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life

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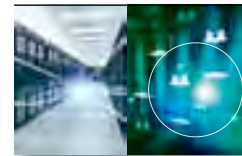
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Ones and zeros.

Digital transformation.



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Digital challenges.

Buildings of the future will be designed, or modelled, virtually. This enables continuous data exchange over the entire life cycle.

A TROX project coordinator initiates orders for components, which then automatically create production orders in the supplier's factory. Ventilation and air conditioning systems automatically adjust to the most energy-efficient settings based on data they receive from various sensors. Fans with a diagnosis system check their own condition and emit a signal or send out a report if maintenance is due. Just wishful thinking? Not at all. It's all a reality already. The HVAC industry is well set up for the digital revolution and already offers convincing solutions in terms of energy efficiency. But the digital revolution is progressing inexorably, and it is not limited to production processes or equipment optimisation.

Digital Services. TROX is working hard on digital services and offerings. Digital services will no longer be computer-based, but instead they will be available in the 'data cloud', any time, anywhere. We are working on solutions that will reduce or facilitate the complex tasks of our customers. Our goal are less complicated digital processes, easier-to-use design tools, a rapid information exchange, easier product configuration and faster product delivery.

In this issue of TROX life we travel with you into the future. Immerse yourself in the digital world. We discuss our ambitious goals for digital services as well as a clever, radio-based solution for the digital retrofitting of existing ventilation and air conditioning systems we call RadioDuct.

We also report on a great project: Hall 12 on the Frankfurt trade fair grounds. Intelligent smoke extract systems enable quick and safe escape in the event of a fire. Yet in spite of all digital technology, the building owner also relies on analogue solutions. The fire alarm system combines both: highly complex technical procedures and the analogue solution for firefighters. Using a floor plan, the firefighters can quickly orientate themselves in the event of a fire and switch to the right scenario. This is a good example of how we understand digitisation. Digitisation is a matter of course for us. Our customers expect things such as tools or a cloud, and we provide them. And yet: The 'analogue' personal contact remains an important pillar of our sales strategy. We are convinced that businesses which want to be successful in future will have to reconcile these two aspects.

Last, but not least, we entertain you with exciting topics from the cyberworld. Ever wanted a simple explanation of blockchain? You can find it here. Do you enjoy reading science fiction? We have put together the most thought-provoking scenarios of the future for you. The world of ones and zeros. An exciting read that will captivate you.



Udo Jung
 TROX Board of Management

TROX 4.0. The digital transformation.

Digital transformation is a continuing process of change that affects individuals as much as businesses and entire societies. It is based on digital technology, including:

- information technology, for example application programs and information systems
- digital infrastructures, for example networks and computer hardware
- digital business models and added value networks



**Digital transformation.
For TROX not an end in itself.**

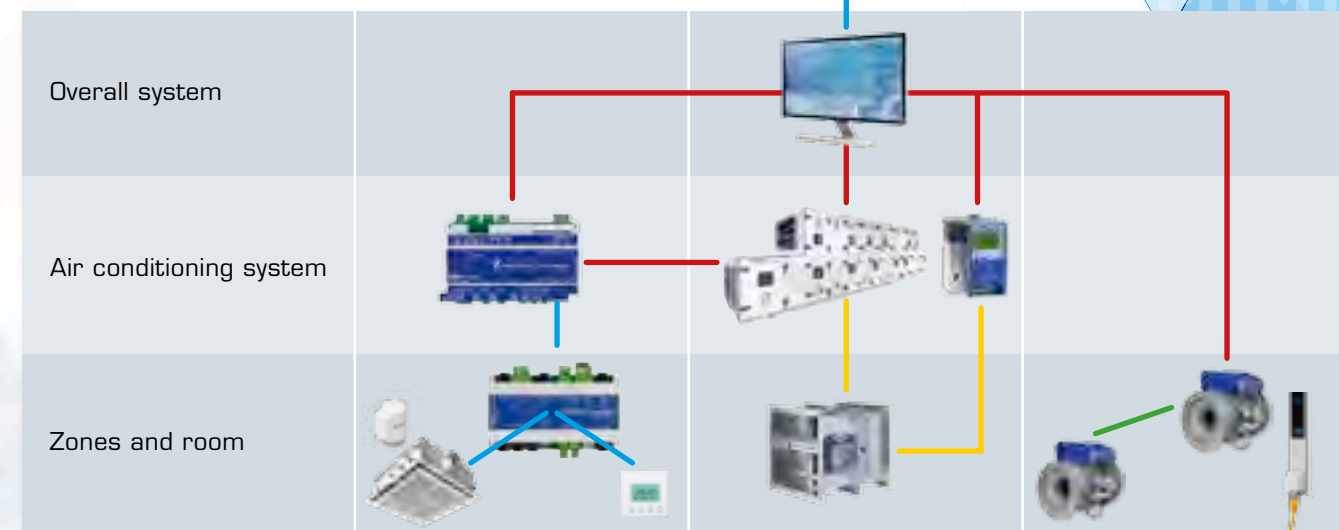
TROX has long been committed to the path of digitisation and digital change. The first step was fitting components such as VAV terminal units with digital controllers; this was followed by linking several components, for example all the components in a zone or in a room. The latest step has been an air handling unit with X-CUBE control, transforming a 'dumb' unit into an intelligent overall system for ventilation and air conditioning.

And now? The next logical steps are the Internet of Things and cloud-based building services. Ventilation and air conditioning systems will be managed via a cloud. Both TROX and its customers will be able to access air conditioning systems, monitor and manage them, and even optimise them via the internet.



Automated manufacturing in the Anholt production facility.

Example



For TROX, digitisation is not an end in itself. Rather, customers come first. This is why TROX is striving to develop solutions that reduce or facilitate the complex tasks of its customers. The goal are less complicated digital processes, easier-to-use design tools and a more straightforward exchange of information. Almost needless to mention that digitisation does not stop at the factory gate. Design processes and manufacturing processes are being automated to become more efficient. Products are being improved to be more intelligent, which allows us to provide

individual solutions, services and information to customers on a scale previously unknown.

It is our primary goal to offer our customers the most user friendly, easy-to-navigate front end with easy-to-use tools that help them select components and systems, and configure and order them. Customers will even be able to design, install and commission systems, and to maintain and optimise them. All this is made possible by new TROX customer portal called myTROX.

myTROX. Our new customer portal.

myTROX is based on four pillars:

- Design tools for selecting, configuring and sizing products (Easy Product Finder, BIM)
- Project management, purchasing products online, and viewing the order history and shipping information
- TROX ACADEMY with webinars, seminars and other events that can be booked
- System monitoring, remote operation and maintenance

Design tools.

Digital services such as the provision of data required for Building Information Modelling (BIM) or CAD software are still mostly PC-based applications. This means that users have to download the application software and save product data on their computers. But new design tools as well as the increasing complexity of computing require more and more storage space. The TROX solution is web-based: The myTROX front end includes web services that communicate with BIM applications for design, configuration and operation so that customers have always access to up-to-date information and can access their systems at any time and from anywhere.



The TROX Easy Product Finder (EPF) design tool goes online.

To select TROX components, customers can now go to the EPF web version from anywhere – from a construction site, from their office, or while on the road. The EPF online version also allows customers to size and configure the products they have selected. The scope of this is huge: The FK-EU fire damper, for example, allows for so many variants and order options that roughly two billion different dampers can be created. There are already seventy TROX product types available in Germany that can be selected and sized online. Customers who register have also the option to manage their projects online. Once they complete the online process, they will receive all the technical information and specification texts.



Online purchasing.

After choosing the components they need, customers can access their personal, password-protected webpages and order the products online. The individual conditions for each customer are stored right there.

Individual access.

Their individual password allows customers to see each item they have ordered including detailed information and delivery dates, and all this from any device, be it a smartphone, tablet or personal computer.

TROX ACADEMY.

This is where customers find information on TROX seminars and webinars which they can book and get a reply immediately.

System monitoring.

Once customers have completed the purchase and commissioning of a system, they can use their account and password to access 'private' pages of myTROX that allow them to see and monitor their installed systems. Remote access not only makes monitoring a system much easier, it also helps to optimise and maintain it. In case of a malfunction, the TROX HGI Technical Service can offer support quickly and easily. This type of service is particularly useful for systems installed in very sensitive areas and it is made possible by our Remote Operation Center (ROC), which can also perform monitoring if requested. The ROC monitors systems 24 hours a day,

365 days per year, and can hence react immediately if there is a problem. Continuous monitoring of a system means that any preventive maintenance steps can be taken before a serious problem arises. Regular filter changes or fan maintenance ensure trouble-free operation and operational reliability. In other words: effective and efficient life cycle management.

Advantages of myTROX®

The web-based myTROX front end offers customers advanced tools and up-to-date information:

- up-to-date product data in various data formats
- information on product installation and commissioning
- web-based design and configuration wizards
- interfaces to BIM application software

The password-protected section provides:

- online purchasing functions (component selection, configuration and ordering)
- project-specific shopping cart
- overview of a customer's own orders and delivery dates including information on shipping and the number of packages that will be delivered
- seminar bookings and seminars attended
- download of seminar and workshop documents
- system monitoring, maintenance and optimisation using cloud-based systems
- managing of access rights for customers
- information on TROX contacts

Frankfurt trade fair grounds. Hall 12.

The new Hall 12 was designed by architects kadawittfeldarchitektur, based in Aachen, Germany, and it is a prime example for aesthetic appearance combined with function, and for setting new standards in economy and sustainability, visitor management and comfort. On top of all this, it is also an ideal event location and represents the 'new' Frankfurt. The striking building can be found in the westernmost area of the trade fair grounds. It is an inspiring accent on this global marketplace and a new landmark in the European Quarter of Frankfurt. Innovative ventilation and air conditioning components and systems provide excellent comfort and safety.



Energy-efficient: the air-water system with active chilled beams.

Gigantic structure.

A total of 97,620 m² of walkable area, 33,600 m² of exhibition area: roughly the size of six football fields. A space with a volume of nearly 340,000 m³. A structure with a capacity for 24,000 people. The new Hall 12 is nothing less than a superlative building.

In a space where so many people exhale CO₂ and radiate heat, and where lighting and technical equipment generate even more heat, the ventilation and air conditioning system not only has to provide huge quantities of treated fresh air, but also dissipate enormous thermal loads.

Energy-efficient ventilation system.

The two exhibition floors are ventilated with a primary volume flow rate of 840,000 m³/h; with induced air, a total of 3,500,000 m³/h result in an output of 10 MW for cooling.

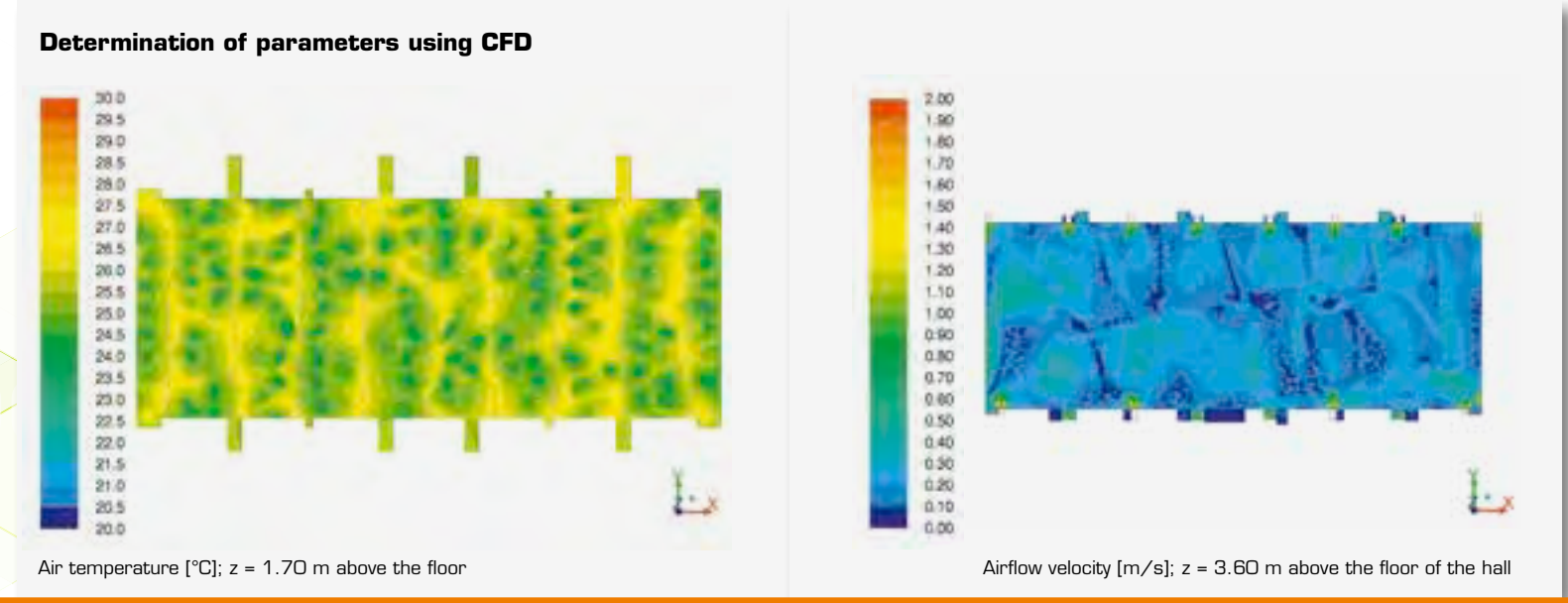
'In Hall 11 we've had a very positive experience with the energy efficiency of an air-water system and the comfort it provides', says Anton Heisler, who is responsible for building services in all the buildings on the trade fair grounds. 'This is why we've again opted for active chilled beams.' Two thirds of the heating energy are dissipated with water. The advantage of air-water systems is that they 'transport' energy with water, which is more efficient than with air. By comparison, an all-air system requires a primary volume flow rate that is three times as large to cool the space.

The experience from Hall 11, which is equally wide, but 60 m longer than Hall 12, plus the results from energy monitoring provided the specialist consultants with valuable information. In Hall 11 as in Hall 12, INNIUS GTD from Dresden, Germany, carried out complex CFD calculations (Computational Fluid Dynamics). In order to achieve the best possible results and the best possible air quality, the design, sizing, arrangement and orientation of the TROX active chilled beams was based on precise data.

A sustainable building.

Sustainability has been very important to the building owner. In addition to the energy-efficient ventilation and air conditioning provided by the air-water system in the hall, a photovoltaic system on the roof generates energy that would suffice to satisfy the energy consumption of 241 families of four. Solar energy is estimated to cover about 20% of the electric base load, or 1.5 MW.

CFD was used to design the space. Dimensions as well as the number, size and arrangement of nozzles were optimised with regard to induction values and the capacity of the chilled beams. Source: INNIUS GTD, Dresden, Germany.



Acceptance test with hot fire gas in Hall 12.

Virtual design.

The design bureau, Brendel Engineers, used the most advanced methods in the development of the air conditioning and fire protection strategy. They actually created a virtual 3D model of the building services.

Fire tests.

In the event of a fire, up to 25,000 people will have to leave the hall quickly and safely along smoke-free escape routes. With the digital TROX fire and smoke protection system all the components complement one another and work reliably.



Pressure differential systems in the stairwell keep escape routes free from smoke.

Extensive CFD simulations have been used to prove that escape and rescue routes will remain free from smoke, in spite of the complex room layout and the three-dimensional airflow. A simulated fire was used to detect problem areas and develop a feasible solution. A solution with which the safety objectives can be achieved under the existing conditions. In the event of a fire, volume flow rates of 1,000,000 m³/h on both exhibition floors and of 400,000 m³/h in the two foyers will ensure effective smoke exhaust, and tests with hot fire smoke (to the VDI 6019 standard) were carried out to prove that smoke-free layers would be created.

Proven and reliable systems: The fire alarm system has pictures of the hall as well as colour diagrams of various scenarios. This helps the fire brigade to immediately see where an incident has happened. With manual push buttons they can quickly initiate the correct actions.





On the roof of Hall 12: TROX X-FANS smoke exhaust fans of Type BVD, fitted with the intelligent fan diagnosis system.

Advanced fire and smoke protection strategy.

The very high foyers on the west and east sides of the hall are fitted with air transfer dampers so that the foyers can be supplied with sufficient air from the exhibition areas in the event of a fire. TROX X-FANS roof fans with the optional DAX casing meet the requirements of the German Energy Saving Ordinance (EnEV) and ensure a controlled smoke exhaust, and also save costs.

Heat and smoke from the lower floor of Hall 12 are extracted and led to FK-EU smoke control dampers, from there to the X-FANS BVD smoke exhaust fans on the roof. X-FANS supply air fans of Types AXN and DRV-EC are installed on both floors of the hall and

move the supply air, which is to replace the extracted air (smoke), to the Type AH ventilation grilles. The upper floor of Hall 12 is directly connected to the fifty X-FANS roof fans of Type BVD.

Sixteen stairwells surround the actual exhibition areas on the two floors and serve as escape routes in the event of a fire. Pressure differential systems keep them free from smoke by creating a positive pressure in the stairwells so that no smoke from the incident floor can enter the stairwells. Type EK-JZ smoke control dampers at the outdoor air inlet are part of the system and provide fresh air. In the event of a fire outside of the hall, they close and prevent the fire and smoke from spreading to the inside of the building.

Smoke control damper.



The intelligent X-FANS fan diagnosis system.

The fans installed on the roof of Hall 12 are equipped with an intelligent fan diagnosis system and a volume flow rate measuring unit. The volume flow rate measuring unit is used to measure the operating volume flow rate, for example at connection points of ducts. This speeds up adjustment work considerably. Somewhat difficult discussions between those involved in installation, be it discussions with regard to measurement points or measuring methods, are a thing of the past.

During mandatory test runs every six months the diagnosis system checks the condition of the smoke exhaust fans and in particular the condition of the fan motors. This ensures operational reliability in the long term. Specific maintenance work is required only if the fan diagnosis system has detected a problem. Intervals for the replacement of bearings or for grease changes as suggested by the manufacturers may be omitted and have to be carried out only when the fan diagnosis system signals that a change is necessary.

This is a great advantage especially in smoke exhaust fans and it saves a lot of money as previously regular inspections were necessary.

Cost advantages and safety thanks to digital intelligence.

With solutions such as the TROX X-FANS fan diagnosis system it is not only possible to quickly assess the condition of a fan, i.e. wear and tear, but also to save the results in the software for comparison at a later date. In this way, optimising the fan performance and adjusting it to the duct system can be easily achieved. Linking the fire protection and smoke extract components ensures functional reliability of the system in the event of a fire.



Diagnosis system and volume flow rate measuring unit – benefits for HVAC contractors and system owners

- Diagnosis based on the actual condition extends the replacement intervals for bearings and other parts and ensures operational reliability of X-FANS smoke exhaust fans.
- The diagnosis system for smoke exhaust fans helps system owners to prove the functional reliability as required by law. No parts replacement based on fixed intervals.
- No futile discussions with regard to performance data (volume flow rate / pressure relationship).
- Maintenance intervals are easy to document with the software.

The building

Building owner: Messe Frankfurt Venue GmbH
 Specialist consultants: Brendel Engineers
 Fire protection expert: Peter Vogelsang
 Architects: kadawittfeldarchitektur
 Building owner responsible representatives: Anton Heisler and Stephan Hahn

Area: 16,800 m² per floor;
 lower floor with variable area
 Internal dimensions: 211.90 x 79.50 m
 Clear height: 10 m on each floor
 Capacity: 11,800 people on each floor

Internet of Value.

The fourth industrial revolution* has only just begun. Industry 4.0 and the Internet of Things have barely found their way into conversations when the next digital paradigm shift is just around the corner: the Internet of Value.

* See also the May 2015 edition of TROX life, 'Clean room air'



While the Internet of Things is about endowing objects with artificial intelligence, thereby enabling them to exchange information via the internet in order to make production processes faster and more efficient, the Internet of Value allows for real-time financial transactions between individuals, businesses or even countries via the internet. It all revolves around blockchain and cryptocurrencies.

Blockchain. What is it anyway?

It may seem like a mystery, but it can be explained. Let's try.

To explain the principle of blockchain, a German bank (Sparkasse Mainz) has published a convenient example on their website. Picture a pub or bar.

Five people are sitting at the counter, and they keep ordering drinks. The bartender takes all the orders, and when it's time to pay, he charges the guests individually. Problem is: After so many drinks, nobody can clearly remember who had what. The bartender, however, has been making a list. He has written down the drinks and who ordered them. But has he listed all the drinks, assigned them to the correct customer and put the correct price? The guests have no choice but to rely on him and on his honest character.

Now for a different scenario. Same pub or bar. This time, however, each guest invites all the others to rounds of beer. Whoever orders a round, gets a mark on his coaster. With five guests and five rounds, everybody eventually has five marks on his coaster. The coaster is like a log, or ledger. So the bartender's centralised bookkeeping – as in the first example – is replaced by individual ledgers.

Let's continue: Guest A has ordered some other drink with each of his five beers, so the bartender has marked this not only on Guest A's coaster ('A has ordered drink XYZ'), but also on the coasters of the other four guests. This is to prevent any attempt at cheating. So Guest A cannot just delete the additional mark from his coaster as if he'd never had any additional drink.

This is basically the principle of blockchain. It is a decentralised database that functions as a distributed ledger. It records all changes between all the people involved, and the changes are visible to everyone (it is actually much more complex than in our example with five beers and an extra drink). This ledger is, however, not hidden in someone's drawer; rather, there are thousands or millions of copies stored on computers all over the world. Each blockchain participant has access to all the information. Should any individual try to cheat and manipulate any data, all the others will immediately know.

As soon as a new line item, or value, is added, this line item also appears in the ledgers of the others and is verified by all the computers (more on this later). As each verified, or authenticated, line item remains in the ledger forever without being changed, blockchain transactions are considered to be safe and not susceptible to fraud.



So how does blockchain work?

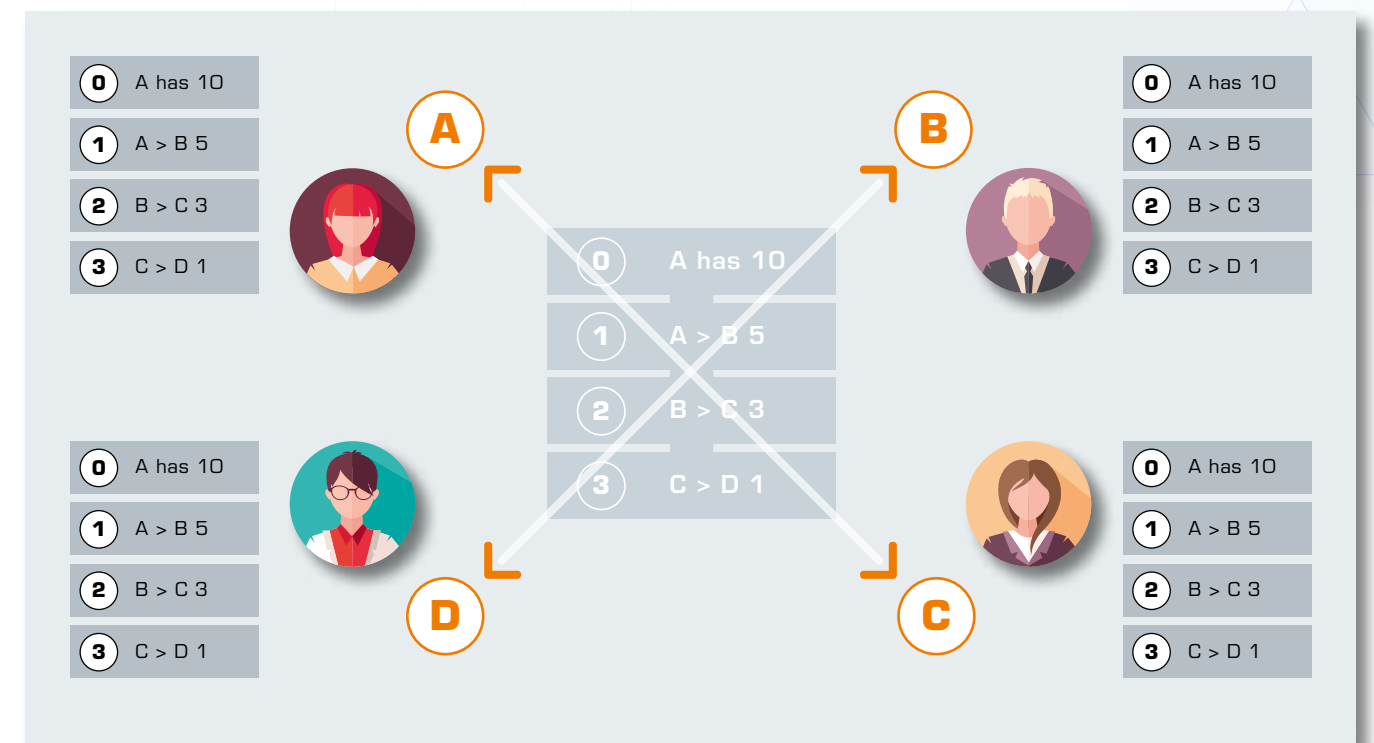
Until now, transferring money or carrying out similar transactions has required an intermediary, i.e. a third party. For money transfers this is usually a bank. The intermediary identifies the sender, legitimises the recipient and authenticates the transaction. This takes time and costs money. And as there is no direct contact between the parties involved, the entire procedure is vulnerable to fraud.

In future, intermediaries shall be replaced by the blockchain database. Thanks to a shared ledger, transactions such as money transfers, buying, selling, signing contracts etc. shall be transferred from one party directly to another, with no intermediary, but in real time, hence cheaper and safe.

An example.

Person A is at the beginning of blockchain and has €10 in her account. She transfers €5 to Person B; then Person B transfers €3 to Person C and €1 to Person D.

So there is no bank or other organisation that has a central ledger; rather, the blockchain software creates an open ledger and a copy of all transactions for each participant. No intermediary is necessary. But how can we be sure that all participants see the same ledger and that this ledger always shows the current data?



There is no 'open ledger' in a central place; instead, each participant has a personal copy that is identical to all the other copies.



Reason for doubt.

Is blockchain as safe as it seems? Not so long ago, six hundred mining computers worth two million dollars were stolen from data centres in Iceland. According to police inspector Olafur Helgi Kjartansson from the Reykjaneskagi peninsula, where two of the computers went missing, the police suspect organised crime.

Another worrying aspect is not only the rapid loss of value of cryptocurrencies in recent months, but also the huge computing performance required. According to the latest calculations, the energy consumption for mining amounted to more than 70 TW/h; this is more than the entire annual energy requirement of Austria.

Not to forget: In 2018, the market for cryptocurrencies was shaken by crash after crash, with losses of 70% and more.

A software links your private key to your public key in order to verify that it is actually you who has initiated a transaction. Your private key, i.e. your signature, remains private.

Encryption.

Encryption means that algorithms scramble data in such a way that it becomes illegible; to decipher the data, it has to be decrypted first.

Decryption requires special software and hardware that checks and verifies whether transactions are genuine. Finding the data key for decryption requires complex mathematical operations, and this is what so-called mining computers do. They require huge processing power.



Making transactions safe.

After Person B has received €5 from Person A, he wants to transfer €3 to Person C. How does he proceed?

First, he makes his intention known. At this point, the transaction has not yet been made, it has not yet been confirmed, and it does consequently not yet appear in the ledger copies of A, B, C and D. This is where data protection and privacy issues have to be considered. The data is automatically encrypted, and to ensure data security, it is also validated by an independent algorithm. The consistent linking of all transactions, the blockchain, makes them transparent, or visible to everyone involved.

How to make transactions.

First you need a (virtual) paper wallet for the (virtual) coins of your cryptocurrency. When you create a paper wallet, a random number generator generates a pair of crypto keys:

- A public key: This is the encrypted address of your wallet, a pseudonym which you can give to others without any issues. Other people can use this key to transfer money to your wallet. You can see your account balance at any time.
- A private key: This is your PIN, which you need to access your wallet and transfer money (coins) to others, for example. Your PIN is like a signature, you use it to authorise transactions.



Here's a YouTube video that explains blockchain:

https://www.youtube.com/watch?v=SSo_ElwHSd4

Cyborgs. Fantasy or reality?



Can the brain feed the computer with news? Can it be connected to the internet? Will it be possible to manipulate our thinking by brainhacking? Does the digital world influence our behaviour? Can digital technology help patients? Science fiction? Or is this already reality? Yes, partially!

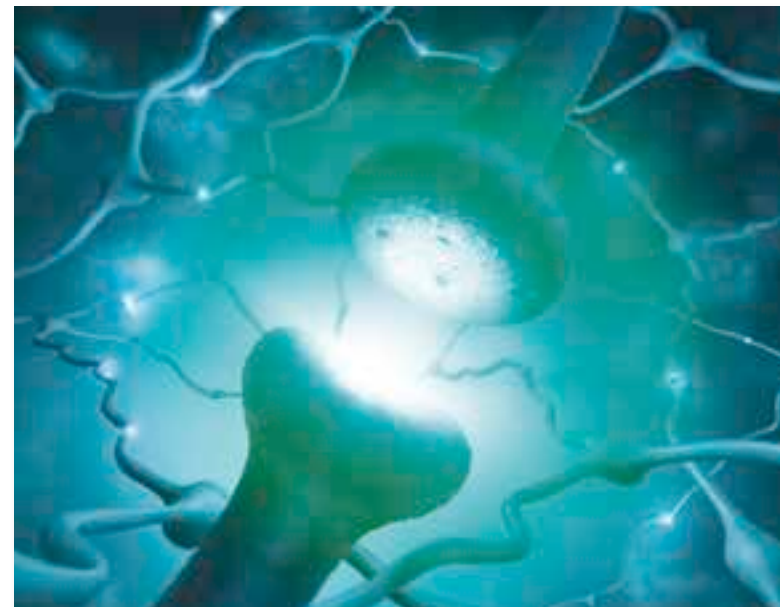


Brain-to-Internet.

The next step, according to Miriam Meckel, would mean that we do things much more directly. Devices, or implants, on the outside the head or brain act as a computer-brain interface that is connected directly to the internet. We recognise these cyberworld scenarios from movies. So-called sleeper agents are 'awoken' over the internet and turned into killing machines. Pure fiction, or fact?

Miriam Meckel has conducted a self-experiment to show the manipulability of the brain. An over-the-counter Boston product is designed to calm or activate the brain. To do this, two electrodes are attached to the head, which are connected to each other. They can be controlled via an app to send a special electric signal to the brain. This experiment on Miriam Meckel failed. She felt like she was on drugs afterwards.

Elon Musk works with his company, Neuralink, to link the brains of humans in a braincloud that is enriched by artificial intelligence. Facebook is developing a system 'that will allow you to type right from your brain, five times faster than you can type on your phones today,' writes Mark Zuckerberg in a blog post. Neuronal signals of the brain are read by a sensor and converted into text. Do thoughts, then, remain private, or are they an open book in which anyone can read, Meckel asks.



Cybermen. Behavioural disorders?

What will happen if we connect our brains to the internet? Miriam Meckel asks herself this question in her book 'Mein Kopf gehört mir' ['Own your mind']. Actually, albeit indirectly, that already happens. The smartphone, a constant companion, is a computer in mobile format. We use it as a remote control, navigation system or jukebox; for measuring blood pressure and heart rate, and soon the insulin value.

The digital world has had a lasting effect on our behaviour. There is much less face-to-face communication taking place. Instead, it is texted or tweeted. Our eyes are constantly attracted to the screen so we don't miss anything. However, what is happening around us is no longer properly perceived, which has led the city of Honolulu to impose a cell phone ban on pedestrian crossings.

Psychologist Gary Small (UCLA) is convinced that digital addiction influences us: how we read, learn and interact with each other. The nervous system could become weaker with constant digital preoccupation. Possible consequence: social incompetence and isolation, inability to verbally communicate, and behavioural disorders.



Cyber-Med.

Digitisation is not stopping at medicine, either. Already in 2001, a 68-year-old woman in Strasbourg had her gallbladder surgically removed from across the Atlantic. The surgeon, Jacques Marescaux, worked from New York; the connection between the patient and the surgeon was via a fibre-optic cable.

Digital surgical methods.

Minimally invasive surgical methods are constantly being refined. The hand movements of the surgeon are translated into precise, steady movements by computer-controlled systems. Thanks to state-of-the-art camera technology, the surgeon has at his disposal a high-resolution, three-dimensional view of the operating area. The very high flexibility of the instruments makes it possible to minimise tissue damage.

Scientists are also working to decode the mystery of the brain. Locked-in patients can now speak, make music or move a robotic arm via a computer-brain interface.

Digital speech generator.

Digital technology also made it possible for Stephen Hawking to 'speak', if you will. He lost his voice in 1985 due to pneumonia. In the hospital, he was artificially ventilated, and the doctors had to perform a tracheotomy to supply his lungs with oxygen via a tube. The physicist could no longer speak. Using software, Hawking at least partially recovered his language. At the press of a button, he was able to select letters and commands on a computer, which were then processed by a speech generator.

Digital diabetic diagnosis system.

A research team from Google X presented its smart contact lens project in 2014. It's a digital contact lens that analyses the tears of people with diabetes every second and sends their blood glucose value to their smartphone for evaluation.

Digital vision.

Thanks to retina implants, blind people can recognise faces or even read texts. People get back some of their eyesight. A camera sends visual information to microchip implants, which transform the image into electrical signals and send them to the nerves via stimulation electrodes. They pass the information on to the brain.



Scenario.

The cyberworld. The decisive factor will be how humans deal with it. Horror scenarios inevitably come to mind: Do Google & Co. have even greater influence on our behaviour? But it inevitably offers us positive perspectives. Medicine advances digitally and gives people hope!



IoT - Internet of Things. Challenge for the HVAC industry.



Digitisation is progressing rapidly in all areas. Ambitious IoT projects are initiated and help the Internet of Things to make a breakthrough. According to a study, every fourth company surveyed achieved average revenue and earnings growth of 12.8 and 19.8 percent*, thanks to digitisation.

* MIND DIGITAL and FH Cologne: Digital dividend among medium-sized businesses. [Digitale Dividende im Mittelstand]

Connected buildings.

Increasing the equipment of room air conditioning components with intelligence, their increasing information technology networking and interaction with the internet have revolutionised energy management. Monitoring, diagnosis, analysis and control of a ventilation and air conditioning system are possible 'from a distance'. The service technician is in control of the system 24 hours a day, 365 days per year and can intervene in case of faults, maintenance indicators or inefficient operation.

Therefore, it is not surprising that, according to IoT Analytics, networked building technology achieves the strongest growth of all segments (+7%). Because there is immense savings potential in building automation: For example, the Marriott hotel chain in China was able to reduce its energy costs by 10% to 15% thanks to automation solutions.

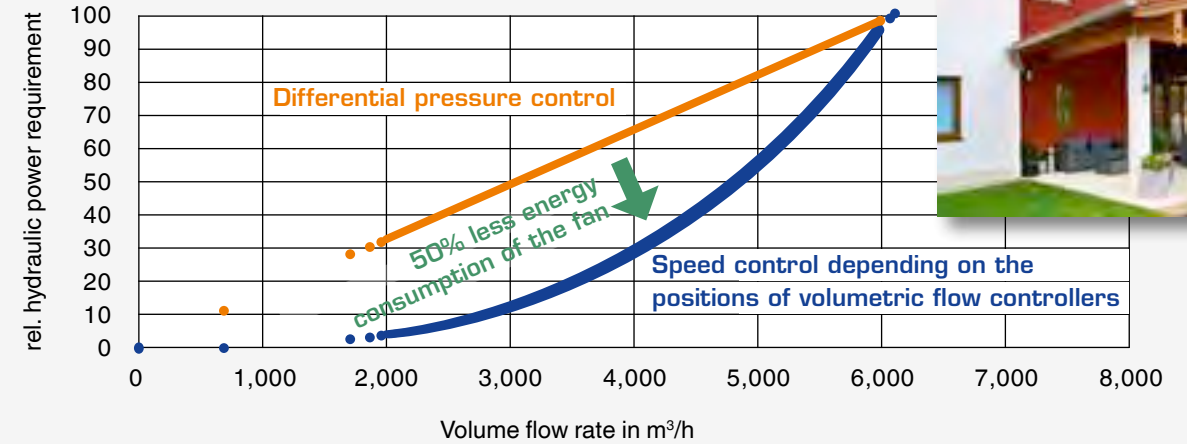
Automation in existing buildings.

With the new European EPBD* directive on the overall energy efficiency of buildings, existing buildings will also be brought into the view of lawmakers. Because that's where the greatest potential for energy savings lies. The new directive regulates methods for assessing the energy performance of buildings.

This means that, in the future, the energy consumption of existing ventilation and air conditioning systems will be examined much more critically. This is why solutions are urgently needed to make 'energy-wasting' buildings more energy-efficient through appropriate measures. TROX is therefore developing an innovative solution for ventilation and air conditioning systems in existing buildings in order to subsequently make it possible to control energy consumption as required (see page 42).

* Energy Performance of Buildings Directive.

Demand-based air volume flow control.

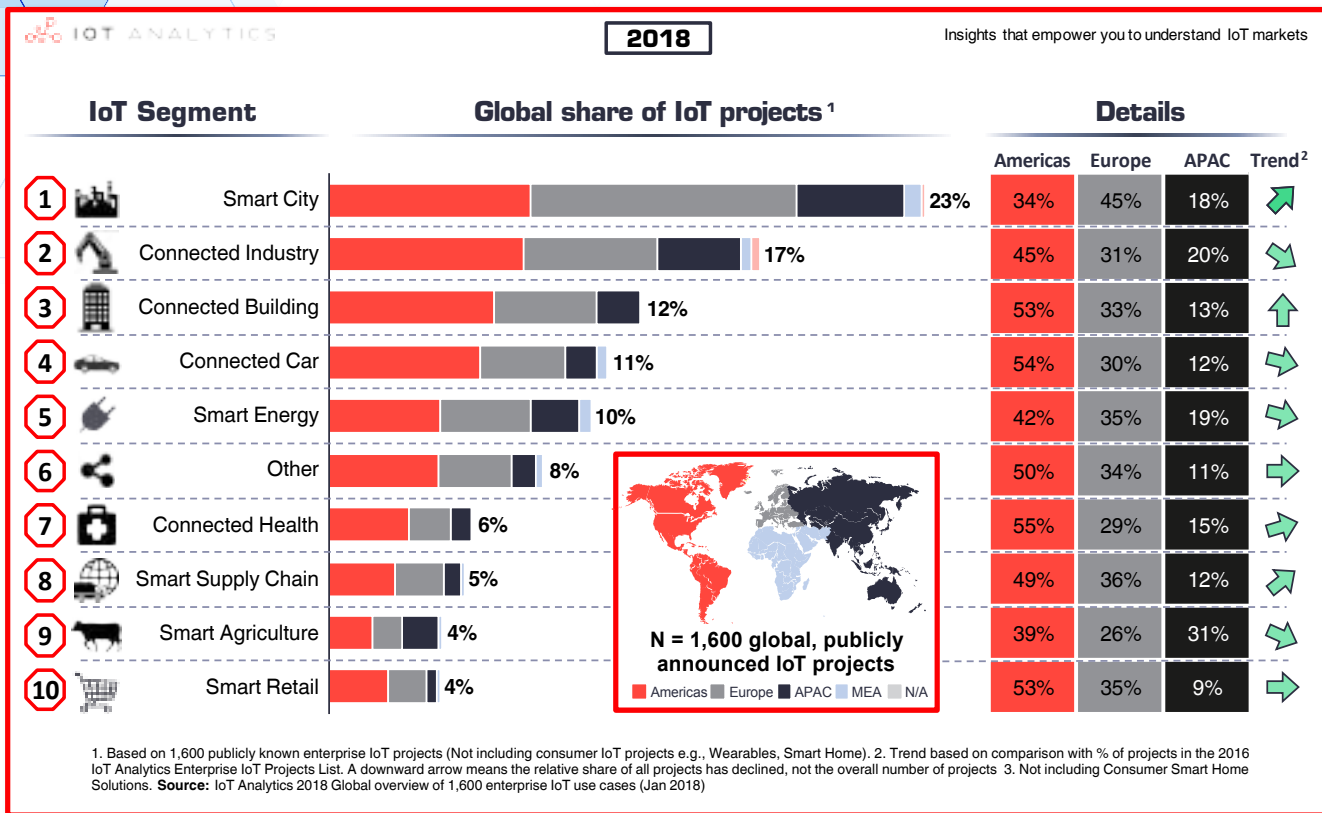


50% energy savings thanks to demand-based air volume flow control.

A recent example from the hotel industry shows the enormous savings potential that lies dormant in the demand-based control of a ventilation and air conditioning system.

At the STYLES Hotel Piding, TROX has created a complete room air conditioning technology subsystem. The hotel rooms are ventilated with energy-saving air-water systems. Thanks to the innovative control system X-CUBE control that is integrated in the X-CUBE central control units, and intelligent networking of the components, the building sections and rooms are supplied as needed.

In contrast to differential pressure control in the main duct via the volume flow controllers, the volume flow rate is controlled via the speed of the fans depending on the position of the volume flow controller. The intelligent control system supplies the hotel with exactly the airflow required, based on the information reported by sensors and user requirements. In exactly the condition as it is desired – with less pressure loss and thus an energy saving of about 50%.



Views and visions. Meet the TROX digital experts.

We met the TROX 'drivers' of digital transformation, Dr Alexander Hoh and Tim Boysen, for a chat, and asked them about their IT passions, tasks and activities.

A device driver, simply called driver for short, is a computer program or software module that controls interaction with attachments – whether hardware or virtual devices.



Mr Tim Boysen (left), Dr Alexander Hoh (right).

Industry 4.0, Internet of Things, digital revolution, smart buildings: buzzwords that keep the industry and our field in suspense. What about you?

Dr Alexander Hoh: These are indeed many exciting topics that don't only pertain to our industry. However, it is important to us that they do not remain just slogans, but that they create added value for our customers and improve internal processes. That's why we've launched a whole range of investments and measures – from production to IT infrastructure and digital design tools, to the development of new products and services based on digital technologies. In this sense, almost every division is more or less involved in digital transformation.

Tim Boysen: The topic definitely keeps us in suspense, and the implementation of our strategy takes place on many levels. First and foremost, we are developing a web-based solution for our long-established Easy Product Finder (EPF).

This will enable architects, specialist consultants and HVAC contractors to access, interpret and configure up-to-date information for TROX products, anytime, anywhere. In the medium term, we hope to serve the BIM world via web services as well. In addition, TROX IT solutions are being redesigned to work seamlessly and securely with the Internet of Things. The relaunch of our TROX customer portal plays a major role here. In the portal we provide order information, as a start, and in the future we will be adding more value, bit by bit.

So we use the potential of the IoT world first and foremost to simplify procedures for our customers, to offer them solutions, and to interconnect components intelligently; but we also strive to optimise our production processes and make them more efficient.

Do you have an example, Dr Hoh?

Dr Alexander Hoh: X-CUBE air handling units are a good example for digitising the entire life cycle, from configuration to operation and maintenance of the units.

It starts with the web-based configuration of the unit by the customer or a TROX employee. Then all the data for the unit is passed on in digital form to production and material procurement. Thus, efficient production is possible even with non-standard units.

The customer can look up the corresponding order information at any time via the customer portal. During commissioning and the subsequent operating phase of the unit customers can remotely monitor all important parameters via the customer portal, and if they wish, they can also get support from TROX experts. So X-CUBE air handling units are a good example of a product in which digitisation is already being used over almost the entire life cycle.

Dr Hoh, energy efficiency is the predominant topic of the industry, keyword: smart buildings.

Dr Alexander Hoh: Rightly so, because the energy-saving potential in the air conditioning sector is far from exhausted. Thus, increasing energy efficiency will continue to be an important driver for new developments in the coming years.

Great progress has already been made in the optimisation of individual components. Now the focus will increasingly be on the efficient interaction of the components in an overall system. From our point of view, the greatest potential lies here.

Design, sizing and the subsequent adjustment of systems usually take place for a selected operating point or a small operating point range. At TROX we know that this does not usually lead to the best results. In up to 50% of systems, better operational management would be possible, especially in partial load operation, if fan speed control was based on the position of the damper blades in VAV terminal units.

If we link the various systems into networks we can keep an eye on them 24 hours a day throughout the year and take appropriate action if necessary. With modern algorithms this can even be largely or completely automated. This will have a positive effect on not only the availability, but especially on the efficiency of the installations.

The EU also recognises the immense potential. In the revised version of the EPBD, the topics of building automation, 'smart technologies' and monitoring in particular have become significantly more important.

Mr Boysen, where do you see the biggest challenges of digital transformation?

Tim Boysen: I think the biggest challenge we're facing is recruiting talent. TROX is a big player in the market for room air conditioning solutions and hence very attractive for people with a degree in building services engineering or for other professionals who may have done an apprenticeship in this or a similar field, for example. But how do we attract these people? How do we attract the next generation of computer scientists, IT project leaders and digital natives to this region and to our company? How do we attract people who enjoy changing the game, i.e. developing new business models, fiddling with even unusual ideas until they find a solution, and eventually steering the company into a new direction?





The digitisation potential is enormous, but resources are limited. Therefore, a clear strategic focus is important. We have drawn up a roadmap for the implementation of our initiatives, including priorities, and we stick to it and constantly improve it so that we don't lose sight of our goals or 'get bogged down' with other ideas.

Ultimately, the change associated with digitisation is a significant challenge. Change naturally causes discomfort in many people. New doesn't mean perfect, either, and thus represents a fault. Finding colleagues and employees that follow this path with confidence, dare to venture, and think more about potential than risks and threats, is a major task for the stability-orientated TROX GmbH.

May we ask you about the reason for your passion for IT?

Dr Alexander Hoh: My interest was awakened relatively early by my father. At a time when there was virtually no commercial design software for building services engineering, he had to develop his own programs at a relatively early stage to facilitate daily design work. I came into contact with this new technology as a child and was able to approach it by trying it out and playing around.

I gained my first application experience during my studies of building services engineering – mainly focusing on building automation – and my work as a student assistant. So one of my topics was the use of artificial neural networks for fault detection and operation optimisation in ventilation and air conditioning systems.

An approach that is extremely popular today under the name of 'artificial intelligence'.

The passion then intensified during my scientific activities at the Hermann Rietschel Institute of the Technical University of Berlin, and at the E.ON Energy Research Centre of the RWTH Aachen University. In particular, I dedicated myself to the development of software for dynamic building and system simulation, and various aspects of building automation. Almost all of the projects at that time, as well as the currently upcoming projects, are a mix of building services technology, automation and IT. It's exactly this mixture that makes it so exciting for me, and also offers a lot of potential for future intelligent solutions.

Tim Boysen: IT got me early. First, of course, with the rise of gaming computers. My first Commodore 64 had just 64 KB of RAM. You hear me right! Kilobytes, not megabytes, let alone gigabytes.

During my mechanical engineering studies, my fascination for IT solutions continued – among other things, I developed a program for the calculation of screw connections. This also applies to my professional life, where I have always held various positions involving IT and, above all, processes.

It is very exciting to work on complex software architectures, and it is a great pleasure to have everything work together smoothly.

What inspires me most about my work are the people I work with. I have had, and continue to have, very interesting and instructive encounters with IT experts and users:

- How do they deal with challenges?
- How do they treat each other?
- How open are they to new and unusual things?

This fascinates me, and is a source of daily learning.

Your conclusion?

The digital revolution must first and foremost make sense and put people first. We work with great passion on solutions that make the work of our customers easier.

The questionnaire was developed by Marcel Proust and popularised in Germany by the FAZ newspaper. We ask the two, briefly, about their preferences.

▶ **Dr Alexander Hoh**



▶ **Tim Boysen**



Where would you most like to live?

I like living in Berlin. But sometimes I think living in a house by the sea would also be quite nice.

In Sydney.

What does real happiness mean to you?

My family and friends.

Freedom.

What kind of mistakes are you most likely to forgive?

Mistakes that you learn or gain insights from.

The first one.

Your favourite fictional heroes?

--

Arthur Dent.

Your favourite historical figure?

--

Siddhartha Gautama.

Your favourite composer, musician or band?

It changes from time to time, but David Bowie is always there.

Mozart, Iiro Rantala, Madonna, Hiromi, Michael Jackson, Die Fantastischen Vier [The Fantastic Four], Zedd and many more.

What's your favourite pastime?

Read and try new technical gadgets.

Enjoy landscapes and nature.

What's your favourite food?

Saltimbocca alla romana.

Lobsouse.

Which qualities do you most value in friends?

Reliability and humour.

Openness and lack of ego.

What's your biggest weakness?

In some situations I'm unfortunately a little too impatient.

Sweets and my ego.

Your dream of happiness?

Independence and good health.

To be able to live my dream.

What would be the worst thing that could happen to you?

Any misfortune that befalls my own family.

Not being able to live my dream.

What's your favourite colour?

Cobalt blue.

Blue.

Your favourite flower?

African lily.

Gertrude Jekyll.

How about your favourite animal?

Almost everything that lives in water.

Buzzards.

What motto do you live by?

The future doesn't happen, the future is made.

Remain true to yourself and you will succeed.

Who would you like to have a drink with?

There is no bar long enough ...

With interesting people, known or unknown.

Taking a breath. New intelligent ventilation.

Digitisation was the central theme of this year's ISH trade show. Taking on digital challenges, TROX demonstrated once again innovative solutions. A key topic: the intuitive, web-based service portal myTROX. It allows customers to access their data at any time, for design purposes, ordering and operation as well as for booking seminars and technical workshops.



With all the advances in digitisation: TROX still pays great attention to personal, 'analogue' customer relationships. This was underlined by the TROX motto for the trade show: Take a breath. It focuses on human perception and our human needs. Digital technology is a means to an end: for better customer support, for greater efficiency and sustainability, and for an increase in personal satisfaction and individual well-being.



Digitisation - driving force behind ISH 2019.



Our experts used the large stage at the trade fair to present the numerous TROX innovations for the future. From left to right: Ralf Joneleit, Udo Jung, Thorsten Dittrich, Martin Müntjes.

Intuitively easy to use: the new service portal myTROX.

TROX and TIBA, Egypt, establish a joint venture at ISH.

In addition to many product optimisations and innovations, two innovations particularly attracted a great deal of interest from visitors: the X-CUBE X2 air handling unit and the VAV terminal units Type TVE.

X-CUBE X2 is designed for small and medium volume flow rates, can be individually configured for almost any area of application and offers optimisations with regard to mechanical strength, hygiene and control

software, etc. Unique: Thanks to a web-based tool on myTROX, the unit can be configured and sized quickly and easily. This ensures a safe choice of equipment even without expert knowledge. The new air handling unit is 25% lighter and features a robust and flexible locking system for doors and inspection access panels. Thanks to an anti-vibration base frame, so-called sound bridges are avoided. The HVAC contractor no longer has to attach insulation material under the air handling unit on site.

Furthermore, a tool is available for calculating life cycle costs in order to make an informed decision on operating costs. This is a joint development by TROX and the E.ON Energy Research Center of RWTH Aachen University in Germany.

The VAV terminal units Type TVE feature a new type of damper blade (patent pending) and allow for a new measurement principle. In many cases the requirement to save energy leads to the installation of larger air handling units, which in turn results in lower airflow velocities. With the new damper blade, however, even the smallest volume flow rates can be 'detected'. The innovative design also allows for a much more compact construction of the terminal unit so that it is easy to install and remove even when there is not much space. Measurement results will be precise even in case of unfavourable upstream conditions; with dynamic transducers, this is independent of the airflow direction.

At www.trox.de/ish2019 you will get many more interesting impressions from the TROX trade fair stand as well as detailed information about this year's product highlights.

German engineering in Egypt: Cooperation with the TIBA Manzalawi Group was sealed during the trade fair. TROX is opening up a promising market with the MENA region (Middle East & North Africa), an area extending from Morocco to Iran with a population of around 380 million.

The new VAV terminal unit Type TVE stands out thanks to its patented measurement method and compact construction.

Attracting a great deal of attention: the new air handling unit X-CUBE X2 in black.



RadioDuct.



Thanks to wireless communication with radio signals, existing buildings can be equipped with intelligent controls and made more energy-efficient.

Ventilation control with radio waves.

Ventilation and air conditioning systems in most existing buildings do not meet today's energy efficiency requirements. Making them more energy-efficient is often difficult, or even impossible, because there is simply not enough space for wiring or for new components. To improve this unsatisfying situation, TROX has done research into a new technology – radio waves in ducts.

Primary air duct prepared for the installation of floor diffusers.



RadioDuct. Control based on radio signals.

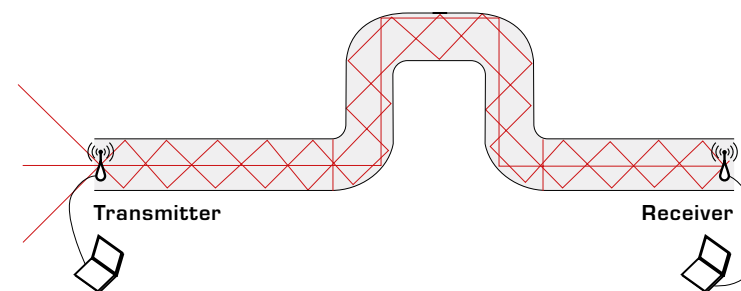
To find a solution, TROX has been cooperating with Aachen University of Applied Sciences, RWTH Aachen University and the BFT design bureau (all in Germany) to develop suitable components and a dedicated refurbishment guide. The project receives funds from the European Regional Development Fund, ERDF, and is organised by ETN in Jülich, Germany.

The research project aims at enabling the energy-efficient management of buildings, from centralised air conditioning to the distribution of air in non-residential buildings that have to be refurbished so that demand-based operation can be achieved. The goal is a new type of control system for ventilation and air conditioning that works with radio signals. As no additional ductwork is needed, the system can easily be installed in existing buildings. The individual components communicate not via physical wires, but by radio signals.

As communication based on radio signals within a building cannot usually overcome large distances (similar to wifi in your home), the existing ventilation ducting is used for the wireless communication. The electromagnetic waves are bundled and reflected in the hollow ducts and can in this way overcome larger distances.

In future, components such as volume flow controllers, active chilled beams or multileaf dampers can be linked and managed with a central energy management system.

TROX has this radio duct technology already have patented.



RadioDuct field test.

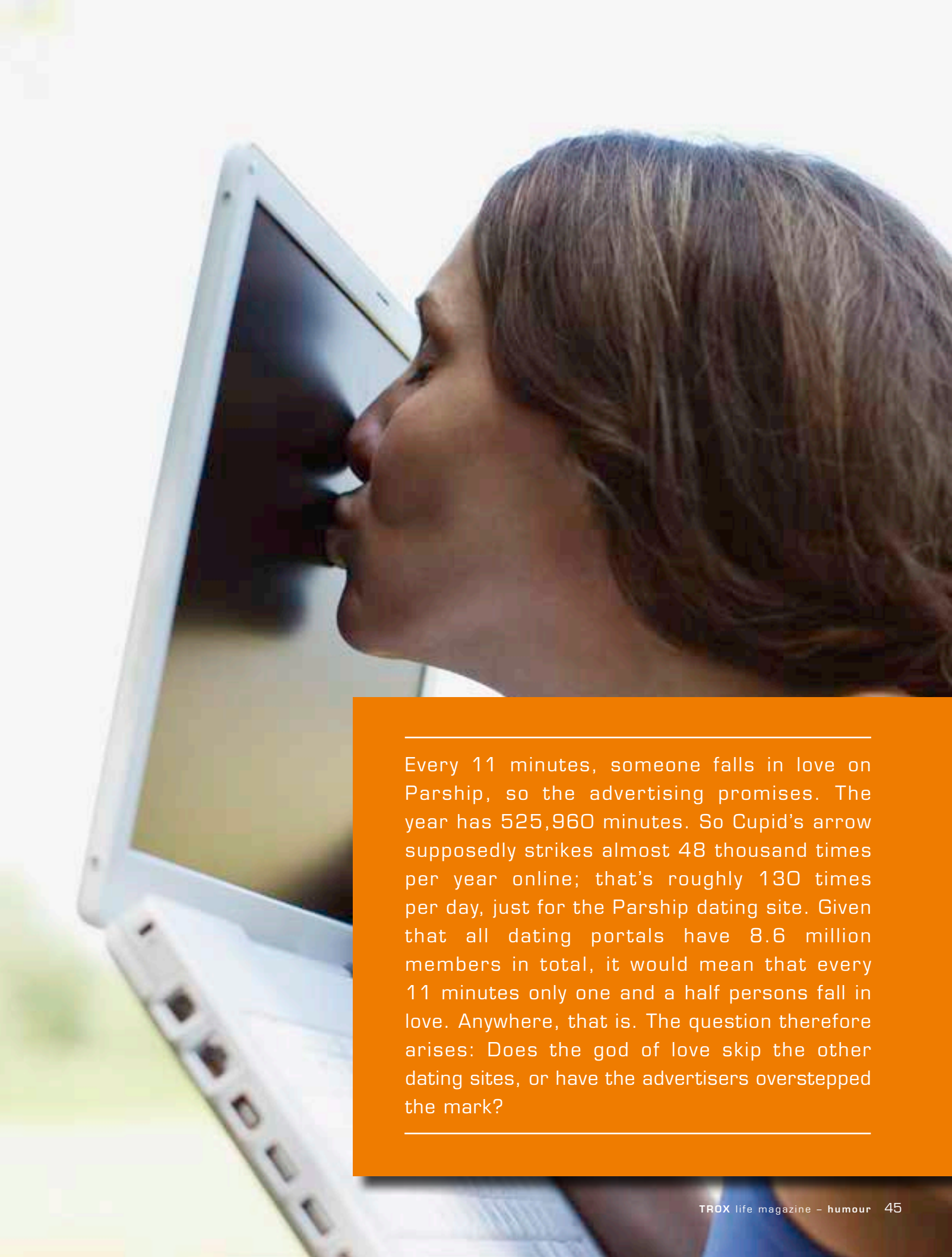
Implementing a pilot project has been another focal point of the development effort. As the second floor of the TROX administration building in Neukirchen-Vluyn has to be refurbished, the newly developed radio component prototypes will be installed and tested under real-life conditions. Monitoring the energy consumption both before and after the refurbishment and then optimising the system based on the results is expected to proof the advantages of this new radio technology application.

We'll keep you posted!





Digital dating. I'm parshipping.



Every 11 minutes, someone falls in love on Parship, so the advertising promises. The year has 525,960 minutes. So Cupid's arrow supposedly strikes almost 48 thousand times per year online; that's roughly 130 times per day, just for the Parship dating site. Given that all dating portals have 8.6 million members in total, it would mean that every 11 minutes only one and a half persons fall in love. Anywhere, that is. The question therefore arises: Does the god of love skip the other dating sites, or have the advertisers overstepped the mark?



Digital illusion?

It may well happen that the 'communicative hunk in his late fifties' turns out to be a bore with a potbelly, or that the 'sexy blonde' in the online photo has since gained 20 kilos.



A money pit.

Some people get knocked out even before their first date: when they get billed. Because pricing is often not transparent. Standard membership over six to twelve

months can cost more than 1,000 euros per year. If a user finds out that online dating is not the right thing for him/her and cancels the contract, the sites still demand compensation. Parship has actually forced a user who changed his mind to pay as much as 361 euros. And even so-called 'trial memberships' for just 2 euros can turn into a money pit. If they are not cancelled in time, they will automatically be converted into expensive premium memberships. It's at the latest then that you long for the old days of analogue.

Analogue dating.

Do you remember your first date (before the internet)? A rather accidental encounter at a dance one evening. The band played 'A Whiter Shade of Pale' by Procol Harum or Santana's 'Samba Pa Ti'. For this reason alone, a vibration in the air could be felt. A special atmosphere – and suddenly, sparks. Conversations didn't take place via smartphones, but via eye contact, and you could only dare a shy attempt in a shaky voice: 'Do you, um, maybe want to meet for dinner? That would be, er, awfully nice.'



The analogy to internet dating: SMS – wanna date, w/ dinner? Meet u at Italian place @8. Can the sparks of love jump through phones? Mhm.

The first digital date. Pretty sobering. Turns out the photos were photoshopped and the information was not exactly true. The Italian cook turned out to be Albanian, the pasta was drowned in cream, the wine was out of a box.

Don't we long for the analogue times of old? The love-at-first-sight butterflies. Unpleasant surprises are not to be expected. The communication is direct and straightforward. Analogue love. Can dating get any better?

Analogue love story.

She worked for TROX in Turkey and he worked for TROX in Spain. In 2013 their paths crossed for the first time at an exhibition and at TROX seminars: Ilgaz Yildiz and Asdrúbal González. And as luck would have it (or Cupid's arrow?), their paths crossed again, because Ilgaz came to Madrid for her MBA. At their first reunion, sparks flew – two years later the wedding. They have been working for TROX in Germany since May 2018. Asdrúbal as Key Client Manager for International Business, Ilgaz as Business Development Manager for fire dampers. On 14 July, 2018, daughter Etna was born and made their happiness complete. No doubt, Cupid aims analogously.



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