



Survey of Tools for Software Engineering

Release Q1 / 2023

Foreword

The importance of software has been growing steadily and rapidly for 60 years. It has an impact in all areas, in company processes, in many products, in daily communication, in health solutions, in energy supply or threatens all our efforts in the area of cybersecurity. Thus, the ability to quickly implement high-quality software takes on great importance for every industrial nation.

In contrast, there has been a strong trend for many years to move development work to regions with a lower cost of living. This started with India and is now moving towards Africa. This raises the question of whether or not the constant implementation of complex software systems is an important basis for taking a leading position in the software sector. If individual countries build the software systems for the entire world, they have a decisive practical advantage in the advancement of methods and tools. They will steadily write faster and more effective programs with higher functionality.

The effects of this development are enormous and are already becoming apparent. The leading position of Germany and other European countries in many industrial sectors such as automotive engineering, chemicals or banking will be difficult to maintain without in-depth IT know-how. This can be clearly seen in the case of operating systems in cars. The large US corporations seem to be winning the race here. The situation is exacerbated by the fact that access to new technologies is also increasingly becoming a component of political sanctions. It is difficult to predict what consequences these trends will have for our welfare state and prosperity.

If Europe is to become a hotspot for software technology, innovation must happen here: The new software approaches must be developed here. The best software development tools must be developed here and the programming of new solutions in the companies must be specified and implemented by local forces. You cannot want to be top in the IT sector and have the practical work done by others.



Dr. Gerd Große

Head of United Innovations
Chairman of the Board of
GFFT e.V. & Managing Director
of GFFT Technologies GmbH

To achieve this goal, it is not enough to emulate the successful path of Silicon Valley. At the moment, our strengths lie neither in attracting the world's best young talents nor in providing large amounts of venture capital. But we are used to defining functioning processes, implementing them consistently and improving them systematically. Optimally, we involve all stakeholders in IT expertise in a joint process: The users of IT, who can best describe their IT needs, the tool manufacturers, who build reusable solutions, and the scientists, who develop and test new methods.

To achieve the fastest possible pace of innovation, it seems sensible to underpin the joint innovation process with a general building block principle. Analogous to Lego bricks or prefabricated houses, the innovation providers should offer their solutions in such a way that they can be quickly adapted and combined with one another. In this way, users concentrate on wanting building blocks, providers and researchers on producing new building blocks, and consultants on quickly introducing building blocks. The individuality of the implementation strategies in the companies is supported by the selection and adaptation of prefabricated and approved building blocks.

With this in mind, this Survey includes several chapters ranging from solution strategies to the latest research projects. In chapter 3 we discuss solution strategies and in chapter 4 we present some exciting new building blocks. Candidates for future building blocks are in chapter 5 and research approaches in chapter 6. If using this as a report seems too unwieldy for you, you can also find all the information in our technology database techL (www.techl.eu).

In the hope that the information we have compiled, filtered and evaluated will help you, I hope you enjoy reading it.

Contents

1 Calendar.....	4
2 United Innovations.....	6
3 Solution Strategies for your individual Progress.....	8
How to fulfil regulatory requirements for test data	10
Data Quality for ML-Systems	12
4 Building Blocks.....	14
Test Automation – Why and How?.....	16
Solving the Cloud Innovator's Data Dilemma.....	18
5 Applicable Use Cases & Success Stories.....	20
Test Data Cockpit for SAP	22
Test infrastructure as a Service - Made in Germany.....	23
A solution to monetize and sell digital products B2B	24
6 New Technologies.....	26
Queryella - An automated analytics platform.....	28
Summetix - Argument Mining to discover hidden insights	30
devmate Testcode Generator	32
Kenbun - Digital voice assistants and AI.....	34
7 Survey of Technologies	36

Calendar

30.03.2023
16:00-16:45

Use Case Award:
Synthetic test data Succet (german)

As part of our Use Case Awards, we present innovative use cases in software testing. The participants can discuss these and evaluate them as a jury. The three best-rated use cases of a season will pitch for the victory at the final event (F2F) at Phoenix Pharma in Mannheim on June 13, 2023.

Isabella Rieger (FMC) will present an innovative use case for synthetic test data generation. succet is a cross-industry technology-independent software for automated "fit" synthetic test data generation. It enables companies to realize high software quality in their software projects through more efficient and successful testing. Jury members are Hannes Brands (Bayern LB), Janet AlbrechtZölch, Dr. Frank Nittka (Andros Deutschland GmbH), Kevin Lawrence Macovich (W&W Informatik GmbH) and Dr. Benedikt Müller (KSB E & Co KGaA). [Info & Registration](#)

05.04.2023
15:30 - 17:30

Insights Test-Track:
Best Practices Test automation (german)

The event explores the latest trends and strategies in test automation, with a focus on practical applications in real-world scenarios. Participants will learn about the benefits of test automation, including the ability to relieve business testers and achieve transparent software quality. The event features experts from leading companies, who will share their experiences and insights on topics such as leveraging RPA tools for testing, implementing IT-cross-functional testing, and using AI components for semi-automatic test generation. [Info & Registration](#)

If you are interested in participating in a workshop or event,
please send us an E-Mail to info@gfft-ev.de.
You will then receive the dial-in data.

All events and further information can also be found at
www.software-innovations.eu/kalender



18.04.2023
16:00 - 16:45

Use Case Award:
Legacy Migration to the Cloud with Delphix (german)

In this use case from Delphix, Christian Bersch presents the topic: "Legacy Migration to the Multi-Cloud". Julia Stumpenhagen (SVA) provides a technical introduction to the topic. As enterprises move more and more applications to the cloud, DevOps teams need to transform legacy, manual processes and optimize workflows. The transformation to the cloud/multi-cloud also presents an opportunity to modernize test data management (TDM). Instead of migrating all your data environments, perform a thin migration.

Delphix synchronizes production data with the cloud and allows you to provision virtual databases to rebuild environments for development, testing, and AI. Eliminate the need to migrate non-production environments, which account for 90% of your data needs. Through a customer use case, you will learn how Delphix technology can accelerate your cloud migration by 30%.

[Info & Registration](#)

26.04.2023
15:30 - 17:30

Insights Data Intelligence: Best practices for business processes that can be automated (german) [Info & Registration](#)

04.05.2023
16:00—16:45

Use Case Award: webmate
Efficient testing of e-mail workflows (german)

E-mails are here to stay. In almost all essential transactions on websites and mobile apps, machine-sent e-mails play a prominent role. And yet everyone has experienced that automated e-mails contain errors: (1) The layout needs to be displayed correctly. (2) The text needs to be corrected or still contains placeholders. (3) Links point to nowhere.

The SaaS platform *webmate* from Testfabrik supports its customers with test infrastructure, making test automation easier. Among other things, webmate saves a lot of time and effort when testing e-mail workflows. Thus, in manual testing and existing test automation scripts, e-mail mailboxes can be created dynamically, and the correctness of received e-mails can be checked. For all this, many real mobile devices and desktop machines are available at the push of a button to execute the tests under the most realistic conditions possible. [Info & Registration](#)

United Innovations - The innovation network -

The United Innovations (UI) platform is a subsidiary of GFFT e.V., a non-profit society dedicated to research transfer. Its primary objective is to drive innovation in Germany, Europe, and beyond. With its extensive network, the platform is committed to achieving this goal.

United Innovation supports the innovation process in each topic area with the same offerings: (a) the technology database techL©, (b) the surveys, (c) the awards for evaluating new technical offerings, startups and scientific prototypes, (d) many events and (e) proofs of concepts and launch projects.



Executing Innovation together

All countries have to deal with various challenges today, including climate change, digitization, and cyber threats. In the face of global competition, the ability to harness the expertise of businesses and researchers to address emerging challenges and develop innovative solutions swiftly will be essential. At UI, we support all companies to define their innovation goals and achieve them through close collaboration with our extensive network of corporate partners.



Join our network

We focus on a wide range of topics that can be positively impacted by IT, including manufacturing, logistics, business processes, and cybersecurity. Our services promote knowledge sharing, incremental improvements, upfront development of new solutions, and recruitment. Join our network and improve yourself.

DEUTSCHER STARTUP- POKAL

UNITED INNOVATIONS AWARDS

Startups from the digital sector will be able to showcase their innovative technologies and products to a panel of experts and a wider audience. Leading companies in the industry will act as co-hosts and sponsors of the event, providing valuable expertise and support to the participating startups. Executing Innovation together.

USE CASE AWARD

UNITED INNOVATIONS AWARDS

The Use Case Award highlights the best practices and innovative solutions to current challenges, which are also featured in the techL technology database. These exceptional use cases are further showcased during our Insights events, providing a platform to share and learn from the best practices of industry leaders.

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3

Solution Strategies for your individual Progress

General progress in companies does not proceed randomly but happens often in many companies at the same time. It seems as if companies move in a channel that depends on the same external influences such as newly identified threats, new technologies, legal requirements, or the introduction of standards. For example, many companies are working at more or less the same time on introducing SAP S/4HANA. They evaluate different steps, obtain advice on implementation plans, and introduce necessary tools for data preparation.

The more similar the companies are, e.g., two medium-sized production companies, as greater the similarities and as higher the saving poten-

tial that can be achieved through cooperation. It is easy to see that implementation time, cost, and quality equally benefit from a joint approach.

In this chapter, we present several articles on solution strategies. In the first one by Matthias Rasking, General Manager of Sixsentix, we can learn how to handle GDPR-Regulations in the area of test data management. In the second one written by Dr. Gerhard Runze, the effect of data quality on the testing of Machine Learning is discussed.



All projects can be found in the

Software Lab

www.software-innovations.eu/themen

How to fulfil regulatory requirements for test data

Ever since GDPR entered our world there have been many discussions on personal data used for purposes other than the actual application to which the user has signed up for. This includes testing purposes, where many companies still rely on production data to (regression) test some of their systems as this is believed to be the only acceptable way to test real-life scenarios. Lately, regulators have increasingly focused on this topic. This article explains some requirements on test data and leading practices to deal with them.

An article from Matthias Rasking

Image credits: Benjamin Nelan, pixabay



How can you navigate the many regulatory requirements when using test data? And how can you efficiently and effectively use them to minimize the risks both towards data protection and appropriate

Many requirements govern and influence which test data to use for adequate testing of software changes before going live. On the one hand, testers want data that is close to existing production

data so that they can more easily and more realistically determine test scenarios resembling real-life scenarios. On the other hand, regulators and IT Security professionals want to limit the amount of actual data from production to be used for testing, as many test environments are typically not as secure as production environments and this usage also makes the “right to be forgotten” much more difficult to implement.

Therefore, quite a few regulatory requirements expand on the GDPR definitions in articles 13, 17 and 32 with details especially for financial firms. In Germany these are covered in the «Kreditwesengesetz» KWG and further detailed in industry-specific requirements laid out in MaRisk, BAIT (or VAIT, KAIT etc) and company-specific policies.

Let's take [GDPR article 32](#) as an example. In summary, this states that the data controller and processor shall implement appropriate technical and organizational measures to ensure a level of security appropriate to the risk. For banks this is further elaborated in MARisk AT 7.2 where the need to safeguard the security, integrity, availability and authenticity of data is being defined, and in BAIT 7.11 where the level of data protection is specifically mentioned for testing purposes. However, these requirements do not cover all details, every organization needs to determine (aided by their data security and IT security officers) what "appropriate" means to them.

How can you approach compliance with these requirements especially in a legacy application environment? A starting point needs to be a systematic risk analysis of the as-is situation. Which kind of test data is being used in which system and environment? Use the (hopefully existing) business impact analysis to determine a risk score for each application as it pertains to data. Take specific note of any personal data being used – where it comes from, whether it is being stored or manipulated locally and who is in charge of updating test environments with this data. Then, turn to the testers themselves – how they document tests, how they determine which test data is needed for their testing and how integrated their scenarios are.

Using the assessment results as guidance, you can determine your further cause of action. For high-risk applications (those that store personal data or where high-availability requirements have been defined) you will need to look into data masking techniques or the usage of synthetic test data to perform your test cases. While many tools exist for this job, tool selection should be less important than

- A. Understanding how testing is typically being performed and
- B. Mapping out the data flow between different systems to ensure that you maintain data integrity between applications (and therefore tests) when masking data.

As a real-life example, a German Bank first went through all applications classified as high-risk and mission-critical (KRITIS) for this institution. They used interviews with testers and operations to understand dependencies of these applications to others during testing and identified common data sources for personal data. Using this knowledge, masking algorithms were developed in parallel to selecting an appropriate tool that fulfilled both functional (use cases such as data masking, archiving, synthetic data generation) and technical (cloud storage, in-place data masking, support for various application platforms) requirements.

A pilot was conducted, replacing the previously used custom-developed scripts for data masking and validating the masked data with typical test scenarios. Business testers had to be trained on using the masked data since in many cases they were accustomed to finding "their" clients in test environments for testing purposes. A central test data management team was also set up in order to guide project managers and testers when it comes to identifying data necessary for testing and populating the test environments with this masked data. The assessment results continue to serve as a roadmap for further improvements, expanding the usage of masked test data throughout the bank.



Matthias Rasking,
Managing Director,
Sixsentix Deutschland
GmbH



Detailed information in the techL profile:

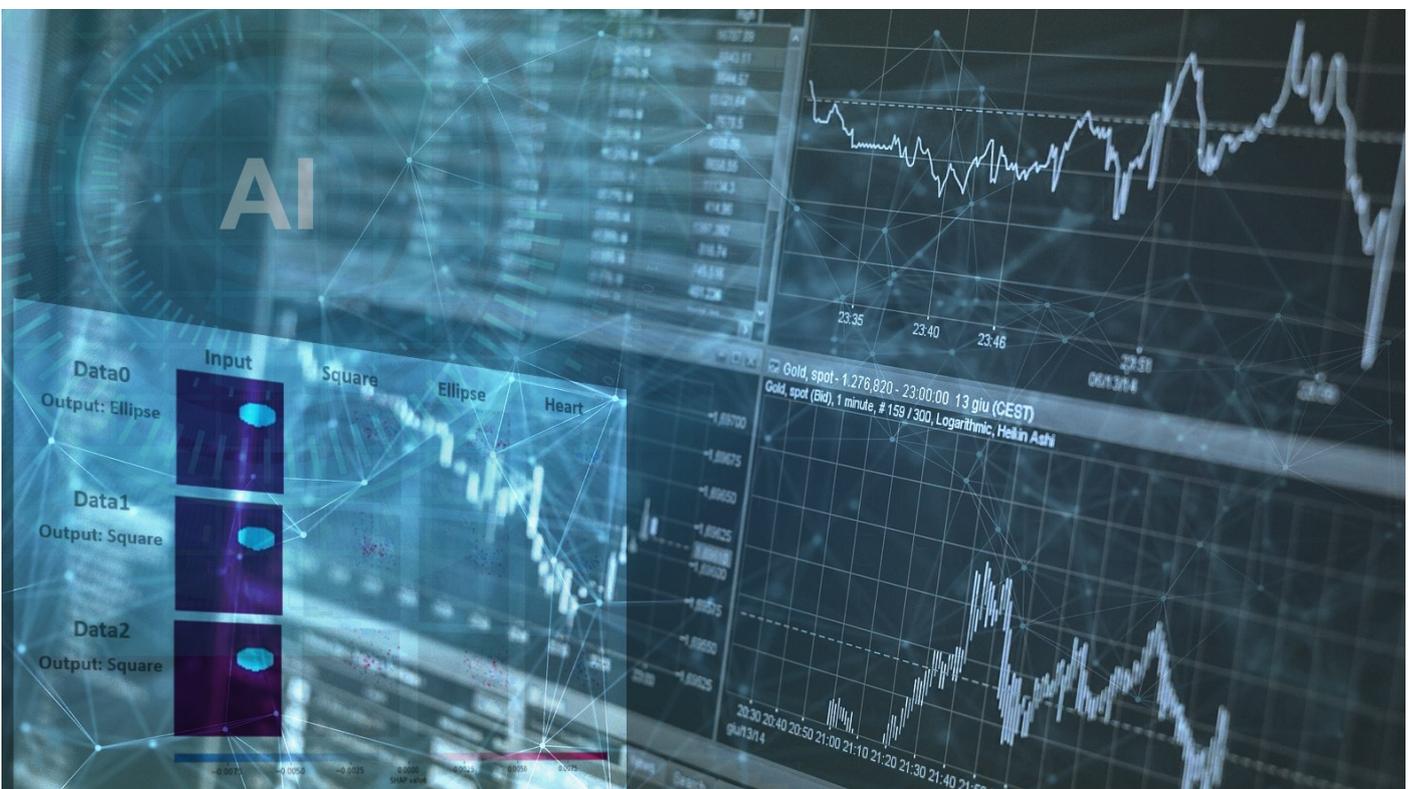
[Sixsentix](#)

Data Quality for ML-Systems

What defines high quality data for machine learning (ML)? How can we measure data characteristics of qualitative nature? Can model quality be predicted from the quality of their training data? A continuous evolution of our guideline towards AI quality.

An article from Dr. Gerhard Runze

Image credits: Lorenzo Cafaro, pixabay



More and more of today's applications use AI-based systems developed through machine learning (ML). The decisive factor here is not only the sole amount of data available for learning, but even more that this data is of sufficient quality.

But what exactly defines data quality? Many of the aspects of data quality that are known in the context of machine learning are rather qualitative in nature. Can they also be made measurable? In a bachelor's thesis we have investigated this question and observed quite interesting effects.

When searching for data quality aspects in machine learning, most publications are focussing on aspects like completeness, correctness, or accuracy [1]. Even ChatGPT tells me about these as highly relevant for data quality. Those characteristics are however rarely quantified. Even though we know from research that e.g. the correctness of the training and validation data is important for an effective model training, it seems there are only

very few investigations published that tried to quantify these characteristics as measurable values. In contrast the quality of an ML-model is very well defined by using the established functional performance metrics like accuracy, precision, or recall, that can easily be measured.

So, skipping a detailed assessment of the data quality and just measuring the trained ML-System looks like a solution – and that’s what unfortunately some data engineers in projects tend to do. The crucial point is that also the well-defined functional performance metrics rely on high quality data as basis. Moreover: Not knowing that the applied data have quality issues, measured accuracy of precision might indicate falsely a well performing model!

Within imbus we have seen these effects when we were doing our first experiments in AI. As company that now has 30 years of experience in software quality assurance and software testing with conventional software, we were constantly looking for new testing methods, concepts and processes also supporting the quality assurance of AI systems.

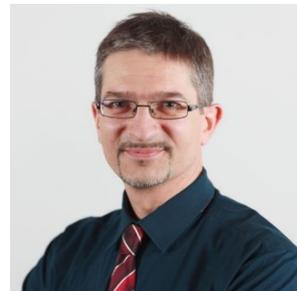
To circumvent the inter-dependency of the quality of the data and the quality of the trained system, we issued a bachelor’s thesis [2] to increase level of objectiveness in this area: Our bachelor student used artificially generated data which she could control precisely in its quality characteristics like correctness, completeness, representativity and freedom from redundancy. We used the artificially clean and worsened data of different degrees to train a convolutional neural network (CNN) for object detection. We then compared the self-defined metrics to evaluate quality parameters from the data, with different methods to evaluate the resulting model quality.

One observation was first surprising, but then very plausible: The more duplicates we inserted into our data (less freedom from redundancy), the better our trained system became! The reason is the increasing overfit of the system, as the probability of having duplicates in training dataset *and* test dataset increased.

We have collected these and many more aspects of data, model, and process quality aspects in our own guideline for AI quality assurance, which we continuously extend and improve.

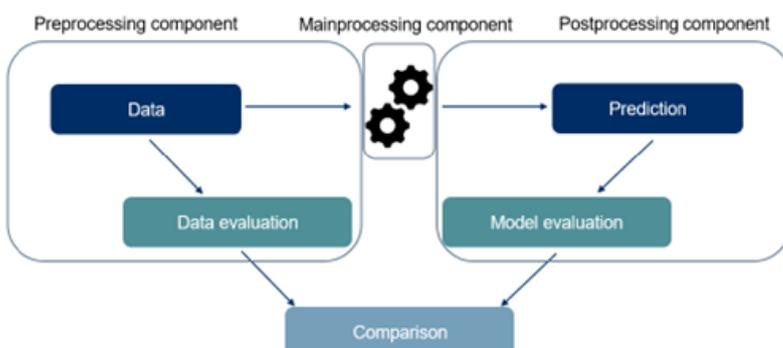
[1] L. Bruns, B. Dittwald, F. Meiners, *Leitfaden für qualitativ hochwertige Daten und Metadaten*, Fraunhofer-Institut für Offene Kommunikationssysteme FOKUS, 22.09.2019

[2] G. Simion, *Synergies of pre- and postprocessing analysis methods to explain Artificial Intelligence*, Bachelor’s Thesis at FAU Erlangen-Nuremberg, 17.10.2022



Dr. Gerhard Runze
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 Detailed information in the techL profile:
[imbus AG](#)





4

Building Blocks

"Innovation" often sounds like research with an unclear outcome. As a result, users are very cautious, take a long time to make decisions, and invest little money. It makes more sense to follow a general building block principle. Analogous to Lego bricks or prefabricated houses, innovation providers should offer their solutions in such a way that they can be quickly adapted and combined with each other.

In this way, both sides accommodate each other to a certain extent. The solution providers and scientists work out their new innovations to such an extent that they can be used without major difficulties. The users build their new solution strategies with the well-developed building blocks and can develop their processes very quickly and without risk.

Individuality is then achieved at the level of the solution strategies and not at the level of the building blocks.

If the building block principle is accepted by many companies, thought will have to be given to the interoperability of the building blocks. This can be achieved in two ways. Either it is possible to ensure that building blocks offer a standard interface that can be used by other building blocks. Or there is an underlying data framework where the building blocks can connect to.

In the following two articles we will present solutions from the test area. Dr. Stefan Jobst's contribution is dedicated to test automation and Emel Rehberg addresses challenges in the area of cloud applications.



All building blocks can be found in the
Software Lab

www.software-innovations.eu

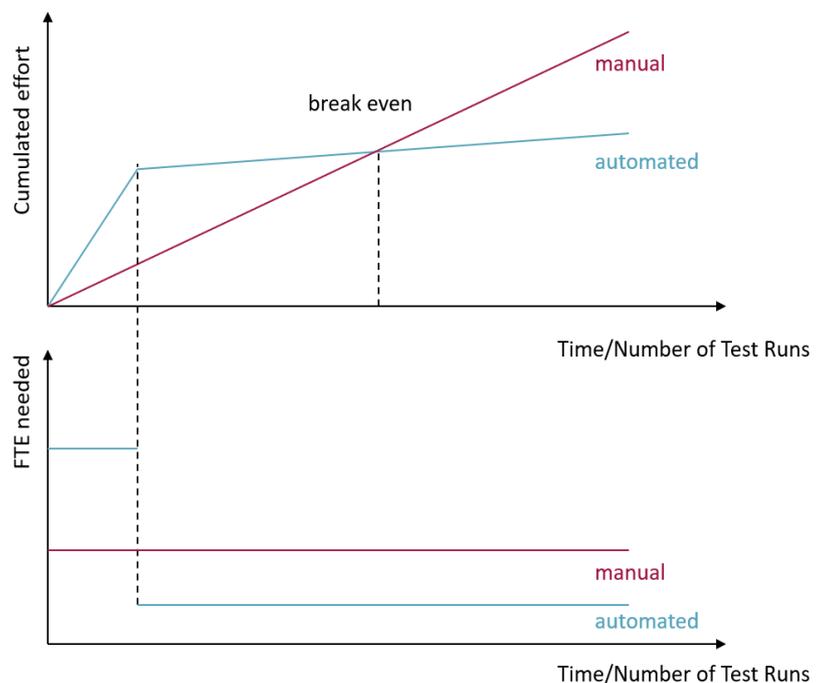
Test Automation – Why and How?

Testing is essential for success in development and operation of software applications. This is common sense but in many cases the magic triangle of project management and general cost reduction schemes interfere here. So project managers and application managers may be seduced to neglect testing in order to fulfil budget constraints. Automation is one of the ideas for escaping from this dilemma. But how to do this and how to avoid the pitfalls?

An article from Dr. Stefan Jobst

Benefits of test automation

- ▶ Reduction of manual test capacities
- ▶ Reliable and consistent execution of test cases
- ▶ Independency from office hours
- ▶ Frequent execution of test cases



Not only cost but also considerations on hidden efforts trigger questions on more efficient testing. A typical trigger for thinking about introducing test automation is that domain experts or heavy users are recruited for testing and their capacity is missing in the business process. In this case we apply our well-tried, proven and successful approach which will be illustrated in the following paragraphs.

Suite of test cases

As a first step we focus on the test case portfolio. Target here is to arrange a repository with well documented and prioritized test cases, which is highly complete and redundancy-free. Dependent on the initial situation a suitable set of actions has to be designed in order to achieve this goal. Examples are

- identifying test basis and relevant stakeholders from business and technology
- conducting workshops for risk-based identification of the relevant test cases
- finding out and defining the right place and form for documentation of test cases
- setting up guidelines and templates for test case documentation
- training domain experts in test case creation methods

Automation tool

Second we concern ourselves on technology and tools which should be used for test automation. Goal here is to find out the most efficient way for doing test automation considering cost and effort. Actions here are typically

- doing a market research and setting up a list of relevant tools
- comparing functional capabilities, license cost and support promise
- identifying the technical skills of the internal staff

The outcome of these actions will be a well argued decision for the most suitable tool.

Technical framework

In a third step we work out a test automation framework which saves us from ending in maintenance hell. Actions for setting up the framework are

- defining the overarching principles for structuring the test cases, derived from business needs
- setting up guidelines for the design of test automation code
- building up libraries of reusable test case components

Automation process

Beside the technical framework also the test au-

tomation process has to be addressed. Usually in this context we concentrate on following actions:

- Defining the role of test automation engineers within the project/product team
- Finding the right domain experts and assigning test automation engineers
- Setting up regular meetings with domain experts for test case clarification
- Ensuring information flow between software developers and test automation engineers

These preliminary steps are essential and have to be elaborated to high extent. Otherwise test automation will be moribund and no gains will be received from the invest because test efforts are still comparable to manual testing.

After all these preparations regular automated testing can start. Test automation experts change between test case implementation, execution and maintenance while continuously improving the automation framework and processes.

Summary

Critical success factors for gaining the benefits of test automation (see figure 1) are

- risk based approach for defining the collection of automated test cases
- cooperative interface between domain experts and test automation staff
- tight integration of test automation engineers in the software development process



Dr. Stefan Jobst
Head of Test Consulting
Munich – msg systems
Company



Detailed information in the techL profile:
[msg systems](https://www.msg-systems.com)

Solving the Cloud Innovator's Data Dilemma

Today, big tech challengers are disrupting every industry. At the same time, startups leverage the Global-scale technology platforms they provide to rapidly build new software-enabled business models to take on the World. Against that backdrop, how confident are you about delivering your digital innovation strategy to stay ahead — before they reshape your industry? If not, will you be able to execute fast enough to keep up?

An article from Emel Rehberg

Do you feel the need for DevOps Data Speed?

The evidence shows that leading enterprises like yours need help fully adopting DevOps to speed up modernisation and time to market with new applications and digital experiences. Deep-rooted concerns about breaching privacy compliance laws, cyberattacks and insider data exfiltration force them to limit access to high-quality data for strategic and mission-critical projects. Indeed, although during the pandemic, McKinsey found that it took 23 days to migrate some assets to the cloud —truly harnessing the benefits remains an onerous high-risk undertaking— as simply lifting and shifting preserved upstream and downstream data dependencies.

Today, technology teams routinely automate servers, storage, networks and code, but patchy, disconnected, manual Test Data Management cannot safely extract privacy-compliant data from a multi-generational stack. This impacts many important use cases. For example, businesses operating on ERP systems such as SAP, Capital Markets or Insurance platforms like Murex or Guidewire need to collaborate with Global Systems Integrators to harden the core and develop applications. But too often, these data compliance, security and delivery obstacles stand in the way of completing those projects.

Top bank harnesses cloud for scale and speed

Shortens time to market to lead in digital payments

As a result, many well-established enterprises continue reinforcing old business models rather than accelerating innovation — which should be the point of cloud adoption. One could argue that simply easing CapEx and OpEx pressures qualifies as a win in the current economic climate. However, how can a leading global business mitigate such wide-ranging and onerous data risks and drive an ambitious digital business strategy?

This customer story illustrates the challenges and opportunities. Two years ago, the CEO of one of the World's leading banks told a CNBC panel that he expected brutal competition, particularly in electronic payments — and had asked his leadership team to keep a close eye on software giants and Fintechs. Since then, a 30% hike in technology spending has boosted digital payment innovations and helped embrace the cloud to accelerate next-gen customer experiences.

Delphix has worked with this organisation on several projects over the years. Initially, infrastructure teams sought to reduce the enormous CapEx and OpEx for Storage Area Networking for test data. While successfully piloting Delphix, they

quickly discovered they could leverage our platform to dramatically speed up new digital payments and CX by automating safe data delivery for Dev/Test.

"... the importance of software testing throughout the development cycle was crucial to achieving our goals. Partnering with Delphix enabled us to virtualise our test data infrastructure. All our non-prod environments are now on Delphix, and provisioning environments for every release takes less than 20 minutes per environment vs weeks before."

Before Delphix, provisioning sandbox data took at least 15 days — slowing everything down and forcing reliance on five-year-old data to test transactions. With Delphix, they continuously and non-disruptively sync data from a multi-generational stack to quickly test modernised applications, de-risk data movement, and achieve CI/CD across the multi-cloud.

The continuous flow of safe data into sandboxes enables developers and testers to quickly leverage ephemeral test runs to knit different products together — ensuring first-class services and client experiences anywhere. Automating safe data delivery across clouds helps tap into huge datasets to improve strategic offerings while infrastructure teams achieve CapEx and OpEx objectives and improve environment utilisation 10x — reducing cost and benefitting the planet.

DATA is the Last Automation Frontier

Finally, Delphix's DevOps data platform speeds up forward-thinking digital innovation strategy. For example, when a leading global sportswear brand needed to move SAP ECC to the cloud to gain the flexibility to build a new eCommerce platform, Delphix scrambled all sensitive data. Our DevOps Data platform safely synced production data copies to the cloud, and rebuilt non-prod environ-

ments virtually to ensure sensitive data was not exposed. The company achieved 100% PCI compliance and maintained referential integrity across SAP and downstream non-SAP while accelerating migration to AWS & Microsoft Azure by 90%. Successful transformation from wholesale to "direct-to-consumer" in two years — boosted revenue from \$5Bn to \$37Bn within 5 years.

That's what's possible when you automate the entire DevOps process, including the data, with Delphix. We help balance speed with data security and compliance to modernise faster, adopt multi-cloud, achieve CI/CD, and recover from downtime events such as ransomware twice as fast.

Join [the GFFT Use Case Award to explore the legacy migration into multi-cloud with Delphix on April 18th at 4PM.](#)



Emel Rehberg
Regional Sales Manager
Company: Delphix Software Limited



Detailed information in the techL profile:
[Delphix](#)



5

Applicable Use Cases & Success Stories

Often, progress is generated by using new technologies and/or adopting the experiences of others.

The task of the leading technology providers and new startups is to simplify cost-intensive processes or solve upcoming challenges with new tools. They usually invest a lot of money analyzing the problem areas and thinking about feasible solutions with initial customers.

The task of consulting companies is to look at the companies' current processes and introduce helpful changes. The use of appropriate tools can accompany this task.

In both cases, a lot of know-how can be used to make rapid progress. This chapter presents several use cases and success stories that may serve as an impetus. The contact persons named in each case are happy to discuss your challenges. Just get in touch with them!



All projects can be found in the
Software Lab

www.software-innovations.eu

Test Data Cockpit for SAP

An article from Tim Tobias

Description of the Solution

Using the Test Data Cockpit (TDC) production data can easily and selectively be transferred, duplicated and anonymized on test and development systems in order to find, analyse and correct errors. Furthermore, TDC makes it possible to create data set libraries by capturing and freezing data that can then be automatically regenerated during test cycles. The data library functionality is compatible with common test automation tools such as Tosca by Tricentis and Unified Functional Testing (UFT) from Micro Focus as well as other tools available on the market.

Use Cases

The common uses for TDC from which our customers have benefited over the years are (1) selective data transfer allowing the user to copy complex data constellations from production systems into test systems for analysis and problem resolution (2) creation and duplication of data for use during test execution and training as well as load and performance tests (3) saving of data enabling repeated refreshing of data for test automation as well as the recreation of data subsequent to full system copies (4) copying of data in bulk to create quality assurance systems with reduced amounts of data.

Real Life Application

TDC is a seasoned and reputable tool that has been on the market since 2011 and is currently in use by 13 existing customers in Germany, Austria and Finland. Each of these clients benefit from the above-mentioned use cases, but perhaps the greatest benefit is in test automatization. When conducting recurring tests, companies are faced with the challenge of creating suitable data for their test automation purposes. TDC has proven itself as a leading solution for this challenge that allows organizations to use pre-existing production or quality assurance data as well as create test data that can then be saved

and reused.

Because of TDC's flexible and simple integration with common test automation tools, the way that the solution is unified with test automation has varied widely. As was the case for our customer in Cologne using oDATA services to intersect with TDC and reset SAP business partner data as it tested new webservices. Or our customer in Salzburg that used TDC in concert with UFT to reset master data and delete newly created smart meters during the ramp up for their meter to cash process. Over the years TDC has proven itself as a flexible and powerful tool that can support test automation efforts with targeted and reusable SAP data.

Target Clients

TDC's application is not limited to any one industry and is beneficial for mid-sized to large corporations who have test data needs within their SAP environments. Supported SAP modules include MM, SD, PM, FI, CO, HRM, IS-U and CRM, but the tool can be easily configured for further SAP modules as well as customer-specific tables.



Tim Tobias,
Principal Consultant,
TDC Product Owner,
ENERGY4U GmbH



Detailed information in the techL profile:

[Atos](#)

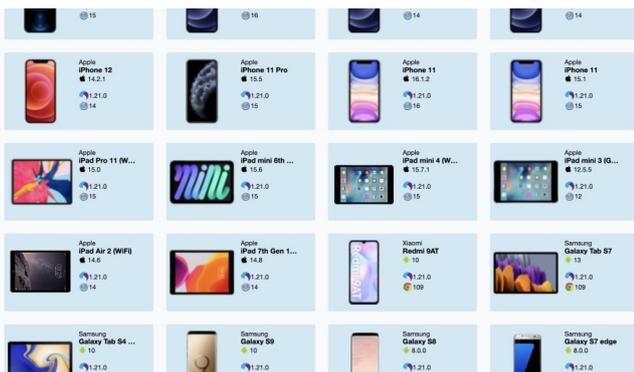
Test infrastructure as a Service - Made in Germany

An article from Dr. Valentin Dallmeier

Testfabrik is a German provider of innovative web and mobile app testing products. Starting as a university spin-off in 2013, we have become one of the market leaders for enterprise software testing solutions in the DACH region. Testfabrik helps large enterprises, such as Atruvia, Allianz, R+V, or Generali, boost tester and developer productivity with scalable and robust testing infrastructure and smart test automation solutions.

Technology

Testfabrik's software quality platform "webmate" provides desktop and mobile testing infrastructure for manual and automated testing. Hundreds of real mobile devices and virtual machines (Windows and Mac) are available on-demand and can be accessed in seconds. Our customers can choose from a large, shared device pool or dedicated devices exclusively accessible to them. It is also possible to host the hardware on customers' premises. Testfabrik operates all devices and services in Germany.



Manual Testers' Assistant

Manual testers can use the webmate testing infrastructure remotely from their browsers. Gestures are entered using mouse and keyboard and hardware interfaces, such as GPS, camera, or biometric sensors, can be simulated.

In webmate, the tester can choose from various tools that simplify testing, e.g., creating temporary e-mail addresses, taking native screenshots

and videos, or documenting defects.

End-to-End Test Automation Platform

Integrating the webmate testing infrastructure into existing CI/CD pipelines is easy. The platform can be used with most test automation frameworks, such as Selenium, Appium, webdriver.io, Puppeteer, Playwright, Cypress, Espresso, or XCUITest. On top of that, the webmate API and SDKs provide advanced functions to test engineers, such as visual regression testing, creating full-page screenshots, or e-mail validation.

Low-Code and No-Code Testing Solutions

Non-technical users may use webmate's low- and no-code features to automate repetitive or onerous testing tasks. For instance, webmate easily automates finding layout differences between two versions of web applications or mobile apps.

Benefits for the user

Replicating the environment of an end-user is as important for an automated end-to-end test as it is for a manual tester who checks a website or mobile app. In both situations, using real devices is crucial, and local, physical hardware may not be an option, e.g., due to limitations in the data center or when working from home. Having a centralized, remote-accessible, flexibly billed test infrastructure therefore saves time and money.

At the same time, test automation engineers may not be readily available, in which case low-code and no-code tools offer an attractive alternative.



Dr. Valentin Dallmeier,
CEO,
Testfabrik AG



Detailed information in the [techL profile: Testfabrik](#)

A solution to monetize and sell digital products B2B

An article from Frederic Ebelshäuser

Yatta Checkout - From idea to packaged product

The transition from science and technology to a marketable product and then moving on to actual sales is crucial. This is true for startups, SMEs, corporate spin-offs, and multi-national enterprises alike. The key to success for digital vendors in today's markets is not only the product or solution as such but providing the best user experience up to the point of sale—and beyond.

If you picture not just the iPhone but how Apple presented, packaged, and sold it around the globe—this is what we are going to talk about. Just for b2b and focused on digital products and services. So, let us introduce Yatta Checkout to you.

What is Yatta Checkout?

Yatta Checkout is an all-in-one ecommerce solution built to help vendors monetize and sell digital products.

Its purpose is (i) to enable software vendors, tech startups and digital creatives to get into the market fast—we mean really *fast and* (ii) to improve the conversion and retention rates of digital products. It streamlines every aspect of the user experience from registration to (paid) usage.

Yatta Checkout includes:

- Identity and access management (IAM) to register customers and users—and so help digital creators generate leads and build a global user community;
- Checkouts, i.e. the online shopping system with the basket and the ordering system, which can be integrated easily into the vendor's website(s)—or directly into their software application;
- Licensing with the matching EULA toolbox to provide vendors with the legal and technical framework they need to offer subscriptions, one-time purchases, trials, and more—worldwide;

- Payment processing to enable users around the globe to make secure payments easily —while also ensuring vendors get paid fast and in the currency of their choice;
- Fully automated invoicing and billing, including sales tax and VAT, adapted to every vendor's corporate design;
- Digital fulfillment that provides all customers and users secure access to the software, digital goods, assets, services, rights and licenses purchased via Yatta Checkout.

The screenshot displays the Productify checkout process. At the top, the Productify logo is shown next to the text 'Productify Single user license · monthly subscription by Primattech'. Below this, the 'Select payment method' section shows a VISA card with the number '**** 1337', the name 'Hiro Nakamura', and an expiration date of '03/2030'. The 'Billing information' section lists 'Hiro Nakamura, Blue Company SE, Trebbiner Str. 9, 10963 Berlin, Germany' and provides the email 'billing@bluecompany.com' and VAT ID 'DE 263191529'. A summary table shows the subtotal as € 20.00, 19% VAT as € 3.80, and the total including VAT as € 23.80. A prominent purple 'Subscribe now' button is located below the summary. At the bottom, there are links for 'Terms', 'Privacy', and 'Legal notice', and a note 'powered by Yatta' with the Yatta logo.

The idea behind Yatta Checkout is to provide vendors with everything they need to monetize and sell digital products globally. And the best thing about it: It can be integrated within 45 minutes as it is a low-code platform now. We hope this helps developers and creatives in b2b to focus on what matters most: building better and more digital solutions.

In short, we enable digital vendors to go above and beyond—by helping end users try, buy and use their products.



Frederic Ebelshäuser,
Co-Head of Yatta Checkout



Detailed information in the techL profile:

[Yatta Solutions](#)



6

New Technologies

Generally speaking, startups are a good measure of the innovative strength of the respective region. The more successful startups are founded, the more dynamic and competitive the innovation location is. Dynamic economic areas tend to attract more highly qualified entrepreneurs and employees, increasing the region's prosperity.

In the subject areas surrounding enterprise IT, startups also strengthen the competitive power of companies.

A high level of dynamism means that potential can be exploited more quickly with new solutions. It would be a great advantage for the local economic area to have its own strong software startup scene. This not only requires funding from the state and venture capitalists but also strong utilization of the solutions developed here among the many companies.



All information about the

German Startup Cup

www.united-innovations.eu/startup-pokal

Queryella

An article from Dr.-Ing. Leonid Glanz

Our private and professional communication vastly takes place in the digital world. We use our smartphones and many apps, generating more and more data daily. Some of this data can be intercepted by third parties and used for unauthorized purposes. We at Queryella aim to protect data from misuse by scanning apps for potential security or privacy issues. This goal is achieved by providing an unprecedented depth of analysis.

Solution

Queryella provides an automated analytics platform that leverages the latest research in security and privacy. It combines static and dynamic analysis using artificial intelligence to identify IT security issues or potentially sensitive data leaks in binary files.

Meta Data Analysis

In the first step, our platform analyzes an app's metadata to identify its starting points, permissions, input types, activities, services, and various interaction options. Subsequently, the essential information from the metadata is used to check whether it is consistent with the stated privacy policy. This check is automated using AI support

to enable matching of the privacy declaration and the information from the app.

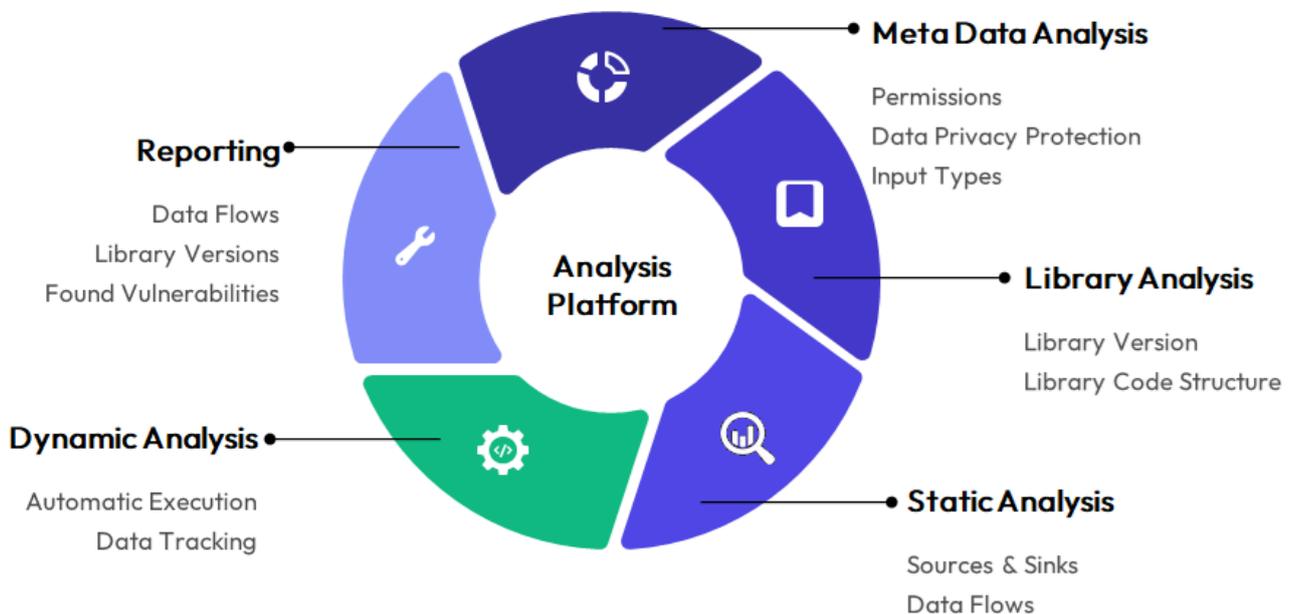
Library Analysis

Our platform avoids having to analyze all components in each app multiple times because the app is analyzed for known dependencies and their versions. These dependencies are matched against known vulnerability databases to identify potentially harmful or outdated ones. In the future, this analysis can also be used to check whether all used dependencies have been listed in the bill of materials (SBOM). Due to our long experience in code structure analysis, we can detect even obfuscated libraries. Furthermore, the detected libraries are compared with a database of sensitive data flows created by us, thus enabling faster data flow detection.

Static Analysis

Our static analysis identifies individual vulnerabilities and traces their static reachability from a starting point. However, the heart of our static analysis is the identification of sources and sinks of sensitive data and their data flow. This analysis also involves tracking whether the code can be reached from a starting point to reduce the number of false positives. The identification of sources and sinks is supported by AI so that our platform can investigate for each API version all new sources and sinks.

Image credits: TU Darmstadt



Dynamic Analysis

The dynamic analysis executes apps using AI support to trigger different events. During the execution, our platform tracks various data points to analyze the behavior of known advertising libraries or other data communications. Using dynamic analysis, the user can identify further information about data breaches and potential vulnerabilities. The platform will allow mapping different app scenarios in the future, as some apps show other behavior depending on the usage scenario.

Combining Static & Dynamic Analysis

Since a static analysis does not execute apps, many characteristics of the app behavior need to be over-approximated and can thus lead to false assumptions in the results. Dynamic analyses execute only individual paths through the app so that not all paths are covered, and some weaknesses can be missed. Combining static and dynamic analyses compensates for their weaknesses and leads to more accurate results.

For example, specific data flows are identified statically and then executed dynamically to analyze the flow more accurately. In doing so, our platform can deliver reliable results even when common measures have been used that prevent the analysis. This feature is enabled by identifying critical points or hidden data in the code, capturing the contextual information of those points, generating missing information, and bringing the collected code paths to execution. Critical points are identified using a machine learning model trained to recognize anomalies in the data.

Reporting

All analyses can be customized to meet individual customer needs. In doing so, our platform provides a user-friendly and intuitive interface that allows our customers to quickly and easily understand the results of the analyses. This characteristic allows them to respond quickly to identified security issues and take the appropriate action to protect their data and business interests. Our platform can be used for individual apps and large portfolios, making it scalable to any size. It also allows users to continuously monitor their apps so that new security vulnerabilities can be

identified directly. With the different analysis techniques, we enable a more accurate assessment of critical risks and thus reduce the effort for security analysts to deal with irrelevant information generated by common open-source analysis tools.

Company

Queryella is a startup that evolved from a team of researchers at TU Darmstadt, Germany. Through extensive expertise in code analysis, IT security, and data protection, we are continuously improving our technologies and solutions and adapting to the ever-changing security situation of our customers.

We are actively searching for collaboration partners to expand our platform for the secure future of apps. If you would like to learn more about us and how we can help to improve the security and privacy of your mobile apps, feel free to contact us. More information at: www.queryella.de



Dr.-Ing. Leonid Glanz
Head of Research & Development at Queryella
TU Darmstadt



Detailed information in the techL profile:

[Queryella](#)

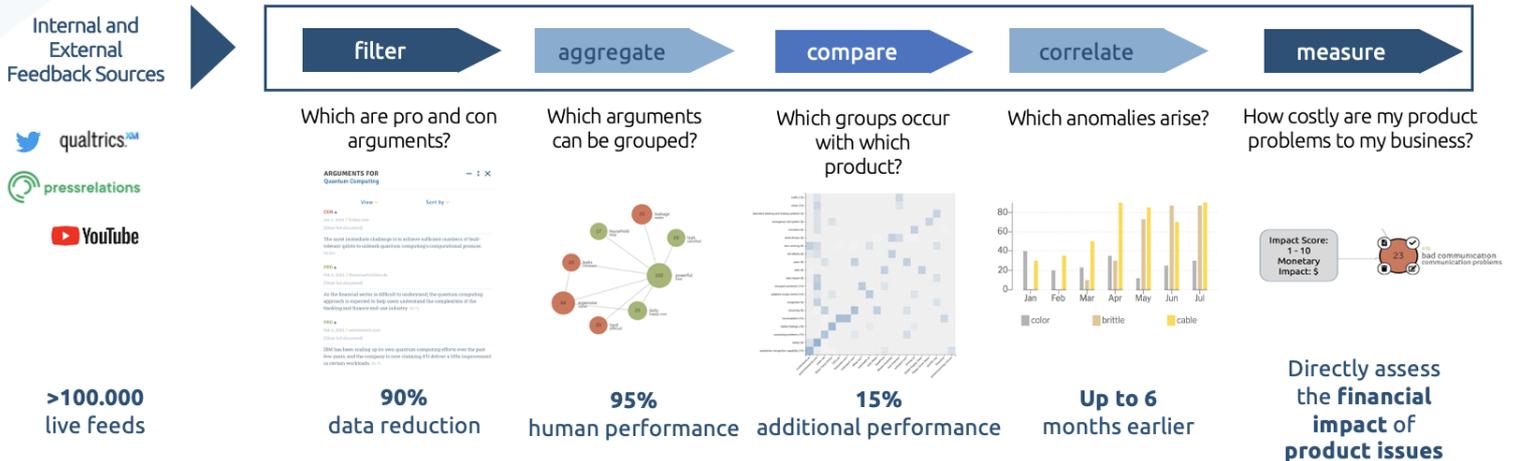
Find the relevant information in a rising flood of data!

In an ever-growing world full of data, how do we get exactly the information that is relevant to us?

An article from Erik Kaiser



Summetix Analytics Pipeline



»In a World that is flooded with Data, access to the relevant pieces of information is essential.«
We have seen this as our task and have created a way to solve exactly this enormously growing problem with summetix.

We as summetix are an innovative start-up, which emerged from a research group of the Technical University of Darmstadt. We have developed a solution that structures valuable statements and information in such a way that relevant ones are filtered out.

Global networking has revolutionized access to information, so that highly topical statements on almost all topics and areas of life can now be found in unstructured sources of information such as social media. While the technical restrictions on access are constantly decreasing, the lack of possibilities for evaluating this information is preventing its actual added value. At the same time, the fast pace of the modern information society continues to increase, so that decisions have to be made in ever shorter time. The speed of innovation and reaction has become a decisive competi-

tive factor. Outsourcing the evaluation of information to consulting companies and expert committees costs a lot of time and money.

Summetix solves this problem with a completely new approach, which relies on arguments as a carrier of core information for decision processes. In addition to the actual options for action, arguments primarily show the advantages and disadvantages of these options for action and thus allow a qualitative and structured processing of the information found and thus an acceleration and objectification of the decision process.

Our technology automatically extracts arguments from arbitrarily large and heterogeneous information sets so that an extremely broad source base can be taken into account. First, artificial intelligence (deep learning) is used to search arbitrary textual sources for arguments on desired topics.

In the next step, these are sorted according to relevance and orientation (pro or con) before an aggregation (clustering) of the identified arguments is created, also fully automatically, in which similar and redundant arguments are grouped together and given a short pregnant title. In addition, based on the behavioral patterns of customers, we can predict to what extent a particular product problem will lead to customer disengagement.

Particularly in large companies in the pharmaceutical, consumer goods and automotive industries, a great deal of customer feedback is generated, which is often not evaluated at all or is evaluated manually at great expense. Until now, this has led to important information from the stream of customer feedback being captured too late or not at all. The core technologies of summetix make it possible to gain deeper insights into customer feedback by means of artificial intelligence and to detect product problems and assess their consequences 6 months earlier than before.

If we have aroused your interest in our technology, we would be happy to present the system in a personal meeting.



Erik Kaiser
Co-Founder, CEO
summetix GmbH



Detailed information in the techL profile:
[summetrix](#)

devmate Testcode Generator

An article from Johannes Bergsmann

About Automated Software Testing GmbH
 Automated Software Testing GmbH is a small deep-tech startup in Upper Austria, founded in 2019 and developing the devmate product family.

The startup's goal is to develop innovative tools and frameworks that enable test automation within system and software development projects more efficiently and with better quality. Currently, an EU-funded research project is being carried out that deals with the use of AI techniques for generating test cases and test data. In addition to pure tool development, consulting and training on the state of the art in unit test creation and test-driven development is also offered.

Technology

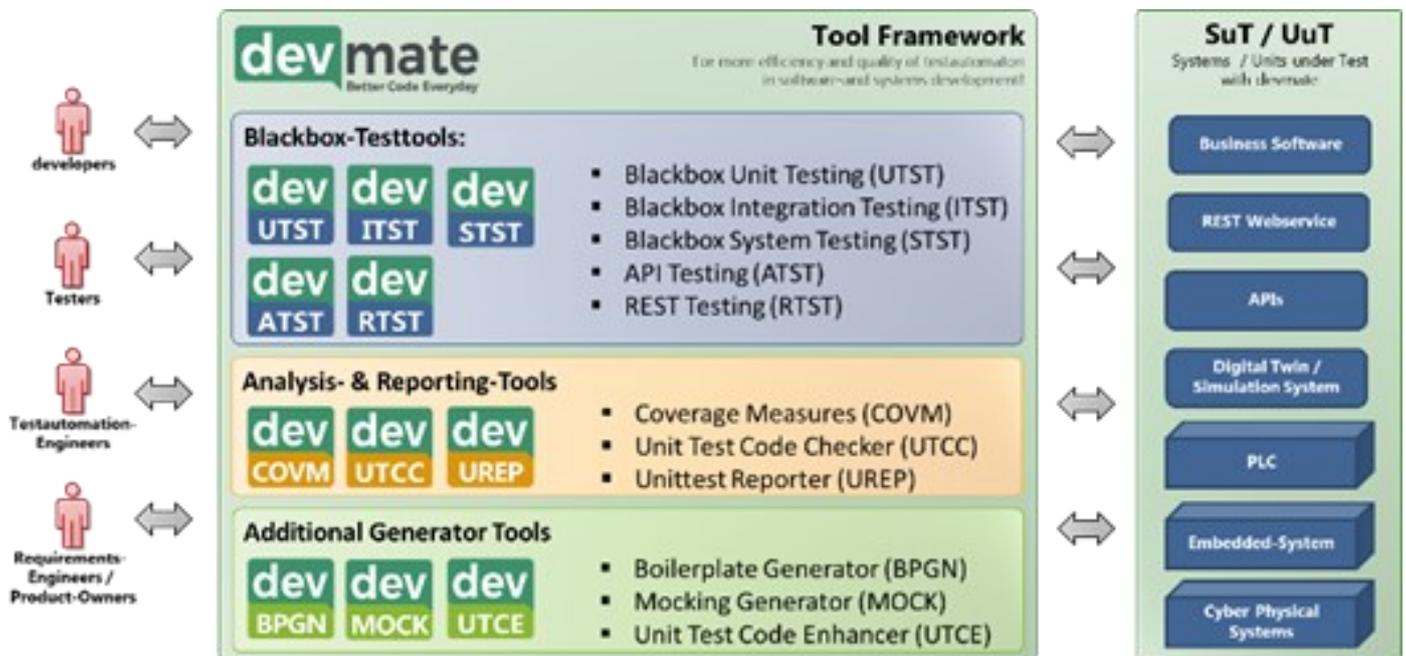
The devmate tool suite comprises the subcomponents shown in the figure, which can be used individually or integrated. Currently the development environments Visual Studio, IntelliJ and prototypically also Eclipse and Visual Studio Code

are supported as well as the programming languages Java, C# and C. Due to the flexible web service-based architecture of the framework, the implementation and integration of further languages and IDEs is easily possible. In the AI area, an equivalence class and test data prediction system based on supervised learning was implemented. Test case optimization based on genetic algorithms and automatic generation of test data based on a language-based AI system have already been successfully prototyped in internal research.

The current version of devmate supports both unit and integration testing. System test support will also be offered in the future.

Benefits for users

- devmate supports test automation for all blackbox domains & systems (units, functions, software, API, web service, PLC, embedded system, etc.) and within all test levels (unit, integration, system level).
- devmate uses AI techniques based on externally available data or even user data that is voluntarily shared and collected to improve test data and test case quality and



increase the speed and efficiency of test data and test case creation.

- Developers and test automators are supported by automatically creating test case combinations as well as automatically generating the source code for most unit and integration tests, which can then be reused (e.g. checked into the repository or included in the Continuous Integration pipeline) as desired.
- devmate uses ONE automated test runner for all test stages (no need for other frameworks)
- devmate can be used by different roles interested in automated testing (developer, tester, requirements engineer, product owner, etc.).
- devmatebridges the gap between multiple test automation requirements, roles and levels.



Johannes Bergsmann,
CTO und Product Manager,
Automated Software Testing GmbH



Detailed information in the techL profile:
[Automated Software Testing](#)

Learn more about *devmate* and testautomation and join the [GFFT Insights Test-Track on April 5th at 3:30PM.](#)

Kenbun

An article from Georg Miller

Voice Assistants for more comfort

We are an AI startup (est. 2018) from Karlsruhe, Germany. As Experts for digital voice assistants and AI, we support your digital transformation. Our mission is to give you access to modern AI and develop custom-fit voice-controlled systems to accelerate and simplify your work processes.

Technology

With our self-developed speech toolkit KIDOU, we create intelligent voice assistants for companies in industry, medicine, sales and management. In addition to voice assistants, our portfolio includes the development of Deep Learning and Big Data solutions.

Benefit for the user



Voice assistants provide support for unpopular and time-consuming work tasks such as documentation, e.g., recording patient data, inspections results or pre- and post-processing customer calls in sales. They are easy to use and can be used on any devices such as laptops, tablets and smartphones. Depending on the use case, voice assistants can be used in many industries, whether in medical and nursing professions, industry or sales, to name just a few use cases.

Natural interaction with voice not only makes life easier and more convenient, but in the corporate world it increases sales and saves costs and time. Increasingly, voice assistance systems are being used in companies and they are benefiting from

the potential of voice-driven AI technology. Speeding up and simplifying work processes is one of the biggest desires of employees and customers.

- Handsfree
- Time and cost savings
- No more interruptions
- No manual keystrokes
- Direct entry into the customer system

KIDOU can be integrated in almost every environment. For customer that require the highest standards of data protection KIDOU can also be deployed on their own servers (On-Premise) and thereby ensuring that non of their data is ever handled by an outside system guaranteeing extra safety for health and highly sensitive data.

- Sales-Assistant
- Inspection-Assistant
- Health-Assistant



Georg Miller,
Sales & Business Development,
KENBUN



Detailed information in the techL profile:
[Kenbun](#)



7

Survey of Technologies

At regular intervals, we ask the experts for building blocks that they currently need. By far, the most frequent response is the desire for tool research for a specific topic. Our team has therefore been expanded to include young students, for whom tool research is a good additional element of their education. In this chapter, you will find a collection of technologies that we think deserve your interest.

Only a short outline of the product is presented. The attached link leads directly to the product datasheet in our techL-database, where more detailed information and contact persons can be found.



All innovations be found in the
technology database

techL

www.techl.eu

7 Survey of Technologies

AI-powered AML/CFT Platform

Hawk AI is a software platform that uses AI to monitor financial transactions in real-time, delivering next generation anti-money laundering compliance for financial institutions. The solution offers classic rule-based models, which are enhanced by auto-closing features based on machine learning models that learn from the investigator's own decisions.

Hawk AI makes use of unsupervised machine learning model, Anomaly Detection in specific, to identify new patterns of crime, deriving insights from the overarching nature of the platform spanning multiple financial institutions.



Bitahoy Watchdog

We believe that smart home users should no longer be faced with the choice between comfort and security. That's why we at Bitahoy are committed to protecting your privacy where you should feel most secure: in your home.

Ready-to-use interfaces to other tools and systems:

The watchdog is accompanied by an easy to use and intuitive App to monitor your home network traffic. The App can be used to get insight into your network and configure additional functionalities.



Asvin

asvin provides a solution to distribute updates safe and secure over the air to IoT devices. asvin is using de-centralized technologies to provide a resilient and secure update solutions for devices during their lifecycle. By asvin the security state of devices can be monitored and reports on threat landscapes can be generated.



CodeShield

CodeShield empowers software developers to build secure software and integrates seemingly into the software development process. Based on new research technologies, CodeShield detects known and yet unknown vulnerabilities. CodeShield does not only scan the application code but also included third-party libraries.



Delphix Software Limited

Delphix is the industry leader for DevOps test data management. Businesses need to transform application delivery but struggle to balance speed with data security and compliance. Our DevOps Data Platform automates data security, while rapidly deploying test data to accelerate application releases. With Delphix, customers modernize applications, adopt multi-cloud, achieve CI/CD, and recover from downtime events such as ransomware up to 2x faster. Leading companies, including BNP Paribas, Michelin, Choice Hotels, Banco Carrefour, and Fannie Mae, use Delphix to accelerate digital transformation and enable zero trust data management.



Microstrategy

MicroStrategy is the largest independent publicly-traded business intelligence company, with the leading enterprise analytics platform. Our vision is to enable Intelligence Everywhere™. MicroStrategy provides modern analytics on an open, comprehensive enterprise platform used by many of the world's most admired brands in the Fortune Global 500. Optimized for cloud and on-premises deployments, the platform features HyperIntelligence, a breakthrough technology that overlays actionable enterprise data on popular business applications to help users make smarter, faster decisions.

imbus AG

Softwarequalität ist die Mission der imbus AG. Seit 1992 steht das erfahrene und hochqualifizierte Team von imbus für Software-Qualitätssicherung und Softwaretest. Die Expertise aus über 9.000 erfolgreichen Projekten bildet die solide Grundlage für die tägliche Arbeit unserer Experten, allesamt mindestens ISTQB® Certified Tester Foundation Level. imbus bietet ein umfangreiches Spektrum an Testing Services und Testautomatisierungstechnologien an, die auch spezifische Themenbereiche wie z.B. Security-, Last- und Performance-, Embedded-Systeme sowie AI-Testing abdecken, und hat darüberhinaus ein Testmanagement-Tool, die imbus TestBench, entwickelt.



Lobster DATA GmbH

User-friendly software adapts. Both to the specific requirements of its users and to changes in technology, economy and society. Lobster has been translating this expectation into scalable digital solutions since 2002 with three no-code based software products and an innovative logistics platform: (1) Lobster_data as middleware between internal and external systems, cloud applications, and data warehouses, (2) Lobster_pro for seamless automation of business processes, (3) Lobster_pim for fluid product communication and (4) logistics.cloud as a neutral cloud-based platform for logistics. Our goal: to connect people, systems, things - everything to everything. Simple. Secure. Scalable.



Sixsentix Deutschland GmbH

IT Consulting and services specializing in Software Testing and QA across all industries. Delivering consulting and IT services projects in topics such as Test Strategy and IT Process Improvement, Test Automation, Test Factory/Test Center organisation, Nearshore test services delivery, Test Data and Environment Management and related areas.



Summetix

summetix (formerly known as ArgumenText) uses Argument Mining to discover hidden insights in your customer's feedback and to monitor and discover tech and innovation trends. summetix GmbH is a Spin-Off of the Ubiquitous Knowledge Processing (UKP) Lab at the Technische Universität Darmstadt.



SPIRIT-TESTING Software & Services GmbH

SPIRIT-TESTING and SPIRIT-ONSIDE are agile consulting companies with a specialisation in agile software quality assurance and development. SPIRIT-TESTING is your solution partner for agile test automation and sustainable test management. With the testOFFICE solution, you can optimally manage your test processes on one platform with reusable modules and automate test cases without programming knowledge. Further advantages of testOFFICE are the clear structure from test planning to reporting, an increase in efficiency of the test process as well as possibilities for integration into your IT landscape. SPIRIT-ONSIDE advises on all questions of agile software quality assurance or you can outsource your test process to our SPIRIT teams.



Worksoft

Designed for the complex enterprise, Worksoft employs a closed-loop approach to intelligent automation, creating unprecedented value from one cohesive automation platform for both pre- and post-production environments. With Worksoft, automation assets are no longer siloed between disparate systems and solutions. Instead, automation can be created, shared, and repurposed to understand, optimize, and run your business processes—all from a single platform. As a result, the Worksoft Connective Automation Platform delivers game-changing process insights, unmatched scalability, and exponential ROI growth potential by connecting process intelligence, testing and robotic process automation.

