Survey of Tools for Software Engineering

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German Startup-Cup

Categories Cybersecurity and AI & Software

Date: Tuesday, 2nd July
Location: Mannheim, Germany

PHOENIX group

www.united-innovations.eu/startup-cup/Security-AI-Software

EDITORIAL

Dr. Gerd Große

Dear readers,

ChatGPT is now 15 months old and yet texts like this foreword are still written by humans. ChatGPT can do a lot, effectively helping to find ideas or the right wording, but it cannot replace the human being who has to check the finished text for accuracy. This also applies to compliance instructions, guidelines, strategy papers or software programmes. The euphoria is followed by noticeable disillusionment . And yet many are still wondering whether we will be needed in the long term or whether AI will replace us.

In my opinion, neither is the case. I would compare the introduction of the new AI processes more to an e-bike. You still have to steer and pedal, but ChatGPT or the electric motor makes many activities easier and faster.

In IT, the introduction of GenerativeAI tools could significantly change the implementation of software projects. Less complex programming tasks might no longer have to be processed via near- or offshoring, but could be automated. Complex tasks such as requirements analyses would be carried out locally in close coordination with the specialist departments. This increases the need for highly trained process and IT experts.

For relatively rich countries such as Germany, whose corporations have often had software work programmed abroad for cost reasons and which have not built up any significant tool manufacturers, this change can also present an opportunity.

It is important to consider which new IT tools are required for the changed software development process and which consulting competences will soon be in demand. In this respect, all IT companies are back at a new starting line and can try to be at the forefront this time.

Of course, politicians can also recognise this situation and invest their funding in this area. The USA and its Inflation Reduction Act can serve as a model here. The reaction here of regarding such an economic programme as foul play and calling for a referee may be due to a certain lethargy. A good counter-offensive in the software sector would make more sense.

I therefore call on you to see these exciting and difficult times as an opportunity and to prepare well for the future now. I hope you enjoy reading this issue. Please feel free to share the articles and help us grow as a network and drive innovation forward.

Best regards,

Dr. Gerd Große

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

CONTENT

CALENDAR

13/03/2024 15:30-17:30	**Insights: Strategies for testing AI-based software systems (german)** Info & Registration
24/04/2024 15:30-17:30	**Insights: The challenge of DevOps, DevSecOps and BizOps (german)** Info & Registration
19/06/2024 15:30-17:30	**Insights: Transformation to the data-driven enterprise (german)** Info & Registration
12/06/2024 15:30-17:30	**Insights: Project for the introduction of AI (german)** Info & Registration
26/06/2024 15:30-17:30	**GFFT consortium project: Strategies for sustainable test data management (german)** Info & Registration

If you are interested in participating in a workshop or event, please send us an email to info@software-innovations.eu. You will then receive the dial-in data.

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

United Innovations GFFT PHOENIX group

Highlight Event

Final German Startup Cup Cybersecurity + AI & Software

Date: July 2, 2024
Location: PHOENIX Group, Pfingstweidstraße 10-12, 68199 Mannheim, Germany
Event Type: Full-day in-person event

Join us at the annual GFFT Symposium for the grand finale of the German Startup Cup and the Use Case Award in Cybersecurity and AI & Software categories. This prestigious event showcases the pinnacle of innovation, recognizing outstanding achievements in the tech industry.

Dive into a day filled with high-level panel discussions, inspiring keynotes, and the chance to explore groundbreaking technologies and solutions presented by exhibitors and innovative startups. This symposium serves as a vital platform for discussing current trends and future developments in cybersecurity, artificial intelligence, and software technologies.

The insights gathered here will contribute to a public call for action to bolster our industrial sector. Together, we aim to tackle the challenges ahead and play an active role in the advancement of Germany's economy. We warmly invite you to be part of this initiative, pushing the boundaries of digitalization and discussing IT's critical role in our future.

More Information: For registration details, additional information, and the event agenda, please refer to page 10 in this magazine. Don't miss this opportunity to engage with leaders in the field and shape the trajectory of technological innovation.

United Innovations

Driving European Innovation Forward

United Innovations (UI) is a dynamic force reshaping Europe's innovation landscape. Our mission is to enhance efficiency in large corporations and promote the adoption of cutting-edge methods and technologies. UI focuses on increasing the success rate of new technologies in Europe, bolstering the continent's reputation as a leading innovation hub.

At UI, we emphasize collaboration through our innovation network, enhancing efficiency, quality, and reducing costs. Our partnerships expedite innovation cycles, facilitating the successful launch of new advancements.

Our innovation strategy revolves around identifying innovation needs, assessing current methods and technologies, and establishing effective innovation processes, including the development and implementation of new solutions.

United Innovations invites you to be part of this vibrant evolution in Europe's innovation sector. For more information, visit www.united-innovations.eu or follow UI on LinkedIn.

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GERMAN STARTUP-CUP

Winter symposia on the future of software quality and the future of data-driven software architecture & semi-finals of the German Startup Cup events in the AI & Software category!

The 3 innovative finalists for the final of the German Startup Cup on July 2nd 2024 in the AI & Software category at the Phoenix group in Mannheim have been announced: tonic.ai, UltiHash and AskUI.

In two exciting and well-attended semi-finals, the day's winners Jake Friedenberg from tonic.ai on 5.12.2023 and Tom Lüdersorf from UltiHash on 17.01.2023 prevailed in direct competition with the other startups. As the best runner-up, Jonas Meesklou from AskUI secured third place in the final. All three will be competing for the favor of the expert jury and the expert audience in July.

We would like to thank our dedicated jury of experts: Ulrich Irnich (Vodafone), Martin Bordt (Schweizer Electronic), Prof. Dr. Hürter (Deutz), Andreas Freiherr v. Streit (Siemens Healthineers), Markus Schaal (voestalpine), Michael Kutz (Rewe Group), Sven Schirmer (MaibornWolff), Andreas Günther (Tricentis). With their targeted questions about the startups' business models, they made a significant contribution to the success of the event.

A big thank you also to the three other startups Queryella, ai.ui and Qdrant, who took part in the German Startup Cup and will also be presenting themselves at the final live event in Mannheim with a stand in the Startup Corner.

GERMAN STARTUP-CUP

UNITED INNOVATIONS AWARDS

Register Now

Secure your place now for the exciting symposium on the topic of agile companies and the final of the German Startup Cup in the Cybersecurity and AI & Software categories on July 2 in Mannheim.

The symposium will focus on identifying innovation potential in the areas of cybersecurity as well as AI and software technologies. With top-class panel discussions, for example with Dr. Andreas Nauerz (Bosch Digital) and inspiring keynotes such as Dr. Roland Schütz (Phoenix group) and "Future of AI" by Prof. Dr. Antonio Krüger (DFKI), we offer a platform for discussing the latest trends and developments in these key areas. In addition, numerous exhibitors and innovative start-ups will be presenting pioneering technologies and solutions at their stands.

The insights and impetus gained from the symposium will subsequently be bundled in a public appeal to strengthen the industrial location. As a joint initiative, we will rise to these challenges and actively contribute to the further development of the German economy. We cordially invite you to join us in driving digitalization forward and discussing the essential role of IT.

Click here to register for Final-Event:
https://www.united-innovations.eu//startup-cup/Security-AI-Software

Creativity in code

How AI is writing success stories in marketing agencies beyond ChatGPT, DALL-E & Co

An article by the Ainovate Company

The world of creative agencies is currently experiencing an unprecedented revolution, driven by the transformative power of generative artificial intelligence (GenAI). In this article, we present our three-layered agency solution and provide an exclusive insight into the methodologies behind the scenes of groundbreaking creative agency success stories.

Unlike new applications of generative AI for text and media creation, our approach takes the creative industry to the next level from a completely different angle. We go beyond the boundaries of ChatGPT, DALL-E & Co and use AI as a tool to optimize internal business processes, revolutionizing the way marketing agencies work in a data-driven world.

Our agency solution is more than just a technological milestone. It is a creative pioneer for the future and at the same time a demonstration of the flexibility and simplicity of AI applications. Through targeted individualization, adapted to the specific requirements of each agency, we not only create an optimized way of working, but also increase employee satisfaction. The triad of increased closing, time and cost savings and improved work quality makes our solution an indispensable tool for every modern creative agency.

For us, "creativity in code" not only means the fusion of technology and creativity, but also the basis for the creation of a new era for marketing agencies.

Step 1: Precision marketing through customer data clustering

The basis of our innovation lies in a precise understanding of the target group. By clustering customer data, we can better group and understand

both potential customers and existing customers. This makes advertising more specific and targeted in hot and cold calls, because good advertising is only really good if it does not miss its target group. The best part is that no agency employee needs to be trained for AI or coding for this and it works across all business areas.

Step 2: Increase the acquisition rate of new customers

Of course, our solution goes beyond advertising optimization by addressing the critical phases of customer retention in sales. By analyzing CRM data in conjunction with classification methods from machine learning, we identify patterns and work out individual key indicators that lead to successful deals. By adhering to the derived recommendations for action, we are able to increase the closing rate of new customers at creative agencies without having to implement automated AI. Does not sound too complicated at all, right? Just as an AI solution should be.

Step 3: Reducing the churn rate

With customer retention, we cover the last important point in the agency's day-to-day work. By analyzing CRM data in depth and applying advanced pattern recognition technologies, we identify early signs of churn tendencies. With the potential of Explainable AI (XAI), we can not only predict potential churn before it is too late, but also explain the individual causes transparently and comprehensibly. In this way, the churn rate can also be optimized through individual recommendations for action without any full AI automation. Again, AI is applied to aid in understanding the business better and drawing conclusions for optimization. No coding, no pain for the employees.

These insights enable us to take targeted measures to retain customers. We address the right customers at the right time, offer customized solutions and ultimately create lasting loyalty. Our approach therefore goes beyond mere customer acquisition. It secures long-term partnerships and strengthens the relationship between agency and client.

What makes our approach special, despite its all-rounder nature, is its adaptability to the specific requirements of each agency. Based on existing CRM data and further sources of own and external data, our solution can be perfectly individualized and scaled. This means not only seamless integration of success factors, but also maximum effectiveness. Our solutions therefore not only break down stubborn sales barriers, but also save time and money. By increasing the quality of work and employee satisfaction, we create a win-win-win situation for agencies, employees and customers.

So in this article, we present a comprehensive revolution in the way creative agencies in particular can work more successfully. Now, our threefold solution has the potential to transform the industry and the only better time to start was yesterday. Of course there is one catch with all these concepts: They rely on a fair amount of high-quality data. After all, the more high-quality data there is, the smoother and more precise our tools will run. But don't worry, we'll end on a positive note: The more high-quality data there is, the smoother and more precise our tools will run!

Dr. Kay Stankov
Head of Data Science & AI
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Better Software with Event Modeling

Some say good software is free of bugs or has a nice user interface. While these are certainly important aspects, good software should be designed to enable users to deal efficiently with tasks related to a certain business domain. But how can we make sure that software is designed like that?

An article by Frank Steimle, Digital Frontiers GmbH & Co. KG

Good software serves a purpose: it is designed to solve a certain problem or to support someone in solving a certain problem. But in order to build software which is useful for domain experts, and which doesn't frustrate them when using it, developers need to understand the business domain. Event Modeling helps users, domain experts, managers, and developers to achieve that in a collaborative way. As a result, it establishes a common understanding of the domain, its problems, and its processes. Therefore, Event Modeling is an enabler for writing good software.

The biggest enemy of good software is not some technical problem but the fact that the software is built on developers' (mis)understanding of the business domain instead of the understanding of the real domain experts. Domain-Driven Design (DDD) addresses this problem by demanding that all developers and all other persons involved in the project or product share a so-called ubiquitous language, which is basically a common language specific for domain and team. A common language can be vital to the success of a project, as a shared language helps tremendously in understanding and reaching the correct goals. However, DDD leaves open how this language is developed.

In the context of DDD, many collaborative workshop formats have been invented which support project teams in developing this language. What all these formats have in common is that they involve all the parties that are part of the project or have relevant knowledge for a project: Domain experts, users, UI/UX experts, product owners, product managers and developers. All these roles (and others if required) are invited to take part in a one- or two-day workshop where they collaboratively explore the domain under the guidance of a facilitator. This means they identify scenarios and try to specify a process for each of these scenarios, and every participant brings in their view on the subject. During this procedure, the participants develop a common understanding and a shared language which can be used as ubiquitous language in the sense of DDD. Additionally, each of these processes can be told as a story and these stories are an asset, in themselves. It is no coincidence that mankind has successfully been passing on knowledge through storytelling for several thousand years. Stories tend to stick in our minds and go well with the way our brain works. So, these stories are a perfect way to introduce new project members to the domain, or to discuss issues of with other projects members.

One of these numerous workshop formats is Event Modeling. It has a lot of similarities to other, more well-known techniques like Event Storming, but in addition it has some specific features that make it worth looking at. The central element of Event Modeling are domain events. Domain events are events that are somehow relevant for

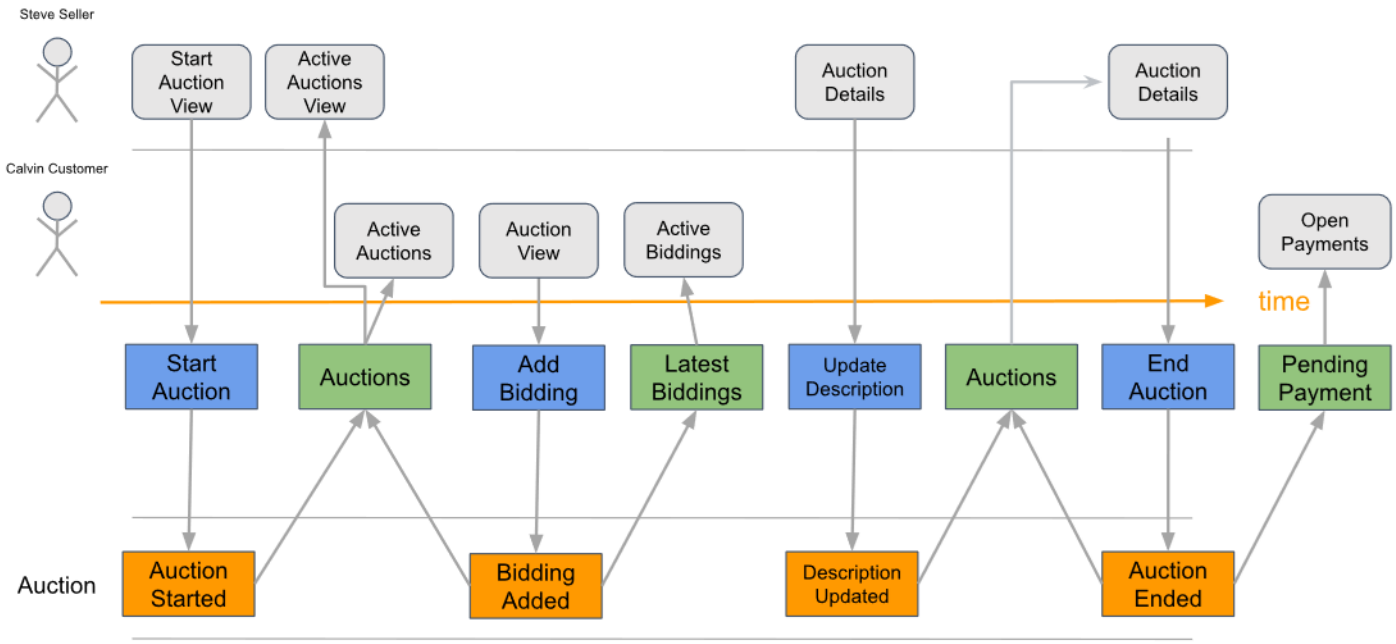

Figure 1: The Blueprint is the result of an Event Modeling workshop (exemplary scenario of an online auction platform, source: internal)

the problem to be solved and describe something that has happened during the progress of the domain processes. They're always formulated using past tense. Examples for an online auction platform might include:

- Auction Started
- Bidding Added
- Auction Ended

One advantage of using (domain) events as key building blocks for your story is that most people are used to tell stories this way: First the seller starts an auction, after that a customer might look in the active auction for a certain item and adds a bidding. Then the seller notices that there is a mistake in his description, and he updates it. After some time, when no further bids have been made, the seller decides to end the auction. So, they are a perfect fit if you're trying to tell a story that way.

An Event Modeling workshop consists of seven phases. In these phases the participants collaboratively and incrementally model a process. In the early phases the main goal is the development of the common language. Each participant is asked to identify domain events which are important for the process to be modeled and write them on stickies. After that, the group collaboratively arranges the events identified in the first phase in a chronological order. Meanwhile, duplicates and unnecessary events are eliminated. In order to identify duplicates and unnecessary events, the group has to discuss the meaning of the events and this is the first (and most important) step to shape a project-specific language. If missing events are identified, they are also added to the chronological order. This ultimately leads to a common understanding of the domain and a common way to describe it i.e., a common language.

After going through all the phases, the participants will have created something that looks like the diagram shown in Figure 1. The final model is also called the Blueprint. The first important part of the Blueprint is the series of orange stickies that represent the identified and chronologically ordered events, which can be read aloud like the story in the previous paragraph.

A second important part of the Blueprint is shown in the upper part of Figure 1. Here, it shows roles involved in the modeled process and their corresponding visual interfaces which they

use to change the state of the process. This is not only helpful for understanding which roles are involved in each step of the process. It is also useful for UI/UX designers when they get involved early in the design of the user journey. Additionally, Event Modeling can play to its strengths one more time: While most modeling techniques for IT processes are mostly abstract, Event Modeling includes a flow of required visual interfaces, so that visual learners can follow the story more easily.

Every event stands for a successful action of a user, e.g., a user of the role customer decided to place an order and was successful. The blue boxes, called commands, represent the wish of a user to do something. Modeling of commands is essential to the Blueprint as these are checkmarks that verify if we're ready to advance in the process. In our example, a certain command represents that a customer wants to add a bidding. This could also fail, e.g., when the customer is not credit worthy. In this case, we cannot proceed with the normal process, and we might need to model compensation actions.

Most decisions of the users of the software supporting the process are based on data. In our example, the customer wants to check the current price for the desired item. Only if they think that the price is reasonable, they add a bidding. So, the visual interface for the auction details needs to show the latest bidding. All information needed for this decision is represented by a green box which is called view. Views represent collections of information that are needed as the basis for a decision made by a role.

The final blueprint can also be useful for a variety of use cases besides passing knowledge to new project members or using it as the basis for discussions about the issues of the domain. It can be used to identify and discuss edge cases which weren't considered yet. Plus, it can be used as a living documentation of the process which is also

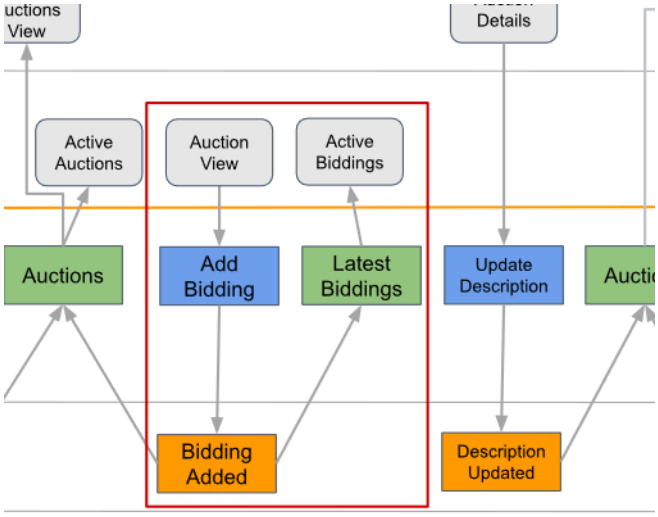

Figure 2: The red box is an example for a slice. It contains one command, one event, one read models and the resp. visual interfaces (source: internal).

readable for people without IT or tech background.

When you combine Event Modeling with architectural styles like Event Sourcing or Command Query Responsibility Segregation (CQRS), you can get even more benefits. The key elements of those architectural styles are very similar to the key elements of Event Modeling: both include events and commands, and Event Modeling's views correspond to read models. Because of this structural similarity, developers can easily transfer the modeled process into program code, instead of having to re-model the process using technical diagrams. This also creates a further benefit: If this additional translation effort is eliminated, developers can directly discuss working methods of the software with non-technical project members without having to translate the written program code into understandable language.

Every feature in CQRS/ES-based software systems involves commands, events, read models and visual interfaces. In Event Modeling these elements are also used to model features. Therefore, these slices consisting of command, event and read model (cf. Figure 2) can be used by, e.g., the Product Owner to define tickets. After a couple of

these uniform tickets have been implemented, the team will eventually recognize that the complexity of these tickets is similar. This lowers the effort involved in creating and refining tickets.

Summarizing, we can see that Event Modeling is an interesting methodology which has various benefits:

- It creates a common understanding of the domain and therefore enables to create better software.
- The UI/UX flow is modeled as first-class citizen and thus visual learners can participate more easily.
- The Blueprint is extendable and can therefore be used as living documentation.
- The Blueprint can also easily be understood by non-technical project members and is therefore a good basis when discussing issues of the domain.
- When combined with certain architectural styles like Event Sourcing or CQRS, the Blueprint can directly be transferred to program code. Plus, the slices of the Blueprint can be used by, e.g., the Product Owner to write tickets.
- The Blueprint can be used by various roles like architects for system design decisions, or quality assurance for verifying whether all data required for regulatory purposes is stored.

If you are curious about Event Modeling, there are many online resources which can provide further information. While the methodology is easy learn and can easily be taught on-the-fly during a workshop, it is worth getting an external workshop facilitator. They can guide through the process and point out blind spots or uncertainties which could cause problems in the further course of time. Event Modeling experts can also help designing services and systems from the Blueprint and defining further steps towards implementation of the modeled process.

Frank Steimle
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The magic of UX design and usability testing: when software becomes fun

An article by Miriam Putschar , SVA System Vertrieb Alexander GmbH

Have you ever wondered why some apps and websites are so much fun to use, while others drive us to the brink of despair? Often the secret lies in the art of user experience design (UX design for short) and usability testing. In this article, we invite you to take a journey with us into the world of user-friendly software and understand why it is crucial.

What is UX design, anyway?

Imagine walking into a cozy coffee shop, sitting down at a table and ordering your favorite coffee. The barista is friendly, the music is pleasantly quiet, and the chairs are super comfortable. You immediately feel at ease, don't you? That's exactly how good UX design works!

UX design means designing software so that users feel comfortable in it. It's about excellent usability and satisfaction at the highest level. A great user experience doesn't just happen. It requires, among other things:

1. **User research**: Do you know who your target group is? What problems or goals do they have? Answering these questions is the first step. So let's start with surveys and interviews!
2. **Information architecture**: Imagine you enter a supermarket and the shelves are messy, without clear labels or categories. Shopping becomes a frustrating treasure hunt. Just like in a well-organized supermarket, UX design creates clear structures so users can easily find what they are looking for.
3. **Wireframing and Prototyping**: What detailed blueprints and miniature models are for architects, wireframes and prototypes are for UX designers. They serve as blueprints and models for digital products before they are implemented in their final form.
4. **Usability testing**: Think of a test driver driving a new car before launch to make sure it runs smoothly. Usability testing is like this test drive. Real users take on the role of test driver and check that your app drives smoothly on the "usability road" before releasing it to the general public.
5. **User interface design**: Again, think of the cozy café where the decor is tastefully designed. Just like in the café, the user interface design adds the final touch of aesthetics and appeal to your software. It is the visual charm that makes your application inviting and appealing.

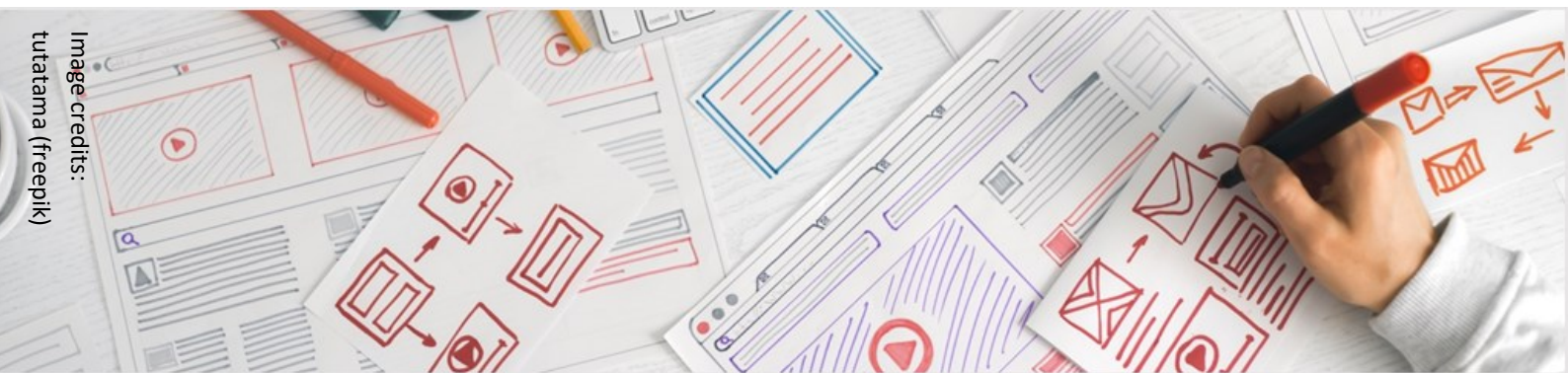

Image credits: tutatama (freepik)

Why is UX design important?

Good question, isn't it? A great UX has some magical powers:

1. **User satisfaction**: Users will love the product. And happy users, are loyal users.
2. **Efficiency**: The software is like a Swiss Army knife – multifunctional and easy to use. This saves time and nerves.
3. **Reduction of errors:** Less errors means less headaches and frustration.
4. **Competitive advantage**: If the competition produces garbage but your app is a pleasure to use, users will reach for your product!
5. **Cost saving**: Early feedback saves a lot of money. It's easier to fix problems before the whole world is using a product.

Conclusion

In a world full of software that brings more frustration than joy, you can make your users happy with great UX design. Remember the coffee shop at the beginning? Create a comparably engaging environment in your application and users will keep coming back. So, why not get started and make the world of software a little more friendly? Your users will thank you for it!

Our offer for you

In a one-day workshop we will take a close look at your application or website and find out how we can create an excellent user experience.

Miriam Putschar
Team Lead UX Design
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AI Engineering for Trust by Design

An article by Dr. André Meyer-Vitali, DFKI Saarbrücken

Some of the current problems related to a lack of trust in AI systems are a direct result of the massive use of black-box methods that depend solely on data. Instead, a new AI generation has its foundation built on hybrid AI systems (also known as neuro-symbolic or neuro-explicit). These hybrids do not rely solely on data-driven approaches, but on the full range of AI technologies, which includes symbolic AI methods for search, reasoning, planning, acting and other operations. "Trust by Design" is achieved through the combination of Machine Learning with symbolic conclusions, the explicit representation of knowledge and interaction among agents and humans in hybrid AI systems. Knowledge no longer needs to be learned when it is represented by semantic and other explicit models, which can also guide the learning process in a direction that improves generalisation, robustness, and interpretability. This hybrid approach is also known as the third wave of AI [1]. The requirements are particularly strict when it comes to applications with significant physical, economic or social risk. The AI systems used in such applications are required – for example by the European AI Act – to have been validated and certified according to well-defined criteria.

When designing trustworthy AI systems, there are several important aspects that should be considered to guarantee the corresponding characteristics, such as fairness, robustness and transparency. In principle, these aspects apply to all software systems. However, they are of the greatest relevance for complex, intelligent systems for critical applications. AI engineering should make use of the lessons learned from software engineering and apply its engineering principles, such as design patterns and architectures. An attempt to model design patterns for neuro-symbolic systems is made in [2].

A fundamental difference between tradition software and AI systems is that the outcomes are not necessarily deterministic, but probabilistic, and that there may be more than one "correct answer". Hence, the goal is shifting from guarantees of correctness towards verifying for plausibility. The following four pillars of AI Engineering are proposed as a framework for creating Trusted AI by Design. We need to stop reinventing the wheel, learning from scratch, but understanding nothing. Instead, we need to use existing knowledge, build on experiments and experience, formulate and validate new hypotheses and theories, in order to gain knowledge and insight at a higher level, and to explain why events happen, predictions are made and decisions or actions are taken. This results in scientific progress by standing on the shoulders of giants.

1. Models and Explanations

Explicit models[1] of the world, or a suitable context in question, enable reliable predictions of the behaviour of AI systems – both in the scope of training data and outside – because they generalise knowledge beyond the limited and biased scope of the training data. Given a certain context, which can be very narrow or broad, explicit models represent concepts, relationships and rules that are always true in that context. For example, the laws of gravity are applicable to the whole universe. Models can be created by experts or learned from experience and data.

[1] The term "model" is used extensively in the ML community. It is necessary, however, to distinguish between the statistical models of machine learning and the semantic models of knowledge engineering. Here, we refer to the latter. See also in [2] for a unified taxonomy of AI.

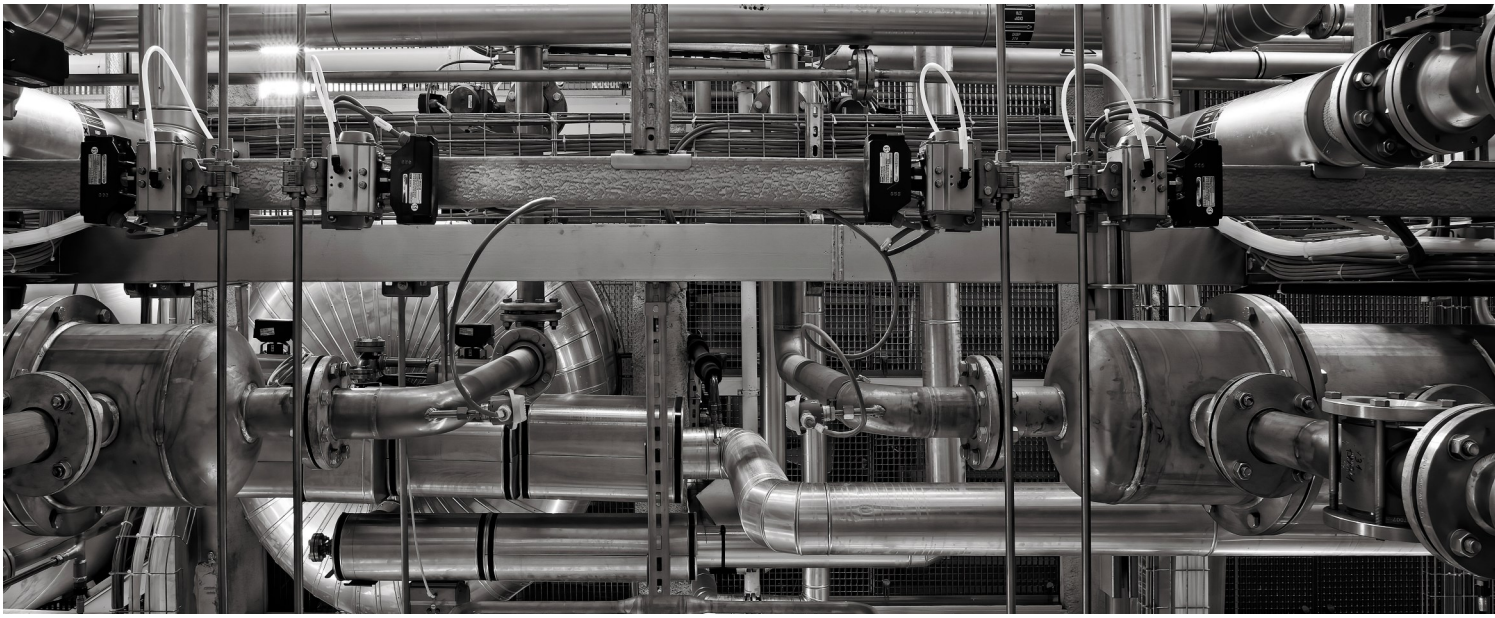

Image credits: Ricardo Gomez Angel, unsplash

Combinations of different types of models are particularly useful and insightful (such as in neuro -symbolic approaches). In this way, models promote reliability, accountability and explainability.

Thus, they make it possible to render the behaviour of the AI systems understandable and plausible, as well as provide means for correcting and adapting their behaviour. In simulations, models can enable the understanding – through experiments – of situations that are difficult or impossible to access otherwise. Privacy is thus maintained, as is safety by avoidance of unexpected and dangerous conditions.

2. Causality and Grounding

Causality refers to the ability to identify and predict cause-and-effect relationships, i.e. which effects are the results of which causes and why [3]. An AI system that can understand causal relationships is able to make informed predictions and solve complex problems. The need to move from correlation to causation is increasingly urgent. If we want to explain why certain predictions are made or decisions are taken, it is essential to know and act on their causes.

Causal inference is concerned with the resulting effect when a corresponding event (cause) occurs, according to a given causal model. Causal inference asks whether an event indeed causes a certain effect by determining the likelihood that one event was the cause of another. In contrast to statistical correlations, causal relationships are directed and asymmetrical.

Counterfactuals refer to alternative choices that could have been made in the past and the corresponding effects that they might have caused. Therefore, they allow for exploring possibilities to find alternative outcomes according to a causal model, allowing to change policies accordingly in the future.

Causal discovery allows for determining whether a change in one variable (representing a state, action or event) indeed causes a change in another, in order to distinguish between correlated and causal relationships in data and to derive corresponding causal models.

Closely related to causality is understanding the anchoring (grounding) of meanings in the real context. A deep understanding of context and meaning requires not only processing data, but also capturing the real-world phenomena that the data represents, such that predictions, decisions and actions are based on them. Layers of abstractions are fundamental for building rich architectures. Semantic models, such as ontologies, are representations of concepts, their attributes and relationships. They contribute to trustworthy AI systems by explaining and constraining the meaning of those concepts.

3. Modularity and Compositionality

One of the fundamental design principles of (software) engineering is modularity, which guarantees that complex systems are broken down into understandable and manageable parts (functions and features) and reliably assembled into system architectures. This increases the reliability of the individual components and their assemblies as systems of systems. It is much easier to verify smaller components than big monolithic artefacts. The evolution in software engineering from structured to modular and object-oriented programming enabled the design and construction of complex systems. In well-designed systems the transitions between successive components can be controlled and protected, making them explainable, such that errors can be detected effectively.

The principle of compositionality also applies to knowledge models and languages [4]: larger constructs are created by joining together smaller units with specific, understandable, and verifiable tasks. Abstract relationships can thus be traced back to their components. These aspects are applied when designing complex systems and should also become a matter of course for AI systems and agents.

4. Human Agency and Oversight

Human agency and oversight mean that in any case a human should have the overview, final decision, and responsibility for the actions of an AI system (human empowerment). Even if many tasks are increasingly being transferred to autonomous AI systems (agents), the principle that humans supervise, assess, and approve actions still applies. Delegation of tasks needs to be interpretable by both humans and (software) agents – in particular, when humans and agents collaborate as hybrid teams in a symbiotic partnership. It is necessary that suitable task descriptions are handed over to the agents and that they understand and execute them in the relevant context, considering the models, explanations and causal relationships explained above.

Instead of relying on AI systems to take over human activities, as some have predicted, it is better to focus on how humans and machines can complement each other's strengths [5]. Trustworthiness in interacting with artificially intelligent systems emerges from experience and as a combination of various properties, such as fairness, robustness, transparency, verification, and accuracy. AI systems are trusted when we have confidence in the decisions that they take, i.e. when we understand why they are made.

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E2E Automation with AI

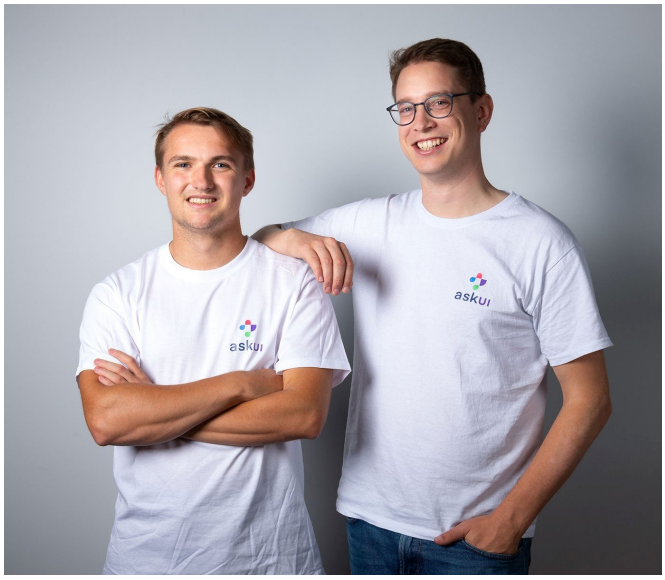
Are you trying to automate native applications? Struggling with automations of third-party application such as Citrix, SAP or ServiceNow? Are you dealing with flaky tests due to changing environments? AskUI leverages AI to tackle those challenges with their automation platform.

An article by Jonas Menesklou, AskUI

While there are many frameworks for web automation out there, desktop automation remains to be very tough in a lot of cases. Missing ways of object identification or countless environments to support are just a few of many challenges. In this case study, we will deep dive how AskUI is used at companies such as SEW-Eurodrive to automate desktop applications using state-of-the-art UI detection models.

AskUI is a startup based in Karlsruhe, Germany and was founded by Jonas Menesklou and Dominik Klotz out of AI research at the Karlsruhe Institute of Technology in 2021. Having faced the modern challenges with desktop automation in their previous roles, Jonas and Dominik decided to take another approach to this problem. The company employs over 15 employees right now and is funded by established institutional investors such as 468 Capital, Seedcamp and Eurazeo. Their clients and partners include SEW-Eurodrive, Intel Software and other enterprises worldwide.

Regarding their technology, AskUI is leveraging a deep learning model for user interfaces. The integrated AI can find any UI element that is visible on an operating system. This enables the automation of workflows in a completely new way. The automation does not access the underlying code selectors or the DOM, but performs real mouse movements and element clicks. Drag & drop, swipe commands and even colour checks are possible.



Its key features can be summarized to:

- **Platform Versatility**: AskUI's ability to automate across various platforms, including desktop, web, and mobile applications, makes it a versatile tool for modern software development.
- **AI-Powered UI Detection**: The deep learning model at the core of AskUI allows for accurate identification of UI elements, a significant advancement over traditional selector-based methods.
- **Real Interaction Simulation**: By simulating real mouse movements and clicks, AskUI offers a more natural and effective way to interact with applications.
- **Visual Feature-Based Identification**: This approach eliminates the need for maintaining object repositories, simplifying the automation process.

- **Cross-Application Workflows**: AskUI's capability to automate processes across multiple applications is particularly beneficial for complex enterprise environments.

The Challenge with Desktop Applications

Third-party systems and desktop applications such as SAP and ServiceNow often do not allow access to their underlying code structure, which makes it hard to access objects in a stable and maintainable way. Each time the software provider releases updates, the automation scripts are up for failure. Companies therefore most often do no automate such implementations and rather rely on manual testing.

However, as many companies also innovate their software development process, continuous integration and deployments are needed to be introduced. Covering these frequent releases with pure manual testing is therefore not sufficient anymore and a need for automation arises. AskUI allows for test automation in these challenging environments to increase test coverage and reduce the time to production.

Requirements for Successful Test Automation

In general, there are multiple requirements towards a successful implementation of a test automation solution:

- **Readability and maintainability of automation scripts:** All team members should be able to read, understand and maintain the automation code to not have any dependencies on specific team members.
- **Integration into existing infrastructure:** The solution should fit into the existing environment and planned deployment pipeline.
- **Simulation of user behaviour:** The automation scripts should imitate real user behaviour to allow for real E2E-testing. There should be no downsides from switching from manual testing towards automation.
- **Reporting:** The reporting of test executions should be done via existing open source solutions to not introduce to many new learning factors within the team.

AskUI covers these requirements by offering its solution as a software development kit which integrates into existing environments. Furthermore, their solution behaves independent of the underlying tech stack of the to be automated application and can be maintained by developers as well as manual testers alike. Multiple companies were therefore able to improve the speed of deployment from monthly to daily releases, while also increasing test coverage to above 90%.

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Detailed information in the techL profile: AskUI

Automizing Administrative Processes with Robotic Process Automation: The RPA Handbook

The value proposition of Robotic Process Automation (RPA) is simple and seductive: a fatigue-free army of software robots works day and night through the mountain of labor-intensive data entry, error-free and cost-effectively. And it doesn't require months of IT development to integrate disparate application systems. What is RPA and what are promising use cases? What are the benefits, limitations and risks associated with RPA? And what needs to be considered during implementation?

An article by Prof. Dr. Carsten Feldmann

Processes are the source of operational value creation. If they are not optimally organised, economic success is at risk. Companies therefore need to ensure that their processes are effective and efficient, and to continuously improve them. Traditional approaches to process management, such as swim lane diagrams, are widely used in practice. But what about digitising and automating administrative business processes such as invoice posting or order processing?

Many companies have been reluctant to use process automation technologies to date - despite the high level of benefits promised by providers. In a recent study, the Institute for Process Management and Digital Transformation (IPD) at Münster University of Applied Sciences surveyed companies on the digitalisation and automation of administrative business processes. Almost half of the companies perceive the lack of personnel (49%) and problems caused by media disruptions (44%) as a problem. Many see the lack of process standardisation (39%) and low process transparency (38%) as obstacles to efficient processes. Almost half of the companies (43%) consider the costs of the solutions available on the market to be too high. A critical gap is the lack of knowledge about digital process management tools: Newer approaches such as process mining or robotic process automation (RPA) are unknown to many respondents (15% and 20% respectively). Only 12% of companies use or test process mining, 13% RPA. This article aims to motivate companies to take a closer look at RPA by highlighting its functionality, benefits and limitations.

RPA refers to software robots (bots) that automate repetitive, rule-based tasks based on structured data in a business process. This automation of human activities on IT systems focuses on individual activities rather than an entire process. The bot mimics the input on the regular user interface of an IT system, such as the input screen. But RPA is not an Excel macro: the software robot is not limited to one application, but can be used for several IT systems at the same time without the need to build development-intensive interfaces. Typical activities include accessing IT systems and web pages to perform routine tasks such as reading, copying and pasting data, filling out input forms in multiple IT systems, performing calculations, or analysing and sending e-mails.

Types of RPA

The basic types are Attended RPA, Unattended RPA and Cognitive Process Automation. With **Attended RPA**, the bot supports an employee locally with certain tasks. An example: A supplier's invoice is received in Accounts Payable as a PDF document in an email attachment. The clerk opens the invoice and starts the RPA bot. This automatically reads the data from the digital document and records it in the ERP system. If the invoice can be clearly assigned to an order with the corresponding invoice amount in the ERP system based on its reference number, the bot automatically instructs it to make payment. However, if the bot cannot identify a corresponding order or if there is a difference in the invoice check, the bot informs the employee to initiate a manual invoice check or clarification

Unattended RPA automates a task without interaction with human employees; certain events automatically initiate the bot's activities. In the example of invoice verification (see figure 1), this is the receipt of an invoice by email. In contrast to attended RPA, the bot automatically opens the document and then reads the data from the incoming invoices in PDF format using an OCR system (optical character recognition) for further processing. A human employee is only informed in the event of escalation, e.g. if there are discrepancies in the amounts or missing information.

For unstructured tasks and decisions that require not only existing data and rules but also empirical knowledge or a certain learning ability, RPA can be enhanced by artificial intelligence (AI) processes. When bots are able to expand the rules independently and solve unstructured tasks, this is referred to as **Cognitive Process Automation** (CPA, also known as intelligent RPA or IPA). In the example of invoice verification, if there is a difference in the amount, the bot decides independently whether the invoice should be authorised for payment by imitating the human decision -making process.

Use cases, benefits and limitations

In particular, accounting, purchasing, sales and HR are currently using RPA to automate processes. One example: In day-to-day sales, customer enquiries often take a long time to process. With standardised, data-driven processes in place, simple customer queries can be answered more quickly with the help of bots, thereby increasing customer satisfaction. For example, requested address changes are automatically read and validated from the customer's emails. If all the details are complete and correct, the customer's master data is automatically retrieved from the CRM system and the address is changed. If the address information is missing or incorrect, the bot notifies the agent and prompts him or her to process it manually.

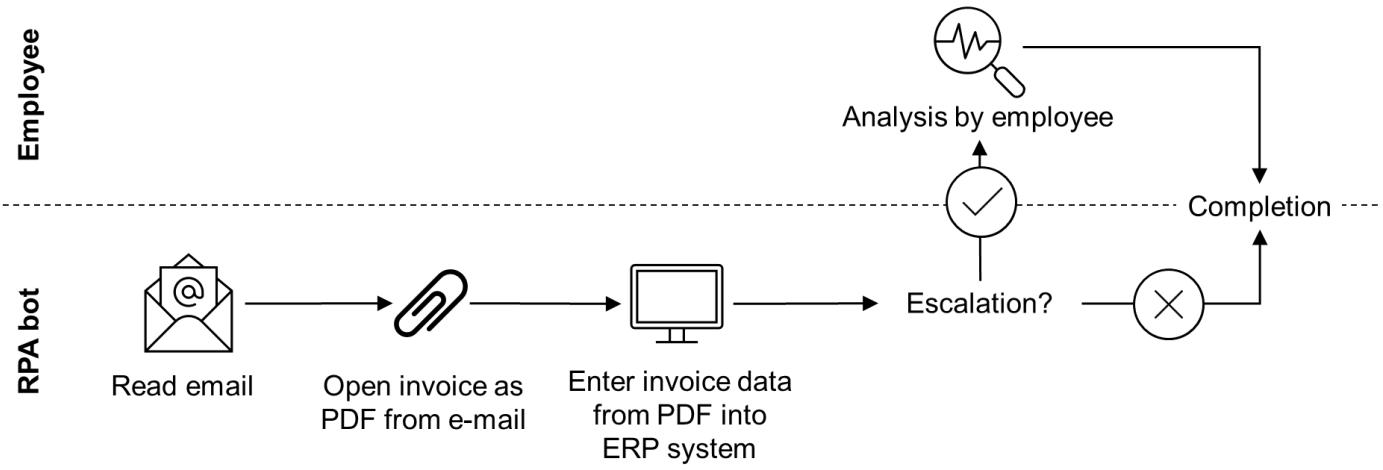


Fig.1: Unattended RPA for Invoice processing

Depending on the use case, RPA offers **benefits** in terms of cost, processing time and quality. Bots handle labour-intensive data entry 24/7 in a cost-effective and error-free manner. There is no need for time-consuming and costly IT development to integrate different application systems. When it comes to personnel costs, it is all about small improvements: many companies are confronted with complex, historically grown IT landscapes. As a result, employees have to use different IT systems in their day-to-day work and transfer data from one IT system to another due to media discontinuities.

One employee may only save a few minutes a day by eliminating the need to cut and paste data. However, significant cost savings can be achieved when scaled across all employees. Process cycle time can be reduced with RPA. RPA improves process quality by eliminating typos and other sources of human error. A valid, comprehensive digital database is available for follow-up processes, analytics and AI solutions. RPA frees employees from monotonous and tedious routine tasks. This increases employee satisfaction. It also frees up capacity for innovative strategic tasks and customer-facing activities that require human creativity and planning. By eliminating human error, RPA improves compliance, i.e. adherence to policies and legislation in terms of process conformity and consistency.

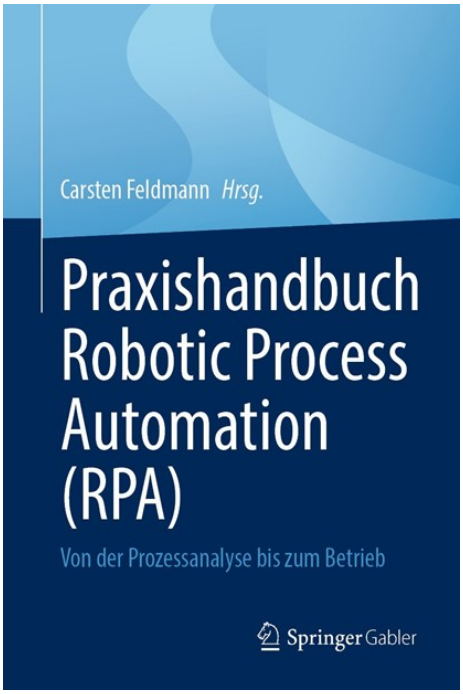
What are the **limitations** and **risks** of RPA? A key preparation for RPA is to optimise and stabilise the process beforehand: if you automate a bad process in the status quo, you end up with a bad automated process. This can lead to disappointment, especially given the current hype and exaggerated expectations, as RPA cannot digitise the entire organisation or fix dysfunctional processes across the business. On the cost side, the cost of ownership should not be underestimated. In addition to subscription models and multi-year licensing commitments, training and maintenance costs must also be factored in.

Conclusions and outlook

RPA is suitable for automating rule-based, routine and predictable workflows. These are based on structured, digital data and standardised, stable processes. RPA software reads data, makes rule-based decisions and transfers data to other IT systems. RPA opens up many potential business benefits, particularly in terms of increased efficiency, strict compliance, improved customer service and higher data quality. However, RPA only mimics manual human activity on IT systems. When creative thinking and action are required to solve a problem, even cognitive RPA with basic AI is of limited help. This is where machine learning and natural language processing (NLP) can complement RPA solutions in the future.

RPA differs from other process automation technologies in that it is flexible and easy to implement. This allows organisations to automate tasks and integrate IT systems where alternative approaches are too complex, costly or time-consuming. In many cases, a combination of human workers and software robots has proven beneficial for process automation: Each resource is used for the tasks it can do best.

For more in-depth information on this topic, we recommend the “Praxishandbuch RPA”. This book provides a practitioner-oriented overview of the implementation and operation of RPA solutions. The 23 authors illuminate Robotic Process Automation from different perspectives in order to comprehensively present the multi-faceted topic: From the software deployment by a consulting firm to IT legal issues to operations in an manufacturing company. In addition to procedural models for the introduction of RPA, the success factors for operation are presented using many practical examples. fundamentals of process automation and empirical findings from practice are presented in a well-founded manner.



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Test Data Management Needs an Upgrade

Legacy test data solutions aren't meeting the needs of today's development and testing teams. To drive developer productivity, a modern platform is the answer.

An article by Jake Friedenberg, Tonic.ai

Data privacy regulations have amplified the importance and impact of Test Data Management (TDM). Engineering teams are faced with more bottlenecks than ever in sourcing quality test data. But the tools they rely on are stuck in the past and were not built for the scale and complexity of today's data.

Solutions must integrate into modern workflows and offer test data that actually works.

Meet Tonic.

Founded in 2018, Tonic.ai is pioneering enterprise tools for data de-identification, subsetting, and provisioning. The Tonic test data platform is built to meet the needs of today's software development teams while satisfying compliance requirements like GDPR. Thousands of developers use Tonic-generated data every day to build their products faster in industries as wide ranging as healthcare, financial services, insurance, and more. The results speak for themselves.

Philips uses Tonic to recreate PHI data in their BioTelemetry cardiac care business. eBay uses Tonic to subset 8 PBs of production data down to 1 GB subsets to rapidly provision 4000 engineers with production-like data. Gabler, which oversees more than NOK 100 Billion in assets, uses Tonic to capture highly complex edge cases in test environments that traditional masking cannot preserve. There are 100s of examples globally, including in the EU.

Tonic isn't simply a test data platform; it's improving how we work on increasingly complex technology in increasingly complex regulatory landscapes.

How is legacy TDM failing developers?

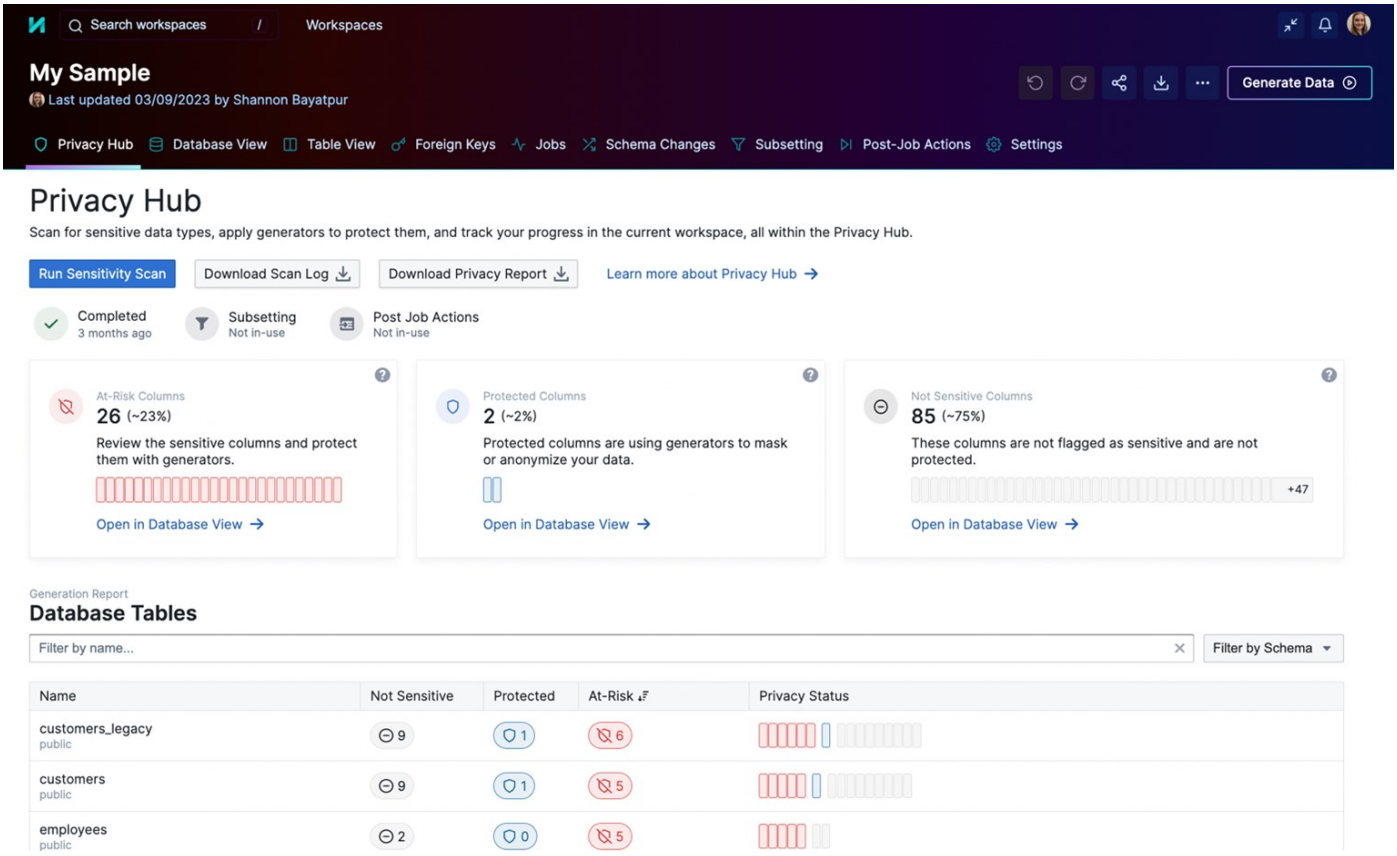
Legacy TDM first arose as a category over a decade ago, with a focus on locking down data access more than ensuring data utility. Their masking capabilities were rudimentary and not built to scale, as the data they processed hadn't yet met the likes of data lakes and data warehouses. And these facts still hold today: legacy TDM tools suffer from poor-quality output data due to their simplistic approaches to data masking, they don't offer native integrations to data warehouses like Snowflake or Databricks, they aren't able to efficiently process data at scale, and their unfriendly UIs suffer from staleness and a lack of investment.

All this translates into several critical pain points:

- Delays in data provisioning, **wasting valuable development time**
- Poor quality test data leading to **unreliable staging environments and test results**
- Increased risk of software **failures or crashes due to ineffective testing**
- **Difficulty maintaining compliance** due to inadequate de-identification workflows

How is Tonic curing these developer pains?

Tonic offers a modern UI for coherent data masking, subsetting, and provisioning all accessible by API and paired with native integrations to the leading databases and data warehouses.



It is architected to match the scale and speed of today's data pipelines to ensure compliance without slowing down development.

The data Tonic delivers is realistic – and one of the most important things in building and testing software is reproducibility.

By utilizing cutting edge technologies in synthetic data and generative AI, Tonic achieves data that preserves the characteristics needed for highly effective engineering teams while ensuring an auditable compliance posture. Core features driving this value include:

- **Consistency:** Coherent de-identification across any number of different data sources
- **Relationship Linking:** Mirrors production data relationships, enhancing test accuracy and coverage.
- **Subsetting:** Provides precise, on-demand data slices, refreshing from production continuously for development agility.

The Value of a Modern Test Data Platform

Tonic unlocks significant cost savings. Compliance and security are vital requirements, but the dysfunction that comes with them is no longer a necessary tradeoff.

Through effective and accurate data provisioning, teams maximize development hours with access to safe-to-share test data that always mirrors production. In short, Tonic is a win-win for CISOs and CTOs seeking a best-in-class approach with a high-impact and battle-tested technology.

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Exponential AI growth is sparking a revolution in sustainable object storage

As AI datasets grow ever more complex, object storage has emerged as the key. Now UltiHash is enabling sustainable data growth without compromising speed

An article by Tom Lüdersdorf, CEO of UltiHash

The rise of object storage for AI/ML

Over the last few years, object storage has been increasingly growing in stature. Initially, it was considered simply a 'cheap and deep' storage solution. But more recently it has proven to be high-performance ready, and the ideal solution for AI and ML applications due to its scalability, durability, and cost-effectiveness.

Leaders across industries as various as autonomous vehicle development, medical imaging, climatology and smart cities development are all turning towards object storage as the cornerstone of their tech stack. In the last few months, in fact, the largest cloud storage provider has tacitly acknowledged that object storage is the future for AI/ML: Amazon is finally offering a high-performance tier. S3 Express One Zone claims to be up to 10x faster, with lower latency, and a design that facilitates the expansive parallel computations needed for AI/ML. With the higher performance comes a much higher price – it is not meant to replace standard S3, but instead be a temporary storage solution for local compute.

So what is it about object storage that makes it so well-suited to these use cases?

The challenge of exponential growth

There are a variety of reasons for the rise of object storage, but the most significant is the challenge of exponential growth. As the unstructured datasets on which ML is often performed become larger and more complex, so too does the underlying infrastructure. As the market seeks solutions to ever more complicated tasks, ever more sophisticated machine leaning models are required - which, in turn, require ever more advanced training and fine-tuning.

What's more, these changes are happening within narrow timeframes. For context in the field of LLMs: in March 2022, OpenAI's GPT 3.5 released with a reported 175 billion parameters; just one short year later, GPT 4 released with a cool trillion parameters - almost six times as many. All these expanding numbers add up to a problem: as MLOps and their training datasets grow, so does the management complexity.

Traditional file and block storage systems typically scale vertically, and so have inherent limitations in their capacity to grow. For example: because network-attached storage (NAS) is designed for smaller-scale file sharing, it struggles with performance issues as numbers of files grow, as the hierarchy of a file-based system make requests ever longer to fulfill due to large path distances. Distributed File Systems (DFS) address this by spreading data across servers, and so handle larger data volumes better than NAS - but at its core it is still a file-based solution. Ultimately, DFS faces the same complexities in scaling efficiently - multiplied by network latency.

Store more for less – just as fast

In contrast, object storage like UltiHash stores data in a flat structure, grouped into broad buckets, and organised using detailed metadata on the object level instead of labyrinthine hierarchies. Items can be accessed very fast, even among extremely large datasets. They can scale horizontally almost without limits, allowing datasets of petabyte scale and larger. UltiHash takes this inherent suitability of object storage for very large datasets, and combines it with a groundbreaking approach to how data is stored that could transform the efficiency, scalability and sustainability of LLM training. Our high-performance layer can handle the massive sizes of LLM training datasets without compromising on blazing fast read speeds.

We employ advanced deduplication techniques that allow us to significantly reduce the storage footprint of large datasets like LLM training corpuses. Files and folders are analyzed at the byte level, and dynamically split into fragments of different sizes. All repeated fragments in the dataset are losslessly deduplicated to save space, leaving only unique fragments. If a fragment has been stored in the cluster before, it is matched; brand-new fragments are added as normal. This innovative approach deduplicates not just on the file or object level, but across entire datasets, making our technology fundamentally different from standard compression. UltiHash can even reduce the size of already-compressed data. And we do all this without compromising speed of access.

Another consideration is deep integration with existing infrastructure, leveraging the efficiency of existing workflows and obviating the need for lengthy and expensive restructuring. So a guiding principle of UltiHash's design philosophy has been seamless integration with, for example, querying engines like Apache Trino, Flink and Spark. That's why we've made it a priority to support applications that use S3-compatible APIs.

A sustainably scalable future for AI/ML

UltiHash is built from the ground up for scalability, in two key ways. The first - more conventional - way is automatically increasing the hardware resources employed by the system depending on

the load. If more storage space is needed, UltiHash automatically adds more data nodes. Similarly, if there is a spike in request load, UltiHash will elastically spin up new resources to keep up with the required workload.

The second way is more unique to the way UltiHash stores data. Exponential growth is no problem for UltiHash; in fact, rapidly expanding data volumes are where UltiHash excels: the more data in a dataset, the more opportunities for deduplication. As LLMs and their associated datasets grow in complexity and size, it will become more and more efficient to use a solution like UltiHash. This kind of fundamental scalability will allow businesses to leverage the full potential of LLMs without being hindered by infrastructure limitations.

It's clear that the storage needs of AI and Machine Learning operations will only grow more significant - particularly when it comes to training data. The storage industry should evolve alongside these changes. UltiHash is being built for a future where storage for advanced technologies like AI need to be highly efficient for large data volumes while remaining highly performant.

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Detailed information in the techL profile:
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AI's Strategic Imperative: Digitizing Enterprise for Competitive Advantage

AI is knocking on the doors - but how can companies fully benefit from AI? An insight into Deloitte's holistic AI transformation framework

An article by Stefan Hartmann & Jan Scherpinski, Deloitte

AI as the Enterprise Lens on Impactful Scoping of Digitization

In the dynamic landscape of digital transformation, Artificial Intelligence (AI) stands out as a game-changer. A Deloitte study unequivocally affirms its transformative potential, positioning AI as the linchpin in reshaping enterprises into data-driven powerhouses by value-oriented digitization. This article introduces a perspective on the interplay between digitization, data, and AI and how to run an effective transformation.

Digitization for Data Quality: The Cornerstone of AI Implementation

Beyond automation, AI emerges as a multifaceted force, propelling enterprises towards revenue generation and fostering a culture of innovation. The infusion of AI into business processes does streamline operations and unlocks unprecedented efficiency. Enterprises, now more than ever, are at a crossroads where the adoption of AI becomes not only a competitive advantage but a strategic necessity. The hype around GenAI serves as a wake-up call, urging businesses to leverage AI capabilities demanding to run a comprehensive digital overhaul.

The effectiveness of AI hinges on the quality of the data – it remains a simple truth: "Garbage data in, garbage AI out". Strategic digitization, capturing interactions across customers, employees, and machines, lays the foundation for a rich and reliable dataset to run AI. This data, meticulously gathered at vital touchpoints of the value chain, becomes the lifeblood of business relevant AI applications. The commitment to gathering, processing, storing, and managing high-quality data ensures that AI algorithms operate on a foundation of accuracy and relevance. How enterprise digitize and process information determines the AI impact.

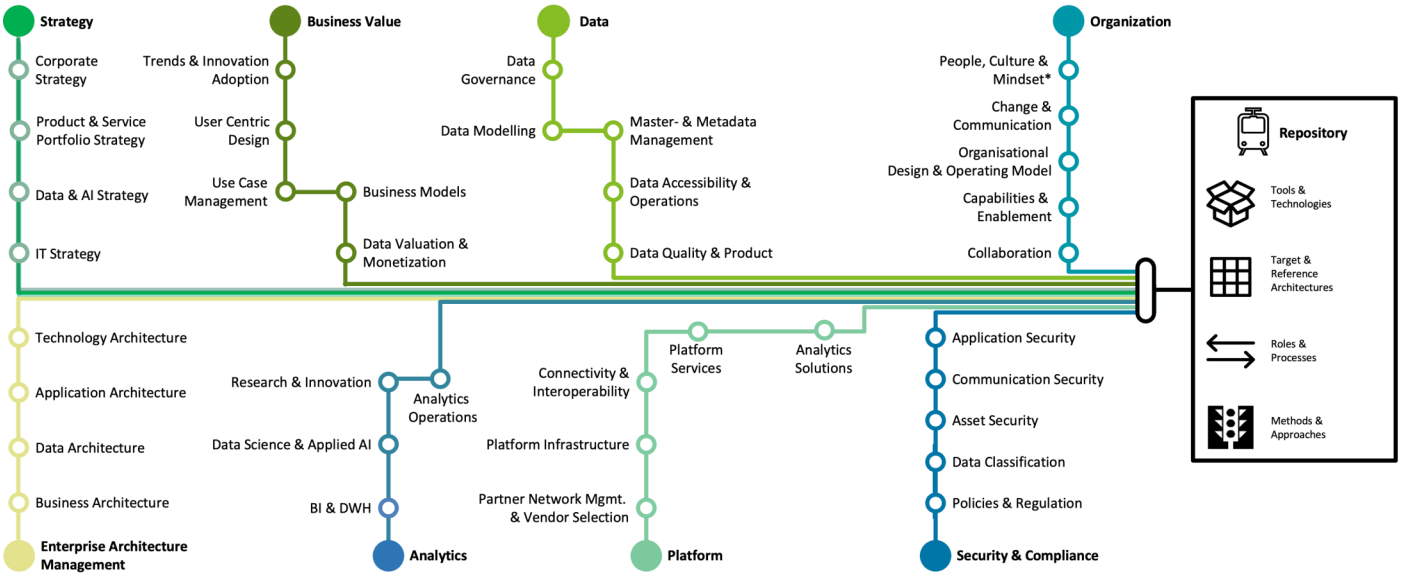
Overcoming Data Challenges: A Holistic View

The triumvirate of velocity, volume, and quality poses a substantial challenge in the realm of AI-driven data. Enterprises must invest in robust data platforms that break data silos while simultaneously establishing efficient procedural, personnel, and organizational frameworks. Success in AI implementation requires data quality ensured by a well-orchestrated symphony of processes driven by employees with a data-driven mindset. The challenge is not merely technological; it is about creating an organizational, processual, regulatory and people ecosystem in which data flows seamlessly, is updated in real-time, and aligns with the strategic goals of the organization.

Deloitte's AI & Data Transformation Framework: Guiding the Journey

To navigate the complexities of such an transformational AI and data journey, enterprises need a compass. The Deloitte AI & Data Transformation Framework offers a systematic and holistic view

Data & AI Transformation Framework by Deloitte



of the AI journey, aligning it strategically and tactically with business values. Initiating the AI journey demands a strategic alignment between business, IT, and AI & data within a meticulously systemized enterprise architecture, ensuring a seamless digital shift. A clear strategic northstar guides the expedition of a use case portfolio, aligning business economics, IT, regulatory and AI. This alignment unveils new business models and monetization opportunities, impacting short, mid, and long-term aspirations allwoing for the the meticulous differentiation between the dream and reality of AI. Deducing requirements from the strategically selected use case portfolio ensures precise alignment with the enterprise's unique demands – from data and analytics management, to the platform design and people skill set. Defining the overaching AI Target Operating & Governance Model unleashes effective and efficient operative handling and a constant evolution. In this strategic roadmap, the synergy between alignment, precision, insight, and efficiency becomes the catalyst for a successful AI journey. Following the framework, enterprise can tailor their digitization ambition to transform AI from a buzzword into a tangible force that reshapes business models, drives monetization opportunities, and positions organizations for long-term success.

Conclusion: The Next 5 Years - Making AI Work for Competitive Advantage

As we look to the future, the next five years will define the winners in the AI race (Deloitte *State of AI, Deloitte 2022). Its a period where the hype gives way to tangible benefits, and enterprises that master the basics of data platforms driven by strategic digitization will gain a competitive advantage that transcends existing market shares.

In this transformative journey, the chain of digitization, data and AI becomes the epicenter of success. Deloitte StarterLab and AI Readiness Assessment can be your boost start or check-in performance routine to bring you (back) on track.

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Deloitte Consulting GmbH

Jan Scherpinski
Market Offering Lead
AI Strategy
Deloitte Consulting GmbH

4 Trends for AI in Manufacturing for 2024

In the ever-evolving manufacturing landscape, manufacturers constantly seek innovative solutions to enhance operations, optimize resource utilization, and gain a competitive edge. AI has emerged as a powerful tool to address these challenges, offering a range of transformative capabilities that are revolutionizing the industry. As we step into 2024, AI is poised to play an even more prominent role in shaping the future of manufacturing, addressing pressing pain points, and unlocking new frontiers of efficiency, agility, and sustainability.

An article by Pierre Goutorbe, Dataiku

Artificial Intelligence (AI) based systems are prominently reshaping our society: technologies such as ChatGPT have wide implications on our daily lives. For medical technology companies, the ability to incorporate AI into their products will be essential, but the practicalities of doing so often appear intransparent. A large part of these uncertainties arise from a lack of regulatory guidance: the novelty of medical AI, combined with regulations such as the Medical Device Regulation (MDR) which do not mention AI, lead to a perceived large grey area. In addition, upcoming regulations such as the EU Artificial Intelligence Act add more rules, but not specificially for medical devices.

Data-Driven Supply Chains

Supply chains in 2023 continued to improve since the COVID-19 pandemic, experiencing smoother operations with less congestion and a more balanced supply/demand environment. However, global supply chains entering 2024 are roiled by disruptions at two of the world's crucial trade corridors — the Panama Canal and the Suez Canal — even as geopolitical tensions appear set to take a more prominent role in sourcing and distribution. While AI cannot prevent supply chain disruptions, if deployed in the correct manner, it could provide predictive probabilities of future disruptions and give real-time insights into demand, inventory levels, and optimal distribution routes. Today, 37% of supply chain organizations already see the benefits of AI solutions; whether you win or lose in the market may soon depend on having the best Generative AI tools and the data quality to match them.

For instance, AI can analyze historical sales data, seasonality, store locations, and online/offline events to forecast demand fluctuations accurately. This predictive forecasting helps manufacturers adjust production schedules, optimize stock levels across locations, and improve fulfillment SLAs. Manufacturers can also leverage those data -driven approaches to answer strategic questions on coverage and competitive positioning and optimize yard management efficiency.

Image credits: Rafael Juárez - unsplash

Smart Manufacturing

Smart manufacturing is revolutionizing all aspects of the manufacturing process, from design to production to delivery, using increasingly more digital technologies such as AI and IoT. Smart factories are equipped with sensors and connected devices that collect vast amounts of data on their production lines, equipment, process parameters, and outputs.

Companies that successfully implement smart manufacturing technologies have already seen a 30% to 50% reduction in machine downtime and a 15% to 30% improvement in labor productivity. While it's still early days for Generative AI, manufacturing companies already see returns when using AI, and it is likely that best-in-class companies will go all-in on their AI investments in 2024. Indeed, a survey shows that for the manufacturing function of companies, costs decrease by 55%, and revenue increases by 66% when adopting AI.

For example, AI-powered predictive maintenance can benefit from maintenance history to detect early signs of equipment degradation, enabling proactive interventions before failures occur. This preventive approach reduces downtime, extends equipment lifespan, and minimizes costly repairs. Additionally, AI can help analyze historical production data to find the most impacting production parameters and, at the same time, enhance data-driven work by identifying trends among a large volume of sensors to understand root cause of failures.

Then, process and production engineers can assess the quality of upcoming production events by analyzing historical and real-time data, enabling them to anticipate and address production quality issues before they occur. Moreover, Generative AI can improve workers' efficiency by reducing the time spent searching for safety procedures and process guidelines, allowing them to focus on high-performance tasks.

Personalized Products and Services

According to a recent McKinsey survey, marketing and sales, product and service development, and service operations are the most commonly reported business functions using AI. It is unsurprising as AI can enable companies to offer hyper-personalized products and services to their customers, enhancing customer satisfaction and brand loyalty. In 2024, manufacturing companies will continue to expect changes in demand, market maturity, and pricing pressures; customers will gravitate toward businesses that can support them with aftermarket services, and the leading companies will use AI to detect asset problems faster and reduce downtime.

For example, product recommendation systems can push the right product to the right consumer by building a recommendation system using collaborative filtering and machine learning. Thanks to AI, manufacturers can segment customer data depending on their purchasing behavior, and they can also predict the future value of their customers to help them optimize their marketing efforts to increase revenues over time. AI-powered customer support chatbots can provide real-time assistance, answering customer queries and addressing concerns efficiently. Generative AI can also help generate new sales lead opportunities, leveraging internal and external knowledge.

AI for Sustainability

As demand for industrial products continues to rise, the manufacturing industry is facing a critical challenge related to its environmental impact. Indeed, the industry sector in 2022 was directly responsible for emitting 9.0 Gt of carbon dioxide (CO2), accounting for a quarter of global energy system CO2 emissions. Annual emissions slightly declined in 2020 and 2022 but did not align with the Net Zero Emissions by 2050 scenario.

As 2023 was the hottest year on record and 2024 could be even warmer, there is an urgent need to accelerate progress in energy efficiency, transition quickly to low-carbon fuels, and develop and deploy near zero-emission production processes faster. For instance, AI-powered applications could help track electricity consumption & CO2 emissions across the company's manufacturing sites and help them minimize energy consumption.

To become a sustainable business, manufacturing companies will also need to positively affect the community, society, and economy. AI can help manufacturers improve supply chain transparency, enable them to design and produce sustainable products, and ensure that their workers get home safe.

Conclusion

AI is transforming the manufacturing industry, enabling manufacturers to optimize operations, enhance sustainability, and personalize products and services. By embracing and leveraging analytics and AI, manufacturers can gain a competitive edge and shape the future of manufacturing towards a more data-driven, sustainable, and personalized era.

Pierre Goutorbe
AI Solutions Director
Energy and Manufacturing
Dataiku

Technical Debt on enterprise architecture level

Technical Debt are a present issue being talked about on every summit. Mainly in focus is the application level as already described by Cunningham and Fowler in the past. What about technical debt in a decentralized IT-Landscape and how about changing the perspective from a burden to exploit it`s opportunities ?

An article by Armin Kugler, TeamBank AG

Technical debt originated in the area of internal software quality, specifically concerning the extensibility of a system. Technical debt conflicts with this extensibility requirement. The metaphor debt comes from future, additional expenses as a result of the delivery of imperfect products in the present. In contrast to this, the external quality should be mentioned, i.e. the customer perspective or from the perspective of people who are confronted with the software program and work with it.

(Image: Bing Creator)

In detail, technical debt is the difference between the state of software today and the state in which this software should be in order to meet software quality criteria and meet the software requirements (see also ISO/IEC 25010).

We distinguish between three types of technical debt. Software quality debt (e.g. code smells), test debt (e.g. missing non-happy case tests) and architecture debt (e.g. non-compliance to a target architecture). At an architectural level only architectural debt is considered.

How can I detect technical debt?

The symptoms of technical debt can be sensed. For example if work is more complicated than necessary, development of the system is severely limited or even impossible, included old or deprecated frameworks, bug fixes generate new bugs, declining productivity in development, more and more occurrences in metrics as well as rise of production disruptions.

Why should I manage technical debt?

They are unavoidable and harmful and occur in all phases of software development; also it will help to avoid bugs, inefficiency and side effects. They might be kept at a low level by regularly investing in maintaining the software. So not managing them will reduce competitiveness through reduced agility. If properly managed they open up opportunities for conscious control and a reliable basis for decision-making for stakeholders to make tactical decisions and take calculable risks. Technical debt is not just an IT issue; it makes sense to approach it together - IT and business – and value its opportunity!

Possible reasons for the occurrence of technical debt at the architecture level

In a project environment, with a fixed project end and often not linear progress, new architectural decisions can be necessary. In the course of projects, new requirements for the architecture can arise, be it due to new requirements or new experiences. The end of the project and budget usually remains the same. The long-term orientation towards the architectural guidelines and targets is weighted against short-term project needs.

Due to project constraints, project artifacts are not delivered optimally aligned with the target architecture at the end of the project. Later on there is no budget for architectural changes.

For agile teams in a distributed IT landscape, there are environmental constraints like guaranteed delivery dates of artifacts from a higher-level control structure or differing sprint timings between teams, leading to neglecting maintenance in favor of additional features. This is fostered by inconsistent technical guidance across teams and therefore focusing on team goals, and neglecting cross-organizational alignment.

The individually developed software systems are no longer developed in alignment and gradually drift apart, making optimal interaction more and more difficult

How can I manage technical debt?

Establishing a system of detection, capture, evaluation and remediation. **After Detection,** technical debt is recognized and categorized by the team, then **Captured** in a raw debt list. Then **Evaluation** and assessment based on an evaluation matrix and documented in a detailed technical debt list, roughly estimated by the team and prioritized by the responsible person. Finally, in **Remediation**, technical debt is handled based on its evaluation. Either planned for *elimination*, or *refinancing* technical debt by delaying it or its impact by an *interim solution*. Alternatively, if neither eliminating nor refinancing is profitable, the debt is accepted and left as is.

Documentation and classification of the technical debt is carried out by an architectural central governance e.g. architecture board using a matrix using four stages. The classification is therefore understandable and documented. Evaluation criterias are the impact on sales and profits as well as expected penalties, user experience and loss of productivity, as well as sunk costs and the expected probability of occurrence and its frequency. The categorization is compatible to the classical business impact analysis of incident and problem management.

This structured list of technical debt will be presented to stakeholders. With the commitment of the managers to take on the debt, the long-term redemption of the technical debt is secured and the short-term, architecturally differing solution can be accepted. Based on this technical debt data we can evolve from the unilateral decision towards a solution that meets business delivery deadlines and at the same time ensures the treatment of technical debt.

In the end: Managing technical debt has to be done anyway, so you should take advantage of the opportunities. The approach offers a reliable way of dealing with architectural deviations from the target architecture. The overarching nature of an architectural debt necessitates mapping the redemption across the board. This offers the opportunity to combine short-term and long-term need.

Armin Kugler
Enterprise Architect
TeamBank AG

Detailed information in the techL profile:
TeamBank AG

Survey of technologies

We regularly consult experts on their current needs, with tool research being a frequent request. This chapter highlights key technologies we find noteworthy, providing brief product summaries and links to detailed datasheets and contacts in our techL database.

All innovations be found in the technology database

techL

www.techl.eu

Adesso

Business success is the result of innovative ideas, forward-looking strategies and perfectly tailored IT solutions that provide optimal support to companies as they face their own particular challenges. This always involves the contribution of people who bring the right mix of technological expertise and a deep understanding of the customer's particular business. With a team of more than 9.000 employees on 63 sites within the adesso Group, we are one of the leading IT service providers in the German-speaking area. We work every day to successfully implement our customers' projects.

techL profile

Ainovate

We are a data science & AI consulting firm in the B2B sector with the goal of being the leading innovative force in the field of AI consulting in Europe. We are ambitiously pursuing our vision of positioning Germany and Europe independently and sustainably in the international AI competitive landscape. With the help of state-of-the-art technologies, we are working on a positive and intelligent future for people and the economy. With our expertise in data science & AI, we develop innovative artificial intelligence applications for companies. We work closely with our industry experts to develop models that can be interpreted across industries to optimize business processes and overcome individual challenges.

techL profile

aioneers

aioneers, a fast-growing German tech company offers its AI-powered technology, the AIO Supply Chain Command Center (AIO SCCC) to help businesses build a resilient supply chain. The AIO SCCC combines advanced analytics and decision support linked intelligently to execution capabilities and right up to fully automated supply chain workflows. Businesses can enhance multiple aspects of their supply chain and achieve optimized inventory across multiple echelons, improved sales & operations planning, intelligent order fulfilment and end-to-end visibility of their supply chain while prioritizing sustainability through decarbonization initiatives with the AIO SCCC.

techL profile

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.

techL profile

AIUI

We are AIUI - the AI experts from Germany, which developed the kit for the development of individual AI solutions.
Our software enables companies to build, test and implement AI solutions quickly and easily. No programming knowledge is required for this. Implementation times are shortened and complexity reduced by providing ready-to-use product decouplings, such as for document automation or as a company-specific chatbot for customer support.

techL profile

AskUI

UI automation across multiple operating systems is a difficult task with countless solutions that get in each other's way. AskUI paves a way to unify UI automation for all operating systems within the same framework, using state-of-the-art AI.

techL profile

Asvin

Asvin provides a solution to distribute updates safe and secure over the air to IoT devices. asvin is using de-centralized technoligies 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.

techL profile

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.

techL profile

CodeShield

CodeShield empowers software developers to build secure software and integrates seemlessly 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.

techL profile

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.

techL profile

Digital Frontiers

Digitalization is advancing at an ever-increasing pace. We assist our clients not just to keep up in this race but to be at the forefront. Our team has extensive experience and expertise to support you in processes, methods, and technologies for your IT transformation. We stand by you as experts, helping you understand the consequences of solution options and to optimally select and implement them. Our focus is on reliability and risk minimization, not on mindlessly adopting the latest technology. Even after implementation, we do not leave you alone; we also support you in operation and further development. Making our clients successful is our passion.

techL profile

Erium

In a data-driven world, many struggle to leverage AI effectively. Erium offers a solution: the Halerium Trinity. Our team of astrophysicists and data engineers developed it to navigate data complexities:
1. Consultants train clients' staff to apply data analytics effectively.
2. The Halerium platform fosters collaboration among data scientists, experts, and users.
3. Our methodology ensures AI projects align with company strategy, managing risks. Erium blends astrophysical algorithms with industry experience, bridging technical possibilities with practicality.

techL profile

imbus

Software quality is the mission of imbus AG. Since 1992, the experienced and highly qualified imbus team has stood for software quality assurance and software testing. The expertise gained from over 9,000 successful projects forms the solid basis for the daily work of our experts, all of whom are at least ISTQB® Certified Tester Foundation Level.

imbus offers a comprehensive range of testing services and test automation technologies, which also cover specific areas such as security, load and performance, embedded systems and AI testing, and has also developed a test management tool, the imbus TestBench.

techL profile

Lobster DATA

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.

techL profile

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.

techL profile

Qdrant

Qdrant is a leading open-source high-performance Vector Database written in Rust with extended metadata filtering support and advanced features. Powering vector similarity search solutions of any scale due to a flexible architecture and low-level optimization. Qdrant is trusted and high-rated by Machine Learning and Data Science teams of top-tier companies worldwide.

techL profile

Queryella

Queryella ensures data protection by scanning apps for security and privacy issues using an automated analysis platform fueled by cutting-edge research. It employs AI to detect IT security issues and data leaks, even amidst common obfuscation techniques. Originating from TU Darmstadt, our team excels in code analysis, IT security, and privacy. We're seeking partners to enhance our platform for a secure app future.

techL profile

Rocket Routine

Revolutionize your business strategy! Our software empowers comprehensive strategy creation, clear goal setting, and precise execution. Align teams, enhance transparency, and drive goal-focused communication effortlessly. Track progress, prioritize tasks, and ensure everyone's aligned with our user-friendly interface. No more wasted time or misalignment. Rocket Routine offers transparency for confident data-driven decisions, steering your company to success. From startups to established firms, conquer strategic challenges. Say goodbye to average – elevate with Rocket Routine! Streamline execution, boost productivity, and reach your goals.

techL profile

Sixsentix Deutschland

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.

techL profile

SPIRIT-TESTING Software & Services

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.

techL profile

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.

techL profile

SVA Systemvertrieb Alexander

SVA is one of Germany's leading IT service providers and employs more than 2,400 people at 26 locations. SVA's corporate goal is to combine high-quality IT products from leading manufacturers with SVA's project expertise, range of services and flexibility in order to develop optimal solutions for its customers. In addition, SVA offers a range of proprietary software products that significantly increase the possibilities for designing solutions.

techL profile

Teambank

Company specialized in liquidity management, concentrating on german and austrian market. Member of the DZ Bank group. Our extensive liquidity management contributes to a carefree life for our customers. With cutting-edge technology and an outstanding team we inspire our customers and contribute to the profitable growth of the Cooperative Financial Network.

techL profile

Tonic.ai

Tonic.ai is a synthetic test data management platform that provides developers with highly realistic data for efficient product development, while ensuring compliance and security. With universal data connectors and flexible APIs, Tonic integrates seamlessly into existing pipelines. Its advanced subsetting and synthetic scaling technology allow developers to tailor and scale their data accurately. Tonic.ai a valuable tool for developers looking to streamline their processes, shorten development cycles, and deliver solutions quickly without compromising on data integrity.

techL profile

UltiHash

UltiHash is the first high-performance and resource-efficient object storage solution for heavy-load use cases such as AI/ML, data analytics and product engineering. UltiHash facilitates data growth without the need for a proportional storage capacity increase. Its technology brings byte-level deduplication independent of data types to every data infrastructure, matching binary fragments per and across datasets from terabytes to exabytes. UltiHash's technology is able to decrease companies' storage needs by up to 50%, helping businesses significantly decrease their TCO, saving millions on unnecessary storage and infrastructure resources.

techL profile