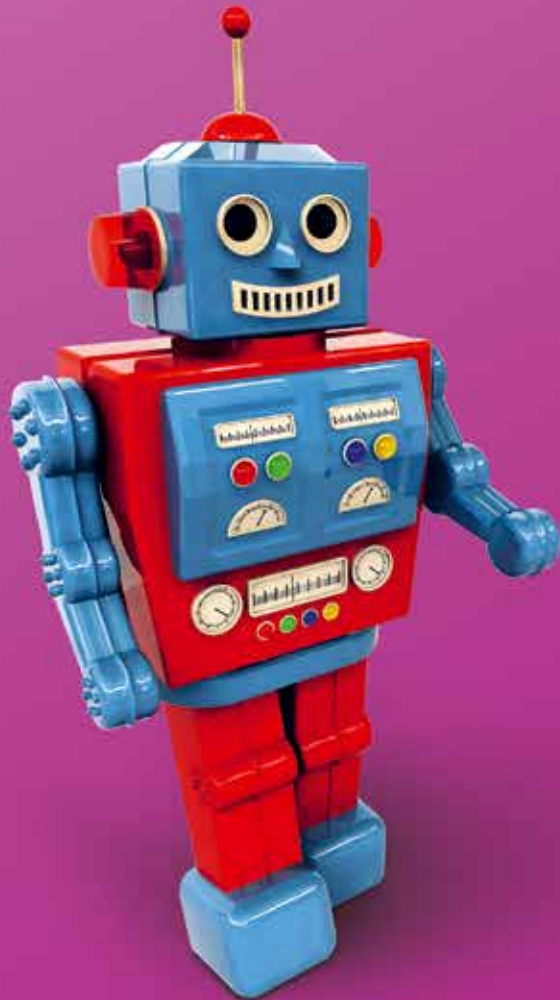


ADNOVUM

# NOTITIA

NOTEWORTHY NEWS FROM AND ABOUT ADNOVUM

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DIGITAL EVOLUTION



Dear Reader,

Machines are now driving vehicles, managing assets and even performing surgery. Closer and closer integration of production and communication technologies makes this possible. Industry 4.0 is the current buzzword, designating the fourth industrial revolution following steam power, electricity and the computer. Intelligent and digital networked systems will allow production to organize itself independently and do so along the entire value chain.

The trend stems from the software industry: After all, without software digital automation would be impossible. But how is the software industry doing? The industry has the clear advantage of being able to master the challenges with their own assets. Software companies now have to apply their expertise to their own processes and help automate them. The goal is complete consistency – from design and development to testing and production. And back again.

Coding is the key. Software that can be infinitely expanded? Already standard. A server at the push of a button? Routine. Having the entire systems in the code opens up limitless possibilities. Software no longer needs to be specified, engineered, packaged, delivered and deployed before becoming operational, instead it is now designed and continuously improved in direct collaboration between customers, developers and operators.

Information technology providers thus need to network both digitally and personally. Consistency is only possible if all the teams work hand in hand. In this case we are referring to the DevOps approach. The change represents a paradigm shift

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in the face of the previously strict division between development and operations. The benefits are obvious: greater flexibility, lower time-to-market.

AdNovum has been using DevOps for a long time. This approach lets them go live with customer solutions early and then improve them gradually. The phase-by-phase approach always leads to more intelligent systems. Once they are fully networked with all their interfaces, self-organizing production and Industry 4.0 will be anything but a utopia.

Reading, however, still requires a personal effort. Enjoy.

Chris Tanner

CEO AdNovum Informatik AG

# WELCOME TO SOFTWARE INDUSTRY 4.0

Next to the Internet of Things (IoT) and Industry 4.0, digital transformation is one of the biggest trends in IT. It has a decisive influence on our customers' business.

But not just theirs.

*By Tom Sprenger and Christian Widmer*

As an independent provider of software solutions, we have noticed significant changes in the market in general, but also specifically for our customers. The key driver in this global trend is a digital transformation wave that impacts all industries. In order to stay competitive in their markets, companies must completely rethink business models and find new approaches at a previously unimaginable pace. The expectations of end customers, for example, have radically changed how they communicate with companies. End customers today expect mobile access to offers and an active exchange. They see themselves as a community on equal footing with the company and increasingly want to be involved.

The speed of these developments constantly challenges our customers in preparing the IT solutions necessary to solve these issues. "Bimodal IT" or "multispeed IT" approaches are highly effective. Gone is the time when IT was just a cost item. Modern technologies (e.g. mobile and cloud) and approaches (e.g. DevOps and continuous deployment) in IT are uncontested as being among the most important factors that enable it to react quickly to dynamic customer needs and new market trends.

**END CUSTOMERS SEE  
THEMSELVES AS A COMMUNITY  
ON EQUAL FOOTING WITH  
THE COMPANY AND INCREASINGLY  
WANT TO BE INVOLVED.**

## Agile collaboration and planning security

In consequence of these developments, collaboration with our customers has drastically changed. The need for agile collaboration has increased rapidly. Before, the customer hired us on a classic waterfall-oriented contractual basis, sent us a set specification, and expected to get the completely developed solution

by the contract deadline. Today, our customers already want us on board during specifications of the solution and throughout development so that they can continually adapt their course to new circumstances. At the same time, our customers' need for (planning) security has increased. In other words: Our customers want a software delivery process that unites agility, which is necessary for the development of individual solutions, with the core characteristics of a highly industrialized production such as planning security, reproducible quality, low production costs per release, and speed.

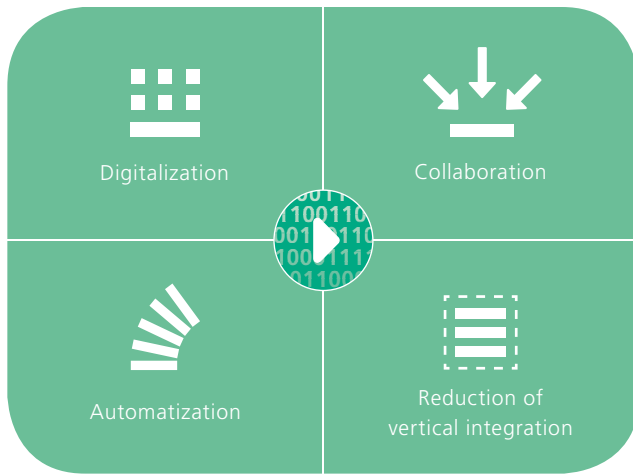
**THE NEED FOR AGILE  
COLLABORATION HAS INCREASED  
RAPIDLY.**

## Consistent digitalization as differentiating feature

This is precisely what we do at AdNovum: We want to offer our customers the option to bring new solutions to the market in a highly agile yet secure way. This requires a systematic digitalization of software development from the customer's request to delivery. The end-to-end digitalization will be decisive for us as a Swiss software company over the longer term as we aim to meet growing market demands. For us, it is an opportunity to differentiate ourselves in the market and to prepare ourselves for an increasingly competitive international arena.

## Stepping into the digital software delivery model

As a prerequisite for successful, networked projects in a distributed ecosystem with customers partners, two key elements must be fulfilled: All participants need location-independent access to the same information base. But the customers as well as the partners must also have access to the important processes of collaborative projects and be able to participate actively.



*The digital software delivery model.*

This is a direct analogy to digitalization initiatives in the finance sector, for example, where end customers and consulting partners now get digital access to a bank's business procedures in order to transact business in direct dialogue with it.

#### The digital information model is key

Location-independent availability and shared access to procedures necessitate systematic change in a digital software delivery model. One such model essentially consists of two main elements: a digital software delivery process and a digital information model. The first one defines the processes of important tasks and production steps from customer inquiry to delivery of the solution. This process can have various characteristics, depending on the customer's project. The variation in

**TODAY, PHYSICAL DOCUMENTS  
(E.G. SPECIFICATIONS)  
OR OTHER ARTIFACTS  
ARE STILL OCCASIONALLY  
EXCHANGED.**

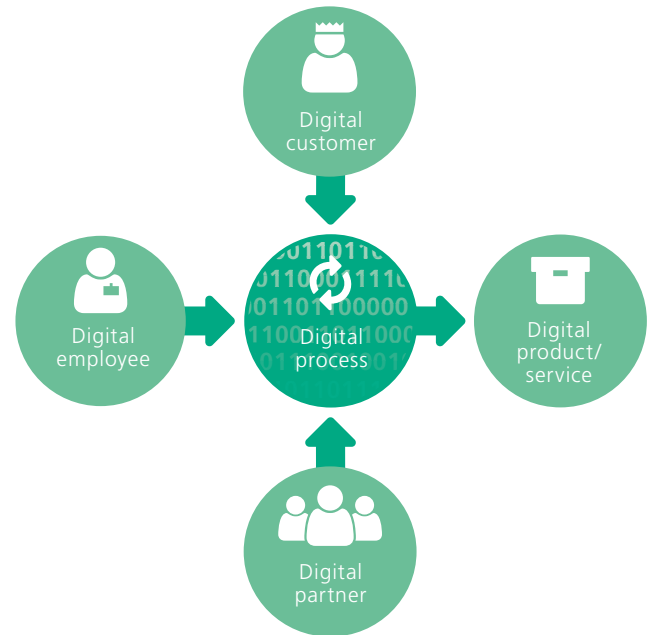
this case is indiscriminate. Important for the process are a clear definition, digital mapping, as well as a solid grounding within the project. The digital information model is decisive for the success of a digital software delivery model, which means that all deliverables are archived digitally and in a structured way. All process artifacts and deliverables like requirements, specifications, GUI designs, and tasks are digitally created and managed. This sounds almost trivial in today's climate. But practice shows that the model is far from being implemented digitally from end to end. Today, physical documents (e.g. specifications) or other artifacts are still occasionally exchanged.



*Tom Sprenger: as CTO in charge of the digital strategy.*

#### Extracting important information

Still, even if all artifacts are digitally archived, that does not mean that the digital information model has been systematically implemented. Digital transformations often fail because, despite a digital flood of data, the really important information cannot be extracted. A central part of every digitalization strategy is to create value from data available after the transformation in order for an existing business to become faster or better and to



*The digital business process.*

### Customers and partners: getting in on the action instead of watching from the sidelines

The digitalization of process and information models is the prerequisite for collaboration in the project ecosystem across different sites and organizations. Any information that is relevant to a project is accessible at any point to any authorized person from any location. The physical presence of certain persons is no longer mandatory for successful project execution. As equal actors in the project-related and highly networked ecosystem, customers, partners, and AdNovum work together on a virtual collaboration platform that draws on the digital process and information model.

Such a collaboration platform includes all the functions that are necessary for digital software delivery and also offers far more than the usual collaboration services such as mail, chat, task management, and wikis. It enables completely new forms of work, such as the joint development of new solutions, also known as cocreation. Customers no longer receive a turnkey solution that covers predefined needs, but rather the opportunity to play an active part in the development of the solution. Along the way, they profit from the development company's know-how, which is based on similar projects, particularly regarding customized project methodology and best practices.

### Cocreation creates transparency and eliminates barriers

Collaboration in digital environments brings change and ultimately also requires adjustments to the procedural landscape. The classic customer-contractor relationship disappears in favor of significantly more transparent and ultimately more productive

implement new business models. We are particularly interested, for example, in how many iterations we must run through during testing until we have met the desired quality standard. This shows where we must start in order to achieve improvements. Or, we want to find out whether services with reuse potential were implemented anywhere in the code, such as services for sending mail. Through the consistent reuse of such services, we can shorten the time-to-market.

work forms like cocreation. By using modern identity and access management mechanisms, like the NEVIS Security Suite offerings, the explicit differentiation of internal and external from the participating organizations increasingly disappears. All participating parties can be equal in the project and can work together seamlessly across organizational boundaries.

Practical experience with customers shows that cocreation approaches significantly increase speed, particularly during phases of great insecurity. At the beginning of a project, for example, when the requirements are not fully established or only a vague idea of the desired solution exists. With a collaborative model-assisted approach, the knowledge of all participants can be used in this phase and can have a direct impact on the result. But initial results (e.g. GUI flows) during the implementation phase can also be demonstrated early and easily in the collaborative environment. Feedback on the process is immediate. Consequently, undesirable developments can be recognized and corrected early on and iteration cycles toward further development of ideas and solutions can be dramatically shortened. As a result, the time-to-market from the idea through implementation and on to the productive introduction is reduced as a further effect, which in turn lowers development costs.

### WITH COCREATION, FEEDBACK ON THE PROCESS IS IMMEDIATE.

#### Digital information generates added value

When all artifacts produced in the software delivery process are stored in the model, they can be constantly analyzed without additional expense, enabling continuous improvement. Manually created artifacts, such as specifications, project structures, source code or entire infrastructure landscapes, offer the most effective lever regarding optimization. In the process, one can differentiate between artifacts that necessarily require creative output and those that are redundant or derived from available artifacts and can thus be treated as technical busy-work.

In order to sound out idle automation potential, we can first use information from the digital software delivery model. To this end, we determine only tasks without creative features in the model and then generate successive artifacts from semantically annotated artifacts. Architectural basic elements, for example, can be extracted from a business specification and can produce automatically from that the project-specific scaffolding of the solution architecture as well as the ground structure of the software project and its system deployment. At this point it must be explicitly noted that it is not about generating business logic – this requires in most cases creative capacity and is not subject to the classic generator approach.



*Christian Widmer: in charge of the regional strategy.*

#### Reducing vertical integration

The production of artifacts requiring creative output is linked to brainpower and, ultimately, to certain persons. Their production is only partially scaled and they are commensurately valuable. Today, such artifacts are often still created and filed on paper or in proprietary formats. In a digital software delivery model, they are always available in a digitally itemized form and semantically linked. New possibilities open up in this





process. Similar artifacts, including their context, can be made visible and available using corresponding tooling. It is possible to merge prefabricated components from an existing service repository while creating a new solution. Reducing vertical integration can enable extensive avoidance of the repetitive creation of same or similar artifacts. This frees up valuable creative capacity and brings a higher added value to another area.

### Digitalization frees up resources

The consistent digitalization of the software delivery model enables new, more efficient forms of collaboration and an additional automation for redundant and creative tasks. It liberates resources and simultaneously increases agility in the project. It becomes significantly easier to test innovative approaches within a project while closely collaborating with a customer. This way, constant innovation can be promoted without great risk.

## CONSISTENT DIGITALIZATION LIBERATES RESOURCES AND INCREASES AGILITY.

Nike shows us the way. Customers can order customized Nike shoes (NIKEiD) online. Nike is combining a highly automated production process with a customization. In the industry this is called individual mass production and digital fabrication. Stepping into a digital software delivery model provides the basis for analogue options in the software industry and enables both us and our customers to quickly seize new market opportunities. In addition, it lays the foundation for innovation, i.e. for completely new offerings – welcome to software engineering 4.0! ■

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### Tom Sprenger

*Tom Sprenger, Dr. sc. techn. ETH, joined AdNovum in 2000 as Software Engineer. From 2002 to 2004 he was Head of AdNovum Software Inc. in San Mateo, CA. In 2007, he was promoted to Chief Information Officer (CIO) and member of management. In this function, he built up the strategic business area IT Consulting. Since 2013 he has assumed responsibility for the company's technology strategy – with a focus on digital evolution – and business unit products in his role as Chief Technology Officer (CTO). In his private life, he enjoys spending time with his family and, in the winter, sunny days on the slopes.*

### Christian Widmer

*Christian Widmer, MSc. ETH in Computer Science, has been with AdNovum since 2002. He had the technical lead in various complex enterprise projects. In 2010, he moved to Singapore to help build up AdNovum Singapore Pte. Ltd. As regional CTO, Christian Widmer has been responsible for the definition and implementation of AdNovum's strategy in the Asia-Pacific region since 2013. Outside AdNovum he, as a passionate dad, enjoys spending time with his family.*

# MIX AND MATCH – HOW TO BUILD SOLUTION TEAMS

The increasing digitalization turns software engineering processes upside down, as customers no longer order a readymade piece of software, but rather the continuous digitalization of their value chain. AdNovum unites developers and operators under one roof, flexibly putting together solution teams to adapt to the changing demands.

Interview with Christian Siffert and Alexander Nolting.

Looking at your order book, how have customers' needs and wants changed?

CS: They have changed fundamentally. In the past, customers ordered software that was delivered on CD or per download, and then they would run it themselves. Nowadays, customers order a full service. The value chain has been extended, the release cycle shortened. While we used to deliver a new software release twice a year, we now do so weekly.

AN: The value chain also starts earlier. The digitalization begins even before we meet the customer for the first time. Certain digital processes are expected to be in place already, so that customer and AdNovum are able to communicate via platforms.

Does this mean that, nowadays, the customers already send their requirement specifications in digital form, for example via collaboration tools?

AN: Our customers always submit their requirements digitally, but not necessarily via collaboration tools. We often still have the good old Word document. And depending on the order, the Word doc might even prove more efficient, since collaboration is not yet standardized beyond one's own company walls, and also because businesses use collaboration tools differently.

CS: In the past, a comprehensive document listing all requirements would form the starting point for our efforts. Of course we would keep exchanging thoughts with the customer in order to adjust requirements and to clarify the finer details. But it would take a long time for the customer to receive the result in form of an actually running piece of software. Today, all of this happens much faster. We are able to deliver individual features on the fly as the project progresses.

The subprocesses are much more interlocked; we produce "just in time", as they say in the industry. Many of the changes industry went through during the postwar period are the ones IT is going

through in our current times. We used to be an artisanal manufactory, delivering a new release every now and then. Now we are designing complete production lines together with our customers, continually delivering features in small batches.

So there's no longer a start and an end to a project?

CS: A project has, by definition, a start and an end. One puts together a team and at the end dissolves it again. Nowadays, we no longer think in projects, but in products or solutions. Those do not have an end.

**WE DESIGN COMPLETE  
PRODUCTION LINES  
WITH OUR CUSTOMERS.**

What exactly do we sell, then?

CS: Our customers no longer order a software project, but the digitalization of their value chain. They want a continuous solution.

AN: What's more, the solution is frequently no longer focused on the goal that was initially set, as it can already have changed by the end of the day. Customers expect us to be able to quickly adapt to changes. We have to be able to get into their heads and their work environment and think the way they do, in order to find out where they want to lead their business and whether the solution may affect other aspects of their business model as well.

CS: Our customers are aware of the short cycles of consumer devices: See it, order it, receive it – all in less than a week. So they think: Why shouldn't this also be possible for a digitalized business process?





*Alexander Nolting and Christian Siffert: working on the coordination of operations and development.*

Speed has increased tremendously, we are constantly improving the software. What does this mean for the collaboration between development and operations?

AN: Developers have to be able to develop on a system that is close to production, tailored to the specific requirements of the customer, without distinguishing between development and operations, a system which has been tested and which provides the same support and monitoring processes. Ultimately, the software has to be functioning not just on the laptop of the developer, but also when deployed in the customer's environment.

CS: There's a saying that goes: "The developer just throws the software over the fence." In earlier times, this used to be a manual and explicit handover of both the software and the installation documents. A member of the operations team had to install the software on the production system and had to ensure that everything was working fine. A time-consuming task, but nonetheless acceptable, since it only happened every few months. Having to continuously do the same thing on the other hand is a real pain. The deployment process must therefore be fully automated. This results in a shift in the value chain. In the past, the two work steps were done sequentially, now they run in parallel. Operations sets up and maintains the deployment process as a service, used by development.

In other words: Operations and development now run concurrently, and there is no handing over of the baton?

CS: Exactly. I recently used an image for a blog post: For a new software release, a truck is loaded and sent onto the road.

There is a pace car on the road which you need to follow to deploy the software. This model is far too slow. Operations needs to provide a smooth highway with guardrails. But once the highway is in place, the solution team must be able to drive on it on their own. This requires major adjustments on both sides.

AN: A lot depends on the know-how of the individual. For example, a developer who writes great algorithms, but pays little attention to the infrastructure in which the solution needs to operate, is going to fail. For this reason, it's imperative for both developers and operators to be able to look beyond their own noses.

CS: Yes, absolutely, that's a must these days. The team has to keep an eye on the customer value as a whole, including operations. This means having mixed teams with T-shaped skill sets, and, as mentioned earlier, enhanced support by underlying self-service platforms.

What exactly does the operations team provide?

AN: Operations ensures the stability of both process and solution. It is not necessarily responsible for the process, but knows what can be operated with the physical and personal resources available.

CS: Operations knows the ins and outs when it comes to implementing processes. This know-how has to flow back into the development projects. So nowadays, I think we should talk about solution rather than development teams, as they have both development and operational responsibility.

AN: However, it has to be noted that development and opera-



tional teams often still act separately today and are both focused on their specific tasks. Interdisciplinary working and thinking is not yet the norm.

CS: Naturally, this has massive organizational consequences. Before, development teams reported to the head of development and operational teams to the head of operations. Now, in the wake of the new methodology, new solution teams are suddenly being created that are responsible for both areas. The slogan behind it is: "You build it – you run it."

Let's take a look at it from the customer's point of view: A customer comes to us with a certain requirement. What he wants from us is not software, but a certain service or "value". Whether the business is about leasing cars or transporting cement, he wants his business organized. Which teams within AdNovum are involved in delivering the service does not matter.

#### Does this mean integration of development and IT operations from a single source is almost imperative?

AN: For a business that offers off-the-shelf solutions, it is not relevant whether development and operations are done by one and the same or two different companies. AdNovum, however, builds custom-made solutions. If we want to offer our customers a complete range of solutions, from consulting to concept development right down to operation and optimization, it is crucial for us to integrate operational processes as part of the development process.

CS: Integrating the two areas is also a question of efficiency – we are not the only software developers on the market. Maybe one day, we will not even call ourselves a software engineering company anymore, but rather an information automation company. Even though software engineering remains a core part of our offering, our performance rating depends mainly on how smoothly the software runs in production and on how long it takes for us to deliver.

AN: The customer's expectations regarding aspects such as reliability and speed are also of great importance. For public-sector companies, long service life, stability as well as low downtime and error rates are primary requirements. By contrast, a company that depends on being able to respond dynamically may be more tolerant regarding operational reliability, if less reliability means increased speed.

#### How can such flexibility be achieved?

AN: We have reached a maturity level in IT operations that five years ago seemed unthinkable. IT tools are being created with such speed that it's almost impossible to keep track of them all. And it is even more difficult to decide which tool is the right one. Here we need to standardize yet again, or we are going to get bogged down by too many options.

CS: In today's IT, the need for flexibility is pushing standardization through containerization. In the shipping industry containers were introduced in the 1960s. If shipping a ton of goods used to cost 6 dollars in 1956, the same load would merely fetch 20 cents after containerization. Flexibility rises slightly thanks to shorter throughput times, and costs are drastically reduced.

#### Transferred to software this means ...

CS: Standardizing components releases funds that enable higher flexibility tied in with better quality. If one looks, for example, at the higher expenditure for recurring manual tasks in development, delivery, integration, and costs for putting into operation, the potential for improvement becomes obvious.

AN: I have to be able to answer several other questions, such as: How do I integrate with the customer's infrastructure? Does he already have a foot in our IT door, so that I can simply send the container over? Or do I need to provide the container by different means? In other words, from an operational point of view, containers are only the first step, just a different way of delivering software. If there is no direct integration with the customer,



we have tools that move things into the public cloud, which is basically just a supersized infrastructure operated by someone. If the customer does not permit the use of a public cloud, AdNovum may act as an interface and operate the customer solution within its own private cloud. Or, we develop in the traditional sense and operate a whole business operation stack via a virtual machine. That, too, would be a form of handover. Containerization alone is not the solution. However, it opens up new possibilities and thereby enables us to address some of the challenges we are facing much more efficiently.

**NOWADAYS, SERVERS  
CAN ONLY BE  
MAINTAINED IN  
AN AUTOMATED WAY.**

[Let's come back to the importance of containerization for the collaboration between development and IT operations.](#)

AN: For the developer, the container paradigm brings considerable changes. He has to formally describe operational processes, and thereby sort of becomes responsible for the operation of his own software. The operator, on the other hand, is progressively morphing into a (performance) analyst, optimizing his infrastructure with regard to stability and performance.

CS: To reiterate our earlier point, infrastructure today is increasingly offered as a service, with the individual order being handled automatically instead of individually by operations staff. This makes both suppliers and users more self-sufficient. What's more, it frees up time – hopefully – for operations staff and developers to actually collaborate, i.e. jointly work out measures to improve availability, reliability, monitoring and concrete measures to prevent incidents, rather than just meeting each other sporadically.

[It was long believed that separating development and operations would make processes more efficient and secure. Does this no longer apply?](#)

CS: This principle, also referred to as “separation of concerns”, is often ascribed to the Information Technology Infrastructure Library (ITIL). But actually, you will not find it in ITIL. In view of today's conditions and requirements, I think that a separation is no longer the most efficient way of providing IT services.

AN: ITIL supports by way of “blueprinting” – that is, it specifies how IT services can be set up to achieve good results. However, the separation doesn't need to be too stringent.

CS: In many cases, this separation no longer makes sense. Interdisciplinary teams that combine all the skills are better suited to coping with today's challenges. Developers know how to code, operations staff knows how to operate a system. For example: In the past, there were no more than a dozen servers deployed in production. Today, there may be up to a hundred – or more. In the old days, individual servers were treated like pets, while nowadays server maintenance can only be handled in an automated way. As a result, there is a need for skills to be transferred between development and operations – in both directions! Developers, for instance, have always used versioning. Today, infrastructure components also need to be versioned. As a matter of fact, we are increasingly pressured to version all available resources, from firewall to storage, to be able to restore them quickly and reliably if required.

[How does this impact on the work of developers and operations staff?](#)

AN: The professional skill sets will change. Personally, I expect system administrators and operations staff to have some developer skills. They have to be able to understand how developers work in order to solve problems efficiently. At the same time, developers can no longer just focus on the coding, but must also spare a thought on how the solution will perform in practice





afterwards. A very good example for this is the handling of databases. In the past, a developer would order a database and its setup from the database team. Now that databases are operated within the container, developers often have to set up the databases themselves, hence they must also possess some DBA know-how.

CS: Operations is no longer alone at the end of the value chain and sets up databases manually on request. More and more work is done in project mode. And the vast amount of hardware, from servers to firewalls and load balancers, is described in code or configuration files to enable automated maintenance.

AN: I really like the way you phrased this: “infrastructure as code”. We have to describe infrastructure in such a formalized way that it is possible to deduce code from it. Which formal language we use in the process is irrelevant.

*That sounds challenging ...*

AN: It all depends on how we deal with errors and downtime. It goes without saying that mistakes happen. One aspect in the container model says: “If I fail, just start another copy of me. The copy will take up work at the exact point where I failed.” This means, we live safely in the knowledge that mistakes do happen, they have been taken care of and are integrated in the plan.

CS: That’s a giant shift. Operations is currently optimized with the expectation that no mistakes occur. But we know that in IT, as well as in globalization, everything is interconnected. Due to the growing interdependency, incidents happen more frequently – and are occasionally caused by services that you didn’t even realize had an impact on your solution. As a result, we have to increasingly optimize toward being back in operation as soon as possible. Development and operations have to join forces and set up solution teams that can ensure stability.



*How is this done at AdNovum?*

AN: We invest in a culture that accepts that mistakes happen, and that seeks ways to get the software up and running again quickly. This necessitates a radical change in thinking. The traditional approach in software development was based on reducing complexity to get a handle on the process – that no longer works in this day and age.

CS: This aspect also has organizational consequences, as development and operations are separate. However, as we operate in a matrix organization, we do not have to turn the organization upside down, but can decide on a case-by-case basis whether it makes sense to deploy a mixed solutions team for a specific project or not. This way we can gather new experiences and find out which is the best solution for us and our customers. ■

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## Christian Siffert

*Christian Siffert, MSc ETH in Computer Science, joined AdNovum in 1999 and has been in charge of Platform Infrastructure Engineering since spring 2016. He gained experience on numerous projects as developer and technical project manager. Since the advent of lean production in IT, he is happy to integrate ideas from his minor subject logistics, or attends lean kanban conferences. In his spare time, he clears his head jogging in the Jura mountains or by spending quality time with his family.*

## Alexander Nolting

*Alexander Nolting, Computer Specialist and Project Manager, joined AdNovum in 2016 as Head of System Integration. He has almost 20 years of experience in managing high-availability solutions for the telecommunications industry. When he is not working, he enjoys riding his motorbike.*

# DIGITALIZATION OF SOFTWARE ENGINEERING

Everything uses software nowadays. Availability, stability and flexibility demands are constantly increasing, making more efficient production methods necessary.

The software industry is now about to take a step most other industries have long behind them – it needs to digitalize processes.

*By Remo Meier and Stefan Ott*

Faster, further, higher. As with athletes, companies are being conditioned for high performance. Efficiency and productivity need to increase, costs need to fall, product changes and new products need to be implemented and launched as quickly as possible. Therefore, procedures and processes need to be optimized at all levels, by harmonizing the transfer of semi-finished products across the production phases.

One solution is obvious: reaching these goals with IT. Many industries are fundamentally changing their relationship to IT. IT procurements are no longer fixed procurements like those for water and electricity. On the contrary, IT is becoming an integral part of a company. As such, IT is moving ahead faster and further in tandem with the companies.

## EXTERNAL INNOVATION CAN CREATE EXPONENTIAL GROWTH AND SUCCESS.

The new relationship to IT means industries are focusing increasingly on successful IT concepts such as mobile apps and the Internet of Things (IoT). The concepts are opening new opportunities. Companies can expand products into platforms by making the interface available to end customers and third-party companies. Doing so allows for external innovation, which can create exponential growth and success.

In short, more and more software is needed. The demand creates several challenges for IT companies: They need to link the development of software from design to operations, improve and accelerate production, eliminate media disruptions and allow for rapid exchange of information in order to meet market demands.

## From project to solution

The increased deployment and higher visibility of IT results in the desire for a new cooperation between the user/customer and their IT service providers. The focus is on closer and more efficient contact, which extends from analysis and conception to production and further development. Today, the typical customer is different. A few years ago, the internal IT department was usually the customer of the service provider. But today, another company department may order an application. The customer has numerous ideas and wants to integrate them. In order to evaluate and comment on them, faster solutions are needed. The same applies to changes. They need to be taken into account as quickly as possible, so the IT provider can meet customer needs. In such a context, the limited project is transformed into a solution with a life equivalent to the entire software life cycle and thus typically years. Software as service – in the best sense of the word. The consequence: The demands on the integration and quality of the software increase.

## THE FACT THAT THE SOFTWARE INDUSTRY CAN FACE THE CHALLENGES USING ITS OWN RESOURCES IS A DECISIVE ADVANTAGE.

## From digital production island to digital assembly line

What is the next step now? The focus is on process automation. The fact that the software industry can face the challenges using its own resources is a decisive advantage with enormous potential. Methodologies and expertise are available. The industry is now required to apply the knowledge to their own processes to redesign and automate them.





*Stefan Ott (left) and Remo Meier describe how automation speeds up development of custom software.*



The significant factor here is that the life cycle of software involves a lot more than development. The most important factor is to create uniformity and consistency and to do so with design, development, testing and production and back again. The following measures can help reduce the throughput times: automating deployment, establishing and coordinating technological and organizational measures for zero downtime, employing risk management, ensuring service availability and performance, tracking performance and last but not least guaranteeing quality. Integration of operations and preventative measures should help reduce required maintenance to an absolute minimum. Collaboration platforms, for example, remove barriers between the relevant organizations, ease the exchange of information and make information available at any time.

### The expansion of code

In doing so, we do not have to start from zero. Software engineering services have been undergoing automation for years. A quick look at the code supports this. The code is more than just the actual application code and the code for the system. Documentation is stored as code with markup languages. Large parts of the infrastructure in servers, networks and storage are defined using code and also automatically created and maintained (Infrastructure as Code, DevOps). Parts of the integration and testing are also automated and transformed to code. And there is more: the fully automated software deployment – without downtime and under integration and fully automated control of load balancers – or the elastic scaling of systems such as servers, applications and nodes based on the load behavior visible in the monitoring system (automated feedback).

**THE CODE IS MORE THAN  
JUST THE ACTUAL APPLICATION  
CODE AND THE CODE FOR  
THE SYSTEM.**

### Code to create reproducibility

Having the entire IT system in the code opens up numerous new possibilities. Code has thus been installed in version management systems for years. Doing so makes archiving possible along with access to and comparisons among versions as well as the reset to previous states. An entire system copy can be created, developed and then be integrated back into the primary development branch. The development branch thus remains fully functional and additional changes can be integrated quickly into the production at any time.

The elimination of all other influences is good for the consistency and the automation of development. Processes and the

systems status should possibly be the same in all environments. This eases detection of problems early or even helps avoid them entirely. Approaches such as immutable infrastructures integrate this concept: Servers are thus no longer installed in the classic sense, but final images are created from code, and these cannot be changed. The images are automatically delivered to, installed on and run in the server. The process is identical for test and production environments. The configurations receive the images from their surroundings. The data entry from business records to auditing and logging is performed in central data-bases. The static nature of the images allows for multiple infrastructure simplifications. Aspects such as firewalls, remote access, user controls and file system authorizations are thus irrelevant in many areas. Precisely the same system can be recreated and started once more from the code, just like software can always be created anew again and again. Every step in the system is reproducible. No manual steps are needed. Doing so increases efficiency, quality and availability. A system is always precisely defined by its code. And an individual version number is sufficient to identify the code.

**EVERY STEP  
IN THE SYSTEM IS  
REPRODUCIBLE.  
NO MANUAL  
STEPS ARE NEEDED.**

### From servers to events

Why stop here? Maintaining the server landscape is associated with significant expense. Once the system is defined in the code and further influences have been eliminated, automation will be able to make a significant step forward. To what extent is a server you have installed, started and maintained still necessary, if the server can be generated at any time from the code, in the most extreme form even for every new query or batch process? Instead of servers, we refer to events. The advantages of the event approach are obvious:

- No installation and starting of servers required.
- Infrastructure will only be claimed when used and can be scaled for the application.
- Redundancy and error tolerance are available automatically and transparently. Events are distributed dynamically to the machines based on the current load, geographic distribution, available hardware and the code performance requirements.
- Server housekeeping is no longer needed.
- No more server processes requiring maintenance over months and years are needed.

Various factors influence the successful application of the event



approach. For example, consistent and, in many areas, automated monitoring is vital in daily operations and easy to implement. The scaling from production to development and testing are essential both for efficient development and for local traceability of the system by the developer. In conjunction with permanence and reproducibility, these factors not only allow the monitoring and overview but also avoidance of many problems – relative to traditional solutions.

### SUCCESSFUL CODE IS SIMPLE CODE: TEXT FILES, WHICH BOTH MACHINE AND PEOPLE CAN READ AND EDIT.

#### Consistency

A successful code is a simple code: text files, which both machines and people can read and edit. Code can be used for more than implementation and deployment; it can also be included in analysis and design. Doing so creates consistency across the entire product life cycle.

Thus larger IT projects now need to have a business analyst on hand. They know what is already in place, ascertain the (new) requirements, design and document a solution. The duties will generally remain the same. The procedure and the type of output will change massively, as the “classic” approaches are associated with media disruptions. The media disruptions prevent speedy and proper information management, which is vital in order to meet today’s demands for efficiency and automation.

The decisive step is now to save the concept and the information model for the business analysis (with use cases, user interfaces, etc.) as a data model. Such a model already exists – at least in the minds of business analysts. The advantages are obvious:

- Information entry is structured: Each piece of information belongs in a specific location and is not maintained redundantly.
- The recorded information is up to date and immediately available in the model: Those who want access to certain data, whether they are the customer, the software team or the operation team, can have it in the desired form at any time. In addition, information also flows back as comments and feedback.
- Relationships/links between concepts may be generated and tracked, which contributes to a coherent overall image of the output.
- Further developments can access the available information. In addition, changes to the information can also be recorded and then links used to avoid gaps and unintended consequences.

The information model forms the basis for project planning and methodologies. Their concepts can be defined as tasks. Links can be used to gather all the necessary information for a task. Doing so allows for a better expense estimate and thus better tracking of the project. Cockpits help in the process as they provide an overview of the progress of the development. The information is then projectbased. The expert information acts purely as a reference to the information model.

Alternatively, domain-specific languages (DSL) can be used in order to model the system in code. The model describes components, their interfaces and interactions. The model can be stored in repositories and made accessible online. Models in this case are not limited to the description but also serve as a starting point for the creation of software components. They can be updated or transferred to newer models in the later phases of a project. In the event of problems they provide valuable feedback regarding the relevant use cases.

#### The findings

The next steps and results of software engineering always remain in the code, however, with the focus on digitalization and automation. This creates new challenges, particularly for architecture and design. All of these tasks require software engineers who are willing to strike in a new direction and able to work in a team. ■

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#### Remo Meier

*Remo Meier, MSc. and Dr. sc. from ETH Zurich, joined AdNovum's Application Engineering team in 2013. The department focuses on providing the means for efficient software development. In this context, topics relevant to the digital evolution are very important. When Remo Meier has free time, he can be found in the mountains.*

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# DIGITAL TRANSFORMATION THROUGH BUSINESS ENGINEERING

Digital transformation is a mega trend.  
Companies cannot afford to be unprepared to face the changes.  
Business engineering can help.

*By Reinhard Jung*



Two words are on everybody's lips: digital transformation. However, many companies have only the vaguest idea of what the concept involves. The process is more than merely having a bank launch an e-banking solution or having an insurance company provide customers with an online portal for signing and managing policies.

## Drivers of digital transformation

In order to understand the "essence" of digital transformation, a glance at the drivers will illustrate what triggered this mega trend or is supporting it:

### 1. Technological networking and pervasive computing

Networks and networked devices are now omnipresent. The iPhone was launched exactly nine years ago. Modern everyday life is impossible to imagine without smartphones. Customers are almost always online meaning the real and the virtual worlds are ever more closely linked.

### 2. Web 2.0, social networks and communities

The World Wide Web, originally a source of information, has long since transformed to a platform for real communication (Web 2.0). From unidirectional 1:n communication from companies to customers, an m:n communication has since developed. IT allows consumers to reach other consumers, completely changing the power dynamics on many markets. Social networks and communities with completely different goals have been created.

## About Reinhard Jung

*Reinhard Jung is Professor for Business Engineering at the University of St. Gallen and Director of the Institute of Information Management. He is the Academic Director of the MBA HSG in Business Engineering and Executive Diploma HSG in IT Business Management and head of the Business Innovation masters program and on the executive board of SIRA (Swiss Informatics Research Association). His research focuses on business engineering, digital transformation and customer relationship management. He is a regular speaker at national and international conferences on business engineering and digitalization.*

### 3. Generating and sharing content

The readiness of "digital" actors to generate and share content with others is constantly expanding. Consumers are taking part in innovation processes with no ulterior motives (prosumers) or are even providing services to other customers. Migipedia of Migros is an impressive example.

**DIGITAL TRANSFORMATION IS MORE  
THAN HAVING A BANK LAUNCH  
AN E-BANKING SOLUTION.**

### 4. Differentiation pressure

Many markets are saturated and are dominated by intense competition. Differentiation by means of original products and



services will become ever more difficult. New, primarily digital services create added benefits for customers and they improve differentiation on the markets.

### 5. Expectations

Convenient online services make customers more demanding of their market partners: Searching needs to be as easy as Google, shopping as convenient as Amazon and digital products as intuitive as iOS products. Providers who cannot keep up will quickly fall behind. The competition is intense and customer loyalty is decreasing.

### 6. New competitors

Two trends are apparent in many industries: One is the penetration of established and sometimes large companies into other industries. Amazon, for example, started with the sale of books and is now more of an online department store for all household needs. On the other hand, new companies are being created focused on the targeted value phases of established companies and substitute them with highly innovative products and services. A well-known example is WhatsApp, which almost overnight “cannibalized” the largest telecoms (text messaging) and caused massive declines in income.

**START-UPS HAVE A  
DECISIVE ADVANTAGE:  
THEY DO NOT HAVE  
TO CHALLENGE EXISTING  
STRUCTURES OR PRODUCTS.**

### The “essence” of digital transformation

Companies, which react consistently to these drivers and use digital transformation to adapt to the changed conditions, usually focus entirely on the following fields:

1. Business model: New products and services need to be defined to meet the new customer needs, existing products and services need to be complemented with supplemental services (hybrid value creation).
2. Customer experience: Starting from customer needs or even processes (customer journey) the customer experience is redesigned.
3. Value creation process: The process is digitalized or automated as much as possible. Production refers to Industry 4.0 in this context.

The interesting factor is that start-ups take almost identical approaches. However, new companies have a decisive advantage: They do not have to challenge existing structures or products. The ballast in established companies creates significant resistance to change.

### Business engineering as a structuring model

The University of St. Gallen developed the concept of business engineering, which can serve as the basis for digital transformation. Business engineering as a comprehensive approach to change illustrates the path forward for transforming all design levels within the company. Leadership aspects play a very important role and often decide between success and failure. Business engineering helps keep the change process transparent and understandable. The concept provides a comprehensive tool box for change managers.

Business engineering is based on consistent outside-in thinking, starting from customer needs and not from production processes and provides methods and models for system and design changes. As a top-down approach, it integrates numerous fields in a uniform change process. As part of digital transformation business engineering may support the following activities:

Business strategy: expanding and reevaluating the business model and supplementing the product portfolio through relevant (digital) services.

Business processes: use of new/additional communication channels with the customer and redesign of the customer service and communication processes in order to generate customer benefits and create an extensive knowledge base about customer (needs).

The systematic approach within the business engineering framework can thus help successfully design and implement change projects for the digital transformation.

Further information on the Executive MBA HSG in Business Engineering is available at: [www.embe.unisg.ch](http://www.embe.unisg.ch) ■

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