


researchNEWS

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EDITORIAL



Applied research and development at Munich University of Applied Sciences (MUAS) is becoming more diverse every day. All 14 departments pursue their research in collaboration with regional, national and international partners in business and research.

To give you an impression of the scope of our research, we have assembled a selection of projects in which we have cooperated with industry partners, other universities or research institutions, and public funding bodies.

The selected research projects also reflect the different ways in which the outcomes can be used: They can add value to basic research, they can help with developing and field testing methodologies, they bolster strong research and help to integrate research areas within the university, they can be marketed as prototypes or in start-up enterprises, and they can strengthen partnerships with industry.

One of our future targets is to give our university an even more refined profile by establishing new research institutes. Research institutes will combine competencies and offer an attractive research environment both to our well-established researchers and our junior scientists. Moreover, these research institutes will further enhance the quality of research at Munich University of Applied Sciences.

Wishing you an inspiring read,

Prof. Dr Sonja Munz
Vice President of Munich University
of Applied Sciences

APPLIED RESEARCH BULLETINS

Combatting the dark side
of the internet

Prof. Dr Hans-Joachim Hof
Department of Computer Science
and Mathematics



Coneect – Launchpad for
clever ideas

Prof. Dr Klaus Sailer, Christian Greiner
Department of Mechanical, Automotive and
Aeronautical Engineering



Resource-conserving
paper production

Prof. Dr Stephan Kleemann, Sebastian Porkert
Department of Building Services Engineering,
Paper and Packaging Technology and
Print and Media Technology



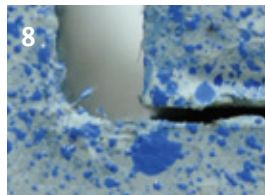
Integrated marketing and
sales for greater success in
business

Prof. Dr Richard Hofmaier, Dr Wolf Hiemeyer
Department of Business Administration



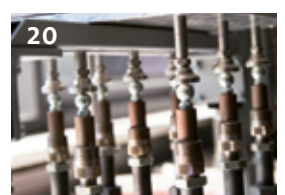
Understanding glass
buildings

Prof. Dr Christian Schuler
Department of Civil Engineering



Lightweight components
from a bed of pins

Prof. Christoph Maurer
Department of Mechanical, Automotive
and Aeronautical Engineering



Sustainable urban district
redevelopment

Prof. Dr Natalie Essig
Department of Architecture



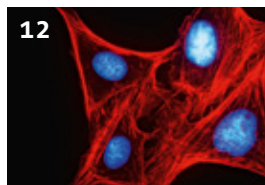
Social pedagogical problems
of the post-war era

Prof. Dr Peter Hammerschmidt
Department of Applied Social Sciences



Tissue from a printer

Centre for Applied Tissue Engineering
and Regenerative Medicine (CANTER)



Set in the right light

Prof. Dr Herbert Pilschke
Department of Applied Sciences
and Mechatronics



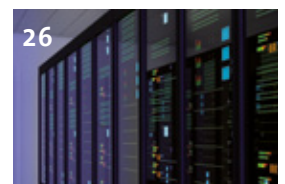
Thinking outside the box

Research domain 'Applied Computer
Science in Business'
Department of Computer Science
and Mathematics and Department
of Business Administration



Innovation through
IT automation

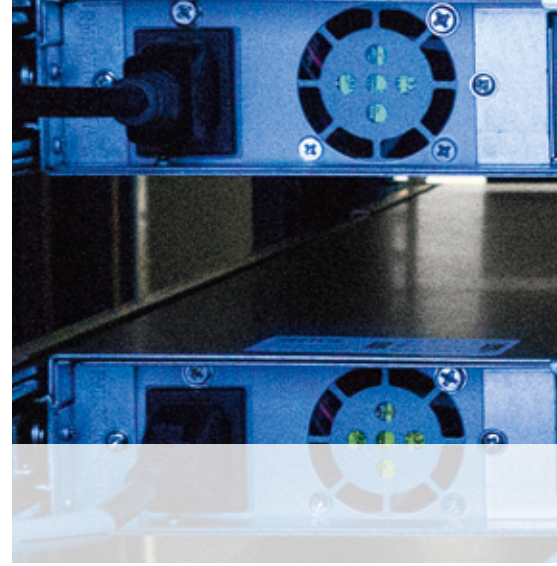
Prof. Dr Rainer Schmidt, Florian Bär
Department of Computer Science
and Mathematics



Combatting the dark side of the internet

Prof. Dr Hans-Joachim Hof

Department of Computer Science and Mathematics



Prof. Hans-Joachim Hof and his team are committed to the fight against cybercriminals. They develop software to thwart malefactors' sinister machinations.

Hans-Joachim Hof is on the move on the dark side of the internet. The professor for secure software systems in the Department of Computer Science and Mathematics tracks down hackers in cyberspace, ferrets out spammers and secures corporate networks. To this end, the IT specialist and his team from the Munich IT Security Research Group (MuSe) develop software that makes using the internet safer. 'I was a hacker myself', smirks Hof. 'But, I was a white-hat hacker', he explains. 'That means I was hired by firms to attack their IT environments and use the insight I gained to make them more secure.' IT security remains a key topic for Hof, now at the Munich University of Applied Sciences (MUAS).

Windows computer connects to the internet, it becomes visible around the globe within 15 minutes', says Hof to elucidate the precarious situation.

Hof and his team have already developed one countermeasure for spam mail on home computers. 'Spam accounts for around 90 percent of all email volume worldwide', says Hof. The IT specialists have programmed a system in which all affected computers reply in concert to the web shop a spam message links to. 'This generates large data streams and, as such, expenses', explains the IT expert. 'This makes it uneconomical to build on spam for advertising.' That this kind of system is not without risk for the programmers was demonstrated at Blue Frog. The firm's employees programmed a similar system that was, however, centrally organised and coordinated from the company's servers. They received serious threats from the spam mailers. 'That is why we opted for extending the idea by running the software on many user computers, ensuring they could not just simply be "shut down"', explains Hof.

In addition to spam mail, viruses plague internet users. What happens to home PCs can affect complex corporate computer systems just as well: Stuxnet is such a virus. The program sabotages the software of control systems in industrial facilities. 'Making the software safer', says Hof, 'requires diligence

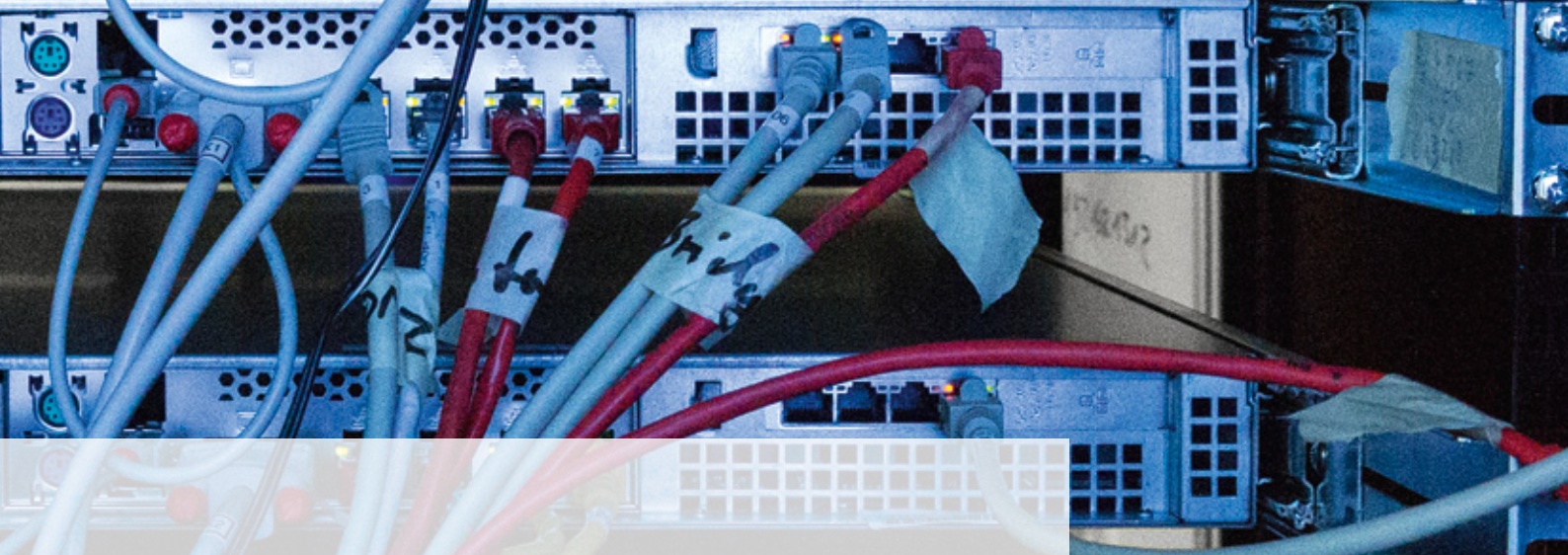


Keeping an eye on the server



Overview of hacker attacks

The computer scientist pulls a poster from a cabinet. It is an illustrated map of the world, littered with myriad skulls with crossbones. 'We opened a computer to hacker attacks', explains Hof. 'Then we kept track of what happened.' The result is this map of skulls and bones. Each skull represents an unauthorised attempt to access the computer. The researchers recorded 180 hacker attacks in 24 hours. 'Unauthorised access by hackers can lead to server overloads, for example', explains the professor. Among other things, a hacker can use the hijacked computer send spam mails. But, it is not only company computers that are at risk for such attacks. Home computers are equally affected. 'When a



right from the start of the development stage.' A commonly used, agile software development process is Scrum. In this approach, specific software requirements are not defined at the start of the development process, but rather, are adapted during programming. In a project that Hof is carrying out with funding from the Bavarian Ministry of Education, Cultural Affairs, Science and the Arts, his IT specialists are investigating ways to optimise this process.

Hof's team is growing continuously. Currently, two research assistants work in the group, together with two Master's and four Bachelor's candidates. The open source project OWASP Top 10 Privacy Risks are an offspring of Stefan Burgmair's Master's dissertation. In collaboration with the team from the Munich University of Applied Sciences, the project group is aiming to compile a catalogue of the biggest risks when using web applications. The aim is to provide companies with guidance in assessing whether or not they are safe on the net.

In addition to computers, smartphones and mobile phones also pose ample opportunities for cyber criminals to penetrate networks. Hof and his staff are developing security software for corporate network environments in which mobile phones or tablets are used. These kinds of devices use proprietary internet applications and apps, for example, example, and have direct

connections to the company. 'We want to minimise the risks posed to corporate networks by these devices', says the scientist. The security measures scan the devices to determine which services are running on them. Then one can decide whether or not a device needs to be excluded from the network.

Hans-Joachim Hof's view on the future of IT security is not optimistic: 'The publications of Edward Snowden have shown that if something is possible, it will be done.' The latest developments from the open source community in the field of IT security are also not encouraging. 'There is not sufficient effort being undertaken to collectively counter malicious software', he says. He believes a political reaction is necessary. 'We need more European or German software in the security sector, and we also need our own hardware platform. It would be helpful if we had more extensive liability rules for software manufacturers, forcing manufacturers to assume liability for damage claims.' *Thorsten Naeser*



Prof. Dr Hans-Joachim Hof

Development of secure software using agile software development processes

Funding:
Bavarian Ministry of Education,
Cultural Affairs, Science and the Arts

OWASP Top 10 Priority Risks (open source project)

Project partners:

- Munich University of Applied Sciences, MuSe
- msg Systems
- European Data Protection Internet Privacy Engineering Network (IPEN)
- International Association of Privacy Professionals (IAPP)

Project Leaders: Stefan Burgmair and Florian Stahl

MuSe

The Munich IT Security Research Group (MuSe) focusses on the systematic development of secure software systems, network security and the secure operation of IT systems.

Resource-conserving paper production

Prof. Dr Stephan Kleemann, Sebastian Porkert
 Department of Building Services Engineering,
 Paper and Packaging Technology and
 Print and Media Technology

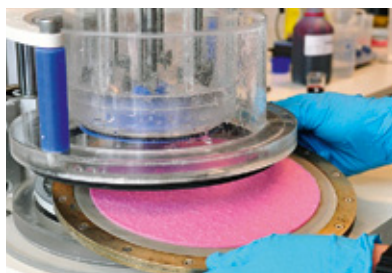


Prof. Stephan Kleemann and his team of the 'ReLeiPa' project research new approaches to resource-saving industrial paper production

In the age of computer tablets and smartphones, fountain pens have gone somewhat out of style – and with them, blotting paper, that trusty, pink-coloured friend for taking up excess ink. So, why do not all types of paper soak up liquids the way blotting paper does? The answer to that question forms the basis of the 'ReLeiPa' research project, which aims to achieve resource conservation through sizing agent reduction during the production of paper and cardboard.



Sheet production on a laboratory scale



Laboratory sheet made with dyed sizing agent

Paper and cardboard are made water repellent using so-called sizing agents. The chemicals used for the process of sizing – which has nothing to do with the size of the sheets of paper produced, but rather with their absorptivity – ensure that the final product can be written and printed on. Untreated, the paper would soak up the liquids, similar to the way blotting paper does. This property is especially important in frozen product packaging and moving boxes. If they get wet in the rain or when frozen fish from the supermarket thaws in the package, they do not just dissolve and fall apart, but rather remain stable by allowing the water to pearl off.

Since 2005, Prof. Kleemann and his team have determined that reactive sizing agents interact with cellulose, the main ingredient in paper production, only minimally. Reactive sizing agents are paper additives meant to bond to cellulose because of their

reactivity, thereby making the surface of the paper water-repelling. The reactive sizing agents ASA (alkenyl succinic anhydride) and AKD (alkenyl ketene dimer) react with five to 15 percent of the raw material, at most – insight that turns what has been traditional textbook knowledge since the 1950s on its head. 'In my diploma thesis of 2008, I confirmed that only a small portion of the sizing is bound', says doctoral candidate Sebastian Porkert. 'The ReLeiPa project ensued from the gap opened between existing literature and this new result.'

The goal of the project is to precisely describe what happens to the remaining 85 to 95 percent of the sizing. 'We do not want to poke in the dark through trial and error, but rather start at the beginning and understand the chemical and physical basics of this process', explains Prof. Stephan Kleemann. The researchers have garnered support from the German Federal Ministry of Economics and the German Pulp and Paper Association (VDP), as well as from nine project partners – from small businesses to large-scale corporations, all in Germany.

To research the optimal use of sizing agents, Sebastian Porkert starts by producing sheets of laboratory paper of various compositions using a laboratory sheet former. The amber-coloured, viscous ASA is dyed so that the sizing agent remains identifiable following the paper production process. Porkert



then examines the sized paper under a table-top microscope with a resolution of up to 150 nanometres, sufficient to make the individual paper fibres visible. For comparison: The diameter of a human hair can be magnified to up to 30 centimetres with the microscope. 'While peering through the microscope, the pertinent questions are: Where is the sizing agent located within the sheet? What external factors influence the location and how? And, which spatial distribution is beneficial for the end result?', says the 29-year-old.

Among other tools, Porkert uses a penetration dynamic analyser to determine how water resistant the paper is. A finished piece of paper is dipped into water in the small device. Ultrasonic waves then work the water into the structure of the paper while the device measures how long it takes for the water to penetrate the paper and weaken its structure.

'If the water remains on the surface of the paper without being absorbed, one speaks of well-sized paper', explains the doctoral candidate. Further tests are done with a portable contact angle

measuring device. Here, a 4 microlitre drop of distilled water is applied to a fibre surface – paper, for example. The device then measures the angle between the flank of the water drop and the surface it is resting on. The smaller the angle, the faster and deeper the water will seep into the substrate, and the lower its water resistance.

These experiments should facilitate improved paper production processes in the long run and reduce the amount of sizing agents required – ideally by as much as half. According to the researchers, this would save several hundred million euro annually in the European market alone. 'The project is interesting especially for small and mid-sized companies, since they will need to deploy significantly smaller amounts of chemicals and thus save large sums of money', explains Sebastian Porkert. *Katharine Linges*



Prof. Dr. Stephan Kleemann (l.) and Sebastian Porkert

Project partners

- Akzo Nobel Chemicals AG
- Bauer Verfahrenstechnik GmbH
- Gebr. Grünwald GmbH & Co. KG
- Hahnemühle Fine Art GmbH
- Kaierde GmbH & Co. Produktions KG
- Moritz J. Weig GmbH & Co. KG
- PaCon Ltd. & Co. KG
- Papier und Kartonfabrik Varel GmbH & Co. KG
- Sappi Stockstadt GmbH

Gefördert durch:

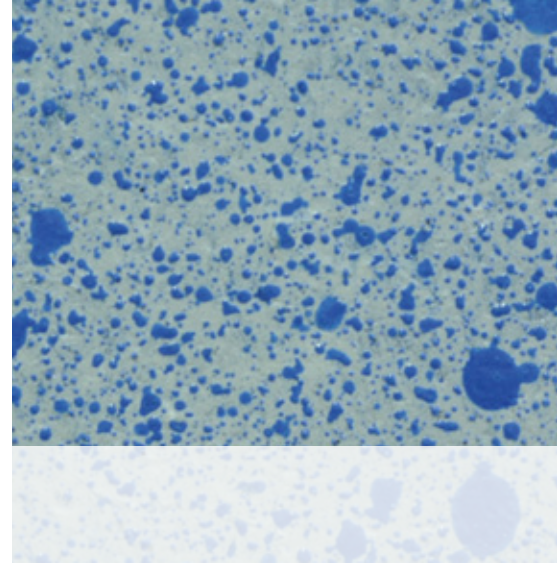


aufgrund eines Beschlusses
des Deutschen Bundestages

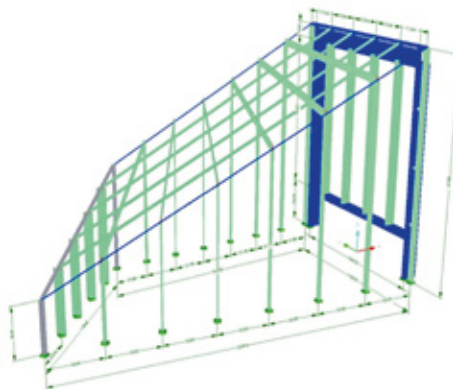
The Collaborative Industrial Research (IGF) Project 17757 N of the research association Board of Trustees for Research and Technology in the Pulp and Paper Industry of the VDP e.v., Adenauerallee 55, 53113 Bonn is funded by the Industrial Research Alliance (AiF) in the context of the IGF programme of the German Federal Ministry of Economics and Energy in accordance with a resolution by the German Bundstag.

Understanding glass buildings

Prof. Dr Christian Schuler
Department of Civil Engineering



Prof. Christian Schuler and his team are specialists for glass. They optimise its appearance, test its strength and run trials on how best to interconnect individual components



Structural system of the Tottenham Court Road Station. Source: se.austria



Rendering of the Tottenham Court Road Station. © Stanton Williams Architects

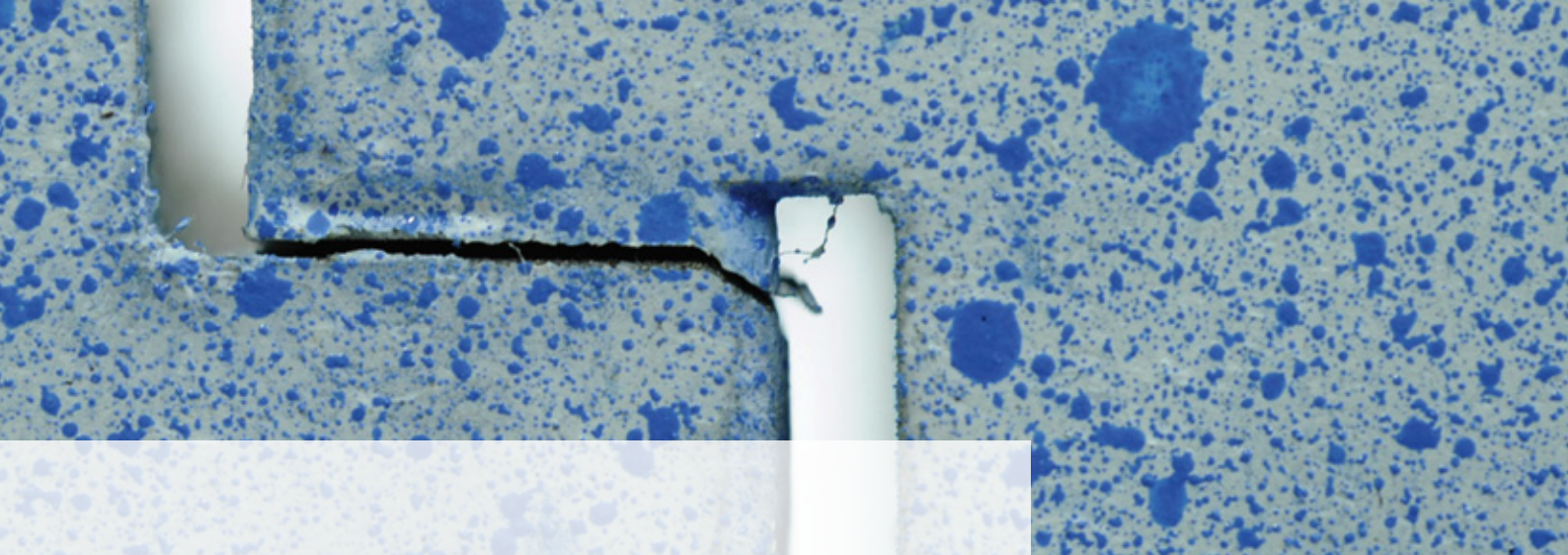
Four men in Chicago must have got the fright of their lives in the Spring of 2016. They were standing on the transparent floor of a bay in the Willis Tower, at the lofty height of 412 metres when the glass suddenly shattered. But, it did not fail. The building operator stated reassuringly that there was never any danger. Prof. Christian Schuler of the Department of Civil Engineering confirms this assessment: 'Modern glass is built up in alternating layers of film and glass. Presumably, only the top layer cracked.'

Schuler is an expert in all things glass. The team that he heads together with Prof. Imke Engelhardt comprises a staff of twelve – including three doctoral candidates. They test and optimise processes for refining glass. The group also tests methods for bonding glass panes to other building materials and then investigates the connections from the perspectives of material technology, building physics and long-term properties. 'Glass is being deployed more and more as a structural element in modern architecture', explains the scientist. That is why its strength and structural behaviour must be tested before it is installed in buildings

Glass is leaving increasingly distinct marks on urban architecture. Glass skyscrapers impart an unmistakable look on metropolitan areas. But lower buildings made of glass also enrich the character of cities. One example is the entrance to the London Tottenham Court Road underground station that

is being designed by se-austria in collaboration with engineers from the Munich University of Applied Sciences. In the animations, the building structure is completely transparent. 'Innovative glass production methods and novel adhesive bonds are being deployed in London', says Christian Schuler.

Soon, a new glass structure by the research group can be admired in Munich. The inner courtyard of the MUAS in Lothstr. 64 will have a glass canopy. 'Here, we are experimenting especially with ways to bond glass panes permanently using adhesives', explains the professor. His team is handling the project in collaboration with scientists from the RWTH Aachen and the TU Kaiserslautern, supported by partners in industry. 'We will test how the adhesive bonds in the structure react under permanent loading in the face of changing weather conditions like cold, heat, moisture and possibly "frost wedging"', explains Schuler. The new construction approach has many advantages: 'In general, "glued bonds" are visually appealing since the usual connectors are missing.' Since high-rise buildings are built with ever more glass, the interactions of glass and light play a decisive role. 'These factors are specified during production', explains Schuler. The optical characteristics of thermally refined and, as such, stronger glass are unfortunately, often determined by anisotropic effects. These are physical properties that result from the refinement process. The



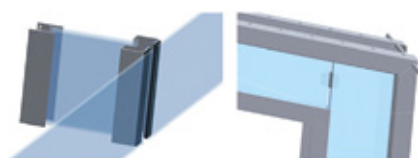
appearance of the light reflected by the glass depends on how tightly the individual particles are arranged within the material matrix and the speed at which light moves through the material.

During production, the 620 to 670-degree Celsius hot safety glass is cooled down abruptly. This shock cooling imparts compressive stress to the surface of the glass. These forces can be anisotropic, in other words: they can vary directionally in their strength, causing phase shifts when polarised light is reflected and transmitted – which, in turn, produces the iridescent hues perceived by onlookers.

Because of the resulting light speeds when two rays of light interact, they form interference patterns. The result is the appearance of spots, bands, rings and streaks that impair the appearance of the glass. The thicker the glass, the stronger the effects, which currently cannot be avoided completely. Schuler and his team hope to identify and measure these anisotropy effects and counteract them in the long term. 'We can already quantify parameters like surface tension states in glass during production', says the scientist. He is confident that it will be possible to reduce the anisotropy effects in the future and may be even prevent them altogether.

Until then, however, we need the ability to classify the quality of glass,

including its anisotropy. That is why MUAS researchers are collaborating with other research groups in Aachen and Darmstadt to develop a standardised, normed measurement system for anisotropy effects that have already been tested in diverse glasses in the laboratory. Schuler believes that the strength and size of glass elements will provide further topics for research in the future. For example, at the new Apple Campus in California, glass panes with a record size of 14 by 3.20 metres have been deployed. 'Ten years ago, nobody would have believed that was possible', says the professor. He is convinced that the end of the road for new developments will not be reached any time soon. *Thorsten Naeser*



Detail of the Tottenham Court Road Station
Source: se-austria



Prof. Dr Christian Schuler

Project partners

- Yachtglas GmbH & Co.KG
- Verroplan GmbH
- GEWA Wärmetechnische Anlagen GmbH
- Glassline GmbH
- RWTH Aachen
- Gesellschaft für innovative Bautechnologie mbH
- Glas Trösch GmbH
- Trumpf Metallbau GmbH
- Montagebau Göbel
- StoVerotec GmbH
- Sika Deutschland GmbH
- Dow Corning GmbH
- Karlsruher Institut für Technologie

Funding

- German Federal Ministry of Economics and Energy (BMWi)
- German Federal Ministry of Education and Research (BMBF)

Sustainable urban district redevelopment

Prof. Dr Natalie Essig
Department of Architecture

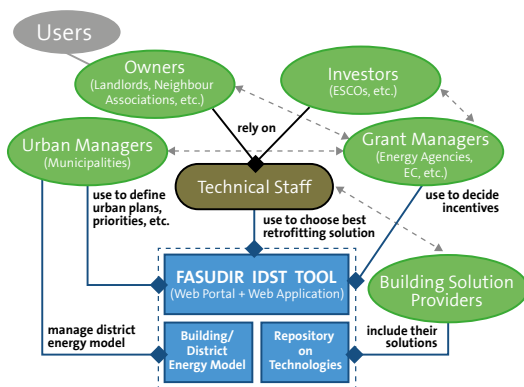


Experience shows, it is not only more economical but also more sustainable to redevelop urban quarters as a whole rather than considering buildings individually. A new software tool is now helping to make this complex task easier for all involved parties.

A house under historic preservation, right next door a renovated structure, behind that a building from the 1960s: That is what a typical Munich quarter looks like. At some point, many buildings will need to be modernized in accordance with today's energetic standards, if only to meet the EU '20-20-20' climate targets*. There is a fitting measure for every building. However, it would be significantly more sustainable to not consider every building individually, but rather to develop a modernisation concept for city quarters as a whole. In the past, this approach posed a great challenge: There were simply no tools available to find the best solution while considering all important aspects.

is doing his doctoral dissertation on energy efficiency and sustainability of existing buildings. The third member of the team is the researcher Ahmed Khoja. Eleven partners are collaborating on the project: in addition to Essig's team, Calcon Deutschland AG and the London Business School, as well as research institutions, municipalities and private enterprises from Hungary, Spain, Great Britain and Italy. The project is funded by the EU in the context of the 7th European Research Framework.

Take a municipal centre like the aforementioned Munich quarter: When redeveloping a quarter, you initially need to determine the existing level of energy consumption. 'The new tool should facilitate this – using compiled empirical figures of various buildings', explains Essig. Next, the renovation requirements and energy saving potential must be examined closely. 'The goal is a catalogue of measures on the municipal quarter level', says the professor. This should answer questions like: Does it make more sense to implement a centralised district heating solution or a decentralised solution with individual measures, like renewing existing heating systems or improving the building envelopes of individual buildings? Most important, however, is to identify sustainable solutions. That is why the environmental performance evaluation must also consider so-called grey energy consumption, i.e. the energy expended during production of building materials. The tool allows the evaluation of various sustainability criteria to facilitate



Potential users of the FASUDIR application

*Here, the EU member states committed to reduce emissions of greenhouse gas emissions by at least 20 percent with reference to 1990 by 2020, to increase energy efficiency by up to 20 percent, and to reach 20 percent of renewable energy in the total energy consumption.

This is where the multinational EU project 'Friendly and Affordable Sustainable Urban Districts Retrofitting' (FASUDIR) comes in. Prof. Natalie Essig is the scientific project coordinator. The architect is a professor and researcher in the Department of Architecture at the Munich University of Applied Sciences. 'The goal of the project is the development of a software tool to facilitate the work of the various involved parties during planning of urban quarter retrofitting', says Essig. The actors are the decision makers, i.e. city administrators, energy utilities, architects and financial service providers. 'These kinds of redevelopment concepts are complex, since an urban quarter comprises many buildings and they interact with each other', explains Paul Mitermeier. He is one of Prof. Essig's researchers and



finding suitable measures. FASUDIR is projected to run for three years. First, the researchers must define what comprises a municipal quarter. As an EU project, multiple countries must be considered; each country has its own idiosyncrasies in urban development. In Germany, for example, many buildings stem from the post-war era. 'The software tool will be applicable to every region', says Mittermeier.

In the meantime, the sustainability requirements for building structures and city quarters have been defined. Up to now, economic efficiency and CO2 emissions have been the main focus of energy-efficient quarter redevelopment. 'What is new is that we are also considering social criteria', says Essig. For example, the tool considers things like bicycle and pedestrian friendliness and the risk of gentrification. Thermal comfort is also considered: While islands of heat are created on asphalt surfaces, vegetated surfaces remain cool. Using the tool, the expansion of vegetated areas can be evaluated. On a building level, interior air quality is one of the social indicators. Criteria in the ecology category are the two levels of energy consumption; in the economic efficiency category, for example, the life-cycle costs and amortisation period.

A beta version of the tool is slated for release end of 2015 for testing in three regions typical for Europe. The case studies focus on a residential quarter in Frankfurt that was built between 1977 and 1982. The two other

areas are a residential quarter in Budapest that includes public buildings and which is currently under redevelopment, as well as a historic quarter in Santiago de Compostela that comprises residential housing and a shop.

What is new is that the tool is as comprehensive as possible. 'There are already various pertinent computer programmes on the market, including energy consultant tools and geo-information systems that can calculate the solar potential of urban roof surfaces. But they are not geared to interact with each other', says the professor. Furthermore, the project brings together various research results. The project builds on the EU 'Open House' project, which includes an evaluation system for sustainable construction.

In the end, designers of energy efficient quarter redevelopment concepts and decision makers, as well as owners and tenants, will be able to access the software tool via an internet portal. Citizens can voluntarily fill out questionnaires on their buildings and browse the results of the quarter redevelopment results. The data will be evaluated via a central server. The benefit will be not only to determine a sustainable catalogue of redevelopment measures for a quarter. The tool should itself contribute to finding the solution. A good basis, in other words, to allow city quarters to be quickly redeveloped and move a step closer to achieving the EU '20-20-20' climate targets. *Daniela Bode*



Prof. Dr Natalie Eßig



Project partners

- CalCon Deutschland AG (a spinoff of Fraunhofer IBP)
- Fundacion Tecnalia Research & Innovation, Spain
- ACCIONA Instalaciones SA, Spain
- Consorcio de Santiago, Spain
- D'Appolonia S.p.A., Italy, iiSBE Italia R&D srl, Italy
- Integrated Environmental Solutions Ltd, United Kingdom
- London Business School, United Kingdom
- Geonardo Environmental Technologies Ltd, Hungary
- ABUD Mernokiroda KFT, Hungary

Funding

European Union

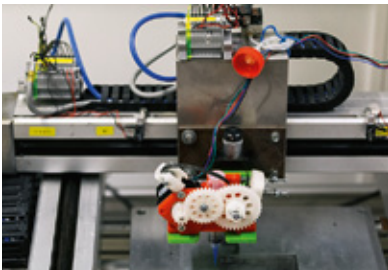
Development programme

7th European Research Framework

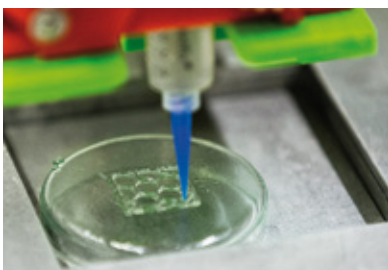
Tissue from a printer

Centre for Applied Tissue Engineering and Regenerative Medicine (CANTER)

An interdisciplinary team of the research focus CANTER is developing a procedure for reproducing human tissue using stem cells and a protein skeleton.



Print head for bio-ink



First layer of a cell-loaded hydrogel

The idea has an air of science fiction: A patient with pain in her knee, the cartilage in the joint has failed. She goes to see a doctor and has her knee precisely measured using a medical imaging procedure. A few days later she is lying on an operating table. Next to her, a 3D printer has produced a perfectly fitting piece of new cartilage. The implant is not a lifeless plastic bone, but rather is made up of living cells from her own body, surrounded by a protein hydrogel. It fits perfectly into the joint, where the cells will replace the defective cartilage.

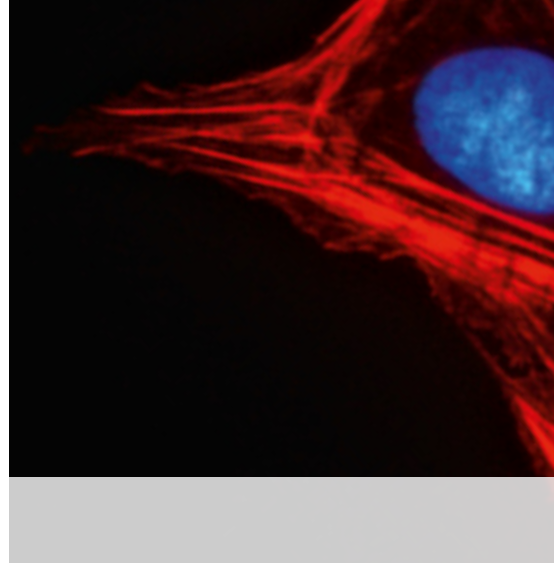
3D printers have been in use for quite some time, in the automotive and aircraft industries, for example. Growing tissue from stem cells is also feasible in this day and age. However, combining printing technology with regenerative stem cell medicine has remained largely uncharted terrain hitherto. The scientists of the research focus CANTER, located at the Munich University of Applied Sciences, want to change that. They hope to produce tissue replacement materials that adapt to the specific needs of patients, combining 3D printer technology with reconstructive medicine. CANTER (Centre for Applied Tissue Engineering and Regenerative Medicine) is an interdisciplinary project at MUAS. 'Compared to our approach, the 3D printer technology used in industry is rather straightforward', explains Dr Stefanie Sudhop, Scientific Director of the CANTER laboratory at MUAS. 'We hope to produce prints comprising a substrate of so-called hydrogel and living stem cells.'

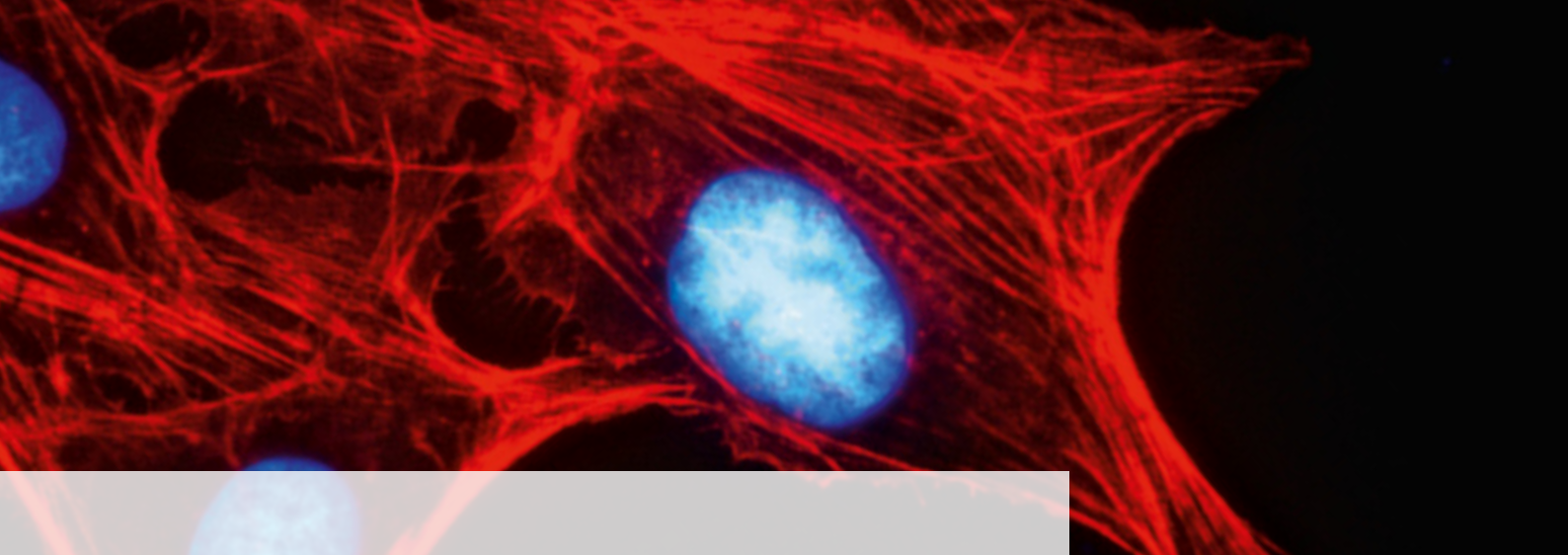
Stem cells can develop into all kinds of tissue. Every person carries stem cells in their body. They can be extracted and later cultivated in the laboratory.

'Patients' previously measured body parts serve as models for the 3D-printed forms', continues Sudhop's colleague, biophysicist Prof. Hauke Clausen-Schaumann. A printed 'copy' is then implanted into the patient. Once in place, the cells multiply, absorb the hydrogel and regenerate the defective body part, a bone, for example.

'Unfortunately, stem cells are somewhat picky when it comes to keeping them alive', explains biologist Stephanie Sudhop. They require an environment akin to that of the human body. When conditions deviate too much, the stem cells die. The great challenge for the CANTER team is, thus, to keep the cells alive as they pass through the printer nozzle together with the hydrogel to form the implant. Afterwards, the cells must continue to 'survive' as they are cultivated in incubators until the implant is placed into the patient's body.

In the CANTER laboratory, technology development and cell cultivation are done in direct proximity of each other. Nano scientist Carina Prein makes the start. She tests human tissue samples under laboratory conditions using an atomic force microscope and converts the signals into digital datasets with nanometre accuracy. These are so precise that even individual molecules can be distinguished.





In adjoining rooms, the engineers Sascha Schwarz and Rainer Stabhuber are developing the specialized 3D printer for the hydrogel-cell mixture. ‘An important characteristic of our device will be that the print takes place in a sealed and heated clean room’, explains Sascha Schwarz. ‘But, the stability of the “copy” is just as important, which is not so easy because the gels need to be as fluid as possible in the print head. As soon as they come out of the print head they must solidify instantly’, he adds. ‘This is somewhat like using molten chocolate as an ink, which you then expect to solidify.’

Right next to the workplace of the engineers is the cell laboratory with the incubation chamber for the stem cells. ‘Unfortunately, stem cells react not only to fluctuations in temperature but also to mechanical stimuli’, explains Stephanie Sudhop. In regenerative medicine the growth characteristics of the cells can be modified via external forces. ‘It scares me on occasion when I consider that my colleagues force these cells through a tiny printer nozzle’, she admits. When the implants are finished, Carina Prein jumps into action: she tests the copies for biophysical suitability.

In spite of the complexity of the task, the researchers are optimistic that they will take the hurdles. Prof. Alfred Fuchsberger, dean of the Department of Natural Sciences and Mechatronics and speaker of the CANTER research focus, is also convinced. ‘Our project comprises three sub-



Prof. Dr Hauke Clausen-Schaumann, Dr Stefanie Sudhop and Prof. Dr Alfred Fuchsberger (left to right)

disciplines: characterisation of the required tissue samples and tissue copies, tissue engineering, i.e. the production of tissue, and the innovative printing technology’, he sums up. ‘Since we bundle all three competencies right here, we have already taken important steps on our journey.’

A new 3D printer developed by the team confirms this impressively. Humming away, it is processing hydrogel into a honeycomb pattern while the bioengineer Julian Blaser sprays it with calcium chloride to trigger the curing process. Stefanie Sudhop, too, is observing the procedure with a relaxed expression on her face. Her delicate cells appear to be in good hands. *Thorsten Naeser*

Participants

- Prof. Dr Hauke Clausen-Schaumann
- Prof. Dr Armin Fritsch
- Prof. Dr Alfred Fuchsberger
- Prof. Dr Thomas Hellerer
- Prof. Dr Heinz P. Huber
- Prof. Dr Robert Huber
- Prof. Dr Johannes Roths
- Prof. Dr Andreas Schlüter
- Prof. Dr Erwin Steinhauser
- Dr Stefanie Sudhop
- Prof. Dr Carsten Tille

Project partners

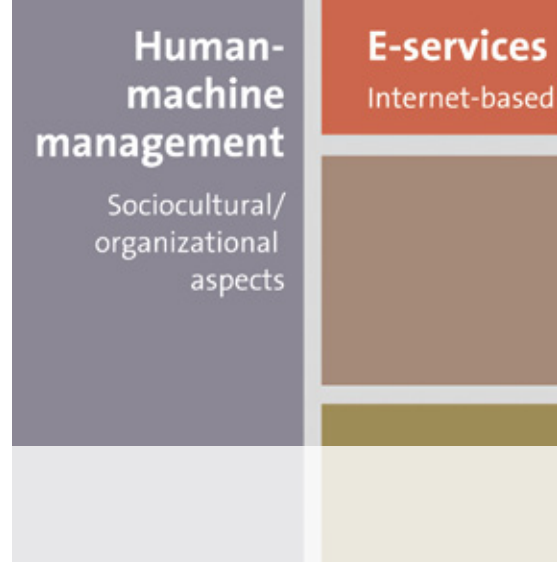
- Clinic for General, Accident, Hand and Plastic Surgery of the University Hospital of the Ludwig Maximilians University Munich
- Clinic and Polyclinic for Plastic Surgery and Hand Surgery at the Rechts der Isar University Hospital of the Technical University of Munich

Collaborating companies

- polyMaterials AG
- PreSens Precision Sensing GmbH
- ibidi GmbH
- m2p-labs GmbH
- Molecular Machines & Industries GmbH
- Livimplant GmbH
- EmaCure (in Gründung)

Funding

- Bavarian State Ministry of Education and Cultural Affairs, Science, and the Arts



Thinking outside the box

Research domain 'Applied Computer Science in Business'
Department of Computer Science and Mathematics and
Department of Business Administration

Researchers in computer science, mathematics and business administration work interdepartmentally on many questions that arise in the development and operation of distributed software systems (distributed applications).

Today, smartphones, tablets and the like help us find the fastest and easiest route between the given points A and B in a city. But what if there is an obstacle on the chosen route? What is the best route now? This is only one of the questions that researchers of the interdepartmental research domain 'Applied Computer Science in Business' hope to answer.

The new 'inMotion' project is currently in the start-up phase. Two of the ten current staff members of the research domain work on the project, with four further doctoral research positions planned. So far, the project is financed with internal funds allocated to the research domain. A project application to the German Federal Ministry of Education and Research is presently under evaluation.

The aim of the project is to develop a kind of navigation system for travellers in urban settings. Whether by car, on foot or by public transport, when traffic jams or other problems arise, the system will suggest alternate routes, ideally allowing users to circumvent a problem well in advance. These alternative routes take into consideration personal user preferences, as well as events that other users have reported.

Solving such complex tasks calls for the consideration of various aspects: 'We are on a broad footing, which we also need', explains Prof. Dr Peter Mandl, speaker of the research domain and the Competence Centre for Business and Information Systems (CCWI).

'There are a variety of basic mechanisms that are required everywhere. We try to consider and deploy these in special applications.'

An example for one of these basic mechanisms is distributed networks, networks of independent computers that communicate with each other, which form the focus of Mandl's research activities. These systems can handle the huge volumes of data required for generating the recommendations.

Prof. Rainer Schmidt in the IT Service Management domain investigates how to handle the data so that it can ultimately be used. Dr Hans-Joachim Hof, professor for software systems and director of MuSe – the Munich IT Security Research Group, is responsible for secure software systems. Prof. Dr Lars Wischhof develops new network technologies that facilitate the combination of mobile phone networks with direct communication between end-user devices (ad hoc communication).

The application example of the 'inMotion' project demonstrates how these basic mechanisms – and with them, the various research domains – are interconnected: Within a one-kilometre radius, there are an estimated 2,000 to 4,000 mobile devices, e.g. smart phones, that can network with each other, thereby forming a distributed system. Information on the current traffic situation, for example, can be collected and communicated via



Summary of application areas in the research domain

RESEARCH DOMAIN

Distributed systems and middleware

Base systems for distributed processing

RESEARCH DOMAIN

Internet and ad hoc networks

Network infrastructure for distributed processing

ad hoc networks. In the process, huge volumes of information are collected. These must be managed and filtered to make them suitable for generating recommendations. Model recommendations are first developed and subsequently evaluated. This is where the mathematician Prof. Dr Gerta Köster comes into play. Using human traffic flow simulations, she tests the quality of the developed algorithms and, consequently, the generated recommendations.

A further interface is the subject of one of Prof. Ulrike Hammerschall's research topics. In addition to the areas of software engineering and requirement engineering, she deals with gamification. Here, the aim is to use game-typical elements in applications to solve problems in non-game contexts and to motivate users. Currently, Hammerschall is investigating how and in which areas such applications can be deployed. In the 'inMotion' project, gamification could be used to encourage users to indicate a variety of events like traffic jams, for example, thereby improving the information quality.

It is readily apparent that this kind of project cannot be implemented by one person alone: According to Mandl, 'There is a lack of sufficient know-how.' What is required is a strong interconnection between the various issues. There are plans to expand the current research domains in the future, with new topics integrated into them. In the process, the collabo-

orative network within the current departments, as well as with others, should be further fortified.

Even students of the Master's programme are closely integrated into research. They participate in ongoing projects through project studies and the development of scenarios, but also as test subjects. In advanced seminars, they work out ideas for further research topics that they can implement, often in collaboration with partner companies, in the context of a Master's thesis. In addition to the practical orientation, a strong focus lies on allowing research results to flow into teaching. 'This lets our students work on innovative ideas using the latest results from research', explains Prof. Mandl. *Dr Anna-Lena Idzkov*



Research Team

Professors of the research domain

- Prof. Dr Peter Mandl (Speaker)
- Prof. Dr Robert Lindermeier (Deputy Speaker)
- Prof. Dr Dirk Fischer
- Prof. Dr Christian Greiner
- Prof. Dr Holger Günzel
- Prof. Dr Ulrike Hammerschall
- Prof. Dr Johannes Heigert
- Prof. Dr Hans-Joachim Hof
- Prof. Dr Rainer Schmidt
- Prof. Dr Lars Wischhof

Project-related support by 'inMotion'

- Prof. Dr Gerta Köster

Number of researchers: 10

Coneect – Launchpad for clever ideas

Prof. Dr Klaus Sailer, Christian Greiner

Department of Mechanical, Automotive and Aeronautical Engineering

The international training programme 'Coneect' teaches University lecturers flexible business thinking and strategies. They then pass on the acquired insight to their students.



At the Munich University of Applied Sciences, start-up activities are fostered and supported by the Strascheg Center for Entrepreneurship gGmbH (SCE), a MUAS institution.

One morning in 2013, Herbert Gillig found himself facing a very special challenge. The professor for Entrepreneurship at the Munich University of Applied Sciences and director of the start-up promotion division at the Strascheg Center for Entrepreneurship (SCE) is accustomed to having students in his audience. But on the morning in question, Herbert Gillig was confronted by a horde of four-year-old kindergarten children, whom he was to talk to about animal welfare. 'I had never been in a comparable situation, and neither had my colleagues, because none of us had children of our own at the time', explains Gillig. 'We were happy that we were able to keep the attention of the youngsters for quarter of an hour. For us it was an exciting experiment', he says with enthusiasm.

The kindergarten visit was part of the international training programme 'Coneect', developed by the Munich University of Applied Sciences in the context of an EU-funded project. The program is geared Europe-wide to university lecturers who want to convey business acumen to their students. The participants receive a full week of training on the meaning of flexible business thinking and action in a highly complex global economy. The intensive course runs from 9:30 in the morning until 11 at night. 'In addition to confronting the participants with situations that may seem unusual to them, our lecturers convey a

myriad of aspects of entrepreneurial strategy and action', explains Professor Klaus Sailer, also professor for entrepreneurship at MUAS and director of the SCE. The course comprises five modules that cover everything, from the presentation of entrepreneurial ideas and the question of how to turn these into opportunities, to entrepreneurship in a cultural context.

'We want to show the participants how to adapt syllabuses to the dynamics of the entrepreneurial field and how to understand innovation processes', explains Klaus Sailer. 'On top of that there is the conveyance of knowledge for developing corporate strategies and continuity, or applying for funding. But also on how to deal with setbacks.'

Alongside the learning sessions, participants must also slip into an active role. 'We want to lure them out of their comfort zone', says Klaus Sailer. Participants are grouped internationally for their project work during the course. In Munich, for example, they had to give a team presentation in a rented tram. On the following day, the topic of the James-Bond-theme-evening dealt with a task no less urgent than saving the world.

'The venues for the course weeks are located in diverse locations throughout Europe', explains Christian Greiner, member of the project research staff. 'Our partners are located in Scotland, Bulgaria, Portugal, and Israel', he says.



This gives the participants insight on a variety of focus topics, specific to the respective host. 'In Scotland, for example, the focus was on oil, in Sofia, in contrast, it was the political conditions in eastern Europe', recalls Greiner. The very distinctive characters of the participants from different nationalities became apparent quickly: 'While the Israelis are very direct in their communication, the British tend to be more diplomatic', recalls Herbert Gillig with regard to the colleagues in his course.

'Today, entrepreneurial activity is an exceedingly dynamic process that develops in the course of a project', explains Klaus Sailer. 'You have to adapt flexibly and quickly to rapidly changing economic conditions.' Sailer is a physicist and contrasting economics and natural sciences is second nature to him: 'Entrepreneurship is similar to quantum mechanics. Results are not unambiguously predictable because of the initial conditions; you have to react quickly.'

But 'Coneect' provides insight not only for the participants. The initiators of the program also learn a lot in the process. 'First, we diligently select applicants; we want to know exactly who they are', says Klaus Sailer.

We look for motivated people. We ask the applicants to fill out an online questionnaire before the course, and afterwards another form provides the scientists with feedback from 'the

participants.' Half a year later, the graduates are queried once more on how they passed on the acquired knowledge to their students, in other words, how knowledge transfer took place. 'This allows us to improve our courses and to develop guidelines for so-called entrepreneurship education', says Christian Greiner. A book on the experiences of the last two programme years is just being compiled.

'Coneect is our contribution to making the Munich University of Applied Sciences viable for the future', explains Greiner. 'We want to create networks for our colleagues and help bright minds introduce their inventions into the market.' Coneect graduate Herbert Gillig would take part again. Through alumni meetings and maintaining contacts made then, Grillig has built up a large network of contacts to business and universities that he profits from today. And alongside their technical schooling, his students now learn how to, one day, turn clever ideas into competitive products. *Thorsten Naeser*



Prof. Dr Klaus Sailer (r.) and a member of the project research staff Christian Greiner

Project coordinator

Hochschule München

Project partners

- University of Aberdeen (UK)
- ISEMI – The Israeli College for Entrepreneurship and Management of Innovation Ltd (ISR)
- PEEP – Educar para Empreender (P)
- Scientific Research Centre of Sofia University »St. Kl. Ohridski« (BG)
- Forschungszentrum Jülich GmbH (D)

Funding

- European Union, CIP (Competitiveness and Innovation Framework Programme)



Integrated marketing and sales for greater success in business

Prof. Dr Richard Hofmaier, Dr Wolf Hiemeyer
Department of Business Administration

Hitherto, coordination of marketing and sales in B2B enterprises has not been ideal. A diagnosis and optimisation model developed by Prof. Richard Hofmaier, Dr Wolf Hiemeyer and their research team hopes to change that.



Concept for integrated marketing, sales and customer management

‘It’s like in football. When defence and strikers don’t harmonize, how can they expect to win the game?’, summarises Prof. Richard Hofmaier of the Department of Business Administration. In this case, defence and strikers stand for marketing and sales in a business to business (B2B) environment. There are a variety reasons why collaboration between the two domains has been suboptimal in the past: Marketing, which was slow to find acceptance and application in B2B companies, tends to pursue long-term goals, while sales (a classical B2B domain) has a more short-term orientation. And managers in the growing B2B market usually have a technical or natural sciences background with little training in well-founded, modern marketing and sales management. ‘It is important to provide managers and skilled employees with professional methods and instruments so that they can work and collaborate successfully and efficiently on the long term’, says the professor for marketing. To date, no such holistic approach exists.

The aim of the project, which is slated to run until February 2017, is the improvement of business practices, while advancing scientific insight, but also the novel and holistic application of teaching methodologies. The undertaking should demonstrate new and well-founded understanding in the field of B2B marketing and sales management while strengthening the MUAS profile in the field of ‘entrepreneurial thinking and action’.

Wolf Hiemeyer is the university IP Manager, a lecturer in the department of Business Administration and a long-time marketing and sales manager in the B2B industry. Together with Richard Hofmaier, he developed an indicator and diagnosis model that gradually integrates the worlds of marketing and sales in the context of their research project ‘Integrated Marketing and Sales Management in the B2B Industry’. The model can be used to evaluate a company’s position regarding the collaboration between sales and marketing. It can already suggest approaches to improving cooperation. By way of literature research and empirical studies, the researchers first determined the relevant influencing factors for the integration of marketing and sales. They then refined their results in 2013 in a preliminary study that queried nine B2B companies in the context of a pre-test. The main study (comprising almost 100 surveys and expert discussions) followed in 2014. Based on these results, the team led by Hofmaier and Hiemeyer determined the respective indicators and ultimately developed the design model. The model uses the refined versions of the specific influencing and optimization factors.

These are, for one, market and customer orientation factors. The type and extent of communication, task, process and structural design in the organisation of the marketing and sales units. The latter are also the relevant corporate integration mechanisms. These mechanisms are factored in using a



cumulative approach. All factors are viewed with regard to the collaboration between marketing and sales.

The model was validated in the context of more detailed research steps. The scientists surveyed marketing and sales managers, as well as marketing and sales staff on the individual integration factors and mechanisms. Following evaluation of the survey results, each company's own profile was presented, interpreted and discussed. 'We thus have a relatively good diagnostic tool that, in the first stage, indicates where action is fundamentally required', say the researchers. The upshot: In general, companies are set up quite well with regard to communications, while most other domains require extensive work.

Thus far, the project has been funded with start-up financing from the university with the aim of improving the chances for third-party funding. 'Public funding is currently geared more towards the natural sciences and technical domains. When developing broad-based economic models, research contracts from companies are – at least in the early stages – less common', explain the researchers regarding the necessity for internal funding. In the long run, however, Hofmaier and Hiemeyer are counting on financing from the business world. 'We will continue to work with a number of previously involved companies, but need to acquire new partners as well', says Hiemeyer.

In 2014, Richard Hofmaier published the book 'Integrated Marketing, Sales and Customer Management' on the subject, based on long-term international practical projects. In the book, he extends the model by a third dimension, B2B customer management. The next project phase will include further companies in the empirical studies. In addition to large-scale surveys, supporting (development and optimization) workshops will be provided in the companies to flesh out concrete action and implementation recommendations. These are the best prerequisites for future defence, mid-field players and strikers, i.e. marketing, sales and customer management, to play not only a good game, but to win a whole series of games.

Daniela Bode



Dr Wolf Hiemeyer (l.), Prof. Dr Richard Hofmaier (r.) and their research team

Collaborating companies

- Adolf Würth GmbH & Co. KG
- DELO Industrie Klebstoffe GmbH & Co. KGaA
- Inplus GmbH
- Keimfarben GmbH & Co. KG
- Knorr-Bremse AG
- Linde AG Industriegase Deutschland
- Rohde & Schwarz GmbH & Co. KG
- Schreiner Group GmbH & Co. KG
- SFS Group AG, Schweiz
- Stihl AG & Co. KG
- Sto SE & Co. KGaA
- Wacker Neuson SE
- Webasto SE

Lightweight components from a bed of pins

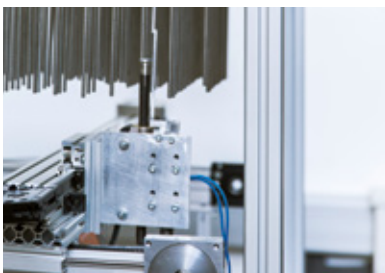
Prof. Christoph Maurer

Department of Mechanical, Automotive and Aeronautical Engineering

In the 'FlexforCFK' project, mechanical engineers at the Munich University of Applied Sciences produce curved components made of carbon – cheaper and faster than previously possible.



Prototype of the Flex4CFK system



Laboratory model: Motor and individually controllable rods

At first sight, it looks like a fakir's nail bed. 15 centimetre pins protrude from a construction of aluminium. Beneath the rods, however, is a fist-sized motor fixed to a track assembly. A lever allows each of the rods to be individually controlled, moving them up and down with millimetre precision. But, unlike the bed of a fakir, the tips are not pointed; they have tiny, ball bearing-mounted platelets on them that can be tilted in any direction.

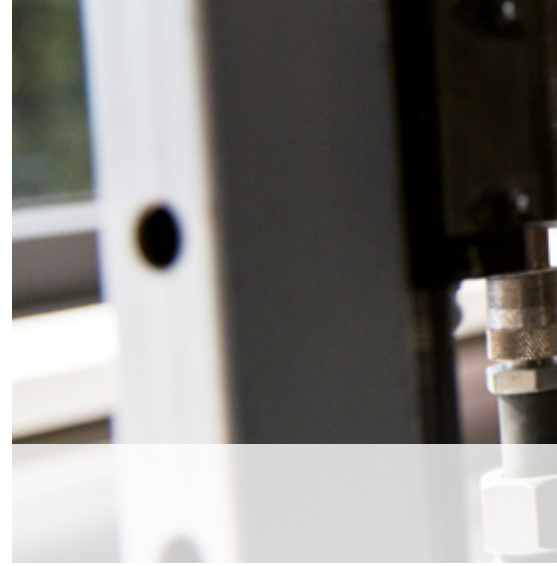
The set-up is located at the Munich University of Applied Sciences in the Laboratory for Energy and Process Technology. Professor Christian Maurer and his team have refined the arrangement over the past few years in various research projects. In the context of the current FlexforCFK project, funded by the German Federal Ministry of Education and Research, the Munich mechanical engineers are using this flexible form tool, referred to as pin-type tooling, to produce three-dimensional components of carbon fibre reinforced plastic (CFRP). First, an intermediate layer is placed on the bed of pins. A carbon-fibre carpet, the actual raw material, is placed on top of this mat. Now, the motor under the pins starts to move them either upwards or downwards until the desired curvature is achieved across the entire surface. The carbon carpet comprising individual fibre strands fits to the new shape of the supporting subsurface, is cured and can then be used as a component.

'These components can be deployed as assembly parts in the aerospace or automotive industries, for example', explains Maurer, the project leader.

A well-matured pin-type machine of the Munich mechanical engineers is already deployed at BMW. 'We conceived the system at BMW so that the designers can transfer their CAD data, the three-dimensional construction design information for a component part, from their computers to the machine and then hold the finished component in their hands around one hour later. This saves us huge amounts of time in the production of prototypes, because before, the production of a comparable part took at least 48 hours', says the researcher. In addition to time, the new process saves material, energy and labour when compared to conventional technology.

The system is thus highly valued, especially in the automotive industry, because cars are built as individual prototypes before they go into series production, allowing designs to be evaluated and optimised. 'Our pin-type system means not only time savings, but also cost reductions by a factor of ten', explains Maurer. 'This makes it ideal for prototype and small batch production.'

But pin-type tooling developers still have plenty of work cut out for them. Manufacturing carbon components with hills and adjoining valleys





remains difficult. Here, the scientists are working on a mechanism that creates a vacuum under the device, allowing for variable curvatures of the form. And there is another big challenge: 'Forming filigree structures is also difficult', explains the project leader. But the engineers want to change that. Christoph Maurer receives a lot of support from his research associate Matthias Wimmer, who is writing his doctoral dissertation in the context of this project. The university is also collaborating with Prof. Rüdiger Hornfeck's team at the Technical University of Nuremberg. With his support, rapid prototyping parts can be integrated into the system whenever required. These are produced in a separate process, then accurately positioned and affixed to the previously configured form by a robot. In this way, even filigree structures could be shaped into the carbon components.

For around 13 years, Prof. Maurer has been working on pin type tool systems. 'We started with acrylic glass processing, then came polycarbonate and now we have arrived at carbon', recounts the mechanical engineer. There is a good reason – after all, carbon fiber reinforced plastics are being deployed evermore widely. For example, the new electric car of BMW, the i3, is made largely of carbon components. 'Carbon simply has excellent mechanical properties while at the same time being light in weight.' Lightweight construction is taking hold, in particular

in the automotive industry. Here, the rule of thumb is: Reducing the weight by 100 kilogrammes saves half a litre in fuel consumption per 100 kilometres.

And Maurer is already working on a further application domain for pin type tool systems. 'In principle, it is also possible to build the machine on a larger scale and then produce curved building elements, for example, a concrete façade construction', he says. In principle, the process is applicable to many materials. The Munich team has identified a market they hope to develop with a spin-off company in a few years, following the respective research work.

Thorsten Naeser



Prof. Christoph Maurer with a test setup

Project partners

- Georg Simon Ohm Technical University of Nuremberg
- Eurocopter Deutschland GmbH
- Huber Kunststoff & Technik GmbH
- Putzin Maschinenbau GmbH
- SGL Carbon GmbH
- 3D CAD GmbH

Funding programme

FHprofUnt

Project sponsor

Projekträger Jülich

Funding

German Federal Ministry of Education and Research

Social pedagogical problems of the post-war era

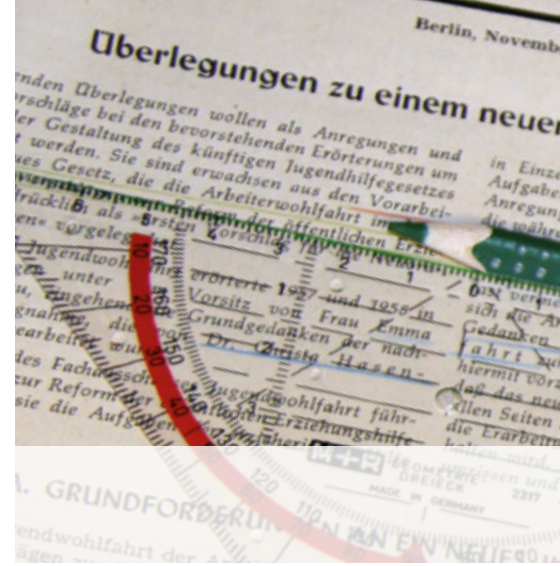
Prof. Dr Peter Hammerschmidt
Department of Applied Social Sciences

The German Research Foundation project of Prof. Peter Hammerschmidt investigates how social pedagogical problems, especially regarding children of working mothers, were analysed and handled in the post-war era.

The endangerment and neglect of youth are among the classical problems in social pedagogy. In the mid 1950s, the difficult material circumstances of families in the aftermath of the Second World War was considered, among other things, a major source of this problem. Depending on the degree of vulnerability, various far-reaching measures were initiated, especially the care of children in industrial reform schools and the voluntary or forced accommodation in community homes.

A new feature of the urban landscapes of the day were the so-called 'latchkey children', recognisable by a house key hung on a cord around their neck. The professional activity of mothers outside the home was viewed as a social pedagogical problem, since they neglected their fostering and care obligations during their absence from home. The idea was to remedy this problem with social pedagogical and political measures – to influence the public perception of house work and prepare mothers for their roles as wives and mothers in so-called mothers schools. Kindergartens of the day were considered a stopgap measure only available to families in which the mother was forced to work out of financial necessity.

Prof. Peter Hammerschmidt's research project analyses expert discourses from the perspective of a specific variant of the sociological/social constructivist problem theory for the investigated time period of 1945 to 1961.



The project reconstructs the development of social pedagogical problem constructions. The goal is, on the one hand, to fill the research gap regarding the development of youth welfare in the post-war era and, on the other, to make a contribution to the theory of social pedagogy. The project, which is funded by the German Research Foundation, is being carried out in collaboration with Prof. Uwe Uhlendorff of the Technical University of Dortmund.

The aim of the investigations, which are slated for three years, is to determine which hitherto unreviewed background processes led to the emergence and development of youth welfare activities and structures in the post-war era. The question posed is: Which actors represented which problem constructions and solutions and how were these implemented on the political-administrative level? A further goal is to advance the development of current problem theories to allow the acquisition of processes beyond the emergence of new problems (the classical approach) and the micro-sociological 'doing social problems' (the current expansion). In the latter, the problem application and, thus, its reproduction, is investigated on a personal level – e.g. the interaction between a social worker and his or her client. The new theoretical and research perspective would then provide an instrument for registering the incidence of social problems that have been 'recognised'. The ongoing debate in society includes, for example, the issue of refugees/



A book cover on the topic from 1961



migration (as a current problem with extensive media coverage) and the classical problems of (youth) crime, homelessness and unemployment.

Here, the project reconstructs the evolution and successful implementation – or failure – of ‘problem careers’ in three ‘arenas’ influencing one another:

- Expert audience – the complete assessment of nine professional journals; in addition: contemporary studies, conference proceedings, etc.
- Internal transactions of the main actors like the federal ministries of the interior and family, welfare and professional associations – extensive archive research
- Public politics – evaluation of discussion and decision processes in the German Bundestag and its special committees, as well as the German Federal Council

After just under one project year, it is too early to speak of substantiated results. Nonetheless, a number of interesting results are crystallising out of the investigation of problem constructions in the expert community. For example, most of the problem constructions are ‘incomplete’, with a frequent tendency to ‘loose associations’ between the problem description and the referenced causal analysis, on the one hand, and between the problem description and the demanded problem solution on the other. The investigation also looks at the Youth Welfare Act.

During the investigated time frame there were two reforms to the law: in 1953, the aim was simply to implement the original version from 1922. Originally, this was not fully implemented due to an emergency decree in 1924 and then, following the war, there was legal uncertainty because of Nazi laws and their invalidity during the occupation period. The reform of 1961 was more extensive and had actual statutory amendments, for example the implementation of voluntary fostering support. This gave parents the freedom – without sacrificing parental custody – of sending their children to a home, forming the basis for collaboration with the parents during a child’s stay in a home.

A further topic of research is the establishment of the national youth plan and adoption of youth protection legislation, as well as the developments in local youth welfare offices and public and independent charitable youth welfare support structures.

A possible follow-on project could investigate the 1970s, a period in which the same topics were viewed from a different perspective. It was no longer the working mothers with their latchkey children that were perceived as the problem, but rather the lack of after-school care program offerings.

Louisa Tomayer



Youth Welfare Act of 1922

Project partner

Technical University of Dortmund

Funding

German Research Foundation

Set in the right light

Prof. Dr Herbert Plischke

Department of Applied Sciences and Mechatronics

The European research project 'SSL-erate' hopes to dispense with the prejudices against LED lighting and clearly emphasize its advantages, thereby raising acceptance of the technology.

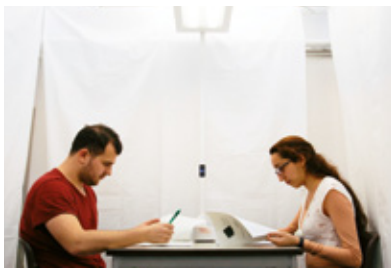
Light is of great significance for us humans. This applies both to natural sunlight and to ever present artificial lighting. But not only the visual effects matter – increasingly, non-visual aspects are playing a major role. Prof. Herbert Plischke of the Department of Natural Sciences and Mechatronics at Munich University of Applied Sciences is investigating the significance of these aspects and the advantages of having the right light at the right time.

A strong blue component, for example, supposedly provides relief from winter depressions and helps keep us awake and concentrated. But, it also inhibits the release of melatonin, which leads to sleep disorders in many people. 'The strong non-visual effect has not been known for too long, since the special photoreceptors of the eyes were first described only 15 years ago. They react specifically to the blue portion of the light spectrum and are pivotal in the proper control of hormones. Since LEDs radiate strongly at the blue end of the spectrum, it is easy to make mistakes when LED lighting is not properly deployed', explains the researcher.

Solid state illumination builds on the effect of electroluminescence: Electrical voltage is converted directly and efficiently to light. Light emitting diodes that generate various colours can be made by using different materials. With the proper triggering on a millisecond scale, the colour temperature can be adjusted in a targeted manner – and precisely that makes LEDs so interesting.

For the lighting to be deployed specifically in the workplace or in hospitals, regulations and standards need to be implemented. To this end, MUAS, in collaboration with other leading universities, is reviewing and analysing scientific publications on the topic. In Munich, Prof. Plischke, the researcher Philipp Novotny and Daniel Stabenau, an external doctoral candidate, are

Since November 2013, Plischke and his team have been participating in the European research project SSL-erate (SSL stands for solid state lighting, i.e. LED lighting). Overall, 24 cooperation partners from 13 EU countries are taking part in the project, which is funded through October 2016. It is structured into three subdomains: 'Human Centric Lighting', 'Open Innovation' and 'Green Business Development'. The stated goal is to clean up with the scepticism towards, uncertainty about and prejudices against LED lighting – too expensive, harsh light, bad for the eyes, and so on. 'Our goal is to achieve a broad market introduction and increased acceptance of a technology that can bestow many advantages upon us', says the professor. After all, LEDs (light emitting diodes) can do a lot more than just light up rooms and displays in an energy efficient manner. The focus of 'Human Centric Lighting' deals with the non-visual effects of light on humans, their well-being and health.



Students test the long-term effect of specific LED lighting in the light laboratory



studying lighting for educational institutions. They are investigating how published measurements can be aligned. 'Lux and lumens are no longer sufficient, since we are in another domain when we consider biological effects. Here, we are dealing with the evaluation of lighting benefits from a melantropic (i.e. non-visual) perspective', explains Plischke.

After reviewing several hundred publications, a plethora of information has been compiled and the first results have been achieved. For example, DIN SPEC 5032-100, a standard for measuring melantropic effects, has been improved recently in the context of the project.

The compiled information will be processed to reflect the latest state of knowledge and disseminated via the internet, scientific literature and pharmacy pamphlets, as well as lectures in the context of the 'International Year of Light'. In addition, the insights will flow directly into the teaching content of the ophthalmology, biotechnology and medical technology programmes of study. Special training programmes for light planners are in the pipeline. The idea is to generate a dose-effect ratio by the end of the project term. This can then be used to make well-founded recommendations and draft guidelines for light planners in which the added value of (currently still expensive) LED lighting is underscored. An example could be the targeted use of dynamic

lighting in learning institutions to positively support the learning and working behaviour of pupils and students. A further field of use might be nursing care. In the treatment of age-related clinical pictures, circadian lighting – i.e. a light cycle with dynamically changing intensity and colour that mimics the progression of natural light throughout the day – could stabilise the sleep-wake rhythm of the elderly, thereby improving their quality of life.

The lighting industry is facing a major transformation: Classical lighting and lamp manufacturers, who hitherto only had to deal with mechanics, must now deal with electronics and computer technology. 'Light technology must make the switch to semiconductors. This is a great challenge for many companies', according to Plischke. Even electronics manufacturers that are storming into the lighting market should be animated to consider not only energy efficiency, but rather to build electronic control units with a certain level of intelligence. Here, key words are Web 2.0, the internet of things and LiFi. This explains a further important aspect of the European research project: fostering start-ups and supporting existing enterprises. The new insight should serve to generate new ideas and support companies in implementing them – with toolkits and/or in collaboration with the Strascheg Centre for Entrepreneurship of the Munich University of Applied Sciences. *Anna-Lena Idzko*



Prof. Dr Herbert Plischke (l.), Dr Philipp Novotny (r.) and students in the MUAS light laboratory



Logos of the EU projects

Project partners

24 members from 13 EU states

Funding programme

Seventh Framework Programme

Funding

European Union

Further information

www.ssl-erate.eu

www.lightningforpeople.eu



Innovation through IT automation

Prof. Dr Rainer Schmidt, Florian Bär
Department of Computer Science and Mathematics

In order to optimize data centers, Prof. Rainer Schmidt and Florian Bär developed an integrated solution for IT-automation together with FNT GmbH. Based on the research results a new product could be created.

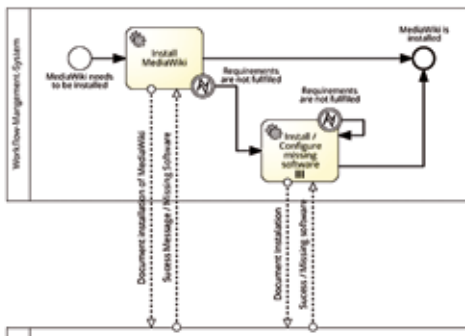
We all know the situation from at home: When tasks need to be frequently done, we are happy to automate it, e.g washing the dishes. The same applies to data centers, where tasks often need to be done on hundreds of servers. Professor Rainer Schmidt of the Department of Computer Science and Mathematics and his research associate Florian Bär identified automation in data centers as a topic for research. In cooperation with the software company FNT, they have developed a software module that automates processes in data-centers. The MUAS team and FNT were previously acquainted through a precursor project on the energy-oriented modernisation of computing centers. This successful collaboration and further topics in the domains of documentation and management of IT solutions led to a project proposal with the Central Innovation Programme for SMEs (ZIM).

One goal of the research project is to provide companies with cost-effective solutions for computing services. ‘The economic significance of the project is associated with cloud computing. In a classical computing centre an administrator might be responsible for 100 servers. In a cloud computing center, that number could be 10,000’, says Rainer Schmidt, the initiator and administrator of the project. The difference lies in the automation. ‘It is important for German SMEs to have

access to affordable IT services without having to resort to foreign computing centers. Our project provides an important contribution to this objective.’ A further goal is to improve the reliability of computing centers.

The project also has a significant green aspect’, says the scientist Florian Bär. And this is where the researchers hope to improve efficiency. The idea is to equip computers as well as possible and utilise them to capacity. The workflow-engine builds on the graphical language BPMN 2.0, which they have adapted to the tasks of a computing center. ‘The workflow engine is a system that executes graphical specifications’, says Bär, project manager for MUAS.

A first application case is the automation of processes in a configuration database. Using the engine, processes in the database are automatically integrated with existing tools, analysed and documented. The configuration database documents the individual systems of a computing center, i.e. the networks present and the software installed on each server center. According to Prof. Schmidt, before the automation, some computer centres used to equip all computers with GPS receivers, in order to be able localise them for configuration. The workflow engine built on an extensive concept development phase: ‘For example, we determined the processes that run in



Schematic representation of the workflow engine developed in the project



computing centers when changes are made, which systems can be used to specify the workflow and which interfaces are required', says Bär. Then the researchers programmed the prototype, which was to be integrated with the Command software program of FNT. They then performed extensive studies using the prototype itself. By integrating the tool into the configuration database, they were able to analyse the effort required to model the workflow using the new system compared to a conventional system. 'We were able to prove that our approach, measured by performance indicators, generally had only half the complexity of the usual approach', says Bär. The tool scored well under security aspects.

Demand for the new system is large. Many companies had already shown interest while the project was still underway, explains Bär. Following a request by FNT, he adapted the module to allow measurements to be carried out. The prototype has been developed to a product. Prof. Schmidt is excited about the successful project and praises the excellent collaboration with FNT. The scientific environment was obviously also ideal: 'The whole project was successful not least because it took place in the very lively research environment of the Department of Computer Science and Mathematics', he says. In addition, it is embedded in an international research landscape including the Rostock University, the

Sorbonne University in Paris, the Reutlingen University, the Stockholm University and the University of Haifa.

Meanwhile, the research effort in the Department of Computer Science and Mathematics is not abating. In cooperation with the Rostock University, Bär is working on his dissertation in a topic related to the project. His doctoral thesis deals with the self-service approach, the circumstance that employees can increasingly put together their IT services on their own. He hopes to investigate methods by which IT departments can none-the-less remain in control. In addition, the next ZIM funded project is starting up. It deals with predicting breakdowns stemming from structural weaknesses in data centers.

Daniela Bode



Project team (left to right): FNT GmbH managing director Haag and project leader Veli with Prof. Schmidt and Florian Bär

Project partner

FNT GmbH, Ellwangen

Funding programme

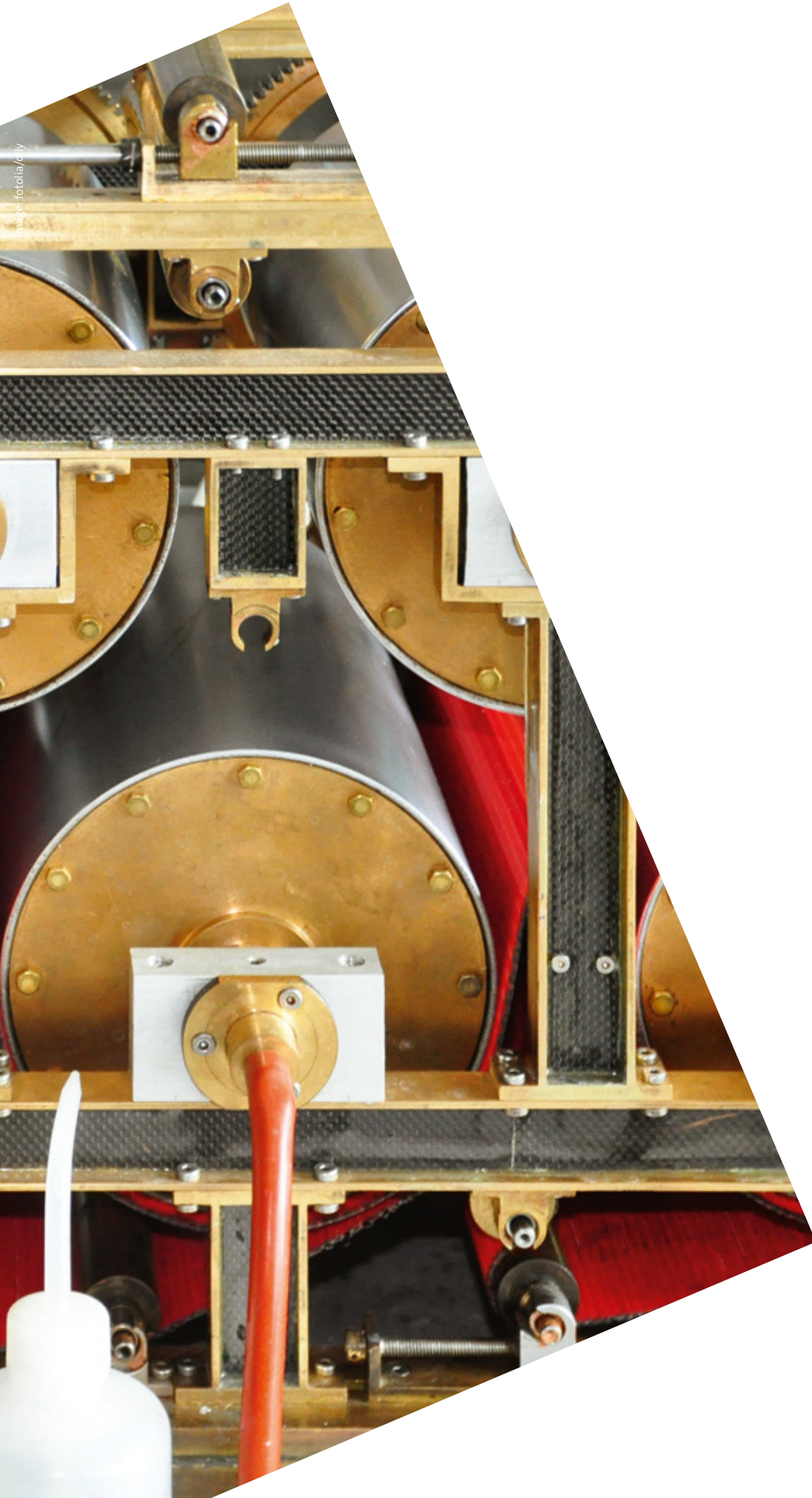
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