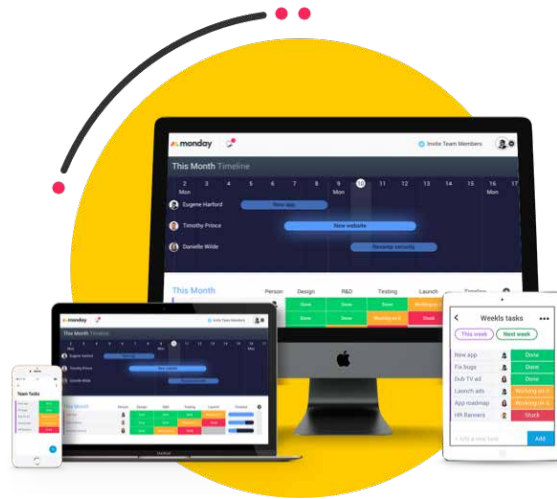
monday.com was purchased and implemented once this preliminary work had been completed. It took around four to six months to implement the



„Thanks to monday.com, we have a much more powerful project management system overall. This has enabled us to significantly reduce the time spent on administrative tasks and we can now perform our actual tasks faster and better. This applies both at individual employee level, as well as within teams – and even beyond.“

– Christina Eberling,
Organizational Development
& Digital Transformation,
Almdudler Limonade A. &
S. Klein GmbH & Co KG

Work OS, from the selection of the tool to the initial training of all employees. “We were in close contact with the monday.com team at MicroNova throughout the entire implementation process, and they provided us with extremely competent advice at all times. We felt very much at ease right from the start, also because we noticed the vendor’s support for its partners,” says Christina Eberling, describing the cooperation with the German monday.com partner, MicroNova.



Almdudler now maps numerous different processes using the new project management tool, both within individual teams and across teams as well as at the employee level. Automation is also used, for example when transferring completed tasks to a corresponding group. The tasks for which the collaborative Work OS is deployed at the beverage manufacturer include, for example, the mapping of projects within the team and their management by those responsible. The tool is also very popular with many employees for maintaining an overview of their individual to-dos at all times. A further advantage is that Almdudler can now map even cross-company processes – from the organization of team-building events to sales processes – in a much more efficient and user-friendly way with monday.com.

As monday.com is constantly being further enhanced, new functions are always available to the companies and teams that use it. These include, for example, monday.com docs, which was launched shortly after Almdudler started using the Work OS. It is a directly integrated alternative to Google Docs, which is also browser-based, making it even easier to create and edit text-based documents directly in the Work OS – a feature that some teams at Almdudler are already using.

The Result – Optimized Processes and Collaboration

A better overview of the status of each task and the associated deadlines as well as more transparent processes overall are among the successes that Almdudler has achieved by using

monday.com. This in turn results in greater clarity and more seamless collaboration, which has led to tangible and measurable time savings. The collaboration options deeply integrated into the tool have proven to be particularly useful. For example, people can be tagged directly in tasks so that they are clearly assigned to them. In addition, chat messages at task level can be exchanged directly within projects, which means that all communication is bundled in one central location and can be tracked at all times.

By implementing monday.com, Almdudler has succeeded in bringing about significant improvements within the company in two major areas: the optimization of the way processes are handled and collaboration. This positive result was also achieved be-

cause – with the exception of the sales force – all departments now use monday.com in their daily work. This also impressively demonstrates the high level of acceptance among staff and the usefulness of “getting the team on board” right from the start. The intuitive operation has also played a part in the positive response from users.

What’s more, one of Almdudler’s core objectives was to find a standardized approach to the company’s internal project management – and this was achieved, as Christina Eberling confirms: “We definitely achieved what we set out to do. Our teams work together in a more coordinated and structured way, simply because they now have a standardized solution with clear guidelines – within which there is the greatest possible freedom

of action. Whereas there used to be somewhat of a project management jungle before the project started, we now have a very useful navigation system that helps us get from A to B faster and with greater satisfaction.”

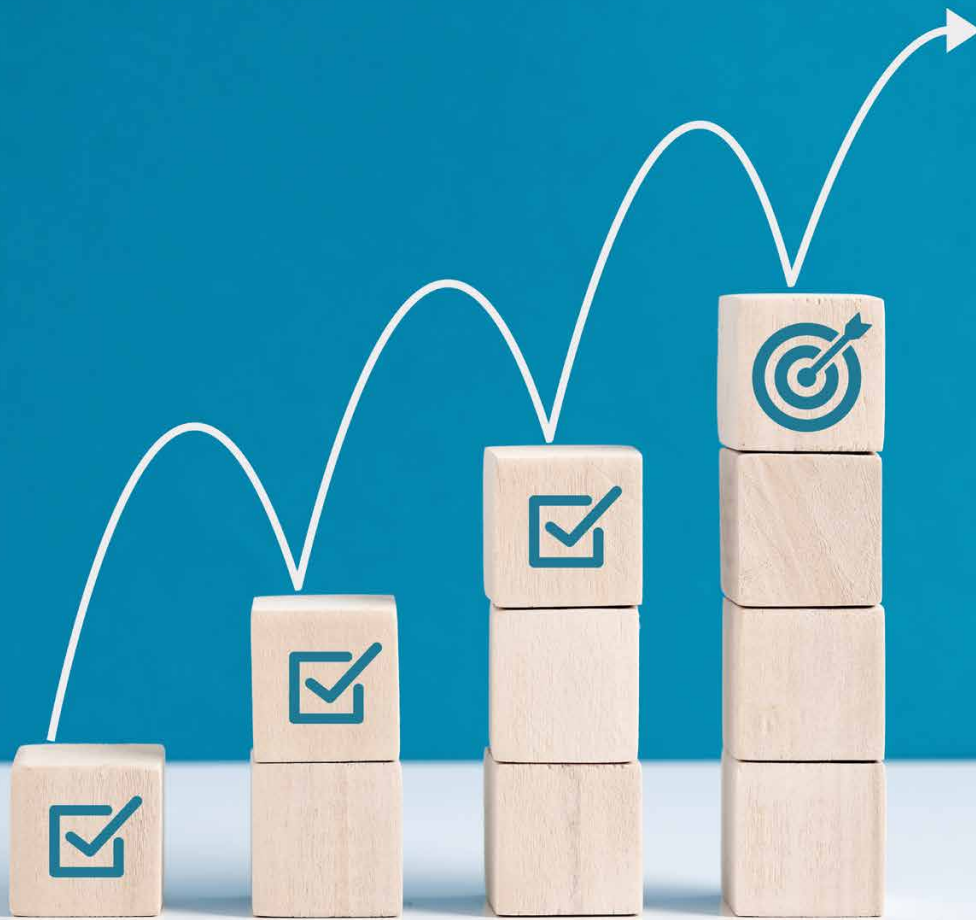
Conclusion

The successful use of monday.com is beyond doubt for Almdudler. It is therefore not surprising that the team is already thinking about expanding its scope. The company is already planning to bring the entire sales team on board at some point in the future – for even greater transparency and even closer collaboration across all processes within the organization. In other words: for successful project management, without the jungle. ■

Customer benefits:

- » Greater transparency for tasks and deadlines
- » Time-savings through automation
- » Optimum process mapping
- » More structured collaboration throughout the company





Monitoring and Measuring Projects Successfully – with monday.com

What is important for successful project tracking?

How can tools support this, and what do good solutions
look like?

TEXT: Felix Bauer, Moritz Bauer PICTURES: © Cagkan Sayin / Shutterstock.com; © monday.com

Project tracking is the process of monitoring the status and progress of tasks in projects. If project managers are running several projects at the same time, it is particularly important to effectively track costs and resources and to use this information to control them. Project managers often have to produce relevant reports in order to provide information and document deviations from the plan. Good project tracking also helps to keep an eye on whether tasks and milestones are being achieved and completion dates are being met. It also simplifies resource planning.

The following questions need to be addressed when setting up a successful project tracking system:

- » Why is it important to track projects?
- » What is the best method for tracking projects?
- » What are the benefits of project tracking tools?
- » What are the key features of project tracking tools?

Maintaining an Overview

As trivial as it may sound, this is often a difficult job in everyday life. Monitoring project progress is important because it allows teams to focus more effectively on key tasks and stay within budget. When organizations continuously track the progress of a project, all stakeholders can monitor key aspects, such as:

1. **Adherence to deadlines:** Companies can check the current status of tasks and milestones against planned deadlines.
2. **Management of resources:** Teams gain insight into hours worked, financial resources, etc.

The screenshot shows a 'Project planning' dashboard with two main sections: 'Next steps' and 'Milestones'. Each section contains a table of tasks with columns for Owner, Status, File, Timeline, Team, and Effort.

Task	Owner	Status	File	Timeline	Team	Effort
Next steps						
New feature release	[Avatar]	Done	[Icon]	May 08 - June 09	#Product	★★★★★
Conference in New York	[Avatar]	Working on it		May 05 - May 23	#Ops	★★★★★
Website redesign	[Avatar]	Stuck		May 01 - June 23	#Design	★★★★★
Milestones						
Hire new product manager	[Avatar]	Done	[Icon]	June 09 - June 22	#HR	★★★★★
Approve Q3 budget	[Avatar]	Working on it	[Icon]	June 02 - June 10	#Finance	★★★★★
Launch campaign	[Avatar]	Working on it		June 02 - June 24	#Marketing	★★★★★
Server migration	[Avatar]	Stuck		May 11 - June 26	#Dev	★★★★★

1 Keep an eye on the project status and schedule at all times – optimized with monday.com.

3. **Estimation of effort:** Project tracking is a better way to determine how much time specific upcoming tasks or the entire project will take.
4. **Variations & risk management:** Is the project still on track? Are there any potential risks or obstacles?

What is the Best Method for Project Tracking?

There are many approaches to keeping tabs on project progress: These may include Gantt charts and project overview. Gantt charts can be used to provide a visual representation of project progress. They reveal the interconnection between tasks to both project managers and team members. A simple Gantt chart can easily be created using an Excel spreadsheet. However, a platform with dedicated project tracking tools is a more powerful version showing real-time changes and updates.

Another option is to create a project overview. In this case, it is advisable for the entire team to work together to set realistic project goals. This helps

to identify the expectations that are placed on the participants as a group and as individuals. It can be useful to include milestones, key project indicators (KPIs), and dependencies in this overview.

Regardless of whether you choose a project overview or a Gantt chart, what matters is that there is clear communication between stakeholders and team members throughout the entire project. A powerful project tracking tool also provides support in this area. It can be used to share relevant information, improve collaboration between stakeholders, as well as track progress. Communication works all the better if all the relevant information is stored centrally, allowing everyone involved to access it and also exchange information directly within the tool.

What are the Benefits of Project Tracking Tools?

The key benefits of project tracking tools are the ability to complete projects on time and within budget, while improving the work environment for team members.

Additional benefits include:

- 1. Simplified project planning:** Powerful project tracking tools provide features such as document sharing, Gantt charts, Kanban views, and other agile workflows to facilitate project planning and ensure efficient organization.
- 2. Clear task assignment:** An appropriate tool can be used to share tasks between team members and flag them on the platform so that everyone involved is always aware of what tasks need to be completed at any given time.
- 3. An overview of the time required at all times:** Good project tracking tools make it possible to monitor the time spent on each task and the progress made in a structured way. This can be helpful, for example, when monitoring the use of resources and optimizing the project schedule.

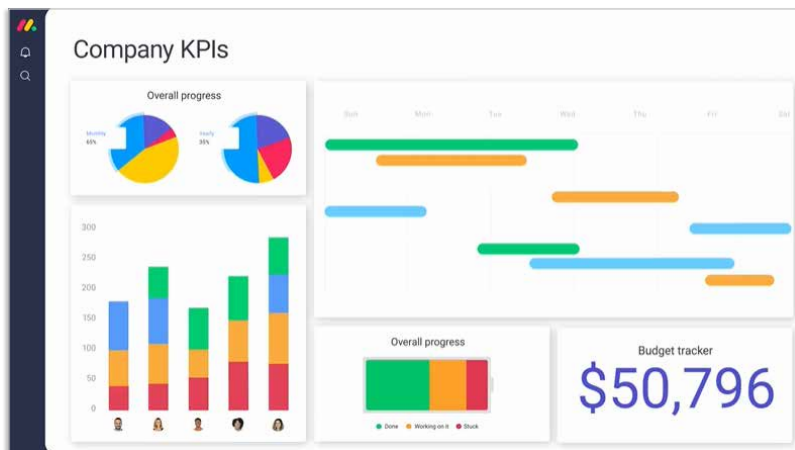
- 4. Project status always up to date:** This allows the overall progress of the team to be assessed. Colored, customizable labels have shown themselves to be particularly helpful in this regard, as they can clearly display the progress of projects and individual (sub-)tasks.
- 5. Efficient project plans:** Project tracking tools also allow you to create visual schedules for all projects and set key start and end dates. This facilitates planning and the completion of milestones.

Collaborative project management systems enable particularly effective documentation of work activities from start to finish because they directly involve the entire team. Managers, in turn, are empowered to better manage their projects, identify bottlenecks, increase efficiency, and ultimately ensure overall success.

Three Essential Functions of Project Management Tools

The following factors contribute significantly to productivity, efficiency, and better teamwork:

- 1. Workflow automation:** This is one of the most valuable features a project management tool can offer. Automation can minimize repetitive tasks, optimize project management, and enhance quality. This saves time and spares the nerves of both project managers and team members, helping them to focus on their actual tasks as well as on achieving project goals.
- 2. Mobile applications:** In the age of hybrid working, it is especially important for a project management tool to offer mobile applications. This gives your team and you access to projects, task updates, and progress monitoring at any time and from any location.
- 3. Software integration:** A professional project management tool offers seamless integration with other software and tool applications, facilitating collaboration and allowing all relevant information to be concentrated in one place. Integration with other tools such as calendars, email clients, or communication platforms promotes efficient information sharing while eliminating data loss.

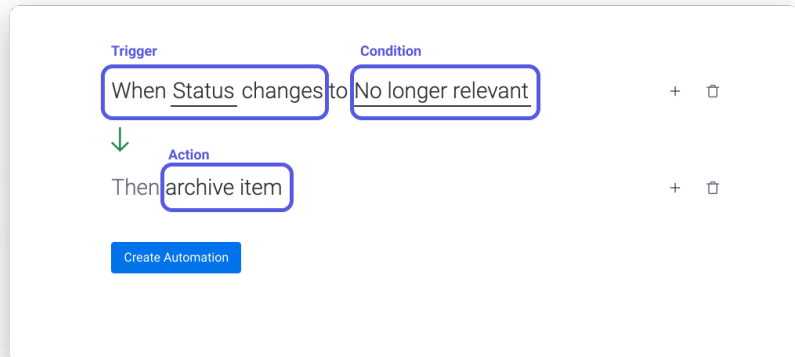


2 Clear dashboards give you a perfect overview of the status, budget and schedule at all times.

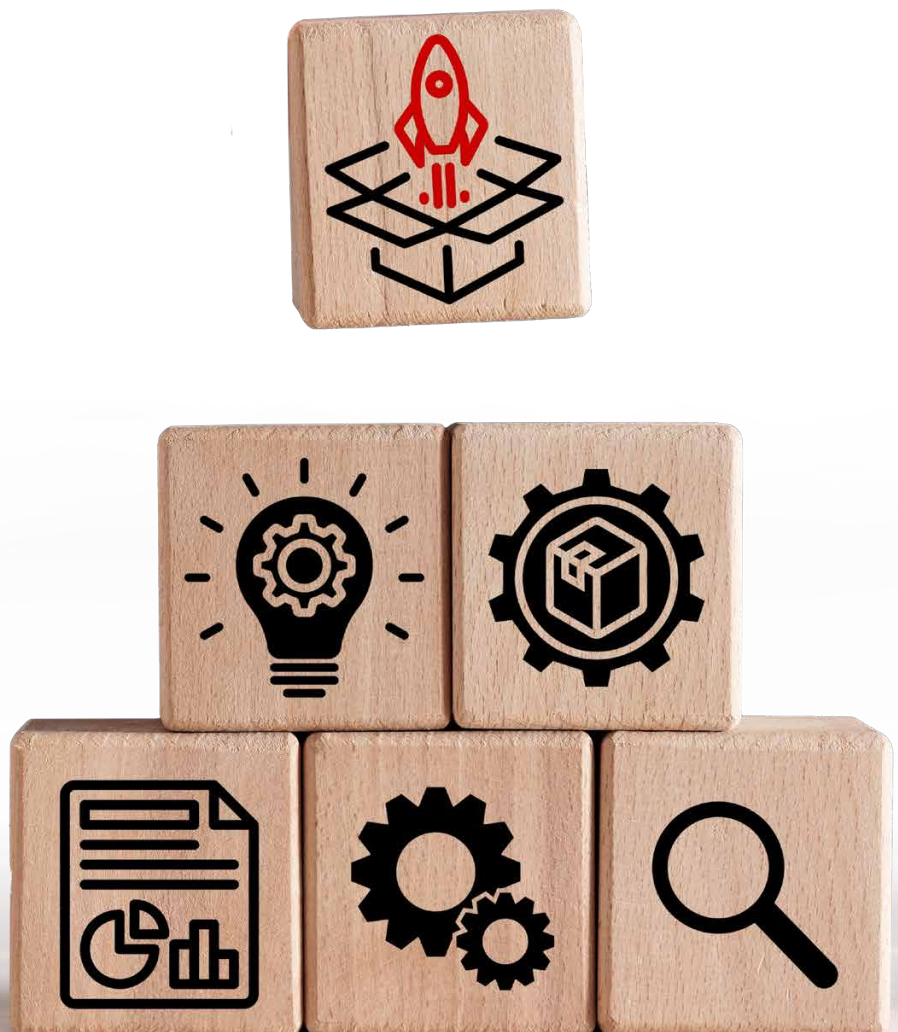
Conclusion: Why monday.com is the Perfect Solution for Project Tracking

Offering workflow automation, a highly functional mobile app, and seamless software integrations, the monday.com project management tool meets all the requirements organizations need for goal-oriented, efficient project tracking. The intuitive user interface, collaborative capabilities, and wide range of available features make the Work OS the ideal choice for project management – thanks to its wide range of customization options for any application.

As a certified Gold Partner of monday.com, MicroNova is happy to provide support, especially with regard to consulting and the development of a customized solution. Contact us if you would like more information or a demo. ■



3 Illustration and explanation of how automation works



The Success Story Continues:

Testing and Telecommunications Portfolio and Enterprise Software Solutions in Great Demand

TEXT and PICTURE: Editorial Staff

MicroNova has expanded from 250 to 400 employees in just five years. Software Consultant Stefan Bernard was warmly welcomed by those gathered for the company's summer party at its headquarters in Vierkirchen, together with other new employees – and he echoed the same sentiments with the following words: “The ‘Welcome Day’ and the onboarding process taught me just what a diverse company MicroNova is. There are plenty of exciting and innovative topics and projects. I look forward to working with all of you,” he said.

Leading-edge software for professional IT and project management as well as solutions for digitalizing business processes in a focused manner: the Enterprise Solutions business unit, where Stefan Bernard works, has become a real success story over the past few years. The division has proven its strength with consistent growth in sales and team numbers, as well as an expansion of its portfolio of products and services. The increasing number of partners and, above all, users also attests to MicroNova's success – around 2,700 companies now rely on the solutions offered by the company and its partners.



1 Orazio Ragonese, CEO at MicroNova (right), welcomes the 400th employee Stefan Bernard, Software Consultant Enterprise Solutions (left).

Orazio Ragonese, MicroNova's CEO, stressed: “Our teams are developing a ‘hands on’ future. In doing so, we always follow the guiding principle of our founder Josef W. Karl: Innovation and a compelling portfolio are the basis for any growth – and all this is only possible thanks to the many bright minds in our company. I'm so pleased that we've now reached 400.” ■

Artificial Intelligence – Curse and/or Blessing?

Dear Reader,

100 million active users – what Instagram took two and a half years to achieve, ChatGPT was able to accomplish in just two months*. Artificial intelligence (AI) has, at least at the moment, crossed the threshold from the almost mystical to the (seemingly?) commonplace. This technological milestone is probably one of those rare great turning points in history. A hype – or one giant leap for mankind ...?

On the other hand, the topic didn't just start with ChatGPT in 2023 or 2022. For example, our CEO Dr Klaus Eder completed his PhD on AI back in 1994. Dear Klaus, please bear with me for a moment. While a lot of water has passed under the bridge since then, it does show very well that the world "out there" has been grappling with AI for some time and that the MicroNova microcosm has several points of contact to it ...! One big difference to the past is that computers are nowadays powerful enough to process huge volumes of data very quickly.

AI at MicroNova of course entails more than just the academic accomplishments of its management. With its consulting services, our "Testing Solutions" division in particular has a wealth of expertise and has been successfully implementing AI customer projects for some time. Verifying AI systems themselves also plays a role in this, as they also require validation. Of course, our website provides further information on the subject, and our customer magazine 2-22 (p. 4 et seq.; p. 8 et seq.) also dealt with AI long before the ChatGPT hype.

It would actually be very surprising if MicroNova did not yet engage with AI. After all, innovation has always been the company's main driver, and our approach has always been to avoid overhyping things. Ultimately, we must not overlook the fact that AI is also "just a tool", or, perhaps more accurately, a toolbox. As stated above, generative AI, which is particularly popular at the moment, is actually only one aspect of this topic.

One example of a tool perhaps also shows quite well why AI can be a curse and/or a blessing: you can use a hammer to hammer in a nail or commit a crime. We all have the duty to strike the right balance between curiosity and a desire for innovation on the one hand and the sensible, responsible use of this toolbox on the other. This is because its potential is too great to let fear – rarely a good guide – completely slow us down. Just think of the opportunities in the field of medicine, and specifically the specific example of cancer research.

But, coming back to MicroNova, there will also be many beneficial and potentially life-saving applications in the automotive and testing sector, for example in driving assistance/autonomy. I have no doubt that you, dear readers, will be hearing the term AI even more often in future. And I promise you that we will always ensure that this technology is used wisely and ethically.

With warm regards

Josef W. Karl



Josef W. Karl
Chairman of the Supervisory
Board of MicroNova

* <https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/>

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