Fraunhofer
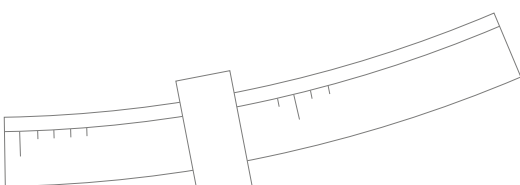## FOKUS

FRAUNHOFER INSTITUTE FOR OPEN COMMUNICATION SYSTEMS FOKUS

MAKING CITIES SMART

ANNUAL REPORT
2014

Econ Award 2015
Unternehmenskommunikation NOMINEE

MAKING CITIES SMART

DEAR READERS,

"No one likes a city that's too smart," writes the sociologist Richard Sennett in his guest commentary on our annual report. He portrays a city designed entirely on a drawing board and controlled by an electronic command center. Powerful computers evaluate all of the accumulated data and tell residents what should be done when, where and how. There is no freedom of choice, no in-between space where something new can spring up, and no organic feeling of community. This is not our vision of the Smart City. If we take a bird's-eye view of a modern metropolis, as the writer Haruki Murakami does in the opening chapter, it looks like a living organism. Traffic and transport routes permeate the different layers of tissue like blood vessels. Cells move and multiply, then die off. Oxygen and water are consumed, energy is converted, waste is produced. All in all, the city appears to be a gigantic machine that absorbs and processes tremendous amounts of resources.

The way we see it, the job of the Smart City is to help its inhabitants use scarce resources as efficiently and sustainably as possible. It should also enable its citizens to lead a good, safe life while giving them the freedom for creativity and innovation. In this annual report, we show you exactly what research into the Smart City looks like at Fraunhofer FOKUS. We start with our work on the communication network of the future. Then we describe concrete solutions for public IT, contemporary forms of e-government and healthcare, energy, transport and public safety. We end with a chapter on quality assurance for critical infrastructures. This is not a dry statement of accounts, this is a city magazine. Through a combination of images and numbers, we show you the diverse aspects of life in the city – and it's not all deadly serious. We are proud of the many interviews with high-ranking representatives from politics and business about their cooperation with FOKUS. Technical articles, success stories, picture stories and short project descriptions round out the magazine. Guest commentary and a cartoon wrap things up – but you'll have to decide for yourself whether escapism is an alternative to city life. Happy reading!

Radu Popescu-Zeletin

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SMART CITIES

"**Eyes mark the shape of the city. Through the eyes of a high-flying night bird, we take in the scene from midair. In our broad sweep, the city looks like a single gigantic creature – or more like a single collective entity created by many intertwining organisms. Countless arteries stretch to the ends of its elusive body, circulating a continuous supply of fresh blood cells, sending out new data and collecting the old, sending out new consumables and collecting the old, sending out new contradictions and collecting the old.**"

Haruki Murakami "After Dark", London 2007

LET'S TALK ABOUT CITIES

Crowds, street canyons and skyscrapers dominate our image of the city. We usually think of megacities like Tokyo or Mexico City, with well over ten million inhabitants. But even Heidelberg – with just under 150,000 residents, winding lanes and old houses – is a city. Urban life has many facets. Planned cities, which are designed completely from scratch, like the carbon-neutral "science city" of Masdar in Abu Dhabi, stand in contrast to structures like Rome or Athens, which evolved over thousands of years and were shaped by multiple generations and cultures. Flashy, up-and-coming cities like Dubai, which leads the race for the world's tallest building with the Burj Khalifa, exist alongside dying cities like Detroit, which officially declared bankruptcy in July 2013. Many cities bear the traces of political events. The townships of South Africa testify to the politically forced resettlement of the country's black population. Divided cities like Jerusalem and, formerly, Berlin symbolize the tug-of-war between two power blocs. The cities of the Arab Spring, especially Damascus and Beirut, have been scarred by civil war. Highly developed Western cities, with functioning infrastructures and full access to resources, contrast with the poor and poorest cities in developing countries, which struggle with serious supply and disposal problems to this day.

INNOVATION AND VULNERABILITY

More than half of all people on earth already live in cities. By the year 2050, according to the United Nations, nearly 70 percent of the world's population – or 6.3 billion people – will be urban residents. But what draws people to cities? The UN mentions work and investment opportunities as primary reasons. Even today, 80 percent of the global gross domestic product (GDP) is generated in cities. People are attracted to cities by the economic incentives, but also because cities provide access to resources like water, energy and food, while offering a wide range of services, culture and recreational opportunities. Cities generate high energy. They are incubators for creativity and innovation in both the arts and sciences. You might think that everything would be easier in the city. But the high population density, concentrated use of available resources, and non-calculable risks – such as extreme weather conditions, technical failures or financial speculation – make even highly engineered and structured metropolises vulnerable. For people in less stable cities, these are often life-threatening. Smart city technologies like those developed by Fraunhofer FOKUS are the backbone of the city. On the basis of intelligent communication technologies and high-quality software architectures and systems, they make it possible to use resources wisely, assess risks and reliably manage catastrophes. They contribute to the dependable operation of urban infrastructures for mobility, energy and healthcare, and they help improve the quality of life for city dwellers in many respects.

An estimated 2.5 million people have been relocated in Shanghai since 1990 – often involuntarily. Due to the housing shortage in the rapidly growing metropolis, the old part of the city was torn down. Modern residential, office and commercial buildings sprung up in its place. They offer so-called "roofers" an ideal environment for their breakneck sport.

Sixty-four percent of women between the ages of 20 and 30 who use the Tokyo subway have been victims of "chikan", a form of sexual harassment where perpetrators take advantage of the tightly packed crowd. To put a stop to gropers in the jungle of cities, Tokyo introduced women-only subway cars during rush hours in 2002.

wikipedia.de

Forty percent of the streetlights no longer work, 80,000 houses are empty and there are 27 jobs for every 100 residents. Population drain and the loss of the automotive industry have brought the Motor City to its knees. In July 2013, the city had accumulated a debt of around 19 billion dollars and filed for bankruptcy.

washingtonpost.com
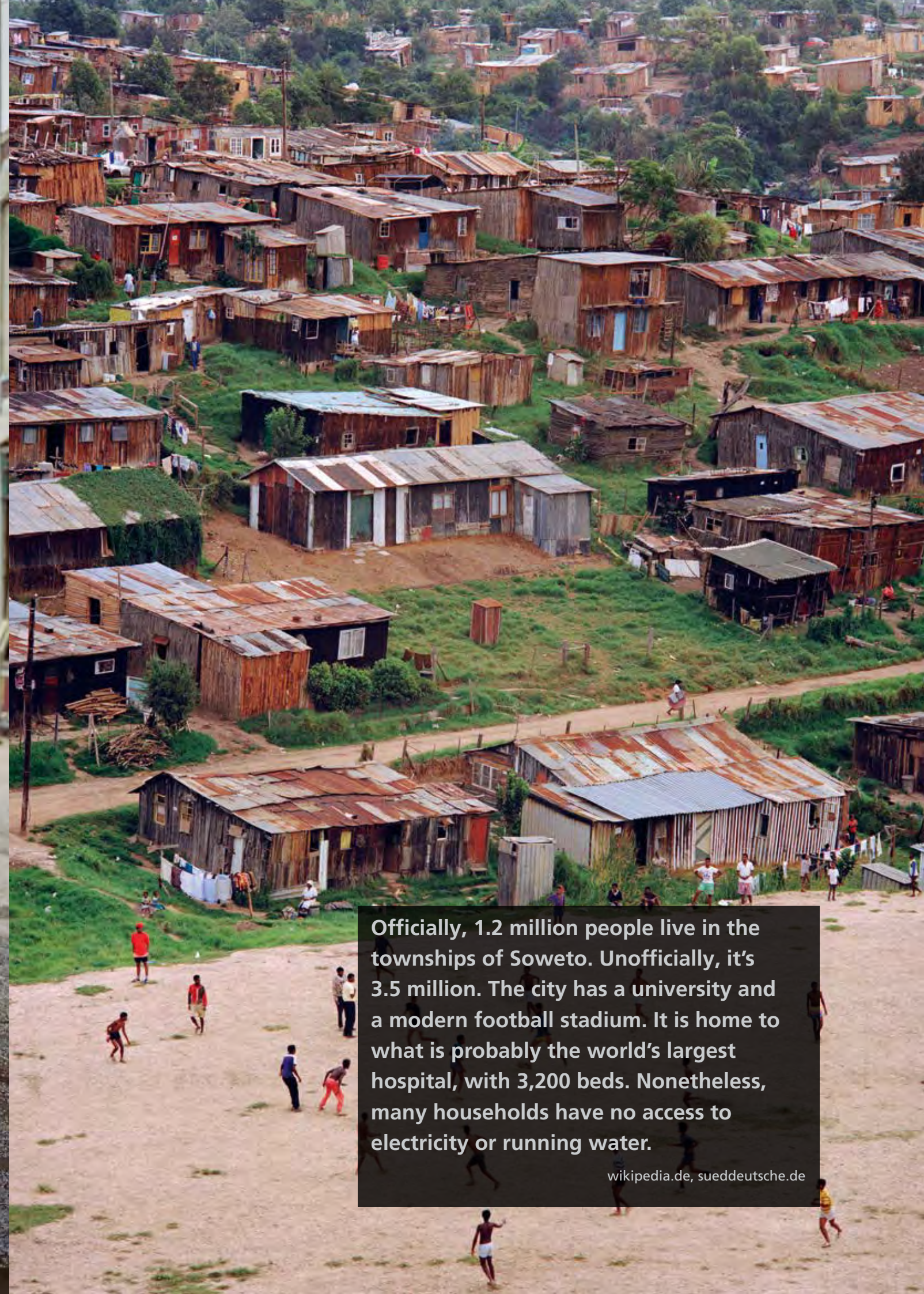
Officially, 1.2 million people live in the townships of Soweto. Unofficially, it's 3.5 million. The city has a university and a modern football stadium. It is home to what is probably the world's largest hospital, with 3,200 beds. Nonetheless, many households have no access to electricity or running water.

wikipedia.de, sueddeutsche.de

"We have to learn how to properly navigate the cyberworld instead of kidding ourselves about security."

BETWEEN CONTROL AND FREEDOM

FOKUS Institute Director Prof. Dr. Radu Popescu-Zeletin talks about the criteria for the sustainable growth of cities, their inhabitants' dependency on critical infrastructures, the deceptive feeling of security and the azure skies over Nice

What are the weak points of a city in your opinion?
Unchecked growth above all. Cities are developing at an alarming rate – today there are over 20 cities with a population of more than 10 million people.* As a result, urban planning mostly revolves around residential space right now. Other resources like air, energy, roads, green areas – everything that makes a city worth living in – are being neglected. It's time to develop indicators to ensure that cities grow sustainably.

"Critical infrastructures" is the new catchphrase – how would you define it?
Every city and every society depends on critical infrastructures such as the water and electricity supply or public transport. In a city, you expect all resources to be available 24/7 – uninterrupted and always accessible. This around-the-clock availability is characteristic of a critical infrastructure. Information

technology is generally what makes it possible these days. In the future, these individual infrastructures will be consolidated in a single, IT-based meta-critical infrastructure. This is why IT is so important for the future.

How can we ensure the security of critical infrastructures?
Certification is especially important – in accordance with the Common Criteria, for example. There are Common Criteria for nearly every product. When it comes to critical infrastructures, it is particularly important to know which components exist, what their standard of quality is and which specification criteria they meet. This is why many companies strive for CC certification and thus a global USP. We need a certification standard for large meta-infrastructures, too. Take our Cloud for Europe project, for example, which focuses on the certification of private cloud

technologies for governments. When every government has a certified cloud, it will be possible to define a Schengen Agreement for data and effortlessly move data back and forth. Despite all the top-class projects, however, I don't believe any system can be 100 percent secure. We have to learn how to properly navigate the cyberworld instead of kidding ourselves about security.

Which specific developments from FOKUS support life in the city?
For one thing, we are trying to develop an overall architecture for meta-critical infrastructures which integrates everything from the communication platform to our five application areas: e-government, energy, medicine and transport. We also have concrete solutions like the KATWARN storm warning system, and solutions for safeguarding communication infrastructures if cables are destroyed in an earthquake, for example, or mobile communications collapse. Our WiBACK technologies are an important alternative here. Last but not least, we have the innovation cluster for secure identities, where we are working on end-to-end identification, among other things. Secure and unambiguous identification is absolutely critical, regardless of whether you have people or machines at each end. It is also a very important asset for critical infrastructures.

FOKUS technologies ensure efficiency, clarity and frictionless processes in the city. But isn't the jungle of cities most fascinating?
Sure. That's why we travel to cities where we don't know anyone, where we can discover something new at any moment. Life in the city is always a question of control versus freedom. The success of the Smart City will be measured against this scale.

Where do cities get their ability to encourage people to achieve and innovate?
If nothing else, it's the fact that so many people come together in such a small space. Diversity and innovation come about when you have a high concentration of people in

competition with one another, who tend to question their own actions and compare themselves.

Is there a particular book or film about cities that you've enjoyed?
The thriller Blackout by Marc Elsberg was very interesting in terms of what can happen if we don't have a grasp on our meta-infrastructures. The book describes what happens when all the electricity networks in Europe collapse. I also like Night Train to Lisbon – it's a lovely portrait of the city.

Where would you like to live?
In Nice. I love the sea, and the city is in one of the most beautiful parts of the world. Nice is not an artificial city. People really live there. It has wonderful restaurants and fantastic, totally secluded beaches, and there are tiny villages in the mountains. I think Yves Klein, who put his signature on the blue skies over Nice, is fantastic.

ABOUT THE INTERVIEWEE

Prof. Dr. Dr. h.c. Radu Popescu-Zeletin studied at the Polytechnic University of Bucharest and earned a PhD from the University of Bremen. He qualified as a professor at the Technical University of Berlin, where he holds the Chair for Open Communication Systems. As Director of the Fraunhofer Institute for Open Communication Systems FOKUS, his name is closely associated with the development of numerous solutions for communication infrastructures. Popescu-Zeletin is a member of the Romanian Academy and bearer of the Romanian National Order of Merit in the rank of Commander.

*23 according to the UN World Urbanization Prospects 2011.

TECHNOLOGIES FOR THE BACKBONE OF THE CITY

At Fraunhofer FOKUS, around 500 scientists are working on technological solutions for the Smart City. Cross-sectional technologies such as Smart Communication and System Quality Engineering are the brackets around specific applications in the fields of Public IT, E-Government, E-Health, Smart Mobility, Smart Energy and Public Safety. Smart communication technologies form the backbone of a city, where everything is connected to everything else. FOKUS is creating platforms and construction kits for communication infrastructures which can be used for the Internet of the future or the next generation of mobile communication. The researchers are also developing concrete solutions for six areas of application: With regard to Public IT, they are advising the German Federal Ministry of the Interior. In the field of E-Government, FOKUS technologies are helping to modernize public administration. In the E-Health competence center, FOKUS researchers are coordinating the development of an efficient telematics infrastructure for the healthcare system, among other things. In the area of Smart Mobility, FOKUS is working on modern traffic management systems on the basis of Car2X scenarios. For the energy sector (Smart Energy), the researchers are developing smart grid technologies which account for the complexity of managing renewable energies, while in the field of Public Safety they are creating warning systems that more closely integrate individual citizens. Finally, as the closing bracket, FOKUS scientists are looking into System Quality Engineering for complex urban infrastructures and researching the development and test methods required for this.

COMPLETE DEVELOPMENT CHAIN

Fraunhofer FOKUS operates within a close alliance of companies, universities, research institutes and government ministries. Market-focused solutions are distributed through a total of 14 spin-offs. In 2012, Fraunhofer FOKUS successfully merged with the Fraunhofer Institute for Computer Architecture and Software Technology (FIRST) and the Berlin-based section of the Institute for Software and Systems Engineering (ISST). It can now cover the complete development chain for urban IT infrastructures, ranging from architectural design and modeling, through middleware and platforms, to standalone applications such as the KATWARN storm warning system.

WE MAKE CITIES SMART

Smart cities have a lot to pull off. Their residents want to be able to get from A to B at all hours, by car or public transport. They need electricity and telecommunications 24/7. They should even be able to get married at the courthouse at midnight, not to mention apply for a new driver's license or register the birth of a new arrival. Emergency rooms and hospitals can never sleep, and neither can supermarkets. Life in the city no longer comes to a halt when the sun goes down. But availability alone isn't enough for nocturnal city-dwellers. The city should be smart, it should optimally adapt to the needs of everyone, offering the right thing at the right time – quickly, cost-efficiently, sustainably and ecologically. And yet, the city shouldn't know everything. What's private should stay private, and it should be protected accordingly. Urbanites want a digital garden fence so they can feel safe and secure. A hefty portion of anonymity and the ability to lose oneself in the city's undergrowth are all qualities of the urban jungle. Ultimately, the success of the Smart City will be determined not only by the reliability of critical infrastructures and the efficient use of resources, but by the leeway between freedom and control.

SMART COMMUNICATION

"One cannot not communicate" wrote Paul Watzlawick in the communication theory he published in 1969, without realizing how visionary he was. 45 years later we live in an age of communication where everyone – and everything – can be connected.

COMMUNICATION ADDICTION

Bill Gates and Carlos Slim Helú come from the telecommunications industry, as does the latest billionaire on the Forbes list, Evan Spiegel, founder of the photo app Snapchat. Start-up prodigies like Mark Zuckerberg and Nick D'Aloisio became millionaires in their youth because they recognized the need for all-encompassing communication. The culmination of our dependency on communication is "nomophobia" – the fear of not being contactable and, according to the Daily Mail, the "plague of our 24/7 age". This, in turn, has ushered in the next trend: More and more people are taking Internet sabbaticals to have time off from being constantly connected. But you can never entirely escape digital communication. Nearly every aspect of public and economic life in cities is managed using communication technologies. This became painfully apparent to the Estonians in 2007 when cyberattacks prevented them from withdrawing money or carrying out other transactions for three weeks.

The desire to be connected everywhere, all the time, is characteristic of society worldwide – and economically, too, mobile communication is part of the future. Giant markets are now being developed with it: 70 percent of new mobile communication contracts come from the Asia/Pacific region and Africa. Kenya is the leading mobile-only country, with 99 percent of its citizens going online exclusively with mobile devices. Employers, too, have recognized the advantages of being able to arrange calls, e-mails and appointments while on the move. On average around the world, there are only seven permanent desks for every ten employees. The worlds of home and office, work and entertainment, concentration and distraction, social networks and desocialization come together on pocket-sized all-in-one devices. Smartphones are now more highly valued than oral hygiene: While 3.8 billion people use a toothbrush every day, 4 billion use a mobile phone. With 40 million hits, "I forgot my phone" became a Youtube sensation – a video version of the digital aphorism "Imagine the love of your life walks by and you're looking at your phone". And yet, one third of all couples in the USA meet on the Internet.

IN THE YEAR 2016, GLOBAL DATA TRAFFIC WILL BE EQUIVALENT TO 328 BILLION DVDS

Bangalore, India's IT metropolis, supplies its residents with free WiFi even on public buses. There are no cease-and-desist lawyers here, and permanent Internet access is more important than personal data protection. In 2015, the number of devices communicating all over the planet will be equal to the number of people on earth. But our communication infrastructures aren't ready for it. Fraunhofer FOKUS is developing approaches, building blocks and tools for the next generation network so that technologies and applications for smart power grids, e-mobility, e-health, smart media and e-government can be imple-mented universally and efficiently in the future. Seamless communication between all devices, services and applications is the focus of media interoperability and autonomous, personalized communication which meets user demands in terms of availability, quality, convergence and interactivity. Communication technology can already do a lot – the question for the Internet of the future is how cleverly it will be used. Will it make life easier, or will people get tangled up in permanent interconnectedness?

We touch our smartphones 150 times a day. 75 percent of Germans don't leave the house without their phone. Most Austrians would rather have a week without sex than a week without their smartphone.

Multiscreen users spend nine hours in front a screen every day in Indonesia, five hours in Italy. Worldwide, smart phones are overtaking the leading medium of television: While users only spend 114 minutes a day in front of the TV, they spend 148 minutes looking at their smartphone displays.

millwardbrown.com

Recycled icons: Hardly anyone needs them as phones anymore, but the English don't want to give up their famous symbol. Through the "Adopt a Kiosk" scheme, Britons have turned 1,500 phone booths into tiny galleries, bookcases and even first-aid centers.

urbanghostsmedia.com, bbc.com, countryfile.com

CONTROL CENTER FOR BIG DATA

Some professions die out because their environment has changed so radically that no one on earth could meet the demands anymore. "Switchboard operator" is one of them. When someone in Germany wanted to make a long-distance call at the start of the 20th century, they had to be connected by one of 4,000 telephone operators. Light bulbs signaled a request, and the operator would link up the conversationalists and then move on to the next call. The job was relatively easy: Person A had to be connected to person B by means of a phone jack. Over the course of just 12 years, what started in Berlin with 94 telephone subscribers became a telephone network with 21,000 stations. The growth in subscribers alone soon turned the dream job into a stress job, one which required a "psycho-technical aptitude test" by the 1920s. Today, telecommunication is much more than just telephony. It's no longer solely about connecting people, it's also about managing communication between machines and providing data for end devices being used in a variety of ways. In the Internet of Things, machines have become independent communicators which respond to requests, communicate with each other and form completely autonomous systems.

Canadian artist Wayne Garrett adds the finishing touches to his installation "Cloud". It consists of around 5,000 energy-saving light bulbs shaped into a cloud of light. The installation was exhibited at i Light Marina Bay, a festival for energy-efficient light

A SMART CITY HAS TO UNDERSTAND ITS DATA

For modern communication infrastructures, sounds, images, text and raw data have to be translated into a universal language of data protocols so that everyone and everything can be connected. Data is increasingly being exchanged within virtual, flexible, software-defined networks (SDN) in the cloud. Switchboard operators today would not only need several billion hands, they would also have to be available simultaneously worldwide, 24 hours a day, 7 days a week, to turn all of the information, inquiries and instructions into a meaningful whole. They would need a complete overview of all channels into and inside the cloud in order to make sure the 84 exabytes of requests each month went to the right places so that people could share information, machines could respond and Industry 4.0 applications could function. Organizing and channeling the masses of data in cities is particularly complicated, but it is also particularly important for meeting the demands of complex areas of application such as transport, health, safety and administration, both in an overall context and in terms of individual needs. Neither human beings nor the network infrastructure has the capacity to handle this now. Old copper cable networks now coexist with fiber-optic, satellite and mobile networks from four different generations. WiFi, 2G, 3G, 4G and Local Area Networks overlap many times over, which is expensive and, above all, inefficient. From the year 2020, the 5G umbrella infrastructure will be the new standard which integrates or acts as a long-term substitute for all communication networks. Thanks to its extremely fast and flexible infrastructure, 5G will be able to quickly connect over 50 billion devices and umpteen billion people via the smart communication cloud. In the Next Generation Network Infrastructures (NGNI) competence center, the researchers of Fraunhofer FOKUS are supplying all of the test environments and toolkits necessary to prepare existing and future virtual network operators and application providers for this network of the future. The Future Seamless Communication Playground (FUSECO PG) is made up of modular components which can be used to establish person-to-person or machine-to-machine communication regardless of the product, network or application. Individually or as a whole, the FUSECO components make it possible to do what telephone exchanges can't do anymore: manage the complexity of a big-city data cloud for the demands of a Smart City. Data packets are prioritized for each application, bundled together, logically correlated and then quickly linked with people or machines by means of dynamic path creation following the principle of "always best connected". For network operators, FUSECO serves as a training camp for the demands of tomorrow so that, as soon as the 5G network spans our globe, intelligent communication and service platforms can establish their own direct connections between big data clouds and the Smart City.

5G CAN MAKE CITIES INTO SMART CITIES

Hartmut Kremling, an expert for innovation projects and future technologies at Vodafone, talks about the future 5G mobile standard, its role in smart cities and the possibility that surgeons will soon be able to carry out tele-operations worldwide with 5G

> "Nearly every branch of industry will benefit from 5G because the new opportunities will improve communication and cooperation in every respect."

The head of technology at Nokia Solutions Networks recently admitted that he has no idea what 5G is. Can you explain 5G?
4G, the fourth generation of digital mobile communication – also known as LTE – is currently being expanded throughout Germany. Speeds of up to 300 megabits per second are currently possible with 4G. But we're already working on the next generation with partners from around the world. 5G will have much shorter response times and, of course, even higher speeds.

Why is 5G necessary? What role will it play in a Smart City?
Today, mobile communication is used primarily to connect people – through traditional voice telephony, but also via SMS, social media and messaging services. But mobile communication is also being used more frequently to

connect machines and all types of devices. This is why we also talk about the so-called Internet of Things. 5G has the potential to make cities into smart cities, where intelligent stoplights monitor and control traffic, for example, and multi-level parking facilities communicate with in-car navigation systems to guide drivers to the best parking spaces and prevent traffic jams.

5G is expected to make services possible that we can't even imagine today. Along what lines should we be thinking?
Above all, 5G will be the basis for the Internet of Things. Thanks to nearly real-time response times, it will be possible for doctors to perform operations around the world using video controls and for machines to respond without delay. In the event of accidents, black ice or other incidents, vehicles can be alerted to dangerous situations in real time and

prevent crashes with intelligent emergency braking or steering systems.

Are you working on specific projects with Fraunhofer FOKUS?
We worked with Fraunhofer FOKUS for the first time almost ten years ago. The team successfully helped us implement Voice over IP in the fixed network. We are currently launching a new joint project dealing with OpenSDNCore and Open5GCore. One of our main goals is to take advantage of the tremendous experience of FOKUS in this area and prepare our teams for the future technological challenges. We have also worked together on communication between people and cars.

What are the most important requirements that 5G will have to meet?
5G networks will have to lead to close integration between mobile and fixed networks. The goal is to achieve very dense coverage with all possible access technologies for all current and future services in a convergent network. In addition to very high bandwidths, there will have to be a focus on very fast response times, extremely high reliability and flexibility. This is the prerequisite for direct communication between end devices or massive M2M applications in the future. This can only be achieved through new kinds of self-organizing networks and self-management. We also expect research and industry to develop these technologies in an energy-efficient way.

What role will virtualization with software-defined networks and network function virtualization play in the creation of 5G?
Some important network functionalities are already being routinely virtualized. These include systems for Voice over IP in the fixed network, LTE roaming agents, network monitoring systems and Voice over LTE. In our view, network function virtualization and software-defined networks will be the core components of 5G technologies. In particular, tactile applications requiring response times in the millisecond range can

only be realized if we introduce a telco cloud hierarchy all the way to the mobile transmitter.

What are the biggest obstacles to establishing a viable concept for 5G by 2020?
One major challenge is standardization so that 5G can be used internationally as quickly as possible. The necessary frequency bands have to be available as well, and hardware manufacturers must offer both the network technology and the corresponding end devices.

Which branches of industry can be newly tapped or used more efficiently with 5G?
Nearly every branch of industry will benefit from 5G because the new opportunities will improve communication and cooperation in every respect. In Germany, we currently have cutting-edge technologies in automation engineering, machine tool building and automotive engineering. 5G will benefit all of this.

ABOUT THE INTERVIEWEE

Hartmut Kremling (born 1957) is a Vodafone Ambassador who has coordinated cooperation between the Vodafone Chair of Mobile Communication Systems and Dresden University of Technology since January 2014. He supports the global CTO of Vodafone in innovation projects and the introduction of future technologies. Kremling previously spent nine years as CTO of Vodafone Germany. He was also a member of the executive board of Arcor Verwaltungs-GmbH, CEO of tele.ring Telekom Service and head of the Central Operations Department at Mannesmann Mobilfunk. Hartmut Kremling studied information technology at Chemnitz University of Technology, where he earned a degree in engineering.

LATENCY AS A STRESS FACTOR: OBSTACLE OUT OF NOTHING

2 *Latency can lead to serious errors. Latency times play a huge role in operations involving real-time image processing because data transmission delays can easily lead to surgical errors. VISCOM enables the real-time processing of high-resolution images and generates 360° panoramas which can be linked with MRI images, for example. Medical device manufacturers are supporting researchers by integrating touchless user interfaces such as head-tracking, eye-tracking, voice and gesture controls.*

3 *Entertainment without limits: Multiscreening isn't fun if a basketball coach is still talking on the second screen when his player starts to jump, or if you're about to answer a quiz question on your tablet but the TV is already showing the answers. Future Applications and Media is working on technologies for synchronous media usage across all devices. With the FAMIUM development platform, the researchers are creating solutions which enable adaptive content streaming on different devices with the help of the MPEG DASH ISO standard, second-screen applications and content protection.*

Latency [the existence of something that exists but has not (yet) appeared]

In philosophy, latency is defined as a hidden possibility, while in medicine, it means the temporary invisibility of an illness. In technology, latency is a momentary nothingness – or, specifically, the delay between two events. On the stock market, the length of this period of nothingness between a purchase and the actual transaction can mean a profit or loss of billions for high-frequency traders. Even today, latency affects many areas of everyday life without us even noticing. But in the future it will play a much more important role, because the Internet of the future and all of its associated technologies will depend on extremely short time delays. Fraunhofer FOKUS has dealt with this disturbance variable for years in a variety of contexts.

1 *5G will push latency times into the microsecond range. High latency in mobile communication is already an obstacle to the tactile Internet. The future mobile 5G network is expected to be up to a hundred times faster than our current 4G/LTE network and should enable latency times in the microsecond range. By 2020 at the latest, the wireless communication infrastructure for the tactile Internet should enable Industry 4.0, networked mobility, the smart grid and innovative medical applications in a highly efficient way. NGNI already offers test environments and toolkits for realistically simulating the mobile Internet of the future in order to make devices and applications "5G-ready".*

The smart TV becomes an interactive decision-making aid: A new app brings the neighborhood experience into the digital living room.

Articles like "Will Maxvorstadt be Munich's new trendy district?" are followed closely by "Hamburg: Death of a neighborhood scene" (both from sueddeutsche.de). Other magazines try to satisfy all city-dwellers with neighborhood tests: "What's the most livable neighborhood in Berlin? We've defined 11 criteria and compared the city districts in detail" (Prinz). In Berlin especially, affiliation with a neighborhood has an unsurpassed identity-forming power. With its "Neighborhood Report", the Berliner Zeitung newspaper created a whole new section of the newspaper to offer guidance to identity-seekers and Berlin newcomers. After all, what's in today might be out tomorrow.

DECISION-MAKING AID IN THE DIGITAL LIVING ROOM

But not everyone wants to live in the middle of a trendy neighborhood. New technologies now help people find the perfect all-round package for them, far from the short-lived hype. In November 2013, Germany's largest property portal – ImmobilienScout24 – and Fraunhofer FOKUS began developing a smart TV app for house hunters. With selected supplemental information, the app brings the neighborhood experience into the "digital living room" across all platforms and devices (tablets, smartphones, PCs). While users enter search criteria (house size, price, location) on their smartphone or tablet, the application connects to the TV as a second screen and brings the new living experience right into the living room. The smart TV becomes an interactive decision-making aid: Users can see videos of the properties, view short films to get an impression of their prospective new neighborhood and retrieve data on the social environment.

PROPERTY SHOWS OF THE FUTURE

Immobilienscout24 is considering establishing a TV channel using the FOKUS technology to make the service even more attractive for the 10.5 million people who use it each month. The channel would show advice videos as well as even more on-location videos and interviews with real estate agents and neighborhood characters. The idea of bringing value-added information relating to construction, housing and living to television is not new. More and more formats have appeared on the market in recent years, from interior design and home improvement shows to programs about renting, buying or emigrating. The disadvantage of these shows – aside from the amateur actors – is the lack of personal relevance. The link between real market availability and real demand, and the ability to respond to user requirements and questions through second screens and smart TVs, is unique – and just what we want from the television of the future.

WHICH NEIGHBORHOOD IS RIGHT FOR ME?

Where you live creates a sense of identity. The Reeperbahn is to Udo Lindenberg in Hamburg as Broadway is to Frank Sinatra in New York. At the same time, the identity of a place is a product of its inhabitants. Urban psychologists view cities as living organisms whose local identities emerge from the residents and their interaction with each other. This "neighborhood feeling" is often the determining factor when choosing where to live in a big city. Ninety-seven percent of Germans feel that a nice home is one of the most important things in life. Only health and security in old age are ranked equally as important. But it's not only the house itself that makes the difference. Along with standards such as rental prices, square footage and floor plans, most property hunters consider the surroundings to be a key factor in whether they decide to sign on the dotted line. In his book Happy City, the journalist Charles Montgomery looks at how urban environments affect the human psyche. The upshot: The closer connected we are to our environment, the less likely we are to experience a heart attack, stroke, cancer or depression. Every year, city journals and magazines come up with new answers to the question of "which neighborhood is right for me?" In big cities in particular, readers and journalists never tire of building up or abandoning the latest hip, happening or next-big-thing neighborhood.

How can we bring more light to the pitch-black deep sea? The key to underwater adventure lies in the automatic calibration software from VISCOM.

VIRTUAL DEEP-SEA DIVERS

"The conditions down there are hostile to life. It's pitch-dark and ice-cold, and the pressure on every square centimeter is equal to the weight of a car." Volker Ratmeyer's voice doesn't betray the slightest bit of aversion. The 48-year-old scientist from the Bremen Center for Marine Environmental Sciences (MARUM) actually tends to rhapsodize when he talks about the dark place that very few researchers ever penetrate. "The deep ocean is nearly untouched territory. The layers of sediment there are a real archive of the Earth's history. Climate processes, tectonic plate activity, practically the creation of the planet – it's all been preserved there, layer upon layer." To unlock the secrets of Earth's history, scientists are looking for places 1,000 to 6,000 meters deep where key processes are taking place: sulfur vents, deep-sea volcanoes and "black smokers" (hydrothermal vents on the seabed). But these are extremely rare and very hard to find. Just one percent of the deepest underwater worlds have been mapped, even though the deep ocean covers more than half the Earth's surface. This is because the incredible pressure makes crewed diving missions extremely dangerous. The glass dome of the submarine in Wes Anderson's film "The Life Aquatic" would shatter immediately under this pressure. Scientists have therefore tried to map the ocean floor primarily using satellite imagery and sonar signals. More information is supplied by autonomous vehicles that are thrown from a ship and can chart an area the size of a tennis court using underwater cameras.

RESEARCHERS KNOW MORE ABOUT THE DARK SIDE OF THE MOON

"But autonomous vehicles are relatively dumb," Ratmeyer says. "They basically just go back and forth and take pictures or acoustic soundings. This means we only see very small, random sections, and it's just a question of luck whether we find someplace that's interesting to researchers." How can we bring more light to the pitch-black deep sea without sending more robots down there? For two years, the researchers at MARUM worked with the Visual Computing Competence Center (VISCOM) of Fraunhofer FOKUS to develop the ARMARE technology. The system is being tested on the H-ROV (Hybrid Remotely Operated Vehicle) diving robot, which is equipped with three HDTV cameras. The key to this underwater adventure lies in the automatic calibration software from VISCOM which is now being used worldwide. Via a 4,000-meter-long fiber-optic cable, H-ROV sends all kinds of real-time data from the deep ocean to the researchers in the control container on the ship: multidimensional sensor field data, multichannel HD video footage, geodata and all of the measurements it can take. The autocalibration software precisely assembles all of the individual data and calibrates it with precalculated 2D and 3D datasets. The multidimensional media channels are synchronized so that images can be projected onto a virtual glass dome, enabling researchers in the container to experience the deep sea through augmented reality. This allows the H-ROV pilot to act intuitively (situational awareness) when collecting samples of sediment, gases or organisms.

TARGETED EXPLORATION

The virtual glass dome brings an element of calculability to discoveries that would otherwise rely on chance. "For example, we organized a full four-week expedition to find a 15-meter-high black smoker that we had repeatedly passed by for a month with the autonomous vehicle. On the next expedition we finally found it – and realized it was just ten meters to the side of our exploration area." The expanded field of vision therefore saves money and nerves as well as time. The virtual deep-sea divers are not yet being used on expeditions, however. A few test runs need to be carried out in the pool, and then the crew wants to send the H-ROV under the ice of the Arctic Ocean. It will dive down to 6,000 meters in the polar waters to investigate the deep sea and lower layers of ice. In mid-2016, the researchers hope to explore the icy oceans – from a warm and safe distance – under the virtual glass dome on the sea.

PROJECTS

DIRECT DESKTOP WARPING: VISCOM COOPERATES WITH NVIDIA

The VISCOM competence center has developed a desktop warping method in cooperation with the graphics processor manufacturer NVIDIA. The autocalibration software from VISCOM processes individual projector images directly on the graphics board to create a single seamless, rectified, high-resolution image. The method is already being used success-fully in multimedia control rooms to depict maintenance systems for conveyance infrastructures in the oil industry, for example. The technology makes it possible for multiple employees in a control room to work together on a single screen and monitor each other's work from different computers.

www.fokus.fraunhofer.de/go/en_desktop_warping

WIBACK – WIRELESS BACKHAUL TECHNOLOGY

WiBACK, a broadband solution based on point-to-point radio relay, can connect schools, companies and other institutions over distances of up to 100 kilometers, very cost-efficiently and using solar power, with bandwidths of currently up to 180 Mbit/s. The hardware consists of standard components. Unlike alternative technologies, WiBACK is a self-configuring and self-managing system. The investment and operating costs are low since very few people are needed to run it. Another reason for its cost-efficiency is the fact that the WiFi spectrum can be used for the radio link, meaning that there are no high license fees. The system's ability to manage itself also ensures a high degree of reliability because it can identify disruptions on its own and quickly fix or report them.

www.fokus.fraunhofer.de/go/en_wiback

FI-STAR

Duration: April 1, 2013 to September 30, 2015
FI-Star is a European research project that should lead to far-reaching innovation in the field of medicine by system-atically using the latest information and communication technology. To this end, FI-Star is carrying out seven selected early trials to investigate examples of the diverse applications for future Internet technologies in medicine and healthcare. It is also gaining initial experience with actual use cases, including monitoring vital parameters, tracking distribution chains to prevent counterfeit medications, and developing virtualization technologies to improve minimally invasive surgical methods. FI-Star brings together 43 partners and is part of the Future Internet Public Private Partnership Program (FI-PPP) of the European Commission.

www.fokus.fraunhofer.de/go/en_fi_star

OPEN MTC PLATTFORM

The OpenMTC platform is an open, cloud-enabled component of the FUSECO Playground which bundles services for applied research and the development of innovative machine-to-machine (M2M) and Internet-of-Things applications. The platform connects various sensors and actuators from different vertical domains and then collects, aggregates and forwards their data in an application-specific way. To do this, OpenMTC conveys instructions to end devices via event-based control mechanisms. OpenMTC is a cooperative project between Fraunhofer FOKUS and the Technical Univer-sity of Berlin (TUB).

www.open-mtc.org

FAMIUM FRAMEWORK

FAMIUM is an end-to-end prototype implementation for technology evaluation and interoperability testing which was developed by the Future Applications and Media (FAME) competence center. FAMIUM facilitates multiscreen displays, adaptive media streaming, content protection, cross-platform developments and content synchronization by supporting a variety of applications for mobile phones, PCs and connected TVs. This enables early prototyping, experimentation and the testing of new functions.

www.fokus.fraunhofer.de/go/famium

PUBLIC IT

"Any serious understanding of the public sphere requires that everyone is granted access to participation in the public sphere, both technically and practically as well as politically. […] The public sphere is sustained by the expectation that it is open to every single person, wherever they are, whatever they can do and whenever they were born."

Volker Gerhardt "Öffentlichkeit", Munich 2012

FROM THE AGORA TO THE VIRTUAL SPHERE

In the Greek polis in the fifth century B.C., the public sphere was manageable. Life played out in the agora. Markets, courts, offices and temples were within walking distance of one another. According to the comic poet Eubulus, you could buy anything there: "Figs, bailiffs, grapes, apples, witness statements, roses, honey, lawsuits, myrtle, […] laws and accusations." The center of the agora was used for trade as well as public debates, athletic events, religious services and all kinds of entertainment. Even today, the agora remains the ideal image of public life. But compared to the ancient world, the public sphere today is confusing. Due to the size of cities alone, centers of activity lie far apart and many services are offered in multiple locations. Berlin, for instance, has 13 registry offices, 18 law courts, 96 hospitals and 642 public schools in 12 districts covering 892 square kilometers. The urban rail network is 330 kilometers long, and the electricity network is 36,000 kilometers long. The inhabitants have 2,500 parks available to them. All in all, this is a highly complex public infrastructure which is used by citizens every single day. But who does it "belong" to? Who is responsible if a train doesn't show up or the power goes out? And what role does the state play in this complexity? According to the Brockhaus encyclopedia, which defines public space as "the publicly accessible area of an entity under public law", the state is responsible only for the "thoroughfares". It handles the maintenance and safety of publicly accessible spaces, meaning physical spaces.

EVERYTHING WILL BE DIGITAL

In the digital age, this definition seems out of date. The public space is increasingly being recreated in a digital space, and many aspects of public life are now digitally supported. Part of the interaction between citizens and the state now takes place online; public networks for electricity, telecommunication and traffic are controlled electronically; and much of today's trade is based on digital technologies. As a result, calls for public IT and questions about the extent of the state's responsibility for the IT infrastructure are growing louder. Progressive solutions for political participation, e-government, safeguarding critical infrastructures, protecting (digital) identity and providing basic IT services are of paramount importance. As a think tank for government institutions, Fraunhofer FOKUS supports the development of public information technology. The Public IT (ÖFIT) competence center, which is funded by the German Federal Ministry of the Interior (BMI), supplies scientific expertise for answering questions about the configuration of the state's information technology. The Electronic Government and Applications (ELAN) competence center has developed modern e-government solutions and technologies for digital participation. In a number of individual projects, FOKUS is working on the integration of public and private transport, intelligent energy management and a unified telematics infrastructure in healthcare. It is developing technologies for supplying broadband to rural areas, safeguarding critical infrastructures and protecting digital identities. Fraunhofer FOKUS works on cross-sectional technologies such as smart communication and system quality engineering as well as solutions for specific areas of application. In doing so, it is recreating the functions of the ideal agora in the digital world.

GOING OUT IS YOUR CIVIC DUTY

IT'S YOUR TOWN NEW AMSTERDAM

NEW AMSTERDAM VODKA

28

27

MTA
Metro-North
Railroad

With 67 tracks and 44 platforms, Grand Central Station in New York is the largest train station in the world. 750,000 people pass through it each day and use a hub of five local trains, seven subway lines, 46 buses, three airport shuttles, and two million taxis every year.

grandcentralterminal.com, thedailybeast.com

"The fact that we move in a digital space means that the state also has to carry out its tasks digitally."

WE MUST IMPROVE OUR OWN ASSESSMENT SKILLS

Martin Schallbruch, Chief Information Officer at the German Federal Ministry of the Interior, talks about public IT, security in the digital sphere and the need for research to accompany the establishment of public IT architectures

Mr. Schallbruch, what is public IT?
Public IT is the IT that the state itself uses for e-government solutions or public administration, for example, but it is also the information technology that the state establishes, influences, or specifically defines through guidelines.

Why should certain areas of IT be publicly managed and maintained?
There is no question of "why". The fact that we all move in a digital space means that the state also has to carry out its tasks digitally. It has to offer protection, provide certain infrastructures and tend to public services. All of this is now done through public IT, not just through civil servants, subsidies and laws.

Do we need national regulations for public IT?
We need both national regulations and international harmonization. Many things are organized globally in the digital sphere, making it difficult to create uniformity through national regulations. On the other hand, the state is responsible for ensuring that critical infrastructures function smoothly, for example. We can't wait for global regulations which take a long time to establish. We have to act nationally while also pushing for international and European regulations.

The NSA scandal prompted fierce debates about IT security. What's your view?
The cybersecurity situation has become much more acute in recent years. We have organized crime, economic and industrial espionage and a drastic increase in identity fraud. The German Federal Office for Information Security (BSI) recently had to inform more than 16 million people that their

user data had been stolen. In terms of cybersecurity, the new coalition has resolved to look more closely at the responsibility of providers. I believe there needs to be greater awareness on the part of companies as well. I also think the security of critical infrastructures is important. The state needs to ensure a minimum level of protection against cyberattacks. This is why we are working on an IT security law that will cover the minimum requirements for such infrastructures.

Where can we make changes when it comes to security? Will stricter rules help?
Rules alone can't guarantee security. We must improve our own assessment skills. We also need technical testing methods. We want to expand the BSI, which carries out certifications and issues technical guidelines. Germany has a good reputation when it comes to auditing and testing. It would be nice if we could extend this image to IT security and offer our services worldwide.

What's the state of IT access in Germany?
Access involves different levels. We have the infrastructure level, specifically, broadband expansion. We've made good progress here in Germany in recent years, but we're still a long way from where we want to be, particularly when compared with other countries. Access also involves the ability to develop diverse and innovative business models or to autonomously configure our private communication over the Internet. Questions of equal access and net neutrality are critical here. Furthermore, access naturally concerns the ability of individuals to use the Internet. This is a question of training and further education. The coalition agreement clearly addresses all of these points.

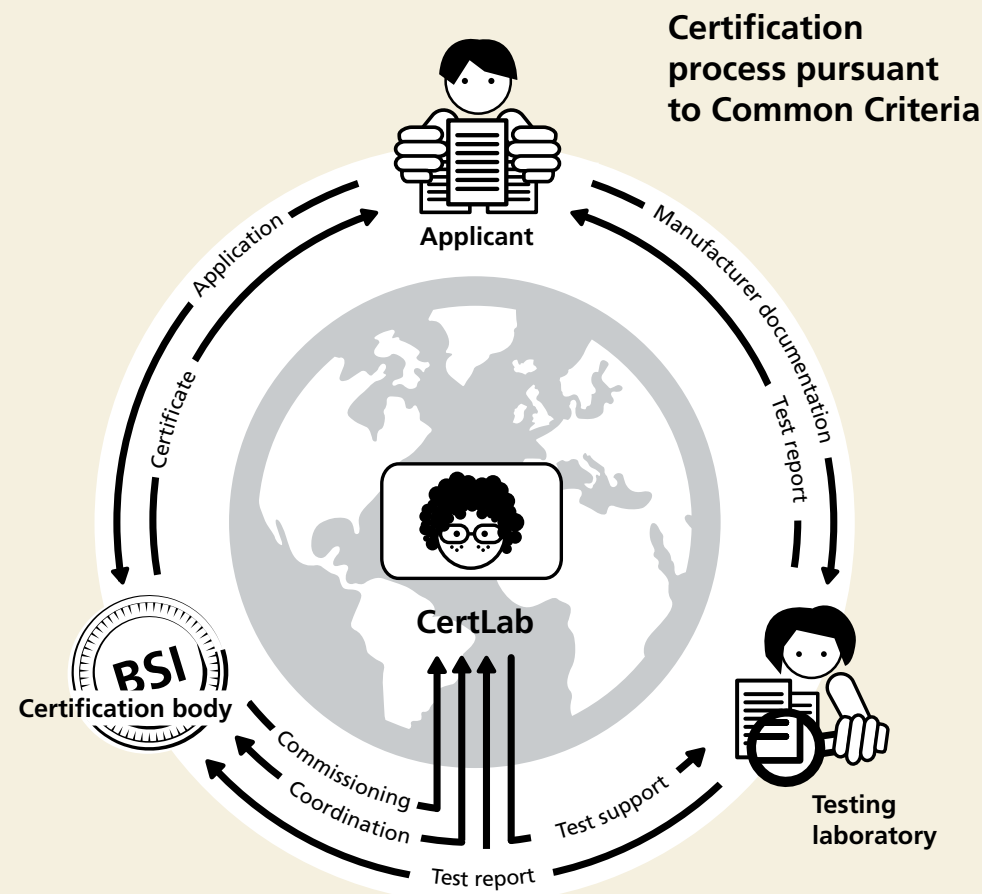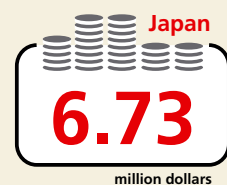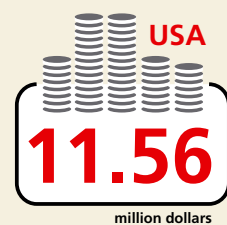**You work with FOKUS in the ÖFIT competence center. What's your goal here?**
Our cooperation with FOKUS in the Public IT (ÖFIT) competence center aims to establish sustainable, high-quality research to accompany a public IT architecture in Germany. Individual aspects of this have been investigated in healthcare, e-government and energy, for example, but we haven't had an overview of where the state is actually shaping IT.

We expect ÖFIT to provide this overall view, carry out more in-depth interdisciplinary research in individual fields and identify trends in public IT. The combined competencies of FOKUS in the fields of e-government, architectures and standards as well as telecommunication are a very good foundation for this complex task. Together with ÖFIT, we are developing communication formats which make these research findings more accessible to policy makers and public-sector employees and facilitate the necessary discussion of IT issues in society.

ABOUT THE INTERVIEWEE

Martin Schallbruch is the Chief Information Officer of the German Federal Ministry of the Interior (BMI) and deputy to the German Federal Commissioner for Information Technology. He is responsible for IT strategy and controlling within the federal government and for coordinating cooperation between the federal government and states through the IT Planning Council. His department manages the federal government's IT and e-government projects and the implementation of its national e-government strategy. His responsibilities extend to cybersecurity and IT security policies, the Federal Office for Information Security, the Federal Office for Information Technology (BIT), and passport and ID card services. Before being appointed CIO, Schallbruch was the personal assistant to the State Secretary at the BMI until the end of 2001. After earning a degree in computer science from the Technical University of Berlin, Schallbruch was a research assistant at Humboldt University in Berlin, where he was also head of an IT service center. He joined the federal government in 1998.

Costs due to cyber crime in 2013, per company

USA
11.56
million dollars

Germany
7.56
million dollars

Japan
6.73
million dollars

Certification process pursuant to Common Criteria

Applicant

Application

Certificate

Manufacturer documentation

Test report

CertLab

BSI
Certification body

Commissioning
Coordination

Test support

Testing laboratory

Test report

SECURITY IN CYBERSPACE

In 2013, the number of successful cyberattacks on companies rose by 20 percent worldwide compared to the year before. In the USA, the attacks led to average costs of 11.56 million dollars for companies with more than 1,000 employees. In Germany, it was 7.56 million.* To prevent a massive rise in cyberattacks, digital identity theft, IT system penetration and the unauthorized interception of e-mail, authorities and research institutes are working together on a standardized international certification program.

WORLDWIDE CERTIFICATION

One of the institutes involved in this is the CertLab, which is run by Fraunhofer FOKUS on behalf of the BSI. Through the CertLab, FOKUS is monitoring certification processes for products such as smart cards, smart meters, operating systems and firewalls in accordance with the Common Criteria for Information Technology Security Evaluation (CC). The CC standard is an internationally recognized collection of criteria for evaluating IT security products. Compared to other international guidelines, it is relatively new. Its development began in 1993 with an attempt to harmonize European, American, Canadian and German security standards. In 1999, the CC was adopted by the International Organization for Standardization as ISO/IEC 15408. The CC is used to evaluate the functionality and trustworthiness of a system. CC certification is recognized internationally up to Evaluation Assurance Level 4, which means that the product has been "methodically designed, tested and reviewed".

In January 2014, the BSI announced that 16 million e-mail addresses had been stolen. International certification should help remedy this problem.

SEVEN TO EIGHT CERTIFICATION PROCEDURES PER YEAR

When a company launches a new product, it turns to an accredited evaluation facility for certification and submits a certification application to the BSI. The BSI then commissions the CertLab to monitor the evaluation process. While the evaluation facility carries out the actual evaluation, such as software testing, the CertLab monitors the evaluation process and comments on the corresponding documents. FOKUS takes part in seven to eight certification procedures each year. The BSI is the authority responsible for these procedures and for issuing certificates. "We've worked with Fraunhofer FOKUS since 2010," says Bernd Kowalski, president of the Department for Secure Electronic IDs, Certification and Standardization at the BSI. "Their expertise in the fields of software quality assurance and test method development make the certification process much smoother, particularly when it comes to evaluating functionality and vulnerability tests." To keep up with new cyber threats and the fast pace of today's IT products, the scientists at Fraunhofer FOKUS are also focusing on certifying products as they are being developed. Through "security by design", the security standards required for certification are taken into account during the development process and monitored through the entire life cycle of the product. This can speed up certification procedures and cut through bureaucracy. Other focal points include test automation and compositional testing methods. The former entails the automatic generation of test cases and the automation of the testing process, while the latter deals with the interplay of individual components in the system as a whole. "Fraunhofer FOKUS brings together standardization expertise and current research into innovative development methods. This enables us to react quickly to new certification requirements and new threats in cyberspace," says Jens Fromm, head of the Public IT competence center.

*Ponemon Institute: 2013 Cost of Cyber Crime.

Authority for IT security

The German Federal Office for Information Technology Security (BSI) was founded on January 1, 1991, and is part of the Federal Ministry of the Interior. The BSI is an independent and neutral body for questions relating to IT security in the information society. As an official authority, it is unique compared to other European institutions. It currently employs around 600 computer scientists, physicists, mathematicians and other individuals. The BSI headquarters are in Bonn.

Animal oracle: During the 2010 World Cup, Paul the Octopus correctly predicted match results eight times in a row.

BIRD FLIGHT AND DIVINATION

Trend research and futurology have been used for political consulting purposes since the dawn of time. Kings and emperors employed these methods on the eve of battle, to plan states, to assess their political opponents, or to consolidate their own status. Studying the stars in the sky, animal sacrifices and birds in flight were popular ways of seeing into the future, as were divine oracles and trance-inducing gases. Today's trend research is much more mundane – and more arduous: The researchers of the Public IT (ÖFIT) competence center analyzed 60,799 publications, 972,675 word pairs and 587,059 references to magazine articles to reach the conclusions in their *Fields of Innovation in Public IT* trend report. But more about that later. Research-based political consulting even existed in antiquity: "The Oracle of Delphi was far more than just an institution of religious proclamation. It was a think tank run by a secular-religious priestly caste which collected the political, social and economic knowledge of the Classical age and systematized it over the course of nearly 1,000 years for the benefit of the wider world," writes the well-known German futurist Matthias Horx on his website. Instead of a broadband connection, the priests had "fast young runners who moved between the city-states" and gathered information. Even today, scholars debate how much influence those who oversaw the Oracle of Delphi had on the sibylline predictions of their medium, the Pythia, and how much background knowledge informed her predictions.

ANCIENT TREND RESEARCH

It has been proven that even in the fifth century B.C., sources were evaluated, group discussions were held and networks were cultivated so that credible predictions could be made about the future. But different demands were placed on those who consulted the Oracle: "Know thyself" and "nothing in excess" are thought to have been inscribed over the entrance to the temple in Delphi. These maxims encouraged every single person to define their own position and act in moderation.

METHODS AND FINDINGS OF THE ÖFIT TREND REPORT

"With the ÖFIT trend report, we want to make a regular contribution to the discussion about the future of the digitization of society," says ÖFIT director Jens Fromm, explaining the new publication. To predict trends reliably, the researchers combine different social scientific methods in three modules which build on one another. In the first module, *information*, sources and data are collected, processed and evaluated. This data may come from scientific journals listed in the Science Citation Index, for example. The second component, *communication*, is used to validate the results. Previously identified trends are evaluated by experts, and then in the third module, *immersion*, the findings are examined in more detail, expanded and extrapolated for the future. For the *Fields of Innovation in Public IT* trend report, the researchers identified four trends. The first: In the future, IT deliverables will take the form of services. *Anything as a Service* (XaaS) denotes the trend that carries this principle over to all IT services. Services can be bundled and delivered together here, but they are currently still very heterogeneous. This is why standardization – particularly in regard to the quality and description of services – is a key task for the near future. Trend 2: More and more electronically readable data will accumulate in the course of digitization. This will lead to a *sea of data*. One of the biggest challenges facing IT in the future will be to link and analyze all of this data and make predictions based on it. Trend 3: *Wireless sensor networks* will also supply data. Individual sensors are like the sense organs of modern IT. In the future, these will increasingly become connected and self-organizing. Trend 4: With IT as its foundation, even the energy market of the future will change fundamentally. All energy consumers and generators will be linked in intelligent networks known as *smart grids*. Supply and demand will be optimally coordinated with one another. The first ÖFIT *Fields of Innovation in Public IT* trend report appeared in November 2013. The second edition, *Public Information Technology in the Digitized Society*, was published in July 2014.

BOUNCERS IN THE SMART CITY: DISCUSSION IS POINTLESS

"There are a lot of fairytales online about how to get in, but you should just be yourself. The people at the door can tell if you are pretending to be something you're not," writes the Telegraph journalist Scott Campbell, describing his attempt to get into the Berghain nightclub. Weekend after weekend, the hedonistic Easyjet generation seeks out up to 72 hours of fun, exuberance and techno in big cities like Berlin, New York and Tel Aviv. Berlin clubs in particular have an unsurpassed reputation worldwide, one which is nurtured by legendary spots like Berghain, Bar25 and Kater Holzig. Their party culture is just as famous – or infamous – as the impenetrable selection policy of what's reputed to be the toughest door in Europe. For years, those who claim to know the scene have tried to crack the bouncers' code in countless dos and don'ts: "Dress stylishly (black). Go in small groups. Shut up in the queue!" says blogger Evo Lucian. But many comments attest to the minimal success of such tips: "They were both dressed in black and in the correct age bracket. But both were refused entry."*

IT EITHER FITS OR IT DOESN'T

What do door policies have to do with Smart City technologies? A lot. This becomes clear when the few statements made by bouncers about the right kind of "club identity" are compared with the authentication technologies of the Next Generation ID innovation cluster. To access the infrastructures of the Smart City, you need the right ID at each stage of the process. In both worlds, identity is more than just a name, a birthdate or a perfect appearance. It's always about the complete package. It's about making sure that the decision on right or wrong is clear and final, but also inscrutable. "It either fits or it doesn't" applies to all kinds of identities. The process chains have to be maintained from start to end in order to generate the right ID. If just one component is out of place, it means "no entry" – at Berghain and in technology.

BECAUSE WE DECIDED

Digital identities have become the basis of our entire networked society. It is extremely difficult to create, protect and use them, however. Interconnectedness makes ID management an essential cross-sectional technology. This is why interdisciplinary partners from research, industry and administration are working together in the innovation cluster. Their goal is to develop holistic authentication technologies (end-to-end authentication) for people, objects, processes and services. For each area of application, widely applicable prototypes are being developed which can be permanently integrated into the processes of a Smart City. In the field of Smart Mobility, for example, electronic personal IDs can unlock cars for their drivers. In the intelligently networked city – and the legendary nightclub – capable gatekeepers make the right selection decisions. The decisive factor in each situation is the amount of trust placed in their abilities. In both cases, a decision that may seem random to the person seeking access has actually followed a clearly defined, invisible functional principle: "Sorry, you're not getting in. Why, I asked. Because we decided." This is how is should be in the Smart City, too. The identification process can't be decoded from the outside – and that's why it works. In the innovation cluster, security is taken to an even higher level because the identity check goes both ways: Drivers have to identify themselves to their vehicles, but the vehicles also have identities which they use to authenticate themselves with the transport structures and infrastructures of the Smart City. This Internet of Things should prevent traffic jams, maintain compliance with CO_2 guidelines and determine optimal routes which include public transport connections. Five Fraunhofer Institutes and over 20 partners from industry and administration are making it possible to implement this in actual projects and prototypes that can be modularly integrated into all of a city's processes. The result is a detailed and continually growing portfolio of solutions for a "Secure Identity Roadmap 2020". This should bring about something that already works in the club scene: Europe's toughest ID door.

The Telegraph.

PROJECTS

DEMIS: NOTIFICATION SYSTEM FOR INFECTION PROTECTION

Duration: March 1, 2012 to March 31, 2014

In response to the EHEC incident in mid-2011, the German Federal Ministry of Health (BMG) and the Conference of Health Ministers of the German federal states agreed to improve the existing system for monitoring infectious diseases and pathogens by expanding the use of electronic procedures. To this end, the BMG commissioned a concept for a German Electronic Notification System for Infection Protection (DEMIS) in April 2012. The concept was to be validated at the same time on the basis of a prototype implementation. The system requires a very high degree of flexibility when it comes to defining notifications and their content so that potential outbreaks can be handled appropriately and, above all, quickly. Through the consistent and coordinated use of the HL7 FHIR (Fast Healthcare Interoperability Resources) and CTS2 (Common Terminology Service) e-health standards, the DEMIS pilot study was able to show that existing approaches are suitable for comprehensively and successfully facing these challenges.

www.fokus.fraunhofer.de/go/en_demis

IPV6 PROFILE FOR PUBLIC ADMINISTRATION

Duration: May 1, 2011 to December 31, 2014

The public authorities in Germany have started migrating their systems from the old IPv4 address standard to the new IPv6 standard. In its IPv6 Profile of the Public Authorities, FOKUS explains the minimum standards necessary for ensuring interoperability and protecting investments in new devices. A migration guideline describes examples of relevant IPv6 migrations. The project is embedded in a coordinated program relating to IPv6 carried out by the German Federal Ministry of the Interior and the Federal Office of Administration.

www.fokus.fraunhofer.de/go/en_ipv6

OPEN CITIES: INTERNET SERVICES FOR SMART CITIES

Duration: November 1, 2010 to December 31, 2013

The Open Cities project unites three current areas of research (open innovation, future Internet services and living labs in smart cities) to facilitate innovation in the civil service. This is achieved through cooperation between industry and applied and fundamental research in five European cities: Helsinki, Berlin, Amsterdam, Paris and Barcelona. In this project, new technology platforms were developed for the urban management of innovation, open data and sensor networks. Fraunhofer FOKUS coordinated the Europe-wide specification. It also developed and maintained a technology platform for managing open data. Furthermore, FOKUS handled the multi-city integration of the data portals and showed that they could be used in a multilingual tourist app.

www.fokus.fraunhofer.de/go/en_opencities

PUBLIC IT WHITE PAPERS

In May 2014 the ÖFIT competence center published its sixth white paper, this time on the subject of standardization for public IT. It focuses on the purpose, benefits, problems and risks of standardization processes and solutions for public authorities. The white paper looks at whether existing public IT standards can meet future digital challenges. It should form the basis for farther-reaching discussions about standardization.

The paper is part of a series of publications examining different aspects of public IT on the basis of five to eight core propositions. After introducing the respective topic, each white paper describes the associated challenges and concrete solutions. The publications end with an outlook on future developments.

White papers have been published on the following topics in addition to standardization: advanced networks, trustworthy digital identity, digital mobility, big data and public information technology. These white papers round out the range of research publications from ÖFIT, which includes the ÖFIT trend report for identifying public IT trends at regular intervals as well as expert reports on special issues such as cloud computing in public administration and digital participation.

www.oeffentliche-it.de/publikationen

E-GOVERNMENT

The history of written administration starts no later than in China back in the year 105 A.D. The eunuch and court official Ts'ai Lun revolutionized the imperial authorities by introducing an invention that remains the medium and epitome of bureaucracy today: paper. Every single person in Germany uses 244 kilograms of it each year, while the federal authorities use 6,600 tons. And this has become a problem: File storage alone costs the Australian government 200 million Australian dollars annually.

E-GOVERNMENT IS A QUESTION OF WILL

But the mountains of files are just the manifestation of a much bigger problem: The authorities' system of organization is outdated – when it comes to administration itself and the needs and participation of companies and citizens. German companies are subject to 10,000 reporting requirements, and a handwritten signature is needed for 3,500 administrative processes. Not only do these processes cost 40 billion euros a year, they are simply absurd in the age of digital communication. With today's instant-gratification mentality, waiting two hours for a new driver's license or five hours to register a change of address inevitably leads to headlines like those found in the Bild newspaper: "Waiting just to take a number" and "The snail office". Frustration with "inefficient", "time-consuming", "expensive" and "opaque" administrative policy is usually taken out on the civil servants – but many of these issues could have been solved technically a long time ago. Estonia's government has been entirely paper-free since the year 2000. A country that was still considered technologically backward in 1990 is now perhaps the most digitized nation in the world. With their electronic personal ID, Estonians can submit tax returns online, pay parking fees, retrieve medical prescriptions or set up companies. Even the NSA couldn't crack Lavabit's encryption. The Danes are already catching up: The majority of Denmark's 5.5 million citizens can already log in with their NemID to take care of bank transactions and bureaucratic procedures outside of opening hours. E-government nations view the state as a cooperative service provider. Administration is not an end in itself, it is there for the citizens, so offers and services are available on a central online platform in the form of a one-stop government. Government portals like www.korea.go.kr are accessible to companies and citizens alike, around the clock, for handling a variety of matters. Anyone can receive all official correspondence and bills by e-mail if they want. The broadband strategies of this e-government avant-garde make the best possible use of the efficiency offered by the cloud. Singapore, Australia and the USA have long banked on cloud computing for e-government, but most countries in Europe are still struggling.

E-DEMOCRACY: TRANSPARENCY AND PROXIMITY TO CITIZENS

But e-government is more than just electronic data traffic. Modern states act transparently and involve their citizens in political decisions. An open government like this depends on openly accessible data and direct participation in decision-making processes. To date, however, only 24 percent of Germans are satisfied with the existing possibilities for direct citizen participation. The OECD has identified open government as one of the most important goals of the 21st century and declared that the right to information is a human right. Citizens and governments can mutually benefit from this. Informed citizens can use their mobile phones to report damage to a road or express interest in WiFi in the park, for example. This supports city administrators and makes citizens feel like they are being taken seriously. E-government has a long history at FOKUS. Since 2004, the Institute has been developing architectures, standards and solutions for efficient, secure administrative processes which enable greater public accessibility, transparency and efficiency. As a neutral platform, the solutions always take all parties in the e-government process into account during development: administrators, citizens and businesses.

Demokratie verteidigen*

With over 70 million users from 196 countries, change.org was the largest online petition platform in the world in July 2014. More than 500,000 petitions have been started worldwide so far. Over 25,000 new petitions are added each week. The platform was launched in Germany in July 2012 and has reported 39 success stories since then.

change.org/de

Stand up for democracy!

In Singapore, waiting in line at an office is an exception. Submitting tax returns, applying for a driver's license or arranging a funeral – nearly everything can be done online. 88 percent of citizens already use the 1,600 web and 300 mobile services available. 96 percent of them are satisfied.

ida.gov.sg, fr-online.de

> "I don't really believe in national or regional solutions when it comes to cloud computing because the cloud is global by definition."

WE NEED A UNIFIED CLOUD MARKET IN EUROPE

Neelie Kroes, Vice President of the European Commission, talks about cloud computing in Europe, strategies for protecting national data and the need for an open mind and open standards

When you want to communicate securely and reliably, which channels do you use?
I use a wide range of communication channels, especially Skype, to keep in touch with my little granddaughter in California. But if something's really confidential, then I arrange a face-to-face meeting or use the specially protected e-mail systems of the European Commission.

How secure are current cloud technologies?
Cloud services offer most users a higher level of security than they could get if they used their own infrastructure, platform or software. Cloud service providers often have greater expertise and better skills for tackling IT security risks. Nonetheless, there are always certain risks when using cloud services. But these risks apply to most Internet-based technologies and can usually be mitigated with the appropriate measures – such as carefully choosing, managing and encrypting your passwords.

In the wake of the NSA scandal, there were calls for national cloud solutions to protect national data. But you want a unified European cloud for the public sector – why?
I don't really believe in national or regional solutions when it comes to cloud computing because the cloud is global by definition. It's mainly the issue of scale that demands a unified cloud market in Europe. This is the only way we can keep up worldwide. But we also need strong international dialogue if we want Europe to be able to fulfill its potential in cloud computing. Finally, the public authorities and private sector have to work together to make cloud computing secure and reliable. To achieve this, I launched the European Cloud Partnership with 20 high-ranking representatives from the public and private sectors. The partners recently published a "Trusted Cloud Europe" policy vision document, which formulates recommendations for the further development of cloud computing in Europe. I also

support the Cloud for Europe project, which aims to establish shared bidding requirements for cloud computing in the public sector.

Who will manage the European cloud network, and what role will politics play in this?
Cloud service providers must be capable of working in different countries and across borders, and cloud customers must be able to take advantage of services offered in other countries. Politics naturally plays a role here, because cross-border data traffic is still not always possible. This is why the European Cloud Partnership has proposed the establishment of a common understanding of best-practice solutions in Europe. To create a unified cloud market, we at least have to reach a government-level agreement concerning shared security and data protection regulations and shared quality guidelines for the industry. We also have to think about the interoperability of cloud services so that data and applications can function seamlessly between different clouds.

What incentives could the EU and politicians offer to encourage member states to adopt a European cloud strategy for industry?
Cloud computing offers a lot of advantages in and of itself, including cost savings and a high degree of flexibility. Nonetheless, we need to increase the level of trust in and transparency of cloud computing. In the context of our cloud strategy, the European Telecommunications Standards Institute (ETSI) mapped existing cloud standards, and the European Union Agency for Network and Information Security (ENISA) cataloged cloud-related security certification programs. We are also working with industry to support secure and fair contractual provisions, such as templates for quality guidelines that cloud service providers should follow, and a code of conduct for data security.

What role do open data, big data and cloud technologies play in smart cities?
Cloud technologies, big data and open data are all part of the fabric of smart cities. Their combined use brings about

new business models and helps city authorities understand cities better so they can improve them. This is all thanks to new, previously inaccessible data as well as analysis and automation tools.

What is the best way to organize these different trends in development?
By ensuring that they all contribute to a common goal. To take full advantage of the trends, we need a) interoperability on the technological level and b) compatibility and transferability for open data between domains – and, of course, the opportunity to share our experiences with each other in Europe.

ABOUT THE INTERVIEWEE

Since 2010, Neelie Kroes has been Vice President of the European Commission and EU Commissioner for the Digital Agenda. She is responsible for ensuring the reliability and security of Internet and technologies and establishing globally competitive communication, research and innovation in this sector. With the Digital Agenda, she hopes to make the most of digital technologies through access to fast broadband, for example, in order to support the European economy and society. Neelie Kroes was a member of various company executive boards before she started working for the European Commission in 2004.

Weltbevölkerung

Ken Lum's "Pi" multimedia installation in Vienna is an example of public data art. Real-time data such as the "growth of the Sahara" or "global defense spending" prompts passers-by to think

GOLD IS FOR EVERYONE

"2012,505, 'Wales,' 'Gwynedd,' 'A5,' 'PU,' 256000, 371400, 'A487,' 'A4087,' 2.90, 1.80, 78.00, 79.00, 11112.00, 177.00, 1336.00, 58.00, 4.00, 2.00, 1.00, 3.00, 5.00, 75.00, 12780.00" – something like this can save lives. This jumble of numbers and letters is displayed in line 261,367 of a very, very long Excel table. What looks like a secret code at first glance actually describes the traffic on one of London's main roads. "The superb new London 'Datastore' will unleash valuable facts and figures that have been languishing for far too long in the deepest recesses of City Hall," announced London's mayor Boris Johnson in 2010. He was right. That same year, the personal injury lawyers and cycling fans Tim Beasley and Kevin O'Sullivan created the Cycle Injury Map using datasets from the British Open Data Portal. This free map visualizes one of London's biggest road traffic problems with shocking clarity: Each year, 150 cyclists die on the city's bike-unfriendly streets. This can force politicians to take action. In February 2014, Johnson responded by announcing that the city would invest 300 million pounds in the construction of safer cycle and pedestrian paths at 33 of the most dangerous junctions.

DATA HAS THE POTENTIAL TO BECOME A WORLD POWER

Open data is an open source of knowledge. There's a reason data is known as the new gold. But data out of context is just a mass of numbers and letters. Only when pieces of data are connected does their tremendous potential unfold. The World Bank, IMF and the international stock market are already demonstrating this with the proprietary datasets upon which they base their forecasts and recommendations. Such datasets are a guarantee of influence, business and business models for global players. But is open data any less valuable? Absolutely not. Open data takes a fundamentally different approach, however. Open data – especially data from the public sector – should benefit everyone. Transparency should make governments more responsible and administrations more efficient. New apps and services will stimulate innovation and economic growth.

PROSPERITY WITHOUT A GARDEN FENCE

There are now many examples of successful applications and business models that were made possible by open data. The Global Positioning System (GPS) was originally developed by the American military. Its data was released in 1993, and now the navigation system manufacturer TomTom generates revenue of around one billion euros annually with it. But open data is not just economically important. Socially, too, the release of publicly financed datasets should lead to a culture of open government in which citizens work actively with the state for more democracy. In the UK, open data has already proven to be a lifesaver many times over. After the mortality rate following heart surgery was published in 2005, it declined by 21 percent in the space of 5 years. Openness is more than just a name to Fraunhofer FOKUS. Though the Institute was founded primarily to develop open communication networks as an alternative to the IBM monopoly, open systems and infrastructures are now the foundation for all areas of application – from the automotive sector to e-government. When FOKUS implemented the concept for the GovData portal in February 2013, it helped the German federal government take an important step in the direction of open government. Today FOKUS hosts the portal. The first apps using geodata and traffic data – such as a tool for efficiently managing traffic flows and energy supplies – have already been developed, and others are being planned.

Even experienced administrators can spend more than ten hours filling out forms for their newborn.

AN ADMINISTRATIVE OBSTACLE COURSE WITH THE BABY

Having children is relatively unpopular in Germany. Around one in four women in Germany never have a child. Schleswig-Holstein is the German state with the lowest birth rate. This is also where Sönke Schulz lives and works. He is the 34-year-old father of a five-month-old son, and he is involved in the field of e-government and management sciences at the Lorenz von Stein Institute. In December 2013, he embarked on his adventure in fatherhood, complete with parental leave and – less pleasantly – a lot of red tape. In "30 Days of E-Government: Report From a New Father", he describes the unnecessarily complicated administrative procedures that parents are saddled with just as their lives have become a rollercoaster of unbridled joy and sleepless nights. "It starts with registration. A child has been born and the records office wants to know about it. So far, so good. But the information from the maternity hospital isn't enough. They need originals or notarized copies of the parents' birth certificates and their marriage certificate (Section 33 of the Personal Status Statute). That's when I start to wonder: We couldn't have gotten married without our birth certificates (Section 12 of the Personal Status Statute). So shouldn't our marriage certificate be enough? Or why can't they get the data they need from the national registers? […] Next issue: The forms for child benefits, parental benefits, child-rearing provisions for retirement payments and much more. As an avowed supporter of electronic administration, I'm delighted to find almost all of the forms online as PDF documents. But you usually can't fill them out electronically. And submitting them electronically? No way! So you have to print them out and mail them to the authorities by post."*

And that's not all. Expectant and new parents are faced with up to 19 different information requirements, from registering the birth to applying for family allowances and benefits. But there is no central information platform for this and no centralized authority responsible for the largely identical information required in such "life situations", as they're known in administrative jargon. In concrete terms, this means that parents have to click their way through endless websites and read all sorts of brochures so they can draw up an official checklist themselves. If you Google "expectant parents applications", you'll see that baby food manufacturers, health insurers, charities and parenting magazines have all put together their own checklists and "bureaucracy road maps". But if you look for information from the authorities themselves, you'll search in vain.

Sönke Schulz's "life situation" – the birth of a child – was the start of his own personal bureaucratic marathon. Both parents have to visit the vital records office and residential registration office to register the birth, while the state social services office is responsible for parental allowances, and the family benefits office or employment office is responsible for child benefits. The German pension system demands that parents submit a joint declaration of the time spent rearing their children, and some federal states also require three mandatory medical check-ups until the child is five weeks old, all of which must be reported. In addition to the time spent gathering this information, Sönke Schulz needed a good ten hours just to fill out the forms. And this time is in short supply after a baby has been born.

ONE-STOP CITY: ONE-STOP SERVICES

The birth of a child, moving, tax returns or a sudden need for nursing care – in all of these situations, citizens want guidance and government authorities want prompt action. But countless contacts, authorities and applications stand in the way of a process that is efficient and satisfying for everyone. Since the 1990s, so-called "one-stop government" approaches have aimed to centrally bundle all information and requirements. The internal division of administrative labor can be maintained, but it remains invisible to citizens behind an online platform. Berlin has vowed to become a one-stop city by the year 2016. Not only is this technologically, legally and administratively feasible, it is also desirable from demographic and financial points of view.

*"30 Days of E-Government: Report From a New Father", government2020.de.

Virtual marketplace – goBerlin

FOKUS worked with partners for the one-stop city to develop the goBerlin virtual marketplace where residents, businesses, government authorities and developers can come together. Residents can use apps to find the commercial and public administrative services they need for their particular life situation, while developers can offer these apps for each life situation in the marketplace.

PROJECTS

STUDY: A SOCIAL NETWORK FOR PUBLIC AUTHORITIES

Duration: August 1, 2012 to December 31, 2013
Fraunhofer FOKUS and the German University of Administrative Services in Speyer looked into the possibilities, challenges and options for realizing social networks for public authorities. Internal administrative social networks can speed up the exchange of knowledge, break open the culture of information silos and encourage administrative cooperation. From a demographic standpoint alone, it is important for information to remain available in a network even after employees have left. The study presents ten recommendations for the legal, organizational and technical properties of such a social network.
www.fokus.fraunhofer.de/go/soziale_netzwerke_studie

GOVDATA: THE DATA PORTAL FOR GERMANY

Duration: January 1, 2012 to June 30, 2014
GovData is the open data portal for Germany. A prototype has been online since February 2013. It started with just over 1,000 datasets from the federal, state and local governments. Now around 5,500 users each month can access six times that amount of data. The portal aims to give citizens – especially software developers, data journalists, graphic designers and other professional users – easy access to the data of the public authorities to promote the use of this data for the benefit of everyone. In this cooperative project with the BMI, Fraunhofer FOKUS drew up the basic study and designed the architecture, and it has hosted the portal since it was launched.
www.govdata.de

CLOUD FOR EUROPE

Duration: June 1, 2013 to November 30, 2016
In this FOKUS-coordinated project, 23 partners from 11 countries are working on a European cloud strategy. The goal is to determine the requirements of the public sector and to develop usage scenarios. The kick-off conference hosted by FOKUS was held in the fall of 2013 together with the Steering Board of the European Cloud Partnership, and it brought together over 250 leading thinkers from politics and IT. The central question was how to ensure security and create trust in cloud technologies. In August 2014, over 10 million euros will be distributed for a pre-competitive tender for cloud solutions.
www.cloudforeurope.eu

STANDARDIZED IT WORK-PLACE FOR THE STATE OF BERLIN: THE BERLIN PC

Duration: August 1, 2013 to December 31, 2014
The Berlin administrative authorities have around 75,000 PC workplaces which are very complicated to maintain due to a variety of non-homogeneous regional solutions. A standardized IT workplace (BerlinPC) should help establish a modern, secure, powerful and cost-efficient software, services and system architecture. BerlinPC is the central platform for running the special applications of each department. It enables location-independent access to applications and data, reduces the number of fault-prone interfaces and the amount effort expended on IT measures, and will make it easier to automate IT operations in the future.
www.fokus.fraunhofer.de/go/en_berlin_pc

TAG.CHECK.SCORE.

Duration: November 1, 2011 to October 31, 2014
To open up the image archives of the Berlin Ethnological Museum to the public, the museum and Fraunhofer FOKUS developed the Tag.Check.Score. crowdsourcing app in the context of the Code for Europe initiative. The app is based on the idea of digital volunteer work. With the app, users can add metadata to the museum's photos, correct existing tags and earn points doing so. The goal of Tag.Check.Score. is to develop an open-source solution that other museums, libraries and archives can also use to tackle similar challenges.
www.fokus.fraunhofer.de/go/en_tag_check_score

POLICY COMPASS

Duration: October 1, 2013 to September 30, 2016
The Policy Compass research project of the EU is developing solutions for using European open data resources more effectively. This will help policy-makers and citizens analyze and assess the actions of government and administration. The methodology and tools developed in the project will be evaluated in pilot tests with local authorities and policy-makers in Great Britain and Russia.
www.policycompass.eu

E-HEALTH

Demographic change, longer life expectancy and the associated increase in age-related chronic diseases call for a structural change in the provisioning and financing of healthcare. Information and communication systems make it possible to tackle the challenges of an increasingly complex healthcare system with innovative and scalable solutions.

HEALTH IN THE CITY

Noise, grime, stress: Living in big cities and conurbations takes its toll on health. The World Health Organization (WHO) sees a direct link between a region's exhaust pollution and the frequency of cancer in the population. For example, the German cities with the highest population density – Berlin, Hamburg and Bremen – also have the highest rates of lung cancer among women and the third-highest rates of tumor diseases among both men and women in Germany. Nonetheless, more and more people are seeking out an urban life. According to global urban development forecasts, 70 percent of the population will live in cities by the year 2050. As a result, cities will have to adapt to a growing demand for medical care. While health risk factors are cause for concern in urban areas, the lack of healthcare providers is a serious problem in rural areas. Major gaps have been identified in the eastern German federal states in particular. According to TNS Infratest, only 44.6 percent of the population in these states is satisfied with its medical care. This situation is likely to grow more acute in the coming years, as around 51,000 family doctors and specialists throughout Germany will retire by 2021. Recent figures from statutory health insurance associations show that Germany is already lacking around 2,600 family practices and 2,000 specialist practices, including 1,250 psychotherapy practices.

MAINTAIN QUALITY AND REDUCE COSTS

Developing countries are also struggling with a shortage of doctors, and poverty makes the health situation even worse. According to the latest report from UNICEF and WHO, 770 million people still have no access to clean drinking water. 2.5 billion people have inadequate sanitary facilities. The patterns of disease in many developing countries closely resemble those in Europe at the end of the 19th century. Industrialized nations face very different challenges: They have to cope with an aging population. The German Federal Statistical Office has predicted that the proportion of over-60s will be twice as high in 2050 as the number of newborns. Even now, aging is largely responsible for the increase in age-related and chronic diseases, resulting in rising costs and organizational effort in healthcare. Elderly people in particular need health services that are close to home, and sometimes home care as well. More efficiency, less bureaucracy, and maintaining or improving the quality of healthcare are the greatest health policy challenges in the cities and rural areas of industrialized nations. The healthcare system must adapt to social developments such as an aging population and the rising costs that go with it in order to guarantee high-quality medical care in the future. IT systems provide the tools that make it possible to confront the challenges of an increasingly complex healthcare system with innovative and cost-efficient solutions. The digitization of conventional processes is driving the creation of integrated IT-based solutions, interoperable communication and cooperation platforms, regional care networks and patient-oriented telemedicine applications.

Five percent of the German population is over 80 years old. By 2030, this figure will rise to 8.3 percent. Life expectancy is related not only to gender but to income: 65-year-olds from wealthy households in Germany have a longer life expectancy than people with a low income. This amounts to a difference of five years for men and three and a half years for women.

de.statista.com, diw.de

Nutrition, fitness, behavioral change, sleep: Health and lifestyle apps play the role of a "coach" offering users professional guidance, feedback and motivation. Around 200,000 apps are currently available in the health-related categories of the Android and iOS stores, illustrating the trend towards the "quantified self".

ZTG Center for Telematics and Telemedicine, press releases, project news, 2013

Health spending amounted to around 300 billion euros in Germany in 2012. It has risen by 25 percent since 2005. Spending for hospitals rose by 27.4 percent and for doctors' practices by 28.3 percent. The rise in outpatient spending was 58.7 percent.

dkgev.de

In Germany, there is one doctor for every 230 residents. In Malawi, two doctors look after 100,000 people. Medical specialists are in very short supply in Southeast Asia and Africa in particular. While industrialized countries try to compensate for the doctor shortage by hiring foreigners, medical tasks are passed on to less qualified caregivers in developing nations.

World Health Statistics 2010, bundesaerztekammer.de

Percentage of the over-80s in the total population

5,0% over the age of 80

2013

of the total population

8,3% over the age of 80

2030

of the total population

Telematics infrastructure

Doctor

Dentist

Hospital

Pharmacist

Health card (eGK)

Electronic patient record

Communication network

Doctors' contact details
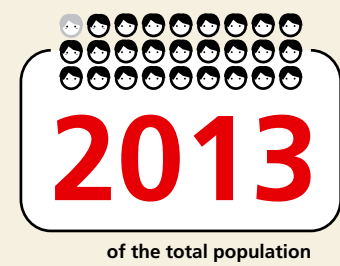
Referral letters
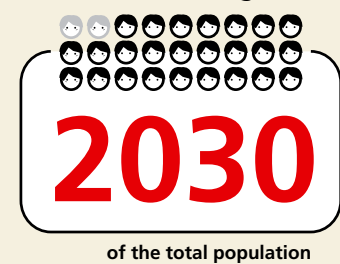
Telematics Infrastructure (TI)
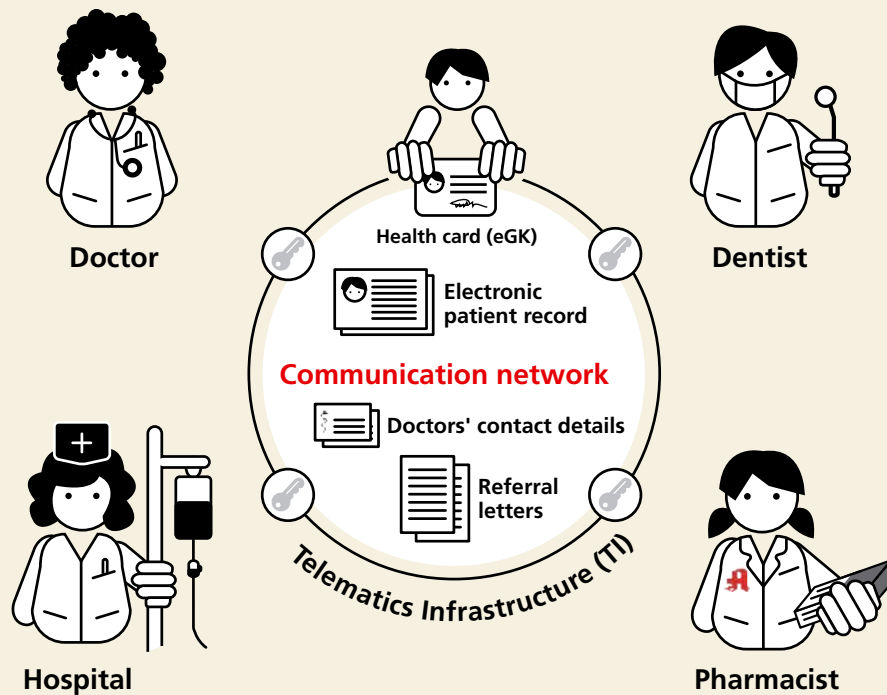
DATA HIGHWAY INSTEAD OF SNAIL MAIL

The working day in a German doctor's office is very "papery": A family doctor will receive an average of 670 referral letters per quarter, 95 percent of them on paper. When a referral letter arrives at a practice, it is usually scanned so that it can be used and archived as an electronic document. A good 80 percent of family doctors electronically document their patients' data. In the age of digital communication, this transfer is actually unnecessary – not to mention inefficient and risky in terms of protecting patient information.

A UNIFIED GERMAN TELEMATICS INFRASTRUCTURE …

A shared telematics infrastructure (TI) which efficiently and securely connects doctors, pharmacies, hospitals, patients and insurers should provide relief. One central component of this TI is the electronic health card (eGK), which was approved in Germany back in 2003 with the Statutory Health Insurers Modernization Act and has been rolled out across the country since 2012. To introduce and develop the eGK and TI, the Central Associations of Self-Governing Organizations – consisting of doctors, pharmacists, dentists and health insurers – founded gematik, a company dealing with telematics applications for the health card, in January 2005.

The decision to create a telematics infrastructure was made back in 2003. In spring 2015, it will finally be rolled out.

This company is responsible for technical specifications, testing, product approval and, last but not least, operations. The telematics infrastructure – the creation of which is regulated by the German Social Code (Book V, Section 291a) – can do much more than just exchange referral letters. The technological backbone of the TI is a communication network with standardized and secure procedures for exchanging data. The contact details of all doctors as well as electronic patient files can be stored here. The standardized health insurance number that was introduced with the eGK ensures that doctors can clearly identify their patients and correctly allocate their electronic data. This is especially important for communication between different attending doctors. For example, electronic referral letters should be drawn up following a single standard so that the medical information they contain can be correctly interpreted by the system that receives them. An end-to-end security infrastructure will also make it possible to reliably encrypt and decrypt data and apply digital signatures.

… AND MANY APPLICATIONS

Parallel to the creation of the telematics infrastructure, a variety of e-health applications are being developed throughout Germany. Fraunhofer ISST and Fraunhofer FOKUS have defined the specifications for the electronic case record ("elektronische Fallakte", or EFA) on behalf of the Elektronische FallAkte association. Since 2008, the EFA has been used as a doctor-led cooperative platform in various regional healthcare alliances. A gematik task force is working to ensure the smooth migration of existing case records to the TI. The companies and hospitals that are part of the organization known as Integrating the Healthcare Enterprise (IHE Germany) have been working since 2012 on a "cookbook" which collects specifications for IHE-compliant records systems. These specifications are already being implemented in the electronic case record as well as in other regional projects in North Rhine-Westphalia (Healthcare eBusiness Platform) and Baden-Württemberg (Rhine-Neckar Metropolitan Region – Space for Health). In 2010, the German Federal Ministry of Health launched a project with the goal of developing a patient-managed medical record which fits within the legal framework of Section 291a, Book V of the German Social Code and integrates the work done by gematik. Fraunhofer FOKUS developed the solution concept and technical specifications for this. Since June 2014, a pilot study has been underway with 30 patients in Osnabrück, and another is expected to follow in the course of the year in North Rhine-Westphalia. In a different project in the Düren region of North Rhine-Westphalia, an electronic referral letter was introduced based on a standard developed by the German Healthcare IT Association. Each month, around 5,000 referral letters are exchanged here via a network provided by the associations of statutory health insurance doctors.

SECURE DATA TRANSMISSION IN REAL TIME

The ability for medical devices to connect and communicate is critical to ensuring fast, efficient treatment. A hypothetical traffic accident reveals the many potential areas of application in healthcare: The patient's injuries and vital signs are initially evaluated in the ambulance. This information makes it possible to identify the best available hospital for treating the injuries. Systems for monitoring the patient's vital signs continually record important parameters and send them to the admitting hospital together with the preliminary diagnoses. The doctor on call can then organize the required resources in advance and arrange for surgery if necessary. In the hospital, medical devices provide additional critical information from imaging procedures, for example, and they also support surgeons in the form of electronically controlled endoscopes or surgical robots. Systems like these, whose failure or malfunction would have devastating consequences, are known as safety-critical systems. They are subject to strict security requirements, especially in terms of their vulnerability to external attack – something that can never be entirely ruled out when multiple devices are connected. Surgical devices must also meet extremely high demands when it comes to real-time capabilities. For example, if live videos of an operation are supplemented with information obtained from earlier imaging procedures, or if experts in another location are supporting the operation, all of the necessary data must be available at the same time. For this to be possible, data has to be processed and transmitted in real time. Due to these security issues and real-time requirements, self-contained systems often stand side by side – unconnected – in the operating room. If these devices are to be networked in the future, it will be necessary to maintain safety-critical standards without losing real-time capability, while simultaneously integrating the communication protocols of different devices in a way that enables data to be exchanged interoperably.

HOLISTIC SYSTEM APPLICATIONS

In the System Quality Center (SQC) and Visual Computing (VISCOM) competence centers, Fraunhofer FOKUS is working on secure IT infrastructures and communication architectures for networked medical control devices. In the Platforms and Solutions for Connected Healthcare (E-HEALTH) competence center, innovative telematics services for the healthcare system are being developed and tested in the field. The competence center is involved with creating integrated IT-based solutions and cooperative platforms for regional health networks as well as patient-oriented applications, such as therapeutic support with the help of telemedicine and teletherapy. Solutions from different fields of research are being integrated to create holistic system applications along the entire healthcare information chain, from service providers and insurers to patients.

NETWORKED MEDICAL DEVICES

The seamless flow of information and exchange of data play a decisive role in modern medical care. Particularly in emergencies, it is essential for medical specialists and technical systems to be perfectly coordinated. Healthcare providers and insurers must be able to access the same diagnostic, therapeutic and procedural data, from personal health records and electronic case records to billing information. This applies to doctors and nurses as well as pharmacies and hospitals. Such data can also be used for follow-up treatments via telemedicine. IT-based systems are increasingly being used to support and automate workflows for managing data across healthcare organizations. As a result, the number of networked medical systems is rising in the healthcare system. Reliable and secure healthcare also depends on the seamless and largely automated flow of information between medical devices in operating rooms, labs and the treatment rooms of doctors' offices and hospitals. The required interoperability, security and compatibility of medical data is regulated by a number of medical informatics standards. Versions 2 and 3 of HL7 as well as IHE profiles define the IT-based exchange of data between healthcare organizations. DIN EN 80001 covers risk management for networked systems in hospitals, while the EN 60601 series of standards define security requirements for medical electrical equipment and IT systems.

PROJECTS

REHAINTERACT: THERAPY ROOM OF THE FUTURE

Duration: September 1, 2013 to August 30, 2015

The sensor-based interactive therapy room being developed in the RehaInterAct project offers users a personalized and intuitive therapeutic environment. During the rehabilitation process, patients first use the system in the clinic before moving the therapy environment to their home for the post-discharge treatment phase. The solution comprises a therapy program with real-time motion-sequence correction, complete with an individual treatment plan, correction assistants and communication functions. The communication mechanisms should make it possible for patients to contact their therapist or doctor and for their documented medical data to be sent automatically to the attending doctors. RehaInterAct offers patients and clinics an innovative therapy platform for remote medical care.

www.fokus.fraunhofer.de/go/en_rehainteract

E-HEALTH INTEROPERABILITY LAB

Duration: August 1, 2012 to July 31, 2015

Hospitals and labs must have access to diagnostic, therapeutic and procedural data – everything from patient records to accounting documents. Researchers at the SQC competence center have developed a testing solution based on the TTCN-3 programming language for the secure and lossless transmission of this data. It is especially suited to testing the interoperability of HL7-based health information systems. The testing solution flexibly integrates a variety of medical devices and individuals, making it possible to thoroughly examine all direct interaction between the agents in the test scenario. The approach used in the E-Health Interoperability Lab will go a long way toward improving the quality of E-Health systems.

www.fokus.fraunhofer.de/go/en_ehealth_interoperability_lab

EPA2: PATIENT-ORIENTED MANAGEMENT OF MEDICATION PLANS VIA AN APP

Duration: January 1, 2012 to December 31, 2014

With the electronic patient record (elektronische Patientenakte, or ePA), patients can support their own medical care. The ePA is an IT platform for storing and communicating information, either as online health records or on a USB stick in the patient's hands. It gives patients and doctors the ability to use and share medical data quickly and securely in electronic form. Compliance with established standards, such as HL7 CDA, OMG RLUS, OASIS SAML and OASIS XACML, has resulted in the creation of an open, secure IT platform.

www.fokus.fraunhofer.de/go/en_epa

MYREHAB: THERAPY IN YOUR OWN FOUR WALLS

Duration: August 1, 2010 to December 31, 2013

A variety of therapeutic goals can be pursued with the help of the MyRehab telemedicine platform. It focuses on personal therapeutic support which is tailored to the abilities of the individual patient. The MyRehab system should encourage people with limited mobility in particular to integrate more movement into their everyday lives and cultivate an active, healthy lifestyle. In the future, the telemedicine platform can be used as an interactive therapy or prevention coach at home, at work or as part of an orthopedic treatment plan. Community-based services could ideally be integrated as well.

www.fokus.fraunhofer.de/go/en_myrehab

OR.NET: REAL-TIME ARCHITECTURES FOR OPERATIONS

Duration: September 1, 2012 to August 31, 2015

The OR.NET project (Secure and Dynamic Networking in Operating Room and Hospital) – a partnership between researchers, medical device manufacturers and clinics – is working to securely, dynamically and interoperably integrate medical devices with each other and with neighboring medical IT systems. The researchers at Fraunhofer FOKUS are developing real-time architectures for this. One key issue is interoperability between service-oriented architectures (SOA) and robust, deterministic real-time architectures for a reliable operations infrastructure. The development of a framework standard for data models and communication requirements will enable seamless communication between the real-time and non-real-time worlds. The project is being funded by the German Federal Ministry of Education and Research.

www.ornet.org

SMART MOBILITY

People want to move around the city quickly, cheaply, ecologically and safely, but everyone has different needs and priorities. Intelligent mobility takes individual desires into account and uses them for efficient mobility planning based on information and communication technologies.

NETWORKED MOBILITY

Mobility is a basic need, and it involves much more than just moving through space. It allows us to take advantage of and experience all that a city has to offer. Cooperation and sharing are trendy right now, as both research and real-world programs have shown. The "TicketShare" campaign in Berlin encourages public transport users to wear a button indicating that they have a ticket which allows multiple people to travel with them at particular times. The goal is to help people who can't afford a ticket enjoy greater mobility at no additional expense. 8,000 buttons were distributed in just a few weeks. "Sharing" is all the rage for other forms of locomotion as well: Rental bikes and car-sharing schemes are booming. According to the German Car-Sharing Association, there are around 150 car-sharing providers in Germany with 757,000 participants. This is an increase of 67.1 percent compared to the previous year. Car-sharing companies are increasingly offering electric cars which are ideal for short city hops. The car industry – which is acting more and more like a mobility service provider – has already reacted to this trend with car-sharing programs such as "Car2Go" from Daimler and "Drive Now" from BMW. But mobility still has a dark side. Drivers waste time stuck in traffic jams or looking for parking spots, cities like Beijing and Paris suffer from severe air pollution, and street noise makes residents sick. Changing individual behavior won't be enough to solve the problem. We need national regulations and targets, such as the obligation of EU member states to cut greenhouse gas emissions to 20 percent below the levels of 1990 by the year 2020. City authorities are already reacting to this by introducing traffic control measures, among other things. London introduced a city toll, Paris offers free metro use when pollution levels are high, and for years Germany has had more than 50 low-emission zones which are restricted to vehicles whose emissions do not exceed a certain limit. The effectiveness of such low-emission zones is debatable, however.

IT'S ALL IN THE MIX

A mobility mix of (borrowed) cars, public transport, cycling and walking will be supported by a technical network enabling more dynamic traffic control. The currently evolving Internet of the Road consists of many sensors embedded in streets, signs, traffic lights, smartphones and assistance systems in cars. They generate data and send it to road users and traffic management centers. This data sharing results in traffic light circuits that take current traffic flows into account, and navigation systems with continually updated maps that guide drivers to free sparking spaces, warn them of dangers like black ice, and combine different forms of transport. New applications go a step further: They encourage collaborative driving, or cooperation between road users. For example, drivers can earn points when they take passengers with them or skirt around heavily trafficked parts of a city. Parking assistants and highway autopilots herald the next shift in mobility. Like something from a science fiction movie, urbanites will soon be able to sit in a highly automated, self-driving car and use their travel time to do other things. Fraunhofer FOKUS efficiently and securely transmits all kinds of information to cars, analyzes and processes these huge amounts of data, and handles quality assurance for the software and hardware systems installed in cars and trains.

There's a lot to be said for cycling in the city: It keeps you fit and it's environmentally friendly and cheap. Some city-dwellers ride bikes for a living. Around 120 cycle rickshaws carry passengers around Berlin each day, and an estimated 4,500 to 5,000 bicycle couriers deliver packages every day in Germany. And then there are the postal employees who often deliver the mail on electric bikes.

berliner-zeitung.de, bdkep.de
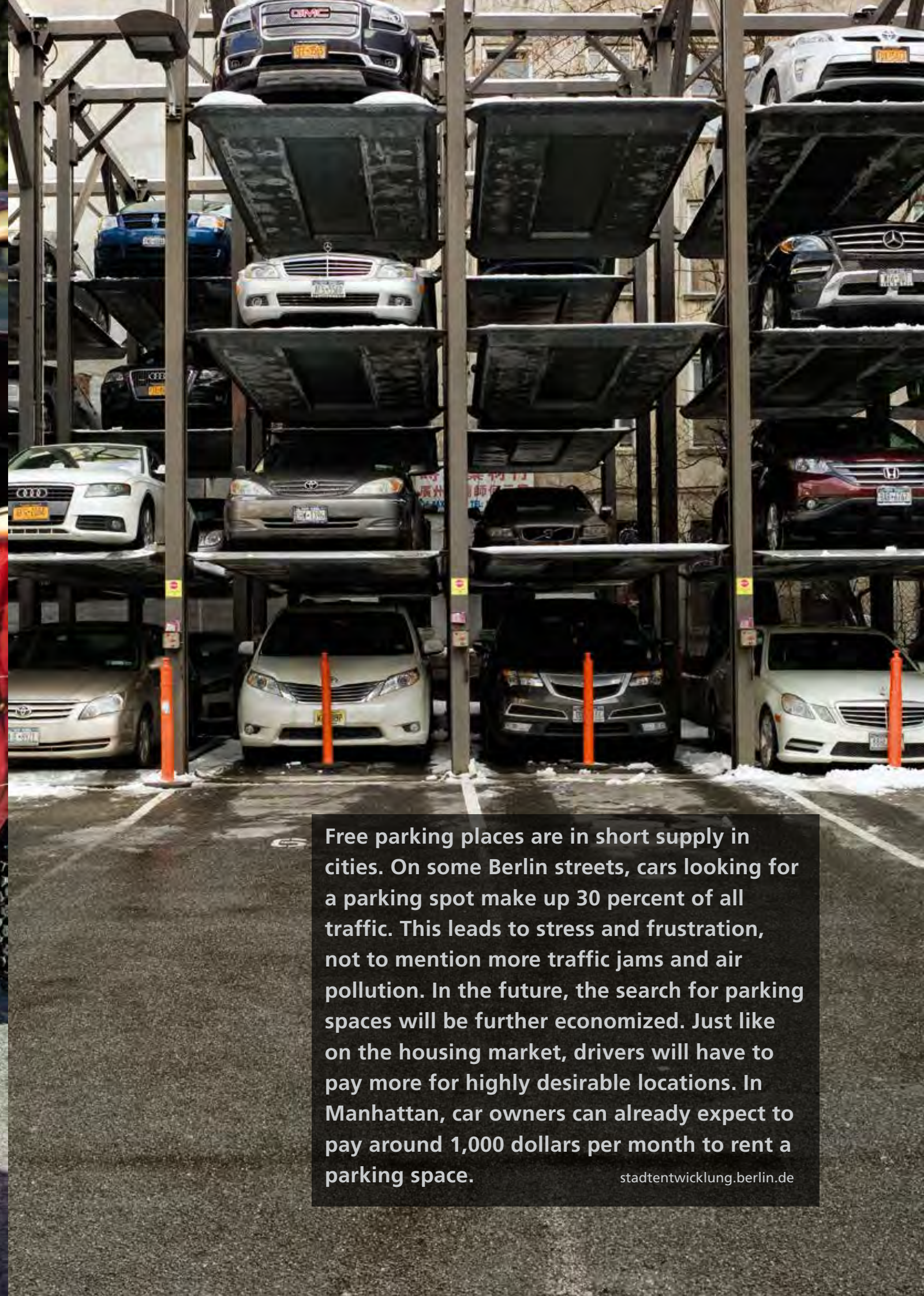
Free parking places are in short supply in cities. On some Berlin streets, cars looking for a parking spot make up 30 percent of all traffic. This leads to stress and frustration, not to mention more traffic jams and air pollution. In the future, the search for parking spaces will be further economized. Just like on the housing market, drivers will have to pay more for highly desirable locations. In Manhattan, car owners can already expect to pay around 1,000 dollars per month to rent a parking space.

stadtentwicklung.berlin.de

The outlook is rosy for electromobility: Electric vehicle sales are expected to rise worldwide from 187 billion euros in 2010 to 459 billion euros in 2030. The German government is standing by its ambitious goal to get one million electric cars onto German streets by 2020. But the reality is still quite different: In 2013, only 6,051 of the 2.95 million newly registered vehicles were electric cars. This is just 0.2 percent.   de.statista.com, bundesregierung.de

Cities make traffic: 64 percent of the kilometers driven worldwide arise in urban environments. How this distance is covered varies widely from city to city. While 30 percent of road-users in Copenhagen ride bikes, 78 percent in Los Angeles drive cars. Cycling is uncommon in Istanbul, but 49 percent of people walk. Residents of Berlin cover two-thirds of their distance on foot, by bicycle or with public transport.

de.statista.com, stadtentwicklung.berlin.de, adlittle.com

FROM THE BIG PICTURE TO THE SMALLEST DETAIL

Tom and his car don't really exist, they're part of a simulation in the eMERGE research project which is funded by the German Federal Ministry of Transport and Digital Infrastructure (BMVI) as part of the Electromobility Model Regions program. As a second-generation electromobility project, eMERGE is looking not only at the technical implementation and everyday practicality of charging infrastructures and vehicles, but also at transport infrastructures and business models. The simulation, which runs in a simulation environment developed by Fraunhofer FOKUS, is correspondingly comprehensive. VSimRTI (V2X Simulation Runtime Infrastructure) simulates traffic in Berlin with conventional and electric vehicles to explore how to increase efficiency using mobility applications. The simulation looks at interactions on the roads as well as possibilities for optimizing the power grid and charging infrastructure. To make the scenario as realistic as possible, different simulators with different levels of detail are linked in VSimRTI: a simulator for traffic in Berlin with streets, traffic lights and road signs; one for mobile radio communications for the app; one for the energy network and energy consumption; one for charging infrastructures; one for the vehicle battery; and a simulator for the app itself. The human factor is also included in the simulation. The project partners from the University of Siegen surveyed the drivers of electric vehicles to define different types of users. Their behavior is integrated in the simulation. The full simulation is complex and detailed, so to simulate eight hours of real time in the center of Berlin the program needs 15 hours of processing time on a simulation server. But the biggest challenge is to get the different simulators to communicate and interact – synchronously, no less. For this, the Fraunhofer researchers have taken the highly complex IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA), which was originally developed for the US military, and adapted and simplified it for the field of transport. What makes VSimRTI unique is that, unlike other simulation environments, it is dynamic, meaning that simulators can be added or taken away depending on the use case.

VSimRTI not only evaluates individual services, it supports intelligent traffic control. For example, in the future it will be possible to define dynamic low-emission zones in some parts of the city where only electric vehicles will be permitted for certain periods of time when fine particulate pollution is high. In the planning phase, VSimRTI simulates the effects of such low-emission zones on city traffic and air pollution so that suitable locations can be chosen. The simulation findings are incorporated into the development of the app and other systems so these can be programmed more precisely and quickly before finally being tested in the field.

JUST LIKE REAL TRAFFIC

Berlin-Friedrichshain at 8 in the morning. Tom gets in his Smart Fortwo Electric Drive and enters the day's trips in his mobility app: First to work in Berlin-Charlottenburg, from there to the gym in the Mitte district at 5, back home at 7. The battery charge will only last for 40 kilometers, so the app reserves a charging point near Tom's work and guides Tom straight to it. It also calculates how much energy will be needed for the trips. The program sends the estimated energy and departure times – but no personal details or information on specific routes – to the energy network operator. The operator can then plan its network load better, ensure that a high proportion of renewable energy is available and avoid peak loads. If Tom changes his plans at the last minute and decides to visit a friend in Berlin-Wedding, or if he's stuck in traffic because of an accident, the app automatically adjusts the energy consumption and reservations.

LEARNING MAPS

2 *Precise positioning within the radius of a cane: FOKUS is developing extremely precise indoor positioning methods that can make it easier for blind and visually impaired people to navigate. The m4guide project is creating a door-to-door navigation app for smartphones which covers public transport as well as footpaths outside and inside of buildings. The project is being funded by the German Federal Ministry for Economic Affairs and Energy.*

3 *Where am I? m4guide can even help people who are not impaired to move around in unfamiliar or confusing environments. The ASCT researchers have developed a program which semi-automatically generates a digital map using pictures of floor plans. Current research findings are being applied to position detection for indoor routing. The solution uses optical signals and disturbances in the Earth's magnetic field – such as those caused by a metal pillar in a room – which are detected by the sensors in a smartphone. Short-term issues, such as out-of-order escalators or elevators, can also be taken into account in the routing thanks to ULR.*

Fold-up maps are becoming rare. In cars and on smartphones, people use digital maps. The advantage of this is that sudden, relevant events can be integrated immediately. To link different maps and incorporate current traffic information, the FOKUS researchers at the Automotive Services and Communication Technologies (ASCT) competence center have developed the unpatented Universal Location Referencing (ULR) technology. This makes it possible to reliably integrate dynamic mobility data into street maps and indoor floor plans.

1 *With the navigation software from Fraunhofer FOKUS, drivers are seamlessly guided from the street to a free parking space in a multi-level parking facility. Individual preferences are taken into account, such as a charging station for an electric vehicle or proximity to a particular elevator. Cameras in a multi-level parking facility identify the current positions of vehicles and free spaces and send this information to the navigation device. The free spaces are then added to the indoor map in real time using ULR.*

"Our goal is that the virtual map should converge with the real world to better address people's needs."

THE MAP AS A GUIDE THROUGH LIFE

Where is the best pizzeria? Is a friend close-by? How do I get home the quickest? Mark Foligno, Product Innovation Manager at Here, a Nokia company, describes the increasingly significant role of digital maps

"Maps for Life" is the slogan of your company. What does this mean?
We consider maps as a guide through life, and our goal is that the virtual map should converge with the real world to better address people's needs. The more the map reflects the real world, the easier it becomes to navigate, as there is a much clearer association. For example, landmarks and points of interest can be used to navigate the driver. Instead of voice guidance telling you to "turn right after 300 meters", it tells you to "turn right after the post office".
Furthermore, it is not merely a matter of guiding someone from A to B. For example, we can recommend a restaurant or an exhibition at the destination based on individual preferences. It is also not a matter of places. We want to create a stronger network among people. The smart map can display which friends are located nearby.

You want to align the virtual world as far as possible with the real world. Do your recommendations and

choice of landmarks change our perception of the real world?
Yes, I think so. By personalizing the map, we draw attention to certain objects in the vincinity that are relevant but might otherwise be overlooked by the user. In this respect we alter the view of the world.

At Here one of your focus areas is the automotive business. What is your biggest challenge in developing applications for cars?
In the context of the car, we will continue to apply strict guidelines that help us to create designs that are the least distracting for the driver. For example, we limit the number of actions and list items as well as the length of texts so that the driver can readily understand a given interface state in a glance, thus greatly lessening risk whilst driving. We also validate our assumptions using our in-house driving simulator to ensure compliance. However, as we look forward, and this is an area that I increasingly invest more of my time, we are exploring

contextual intelligence. The premise here is that the system understands the context and thus the potential needs of drivers and responds by displaying appropriate information. A simple example could be that we know that the driver needs to refuel his vehicle, so as a consequence we navigate him to the closest gas station that best suits his needs. As a result, drivers do not have to take a deliberate action themselves. These examples are reflective of a broader strategy where we capture patterns of user behavior based on users' consent to display only information that is relevant to them and greatly reduce the amount of information that is an unnecessary distraction.

You are working together with Fraunhofer FOKUS on the TEAM project that is funded by the EU with 11.1 million euros. What is the project about?
TEAM stands for "Tomorrow's Elastic Adaptive Mobility". The key concept is help users make more informed decisions by participating in a collaborative network, and encourage more considerate behavior. For example, the collaborative network that we are seeking to develop would capture the performance of a driver and the associated vehicle from both a safety and an environmental perspective. To improve performance, we want to introduce a scoring system that offers real-world incentives such as lower parking fees or communicates potential time savings.

How does the collaborative network work?
In the collaborative network, users, vehicles, and infrastructure exchange data. The data is analyzed, patterns of activity are learnt and precise recommendations are presented. The data comprises both real-time and historical data. This is important in recognizing patterns of activity. The network can only function if we have access to this data. We must build trust with those who participate by being open and transparent about the use of data. At the same time, we could also add incentives. One of the things we are developing with Fraunhofer FOKUS is the human-machine-interface. Parking, which is a huge problem in many cities, is a project focus. We are working on a service that recognizes when a vehicle enters or leaves a parking space. We will also capture the size of the space and present it only to other vehicles that will fit

into that space. The service will also forecast the time it takes on average to locate a parking place in the destination area, and can suggest nearby alternatives which take less time, or even use weather forecasts to only recommend indoor parking places. There are also benefits for society as a whole as more efficient parking can help to reduce traffic congestion.

Sometimes getting lost leads you to the most exciting discoveries. How can you keep people curious and open despite all functioning technology?
We don't just want to make recommendations that the user is either aware of already or that match their interests. We want to expand horizons. As our knowledge of behavioral patterns increases, we would consider adding a discovery feature that wouldn't necessarily fit this pattern but wouldn't be so random either to leave the user uninterested.

PROJECTS

CONVERGE: THE SECURE INTERNET FOR THE ROAD

Duration: August 1, 2012 to July 31, 2015

CONVERGE – COmmunication Network VEhicle Road Global Extension – is exploring the technical requirements for a comprehensive, fast and secure flow of information regarding the traffic situation. The research partners include road network and mobile network operators, car manufacturers and suppliers, universities and research institutes as well as the German Federal Network Agency. The focus is on the development of an open communication architecture in the form of a hybrid model that takes mobile radio and WiFi technologies into account. The ASCT competence center is involved in the security solution so that authenticity, integrity and confidentiality can be guaranteed when sensitive data is exchanged. The project is being funded by the German Federal Ministries of Education and Research and for Economic Affairs and Energy.
www.fokus.fraunhofer.de/go/en_converge

MYWAY: ADAPTIVE MOBILITY

Duration: September 1, 2013 to February 29, 2016

"My way" of moving around is recommended and planned by the European Smart Mobility Resource Manager. The project goal is to develop a smart-phone app which covers all common forms of transport, including cars, bicycles, and car-sharing schemes. The app will be tested in the field in Barcelona (Spain), Trikala (Greece) and Berlin as well as in simulations. These tests will look at the benefits for individuals as well as how the individual mobility recommendations affect traffic in the city.

The ASCT researchers are participating in the development of the app, running simulations and monitoring the field tests in all three locations. The focus is on the "living lab" in Berlin, which is being built in close cooperation with the Traffic Management Center (VMZ).
www.fokus.fraunhofer.de/go/en_myway
myway-project.eu/

DRIVE CAR2X: WARNING, OBSTACLE AHEAD

Duration: January 1, 2011 to June 30, 2014

In this European-funded project, 34 partners from industry and research are laying the foundation for the market launch of C2X technologies and the assistance systems based on them. Fraunhofer FOKUS is contributing to this in a variety of ways: The researchers at the ASCT competence center developed a C2X-based application for the field test which warns cars of slow-moving or broken-down vehicles nearby. FOKUS also bears overall responsibility for the human-computer interface in the vehicle, and it is providing a test environment for software and hardware components and developing tools for planning and carrying out extensive field tests. Each of these developments will be put to use at the seven DRIVE C2X test sites in Finland, France, Germany, Italy, the Netherlands, Spain and Sweden.
www.fokus.fraunhofer.de/go/en_drive_c2X

STREETLIFE: LOWER EMISSIONS, HIGHER QUALITY OF LIVING

Duration: October 1, 2013 to September 30, 2016

In the STREETLIFE project, eleven partners from research, industry and cities are developing a multi-modal mobility information system. Personalized real-time information will be provided for mobile devices to encourage urban mobility to shift to safe, sustainable forms of transport. Traffic management centers and city administrations will benefit from solutions for monitoring and influencing city traffic. These two measures will help reduce emissions in cities. The practicality of the solutions will be tested in Berlin, Tampere (Finland) and Rovereto (Italy). The ELAN competence center is coordinating the EU project, which is being funded in the context of the 7th Framework Program, and it is reviewing and developing concepts for city data infrastructures, smart city data and service clouds.
www.fokus.fraunhofer.de/go/en_streetlife

V2X TEST BED: AUTOMATED TESTING OF NETWORKED DRIVER ASSISTANCE SYSTEMS

The introduction of cooperative traffic systems will pose many new challenges for vehicle manufacturers and infrastructure operators. On the one hand, in-vehicle systems must be secure and reliable. On the other hand, interoperability has to be guaranteed between vehicles from different manufacturers and between different infrastructure components.
The V2X test bed of the SQC competence center is a laboratory test bed for the systematic, automated testing of networked, cooperative driver assistance systems. It can be used during development on all levels of software and hardware integration and provides a flexible, extendable infrastructure for compliance and interoperability tests. The test methodology, test systems and supported V2X message formats all comply with the respective ETSI standards. The test bed was developed in the simTD (Secure Intelligent Mobility – Test Field Germany) and DRIVE C2X research projects.
www.fokus.fraunhofer.de/go/en_v2x

SMART ENERGY

Where and when do people living in cities use energy? When they make a phone call, travel on the subway, when their alarm clock goes off in the morning, in the cinema, and even when they switch off the TV and leave it on standby. The list goes on. It might actually be easier to list all the activities that do not use energy: walking in the park without your mobile phone, buying a croissant from your local bakery. But how much energy did the baker use to make that croissant?

PLANNING AND MANAGING RENEWABLE ENERGY

Life in a city depends on having a permanent supply of energy. While fossil fuels and conventional power plants have always been able to guarantee the necessary security of supply, the impact they are now having on our climate is threatening to make our planet uninhabitable in the future. To prevent this, over 244 billion US dollars were invested worldwide in renewable energy in 2013 alone. In Germany, this investment is subsidized by the state as a result of the Renewable Energy Sources Act (EEG). With renewables supplying 19 percent of global energy consumption, we still have many challenges ahead of us, but we have already made considerable progress. For example, thanks to the enormous technological progress made since the EEG was passed in Germany in 2000, the government has been able to reduce its guaranteed feed-in tariff for solar power by up to 82 percent. In sunny countries, it is now cheaper to produce electricity from solar energy than from fossil fuels. While Germany, in its efforts to make the transition to renewable energy, has been involved in hard political battles for green energy rebates, feed-in tariffs and exemptions for self-generated electricity, it is easy to overlook the fact that public subsidies were originally intended only for a transitional period until sufficient renewable energy came on stream.

THE WAY FORWARD: FLEXIBLE CONSUMPTION

To ensure the stability of the public grid, consumption and production must always be in balance. As renewable energy often varies widely in availability, it is essential that we match consumption to production. To do this, all stakeholders need to exchange data within a "smart grid" via information and communication systems. When there is an oversupply of energy, for example, large cold stores can reduce their temperature to below what is actually necessary, so that when there is a shortage of energy they will use less energy and thus relieve the pressure on the grid. Also, energy storage capacities can be activated in an emergency to prevent power outages. Variable electricity prices – low when demand is low and high when demand is high – are an important incentive that can help balance consumption with availability. If private households are to benefit from variable prices in the future – without needing to look up the cheapest time whenever they want to use the washing machine – each household will have to be equipped with its own information and communication system. Such systems automatically ensure that energy is used in the most efficient and most economical way in the home. Fraunhofer FOKUS develops technologies for tomorrow's energy management needs – from smart metering systems for private households, to building automation, right up to central control systems for virtual power stations.

The number of alternative power generators connected to the German electricity network continues to rise. In 2013, over 1.4 million standalone systems were connected to the national grid, including many small and very small systems. To cope with so many individual producers, the grid needs an intelligent control system.   solarwirtschaft.de
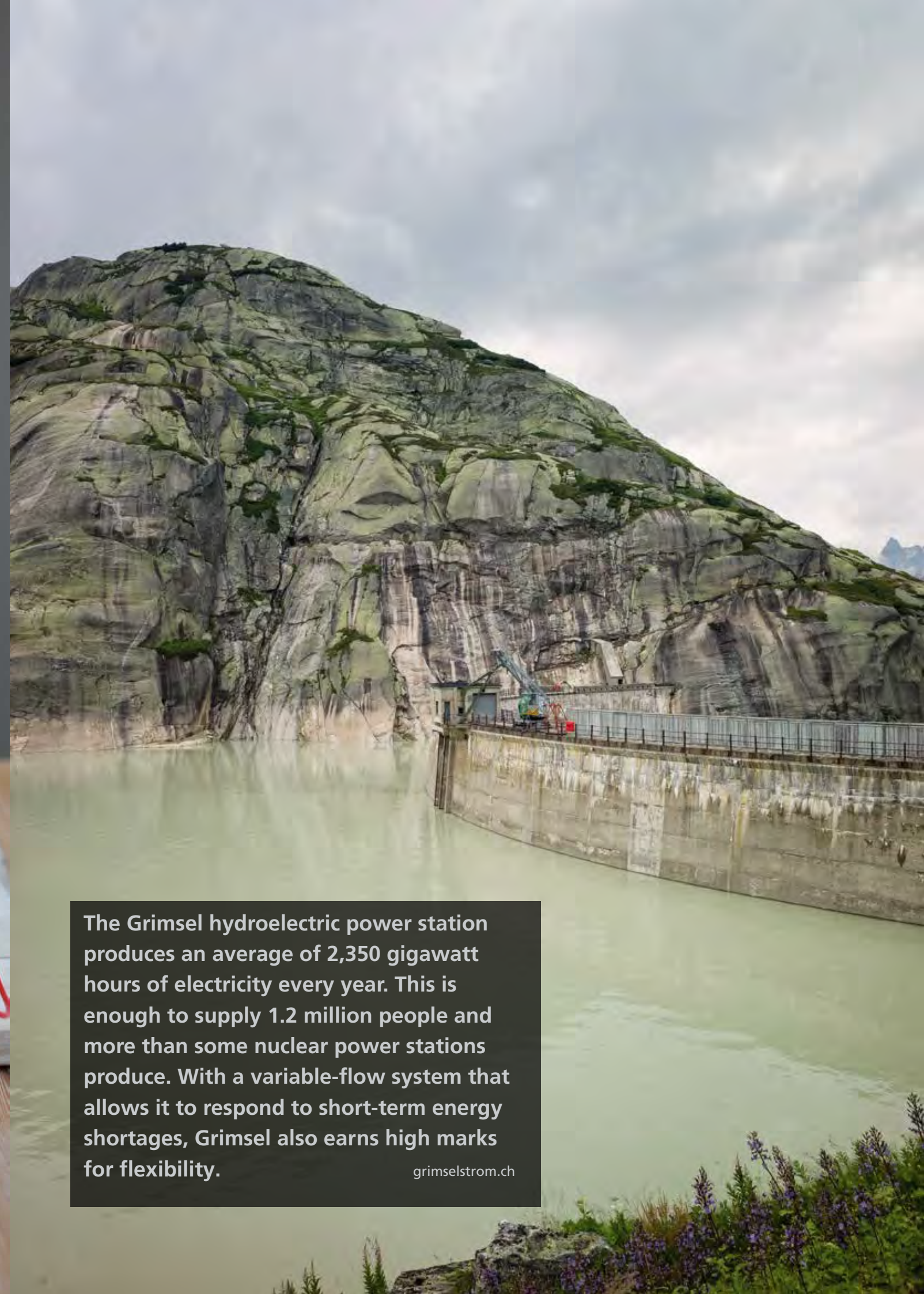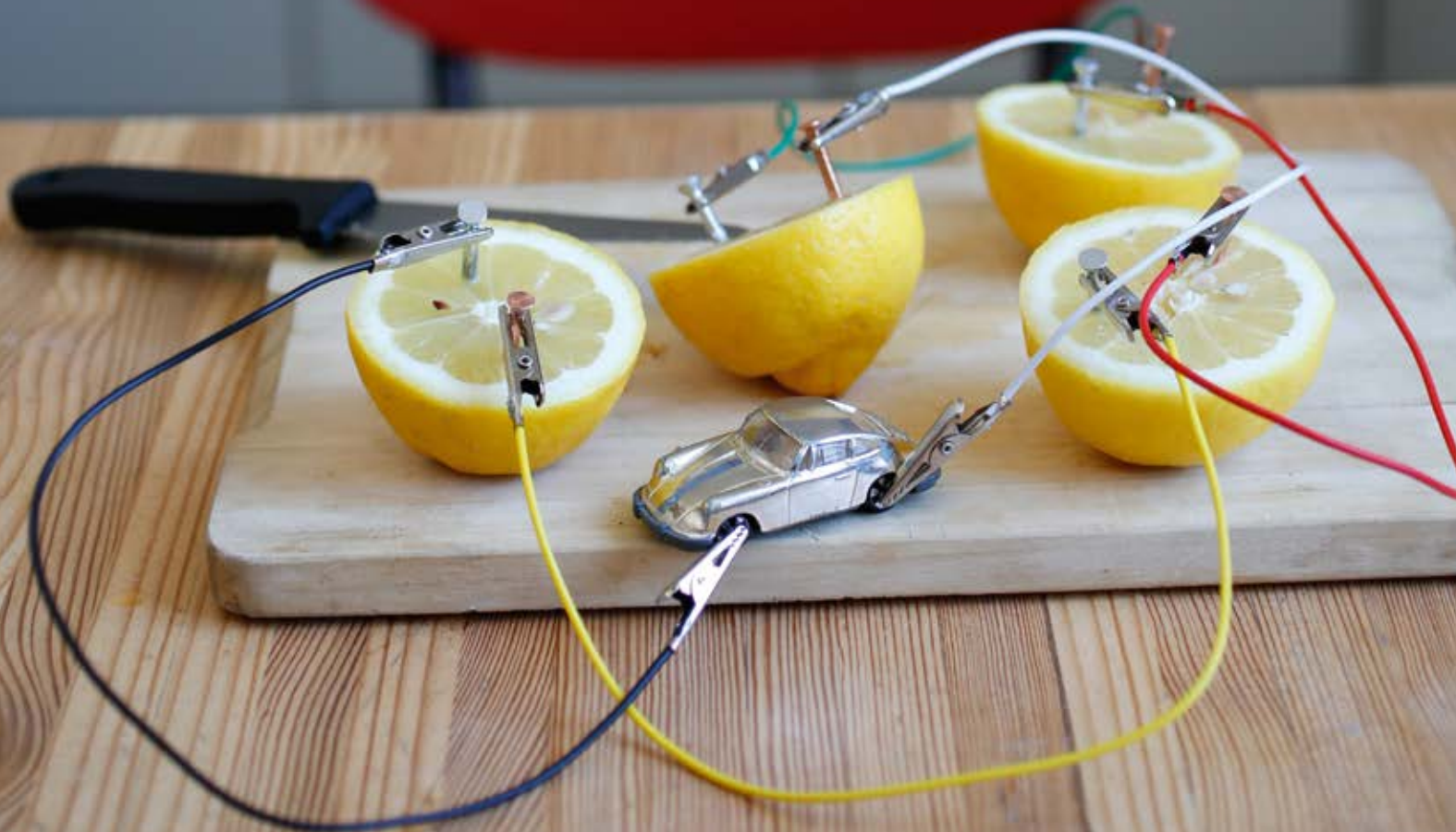
The Grimsel hydroelectric power station produces an average of 2,350 gigawatt hours of electricity every year. This is enough to supply 1.2 million people and more than some nuclear power stations produce. With a variable-flow system that allows it to respond to short-term energy shortages, Grimsel also earns high marks for flexibility.   grimselstrom.ch

"In the future we will see a mixture of renewable energies, variable loads and storage technologies, all of which will require intelligent management systems."

SYSTEMS WILL HAVE TO BE MUCH SMARTER

Jürgen Maaß (left) and Lutz Bertram on the importance of weather forecasts for intelligent energy management, load forecasting and the potential of cold storage installations during the energy transition

How do you view the efforts by our politicians to get us to switch to renewables?

We are big fans of the switch to renewables! And we can help – with weather forecasts and building automation. What is important is that we consider the interests of both energy suppliers and energy consumers.

By 2025, 40 to 45 percent of our energy is expected to come from renewable sources. What consequences will this have for energy management?

Systems will have to be much smarter and more self-contained. To cope with the high share of renewable energies, it is essential that we create self-organizing systems capable of dealing with huge amounts of data.

What will this require?

Building smart systems requires lots and lots of data. This data is currently a well-kept secret: There is no standard database

from which to obtain measurement data, neither is there any way of purchasing the data. To forecast the future energy production of a wind turbine, for instance, you have to know its energy output, the wind strength and the wind direction. You then compare these wind parameters with the wind parameters from previous measurements. An analysis of the relationships will provide you with a forecast.

What do you think an ideal energy management system looks like?

An ideal energy management system is capable of making autonomous decisions on the basis of available information. It's all about deploying the different renewable energy producers at the optimum time. The current status, the expected status and the available mix of generators must all be optimally aligned.

How long-term and how accurate can forecasting be?

Weather forecasts are usually calculated 15 days in advance, in hourly increments. The average error in temperature forecasts for the following day is better than one degree Celsius. We can provide temperature trend forecasts up to 30 days ahead. Because of their great variability, wind and solar forecasts are difficult. We can forecast these up to five days ahead.

Why can't we just store excess energy and use it when energy is in short supply?

If we were able to simply store our excess energy at some time in the future, the entire energy transition process would no longer be a problem. However, the grid is not designed to accept unlimited amounts of power; it was designed to distribute power. Nevertheless, there are some intelligent ways to dealing with the issue. Some companies reduce the temperature of their cold storage warehouses (from -24 °C to -27 °C, for example) when there is a surplus of renewable energy. This stored "cooling energy" can be recouped later by using less power for cooling. A pizza doesn't care whether its storage temperature is three degrees warmer or colder as long as the specified threshold value is not exceeded. Another option is Power-to-Heat. Many traditional heating systems contain storage buffers which retain heat generated from oil and gas. Filling these storage buffers at night when power is cheap means you don't have to switch your boiler on in the morning.

How can we supply energy sustainably over the long term when the supply is so variable?

We will ultimately have to rely on the approaches we just described: using intelligent storage systems to smooth out variable loads – Power-to-Heat, for example. In addition, research is currently being carried out on storing energy in the form of gas that can be burned later to generate electricity when energy is scarce. In the future we will see a mixture of renewable energies, variable loads and storage technologies, all of which will require intelligent management systems. The most important thing is for these systems to be self-organizing.

What role will information and communication technologies play in all of this?

We need much more powerful networks for all system components and more measurement data. Anything that can be measured can also be forecast. This applies to elections, to shopping center visitor numbers and to wind and solar plants. If we had more live data, we could predict energy production much more accurately. Information and communication technology has an essential role in processing this data. We also need independent networks via which to exchange information and intelligent algorithms to help us evaluate it.

What exactly are you expecting from membership of the IT4Energy Innovation Network?

We expect to see synergies developing from the network's various competencies. The sectors represented by the companies in the network include IT, meteorology, distribution, remote control technology, building automation, energy trading, services, and equipment design and development. Cooperation has become a crucial success factor because no single company can expect to master such a complex field.

ABOUT THE INTERVIEWEES

Lutz Bertram is head of the German energy team at MeteoGroup Deutschland GmbH. MeteoGroup is an international weather service provider supplying customers with all kinds of meteorological data. **Jürgen Maaß** is head of Technology and Predevelopment with Kieback & Peter, a building automation specialist with a keen interest in the development of energy management systems.

The fluctuations in a single energy source can be compensated for by feeding in energy from other sources.

VHPREADY – A STANDARD FOR VIRTUAL POWER PLANTS

WHAT MATTERS IS STRIKING THE RIGHT BALANCE BETWEEN THE INDIVIDUAL PRODUCERS

For example, when solar- or wind-generated electricity is in short supply, bottlenecks can be eased by ramping up the output of the biogas plants and cogeneration units within the virtual power plant. The same principle applies when it comes to making use of surplus energy. The heat pumps in the network could be used, for example, to heat water that will be used later for showering or heating. In the summer, entire buildings could be cooled with surplus solar energy without producing any harmful carbon emissions. However, the balance between the individual standalone systems in the virtual power plant does have to be right. You need a sufficient quantity of heat pumps capable of using large amounts of energy at short notice as well as storage tanks in which to collect the heated water. Plus, the system must be intelligently controlled. There must always be sufficient electricity in the storage systems to cover energy bottlenecks. If there is a surge in supply, the storage systems should be large enough to cope with all the excess electricity. It makes sense to integrate weather data into the energy management system to help all the components work together smoothly.

THE DEVICES MUST SPEAK A COMMON LANGUAGE

And not just that. To ensure the successful synchronization of the various components within a virtual power plant, a standard communication and control interface is essential. A virtual power plant's main control center will integrate the devices into the power plant, control them, monitor their effect on the grid and ensure their operational reliability. In February 2014, Fraunhofer FOKUS and 14 partners formed the VHPready cross-sector industry forum to promote the development of the current version of the VHPready standard. The current VHPready specifications define the technical requirements for equipment, data communication and, where relevant, the system as a whole. As long as they comply with VHPReady, new or refurbished systems can be integrated quickly and easily. FOKUS is working on the development, testing methodology and certification of VHPready. The first virtual power plant compliant with the VHPready specification, controlled by the Vattenfall heat control unit, became operational in October 2010 in Berlin.

Where can you actually find a virtual power plant? On the Internet? In the cloud? Or maybe on TV? No, none of these places. Because a virtual power plant is in fact surprisingly real. You can touch it. It produces energy, although as power stations go, it is rather well hidden. Unlike a coal-fired power station, a virtual power station is never an eyesore in the middle of the countryside. It is made up of a large number of components producing energy in different places, which it stores and sometimes also uses. The components include both cogeneration and photovoltaic systems, and the energy storage systems can store energy flexibly in the form of electricity or heat. Virtual power plants are playing an increasingly important role in the switch to renewables by helping to even out the fluctuating availability of renewable energy as it accounts for a growing share of the total. The large number of small energy producers exacerbates the problem of balancing power generation and power consumption. Individuals who were previously only consumers in the energy market have now become "prosumers" by having solar panels fitted to their roofs, thereby making their behavior more difficult to predict. The virtual power plant's intelligent energy management system aims to solve this problem. It integrates wind turbines, cogeneration units, heat pumps, photovoltaic and biogas plants as well as energy storage systems in such a way that fluctuations in a single energy source can be compensated for by feeding in energy from other sources.
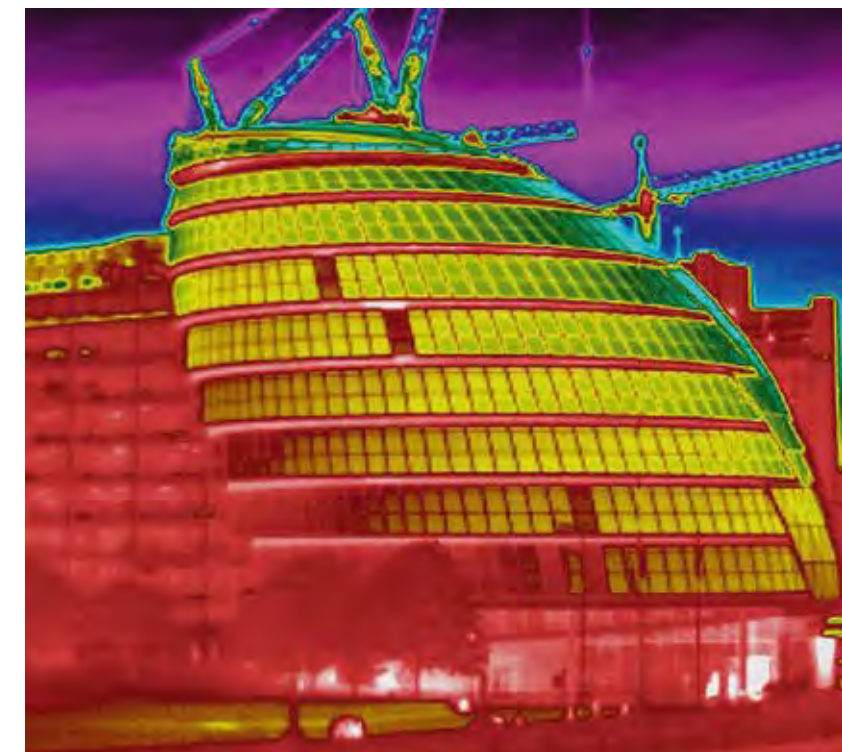
PROJECTS

WINDMILLS IN THE CLOUD

Duration: January 1, 2014 to December 31, 2014

What is the difference between a mini wind turbine on the roof of your home and a large wind turbine in an offshore wind farm in the North Sea? Well, both systems are very different not only in terms of size, performance and cost, but also in the way their power output can be predicted. An industrial wind turbine's energy production can be calculated fairly reliably on the basis of the high-altitude wind speed forecast that is always included in the weather services' forecasts. However, the wind speeds on the earth's surface that ultimately determine the energy produced by small wind turbines are easily influenced by turbulence and topographical obstacles. To experimentally calculate these dependencies on site, the Fraunhofer FOKUS EIT-KIC 2012 EVSGL project is developing a cloud-based prediction tool which enables forecasts of up to one week in advance.

www.fokus.fraunhofer.de/go/en_eitkic

BAAS – BUILDING AS A SERVICE

Duration: August 1, 2013 to July 31, 2016

In the interests of energy efficiency, the energy standards for new buildings continue to become stricter. In addition to upholding these standards, the BaaS project (Building as a Service) aims to reduce the energy consumption of existing commercial buildings by 15 percent with minimal effort. BaaS is based on an intelligent energy management system, the networking of existing systems and the addition of data from external building models. To start the BaaS optimization process, the statistical profile and characteristics of the building are entered into the system. The effects of different control strategies on total consumption are then determined on the basis of this information. Different control strategies may then be evaluated with reference to a number of factors, the most important being the comfort of occupants and users. This is leading to a greater acceptance of automatic control systems because the only time the user needs to adjust the system is in an emergency.

www.fokus.fraunhofer.de/go/en_baas

TRESCIMO

Duration: January 1, 2014 to December 31, 2015

Many developing and emerging countries experience regular power outages – particularly in large cities. The TRESCIMO project (Testbeds for Reliable Smart City Machine-to-Machine Communication) aims to radically reduce the number of power outages in South Africa with the help of an intelligent energy management system. To avoid overloading the grid, power consumption is dynamically adjusted to match what is available. To do this, small control units are installed in the consumer's home and communicate with a control center via machine-to-machine communication. The center thus receives regularly updated consumption data and in critical situations may limit the consumption of individual users. Fraunhofer FOKUS is responsible within TRESCIMO for the implementation of machine-to-machine communication via the Internet of Things.

www.fokus.fraunhofer.de/go/trescimo

ENYPORT

Duration: July 1, 2012 to December 31, 2014

The enyport energy management system improves energy efficiency within the home and so helps to save energy and money. enyport is an integrated IT solution that enables and manages communication between individual components. For complete energy optimization, the system collects data on electricity, gas, water and heat consumption and combines this with data on production, forecasting, pricing, as well as with data from other sensors. Energy use is optimized by means of forecasting, which allows a number of obvious steps to be taken. In the winter, for example, internal blinds close automatically when it is dark to improve thermal insulation and are opened when it is sunny to allow the interior of the building to be heated.

It goes without saying that the enyport gateway also takes care of matters like switching the coffee machine and lights off when nobody is home. enyport also uses local data management for building automation. Consumption data and data from the renewable energy components leaves the home only with the prior agreement of the user. You can, for example, agree to send productions data from your own solar installation to your energy network operator, or allow the network operator to feed power into your cogeneration unit.

www.fokus.fraunhofer.de/go/en_enyport

LARGE-SCALE PERSONALIZED WARNINGS

How bad does it have to be before you call the loss of railway services in winter a disaster? Such an event does not, of course, come under the same category as Hurricane Sandy, which devastated an entire region in 2012, left half a million New Yorkers without electricity for a day and cost 140 people their lives. Nevertheless, urban transport is a critical infrastructure asset and its loss harms public safety. If all the switches are frozen due to extreme cold, steps must be taken to repair the infrastructure and safeguard the people who are experiencing the extreme cold. The steady build-up in the number of passengers waiting on the platform requires a quick response. People expecting to travel on the urban railway must be informed that it is not running before they set off for the station and the size of crowd on the platform reaches critical proportions. But how can you warn a specific group without alarming the whole country?

The Electronic Safety and Security Systems for the Public and Industries competence center (ESPRI) subscribes to the principle of putting citizens first in the event of a crisis and informing them as fully and individually as possible. The FOKUS researchers are great believers in self-help, which is an efficient means of civil protection because the citizens affected by the risk situation are the ones who take action. Instead of relying on a crisis control center to produce a carefully considered solution, each individual gets to decide whether they should return home, call a taxi, or patiently wait it out.

PLANNING, PLANNING AND MORE PLANNING

If a crisis team is to respond quickly to a disaster, it is essential for a civil protection concept to be in place before the disaster occurs. This is because, regardless of the cause of the disaster, when it comes to more serious incidents such as floods, major fires or hurricanes you always have to ask the question: What sections of the population are affected? How can I provide them with the information they need? Which warning concept should be deployed depends on the nature of the incident. Bridging the "last mile" in the warning chain between the authorities and citizens plays an important role in ensuring that those affected receive prompt and effective warnings. Information and communication technologies offer new channels and options for more personalized warnings. They also facilitate risk management and aid communication between the emergency crews in the field. To ensure a smooth flow of information, all available security systems need to be networked. This allows the crisis management team to put its plan into action as soon as possible and to identify unexpected developments at an early stage. In civil protection, the "last mile" refers to the final link in a warning chain that extends from recognizing the danger to getting the message through to the people affected. A variety of channels are used to complete the "last mile" to individual citizens, since the best way of reaching them can vary according to their individual situation, age and ethnic or cultural background. We therefore need a variety of ways in which to warn people of danger or of a critical situation. The options range from the traditional siren to location-specific warning apps for smartphones.

PUBLIC SAFETY

It is dawn on a cold January morning and there are many more commuters on the suburban railway platform than usual. The rail service has been canceled. Have the railroad switches frozen? Has a cable been cut? Or has the power failed? There are no platform announcements and the information board has stopped working.

The German Bundesliga attracted over 17 million spectators during the 2012/13 season and remains extremely popular. Ensuring spectator safety during the 918 hours of total playing time required a total of 1,756,190 police man-hours.

dfb.de
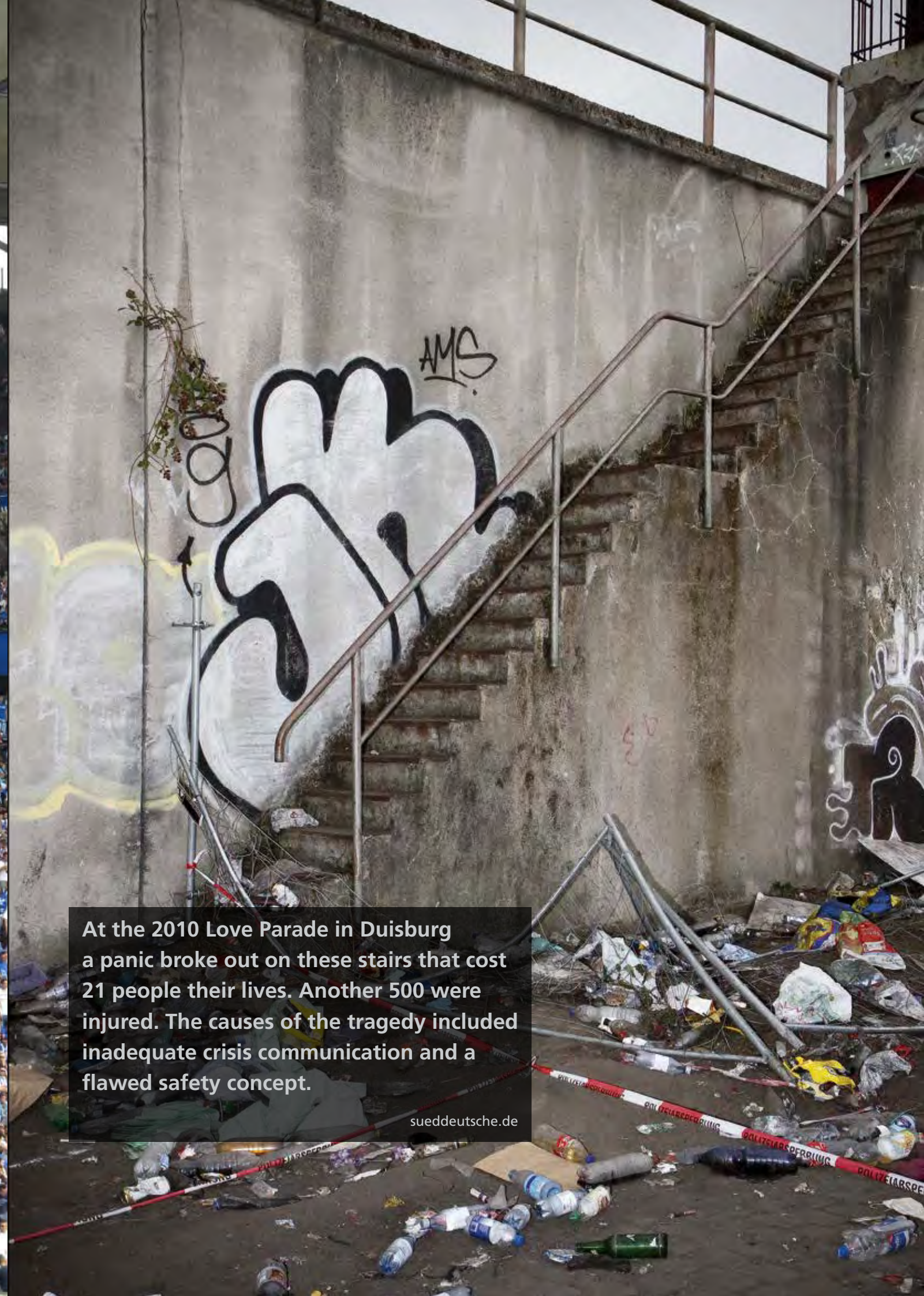
At the 2010 Love Parade in Duisburg a panic broke out on these stairs that cost 21 people their lives. Another 500 were injured. The causes of the tragedy included inadequate crisis communication and a flawed safety concept.

sueddeutsche.de

> "All new technologies require a period of acceptance. If people don't accept the technology, it doesn't matter how good it is."

THE MORE PERSONALIZED THE ALERT, THE BETTER

Prof. Dr.-Ing. Peer Rechenbach, Deputy Head of the Protection Commission at the Federal Ministry of the Interior, talks about disaster management plans, the benefits of KATWARN and crisis communication between grandchildren and grandma

Can you plan for a disaster?

Yes, you can. In fact, you must. There are two pillars to sucessfully tackling a disaster: the disaster management plan and crisis communication. When an emergency occurs, it is important to progress as quickly as possible from the reaction phase to the action phase. In other words, I must create a situation in which I can decide what is to be done over the next few hours. Whether I am facing a flood, an earthquake or a pandemic, the plan must effectively support this transition before introducing other, more general-purpose disaster prevention initiatives such as evacuation or psychosocial emergency care.

What are the most important factors in effective crisis intervention?

The key question is: Who should I involve in which occurrence and for what purpose? A flood that is being kept at bay by flood defenses such as dikes does not yet constitute a

disaster. But the moment a dike collapses, a whole slew of measures is needed. I must therefore know how and where to deploy emergency crews, what resources they have available and who should be communicating with whom.

How do you get through to the civilians affected?

You have to put yourself in their place. The main questions in crisis communication are: Am I affected? What do I have to do to save myself and my family? If the population believes that they are getting answers to these questions, they will follow the instructions issued by the crisis control center.

How quickly do I have to inform the population and what are the best channels for doing so?

That depends on the disaster. If you are dealing with an epidemic, informing the population within twelve hours is sufficient, but when flood defenses are breached, you only have minutes to act. You must then alert those in danger via

a disaster warning system such as sirens or KATWARN, which was developed by Fraunhofer FOKUS. Most importantly, people need to know what to do. One of the main benefits of KATWARN is that, as well as alerting people, it allows you to tell them what action to take. This means you can also alert visitors to the region in which the emergency is taking place without having to explain to them beforehand what to do when a siren goes off.

The mobile phone network and social media are becoming increasingly important means of alerting the population. But how can my grandma find out what is happening if she hasn't got a mobile phone?

This is indeed a problem and one that has always existed in one form or another. You cannot alert someone who is deaf with a siren, for example. In such cases, it is important to have neighbors or family and friends willing to help. The grandchildren, having learned what is happening via Facebook, could call their grandma to tell her. "Grannie, you are about to be evacuated. When the firemen arrive, please go with them." Passing on warnings in this way works surprisingly well in practice.

You say you want to warn people individually. What do you have to take into account when doing this?

The more personalized the alert, the better. The aim is to warn as many people as possible despite differences in status or religious or ethnic background. Allow me to illustrate this with an example. If there is a breach in the flood defenses in Hamburg and you want to evacuate the population using sirens, you have to realize that there will be some people who have no idea what to do when they hear a siren. You still have to find some way of warning them. If you need to evacuate a home for asylum seekers, for example, the residents may not understand the sound of the sirens because they have never heard one in the country they come from. If you turn up with three patrol cars, chances are that only a few of the residents will follow the police instructions to evacuate. What you really need in this instance are multipliers who can spread the message across other channels, like social media for example.

What experience have you had in Hamburg with the KATWARN warning system developed by Fraunhofer FOKUS?

The most important lesson we have learned from using the system is that people are very interested in it and that more people are finding out about it. The system has been very well received by the population as a whole because it alerts them to emergency situations and lets them know what to do. All new technologies require a period of acceptance. If people don't accept the technology, it doesn't matter how good it is. The acceptance and keen interest in KATWARN was evident during the flood caused by Cyclone Xaver on December 5 and 6, 2013. Some Hamburg residents complained they were not informed, but the reason they were not informed was because they were not in a high-risk area.

ABOUT THE INTERVIEWEE

Civil protection is a cause close to Prof. Dr.-Ing. Peer Rechenbach's heart. His involvement with the volunteer fire department in Sülldorf-Iserbrook, Hamburg, began in 1970. His experience has made him a highly respected expert in disaster control and civil protection. He is also a member of the United Nations' Disaster Assessment and Coordination Team and a high-level coordinator for the EU's Disaster Response Mechanism. He is a member of the Commission on Civil Protection of the Federal Ministry of the Interior and a professor at the University of Applied Sciences Hamburg (HAW). He advises Fraunhofer FOKUS on projects such as KATWARN and Opti-Alert.

In regional emergencies such as floods or extreme cold, an app is used to contact and coordinate specific groups of volunteers

EVEN VOLUNTEER HELPERS HAVE TO BE ORGANIZED

Ambulances in Berlin are expected to arrive at the scene no later than eight minutes after receiving an emergency call. But when every minute counts, reaching patients even earlier can save lives. The goal of the ENSURE project, which Fraunhofer FOKUS is working on with partners from academia, public institutions and business, is to see that volunteers are organized quickly and efficiently in emergency situations. The project is concerned with locating members of the public who have the kind of special skills needed in emergencies and disasters. These include, as well as first-aiders, any doctors, psychologists, fire fighters or janitors who may be in the immediate vicinity. The project aims to identify people with the necessary skills as soon as possible so that they can be deployed before professional help arrives. Fraunhofer FOKUS developed a smartphone app to check for availability, issue alerts and coordinate activities. In the event of a regional disaster such as a flood, storm or extreme cold, the app will alert and coordinate selected groups of volunteers. The lessons learned during the Elbe floods in the summer of 2013 have been incorporated into the app. In addition to the local authorities and the emergency and rescue services, numerous volunteers responded to requests on the social networks to help with jobs such as, for example, packing sandbags. Although these volunteers provided valuable support to those helping the flood victims, the process of organizing them left plenty of room for improvement. For example, volunteers were not evenly distributed. In some places they even made access for the emergency services difficult or were not physically able to cope with the demands made of them.

AN ADDITIONAL CIVIL PROTECTION TOOL

In order to integrate volunteers effectively it is important to coordinate their efforts from a central point. This requires communication between the emergency services and first-aiders and it requires the app to be integrated as part of the control center's existing strategy. The aim is to develop an interoperable system that will permit the assessment, alerting and coordination of volunteers with the app. In addition to training volunteers, local on-site emergency personnel needs to be informed of the availability of potential volunteers and to be made aware of any special circumstances that could prove problematical. To ensure that civil protection delivers sustainable value, the practical applicability of the concept and its acceptance by the population and the emergency services will shortly be field tested. Although it appears obvious that involving volunteers is beneficial in many instances, the value of this approach needs to be compared with existing civil protection measures in our cities of the future as well as in rural areas.

VOLUNTEERS ON THE SPOT

It is a Sunday afternoon at the Berliner Festspiele and the film "20,000 Days On Earth" about the life of Nick Cave is showing in a darkened cinema. As Cave is walking along the beach, a loud cry is heard which is completely unrelated to the film. It does not stop. The music falls silent, the screen darkens and the lights go on. A woman is crying and shaking her husband who has collapsed in the seat next to her. The person next to her shouts, "A doctor! We need a doctor. Is there a doctor in the house?" The cinema is packed to capacity and from amongst the audience of 900 a doctor soon emerges. He hurries over and sees to the man. When the paramedics arrive to take him to the hospital, he has regained consciousness thanks to the efforts of the doctor. This situation had a relatively happy ending. But what would have happened if there had only been a few people in the cinema? There are currently over 470,000 doctors in Germany, the equivalent of more than one in every two hundred German citizens. In densely populated cities it is therefore likely that there will be a doctor close at hand who could give a patient first aid before the rescue team arrives – as long as he is aware of the incident. Until now, locating a doctor has largely been a matter of luck.

VULNERABLE CITIES

Disasters do not respect borders. We must therefore view disaster management as a transnational issue.

On January 12, 2010, in the poorest country in the northern hemisphere, 250,000 people died in just 37 seconds. The cause was not a bomb or a war but the biggest earthquake in the history of the American continent. The disaster took the Caribbean island state of Haiti completely by surprise. There were no aid workers, rescue equipment, medicines, drinking water or food. Just five years before, on August 29, 2005, the 280 km/h winds of Hurricane Katrina had created havoc across southeastern USA. Despite the fact that, as one of the world's richest countries, the USA was not unprepared for this natural disaster, the hurricane cost the lives of 1,800 people. Once again, the rescue services were completely overwhelmed. There was no electricity or drinking water, and looting and shootings soon occurred. Events during the past decades have shown quite clearly how vulnerable cities are despite technological progress and national prosperity. Natural disasters, industrial accidents and terrorist attacks have resulted in damage on an increasingly large scale that has had devastating social, health and financial consequences. In almost every emergency, the same problem occurred: Essential information was either not available or was not available in time, and the preparation and distribution of this information was inadequate. Not only that, but crisis management can only be effective if the population responds to warnings in an appropriate way – and this does not always happen. When a bomb disposal team was called to detonate an unexploded bomb in Munich in August 2012, for example, 2,500 local residents agreed to leave their homes. But people repeatedly walked through the barriers. How can you make sure in an emergency situation that the population is informed and follows instructions?

This is the kind of question that the international team of specialists from research institutes, universities and businesses working on the EU's Opti-Alert project tried to answer. The aim of Opti-Alert was to improve the efficiency and interoperability of warning systems through personalized and culturally sensitive communication. An interdisciplinary team of IT specialists, sociologists, media scientists, meteorologists and security experts analyzed how different countries (Germany, Austria, Italy, The Netherlands, Hungary, France, Sweden) and different population groups view threat situations and how they behave in these situations.

"ONE MESSAGE FITS ALL" DOES NOT WORK

The key finding of the study was that crisis communication can only function effectively if it is adapted to suit the region, the target group, the age and expected behavior of those affected. Culturally shaped beliefs and behavioral patterns are important and cannot be ignored. Whereas, for example, most Italians mistrust public authorities as a matter of course, the French are most likely to respond to an alert from a central authority. People in Germany and Austria, on the other hand, trust official organizations like the fire service, ambulance service or technical relief agency, while the Dutch always want to know the "whys and wherefores" before complying with instructions. Differences in life circumstances are also important. Families with young children, older people living alone, non-native speakers and tourists, for example, represent separate target groups. Warnings and instructions to each of these must therefore be designed accordingly. To make sure that they receive the warnings, suitable communication channels must be found for each group. The researchers found text messaging and sirens to be useful media in all the countries surveyed. However, the golden rule of successful crisis communication is still to establish an optimally configured crisis management system by broadcasting alerts on all channels. FOKUS is developing the required infrastructure by linking national and international warning systems with each other. Although sophisticated warning systems and highly realistic simulators cannot control nature, these developments are expected to contribute to civil protection and damage limitation in the future. The key is a combination of timely information, viral dissemination of information and a cooperative population that knows what has to be done. Opti-Alert is providing the design for this internationally applicable key.

PROJECTS

SAFETY LAB

The safety lab offers an independent test environment for networked public safety solutions that focuses on the perspective of the affected citizens. As a demonstration room and research laboratory, the safety lab offers experts, decision makers and politicians an independent framework in which to assess the usefulness of new technologies. Realistic emergency scenarios help to highlight the difference between what a technology should do and what it can do. By studying systems in varying depth, specific shortcomings of the system, or of the entire warning process, can be identified. The studies place particular emphasis on legal, organizational, social and economic issues.

www.fokus.fraunhofer.de/go/en_safety_lab

KATWARN

Duration: since January 1, 2012
KATWARN is a new type of warning system that sends a message to affected groups of the population via smartphone app, text or e-mail when an accident or dangerous situation occurs, thereby supplementing information provided by the police, fire service or media. If the local authority is equipped with KATWARN, warning messages are sent out via the fire service and emergency control centers in collaboration with the civil protection agency responsible. In the event of a major fire, for example, the app broadcasts a push notification message to users in the vicinity of the incident together with a map showing the location of the fire and clear instructions on what action to take. It also broadcasts an "all clear" message when the danger has passed. On October 30, 2013, KATWARN received a commendation from the "Germany – Land of Ideas" initiative.
www.fokus.fraunhofer.de/go/en_katwarn

FIT4SEC

Duration: July 1, 2013 to December 31, 2015
With the aim of strengthening the future of innovation within the EU, the European Commission has pooled its funding for applied research up to 2020 under the slogan "Horizon 2020". Projects being funded include initiatives to increase student enthusiasm for STEM subjects and projects that seek to develop new products based on research findings. The funding program, worth nearly 80 billion euros, has earmarked 1.7 million euros for research in the field of secure societies. The German security industry's participation in research projects is to be strengthened under the fit4sec initiative by the Federal Ministry of Education and Research, which will assist small and medium-sized enterprises from Germany to apply for research funds in collaboration with European partners.
www.fit4sec.de/en/
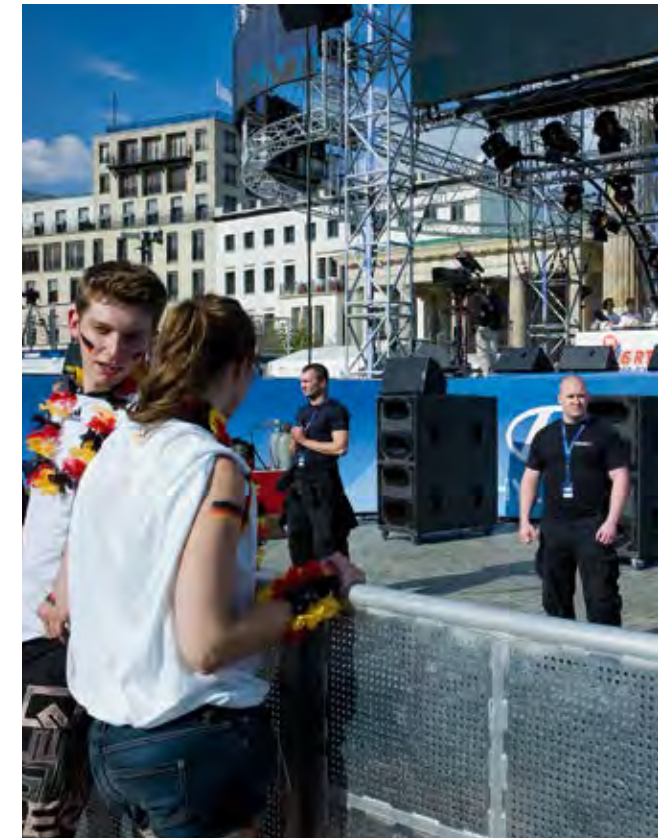
SAFEST

Duration: May 1, 2012 to April 30, 2015
Large crowds of people at airports and railway stations or in stadiums present a particular challenge to those responsible for their safety. In the German-French research project SAFEST (Social-Area Framework for Early Security Triggers at Airports) Fraunhofer FOKUS and its partners from industry and research are developing a hazard detection and crisis management system for high-traffic public areas. With the aid of infrared cameras, the system detects sudden changes in crowd numbers and critical crowd situations before mass panic can break out, thereby enabling evacuation to be carried out in a timely fashion. To protect the privacy rights of the individual, no individual visitor information is collected. The infrared camera is used only to produce a heat profile.
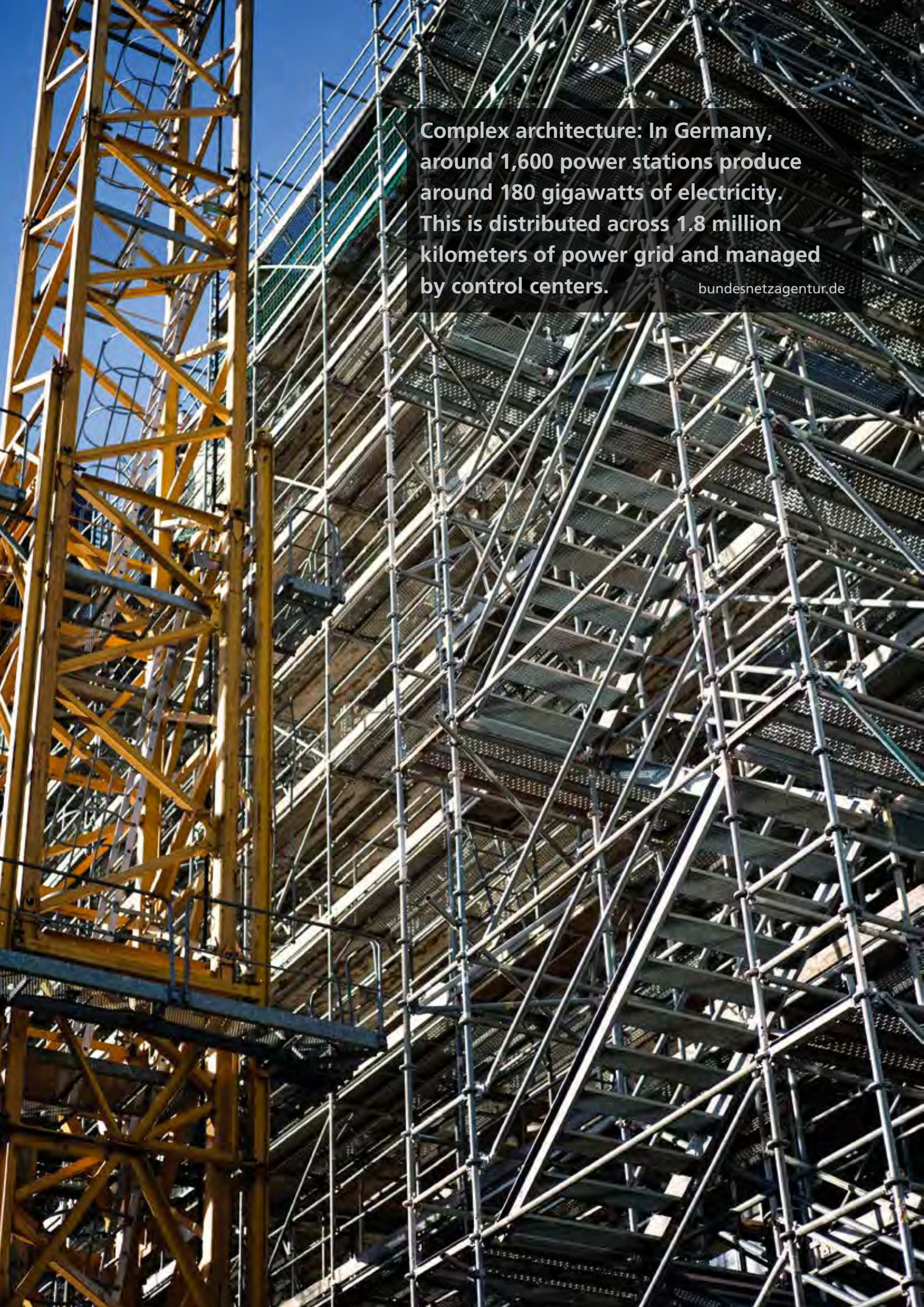**www.fokus.fraunhofer.de/go/en_safest**

MAKING SURE OUR CITIES WORK

Six o'clock in the morning – the city is waking up. People drag themselves out of bed still half asleep, switch on their coffee machines and then their showers. Water consumption quickly rises to its first peak level of the day. In large cities like Berlin and New York, people are used to having water on tap whenever they need it. They rarely give a thought to the numerous pumps and sewage treatment plants that provide their clean water. Berlin, for example, has approximately 8,000 kilometers of clean water pipes. But it's not just water. Electricity and public transport are some of the other basic services that city dwellers rely on every day. These critical pieces of infrastructure must remain available 24 hours a day, 7 days a week. In Germany's two largest cities, Berlin and Hamburg, residents receive their electricity through some 63,000 kilometers of power lines, 133 substations and 13,000 transformer stations. Without those, they would be unable to enjoy their morning coffee, take the train to work or boot their computer. But behind the running water and the fully functional coffee machine there is much more. After all, clean water and electricity must first be produced and distributed to those who need it. It's the same with transport: cars and trains don't drive themselves. Today, you will find information and communication technology behind almost everything. It is only when the power grid goes down, traffic lights fail, trains arrive late or the Internet stops working that people appreciate how dependent they are on properly functioning technical systems, and how complex these systems are.

FROM ARCHITECTURAL DESIGN TO QUALITY ASSURANCE

Our urban infrastructure is becoming increasingly networked. Our cars now communicate with other cars via the Internet and smart meters measure our electricity consumption and automatically select the most economical tariff. To make sure that this all works reliably even in unexpected situations and is well protected from outside influences such as hacker attacks, all of the system functions and environmental factors are taken into account during development. In order to do this – often with the aid of models – the system architecture has to be documented. This documentation is used in the development process to design the hardware and software architecture. Software code is often automatically generated from models and automatically tested. To ensure that the finished system meets all quality requirements, quality assurance starts right at the beginning of the development process, since it is more difficult to fix faults once development has finished. The relevant quality requirements, particularly for safety-critical systems such as cars and trains, are laid down in standards. The finished system will not be released until it complies with the relevant standards. Fraunhofer FOKUS is working on technologies for carrying out quality assurance along the entire development chain of software-based systems. Our scientists are using model-based development and test methods and verification techniques. They are also working on standards for interoperable tool chains, which are used in the development of safety-critical systems. Through this work they are helping to make information and communication technologies more reliable in urban environments.

SYSTEM QUALITY ENGINEERING

Electricity and water don't come out of your sockets or taps on their own. It's the same with transport: Trains and cars don't drive themselves. Take a look behind these critical infrastructure assets and you will find information and communication technologies making sure that they keep working 24 hours a day, 7 days a week.

Two hundred and sixteen kilometers of cable are laid for each ICE 3 train. 38 control units make sure that the brakes operate, the doors open and the air conditioning works. To gain approval, the trains had to travel 400,000 kilometers on the test route.

Siemens AG

Complex architecture: In Germany, around 1,600 power stations produce around 180 gigawatts of electricity. This is distributed across 1.8 million kilometers of power grid and managed by control centers. bundesnetzagentur.de

Berlin has around 16,000 electricity cabinets supplying power to around 2.3 million homes 7 days a week, 24 hours a day, making sure that everyone has their cup of coffee in the morning.

stromnetz-berlin.de

Ever since Chuck Hull invented the 3-D printer in 1983, this technological marvel has been used to produce more than just garden gnomes. You can now find construction plans for thousands of articles on the Internet. In software development, models can supply a blueprint for programs with many millions of lines of code

A BLUEPRINT FOR SOFTWARE

Models provide designers with a blueprint containing a description of the requirements and functions of a software application. And by means of "model checking" they can also check whether the model meets the specification. Tools can automatically produce software code based on the model. Models make teamwork easier for the people involved in the development process because models use a standard format that makes them easy to understand. This improves product quality while at the same time reducing development costs. In the BIZWARE project, Fraunhofer scientists and researchers showed that model-based software development is not just for specialists. They developed a model and software factory (DSL Workbench) that enables end users to generate software for their specific application from models they have created themselves. It is based on domain-specific languages (DSL), which are geared to the challenges of the sector in question as well as to the application. This makes them easier for specialists from different fields to learn than ordinary programming and modeling languages.

MODEL-BASED SOFTWARE TESTS

Models are used not just to develop software but also to test it. Quality control previously relied on manual test methods. Test cases were written out by hand, which took time and limited the number of test cases that could be carried out. With model-based testing methods, a model that describes all the requirements and functions of a piece of software can automatically generate test cases. Scientists from the Fraunhofer FOKUS System Quality Center (SQC) have developed the tool Fokus!MBT for this purpose. It simplifies the preparation of test models and automatically generates test cases. Model-based testing is much more efficient than manual methods, as you can virtually check at the push of a button whether the software application really meets all the requirements. Because of the larger number of test cases, it is theoretically possible to achieve one hundred percent test coverage and thereby improve the quality of the software.
Standards and norms are becoming increasingly important in obtaining approval for safety-critical systems and their software. Fraunhofer researchers therefore use model-based interoperability and conformance testing and participate in the development of Testing and Test Control Notation (TTCN-3) and the UML Testing Profile (UTP). TTCN-3 and UTP can be used to test all complex systems. TTCN-3 is also the only standardized test specification and implementation language used worldwide for automated testing.

CONNECTING ARCHITECTS AND SYSTEM DEVELOPERS

Whether in the car, on the train or at the banknote counting machine: There are a vast number of technical systems working in the background to make our life easier. They all contain software that makes sure the system does what it has been designed to do. For development and quality control purposes, the designers of these systems use software that often relies on models. Models can be helpful in a number of ways. They make it possible to describe complex things like system requirements and functions in an abstract way. Architects use models of buildings or urban areas not only to illustrate their new buildings as realistically as possible but also to simulate light and shade. They can also discover how a new building will affect its surroundings under different lighting conditions. Models are also used in wind tunnels to test the aerodynamics of buildings in order to locate and correct possible problem areas before the building is constructed.

RISK-BASED TESTING

Fraunhofer researchers have been investigating how the security of these systems can be assessed. The DIAMONDS project – Development and Industrial Applications of Multi-Domain Security Testing Technologies – and the RASEN project – Compositional Risk Assessment and Security Testing of Networked Systems – are using risk-based test methods. A detailed security risk analysis forms the basis of the tests in which all suspected vulnerabilities, potential threat scenarios and undesirable incidents are identified, described and evaluated. Appropriate test techniques and goals are then extrapolated from the description. The evaluation helps to determine the appropriate depth of testing. The greater the risk, the greater the depth of testing and thus the greater the test workload. A technique for auto-mating the detection of potential vulnerabilities is known as fuzz testing or fuzzing. This involves confronting the system with invalid or unexpected inputs in order to test whether input validation fails and whether the system ignores invalid data. Systems failing these tests can be made to crash or can be injected with malicious code. Fuzzing can check, for example, whether SQL databases are secure by using semi-valid inputs that differ only slightly from valid inputs. A simple example would be an SQL query that checks whether a password entered correctly matches the username. A security vulnerability in the database could allow a malicious user to bypass this check by entering 'OR I=I in the password field. The quotation mark (') can alter the syntax of a database query to allow SQL commands to be executed and routines to be bypassed by adding, for example, the expression I=I in connection with an OR operation. Input carefully crafted in this way can also be used to change or delete existing records – and even introduce new ones.

VERIFYING SOFTWARE SECURITY

In addition to testing software, our researchers use formal methods to determine whether the software is secure from attack. The STANCE project (Source Code Analysis Toolbox for Software Security Assurance) is looking into how formal descriptions can be used to uncover unexpected behavior in software systems. The first verification level involves preparing a formal specification of the software requirements, which is automatically analyzed and translated into mathematical formulae in which the preconditions and postconditions of the individual program functions are defined. These are then checked by "theorem provers" to see whether the program satisfies the postconditions by complying with the preconditions. This shows whether the software, or at least parts of it, are working properly. The aim of the Fraunhofer researchers is to maximize the number of different, innovative methods used for quality assurance, to encourage them to be used in combination and to support their development.

HEARTBLEED

Heartbleed – this was the name given in April 2014 to one of the biggest software security vulnerabilities in the history of the Internet. What happened? The developers of OpenSSL, a security technology used by many websites for encrypting personal data, discovered a coding error that intruders could exploit to read information transmitted over supposedly encrypted Internet connections. This put sensitive data such as banking information and passwords at risk. Nearly 18 percent of the world's web servers and around half a million website certificates were affected by the vulnerability. Today, about 90 percent of all software security incidents caused by intruders using well-known intrusion techniques such as cross-site scripting, SQL injection or buffer overflow attacks can be traced back to programming errors. It is not easy for the developers to fix these kinds of errors, as they are difficult to identify and localize. Not only that, but modern software often contains several million lines of code. Around 40 million lines were written for the Windows XP operating system; for the Mac OS X 10.4 it was as many as 86 million. To make matters worse, today's software systems are more tightly networked than ever before. The days are long gone when a bank manager or doctor used a standalone desktop PC. Nowadays you will find them working with a complex networked infrastructure, communicating across the Internet through equipment made by a variety of manufacturers.

A large number of developers and their tools work on the development of safety-critical systems. FOKUS ensures they can work together seamlessly.

ABOUT NEEDLES AND SAFETY-CRITICAL SYSTEMS

In his "The Wealth of Nations" published in 1776, Adam Smith discussed the concept of the division of labor. The example he used to illustrate his theory was the making of pins. Instead of making them in a single step, you could divide the production process into separate operations: 1 – draw out and cut the wire, 2 – sharpen the end and, 3 – polish. In this way, it is possible to produce larger quantities at a lower cost. The people producing the product could also specialize in individual parts of the production operation.

HOW A SYSTEM EVOLVES

The process of making pins that Smith described is used today in the development of safety-critical systems in fields like aerospace and automotive engineering. These systems are no longer developed by a single person, as their complexity makes it impossible for one person to oversee the entire operation. Nowadays, entire teams work on development, often with team members based all over the world. They use different tools for each step of the development process – requirements specification, modeling, task description, source code and test case generation. Sometimes the complete process of developing complex safety-critical systems can require as many as 100 tools. But no matter how many different tools are used, they must all be able to communicate with each other.

If a test engineer wishes to validate the requirements of a system, he must be able to refer to the criteria originally specified in the requirements description. To facilitate the exchange of data between different tools, they are linked via interfaces. It can become problematical when these interfaces are altered by, for example, an operating system update because this often requires time consuming adjustments to be made to the tools. Fraunhofer FOKUS researchers are working on the standardization of these interfaces. Another problem is that almost every tool "speaks" its own language. Various expressions may be used to describe the same thing in one system, while these expressions can have completely different meanings in different tools.

A NEW APPROACH

Critical System Engineering Acceleration, or CRYSTAL for short, is dealing with this particular problem. In the CRYSTAL project, Fraunhofer FOKUS is working on an interoperability specification with over 70 partners from ten European countries. This standard for communication between development tools is being developed as an open standard under the name OSLC (Open Services for Lifecycle Collaboration). Different user groups are able to contribute their requirements during the development process, thereby increasing future acceptance of the standard. At the moment, working groups are looking into issues like change and requirements management, testing and product lifecycle management. Each working group receives feedback from the community and refers to this when evaluating its own developments.

Another task being undertaken by the CRYSTAL project is the development of a reference technology platform (RTP). Not unlike a database, this contains tools such as analysis and simulation tools for model-based development. Thanks to its modular structure, developers can easily assemble the tools they need for any particular task. One of RTP's significant advantages is the interoperability of its tools, which allows developers to exchange data easily and quickly, saving time and money during the development process.

The CESAR project has already developed the initial concepts for the reference technology platform. CESAR stands for "cost-efficient methods and processes for safety relevant embedded systems". The ModelBus® Framework developed by Fraunhofer FOKUS was used as the basis for RTP to enable tools from different suppliers to be incorporated into the software and system development process. The tools are connected to the Framework with adapters. ModelBus® is an open-source application that uses model-based system development methods.

PROJECTS

DIAMONDS

Duration: October 1, 2010 to June 30, 2013
More than 90 percent of software security incidents are caused by attackers exploiting known security vulnerabilities. Such attacks can cause considerable material damage, especially when directed at financial institutions and transportation or telecommunications companies. The DIAMONDS project therefore developed methods for model-based security testing which can be used to check, for example, whether the network interfaces of banknote counting machines are secure.
www.fokus.fraunhofer.de/go/en_diamonds

OBC-SA – ON-BOARD COMPUTER SYSTEM ARCHITECTURE

Duration: October 1, 2012 to September 30, 2014
Computer systems used in space flight applications require ever-increasing amounts of processing power to handle tasks such as the pre-processing of large data sets from sophisticated experiments or payloads, and working out on-board control commands. Without this computing power, spacecraft would be unable to carry out complex docking or landing maneuvers autonomously. The OBC-SA project developed an architectural framework for future on-board computer systems to enable the modular integration of systems with different performance and functional characteristics into a redundant system architecture on board the spacecraft. The architecture is based on the new CompactPCI® Serial industrial standard for modular computer systems, which simplifies the configuration of future on-board computer systems. Functionality, computing power, redundancy and I/O interfaces can therefore be flexibly adjusted to meet mission-critical requirements.
www.fokus.fraunhofer.de/go/en_obcsa

IPV6 – INTERNET PROTOCOL VERSION 6

Postal codes are ubiquitous, even on the Internet. Devices are allocated Internet Protocol addresses (IP address for short) to enable them to communicate with each other and to let the service provider know which device has just sent a request. This used to be done using Internet Protocol version 4 (IPv4). By the year 2011, however, all 4.3 billion IPv4 addresses had been used up. This is why the development of Internet Protocol version 6 (IPv6) began as early as 1995. IPv6 provides 340.28 sextillion IP addresses. Fraunhofer FOKUS has several test suites as well as simulation and emulation environments for testing individual network components and architectures, data centers and web-based services. They enable developers planning new (IPv6) networks to verify the conformity of networks and devices to IPv6 and to evaluate other aspects such as practicability, safety, management complexity and availability.
www.fokus.fraunhofer.de/go/en_ipv6lab

SPRINT – SOFTWARE PLATFORM FOR INTEGRATION OF ENGINEERING AND THINGS

Duration: October 1, 2010 to September 30, 2013
Today, engineers working on large system development projects are often located in different countries and use different tools to develop individual system components. Until now, it was not possible to know whether the system as a whole was working correctly until these individual components had been integrated. The SPRINT project developed a web platform that engineers could use to collect design data and make it available to all members of the team. The platform also has a facility for simulating subsystems, integrating them and validating them across the Internet of Things. In the future, it will be possible to check the functionality of an entire system before it is physically completed, thereby saving time and money.
www.fokus.fraunhofer.de/go/en_sprint

HIGHLIGHTS OF 2012

JANUARY

PLATFORM FOR AMBIENT ASSISTING LIVING SYSTEMS

In January, FOKUS and its partners launched a new web-based competence platform for developers and providers of ambient assisted living systems. The platform was developed by the optimAAL project to provide a contact point for people seeking information and expertise on Ambient Assisted Living (AAL). The aim of the project is to improve the quality of life of people in all stages of life.

FEBRUARY

OPEN DATA FOR MODERN CONURBATIONS

Nicolas Zimmer, Secretary of State for Economics, Technology and Research, visited FOKUS to give a talk on Berlin's open data strategy. He was joined by the Institute heads Professor Radu Popescu-Zeletin and Professor Ina Schieferdecker, who discussed how open data can make a positive contribution to the development of modern cities.

MARCH

CEBIT 2012

Federal Minister Annette Schavan visited the Fraunhofer stand at CeBIT. FOKUS scientists gave her a demonstration of the exhibit „Smart Mobility - the future of traffic management". Many other high-ranking government and regional politicians also visited the FOKUS stand at CeBIT.

APRIL

GUESTS OF THE CHANCELLOR

On April 25, FOKUS participated in "Girls' Day" at the Federal Chancellery and presented a vision for the future of traffic in our own science exhibit. Schoolgirls were shown exhibits from the field of engineering and natural sciences at Girls' Day events held across the country. Angela Merkel paid a personal visit to the event in which FOKUS and six other exhibitors took part.

JULY

SMART CITY RESEARCH CONCENTRATED IN BERLIN

The merger with the Fraunhofer institutes FIRST and ISST is complete. All three institutes will now combine their specialist knowledge in smart-city research under the FOKUS banner. 540 employees from 32 countries will be working in 11 competence centers on technologies for tomorrow's smart cities.

OCTOBER

FRANCE WANTS TO KNOW

Fleur Pellerin, France's minister responsible for small and medium enterprises, innovation and the digital economy, expressed keen interest in Germany's digital strategy when she visited FOKUS. The main purpose of the visit was to learn more about the synergy between applied research, inspiring ideas and innovative commercial solutions.

OCTOBER

PUBLIC EVENING – OPEN GOVERNMENT@FOKUS

On the eve of the "Modern State" exhibition, representatives from politics, government, civil society, academia and industry assembled at FOKUS for a "Public Evening" at which they discussed the status and trends of the Open Government initiative. The topics of openness, transparency, citizen involvement in the political decision-making processes, and the provision of public information were discussed by means of lectures and panel discussions.

NOVEMBER

GERMAN CHANCELLOR LAUNCHES THE FIRST CENTRAL GOVAPPS PLATFORM AT IT SUMMIT

Chancellor Angela Merkel, along with the Federal Government Commissioner for Information Technology, Cornelia Rogall-Grothe, launched the first central distribution platform for public apps. FOKUS was commissioned by the Federal Ministry of the Interior to develop the OS-neutral GovApps platform. It offers citizens a wide range of services for smartphones and tablets.

GO! START-UP OF THE GERMAN TELEMEDICINE PORTAL ON MEDICA.DE

Secretary of State Thomas Ilka activated the „German Telemedicine Portal" developed by FOKUS at the MEDICA trade fair. The web portal was developed for a Federal Ministry of Health research and development project. It provides access to information on telemedicine solutions and is used in the preparation and planning of telemedicine projects.

NOVEMBER

VISIT TO THE MINISTRY OF THE INTERIOR

Fraunhofer President Professor Reimund Neugebauer and FOKUS Institute Director Professor Radu Popescu-Zeletin visited the Ministry of the Interior at the invitation of Interior Minister Hans-Peter Friedrich and State Secretary Cornelia Rogall-Grothe. They discussed the continued cooperation between the Ministry and the Institute.

NUMBER 1 IN THE APPLE STORE

The KATWARN app developed by FOKUS reached number 1 in the Apple Store. Shortly after the launch of the German Meteorological Service's new disaster and severe weather warning channel, the popularity of the system pushed the app to no. 1 in the „Free News" category and to 56th place in „Top Free Apps".

DECEMBER

OPEN DATA PORTAL FOR BERLIN'S ELECTRICITY GRID

Vattenfall and FOKUS have launched the Open Data Portal for the Berlin electricity grid. Data from Berlin's electricity grid can now be viewed openly and be processed on the Internet. Berlin-based energy distribution company Vattenfall Europe Distribution Berlin GmbH is providing information on the structure, distribution and network fees in machine-readable form. FOKUS was in charge of implementing the portal.

HIGHLIGHTS OF 2013

MARCH

COMPETENCE CENTER OPENED

In March, FOKUS opened its new public information technology competence center ÖFIT, where more than 15 scientists are now working on information technology for the public sector. Its focus is not limited to technical infrastructure but extends also to practical concepts, applications and prototypes. ÖFIT is funded by the German Federal Ministry of the Interior.

NEXT GENERATION ID DEVELOPMENT AT CEBIT

The Fraunhofer innovation cluster „Next Generation Identity" (NGIS) was shown to visitors for the first time on the opening day of CeBIT. Five Fraunhofer institutes, industrial partners and universities are bundling their expertise to promote the development of ID technologies. The cluster is being supported by the state governments of Berlin and Brandenburg.

APRIL

IPV6 STARTS NOW

In 2013, local authorities and government organizations in Germany began the migration of their systems to the new IPv6 address format. FOKUS published an IPv6 profile for administrative departments along with migration guidelines for the public sector. These explain which IPv6 standards have to be complied with to ensure interoperability and to protect investments in new equipment.

MAY

"CITY OF KNOWLEDGE" FOR ECUADOR

The Ecuadorian Minister of Education, Science, Technology and Innovation, René Ramírez Gallegos, visited the Institute in May to learn about our research into "smart cities". The minister is planning a "city of knowledge" in Ecuador to boost the economic recovery.

JUNE

OBAMA INTERACTIVE

In June, in partnership with the Berliner Morgenpost newspaper, FOKUS made Barack Obama's speech at the Brandenburg Gate into an interactive video event. Shortly after the US President made his appearance, users could obtain a video recording of his original speech formatted to allow them to jump to interesting sections of the video and to obtain further analysis and information on specific passages simply by clicking on them.

JULY

STANDARD FOR VIRTUAL POWER PLANTS

In July, FOKUS and Vattenfall set up the VHPready industry forum to develop sustainable IT solutions for the energy transition in partnership with leading companies. Research and industry are working together on a communication standard for virtual power plants.

SEPTEMBER

TOUR OF THE SMART CITY INSTITUTE

In September, FOKUS demonstrated our applied research for the smart cities of tomorrow to Cornelia Yzer, the Berlin Senator for Economics, Technology and Research.

AT THE IBC WITH MICROSOFT

FOKUS and Microsoft joined forces at the IBC in Amsterdam to provide their first demonstration of DRM interoperability. This enables the playback of protected premium content in HTML5-based browsers. FOCUS integrated a W3C-compliant video content decryption module (Content Decryption Module, or CDM) into its FAMIUM platform for the digital rights management of Microsoft PlayReady.

OCTOBER

EXCELLENT PLACE 2013

FOKUS developed the KATWARN local warning and information system on behalf of public insurer companies. They system informs citizens via app, text message or e-mail of disasters such as large fires or approaching storms. With their annual awards ceremony "Excellent Place", the "Germany – Land of Ideas" initiative and the Deutsche Bank intend to increase awareness of the innovative prowess of German companies and institutions.

OCTOBER

WIBACK. FIRST WIRELESS-BASED INTERNET IN THE SOUTH TYROL

The first official WiBACK node was formally opened in the South Tyrol. Bruneck department of works are using the FOKUS wireless-based WiBACK solution to deliver a reliable and fast Internet connection to companies and private homes, even in remote areas.


NOVEMBER

EUROPEAN CLOUD STRATEGY

At the Cloud for Europe conference and the meeting of the European Cloud Partnership Steering Board, leading figures from politics and IT discussed the future of a European cloud strategy. The central theme was the issue of security and trust in cloud technologies in the wake of the NSA surveillance scandal, and the creation of a standardized internal cloud market in Europe. Cloud for Europe is an EU-funded research project in which 23 partners from 11 countries are collaborating.

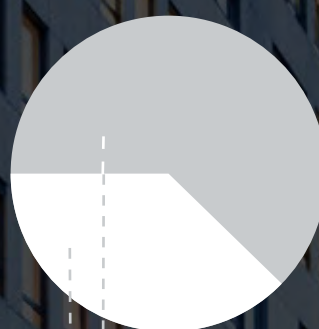## 2012

Budget: EUR 35 million total

Own revenue and institutional funding

Personnel: 490 total
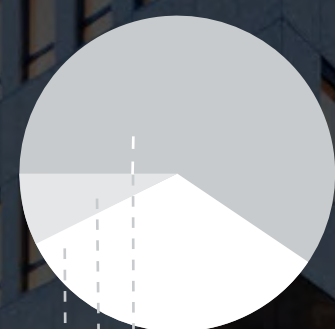
Personnel: EUR 20.8 million
Investment: EUR 2.6 million
Equipment and materials: EUR 11.6 million

Own revenue: 62.5 %
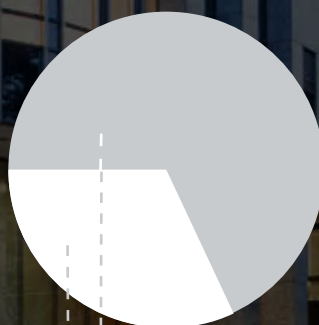*Institutional funding: 37.5 %*
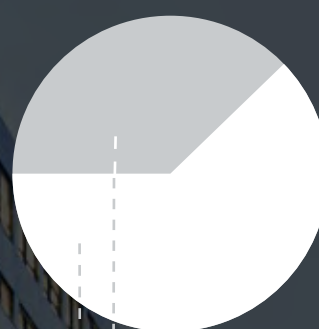
Students and interns: 185
Employees: 305

2013

Budget: EUR 34.2 million total

Own revenue and institutional funding:

Personnel: 507 total
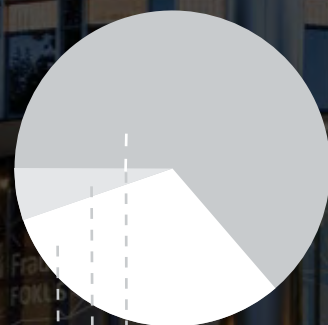
Personnel: EUR 21.8 million
Investment: EUR 1.9 million
Equipment and materials: EUR 10.5 million

Own revenue: 68 %
Institutional funding: 32 %
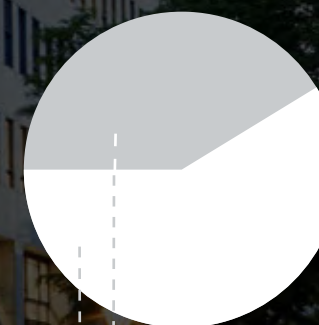
Students and interns: 210
Employees: 297

FACTS AND FIGURES

BUDGET

The Fraunhofer FOKUS budget in 2012 was 35.0 million euros. 20.8 million euros was spent on personnel, 11.6 million euros on equipment and materials and 2.6 million euros on investments. Own revenue accounted for 62.5 percent of the budget, with institutional funding making up the remaining 37.5 percent.

The budget in 2013 was 34.2 million euros. 21.8 million euros was spent on personnel, 10.5 million euros on equipment and materials and 1.9 million euros on investments. Own revenue accounted for 68 percent of the budget, with institutional funding making up the remaining 32 percent.

PERSONNEL

A total of 490 people were employed by Fraunhofer FOKUS in 2012, including 185 students and interns. In 2013, FOKUS employed 507 people, including 210 students and interns.

PUBLICATIONS

In 2012, Fraunhofer FOKUS supervised 30 "Diplom", bachelor and master theses and four dissertations. FOKUS scientists published a total of 145 scientific publications. They ran 42 university courses and applied for 11 patents.

In 2013, Fraunhofer FOKUS supervised 16 "Diplom", bachelor and master theses and one dissertation. FOKUS scientists published a total of 117 scientific publications. They ran 69 university courses and applied for one patent.

NO ONE LIKES A CITY THAT'S TOO SMART

Thanks to the digital revolution, at last life in cities can be brought under control. But is this a good thing?

by Richard Sennett

Doing more than programming traffic, the smart city's computers will calculate where offices and shops can be laid out most efficiently, where people should sleep, and how all the parts of urban life should be fitted together. Science fiction? Smart cities are being built in the Middle East and in Korea; they have become a model for developers in China, and for redevelopment in Europe. Thanks to the digital revolution, at last life in cities can be brought under control. But is this a good thing?

You don't have to be a romantic to doubt it. In the 1930s the American urbanist Lewis Mumford foresaw the disaster entailed by "scientific planning" of transport, embodied in the super-efficient highway, choking the city. The Swiss architecture critic Sigfried Giedion worried that after the second world war efficient building technologies would produce a soulless landscape of glass, steel, and concrete boxes. Yesterday's smart city, today's nightmare.

The debate about good engineering has changed now because digital technology has shifted the technological focus to information processing; this can occur in handheld computers linked to "clouds", or in command-and-control centres. The danger now is that this information-rich city may do nothing to help people think for themselves or communicate well with one another. Imagine that you are a master planner facing a blank computer screen and that you can design a city from scratch, free to incorporate every bit of high technology into your design. You might come up with Masdar, in the United Arab Emirates, or Songdo, in South Korea. These are two versions of the stupefying smart city: Masdar the more famous, or infamous; Songdo the more fascinating in a perverse way. Masdar is a half-built city rising out of the desert, whose planning – overseen by the master architect Norman Foster – comprehensively lays out the activities of the city, the technology monitoring and regulating the function from a central command centre. The city is

conceived in "Fordist" terms – that is, each activity has an appropriate place and time. Urbanites become consumers of choices laid out for them by prior calculations of where to shop, or to get a doctor, most efficiently. There's no stimulation through trial and error; people learn their city passively. "User-friendly" in Masdar means choosing menu options rather than creating the menu. Creating your own, new menu entails, as it were, being in the wrong place at the wrong time. In mid 20th-century Boston, for instance, its new "brain industries" developed in places where the planners never imagined they could grow. Masdar – like London's new "ideas quarter" around Old Street – on the contrary assumes a clairvoyant sense of what should grow where. The smart city is over-zoned, defying the fact that real development in cities is often haphazard, or in between the cracks of what's allowed.

Songdo represents the stupefying smart city in its architectural aspect – massive, clean, efficient housing blocks rising up in the shadow of South Korea's western mountains, like an inflated 1960s British housing estate – but now heat, security, parking and deliveries are all controlled by a central Songdo "brain". The massive units of housing are not conceived as structures with any individuality in themselves, nor is the ensemble of these faceless buildings meant to create a sense of place. Uniform architecture need not inevitably produce a dead environment, if there is some flexibility on the ground; in New York, for instance, along parts of Third Avenue monotonous residential towers are subdivided on street level into small, irregular shops and cafes; they give a good sense of neighbourhood. But in Songdo, lacking that principle of diversity within the block, there is nothing to be learned from walking the streets. A more intelligent attempt to create a smart city comes from work currently under way in Rio de Janeiro. Rio has a long history of devastating flash floods, made worse socially by widespread poverty and violent crime. In the past people survived thanks to the complex tissues of local life; the new information technologies are now helping them, in a very different way to Masdar and Songdo. Led by IBM, with help by Cisco and other subcontractors, the technologies have

been applied to forecasting physical disasters, to co-ordinating responses to traffic crises, and to organising police work on crime. The principle here is co-ordination rather than, as in Masdar and Songdo, prescription.

But isn't this comparison unfair? Wouldn't people in the favelas prefer, if they had a choice, the pre-organised, already planned place in which to live? After all, everything works in Songdo. A great deal of research during the last decade, in cities as different as Mumbai and Chicago, suggests that once basic services are in place people don't value efficiency above all; they want quality of life. A handheld GPS device won't, for instance, provide a sense of community. More, the prospect of an orderly city has not been a lure for voluntary migration, neither to European cities in the past nor today to the sprawling cities of South America and Asia. If they have a choice, people want a more open, indeterminate city in which to make their way; this is how they can come to take ownership over their lives. Technology is a great tool, when it's used responsively, as in Rio. But a city is not a machine; as in Masdar and Songdo, this version of the city can deaden and stupefy the people who live in its all-efficient embrace. We want cities that work well enough, but are open to the shifts, uncertainties, and mess which are real life.

Richard Sennett, born on January 1, 1943 in Chicago, Illinois, is an American sociologist. The son of Russian immigrants teaches sociology and History at New York University and the London School of Economics. His main research areas are cities, labor and cultural sociology. Sennett became well-known as a theorist of urban life. His timeliness topics and his catchy, essayistic style of writing make his books worldwide bestsellers.