BEST PRACTICE

BRILLIANT PROSPECTS.

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T··Systems·

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PROCESSES THAT ARE OPTIMIZED.

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LIFE IS FOR SHARING.

Adel Al-Saleh, Board
Member of T-Systems
Deutsche Telekom AG
and CEO of T-Systems

Think like your customers.

WHAT HAVE YOU DONE WITH YOUR SMARTPHONE TODAY? Requested a taxi? Paid for a ticket? Found your car again? For millions of people, downloading a new smartphone app has become an almost daily ritual. That shows us two things:
– How quickly digitization brings new services to us 24 hours a day
– That there are already far more innovations than we can use

Some apps will be our constant companions for years. Others, we'll uninstall within two days. What does that mean for companies?

First of all, companies can treat technology as a given. Such as when they thrill their customers with new predictive services. The technology's already here – from IoT to the cloud, from data analytics to networks. These days, digitization focuses less on cutting costs and more on enabling new business models. However, enabling stands the best chance of success when our technology decisions start with our customers' needs. In other words, we ask ourselves, "What technology can I use to make it more attractive for my customers to purchase and use my products and services and strengthen their brand loyalty?" I think these decisions are easier when we really and truly understand our customers' needs and preferences.

In the automotive industry, new prototypes often generate tens of petabytes of data in the course of 150,000 km test drives. So what worries carmakers most? Answer: getting this much data transferred, imported and analyzed as quickly as possible. Today, the whole process takes only a few hours – all thanks to a T-Systems solution that's featured in this issue. It used to take several weeks!

Or take the food industry. Their value chains are fragile largely because – and this is hard to believe – nearly 60 percent of them depend on pollination by healthy, industrious bees worldwide. And that's why T-Systems' Innovation Center asked an important question: How can we help the food industry and retailers reliably supply customers with food, vegetables or cosmetics? Its answer consists of a cloud-based IoT platform that will provide a form of preventive healthcare for the world's third most important domestic animal by making its life and work easier. Healthier. More reliable. More productive. Some of the ingredients were already in place: sensors, networks, computing power and algorithms. But they hadn't been supercharged by the critical services that sustainably supported processes at honey producers, farms, retail establishments and manufacturing companies – and, even more importantly, our environment. And that's my point. In the end, it's the underlying idea that makes an innovation an asset, and not just a gimmick, for companies, their customer relationships and potential new business models.

That's why we're blazing new trails at T-Systems – and not just in our Innovation Center, either. Over the next few months, we'll be building a new Digital Solutions unit, staffed by 4,800 people whose sole concern is to quickly add value for companies. Their top priority will be co-innovation, conducted in collaboration with our customers. They will provide fast solutions to issues facing today's organizations.

Obviously, digitization already provides a lot of what this approach demands. In and of itself, though, technology isn't what can swiftly pulverize a business model with a decades-long track record of success. Instead, the biggest threat to the continued viability of any business comes when you lose sight of your customers.

Best regards,

Adel Al-Saleh

The renaissance of prophecy.

6

Predictive. Nostradamus is a thing of the past. But the desire to predict the future is more present than ever.

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The end of happenstance?

Unplanned machine failures. Unexpected crashes on the stock exchanges. A sudden heart attack. People everywhere are looking for ways to detect these risks early, to prevent them, or at least to optimally prepare for them. "Predictive" (i.e., anticipatory) is the buzzword companies in all industries and private individuals rely on. The basis: data.

COPY —— Roger Homrich

Let's start with Nostradamus, a predictive superstar among the prophets. French pharmacist, astrologer, and visionary, he predicted little good for 2018: unusual weather phenomena, floods, drought, and heavy hurricanes with devastating effects. Not to mention, a big war ahead that will divide the superpowers.

Whether you believe the prophecies of Nostradamus or not, one thing is certain: He has often been wrong and many of his predictions are so general that they inevitably happen sooner or later. Interestingly, many people are fascinated with the predictions of prophets, fortune tellers, and astrologers. They seek to prepare for and arm themselves against what may come in the near or distant future. But very few believe specific predictions because they lack the numbers, data, and facts.

Today, however, there are plenty of numbers, data, and facts. And they are constantly increasing in volume. Credibility is increasing. The forward-looking knowledge that will befall us, our companies, and our machines is based upon facts.

Thanks to sensors, the Internet of Things, and new methods for comparing recent data with information from the past, future changes – whether short- or long-term – can be anticipated with increasing accuracy.

A PROPHET IN THE MACHINE ROOM

Example weather forecast: Today, the accuracy of the forecast for the next six days is as good as the forecast for the next day 50 years ago. The German Weather Service uses satellite information, data from hundreds of floating measuring buoys and national meteorological services, thousands of merchant ships, commercial aircraft, and weather stations, for example. High-performance computers process this flood of data and update the weather forecast every few hours. Outdoor pool or sauna: Accurate weather forecasts determine how we plan our leisure time. In this case, they fall under the lifestyle category. For farmers and shipping or logistics companies, however, the weather can be existential. As such, the use of weather services has been standard ever since they have existed.

In industry, however, short-term forecasts are new, because the technological conditions first had to be created. And today they exist. The machines themselves acquire status data. In addition, sensors read data and send it via data networks to the cloud, where special algorithms process it together with historical data, aggregate it, and make it understandable for every machinist. And all in real time if desired.

"Self-learning algorithms and analyses identify patterns and dependencies of various operating parameters. On this basis, forecasts of failures and their causes can be made. This allows companies to determine machine and robot downtimes days in advance, to plan maintenance while optimizing resources, and to adjust the production process," explains Georg Rätker, T-Systems expert for automotive and manufacturing solutions.

> "Self-learning algorithms and analyses identify patterns and dependencies of various operating parameters."

GEORG RÄTKER,
Global Delivery Unit Automotive & Manufacturing
Solutions, T-Systems
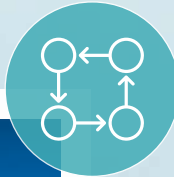
REDUCED UNPLANNED DOWNTIME

Prevention is better than repairing: Everyone will sub-scribe to this truism. But what are the actual benefits for companies that rely on predictive maintenance for their machinery? They want to minimize unplanned downtime and thus reduce costs. After all, the loss of production caused by stationary machines alone costs the automo-bile industry around one billion euros a year. And the costs of operating and servicing capital goods like conveyor and production equipment make up 80 percent of the total cost of ownership of capital goods such as the former. The acquisition costs, however, account for only one euro of every five.

Depending on the industry, maintenance costs are up to six percent of the total cost of an industrial enterprise. In addition: "Businesses in Europe are not overly optimistic about the efficiency of their industrial equipment and vehi-cle maintenance processes. A significant majority of com-panies consider their maintenance processes to be not very efficient," confirms Miloš Milojević, industrial analyst at PAC.

Weighty arguments. But according to a November 2009 Frenus poll on the status quo of the mechanical engi-neering industry in Western Europe, more than three-quar-ters of companies still do not use predictive maintenance solutions. "At the same time, however, a clear majority be-lieves that the use of such solutions in the long run is vital for the survival of mechanical engineering companies, since they will help to survive against competition from low-wage countries," says Rätker.

CURRENT MAINTENANCE CONCEPTS OUTPACED

The consulting firm BearingPoint also found out that pre-dictive maintenance is rather discussed than imple-mented. While 84 percent of respondents have already addressed predictive maintenance in their organization, only one out of four have completed their first projects, "although traditional maintenance concepts no longer meet today's needs," says Donald Wachs, Global Director of Manufacturing at BearingPoint and an Industry 4.0/IoT expert. "They tie up capital and consume too many resources." With predictive maintenance, however, four out of five companies want to increase equipment avail-ability and reduce maintenance costs by 60 percent.

So why this restraint when the benefits are obvious? The supposedly high costs of expensive solutions and sensors are one reason. BearingPoint also discovered that the majority of companies (57 percent) see IT security as the biggest technical hurdle. And 61 percent fear the high costs of implementation. There is also a lack of courage to make mistakes and learn from them, says Donald Wachs. "This inhibits companies and blocks the potential of predictive maintenance."

Lack of data, according to Britta Hilt, Co-Founder and Managing Director of IS Predict, is another reason companies are having a hard time with predictive maintenance. The software provider has been developing solutions based on self-learning artificial intelligence and predictive data analytics for nearly a decade. "We face the typical problem of different innovation cycles," says Hilt. "Many machines have been running for ten years or more, so they are not equipped for today's analytical capabilities." While most machines capture process and product data, these data oftentimes cannot be read out for predictive purposes. "New machines, on the other hand, have an increasing number of IoT modules that can capture and transmit status data. It will take some time for all machines and equipment to be equipped for predictive maintenance from the outset," predicts Hilt, who has been involved with predictive intelligence for more than 20 years.

To minimize the maintenance and downtime of locomotives, up to 900 data points are tapped on each railcar.

In today's manufacturing industry, IoT modules are already being factored in production planning.

The potential, however, is great. For example, IS Predict has used predictive maintenance to reduce unexpected failures of locomotives of an international logistics company. For the analysis of the machine data, IS Predict taps up to 900 data points for each of the more than 4,000 locomotives. Using eight parameters, specialists were able to develop a characteristic pattern that indicates when engine failures occur, thereby reducing the number of engine failures. Today, the logistics company detects failures up to three weeks in advance and proactively maintains the affected locomotives without failures. This saves money, since the cost per engine change incurred until now was around 200,000 euros.

NEXT GENERATION MAINTENANCE

Another example: With IS Predict, T-Systems has developed a process in automobile production that can optimize the maintenance of welding robots. If a robot fails unexpectedly, the entire production line shuts down. And, according to a survey by market research firm Nielsen, this costs the company up to 22,000 US dollars per minute. Today, the T-Systems customer identifies failing welding robots up to six days in advance and also recognizes the causes of the impending defect. Spare parts that fit those of the OEM are available and maintenance is scheduled during production breaks.

T-Systems goes a step further than predictive maintenance with their "Next Generation Maintenance" approach. In this case, however, data is not just processed for the purpose of reducing downtime or optimizing service: "We link the machine data from maintenance back to engineering," says Rätker, describing the new approach. "Weaknesses in production equipment identified during maintenance are incorporated into the further development of a machine. An analysis of the maintenance history provides the necessary conclusions. "In this way, the quality of the products can be optimized, and the service life of a machine or entire production plant extended. Rätker: "This can significantly reduce the total cost of ownership." For example, if a machine breaks down more frequently at certain temperatures, the producer can change the material composition at the critical weak points. Or the company ensures the temperature in a production hall is optimally adjusted.

€1 billion

The automotive industry alone loses one billion euros a year due to production downtime caused by idle machinery.

Predictive and blockchain.

Black lists for stolen smartphones.

Every year around four million cell phones disappear in Germany. With every theft or loss, the owners face expensive replacement costs. A blockchain for smartphone identification numbers could facilitate the locking of mobile devices.

COPY —— Roger Homrich

The theft of a smartphone or iPad entails not only a financial burden: Even more serious is the loss of valuable data, be it contact and account information, image files, or passwords. The only way to protect this data as soon as possible after the theft is to lock the device. For this purpose, network operators place missing registered smartphones on an internal, locally stored blacklist based on the identification number (IMEI). Once this is done, the thief can no longer dial into the network using the stolen device.

DECENTRAL BLOCKCHAIN BLACKLIST

That's how easy it was to date. But it will get more complicated in the future with eSIM smartphones, since the previously exchangeable SIM card is now permanently installed. This allows service to be obtained from multiple providers, for example, from local providers when on vacation. It is no longer necessary to replace the SIM card. This is convenient but carries risks if the smartphone is lost because the owner must then contact each individual provider to block his number.

With a decentralized blacklist based on blockchain technology, Deutsche Telekom IT together with SAP and Camelot will be able to ensure that customers can have their smartphones blocked faster, regardless of the number of contracted service providers and phone numbers. "The goal of Global IMEI Storage and Services is to build a decentralized blacklist that allows providers worldwide to view the blocked IMEI number," says Stephan Westermeyr, Director of Order Management & Billing at Deutsche Telekom IT.

The newer the smartphone, the more attractive it is – unfortunately for pickpockets, as well. According to a survey conducted by the industry association Bitkom, more than 400,000 mobile phones per year are stolen in Germany alone.

PROTECTION FOR ONLINE PURCHASES

"In the first step, Deutsche Telekom's blacklist will be anonymized and decentralized for other partners." Then other network providers, government agencies such as the police, or the users themselves can see which smartphones are locked. Also, for online purchases, for example, on eBay, a public blacklist makes sense. This means the buyer can check with just a few clicks if the cell phone has already been reported stolen. "Meanwhile, other network providers have announced they want to support the blacklist blockchain," says Westermeyr. "We then plan to roll out blockchain more broadly for smartphone abuse and involving manufacturers as well as other telecom providers."

> **TIP**
>
> Smartphone owners should know and note the IMEI number of their device. The individual 15-digit number uniquely identifies the device. The number is often found on a sticker under the battery of the device or on the packaging. For Android smartphones, the IMEI is hidden in the general settings under "Device Information," "Phone Information," or "About the Phone", for example. Then go to "Status." For Apple smartphones with iOS operating system, the number is found under "Settings," "General," and then "About."

The Federal Ministry of Transport checks the driving conditions of national highways and autobahns using special measuring vehicles. Devices called "pothole detectors" measure patches, cracks, etcetera and their courses, ruts, and fictitious water depths.

Predictive road maintenance.
Fighting potholes.

Germany's roads are under constant stress. Traffic has quintupled during the past 30 years. This increases the occurrence of road damage – and thus the cost of repairs.

COPY —— Roger Homrich

It was time again in May 2018. The German Federal Ministry of Transport sent special measuring vehicles on journeys through nine federal states. Their task: to capture the condition of more than 18,640 miles of driving lanes on highways. High-resolution sensors detect, among other things, condition characteristics such as longitudinal and transverse flatness. CDA – a "condition detection and assessment of roads" – is the process by which over 8,000 miles of federal highways and around 25,000 miles of federal roads are checked for damage. "Currently, however, this data is collected only every four years. Evidence of potential road damage is often detected late. This makes the repairs more complex and can drive up costs," says Martin Rous, computer scientist for Bosch.

CARS DETECTING ROAD DAMAGE
Bosch founded the start-up project StreetProbe together with additional partners and funded by the German Federal Ministry of Economics and Technology. StreetProbe is developing a procedure that permanently records the condition of roads – and does so incidentally. Sensors that already exist in vehicles, such as acceleration and wheel speed sensors, register movements caused by unevenness in the road or potholes.

To connect the vehicle sensors to a cloud, the test vehicles are equipped with a so-called connectivity control unit (CCU). It collects, stores, and processes the data in advance and sends it encrypted with GPS-accurate position information to the cloud. In this way, road damage can be detected early and cost-effectively repaired before large potholes are created. "It would be ideal to equip entire vehicle fleets. The data could complement the CDA information and thus more regularly monitor road conditions without the additional use of vehicles and personnel," explains Rous.

TARGETED REPAIRS COST LESS
StreetProbe is currently developing reference data and a damage catalog with a pattern recognition system based on test vehicle data. A test fleet then checks the results. This solution is of primary interest to public road construction authorities, who will no longer have to regularly drive the roads to assess their condition. If there are signs of damage at a given point, they can examine these in a targeted manner and, if necessary, repair them with little effort before a harmless pothole turns into a dangerous crater.

Over 8,000 miles around 25,000 miles of federal highways and federal roads are checked for damage by the CDA-process.

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www.t-systems.com/solutions/predictive
www.t-systems.com/logistics/predictive-analytics
www.t-systems.com/automotive/next-generation-maintenance

INTERVIEW

What are the biggest obstacles to using predictive maintenance?

In addition to IT security, according to our study the high implementation costs and availability of data are the main reasons why predictive maintenance is only gradually gaining ground. In particular, there is often a lack of truly relevant data from intelligent products and assets to assess the prediction of conditions. The complexity of the solutions also plays a role. There are hardly any finished solutions. Therefore, companies have to develop individual solutions with appropriate partners. And last but not least, management often fails to commit.

When does predictive maintenance pay off?

For the most part, use cases are only designed for small projects, but at the same time one hopes for early amortization. However, a predictive maintenance project often pays off in the context of major roll-outs or a large number of integrated intelligent systems. In addition, predictive maintenance cases should be enhanced with additional digital products to support economic efficiency.

What do you advise companies: How should they approach predictive maintenance projects?

They should develop a real use case to avoid the risk of creating data pools without added value. Depending on the goal, the starting point should be a well-defined and relevant use case. For example, the desire to increase equipment availability or reduce costs. This involves virtual inspections or remote maintenance. If the first tests are successful, they can be expanded successively. Companies may also wish to improve customer satisfaction. For this purpose, they can provide customers with status information or incident histories for the machines they use via a Web portal. This means: Start with a pilot to learn and test. Consider aspects such as data connection, data analysis, and holistic and economic integration into maintenance management. Last but not least: Learn from mistakes instead of planning every detail in advance.

Excessive complexity is another reason for the cautious use of predictive approaches. Are the solutions really that complex?

Every solution has to be tailored to the individual needs of the company. Although there are blueprints available for certain components, the behavior and wear within a specific system are always different. In particular, the algorithms require special consideration and continuous improvement. The validation of their respective parameters, considering individual impact factors for detecting anomalies, still presents a methodological challenge in the context of a superior prognosis.

Starting with lighthouse projects.

According to a survey conducted by BearingPoint, predictive maintenance in industry has been discussed more than it has been implemented. While 84 percent of respondents from the mechanical engineering, chemical/pharmaceutical, and automotive industries deal with the subject of predictive maintenance in their company, only one in four companies has actually carried out initial projects. There is a lack of courage to make mistakes and learn from them, says Donald Wachs, Global Director of Industrial Manufacturing and Industry 4.0 at BearingPoint.
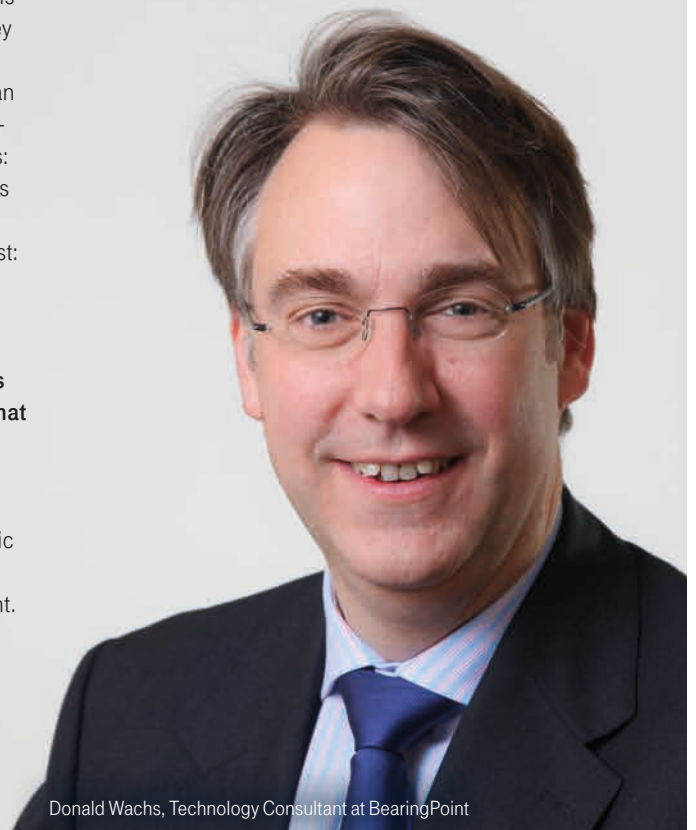
INTERVIEW —— Roger Homrich

www.t-systems.com/solutions/predictive
www.t-systems.de/video/predictive

Donald Wachs, Technology Consultant at BearingPoint

"A needle in a haystack".

From online shops to steel production: how artificial intelligence is changing the way we live. And why it is also helping us track down the origin of the universe, but why it cannot replace thought. A conversation with AI expert Katharina Morik.

INTERVIEW —— Manfred Engeser, Nils Klute

Professor Morik, internet retailer Zalando has recently announced plans to set up an individualized online store for each customer by mid-2019 – using artificial intelligence. Is this realistic?

Realistic? Sure, of course! But certainly not revolutionary.

No? Zalando already has 22 million customers, and this number is likely to increase. Addressing each individual customer's intentions surely must be a rather complex undertaking...

Every Google search query generates an individual website with personalized advertising in real time. Why? Because the search immediately triggers an auction to display an ad in the browser sidebar that matches the search. With the help of machine learning, hundreds of thousands of profiles are compared with hundreds of thousands of products – which is very sophisticated, especially because of the speed. Nobody wants to wait for their search results just because the matching advertising still needs to be produced. The challenges surrounding artificial intelligence are quite different.

Which ones are those?

Bringing smart learning to all the little devices around us in the Internet of Things, keyword: edge computing. Data is collected from devices with limited computing, power, and storage resources. Some are so severely limited to save energy that they cannot even process commas. Such ultra-low power devices are used, for example, as intelligent consignment notes in logistics.

How are intelligent learning methods applied?

Without analysis, data is not useful. Machine learning first has to preprocess the sensor current of a small device. The result is then sent continuously to a central computer. There, a predictive model is learned from the many sensor currents, which can then be executed on a small device.

How far along is the research?

We've specifically developed solutions for using machine learning on very limited devices. We have even managed to learn very complex predictive models onto ultra-low power devices and with theoretical guarantees! A breakthrough.

Why?

In this way the device can perform some data analysis on-site, so it sends less data in the end, which in turn saves energy. But most of all, because we did not just program it willy-nilly. It has a clear theoretical basis, so users know how reliable and accurate the learned model is.

How are such solutions used?

In astrophysics, for example, in search of the needle in a haystack: the answer to the question of how we find extremely rare gamma rays in the vast amounts of data collected by Cherenkov telescopes to determine events that took place thousands of years ago outside of our galaxy.

What about something closer to our everyday lives?

Sure: we're examining traffic in Dublin and Warsaw. Sensors measure traffic flow in the streets, in Warsaw also in streetcars, and count the number of mobile phones registered in a radio cell. We have also evaluated recent social media posts. For example, when someone posts they are stuck in a traffic jam. Or when people on Twitter interact about upcoming concerts or sporting events, which will have an impact on traffic.

> **"Hardly anyone understands the possibilities of artificial intelligence. And almost everyone imagines something wrong: robots!"**
>
> **KATHARINA MORIK,**
> Head of the Department of Artificial Intelligence, TU Dortmund

ARTIFICIAL INTELLIGENCE
Created as a discipline in Dartmouth in 1959, artificial intelligence (AI) stirred up public controversy by winning games that required intelligence. AI focuses on games, planning, computer-assisted proofs, robotics and the comprehension and generation of natural language, images and videos. Machine learning can improve all these capabilities and is the fastest-growing sub-discipline of AI.

Vita

Katharina Morik, 63, is a professor of computer science and heads the Department of Artificial Intelligence at the Technical University of Dortmund. She earned her doctorate in 1981 with research on the conviction systems of artificial intelligence in Hamburg, became a professor on machine learning in 1988 at the Technical University of Berlin, and then accepted a position with the University of Dortmund in 1991. Today, she is one of the world's most renowned experts in artificial intelligence with a research focus in the areas of machine learning and data mining.

What did you do with this information?

Through machine learning, we are able to predict when and where jams occur. It's not just about passenger cars, it's also about streetcars. This allows us to predict traffic anywhere in the city at any time and divert road users in real time right around the traffic jams.

If everyone uses the same diversion, then don't the jams just shift...?

Correct. This is why we are working on an auction type model that distributes different route recommendations, so each driver receives an individual route to avoid making new traffic jams out of the diversion.

Why can't we continue relying on the calculations of classically trained engineers?

Engineers plan processes according to natural laws. That is, under known conditions, the behavior of a machine or process is firmly defined. We, on the other hand, collect the data of each individual process. In the case of Industry 4.0, for example, to forecast success in terms of a production result. There are many factors that are not fully known or controllable, such as weather, room temperature, and humidity. How all these parameters affect a manufacturing process, for example, can only be recognized with data from the individual processes. The model that is machine-learned from the data thus complements the engineering model and can readjust and control in real time.

Are there areas where machine learning reaches its limits?

Areas? No, there are always ways to improve processes in real time – as described using the example of Dublin in transport and logistics, but also in production, where data analysis helps to identify anomalies early and make quality forecasts to reduce resource consumption. Or in medicine, where we examine genetic data for therapy profiles, for example, in the fight against neuroblastoma, a cancer that especially occurs in very early childhood. And even in analog industries like steel production, machine learning helps to improve processes.

How so?

For example, we looked at a specific type of furnace used to make steel and examined four targets: the tapping temperature of the pig iron, the content of carbon and phosphorus at the end in the melt, and iron in the slag. Using a machine learning process, we established a correlation between different combinations of multiple measured variables on one hand and the targets on the other. As a result, the moment when the melting process should be terminated can be determined even more precisely. Which saves a lot of energy – and money – every day!

And how did you conclude the combination of the particular values you chose is the right one?

The selection of characteristics is also part of machine learning, for which there are algorithms. But in this case, in fact, a newly designed feature has significantly improved the model, and there's only one thing that helps: reflection.

http://www-ai.cs.uni-dortmund.de

www.t-systems.com/perspective/ai

www.t-systems.com/video/prof-morik

T-Systems Principal Architect
Christoph G. Jung (l.) and Erik Redl,
Head of the BigAnalyTics Department
of the Telekom subsidiary

Digital harvesters.

Although state-of-the-art technology is no longer able to cope with the analysis of huge volumes of data, experts are still talking about "huge data". A patent-pending T-Systems development is now finding the "digital truffles" hidden in vast expanses of data in record time.

COPY —— Sven Hansel

E very eight weeks on Thursday at 9 p.m., an icon of German television in 1987: the car test on the program "Telemotor" by broadcaster ZDF. Fast-paced music, dynamic camera work, and quick cuts phase the brandnew Audi 90 2.3 into the picture. The car roars through deep, artificially created puddles on the test track. The camera stops abruptly, and the hard-hitting tester starts in: "In practice, consistent aerodynamics also have disadvantages. Turbulent water heavily soils the body of the Audi and rain or snow falls onto the seats when the doors are opened," the speaker says in a serious and sonorous voice. No question about it... at that time, it was a statement with high information value for all viewers, but more or less "measured" on the basis of experience, intuition and pure manual work. Today, in contrast, test drives are the real force behind the carefully planned propagation of mountains of data.

The futuristic autonomous vehicles which premium manufacturers are currently developing are becoming more and more complex because all the components communicate with one another and are networked for external access. HD cameras with panoramic view, distance sensors, radar devices, emission sensors, internal

10,000 channels

capture data from the car's advanced sensors, including not just traffic signs and passers-by, but also the driver's own pupil movements to counteract inattention or fatigue.

microphones: All of these record signals, providing important insights into the quality of the advanced driving functions for the prototype pre-production tests. "These vehicles deliver one to three terabytes of specially coded data per hour," says Christoph G. Jung, principal architect at T-Systems, describing the changing times – and thus a new challenge for all digitized industrial sectors.

For the companies concerned, it is almost irrelevant whether the number of devices and sensors interconnected by the IoT will be 50 billion or 60 billion by 2020. The immense challenge lies in what their measurement and control units generate in terms of big data, and its subsequent evaluation in real time. This is basically a sort of hunt for digital truffles. If, so to speak, the harvest time of the precious raw data is the commodity, then the valuable commodity must be extracted in the shortest possible time and made palatable; otherwise, the contained information becomes obsolete. In the automotive industry, there are several hundred vehicles that professional test drivers push to the limits around the world and around the clock in multi-shift test track operations – always looking for abnormalities, and always focused on discovering any safety issues in the "thinking" ECU software as early as possible – scrupulously accurate and down to the last bit and byte. Speed, consumption, engine and transmission data, radar scans: Up to 10,000 channels capture data from the car's advanced sensors, including not just traffic signs and passers-by, but also the driver's own pupil movements to counteract inattention or fatigue. During the journey, all this information is logged using a sort of "black box" on modern, shock-resistant, solid-state disks, which, at the end of the working day, "only" actually needs to be output at the depot and fed into the evaluation software – actually.

After all, with the bandwidths required worldwide for data processing, every company reaches its limits with today's on-board resources (4G networks, WLAN, VPN, and host computers). It does not take long to reach the multi-digit petabyte range, which is why one speaks today of "huge data". However, engineers need to be able to evaluate the captured signals in just a few hours to fix critical errors and prepare the next important tests while the data is fresh. It can be compared to a huge field with a considerable number of truffles of the highest quality hiding in the soil, but there are far too few harvest workers laboring for the star chef.

With conventional technology, automotive engineers are often condemned to a test of patience over several days and hypothetical games of thought, as the reading and analysis of the resulting data mountains take far too long – a prohibitive cost and factor that is not insignificant for industry.

This is because reading data is a special technological challenge.

Unlike texts, for example, this "signal data" so far can only be compressed poorly and interpreted efficiently. Software developers know this: The files of a large book, for example, can be broken down, figuratively speaking, into more manageable excerpts. One computer then scans the first half, another takes care of the second in the meantime, and the results of both analyses are then combined. The job is completed twice as fast with two computers; with a whole stack of computers (cluster), the result is available after just a few seconds.

However, such a procedure has not been able to be applied in automotive development so far. "When recording machine signals, fixed character sets are not used, as is the case with texts, but rather variable, situation-dependent codes. For example, if a car changes to a higher speed range, then certain channel groups related to the engine will have to be sampled more often," explains Jung. Translated to a cookbook, this would mean that each of the international recipes would have been written in its native language (and also its proper writing system!), such as German, Spanish, Russian, Greek, Chinese, etc. This is difficult for classic data compression methods. "But I was not prepared to settle for this and I thought more about it," reports Jung.

His groundbreaking invention – patented by Telekom – overcomes two obstacles. First, it cracks the supposedly unpredictable data formats and brings them into logically related technical pieces (called chunks). These are put "in the cradle" of the computer system as a kind of second foreign language. And secondly, the solution – a "transcoder" similar to an MP3 converter in modern audio equipment – ensures rapid and compressed storage, even in the cloud. When an engine runs faster, the temperature or oil pressure does not always suddenly change faster. The resulting software-based signal processing ("big data signal processing") takes advantage of this fact and can thus operate without loss of information on a fraction of the original data, but at the same

Hardware-in-the-loop – based on ever more powerful microprocessors, HiL systems will increasingly make ideal laboratory test environments possible.

On their test drives of up to nearly 100,000 miles, the "prototypes" of the automotive industry produce data volumes in the multi-digit petabyte range.

Photo: BMW

time on every computer core of a provided cluster. The speed achieved in practice is 40 times higher than in previous methods; the stored data amount shrinks depending on the measured channels to up to 10 percent of the original volume.

"Unlike what private MP3 users are used to, we can also return the data exactly to its original form. So, if an engineer wants to investigate a detected anomaly in detail and needs the corresponding partial detail in full, then this is possible at any time with our huge data method," reveals Jung.

In addition to the original signals, derived channels that a simulation computer artificially generates can also be faded into this microscope function. The new type of signal processing is flexible enough to handle simulated test runs. After all, if a supplier changes the software of one of its ECUs only minimally, automobile manufacturers would ultimately be forced to repeat the entire test drive on the road – an elaborate affair, because up to nearly 100,000 miles of test track is the industry standard. Instead, the manufacturers install the updated control units in a simulator, which merely plays the recorded signals of the test vehicle to the relevant control unit and then records its changed reaction ("hardware-in-the-loop"). The T-Systems development fits right into this profitable and possibly repeated harvesting loop.

The huge data turbocharger was so well received among users that the T-Systems inventors are already planning their next coup. Consequently, endurance tests – long-term tests on rough desert terrain, tropical humidity or Arctic cold – generate huge amounts of data, especially

> **"Ultimately, EDGE computing will certainly play an increasingly important role."**
>
> **CARSTEN BANGE,**
> Managing Director of Wurzburg-based BARC-GmbH

in inhospitable areas, where even a future 5G supply would reach its limits. Which is why Jung is working with his colleagues on a mobile cluster, a sort of transportable, air-conditioned mini-computer center, which can also be shipped to and operated in the most remote locations in the world. "That's where our invention comes in; the compressed results of the analyses are sent to the company headquarters of the carmaker quickly," reports Erik Redl, head of the BigAnalyTics department at T-Systems.

The principles of a successful data harvest are so fundamental that they can be seamlessly transferred to other industries. In rail transportation, for example, for detecting malfunctions, defects, or structural defects in the track bed by means of cameras mounted under the trains. "We have now also been able to transfer our solution to multi-hour video files and have them evaluated by hundreds of computer cores simultaneously," says Jung of the progressive development. The result: similar time gains as the carmakers.

For this reason, well-known big data experts like Dr. Bange foresee great potential for such inventions. "They cover all industries where machines are involved. They cover individual production. The healthcare industry and complex products in any case – digitization makes new procedures such as this imperative," says the CEO of Würzburg BARC GmbH. Big data will have to be filtered at the source in the future, novel reduction methods are important, "and, ultimately, EDGE computing will certainly play an increasingly important role," explains Dr. Bange.

In short, the digital harvester is already an indispensable tool for successful data analysis in the automotive industry as soon as the dimension of data far exceeds the scope of big data. Certainly, in the future it will ignite the turbo across industries.

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www.t-systems.com/solutions/big-data-analytics
www.t-systems.com/whitepaper/big-data-automotive

"Big data and an orange juice, please!"

When you are stuck, you turn to your apps for help. Prescriptive analytics is maturing into an effective, all-purpose weapon for better decisions.

A simple recipe: A perfectly maintained supply chain, constant, intensive analyses, and meticulous work over many years ensure that the burgers from large restaurant chains have the same great taste all over the world.

Powerful prescriptive analytics are not possible without artificial intelligence (AI) and machine learning (ML).

HELENA SCHWENK,
IDC expert

COPY —— Sven Hansel

Prescriptive analytics is the next logical step.

Fast food fans know the flavors that are nearly identical worldwide: meat, bun, pickles, onions, and, of course, sauce. The fact that these individual components combine to create the same burger taste in the almost 40,000 restaurants of the world's largest fast food restaurant operator is the result of years of meticulous, precision work, intensive analysis, and a perfect supply chain. However, this goal is much harder to achieve with the hardly controllable product orange juice. One year, the harvested fruit are very sweet and other years they have less flavor. Sometimes the oranges are juicier and other times hail storms decimate crops – the effects of Mother Nature. And yet, customers expect "their" juice to taste the same. For this reason, a special methodology ("blackbook") is becoming more and more important for the largest fruit juice producer in the world, which is based in Atlanta, Georgia, just like Coca-Cola. The beverage company uses this technology to synchronize its orange juice production and ensure a consistent taste experience. The supply chain is meticulously evaluated and based on available weather or harvest data, and the juice mixture is determined in advance. Welcome to the world of prescriptive analytics.

It is the next logical step in the evolution of data analytics. After descriptive ("What happened?") and diagnostic analytics ("Why did it happen?") came predictive analytics ("What will happen?"). Now the time has come for what may be the last supreme discipline: prescriptive analytics ("What should happen?").

The market for business intelligence and analytical tools reached a global volume of 4.79 billion euros in 2016, according to IDC experts. By 2020, they expect annual growth of more than 8 percent. "This increase is driven primarily by the continuing need to digitize business and increase the value of the massive amounts of data that businesses capture and store – to better understand and serve their customers and move their business forward," says IDC expert Helena Schwenk.

With the orange juice example, not only does this discipline analyze what is likely to happen, but the technology also provides concrete instructions or suggested solutions.

Schwenk's colleague Axel Oppermann, head of the analyst firm Avispador, considers the technology to be "decisive for the war.". "All companies, all those in charge who ask themselves, 'What should I do,' that is, who actively pursue future and business planning, benefit from the technologies and thinking patterns of prescriptive analytics," Oppermann emphasizes.

A second, major reason for the strong demand for prescriptive analytics is that these technologies are mutually beneficial for other trendy digital developments. "Just as analytics evolves along these lines, they need support like machine learning, which can expose patterns in the data and continually build knowledge over time to predict problems and take the necessary action," explains Schwenk. In other words, powerful prescriptive analytics are not possible without artificial intelligence (AI) and machine learning (ML). And, conversely, the two technologies only gain momentum and their special value through analysis.

Schwenk knows how this will look in practice in the future. Accordingly, AI and ML feed the prescriptive analytics tools gradually, learn permanently, and can give their operators or other machines recommendations on what to do specifically. "These can be precise forecasts, automated processes such as fully automatic ordering of goods, or the metering of certain goods." Carsten Bange, from the analyst firm BARC, provides another example: "Predictive analytics is about having plenty of fresh salad on Saturday, for example, by analyzing weather data or

Artificial intelligence and machine learning support the market-driven production of natural foods.

the shopping behavior of customers. In the future, the software will say: "Have 30 heads of lettuce on hand. This way you won't run out and won't have a lot left over."

In sum, the new prediction method reduces the guessing game more and more. It provides clarification, supports decision-making in a very targeted way, and can even completely eliminate the need for it. This results in other application scenarios for experts like Schwenk that are almost limitless, such as in the detection of fraud, diagnosis and further treatment of illnesses, or automated settlement of insurance claims. For Oppermann, prescriptive analytics will also occupy an outstanding position in supply chain management and, last but not least, in energy management. "Especially in the field of renewable energies, this technology will be enormously important when it comes to avoiding supply bottlenecks."

An investigation from last year shows just how realistic Oppermann's assessment is. The costs of managing bottlenecks in the power grid today can already be reduced by more than 200 million euros per year. This

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was the result of an interdisciplinary working group led by the German Energy Agency and the Office for Energy Management and Technical Planning – and initiated by the Federal Ministry for Economic Affairs and Energy. Recently, it has cost almost one billion euros every year to avoid bottlenecks in the German power grid and to ensure system stability. Given the world's ambitious targets for renewable energies, it is therefore more than understandable that prescriptive analytics will also play a major role here. Climate data and consumption parameters are included in the calculations, on the basis of which sound recommendations for energy management can then be made.

Another example comes from the procurement of raw materials. The experts at the Technical University of Munich found that data-driven optimization approaches with prescriptive analytics produce valid procurement strategies. For example, these industries can significantly reduce both the operating risk due to price fluctuations and their procurement costs. In this way, companies could achieve natural gas purchase prices up to 11 percent cheaper on average instead of relying on traditional cash transactions or futures.

Ultimately, companies benefit from prescriptive analytics across the board. And, according to industry experts, fast food chains are currently working on having the analysis tools independently suggest new recipes and burger ideas. So maybe big data on the menu will become reality within a few years – who knows.

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THE TEN BIGGEST ORANGE PRODUCERS WORLDWIDE (2016)

Rank	Country	Amount (in tonne)
1	Brazil	17,251,291
2	People's Republic of China	8,419,881
3	India	7,503,000
4	United States of America	5,160,000
5	Mexico	4,603,253
6	Egypt	3,438,030
7	Spain	3,137,546
8	Indonesia	2,138,474
9	Iran	1,944,023
10	Turkey	1,850,000

Source: Telekom

Prescriptive analytics can minimize the effects of weather-related – and latently huge – default risks on the most important supplier countries of agricultural products for food producers.

The end of contact failure.

In the future, product lifecycle management (PLM) will be pulling the strings by giving the "customer-centric" approach of many companies completely new perspectives: the digital twin. Behind this is a development that, according to the Market Research Future Institute, will see the market for digital twin applications rise from the current 5 billion to 15.66 billion US dollars by 2023.

COPY —— Thomas van Zütphen

Developing and building products with a focus on customers right from the start is becoming an increasingly critical factor for more and more companies. Monitoring the function of products 24/7 over their entire period of use, keeping them up to date, and even continually optimizing them are entirely new possibilities – a direction in which nearly all companies in the manufacturing industry are placing high hopes. And the reasons are obvious.

For example, hardly anything causes greater financial loss and damage to image in the manufacturing industry than product recalls. One example from the automotive industry: In the five years before "Dieselgate," manufacturers in Germany alone ordered 6.5 million cars to be brought in for servicing, thus effectively removing them from the streets for a time. The recall rate for new registrations in Germany averaged 63 percent in 2014. In other words: Almost two out of three new cars across the board, whether they came from the Far East, the US, or Europe, had to be taken in at least once in the first year of use. In other industries, the same picture – whether pacemakers, washing machines, laptops, microwaves, baby toys, or self-assembly furniture.

Why is this happening even though today's products are developed and produced with the utmost care, a wealth of experience, and state-of-the-art tools? One reason is that products are always developed based on assumptions and empirical values regarding later use, operating conditions, and loads, which may subsequently prove to be inaccurate. Fast, systematic, complete, and automated feedback from the field on product quality, safety, and use could help by using this type of feedback to proactively drive timely product improvement. However, this is still a dream far off in the future for many engineers: Collecting and evaluating feedback from the field is often a lengthy process and often only makes its way back to engineers after a long delay.

The digital twin can change this. In essence, it is the virtual representation of a specific product that accompanies its physical counterpart for a lifetime. Each representation/data model remains assigned to an individual product – from development and production to subsequent operation – and is fed with its real operating data. "This allows us to monitor the condition, quality, and use of, say, a vehicle or an entire fleet under load, and to determine decisive cause-and-effect relationships by analyzing the data," explains Sascha Leidig, Head of the PLM Global Competence Center at T-Systems.

But not only that. "The digital twin opens up completely new possibilities in product development," predicts the expert on digital twins, Christian Völl, from the consulting

Successively, OEMs are making the digital twin the "lifelong" companion of their cars.

> **"The digital twin opens up completely new possibilities in product development."**
>
> **CHRISTIAN VÖLL,**
> expert on digital twins,
> consulting company Detecon

company Detecon. According to Völl, structured innovation management which leads to products with significantly higher customer attractiveness is already a critical success factor for surviving in the market.

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www.t-systems.com/automotive/plm
www.t-systems.com/video/digital-twin

WORKSHOP
For individual appointments for the "Digital Twin" workshop offer from Detecon and T-Systems, please send an email to Sascha.Leidig@t-systems.com.

Paperless transport.

It sounds simple in legalese: "The carrier may require a consignment note to be issued containing the following particulars..." states Section 408 of the German Commercial Code (HGB). This entails time, money, and a lot of paperwork.

COPY —— Roger Homrich

Both senders and recipients must deal with quantities, shipping notes, and numbers associated with the freight items, as well as gross weights, packaging types, customs instructions, and other official handling of the goods. Anyone transporting goods from point A to B ends up sending piles of consignment notes with information about the transported goods – three copies of course. What follows is a series of signatures and confirmations as well as the required archiving period of six years.

Digital freight documents make transportation processes faster and less expensive.

HUGE POTENTIAL FOR SAVINGS

According to the Bundesverband Güterkraftverkehr Logistik und Entsorgung (Federal Association of Road Haulage Logistics and Waste Management, or BGL), tens of millions of euros would be saved every year in Germany alone if goods traffic were to be completely converted to digital consignment notes. According to the Dutch freight carrier association TLN, the savings potential is about 4 euros per consignment note. In Germany, with an estimated 150 million consignment notes issued, this would amount to around 600 million euros. The BGL and the Deutsche Speditions- und Logistikverband (German Freight Forwarding and Logistics Association, or DSLV) have been campaigning for years for electronic consignment notes. According to Hubert Valder, BGL's legal advisor, the cost of archiving and shipping documents would decrease significantly. In addition, electronic consignment notes enable the transfer of information such as goods receipt or acceptance in real time.

The time savings would be immense. Maersk wanted to know exactly how much and documented the path of a refrigerated container filled with avocados from a farm in Kenya to a Dutch supermarket. The logistics company found that nearly 30 people from different organizations had to deal with the shipping documents along the way. Without the constant processing of documents and associated wait times, the journey would have taken only 24 days instead of 34.

DISPLAYS INSTEAD OF PAPER

The cloud-based IoT solution Paperless Logistics from T-Systems exploits this potential for savings. It facilitates the digital dispatch of shipping documents, accompanying documentation, and barcodes. To support this, developers have expanded telematics modules into intelligent displays that are temporarily or permanently installed in the compartments of containers and transport boxes. "The display technology consumes little energy and is compatible with e-readers, among other devices," explains Torsten Chudobba, Head of IoT for Automotive & Manufacturing Industry, which came up with the idea. The scratch- and break-resistant hardware is particularly robust and eliminates shocks and jolts to ensure that the device does not malfunction during the first trip.

The intelligent display also captures locations, movements, and conditions such as temperature, humidity, vibration, and speed of the cargo and sends the data over the mobile network to Deutsche Telekom's IoT cloud platform (the so-called Cloud of Things). The necessary technology is already integrated in the device. Crates

600 million €

According to the Bundesverband Güterkraftverkehr Logistik und Entsorgung (Federal Association of Road Haulage Logistics and Waste Management, or BGL), 600 billion euros would be saved every year in Germany alone if goods traffic were to be completely converted to digital consignment notes.

Paperless logistics could reduce transport times in global container freight transport by up to 30 percent.

and containers can also be equipped with beacons that communicate with the device via Bluetooth. "This way it can be determined at any time on the road if something unusual has happened during transport," says Chudobba. "It's even easier to define thresholds and limits before the start of transport. If values deviate from the target, the system alerts the recipient by e-mail or text message." And should a device ever be damaged, the data is retained – all documents are stored in the cloud and automatically archived.

ELECTRONIC MODIFICATION AND CONFIRMATION OF SHIPMENTS

Thanks to GPS positioning and geofencing, the display shows specific location-dependent information. In the future, different languages will also be supported. When the shipment leaves the supplier, for example, the system displays the consignment note. When the goods reach the customer, the display automatically reports the unloading point. If required, the deliveries can be confirmed with a signature directly on the display. Employees can also make changes to parts lists electronically. If, for example, it turns out there are fewer goods in the transport container than indicated, the quantity can be corrected. This information is then provided in real time

"The display technology consumes little energy and is compatible with e-readers, among other devices."

TORSTEN CHUDOBBA,
Head of IoT for Automotive & Manufacturing Industry

through the IoT cloud platform and is available online or transmitted to the customer's systems. The display always shows the updated information.

"Paperless Logistics is already attracting great interest from companies where the correct delivery of individual parts plays an essential role in the production process," explains Chudobba. For example, if a shipping crate reports a severe shock, say on the way from Asia to the final assembly site or vice versa, the mechanical engineers must carefully inspect parts prior to installation. And the solution is being developed further. "For air freight, we are aiming for certification that meets American and European aviation regulatory standards," says Chudobba. "Goods marked with Bluetooth low energy beacons can be automatically recorded in shipping manifests. And we are currently analyzing whether paperless logistics can support existing RFID infrastructure."

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www.t-systems.com/industries/ttl

www.t-systems.com/video/paperless-logistic

SURFACE WEB

< 10 % of Internet
– Indexed Internet

DEEP WEB

> 90 % of Internet
– Unindexed Internet

DARK WEB

– of Internet
– Unindexed Internet

Bermuda triangle for hackers.

NRW Police Cloud, HiPoS, and B.E.A.S.T. – with a quantum leap for its own cybercrime forensics, the police in North Rhine-Westphalia are ensuring that cybercriminals are caught more and more often.

COPY —— Thomas van Zütphen

"North Rhine-Westphalia has become safer," said NRW Interior Minister Herbert Reul at the presentation of police crime statistics in March of this year. The number of crimes reported in 2017 decreased by a solid 6 percent to 1,373 compared to the previous year. And at 52.3 percent, the police's rate of solved crimes was as high as 50 years ago. One sphere of criminal activity that does not fit this trend at all is cybercrime – and not only in NRW. Between the Weser and the Rhine alone, in the federal state with the highest population and corporate density in Germany, cybercrime increased by 5 percent to 23,000 cases. And these are just the reported cases. According to estimates by Germany's criminal investigators association, the Bund Deutscher Kriminalbeamter, around 90 percent of cases are unreported.

Whether data theft, manipulation, or fencing: The number of attacks on PCs, laptops, tablets, etc. is increasing. Helmut Picko of the Cybercrime Center of Excellence of the NRW State Criminal Police Office in Dusseldorf confirms that cybercrime is an inherently unreported crime. For fear of damaging their reputation, companies often do not report hacker attacks. In many cases, victims do not realize they have been the target of

Photos: iStockphoto, LZPD NRW

cyberattacks. Picko heads the project "Hybrid Integrative Platform Police Special Networks" (HiPoS) at the NRW State Office for Central Police Services. And precisely in this role, the expert on cybercrime wants to "encourage victims of cybercrime to report cyber-attacks early on, even when a crime is merely suspected".

SPYING, INTERCEPTING, SABOTAGING

Whether in networks like Tor or the public Internet – highly available and government-compliant hardware resources are of vital importance for combating criminals first and foremost. Therefore, the State Criminal Police Office in Dusseldorf is equipped with a cybercrime system that simultaneously evaluates ever-increasing amounts of data. The faster the data stream is distributed in the system, the faster data of any format can be analyzed and evaluated with a higher hit rate. The result: faster access to the alleged perpetrators. To this end, T-Systems, together with Dell, implemented an innovative and modern high-speed storage solution in 2016 that meets all the requirements of the NRW police in terms of security, performance, and manageability.

RESULTS EVERY SECOND

Shortly after its launch, the new system was already 540 times faster than its predecessor, which even then consisted of powerful servers and hard drives. Today, up to one petabyte is copied in the morning – an amount of data that would fit on 213 DVDs. Thus, data from the last 24 hours is fully available at the start of work at seven o'clock. The system is fully compliant with the Federal Office for Information Security's IT baseline protection approach. A key module of HiPoS is a Big Data enhanced analytics system (or B.E.A.S.T.) – a fast, highly secure, and powerful cybercrime forensics and analysis system commissioned by the State Criminal Police Office in 2016. The new evaluation process with B.E.A.S.T. allows queries to be run through a "database of six billion data sets in about one to three seconds". At this speed, the forensic methods of the experienced investigators now produce results every second that previously required weeks or months.

Since 2016, B.E.A.S.T. has been almost completely virtualized and transferred to an NRW police cloud. That the NRW police now has a storage capacity in the double-digit petabyte range is only one of its advantages. Today, the agency can carry out high-performance, innovative

> ## "Cybercrime, by its very nature, is the kind of crime that goes undetected."
>
> **HELMUT PICKO,**
> Head of the HiPoS Project at the North Rhine-Westphalian State Office for Central Police Services

analyses, particularly in the field of cognitive services. For example, they use artificial intelligence to meaningfully analyze the written and spoken languages of criminals (up to 40 different languages) to understand certain police issues and to apply them to communication of perpetrators.

Another advantage for Helmut Picko is that "today, on a large, uniform infrastructure, we can set up almost any number of IT applications on short notice as a proof of concept and then, if necessary, quickly put them into operation." This is an aspect that is not unimportant for the police, since police are testing new applications for attack detection and defense constantly to keep up with the pace of hackers and the state of development of their tools. But many products fail in the test phase because the tough police requirements on IT forensics – in image recognition, for example - are significantly higher than usual on the market. "As a result, today we have the forensic analysis tools and resources needed to parse the amount of data that was possible before virtualization many times over," explains Helmut Picko. "Acquiring up to 55 terabytes of cleaned data in a single investigation, that was impossible for us in the past – today it's no longer a problem."

B.E.A.S.T. and HiPoS – essentially the core of the NRW police cloud – go far beyond the C5 requirements of the Federal Office for Information Security for cloud providers. This makes the system something of a trendsetter for authorities with comparable structures and duties in Germany.
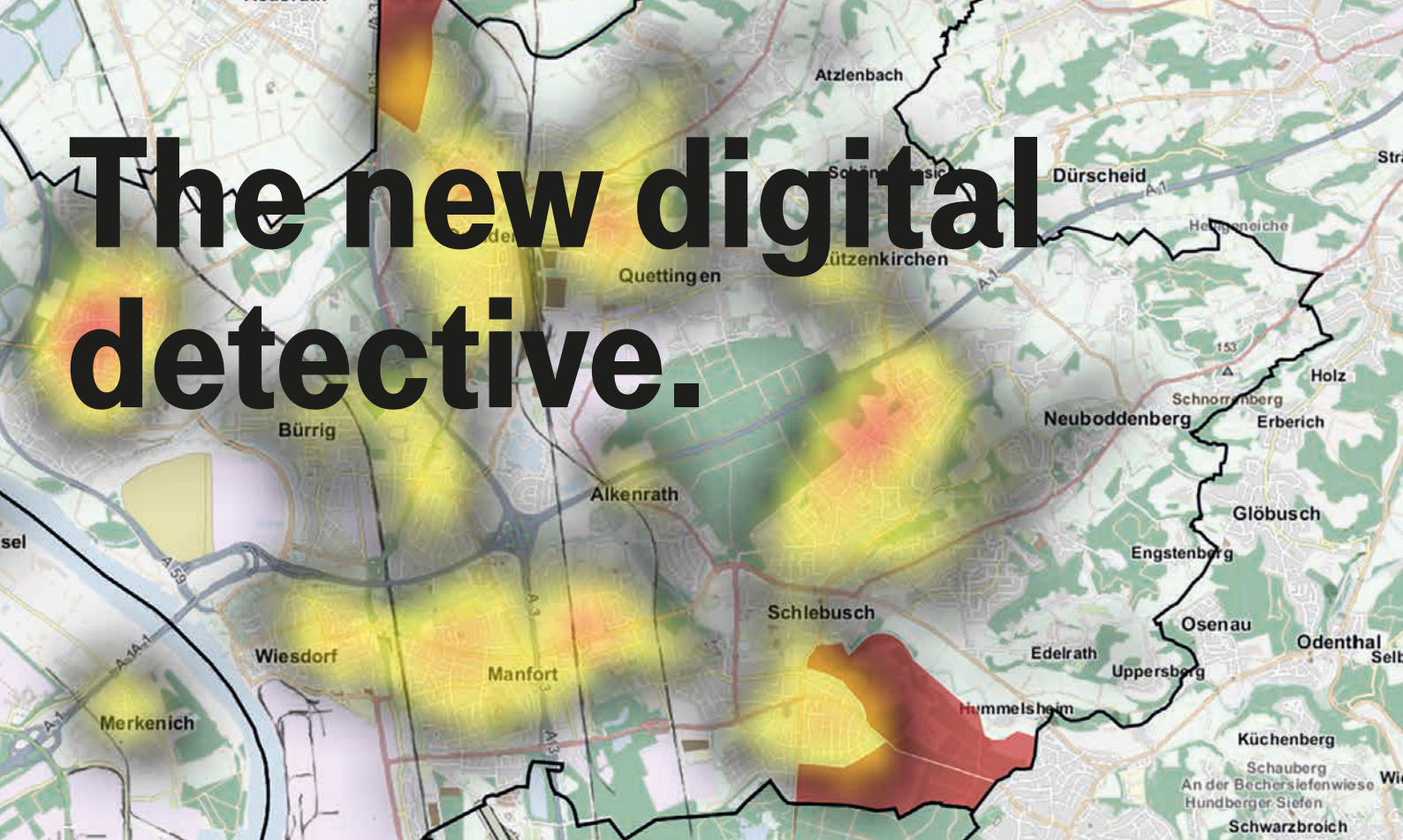
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The new digital detective.

With their "system for crime analysis and location anticipation" (Skala) the police in NRW determine potential burglary risk areas in Cologne, Dusseldorf and Essen, among other places, based on what are called heat maps.

It's what most policemen dream about: To prevent crimes instead of investigating them – to know the when, where, why of a crime, maybe even before the criminal. This could serve to protect potential victims as well as perpetrators. It sounds appealing, but it's not without controversy. Thanks to predictive policing, modern investigators can now selectively look into the future. Burglary is the focus of this technology in Germany. In the USA, they are already working on other types of crime.

COPY —— Yvonne Nestler

The skylight crashes in and four masked policemen repel into the building ready for action. In no time, the likely murderer-to-be is overwhelmed and subdued. If this sounds like a scene from Steven Spielberg's science-fiction thriller „Minority Report," it's because it is: Three psychics who see into the future help the "Chief of PreCrime," performed by Tom Cruise, to track down and arrest offenders before crimes can take place.

This 2002 blockbuster with box office sales of 131 million US dollars is based on a short story from American science fiction author Philip K. Dick, published in 1956. At a time when big data still wasn't a topic of discussion for a long time. Unlike today: Dick's idea of a clairvoyant state power is no longer fiction. Although not thanks to human intuition, but – much drabber – thanks to huge amounts of data that fast computers automatically search through for patterns.

82 %

of burglaries
in Germany in 2017
remain unsolved.

Source: Polizeiliche
Kriminalstatistik 2017

In Germany as well. Here, the police use data-driven predictions – predictive policing – primarily to predict in which areas of a city houses and flats are likely to receive uninvited visitors and when. One reason: Domestic burglaries were one of the most common offenses in Germany with 117,000 registered offenses in 2017, despite a decline compared to the previous year. In addition, professional burglars usually follow certain patterns, like the way they pursue and select their targets.

RECURRING CRIMES

The State Criminal Police Office (LKA) of North Rhine-Westphalia, for example, has been using the "Skala" software since 2015, a system for evaluating crime and anticipating situations. Skala uses past experiences, such as the near-repeat theory. This means that burglars like to return to areas where they were previously successful. A connection that is scientifically proven. However, the forecasts also consider other theses and questions like: Is

Victim and perpetrator protection at the same time – the police are increasingly searching for clues before crimes even occur.

there freeway access near the property that allows for a quick getaway? What kind of loot can one expect in a particular district? Detectives feed the analysis system with data from police incident processing systems such as the scene of the crime, the time of the crime, and the circumstances surrounding previous burglaries, as well as information on the development, infrastructure, and social structure in certain areas within the framework of data protection.
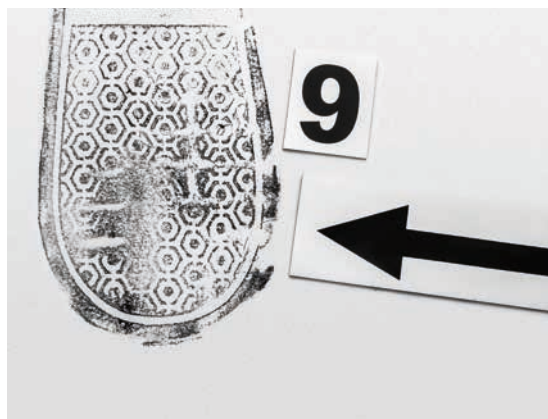
Once a week, Skala spits out forecasts of residential burglaries for police authorities in Bonn, Duisburg, Dusseldorf, Essen, Gelsenkirchen, and Cologne – maps showing residential districts with a high probability of burglary. The police use the forecasts to decide, for example, where to send more patrol cars and whether to personally advise the population in vulnerable areas on burglary protection. At the beginning of May 2018, NRW Minister of the Interior Herbert Reul announced that it would extend its deployment to the whole of North Rhine-Westphalia, initially to all main crime departments. "Where exactly we can use Skala depends on the crime volume of the respective areas. Without data, forecasting is impossible," points out Dr. Felix Bode, who heads the six-member Skala team at LKA NRW. "In rural areas, we are thus considering models other than predictive policing."

LIKE AN EXPERIENCED INVESTIGATOR, ONLY FASTER

The Bavarian State Criminal Police Office also relies on predictive policing. After a feasibility study in 2014 and 2015, the authority introduced "Precobs," a software solution reminiscent of the three psychics from Minority Report: the Precogs. This forecasting software is also used in Baden-Württemberg: Since September 2017, the second phase of a pilot project has been running in Stuttgart and Karlsruhe, which started in 2015.

In contrast to the LKA NRW, the forecasts of Precobs are based only on recorded offenses. According to a report by Ulrike Heitmüller on heise.de, socio-demographic data would not have significantly improved the forecasts. The program uses predefined crime scene, target, and action criteria to assess whether another break-in could occur soon in the same area. Experienced police officers would come to similar if-then decisions – the program is only faster, writes Dominik Gerstner of the Max Planck Institute for Foreign and International Criminal Law in an evaluation of the first project phase with Precobs in Baden-Württemberg (also see the box). If a break-in is detected that could be part of a series, the police officers who operate the program receive an alert.

The state police departments in Berlin, Lower Saxony, and Hesse use self-developed predic-

117,000

attempted and successful residential burglaries reported to the police in 2017 in Germany.

Source: Polizeiliche Kriminalstatistik 2017

tive policing programs. Other federal states such as Hamburg and Rhineland-Palatinate are considering introducing such a system. The states regularly exchange information with each other and with the Federal Criminal Police Office. Germany has not yet used predictive policing at the federal level and does not plan any such systems. The federal government confirmed this in April 2018 in an answer to a minor inquiry from the Free Democratic Party. This means that Germany's law enforcement officers are nowhere near their US counterparts in terms of technology and coverage, whose methods are more reminiscent of the Wild West.

WILD WEST FOR COPS

2011 marked the very first time a computer program in Santa Cruz, California sent police patrols to areas where burglaries and car thefts were expected that day. The "Predpol" software is a development of Santa Clara University and the University of California Los Angeles. Today, US cities such as Atlanta, Richmond, and Seattle are using the solution, and Kent in the UK is also relying on Predpol. The system now even predicts armed violence, personal injury, drug-related crime, and bicycle theft – without using personal information.

Unlike Precobs, Predpol's algorithm is not based on simple if-then decisions, but on complex math and machine learning. Dr. Tobias Singelnstein, Professor of Criminology with the Law Faculty of the Ruhr University Bochum considers this to be legally and criminologically very problematic, since the results are incomprehensible. "Firstly, the forecasts often include measures that interfere with fundamental rights. Whether the necessary conditions are met must be verifiable. Secondly, predictive policing techniques can only capture certain forms and methods of crime. This selection process must be comprehensible."

ON THE BLACKLIST

In Chicago, the omission of personal data is irrelevant. There were 650 homicides in 2017 in the third largest city in the United States – more than in New York and Los Angeles combined. To deal with the violence, the police in Chicago have been working since 2012 with an algorithm that targets individual citizens. It spits out a list of people who are likely to be the victims or culprits in a shooting: the so-called "strategic subject list." A list of nearly 400,000 entries is available online without naming any names.

Photos: Landeskriminalamt Nordrhein-Westfalen, iStockphoto (2)

The risk score of individuals is calculated, for example, from their criminal records, gang memberships, and age – the younger the higher the score, for example. As a precautionary measure, the Chicago police have reportedly visited people on the list together with social workers to deter them and help them with their personal lives. According to the news network CBS Chicago, 1,400 such house visits occurred between 2013 and 2016. "Processing personal data for predictive policing would be possible in Germany within extremely narrow limits," says Singelnstein. "The right to informational self-determination requires a legal basis and cause for such interventions. In addition, person-related predictions are more prone to errors the earlier they are made before the potential damage."

But how successfully do predictive policing systems prevent crime? For Chicago, an analysis by the consulting firm Rand in September 2016 showed that the risk list and police visits neither reduced the murder rate, nor the likelihood of someone being involved in a shooting. In addition, the listed persons were likelier to be arrested more often than others. Perhaps, the analysts guessed, because the law enforcement officers did not use the list to provide social services, but to identify suspects for crimes already committed. The Chicago police department responded that RAND evaluated old versions of the forecasting software and intervention strategy.

EFFECTIVENESS IS HARD TO MEASURE

In Germany, the state criminal police are restrained when it comes to the success rate, even though burglaries fell in the Bavarian, North Rhine-Westphalian, and Hessian test areas after the clever police oracle was introduced. But it is difficult to say whether the respective predictive policing system is responsible for any of the other prevention measures or whether the perpetrators are simply behaving differently. "Success cannot be claimed based on just one factor alone," explains the project manager for the Bavarian test area, Günter Okon, to heise.de. "The control concepts, especially in the area of home burglary, are very complex and multifaceted."

The Max Planck Institute for Foreign and International Criminal Law in Freiburg draws a conclusion in its analysis of the Precobs project in Stuttgart and Karlsruhe: The crime-reducing effects of predictive policing in the pilot project are probably only moderate. The study's author, Gerstner, points out its limited scope, however, occurring only over a short period of six months and in two pilot areas. The recently published final report on the LKA NRW project draws a positive conclusion: "The probability of burglary in selected forecast areas if often three to four times higher than in other residential areas of a police district."

How predictive policing will continue to evolve remains to be seen. What it certainly should not be, however, Philip K. Dick knew 60 years ago: an inscrutable system that orders people to be arrested before they have even committed a crime.

lka.polizei.nrw
www.ifmpt.de/lka-bayern/ (German only)
www.t-systems.com/security

"Expect no wonders".

Dominik Gerstner from the Max Planck Institute for Foreign and International Criminal Law evaluated the predictive policing project in Baden-Württemberg. The software predicts where break-ins may occur soon, on the basis of reported residential burglaries and defined parameters.

INTERVIEW —— Yvonne Nestler

Mr. Gerstner, what effect does it have from your point of view that the analyses of the Precobs system only include reported burglaries?
Through dark field research, we know that most residential burglaries are reported. That's why this isn't a problem. Problems arise, however, in that the burglaries usually take place when no one is home. When the residents are gone for a longer period of time, the incident is oftentimes discovered and reported very late. This makes it difficult to predict regionally limited and small crime sprees.

What do the police think of Precobs?
The police who operate the software see it as a useful addition to existing resources. However, opinions differ among the cops on the ground who respond to Precobs alerts. Because the system challenges established routines and makes decisions on behalf of officials. In addition, the preventive benefit is not directly noticeable among patrol officers, of course.

You rated the project's success only as moderate. Do you think that predictive policing can yield better results if the algorithm is self-optimizing with machine learning?
It is hard to say – mainly because there are virtually no research results so far. Also, machine learning, like predictive policing, is a broad field. In the case of residential burglaries, we know which parameters can explain spatiotemporal patterns. However, there are a great number of cases that cannot be explained. Chance plays a major role here, but machine learning may also help in these cases. However, it should be remembered that predictive policing is a process: What happens with the forecasts must be measured and incorporated again and again into the models. This is laborious – and miracles cannot be expected either. But it would be exciting to explore this.

When every minute counts.

For millions of commuters, public transit is a blessing and a curse – but not in equal measure. The situation is bound to get worse, too, as passenger numbers are skyrocketing. To keep buses, trains and streetcars running on time and help passengers make their connections, the ITCS-KöR project has built an information and communications system for road and rail transportation based on a predictive analytics solution from T-Systems.

COPY —— Thomas van Zütphen

With its local transportation hubs, the Ruhr region is Germany's largest contiguous commuter region.

Driving isn't really an option when your commute takes you across the Ruhr region twice a day – say, from Oberhausen to Hagen, from Dortmund to Duisburg or from Hamm to Mulheim. Wednesday, May 30, 2018, 4:34 p.m.: "You're listening to WDR 2. And now the traffic reports. Get ready to wait if you're on the road today. Germany currently has 370 miles of traffic jams, but 257 miles – that's nearly 70 percent – of them are in North Rhine-Westphalia. Let's start with the A 1 highway: between the Dortmund/Unna junction and the Hagen-Nord exit…"

No wonder more and more workers are resorting to buses and trains. All told, 2.3 million people commute to work regularly within the Ruhr region, making it the largest contiguous commuter region in Germany by far. While Dusseldorf, Cologne and other metropolitan areas draw commuters from the surrounding towns and communities and experience a mad rush into town in the mornings and a mad rush out in the afternoons, cities in the Ruhr region "swap populations on a grand scale" every day, according to Westdeutsche Allgemeine Zeitung, a daily newspaper.

COMMUTING BETWEEN COMFORT AND CRISIS
Waiting, crowding, jostling and shoving. Shoulder bags, laptop bags, messenger bags. "'Scuse me, would you mind getting your backpack out of my face?" Switching from the "7" to the "44"? Quick, jump out the bus door, sprint across the train station plaza, scurry down the stairs while keeping an eye on the "Next train arrival" sign. Made it! Hey, mind the gap! These days, buses, streetcars and subway trains in the eastern Ruhr region get much better to their destination.

The improvements are the result of a joint project between Dortmunder Stadtwerke AG (DSW21), Bochum-Gelsenkirchener Straßenbahnen stock company (BOGESTRA) and Straßenbahn Herne – Castrop-Rauxel GmbH (HCR). These public transit companies collectively rolled out a computer-powered traffic management system for buses in their operating area and extended it to trains and light rail last year. The cloud-aware Intermodal Transport Control System (ITCS), which is based on TETRA digital radio, represents a new generation of cross-company traffic control system communications. Norbert Grossek, Head of Strategic IT Projects at BOGESTRA, explains what that means: "By integrating light rail into our management system, we can provide better everyday reliability for passengers in the region of BOGESTRA and DSW21, which number 300 million each year. Our customers benefit directly from real-time passenger information and from making more connections when switching between trains, light rail and buses."

PUBLIC TRANSIT UNDER HIGH PRESSURE
In general, public transit systems are under tremendous pressure from three different sources. First, the traffic infrastructures in metropolitan regions and megacities like London, Paris and New York are bursting at the seams. The Ruhr region, with nearly 5.5 million inhabitants, is no exception. Its available capacity is virtually exhausted.

Even the smallest disruptions and unexpected breakdowns cause delays that often affect downstream trains, buses, streetcars and subways for hours to come. There's no relief in sight, either: in the future, public transit authorities will have to transport significantly more passengers with their current rail and road systems. The burgeoning passenger numbers will be next to impossible to handle if there are any interruptions in service.

It doesn't help that customers are getting more demanding, too. They know about real-time planning and communications and so expect trips and commutes to be perfectly coordinated by smart mobility solutions. To complicate matters, passengers move seamlessly from trains and buses to car or bike sharing programs. Deutsche Bahn has responded by becoming Germany's largest car sharing provider (Flinkster), ahead of car2go, DriveNow and other competitors, as well as the nation's most successful bike rental service (Call a Bike). Everything can be planned online or in smartphone apps.

The ITCS communications portal allows to inform drivers and pasengers of buses, suburban railways, and subways about arrival, departure, and connection times with the aid of the "Rbl-Assis!" app.

3.100 miles

of roads and railways is used by the KöR-vehicles connected to the system.

Customers also expect exact, accurate information on bus and rail delays, actual arrival times and alternative transportation and connection options. Transit providers are left with no choice but to accommodate customers with intermodal mobility solutions that make their services simple, reliable, flexible and attractive.

COMPETITION IS HEATING UP

At the same time, however – and this is the third source of pressure – competition in the public transit market is mounting rapidly. More contracts to operate bus and train lines are being put out for tender every year. Competition for each route is fierce. Bidders are expected to present proof of their punctuality and ability to make connections. And to do it all at the lowest possible price. Commuters, after all, care whether their co-payment for corporate transit passes is 65, 80 or 90 euros. These reasons have prompted a growing number of transit providers to establish cost-saving partnerships, subcontract out individual services and optimize internal processes. In the case of KöR in the eastern Ruhr region, T-Systems' ITCS plays a big role in helping participating companies meet all these requirements. "The Deutsche Telekom subsidiary has deep industry expertise, profound knowledge of the applicable technologies and extensive familiarity with our operational processes," explained Franz-Josef Senf, Head of Information Transmission and Process Technology at DSW21. And this combination, "together with its professional, collaborative project development, is what makes T-Systems an ideal partner for us."

As it builds the complete system for the three companies, T-Systems is equipping 550 buses and 200 trains with onboard computers to connect both the vehicles and their passengers to the central traffic management system. That way, even rail passengers can receive the latest real-time information across system lines. That translates into fewer delays, more reliable connections and happier customers. The solution can be optionally supplemented with multimodal ticketing systems that span multiple distribution channels. For the train crew, the "RBL-AssisT" onboard computer application is more or less the solution's centerpiece. It communicates with the central ITCS systems over the cellular network using a standardized user interface, sharing location information, route data and planned vs. actual comparisons of punctuality. Virtually no other modifications to the vehicles are needed, which keeps hardware and installation costs manageable for the transit companies.

REAL TIME EVERYWHERE

An analytics solution in the ITCS core tracks all the movements for each public transit operator in real time. Timetable data is constantly checked against current traffic conditions and the vehicles' regular status reports. The data is used to forecast estimated arrival times and the knock-on effects for possible connections. And that's the first step toward predictive analytics. Passengers can look up all the arrival and departure times that they need in the app or on the displays located along the more than 3,100 miles of roads and railways used by the KöR-vehicles connected to the system.

To ensure this information is available everywhere, the T-Systems experts had to outfit all the tunnels in the railroad system – over ten kilometers in total – with redundant TETRA digital radio communications technology with at least one fallback level. They also had to implement secure, encrypted data communications and link ITCS to the emergency services network used by the police, fire department and rescue services. "This new intermodal, cross-company communications solution that interlinks public rail and road transit systems can do much more than manage everyday traffic flows," explained Thomas Preußner, Head of the Rail & Transport Management Solution Center at T-Systems. "Integrating rail services into the traffic management system also improves overall traffic flows and every passenger's transportation options during trade shows, soccer games or any other of the large-scale events that happen all the time in a densely populated area like the Ruhr region." Not to mention the twice-a-day rush hours that often seem to flow seamlessly into one another.

ITCS's benefits – full multitenancy and rapid integration – haven't been lost on other regional transit companies, either. One has already knocked on the door: Verkehrsgesellschaft Ennepe-Ruhr mbH (VER) recently issued a call for tenders to connect to the system.

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www.bogestra.de/ueber-uns/kooperationen/koer (German only)
www.t-systems.com/industries/public-transport
www.t-systems.com/logistics/predictive-analytics

Photos: Bildarchiv Stadt Bochum, dpa/ picture alliance/Daniel Karmann

Delicious & precious.

Using a cloud-based IoT platform, a monitoring sensor system from the Telekom Hub:Raum-sponsored start-up BeeAnd.me protects bee colonies from disease outbreaks and thus secures honey harvests for beekeepers and consumers – with a not insignificant multiplicative effect; worldwide pollination by bees is valued at hundreds of billions of euros in agricultural and food industries.

COPY —— Thomas van Zütphen

Whether used as a spread, to sweeten beverages, or to refine foods – honey is considered both delicious and healthy all over the world. Its production relies less on people and their machines, but rather is the result of hard work by honey bees. These small creatures collectively fly up to 75,000 miles – about three times around the world – and visit five million flowers to produce just one kilo of honey. This is how beekeepers worldwide achieve an average annual harvest of 1.3 million tons in a highly sensitive market with a volume of between 12 and 14 billion euros – just a tiny niche in the global food market. Not to mention the natural remedies industry. Small. Delicious. Precious.

Because no matter on which continent – the threats to honey bees and numerous other beneficial insects has increased significantly in recent years. As a result, the "pollination beekeeping" business is booming: entire bee colonies are contracted out to fruit growers and orchard owners and transported from field to field.

To help beekeepers identify emerging health risks in their hives faster and, above all, before it's too late, the start-up BeeAnd.me, sponsored by the Deutsche Telekom business incubator Hub:Raum, has developed a digital beehive sensor designed to replace regular health checks by humans. A solution that is just as interesting for part-time beekeepers, who make up nearly 99 percent of the "industry" in Germany, as it is for large companies.

ANIMAL WELFARE FROM THE CLOUD

Industrial producers, such as Germany's market leader Fürsten-Reform, with its brands Langnese and Bihophar, operate huge beekeeping facilities in Guatemala, Mexico, and El Salvador. Specifically, the BeeAnd.me system records sounds, weight, humidity, and temperatures using hives scales, microphones, and sensors to monitor the health and activity of the bees on each level, and to analyze the well-being of the hive.

The data is collected and then stored in the Open Telekom Cloud. To keep the amount of data to a minimum (smart data), it is only transmitted when an IoT platform in the cloud detects patterns or recurring anomalies. Not least for this reason, the system and its rechargeable batteries, with a two-year data transmission lifetime, achieve outstanding energy efficiency and make data accessible to beekeepers from anywhere via the Web, smartphone or tablet.

Just 2 dozen of the more than 500 bee species collect nectar for use beyond their own. But where were the bees especially busy? Do their yields keep honey prices stable or drive them up? Where 500 g jars of honey are frequently available in supermarkets for 4 to 5 euros, certain single-variety products can cost twice as much. One kilo of honey from the madrone costs 18 euros.

A long way: Bees have to cover up to 75,000 miles in flight before a beekeeper can harvest one kilo of honey from their honeycomb.

Whether for climate change, biodiversity, or social justice and engagement – according to GeSI's Transformation Report system, digitization is the central lever for achieving further milestones of the 17 UN Sustainability Goals from 2016. For more information on Deutsche Telekom's corporate commitment, visit www.telekom.com/corporate-responsibility.

One kilo of lavender honey is 23 euros. Manuka honey from New Zealand can reach prices of more than 100 euros per jar.

THE "HEAVY-HITTER FOOD PRODUCER"

This is the one side of value creation from beekeeping to honey marketing. The small one. A completely different side – the big side, as it were – looks like this: Around 80 percent of the up to 3,000 agricultural and wild plants native to Germany alone depend on honey bees as pollinators. Accordingly, more than 85 percent of agricultural yields from crop and orchard cultivation depend on bees as pollinators.

According to the nature conservation initiative beecareful, the economic benefits of pollination by bees reached a value of 265 billion euros globally in 2015.

According to other sources, such as the German nature conservation association NABU, the value is estimated to be nearly twice as much. Almost half a quadrillion euros. This is why bees – in addition to swine and cattle – are considered to be one of the most important farm animals in the world, indispensable for our entire terrestrial ecosystem, and, in critical areas, essential for global food production.

When, in May of this year, as part of a joint campaign with NABU and the Lower Saxony Ministry for the Environment, the retail group PENNY removed all products from the shelves of one of its stores in Hanover that would no longer exist without bees, most customers visiting the store in the Langenhagen district were initially speechless: coffee, kiwis, cherries? Gone. Frozen pizza, chocolate, skin care creams, and deodorants – all products that contain canola, olive, or sunflower oils were "out". Around 60 percent of the 2,500 various common products one store carries were not available. Almost two-thirds of the shelves were empty. Even PENNY COO Stefan Magel was affected: "I was shocked when I saw the list. It's very hard to imagine."

1 kg
honey from the madrone

18 €

1 kg
lavender honey

23 €

Manuka honey from
New Zeeland costs

100 €
per jar

For more material
on this topic, visit:

LIKE A BABY MONITOR FOR BEES

Is a hive not gaining any weight over a number of hours? Is the number of flight movements decreasing significantly? Is the temperature in the brood nest rising to heights that are dangerous for offspring? BeeAnd.me alerts beekeepers using predictive analytics to react to unwanted events in a timely and targeted manner, much like a baby monitor for bees. "The fact that beekeepers are alerted in this way to any potential indicators of disease in their colonies very early on allows them to take anticipatory, targeted action to prevent the potential loss of an entire colony," explains Patrick Köhler. The innovation manager of T-Systems is the project owner of the Digital Beehive and is responsible at T-Systems' Munich Innovation Center and the Telekom Group headquarters in Bonn for the construction of two functional exhibits with, currently, twelve real hives that will be presented to customers.

While the Telekom partner Microtronics provides hardware, software, and defined interfaces for data transmission, "the cloud-based system evaluates and analyzes the data," says Köhler. "Health analysis and sound pattern evaluation, that is, data mining and machine learning, are core areas of expertise at BeeAnd.me." In addition to accurately measuring the quantities of honey produced, the system also allows beekeepers to determine when the entire hive is completely inside the digital beehive, to specifically apply beekeeping treatment concepts, such as mite prophylaxis, and to sustainably manage the health care of the bees.

Environmental conservation and animal welfare supported by IoT and the cloud, sensors, data and networks, honeybee hive welfare, and the sustainability strategy practices throughout the entire Rewe Group: PENNY's "Silent Spring" campaign in its Hanover supermarket certainly contributed to raising awareness of these important topics. To the same end, Dr. Gerlind Lehmann, Professor for Evolutionary Ecology at the Humboldt University of Berlin, is already developing "a nationwide and uniform insect monitoring program, which will allow us to quickly develop strategies to halt and reverse the trend of declining biodiversity among our insects." A goal to which the Digital Hive can contribute.
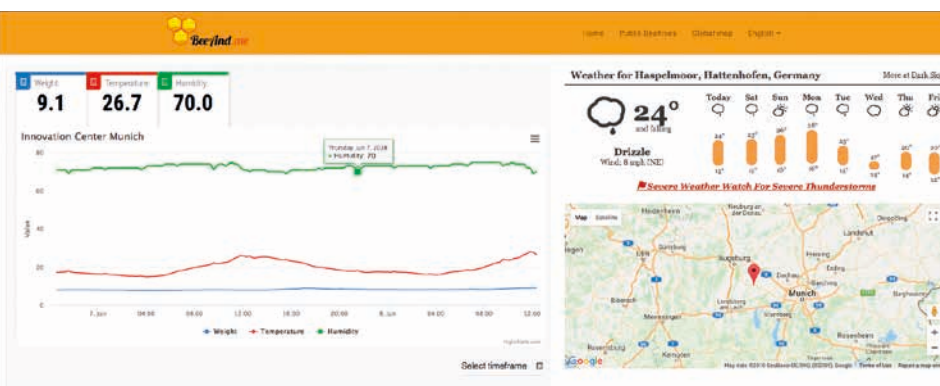
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"Data science starts in school."

When Ralf Klinkenberg founded an open source project in 2001 that was the precursor to the company RapidMiner, the value of data was not yet clearly understood. Since then, not only his company, but also the handling of data has changed rapidly.

COPY —— Sabrina Waffenschmidt

His job is to look into the future. And this vantage point is more in demand than ever. Ralf Klinkenberg is co-founder and Head of Data Science Research at RapidMiner, one of the world's most popular software platforms for data science, data mining, and predictive analytics. Unmistakably like no other, it helps companies to generate forecasts from their data.

Klinkenberg has developed the software since 2001 together with Dr. Ing. Ingo Mierswa at the Technical University of Dortmund as a flexible open source tool that examines large amounts of data for trends and associations and facilitates organizations' internal work with data mining. Whether Lufthansa, Intel, or BMW, PayPal, Ebay, or Siemens, with each new customer the two founders expanded the user base of their software. Today, RapidMiner has more than 380,000 registered users in over 100 countries.

MORE THAN 100 PARTNER COMPANIES

While RapidMiner initially followed the relatively typical service-based business model of an IT service provider, today the company relies on a licensing model with more than 100 partners worldwide. "In addition to being innovative, IT organizations need to build large ecosystems and communities of developers to survive. Companies that believe they can do it all alone will perish."

Klinkenberg and his business partner recognized this early on. They measure their success mainly based on downloads and subscription rates, so they can easily understand what works and what doesn't. "In the beginning, RapidMiner was a tool for experts. The first version had no design interface and was difficult for new users to utilize. When we added the graphical environment, user data rose dramatically. Similar to when we added the installer."

Today, the tool offers online tutorials, application templates, and transparent example processes with sample data records and an auto modeler function. The most important thing for Klinkenberg: "Facilitate operation and increase automation while maintaining transparency and flexibility. Add to that our large community and marketplace, so other companies and universities can build their own projects based on our software and share RapidMiner expansions with the community."

DATA SAVE LIVES

RapidMiner now works across all industries: Automotive, aviation, chemical, metalworking, food, insurance, banking, internet. Above all, the topic of ‚predictive' is now established and growing rapidly. Nevertheless: Many organizations are still in the testing phase. Even industries and companies that are already engaged in predictive analysis still have much untapped potential, says Klinkenberg. "Although many machines are already connected in industry, there are still many unused interfaces along the production chain. And the chain itself is often forgotten."

According to Klinkenberg's assessment, the greatest effects can be achieved in production and industrial manufacturing through the comprehensive use of data: Production becomes more plannable and efficient, products are better and more individual, and environmental resources are conserved. Klinkenberg also sees strong effects in the healthcare and medical industries. Proper use of data will not only allow for more personalized treatments, it will also help prevent medical problems such as heart attacks and strokes – and with the appropriate treatment recommendations.

BREAK UP DATA SILOS

To work efficiently with data, it is particularly important to break up data silos and to connect the data across all processes. Klinkenberg advises: "Just start somewhere. Often you can achieve a lot with minimal effort. But most of all, you acquire a sense of your own data quality along the way. External consulting can help, but it is becoming increasingly important for companies to build their own data science competence. This creates a real competitive advantage."

BUILDING SYSTEMATICALLY AND WITH CARE

Since 2013, the company has also maintained a location in Boston and thus has a direct comparison of developments between the US and Germany. "The US is a bit ahead of Germany and Western Europe. Americans are often quick to opt for an innovative solution but throw it overboard more quickly if it does not work right away. In Germany, the start-up time is a bit longer, but development is more systematic and sustainable."

Politicians must also become more aware of data science, demands Klinkenberg. "It is important to me to establish the topic in Germany more strongly in politics and to reduce fears in society. Germany is a very strong industrial nation and on a good trajectory. But the wheel is turning faster and faster, and local companies are now competing with global corporations. There are huge potentials and they have to be recognized. Certainly not everyone has to become a data scientist, but everyone has to be aware of it. This should already be taught in school."

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Vita ——

After studying computer science at the Technical University of Dortmund and the Missouri Institute of Science and Technology (MST) in the USA, Ralf Klinkenberg began researching machine learning, data mining, text mining, and predictive analytics at both universities in 1996. In 2001, together with Ingo Mierswa, he founded the project and later the company RapidMiner, which Klinkenberg leads today as the Head of Data Science Research.

Limitless in principle.

**Predictive analytics opens up many new opportunities.
And not just in the area of production control and monitoring.
A guest contribution by Prof. Stefan Wrobel.**

COPY —— Prof. Dr. Stefan Wrobel

Knowing what tomorrow brings – an ancient human dream. Digitization can make this dream reality, at least in part. Predictive analytics is a machine learning application. An algorithm models a time series from currently available data and continues to write the extrapolated data into the future. The use and benefit of such an analysis method are limitless in principle. In practice, the availability and quality of data, algorithms and processing power as well as the knowledge of how to combine these ingredients are limiting factors.

Predictive maintenance is one of the most popular application areas of predictive technologies. From the – ideally – large amount of process data collected in the production plant, an algorithm generates a prediction of expected disturbances, such as the failure of machine components. System downtimes can be shortened and the procurement of required spare parts can be accelerated as a result.

THE QUALITY OF THE DATA

A prerequisite for such a prediction is good quality data. Only if all conceivable states of production are depicted can a consolidated forecast be made. Included in these conditions should be those which are preferably avoided in practice: failures, breakdowns, disasters. If certain conditions are over- or underrepresented, expert knowledge from production is required.

Pure data-based solutions are, therefore, not considered the last word of wisdom. It is smarter to go hybrid and combine data from IT and production. Therein lies the answer to the question of numerous manufacturing companies: Do I have to become an IT company as part of the digital transformation? Only in part. Of course, building up IT expertise and manpower makes sense and is necessary. However, engineering knowledge is not curtailed in the process. Not everyone who knows how to use a predictive analytics tool can contribute the necessary expertise to the analysis.

As a result, individualization in production as well as other factors can lead to an unfavorable data situation, a so-called thin data case. In this instance as well, the increased incorporation of production knowledge is needed.
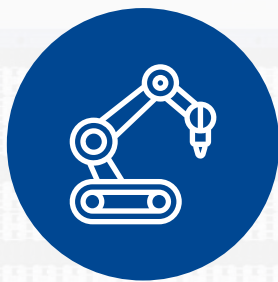
Once renewable energies make up

50 to 60 %

of the energy mix, there is no way around predictive energy.

Predictive Maintenance – the visionary service

Photos: iStockphoto, Fraunhofer IAIS

LOOPED DESIGN

Can the algorithm make erroneous predictions even with good data? Naturally. Therefore, it is essential to design such a system with a feedback loop in order to give the algorithm – as the learning system – a chance to identify errors and their causes and avoid them in the future, in cooperation with human control and evaluation.

POSITION OF OUR ECONOMY

German industry is well aware of the importance of introducing forward-looking technologies and has a good starting position. Of course, big international tech companies are generating huge amounts of data and thus have a better basis for predictions in this area. However, manufacturing enterprises have specific data in their sectors and expertise in their fields. Many German companies are market leaders in their segment and, therefore, have stable foundations.

When exchanging the necessary data, security concerns are often an inhibiting factor. The exchange of data between machine operators and IT platforms or machine operators and machine suppliers certainly fuels security concerns. Such exchanges require platforms that allow participants to confidently exchange data, ecosystems, as it were, between peers. Fraunhofer and many business enterprises have jointly founded the International Data Spaces Association. Among other things, we want to demonstrate from Germany that data can be exchanged differently than what is currently implemented at large internet companies.

The shortage of qualified specialist personnel also poses a challenge, especially since all sectors in general require expertise. We have had good experiences in this

Vita

Prof. Dr. Stefan Wrobel is Head of the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS and Professor of Computer Science at the University of Bonn. As Director of The Fraunhofer Research Center for Machine Learning, Spokesman of the Fraunhofer Alliance for Big Data • AI, Deputy Chairman of The Fraunhofer Association for Information and Communication Technology, and Spokesman for the expert group "Knowledge Discovery, Data Mining, and Machine Learning" of The Gesellschaft für Informatik, he is engaged nationally and internationally in the topic of digitization as well as the intelligent use of big data and cognitive systems.

area with the development of company-specific training programs for qualifying our own employees.

It is now important for companies not to lose sight of the future, even with currently full order books: The focus on digital transformation cannot wait.

USE IN TRANSPORTATION AND ENERGY

Advancing technological development will not only make predictions more and more reliable in the context of predictive maintenance, it will also open up an increasing number of areas for technology. Anomaly and pattern recognition as well as quality control are additional worthwhile application possibilities in the field of production. Even finance and retail can benefit greatly from reliable forecasts, as well as medicine and science.

The segments of transportation and energy are also areas with potential for special applications. The general limitations of traffic areas and the future emergence of autonomous vehicles make forecasts of expected traffic volumes necessary. The increased use of renewable energies, the production of which is very irregular, also requires forecasts. Once renewables make up 50 to 60 percent of the energy mix, there is no way around predictive energy. For example, energy-intensive production can be planned to start when a strong wind over the North Sea is predicted.

www.iais.fraunhofer.de/en/institute/about-us/stefan-wrobel
www.t-systems.com/solutions/predictive

"Managing data the smart way – a matter of partnerships".

Vitro CIO Humberto Figueroa and Francisco Meneses, T-Systems Sales Director Mexico, discuss critical tasks in a growing global enterprise, ticking clocks and the increasing importance of predictive planning, production and logistics.

INTERVIEW —— Thomas van Zütphen

Mr. Figueroa, Vitro has been advancing glass technology for more than a century. How has ICT contributed to this success story?

ICT has been critical in many ways, such as for the growth and standardization of our operations. We wanted to adopt a standard model of operations and we selected SAP to do that. We invested a lot of time in deciding on, defining and aligning rules and structures for a new Vitro model to be implemented in the new system. Now we have the same charter of accounts in all our businesses, so our financial team has an integrated overview of all the companies. Part of the challenge was that we have several businesses (cosmetics and pharma containers, automotive glass, architecture, mining and a metal-mechanic business). Meeting the diverse requirements of these businesses within a single SAP instance was far from straightforward.

The transition took two or three years; we consolidated five or six different systems into just one. Now, we only need to implement new functionality once, rather than five or six times.

We integrated effort and centralized our systems and were able to organize our IT group by processes, rather than by businesses. Now, we have central IT teams with horizontal responsibilities, such as R2P (Record to Report), H2R (Hire to Retire), O2C (Order to Cash), P2P (Procure to Pay), F2I (Forecast to Inventory) and Business Analytics teams that take care of everything for all businesses and regions. We also created a shared service center that enabled us to provide back-office services to the rest of the company.

Being able to digitize and centralize all the back-office processes is one of the main benefits and it has helped us to improve efficiency.

Vita

Before Humberto Figueroa was appointed Chief Information Officer of the glass manufacturer Vitro in 2007, he worked as a CIO for the airline Aeromexico. After studying computer science in Monterrey and completing an MBA at the University of Texas at Austin, he initially worked at telecom service provider Avantel in various senior IT management roles before moving on to become Infrastructure and Operations Director for Nextel, the US mobile operator.

14,817
Employees

2.07
billion USD consolidated sales 2017

More than **30** subsidiaries in the
Americas, Europe
and Asia

To achieve all of this, we also centralized communications, net-
works and data in a single data center; this gave us a high level of
reliability, and redundancy on a secondary DRP data center.

**The company is growing very fast, particularly in strategic terms.
What do you expect from an ICT provider to keep up with this
speed?**

They need to react fast, and we need flexibility to help us scale. We
want to make our model more rich and powerful and achieve syner-
gies as we acquire different companies and grow. We have to be fast
to react and integrate new companies quickly so we can benefit from
synergies.

**That's a good keyword. With regard to mergers, your CEO Adrián
Sada Cueva says "the priority is on integrating new businesses with
the existing businesses in the shortest possible time to harness
economies of scale, maximize competitive advantages, and share
best practices". How does Vitro IT deal with this pressure?**

In the last 18 months, we acquired two big companies in the US – an
architectural glass company and an automotive glass producer. This
means we have increased our footprint and become one of the largest
glass manufacturers in America, so we are very relevant in the US
market and have more than 20 plants. One of our goals is to help
achieve synergies from these acquisitions and support the business
case in a very short period of time.

We launched more than 30 projects for the first case in order to
reach these objectives, and we had a timeframe of only 12 months.

Rear windows, windscreens and sunroofs are Vitro's most important business segments as an automotive supplier.

As soon as the merger agreement was signed, the clock started ticking for us to execute these projects. We needed to migrate the new business to our systems. We wanted to provide our own services and migrate all of the new company's systems to our own infrastructure, which is run by T-Systems.

Moreover, as part of that project, we needed to consolidate network services and data in our data center in Houston, which is also operated by T-Systems. This was a critical task because without transferring all these systems, nothing would have worked and we wouldn't have been able to provide access to SAP or even migrate employees from the acquired company to the Vitro email server. This project last year was very challenging, but it was also a real success, and we were very happy with it and with T-Systems. We were able to reach our go-live targets. It took a long time to migrate everyone – around seven months – but we did it.

We achieved synergies and were able to reduce IT operation costs. At the same time, we had to work closely with our new colleagues in IT at the companies we had acquired; we needed to make them part of our team for the projects to be successful.

What was the initial driver for Vitro in 2017 to renew the outsourcing deal with T-Systems that included Dynamic SAP services, desktop services and network management services?

We needed a solid partnership with someone that we knew and trusted, who could help us achieve our synergies quickly and efficiently. The first project we executed with T-Systems was an SAP hosting project back in 2010 where we migrated our on-premise SAP systems in Latin America to T-Systems Dynamic Services and implemented a completely dynamic pay-per-usage model. We achieved savings and performance goals, and were able to run the system faster than when we ran it on our own premises. This contract was set to expire in 2017/2018.

In 2016, ahead of the mergers, we had already developed a very strong and positive relationship with T-Systems; they were also achieving excellent compliance with agreed service levels. As a result, we asked them about extending the existing contract to include the new subsidiaries. It made sense to extend the contract so we could focus on the migration and acquisition.

We have created a 'OneIT' program, which means we have to be able to provide the same quality of IT services that we have in Mexico

to all Vitro companies around the world. Against this background, it made complete sense to us to stay with T-Systems.

When it comes to innovations related to the glass industry, what role do predictive planning, predictive production and predictive logistics play for Vitro?

It's already very relevant, and it's becoming more and more so. We have over 100 years of expertise and large volumes of data from our production lines, and we started to ask ourselves what we could achieve with all that data. As a consequence, we have launched initiatives to analyze that information and start playing with it so we can pinpoint root-cause problems with quality, yield, performance and so on.

The amount of information Vitro gets access to increases day by day. To manage this data, you need transparency, seriousness, order and agility. How do you ensure these vital values are in place?

This is a matter of partnerships. We maintain a partnership with a company called OSIsoft; all of the sensor data that is created in our plants is stored in their systems, and this enables us to analyze and present this information to the plants and operations teams to aid their decision-making. Based on this data, we can also create dashboards that we can show to top management.

We are building an architecture layer to ensure we have real-time production data that we can provide to our businesses or operations teams – or send out to the cloud for further analysis, depending on the specific problem we want to solve.

To predict the life cycle of Vitro products is one thing. Another thing is the life cycle of your manufacturing infrastructure worldwide, particularly the dozens of very expensive furnaces. How do you protect these facilities?

We have a solid, well-designed maintenance and repair process that we review annually, so that we can maintain the quality of our equipment and extend the life of those assets. In our SAP model, we have created a manufacturing and maintenance model that allows us to evaluate the maturity process for all maintenance operations, such as how many repairs are done correctively, urgently, predictively or independently. We use this model to evaluate how plants are performing in this regard.

Electric and self-driving cars are topics that concern all of your automotive customers worldwide. Players such as Daimler, Ford, Mazda, Toyota and Honda, to mention just some of them, must be taking note of how Vitro is increasing its competitive advantage in their industry. How do you make your choice (in terms of IT), bearing in mind that there are many potential innovation partners you could consider?

We've been working with OEMs for a long time. We currently provide advanced technology windshields and glass parts, with the specific capabilities that OEMs are requesting. Many of these innovations are jointly designed with the OEMs, to improve the quality of the antennas, components or the glass, for example.

We have various ways of integrating innovative ideas into our business. For example, through our acquisition of the Flat Glass business, we gained access to a very strong R&D division which gives us a competitive advantage. Moreover, our IT organization has a relationship with an incubator in Silicon Valley that connects us to startups in various fields, including mobility and new materials. We talk to them to see what they're doing and explore how we can help – for example, in making cars lighter.

Strategic growth. With the acquisition of the US company PPG, Vitro significantly expanded its international market position in the field of architectural glass.

Vitro-CIO Humberto Figueroa is convinced – for future product innovations of the glass industry IT solutions will become an integral part.

The company

Founded in 1909, today Vitro is one of the largest manufacturers of glass products worldwide. Vitro's companies produce, distribute, and market a wide range of glass articles, which are part of the daily life of millions of people in 58 countries.

We have talked to T-Systems and their innovation group to generate new ideas, not just for automotive but also in other areas of our glass business. We explained to them our challenges regarding sensors or developments for augmented reality, for instance – and we recognize that they can deliver ideas and innovative proposals that could really help us. In that sense, it is definitely an advantage to know us as a company and understand our business processes as deeply as T-Systems does.

Today, we already see low-e glass installations in residential and commercial architecture, as well as in windshields and sunroofs. What's going to be the next big thing for solutions in the glass industry?

From the IT perspective, I think data will play an increasingly key role across the manufacturing industry; in fact, this is already happening. How do we get data from our product that we can leverage, for example, to provide services or maintenance, or to understand how our product behaves once we deliver it?

This is also part of becoming a digital company, which is challenging in manufacturing as we don't sell to the end consumer. So how do we connect with and access data from those endpoints that can help us enhance our processes – and by extension, our products? To put it simply: whatever the next big thing will be for the glass industry, IT will surely play an integral part.

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www.t-systems.com/solutions/predictive
www.vitro.com/en

www.t-systems.com/video/vitro

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IoT: planting the seeds of success.

A wholesale grower in North Rhine-Westphalia has built its success on speed and a high-performance, high-quality supply chain. For support, it has turned to a T-Systems solution that translates IoT technology into real-life benefits.

COPY —— Sven Hansel

2,500 mature impatiens plants were rolled into a waiting truck by three workers.

t's **7:30** in the morning in late May in Tönisvorst, Germany. One corner of this small town houses a heavenly smelling, but extremely busy work environment. Two workers adroitly stuff delicate seedlings into flowerpots that have been mechanically filled with peat. In a few minutes, they manage to fill an entire pallet's worth of pots. At the next station, three workers roll 2,500 mature impatiens plants into a waiting truck. The moment it trundles out of the parking bay, the trio move on to their next task. Walking amid this hustle and bustle is CEO Herbert von Danwitz. One moment, he's murmuring an encouraging word to a packer; another, he's crumbling potting soil between a pair of practiced fingers. All while answering an incessantly ringing cell phone. Sometimes, the caller wants "3,400 items to Venlo;" other times, "2,300 plants to Cologne". This buzzing enterprise has nothing in common with the sunrooms shown in Hollywood movies in which aging, elaborately made-up divas delicately snip at their roses while Chopin plays softly in the background. This is hard, focused work. "Our industry now runs on a 24-hour schedule," says von Danwitz.

> **"Sometimes we receive an order in the morning for 4,000 plants, which must be in Cologne the next day by 7:30 a.m."**
>
> **HERBERT VON DANWITZ,**
> CEO Horticulture von Danwitz

CUSTOMER SUPPLY CHAINS SET THE PACE

The business, established in 1952, but now owned and operated by the second generation of the family, brings color into German households from a 26,000 square meter facility in Tönisvorst and a 32,000 square meter site in the Netherlands. Today, roughly 30 employees aim to execute the company founder's credo: "Satisfied customers come from quality, expertise and delivery reliability."

Delivering on this promise, however, demands a concerted effort from the floricultural firm. "Gone are the days when nurseries would roll up in a truck and pick up a couple of pallets.

Today, our business is all about bulk orders from large discount chains, hardware stores and grocery retailers," says von Danwitz. In other words, notes the CEO, "their supply chains set the pace."

By **11:45 a.m.**, it's clear what von Danwitz means by the "pace". Small details such as RFID chips under the carts reveal a heavy reliance on industrial-scale logistics processes – real "flower power". Right now, employees are preparing an entire truck for a regular customer in Cologne. And the order didn't come in a few weeks ago, either. "Some mornings, we'll get an order for 4,000 plants that have to be in Cologne by 7:30 a.m. the next day," mentions von Danwitz. His telling gaze and emphasis on the words "have to" speak volumes. He explains that they dispatched a truck used to haul other suppliers' perishable goods, such as lettuce or fruit. He adds that customers would be "very displeased" if the truck left with an empty pallet position because his employees hadn't finished packing the plants on time – and not just on efficiency grounds, either. Interrupting the supply chain is a huge no-no in his industry. "Delivery reliability is what matters most to today's customers. If you miss two or three deliveries, they'll stop calling," concludes von Danwitz.

TURNING VARIABLES INTO CONSTANTS

These conditions leave no room for maudlin romanticism in modern-day greenhouses. Technology has long been a process driver. A fully automated irrigation system collects rain water and distributes it among hundreds of thousands of flowerpots. Plant growth is calculated by computers; the staff horticulturalist incorporates weather data – "Has the spring been sunny or overcast?" – into his planning calculations. Von Danwitz even controls the air-conditioning systems with a cell phone app. "We have the tools to convert a lot of variables, like weather conditions, into constants. But there's one variable we can't change, and that's labor," stresses the CEO.

Like most companies, the North Rhine-Westphalian business faces a shortage of skilled staff members: from trained truck operators to horticulturalists. Even seasonal workers, a mainstay in his industry, have to be recruited from all over Europe. In peak months, von Danwitz has up to 40 seasonal employees working for his company, all earning minimum wage. Obviously, some people will get unexpectedly sick, prove to be incompetent or turn out to be just plain unreliable. And these hiccups can produce the very supply chain problems that the flower supplier simply cannot have.

## BLACK, RED AND GOLD FOR IMPULSE SHOPPERS

At **2:23 p.m.**, von Danwitz answers the umpteenth call on his cell phone. The purchasing agent for a chain of hardware stores is absolutely taken with the entrepreneur's latest idea: flowerpots filled with black, red and gold petunias – the perfect plant for the World Cup in soccer. She immediately orders several thousand. Von Danwitz leaps into action – it's time to move swiftly and precisely since the supply chain has to deliver. Still, to make sure everything works smoothly, he now uses a smart IoT solution from T-Systems to track efficiency and performance in his production processes.

His reasoning is simple: when these kinds of calls come in, his biggest question is, "What's the current human resources situation in our processes?" That's a challenge in a 26,000 square meter facility since it increases the already relentless time pressure even more.

Now, though, with each new work order, the employees pick up a small box with a QR code and a smartphone and scan an NFC tag associated with the order. They repeat this process whenever they go on break and once again after they've filled the order. The information is automatically routed through the cellular network to a cloud-based IoT platform that collects, analyzes and processes the performance and production data. Von Danwitz can then simply pull up a dashboard on his office computer or smartphone and get exactly the information he needs: How many flowerpots are already loaded onto
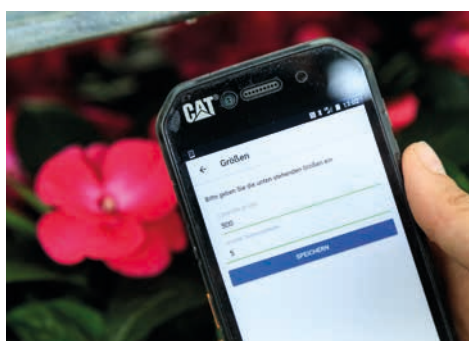
pallets and ready to ship? What are the KPIs for the individual teams? How efficiently was a particular flower cultivar readied for shipment? What team got done early and is ready to help out at another station? "All this data helps tremendously in keeping our supply chain running smoothly," explains von Danwitz.

CONTINUITY OF WORKLOAD
The IoT solution also provides information for future planning. With it, the wholesale grower can track how efficiently a particular flower cultivar was readied for shipment and adjust the cost calculations accordingly. It also allows the company to optimize larger processes, notes the CEO. "We've started to irrigate all our plants while our employees are on break. That's an idea we got from data analysis."

One of the platform's main benefits for the North Rhine-Westphalian company is that it helps maintain a certain continuity in its work processes. "I want my people to always give 100 percent, not 110 percent. Under no circumstances do I want them to work under constant stress. Then, we'd only be increasing our reject rate, not delivering the quality that our customers expect from us," explains von Danwitz. "I want my people to look forward to coming to work."

That's a universal sentiment. "And that's why we believe our platform has a lot to offer in many different industries," says Ralf Konrad, the product manager for the T-Systems solution. Indeed, the IoT platform is better and more accurate at conducting competitive analyses, supporting process integration, identifying innovation requirements and tracking cost trends, current shipments and actual production conditions than old-fashioned manual methods. Its clean design means customers don't have to make major technical preparations or engage in any programming, either. The dashboards come pre-configured, as do certain alarms, such as when a company runs the risk of missing a production target. "Our solution can help any organization that does a lot of loading and unloading or has a complex or sensitive supply chain," says Konrad. From Tier 1 automotive suppliers to craft enterprises working on large projects to slaughterhouses, there's always a way to optimize the flow of goods. Partly because the solution keeps up with current technology.

DIGITAL VISIBILITY INTO THE VALUE CHAIN
The platform is open by design and interoperates with any end-user device. This openness extends to connectivity, too: the solution supports all communication protocols and transmission channels. It's built on the powerful Microsoft Azure cloud platform and features interfaces for easily integrating Salesforce, SAP, manufacturing execution software (MES) and other solutions.

For the World Cup, the horticultural company Danwitz supplied a German hardware store chain with black/red/gold petunias in appropriately colored flowerpots.

All labor-intensive businesses can leverage the solution to gain digital visibility into their supply chains. Production status checks can be conducted on the fly and automatically forwarded to customers – which is the kind of digital reporting that large companies in particular are increasingly demanding from their suppliers. The extra visibility supports cost-cutting and gives executives more leeway when scheduling and managing teams. Greater inventory visibility can also help in identifying hidden opportunities to generate more revenue, such as by selling off remainders. That improves customer satisfaction and rewards employees for their performance.
It's **6:12 p.m.**, and von Danwitz takes another call from a customer. He just got his first order for the Advent season: poinsettias for several hundred grocery stores in a major chain. "By early summer, we know exactly how many plants we need to have loaded on the pallets by the first Sunday of Advent. But with the new IoT solution, I'm far more confident that everything will go smoothly," says von Danwitz before whirling into action again. A Dutch supplier is on the phone; this time, the call is about vegetable seedlings for balconies. In a few weeks' time, this latest hot trend may appear on his employees' smartphones as a new item to be scanned in.

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Data treasure instead of digital graveyards.

In two years, up to 33 percent of the "digital universe" will consist of unused information, according to the IDC. Companies that run the right analyses on this hidden treasure could unleash tremendous value. Deutsche Telekom's Data Intelligence Hub (DIH) offers a way to thread this tricky needle.

COPY —— Thomas van Zütphen

V irtually every company, regardless of its target market, aims to leverage competitive advantages, cut costs and optimize processes. So what could be better than finding a way to analyze, interpret and harness data that could be used to drive growth or even develop innovative business models? However, many firms don't know how to go about it. Their dilemma: how do they get access to the data and how do they use it properly to generate (shareholder) value?

Some data may be generated internally. Though easy to access, this type of data is often incomplete. External data, in contrast, is plentiful, fragmentary and available from a variety of sources – free data, data from closed ecosystems and even data from service providers and other companies that are linked together by processes. The digital universe, which is expected to hold 44 trillion gigabytes by 2020, is constantly being supplied with new data, including data generated by the 212 billion devices that the IDC expects to be online by then. But untapped data can also lay hidden in various patterns, such as the use of social media and social content or in correlations between medical information and sociological data. Only one thing is certain, though – most companies are not using these data pools intelligently.

BRINGING ORDER TO THE DATA TREASURE
The reasons are manifold, ranging from the profound to the mundane. Companies may not be aware of the interactions, appreciate how they could use the data or even know that the information exists. Plus, a lot of the data is completely unstructured. The main challenge is to integrate the new data into the corporate database and link it so that it speaks the same language. To complicate matters, companies obviously pay close attention to any competitors who may also be in line to use the data.

This is where Deutsche Telekom's Data Intelligence Hub (DIH) comes in. It serves as an interface and marketplace – one that is sorely needed, especially for data management. DIH offers central management and a comprehensive market overview of all the data that is freely available or for sale. DIH also allows experts to connect with companies that have few internal resources or little expertise in artificial intelligence – an essential ingredient in useful data fusion and analysis – so that, together, they can leverage all the data in the marketplace to optimize their processes and close gaps in their value chains. Combining data "particles" across functions, no matter how small or widely dispersed they may be, drives genuine data fusion and ultimately helps avoid

In the Data Intelligence Hub, Telekom acts as a trustee that only exchanges all project-related data decentrally, transparently, and directly between the partners in accordance with their respective rights.

production delays, unnecessary costs from waiting and excess inventory.

IMPARTIALITY GUARANTEED BY CUSTODIAN

Telekom's DIH serves as an impartial data custodian who observes strict security standards, protecting all the collected data and only sharing it between partners when permitted by the corresponding authorizations. Throughout this process, DIH provides the oversight, transparency and management of a decentralized and encrypted exchange without requiring Deutsche Telekom to store the data itself in the transfer process.

In logistics, for example, every freight or transport chain contains fragmentary data that can be used to forecast approximate delivery dates. However, customers – whether individuals ordering from Amazon or businesses expecting a rail consignment – expect punctuality, precision and reliability. With package deliveries, it's clear where and when the package was loaded on the truck or train and what its current approximate location is. But some data is missing from the process chain. For example, there's no intelligence on whether, when, why and where a consignment may be delayed. Having this information would allow transportation providers to intervene in real time, reduce waiting times and warehousing costs and ensure reliable planning for manufacturers.

The data is available, but is scattered across various pools in fragments. With DIH, companies can obtain the missing data, analyze it and merge it with their own data in a standardized way in order to fill in any gaps in their knowledge and take swift action as needed.

"Deutsche Telekom's DIH was developed to minimize the complexity of individual process chains for companies, transfer knowledge and provide a secure, centralized and standardized portal for optimizing data-driven value chains," said Sven Löffler, Business Development Executive Big Data & Data-Driven Business at T-Systems.

SECURITY IS MISSION-CRITICAL

DIH, which is the first product of its kind, satisfies the principles and high security standards of the International Data Spaces Association (IDSA). According to Löffler, companies benefit by having "legal constraints that are easily and precisely defined for each data interchange interface. You end up with legally watertight definitions and documentation of four key questions: Who can use the data? What can they do with it? What data can they use? And for how long? Everyone's right to informational self-determination is assured using transparent, technically suitable methods and properly documented for all process stakeholders." And that's a key issue for companies like Setlog.

212 billion devices expected to be online by 2020

Established in Bochum, Germany, in 2001, the software firm and its US subsidiaries provide cloud-based supply chain and vendor management systems for planning, managing and optimizing global production, supply and logistics chains based on early warning, dialog, analysis and data management tools. Setlog is currently using Deutsche Telekom's DIH as a platform for data fusion and analysis in order to launch a supply chain navigation system for global transport chains. The software company's anonymized freight data is merged with public data within an extensive data sharing process. It intends to make international supply chains more reliable and transparent across all modes of transportation through dynamic simulation models. "Sharing and analyzing freight data lets us eliminate costly buffers and imponderables. In the future, everyone involved will be able to safely and transparently plan complex international supply chains," said Ralf Düster, Managing Director of Setlog GmbH.

AI FOR RENT

Deutsche Telekom's Data Intelligence Hub includes a "Rental Workshop for Artificial Intelligence". It gives data scientists access to tools and open source applications for data processing and enables companies, particularly smaller and mid-sized ones, to start using AI.

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Photo: iStockphoto

IN WISE FORESIGHT

Nine future answers to
What. When. Why. How.

Around
80 %
of the up to 3,000 agricultural and wild plants native to Germany alone depend on honey bees as pollinators.

600
million euros
would be saved every year in Germany alone if goods traffic were to be completely converted to digital consignment notes.

MDU

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NetPad

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At DB Cargo, preventative measures limit costs to
less than
10 %
compared to engine total loss of a locomotive.

Near-repeat theory: burglars like to
return
to areas where they were previously successful.

The costs of managing bottlenecks in the power grid today can already be reduced with the help of prescriptive analytics by
more than
200 million euros
per year.

The market for digital twin applications will rise to
15.66 billion
US dollars
by 2023.

With the invention of T-Systems experts, stored amount of data can be reduced to up to
10 %
of the original volume.

Faster and on time! T-Systems is equipping 550 buses and
200 trains
with onboard computers.

Thanks to IoT,
the precise piece-count poinsettia production matures in early summer.

Sources: **1.** German Beekeeper's Association (Deutscher Imkerbund e.V.) **2.** Federal Association of Road Haulage Logistics and Waste Management, or BGL (Bundesverband Güterkraftverkehr Logistik und Entsorgung) **3.** IS Predict **4.** I. Hearndon, C. Magill: Decision Making by House Burglars: Offenders' Perspective. **5.** German Energy Agency and the Office for Energy Management and Technical Planning (initiated by the Federal Ministry for Economic Affairs and Energy) **6.** Market Research Future Institute **7.** T-Systems **8.** KöR **9.** Herbert von Danwitz