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MOBILITY

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SAFETY & SECURITY

TOMORROW**TODAY**

/// SECURING THE FUTURE

ICT SECURITY RESEARCH:

PROVIDING THE SOLUTIONS TO TOMORROW'S PROBLEMS





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SECURITY. GUARANTEED!

/// The market for security technology and services in Austria and beyond is rapidly outgrowing economic performance – driven by people's need for greater security. And security is one of the Federal Government's main priorities. The government is turning towards innovative approaches to research – such as those practised by the AIT Austrian Institute of Technology. ///

TRYING TO DEFINE THE SENSE OF "SECURITY" ACCURATELY AND UNEQUIVOCALLY is virtually impossible. Today, security no longer means military protection, as it did to our grandparents almost two generations ago. Now, when we talk about security, we mean the ability to go about our business at night with a feeling of total safety, the confidence that our online bank transfer has gone through successfully or that our belongings are safe from potential flooding. But security is about much more than that. It affects practically every aspect of our day-to-day lives and as such has become something of a catch-all term. Security, at least in the commercial world, is therefore attributed the same significance as the labour market, healthcare and environmental protection. Consequently, security research has to be sufficiently thorough to meet all of these demands.

COMPLEX CHALLENGES

The challenges involved in security research are extremely complex. Not least because of the increasing mechanisation of the systems needed to make a society work. Even a minor malfunction would be enough to bring our day-to-day lives into disarray. Such a failure can snowball very quickly, culminating in the almost uncontrollable breakdown of the critical infrastructure. For example, the failure of central power supply nodes – even if only for a few hours – would have dramatic consequences, especially for a metropolis such as Vienna. The results would be fatal, from the breakdown of the traffic system and the



loss of power at hospitals to far-reaching implications for individual households. And the total failure of power grids in Italy and New York are proof enough that this scenario is anything but science fiction, demonstrating the importance of a fail-safe infrastructure and how security needs to be looked at holistically. In the context of



Federal Minister of Transport, Innovation and Technology Doris Bures: "Security is about much more than protection against threats – there is also a social dimension. Our aim has to be to guarantee human prosperity and a high quality of life. Which is why we favour innovative approaches to research such as those practised by the AIT, for example."

increasing globalisation, however, not only has the world become smaller in terms of global networking, but systems have become more dependent and vulnerable.

LEADING EXPERT IN EUROPE

Austria has been tackling these research issues for several years already – and was one of the first European countries to do so – and is now one of the leading security research nations in Europe. Whereas other European countries are only just beginning to embark upon security research, the Republic of Austria already has a wealth of research results from projects such as the KIRAS national research programme.

SECURITY FROM A SOCIAL PERSPECTIVE

"As Europe's security research pioneer," says Federal Minister of Transport, Innovation and Technology Doris Bures, "we are aware that greater security can have a positive effect in many areas, not least in terms of economic added value. What we need are solutions which safeguard our well-being - guaranteeing communication, the supply of energy and, of course, the health system as a whole. But security is about much more than protection against threats – there is also a social dimension. Especially with

regard to the ageing society. Our aim has to be to guarantee human prosperity and a high quality of life. Which is why we favour innovative approaches to research such as those practised by the AIT, for example. This affects areas such as secure jobs and guaranteed medical care. Areas which are supremely important to this government and which are therefore high on our agenda. I therefore embraced the decision of the AIT – Austria's largest non-university research institute – to prioritise security following its restructuring initiative."

AIT'S INNOVATIVE APPROACHES TO RESEARCH

"Our goal," says Anton Plimon, commercial manager of the AIT Austrian Institute of Technology, "is to leverage innovative approaches to research with a view to giving industry as well as political decision-makers the tools they need to realise new modules for security-critical systems. Our research efforts are geared towards developing ever more sophisticated technologies for Austrian security management, while also focusing on the implications and challenges of autonomous systems for the 'man in the street'. Promising approaches such as those currently being taken in the areas of software validation, telemedicine or image processing, for example, will also help to put a face to the abstract term "security research".



AIT Managing Director Anton Plimon: "Our research efforts are geared towards developing ever more sophisticated technologies for Austrian security management, while also focusing on the implications and challenges of these technologies for the 'man in the street'."

The development of solutions in a security policy context requires an integrative approach which is not just restricted to what is technologically feasible."

INTERNATIONAL NETWORKING IS THE ORDER OF THE DAY

"It goes without saying that security research," continues the AIT's scientific manager Wolfgang Knoll, "always has to be consistent with privacy laws. Austria is involved in

an EU security research project compliant with fundamental rights which has been under way for some time already."



AIT Managing Director Wolfgang Knoll: "International networking is fundamental, especially in the area of critical infrastructures. To be able to sustainably deal with any breakdowns, joint European strategies and concepts need to be developed."

"And because technical failures of all kinds have a tendency to ignore national borders, international networking is a major concern, especially in the area of security research. To be able to sustainably deal with any breakdowns, joint European strategies and concepts need to be developed. Security research and the application of the results can, therefore, only be effective in a European context."

"For this reason, we at AIT place a premium on international research partnerships which encourage close collaboration on a European scale and which allow us to leverage the results."

ECONOMIC ASPECTS

Besides the high level of national interest, the economic aspects are another argument for stepping up domestic security research. Several studies in this area paint a very clear picture. For example, "4C-Foresee Management Consulting" discovered that public authorities in Austria are investing around one billion euro in the protection of critical infrastructures. This makes Austria one of the biggest investors worldwide, ahead of the USA and Germany in terms of per capita expenditure! At the same time, another study by "PlanConsult Holding" reveals that it is primarily domestic companies which are benefiting from these investments. But these studies did not just focus on the economic significance of security research. Another topic frequently addressed by such studies is national awareness. For example, a current Mitropa study revealed that the average Austrian values the diverse security measures implemented by the government very highly. Even the sometimes controversial video sur-

veillance of critical spots is welcomed by the majority of the Austrian people, because they regard this measure as a form of protection rather than intrusive monitoring. Peter Koren, Deputy Director General of the Federation of Austrian Industries: "Security is without doubt fundamental to national added value and to securing existing and creating new jobs in Austria. The international competitiveness of domestic security technology can only be guaranteed, however, if industrial core competence can be retained in Austria and further consolidated. In this case, the government as a major consumer of security solutions also has a responsibility to help establish an innovative market and thus make it easier for domestic providers to introduce new technologies." ///



Peter Koren, Federation of Austrian Industries: "The government as a major consumer of security solutions has a responsibility to help establish an innovative market and thus make it easier for domestic providers to introduce new technologies."

HOW ICT RESEARCH INCREASES OUR SENSE OF SECURITY

/// The AIT Safety & Security Department plays a significant role in the context of ICT and is primarily focused on ensuring the operational efficiency and reliability of all critical infrastructures – in both the private and public sectors – especially in times of possible ecological, economic and political crises. ///

THE AIT SAFETY & SECURITY DEPARTMENT is dedicated to expanding the national infrastructure and developing state-of-the-art technologies for public administration (eGovernment, eEnvironment), power supply, healthcare (eHealth, AAL), transmission networks, payment systems, telecommunications, Internet and industry and commerce, with the aim of positioning Austria at the forefront of the European ICT sector.

Safety & Security are the two areas which continue to grow in importance in today's world and which are absolutely critical to the future information society. Both terms refer to the safety and security of individual people as well as security systems. On the one hand, it has to do with safety / security in terms of physical integrity. Security systems have a role to play here, such as medical care systems as well as technologies which keep us out of harm's way. On the other hand, it has to do with the availability of the fundamental infrastructure of a society.

In more specific terms, 'safety' in this context refers to the technologies and the personal safety of individuals who are directly or indirectly dependent on the proper functioning or availability of a data processing or autonomous system.

'Security' refers to areas such as data protection, surveillance and monitoring of critical infrastructures as well as to information and communication technologies which support security-critical processes.

TECHNOLOGICAL BUILDING BLOCKS FOR THE ICT INDUSTRY

Generally speaking, the department's expertise is in Information and Communication Technology (ICT) for applications in the area of Safety and Security. The department's research activities are focused on two branches of this innovative market. Firstly, the department's experts are researching and developing technological building blocks for the ICT industry. Secondly, they are helping public authorities with innovative,



The AIT Safety & Security Department consists of around 200 highly qualified people and combines three Research Areas



Photos: Krischanz & Zeiler

complex technological decision-making processes. Given the possibilities opened up by future Information and Communication Technologies, the huge volumes of data and system complexities that have to be dealt with, and the diverse implications for developers, operators and users of technologies, it is necessary to address social and economic implications in addition to the technical aspects.

All of the AIT department's ICT eHealth solutions are designed and developed from the ground up in collaboration with medical experts and evaluated with the help of end users.

Based on the results, an overall concept which aligns all of the individual participants' needs is defined. This allows the researchers to bridge the gap between technology and end user in an area which has major societal implications. Similarly, the department is also working on solutions for eGovernment.

The department consists of around 200 highly qualified people and combines three Research Areas: Highly Reliable Software and Systems (HRS), Future Networks and Services (FNS) and Intelligent Vision Systems (IVS).

HIGHLY RELIABLE SOFTWARE AND SYSTEMS (HRS)

The HRS Research Area focuses on the development of new software standards as well as new techniques, tools and process strategies for the verification and validation of ultra-reliable and secure software in the field of autonomous (e.g. robotics, automotive engineering, smart systems for vehicles, special-purpose machines, etc.) and cooperative systems, with particular emphasis on transport infrastructure. Core competence in this area encompasses the design, development and integration as well as the verification and validation of reliable and secure systems. The main objective is the safety of autonomous and cooperative systems.

The emphasis is on the development of techniques and solutions which ensure that computer systems remain safe. Furthermore, these systems have to be constructed cost-effectively. High safety standards can be achieved for aeroplanes through redundant systems and complex tests, but this cannot be transferred to the automotive industry, for example, at a reasonable cost.

Mobile phones as well as any device equipped with a microchip - which pretty soon will be just about everything - should also be fail-safe. But if everything communicates with everything, the big challenge will be to ensure the bulletproof reliability and stability of such a network. The researchers of the AIT Safety & Security Department are therefore working on test systems which prevent programming errors from getting out of hand and endangering the entire network.

The assumption is not that flawless systems can be programmed, but the department is instead trying to identify ways of preventing faults from becoming a threat in distributed systems. The main concern here is security

in distributed systems. And special approaches to technological development are the basis for the growing complexity of these systems.

FUTURE NETWORKS AND SERVICES (FNS)

The FNS Research Area encompasses information, communication and data access for complex distributed architectures in the ICT arena, focusing on different areas of application such as eGovernment, eHealth and large-scale sensor networks, based on next generation technologies and concepts such as cloud computing and optical quantum technologies.

In critical areas, for example in the environmental, government and health sectors, the department also develops techniques and tools enabling new technologies to be made available to Austrian society and European industry.

Given vast increases in volumes of digital data and the diversity of applications and data types, the long-term availability of data is becoming the fundamental problem of our modern information society.

The Safety & Security Department is focusing on the research and development of tools (software tools), process workflows and systems designed to enable us to relocate and read these digital data long into the future. Given that digital data, owing to increased networking and the growing number of end devices, are increasingly being created and stored in distributed systems, the department's researchers are also developing techniques and solutions designed to ensure the secure exchange of data across these networks.

The availability of new Information and Communication Technologies also allows us, however, to take entirely new approaches to a modern health system. In addition to traditional medical care, new approaches to healthcare – especially from the perspective of an ageing population in today's modern society – for the population in general and the elderly in particular are increasing in importance.

The Safety & Security Department's eHealth research group specialises in the application of cutting-edge Information and Communication Technologies in the field of telemedicine, aiming towards "Closed Loop Healthcare" in the future.

INTELLIGENT VISION SYSTEMS (IVS)

The IVS Research Area centres around hardware and software development and is geared towards current trends in miniaturisation and integration and their application in the context of critical infrastructures.

This Research Area also brings together all software technologies for image and video processing within the department and is focused on the implementation of relevant strategies in line with the demands of industry partners. This Research Area is geared towards high-performance video processing for high-performance applications in the security arena, such as traffic data,

"WE CAN'T MAKE THE FUTURE MORE PREDICTABLE, BUT WE CAN AT LEAST MAKE IT SAFER"

/// Helmut Leopold, Head of the Safety & Security Department, on the strategy, positioning and objectives of his team.

video surveillance, print quality control and robotics, and researchers hope to achieve their objective through new hardware platform capacities, improved algorithms or new, biologically inspired concepts.

Highly sophisticated, high-performance image processing technologies are being developed, allowing even large-scale areas to be monitored precisely, safely and quickly.

For example railway lines – although not directly associated with the term safety – are a potential disaster area in the event of material fatigue or defects.

Unlike conventional, expensive test vehicles, which take measurements only randomly, the department's innovative system will in future be able to use infrared to check the rail tracks for hairline cracks and rail breaks directly from the train's engine during regular service. Railway tracks are only one example, however. Image processing systems will soon be used in many different areas. The challenge lies in teaching these modules how to locate and display specific things.

Possible areas of application for smart systems such as these range from crime prevention to everyday households, where they can protect children and young people from salacious websites, for example. ///

Mr. Leopold, why should potential clients commission the researchers of your department?

In order to be able to fulfil its official obligations, such as public safety, disaster control and national defence as well as administration, a government needs a secure, available and high-quality communication infrastructure – now and in the future. It is a question of national security and the viability of a nation. We in the Safety & Security Department research and develop relevant concepts and instruments. Austrian industry also needs a suitably modern ICT structure, i.e. telecommunications and secure information systems. There is a lot of risk and expense involved in setting up and maintaining systems like these, the technological effort is high and development periods are lengthy – this leads to correspondingly complex business models which are often inappropriate for private sectors of industry, which is why they have to be massively supported by the state. We provide the framework for estimating the effort involved and for making decisions about such systems as well as the know-how required to develop them.

So you are focused on securing the domestic infrastructure?

Yes, from personal security, safeguarding critical infrastructures, communication, transport logistics and healthcare to the archiving and storage of our society's knowledge. The Safety & Security Department operates three Research Areas, namely HRS or Highly Reliable Software Systems, FNS or Future Network Services and IVS or Intelligent Vision Systems.

Is your department strategically equipped to handle such a challenge?

Firstly, my team – which comprises around 200 people – and I have defined a clear strategy around which all of our activities are based. In a second phase, we introduced a clearly structured development process, the like of which has long been state-of-the-art in the automotive industry. It is based on four gates, or steps. The first step, or Gate Zero, is where an idea is born and then compared with existing concepts on an international scale. In the second step, a team is tasked with conceptualising the idea. In step three, a decision is made as to whether the concept will be realised or not. The first three steps therefore reveal the technical feasibility of a project. In step four, its marketability is assessed. The project is only given the green light, i.e. brought to market, if the result is positive.

What are your long-term research goals?

Through networking based on cutting-edge Information and Communication Technologies, society produces an incredible amount of data, which has to be interpreted usefully and productively. So the idea is to make this information available – in line with data protection laws, of course – for precautionary models. This would give those in charge reliable information on which decisions can be based. Although this doesn't make the future more predictable, you can still prepare for certain events properly and in good time. ///



SECURITY IN OUR (VIRTUAL) LIVES

/// The Internet has become a virtual living space. Even transactions and administrative affairs can be handled online. To ensure that personal and sensitive data are sufficiently protected now and in the future, researchers of AIT's "IT Security" working group are developing new security solutions. ///



Andrea Nowak: "We want to be able to access the Internet any time, from any place and with any device. But security across such complex networks can no longer be guaranteed using conventional methods."

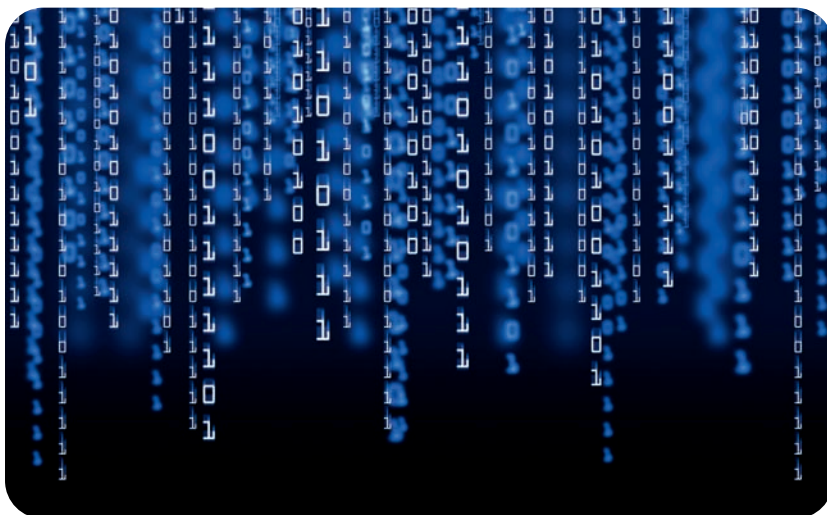
Photos: Krischanz & Zeller, AIT Austrian Institute of Technology, Photos.com, BMWIT

"LAST WEEK I WAS STRANDED IN BRUSSELS", says Andrea Nowak. She is the deputy head of AIT's Safety & Security Department. "But I didn't mind at all. I had my laptop with me and was able to work even in Brussels." In the evening Nowak was able to find out the cause of her cancelled flight via webstream. The Icelandic volcano Eyjafjalla had spewed a giant ash cloud into the atmosphere, grounding all air traffic.

THE INTERNET AS A VIRTUAL HABITAT

"We want to be able to access the Internet any time, from any place and with any device," says Nowak. Our society depends on the availability of this all-encompassing network in order to function properly.

The Internet has long been a virtual living space in which we can take care of most of our day-to-day business quickly and easily. Even banking and administrative affairs can be dealt with online.



Companies also use the Internet to take care of business. Some even no longer have a head office in the bricks and mortar sense. They exist only on the Internet. Their staff, suppliers and business partners are located in Vienna, New York or Sydney. Networking is what makes it all possible. The Internet has given globalisation a significant boost. The number of devices with which we can send and receive e-mails or access company software is also growing. Many Internet users don't just possess a PC; they also have a laptop and a mobile phone with Internet access.

WHERE IS MY DATA STORED?

Who can escape this development? Modern ICT systems are prevalent. Owing to increased networking and the growing number of end devices, they are becoming more and more complex. Developments such as cloud computing are also contributing to this phenomenon. Users working on computers in the future will no longer be working with software installed on their own PCs. The different services will be accessible from a central computer and simply rented by users. This will enable companies to save money, since they will no longer have to pay for expensive software upgrades. But a huge data cloud will be the inevitable result, begging the question: where is my data and what is happening to it?

ACCESS RIGHTS AND UNREALISABLE MAINTENANCE OBLIGATIONS

"Security across such complex networks can no longer be guaranteed using conventional methods," says Nowak. Which is easy to understand. You only need to think of an international company with thousands of employees and hundreds of business partners. Every single member of staff and every single business partner has access to certain services made available by the company.

And everyone has different access rights. While the boss of the company has unlimited access to all services, some staff have access to certain services only. Staff will also have access to services which are unavailable to business partners. If an employee leaves the company, they must also relinquish their access rights. Their e-mail account will be suspended and they will no longer be able to access the company's internal servers and databases.

To ensure systems like these remain secure, every single connection from any end device of any employee or business partner must be secure. In a company whose staff and business partners are located all over the world, this is virtually impossible. "Implementation effort for systems like these is extremely high," says Nowak. "As a result, errors are more likely to be made and the system becomes less and less maintainable." Which is why researchers in the AIT's Safety & Security Department are trying to find methods which can be used to make even the most complex systems secure.

SECURITY IN SERVICE-ORIENTED "ARCHITECTURES"

The primary focus is on security in service-oriented architectures. A service-oriented architecture can be described in simple terms as a method for loosely coupling and integrating disparate services offered by a company to form one "greater application". Service-oriented architectures can help to make organisational processes more flexible and modifications easier. Most important in this context is the reusability of data.

Service-oriented architectures are important for business processes in particular. For example, in a bank. Before bank staff can approve a loan, they need certain information about the applicant. Including, of course, name and account number. This information should already be in the system. The "enter customer name" and "open account" services have to be linked for the clerk to be able to access the required information about the customer and approve the loan.

Complex business processes can be simplified by coupling disparate information. But there are also a number of new security requirements which have to be met. Frequently, service-oriented architectures are not just used within a company but also combine several different services provided by several different companies. In turn, these services are used by different people of differing security levels. A system which ensures a service-oriented architecture as a whole is also capable of significantly reducing susceptibility to errors within service-oriented architectures.

PLATFORM-INDEPENDENT MODELS FOR SECURE BUSINESS PROCESSES

"We need new security architectures, techniques and tools in order to implement the necessary safety requirements effectively, transparently, comprehensibly, efficiently and cost-effectively," says Andrea Nowak, summing up the demands placed on the security systems of the future. Even if complex network structures necessitate just as complex security architectures, users have to be able to use them quickly and easily.

"Security for many people sounds like an occult science. You can't see security. If users are unable to understand a security system, they are less likely to accept and therefore use it. So it has to be ultra-complex and yet usable at the same time," says Nowak. In a bid to bridge this gap, the researchers of AIT's Safety & Security Department employ special software design approaches.

For example, a system based on the application of the model-driven architecture (MDA) approach. This involves mapping complex applications in two models. There is a platform-independent model (PIM) and a platform-specific model (PSM). The PIM is the basis for all business processes. This is where general security requirements are defined. "Data integrity" is one example of such a requirement.

The defined security requirements are then transferred to a platform-specific model and adapted to the specific needs of a business process. The PSM is the "actual" software. It clarifies what "integrity" means in a specific business process and how this security objective can be achieved.

Finally, a generator transforms all security requirements into codes. They have to be transparent and clear to ensure that the user is not overwhelmed and actually uses the system.

The advantage of model-driven solutions is that they are easily understood by the user. User access no longer has to be secured and maintained in each separate case. The system is secured as a whole. By separating the two models, security requirements can also be adapted more easily to cope with changes to a business process.

APPLICABLE SECURITY STRATEGIES FOR TOMORROW'S PROBLEMS

In the development of security solutions it is, of course, important that they work. But it is also crucial that a company can afford them. And every company is structured differently. A small regional company with ten employees and an international group with several thousand staff will need different security systems.

AIT scientists are researching the latest technologies in the IT security arena. Particular emphasis is placed on the commercial applicability of the solutions and their potential for integration with existing Information and Communication environments.

NEW SECURITY SOLUTIONS FOR E-GOVERNMENT

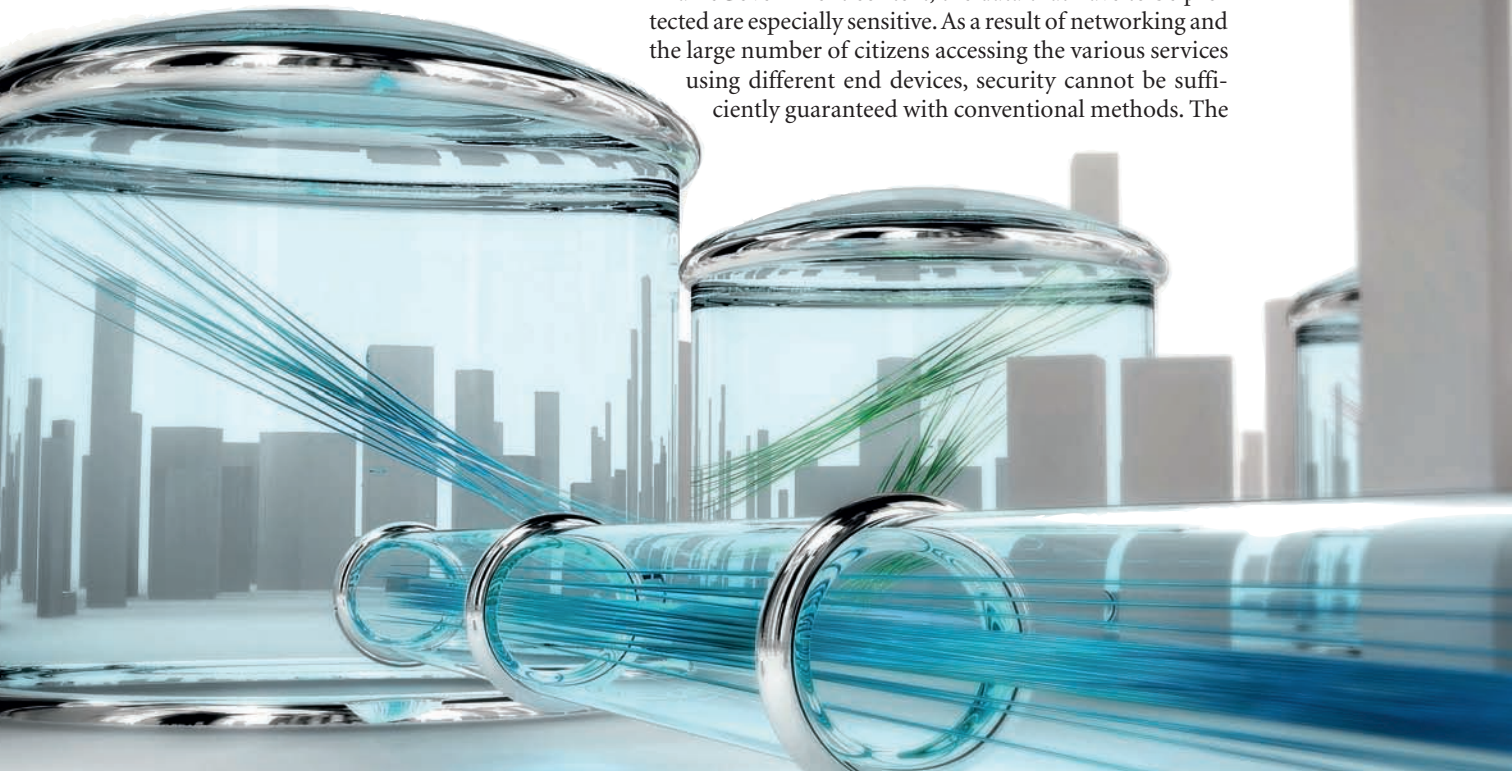
The shift towards handling many business processes online means that companies are not alone in demanding greater security. The security of critical infrastructures such as medicine, transport and eGovernment also has to be guaranteed.

Through the use of new media, the authorities can make their services more easily accessible to the public. Communication between the authorities and citizens is rendered much more straightforward. Authorities are already offering a number of services online.

In future, administrative affairs will be handled completely online. This means that forms will no longer have to be downloaded, but can simply be filled out, digitally signed and submitted online. If, for example, you move to a new town, you can save yourself a trip to the registration office and no longer have to wait in line to be seen.

But procedures like these only start to make sense if a whole range of services can be offered. If, for example, you wanted to open a new place of business, you would not have to struggle through the different pages of the individual authorities, but could obtain all the relevant information and forms through a single service. Service-oriented architectures are also used in the eGovernment arena to link the individual services of the various authorities. This results in similar security issues as experienced by large companies.

In an eGovernment context, the data that have to be protected are especially sensitive. As a result of networking and the large number of citizens accessing the various services using different end devices, security cannot be sufficiently guaranteed with conventional methods. The



AIT's Safety & Security Department takes innovative approaches based on model-driven security architectures, allowing future problems in next-generation networks to be addressed.

KIRAS: RESEARCH PROJECTS FOR OUR SECURITY

The Austrian eGovernment system is just one area in which new solutions for greater security have to be found. The shift in our society towards an information society means that ever greater importance is being attached to security – in the most diverse of areas.

Modern Information and Communication Technologies hold significant potential for minimising security risks. You only need to think of the latest surveillance systems or the progress which these technologies have allowed in the field of medicine. Because security is a fundamental requirement for society, Austria has implemented a dedicated programme geared towards encouraging security research: KIRAS. It is a nationwide programme whose aim is to promote research into security issues. It was initiated by the Federal Ministry for Transport, Innovation and Technology (BMVIT).

The aim of KIRAS is to improve security for Austrians in all areas of life. It is not simply about preventing terrorist attacks or crimes of violence. Research activities also encompass disasters such as flooding, avalanches, tunnel fires and – more generally – climate change.

The AIT is able to leverage its extensive expertise in image processing to develop new and innovative approaches to the use of image processing techniques with the aim of increasing security in critical infrastructures. In order to seamlessly integrate the latest scientific findings in modern ICT into the nationally critical security processes of tomorrow, as well as networking the various actors within an efficient innovation process, the AIT positions itself as Austria's biggest application-oriented research institute in those areas which are crucial for Austria.

The AIT thus makes an important contribution to improving security in our information society. And to personal security. After all, we are part of this society. ///



/// GERNOT GRIMM, HEAD OF STAFF GROUP FOR SECURITY RESEARCH AT THE FEDERAL MINISTRY FOR TRANSPORT, INNOVATION AND TECHNOLOGY, ON SECURITY AS A MATTER OF NATIONAL CONCERN.

Mr. Grimm, how important is security research in a national context?

Ensuring the security of Austria's citizens is one of the biggest challenges of today and tomorrow. Security research, which affects several key areas of politics, is therefore one of the cornerstones of government policy. Because we are talking about promoting research in a fast-growing technological field, security research is inextricably linked to goals in both technology and innovation policy in addition to security policy. But the promotion of research should also lead to more jobs and generate added value in Austria, wherein lies its significance for labour market and economic policy. The KIRAS security research programme in Austria makes a valuable contribution right across the board. This is confirmed and ensured by accompanying evaluation measures.

You describe security research as a fast-growing field. How do you see this research area in the context of creating a national RTI strategy?

Security, with all its many facets – from "hard" technological solutions for guaranteeing security to "soft" sociocultural issues – is a hugely complex subject. Through the comprehensive approach taken by KIRAS and by including the relevant stakeholders, such as federal ministries and social partners, in the steering committee – set up on the basis of a decision of a council of ministers –, allowances can be made for this level of complexity. By gearing research promotion towards the needs of the central actors of national security policy, KIRAS can avoid needless research and ensure the efficient and effective use of taxpayers' money – especially important in times of economic crisis. KIRAS is thus a front-runner in terms of "RTI governance" and forward-thinking issue management is already standard practice.

What are your expectations of an application-oriented research institute and to what extent does the AIT meet these requirements, in your opinion?

The Federal Ministry for Transport, Innovation and Technology's Staff Group for Technology Transfer and Security Research has already been working with AIT specialists for many years, because they have precisely the research expertise we need to implement our strategies. In the context of KIRAS in particular, the AIT's Safety & Security Department boasts specialist know-how which we can, for example, leverage for the protection of critical infrastructures. In areas such as this we generally tend to employ the services of national research institutes. ///

ICT AND HEALTH

/// The AIT Safety & Security Department's eHealth group, led by Key Researcher Günter Schreier, is conducting research into innovative health systems. These systems are being influenced more and more by telemedicine, the remote treatment of patients. ///

Günter Schreier: "Our mission is to leverage ICT to create new links between doctors and patients and to improve communication between partners across the healthcare network using eHealth systems."



INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) is an integral part of our lives. We use it on a day-to-day basis, of course – and it is also used in the medical care of people.

The eCard, which we all take with us to the doctor's, is the most obvious example. eHealth has a virtually unlimited remit. Consequently, the AIT's Safety & Security Department has its own dedicated eHealth group. It is focused on medicine using the latest Information and Communication Technology. The group places a premium on developing all innovations in close collaboration with doctors and hospitals. The emphasis is always on the benefits for doctors and patients. And technology lends a helping hand.

To put research and development in this broad area into perspective, to spread the word and put R&D on an international platform, the AIT's eHealth group organises each year what has now become the largest scientific eHealth conference in Austria. The focus is on current experiences and achievements in telemedicine. Discussion also centres around support for medical research and care using the latest generation Information and Communication systems.

The aim is to lay the foundations for decision-makers in the Austrian health sector. Standardisation in this area is one important area which is actively influenced by the AIT's eHealth group.

But what is the point of telemedicine? Telemedicine involves nothing more than saving patients a trip to their GP or the hospital for inpatient treatment. The AIT's eHealth group is developing techniques for sustainable remote treatment. The benefit for doctors is that patient treatment is both easier and more flexible. Telemedicine is ideal for treating chronic illnesses, which require constant monitoring.

It is conceivable that patients with chronic heart problems or diabetes, for example, can be helped by telemedical monitoring in all aspects of their day-to-day lives.

REMOTE SURVEILLANCE SAVES LIVES

Telemonitoring is a specific area of telemedicine. A practical telemonitoring system for the remote monitoring of patients with heart problems has been developed by the AIT's eHealth group.

The system is based on cost-effective and readily available technologies which are easily used externally.

Equipped with a mobile phone, scales and blood pressure gauge, they transmit vital signs such as blood pressure, heart rate, body weight and medication to a central monitoring station on a daily basis. The attending physician has online access to the data transferred.



If predefined threshold values are exceeded, the system notifies the responsible doctor. This allows the relevant patient's situation to be assessed quickly and appropriate measures, such as an adjustment in medication, to be taken by, for example, giving the patient direct instructions.

QUICK AND IMMEDIATE DECISIONS

Telemonitoring enables doctors to identify critical developments in their patients early and to take appropriate countermeasures. This also gives patients additional peace of mind on a daily basis. The risk of their condition deteriorating can be reduced through quick diagnosis and appropriate medical treatment. As a result, patients are required to travel to hospital for inpatient treatment less often.

Clearly structured, secure communication, independent of location and time, between doctor and patient makes life easier for both parties. Telemonitoring increases the personal sense of security and the quality of life of patients with chronic illnesses. It is also reassuring for doctors to know that they are in a position to do the very best for their patients at all times, quickly and with minimal effort. Tele-

monitoring also allows the costs involved in inpatient treatment in hospitals to be reduced.

The benefits of telemonitoring have been revealed in a high-grade clinical study by the AIT and the Medical University of Graz. The study involved 120 patients with cardiac conditions in eight Austrian hospitals. It was published in the "Journal of Medical Internet Research" (www.jmir.org). A direct comparison revealed that in the group of patients receiving telemedical treatment – in contrast to the group not benefitting from telemonitoring – the number of hospital stays could be cut by half. And in terms of time, the remaining hospital visits were a third shorter.

CLOSED LOOP HEALTHCARE

Telemonitoring enables us to establish a permanent, location-independent link between patients, doctors and caregivers. This link is referred to as "Closed Loop Healthcare". It is the cornerstone of next generation healthcare, allowing patients and their carers to remain in permanent contact – and to actively link up whenever they are required to. Researchers of the AIT's eHealth group are collaborating with health professionals on the development of specific applications (including the relevant medical validation) for future Closed Loop Healthcare. One important area of research focuses on the simple and, more importantly, secure gathering of data and data processing. The communication structure itself is another key aspect, since it helps doctors and caregivers to make decisions.

HIGH USABILITY

Parameters such as weight, blood pressure and the patient's condition are also recorded when gathering patient information.

The patient can measure these data him or herself using devices specially adapted by the AIT's eHealth group. They allow results to be read using a mobile phone and Keep In Touch (KIT) technology.

AIT researchers place a premium on the simple and secure use of devices for patients. Data input should be intuitive and technology-neutral, thereby increasing the acceptance of telemedical applications among patients.

The measured data are transmitted to a central point, where they can be analysed and accessed by the attending physician using a Web browser. Doctors can use the system to send messages to the mobile phones of patients.

PROTECTION AGAINST MISUSE OF DATA

Health data are extremely sensitive, so their security is of paramount importance. AIT researchers guarantee one hundred percent data security for patients based on special concepts. As well as absolute data security during the integration of new telemedical applications into existing IT infrastructures. ///

THE ELDERLY AT HOME

/// A research team led by Ahmed Nabil Belbachir has developed a technology which makes life easier for the elderly living in their own homes by allowing care to be administered in the home and immediate help to be called for in the event of emergency. ///

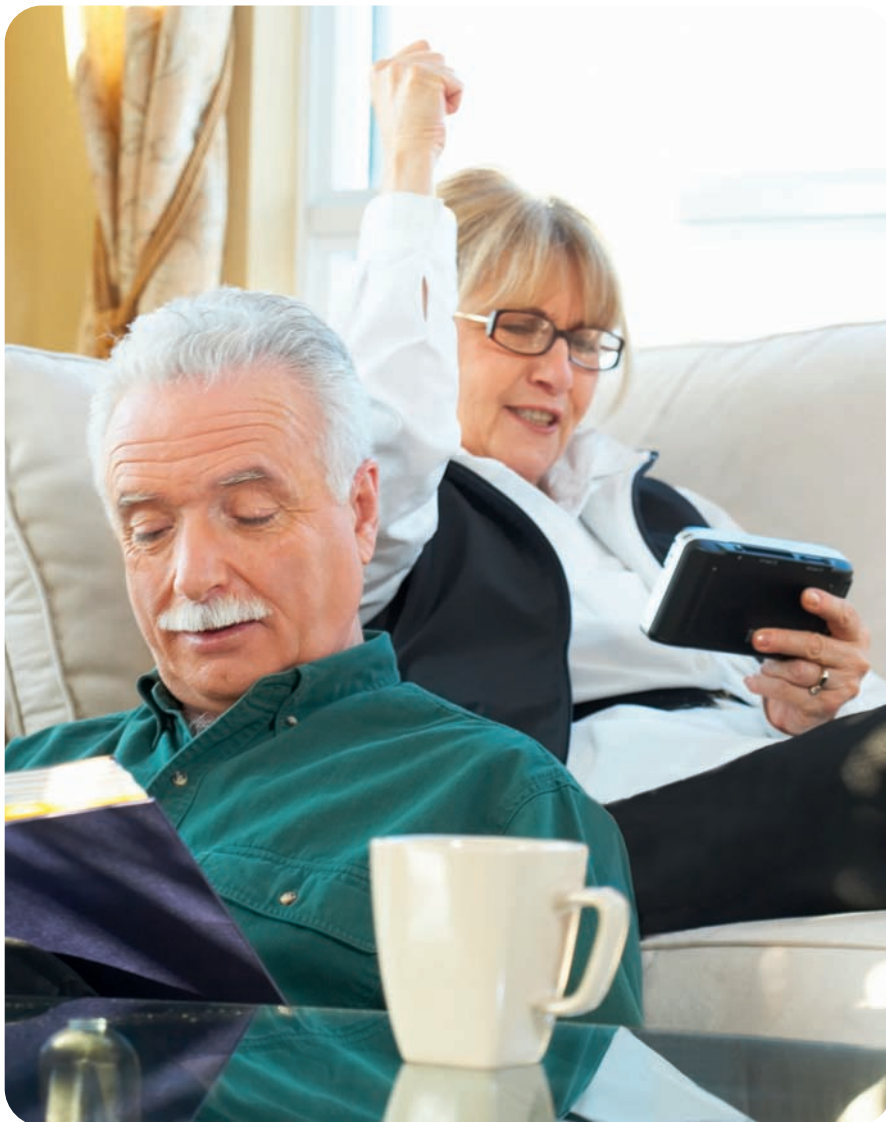
CARE (SAFE PRIVATE HOMES FOR ELDERLY PERSONS) is an EU-wide research project. It is funded as part of the European "Ambient Assisted Living Joint Programme". The aim of the project is to allow the elderly to carry on living independent lives at home.

In so doing, the latest technologies are used, including smart bio-inspired optical sensors developed at AIT.

Smart bio-inspired optical sensors are capable of automatically recognising critical situations such as falls and sounding the alarm. As part of the project, the system is being tested in two assisted living facilities in Finland and Germany. One major advantage of the technology is that it can be integrated into the existing healthcare systems of private households.

SMART BIO-INSPIRED OPTICAL SENSORS work in a similar way to the human eye. A camera interprets the surroundings and transfers the information to a data processing system. The information is then processed and interpreted. Smart bio-inspired optical sensors have the ability to learn. Using special algorithms, they recognise speed and direction of movement. Colours signalise depth information, i.e. movement height and depth. This allows critical situations to be recognised. The camera's sensor does not take in all of the surroundings, but interprets only movement within its field of vision. The system does not, therefore, restrict privacy in any way. In fact, it has more in common with a fire extinguisher than a surveillance camera. In the event of a critical situation, nursing services are notified by an acoustic signal rather than through an image.

ONE CRUCIAL AREA OF APPLICATION is the recognition of falls. Falls are the biggest risk to elderly people who live alone. The technology used in smart bio-inspired optical sensors allows different types of fall to be recognised and is capable of identifying similarities. If a person lies down on a bed, the situation is not recognised as critical. Even if somebody falls down and gets up on their own soon afterwards, no alarm is sounded. Only in cases where a person falls and stays down does the system sound the alarm. Unlike other fall sensors, the system developed by the AIT can be integrated into existing healthcare systems. A button does not have to be pushed to trigger the alarm, and the sensor does not have to be worn on the body. This allows the elderly to carry on living independent lives in their own homes. These technologies – in conjunction with telemonitoring – open new doors in terms of "growing old gracefully" at home. ///



Photos: Photos.com, istockphoto/www.markus-hoffmann_de, IBM

BETTER QUALITY OF LIFE FOR EPILEPTICS

/// An AIT research team led by Tilmann Kluge is developing a special technology which allows epileptic fits to be recognised quickly based on the evaluation of EEG data. ///

THE HUMAN BRAIN is made up of billions of brain cells. These are called neurons. Neurons communicate with one another by transmitting electric signals. Consequently, there is a lot of electrical activity in the brain. The electrical signals sent by the brain are recorded by electroencephalograph (EEG).

This is a standard neurology test which allows epilepsy to be diagnosed, for example. It can also be used to ascertain brain death, depth of anaesthesia or coma and in sleep medicine.



During head operations – to remove a tumour, for example – it helps to prevent nerve damage through appropriate monitoring of the electrical signals.

ELECTRICAL BRAIN ACTIVITY can be measured using special devices. This involves placing electrodes at particular points on the scalp or – if the signals are too weak or to improve spatial resolution – directly on the cerebral cortex. The resulting image resembles the zigzag lines produced by a seismograph. Changes to the image could point to pathological, that is to say abnormal, developments. Unlike an ECG, there has hitherto been no suitable method for interpreting EEG data automatically. This is because of the high complexity of the brain and, in turn, of the EEG signal. Evaluating EEG data has always been a time-consuming process.

IMPROVED EVALUATION OF EEG DATA

The scientific team of the "Advanced Algorithms for Brain Signal Analysis" working group at the AIT is researching methods for the automatic interpretation of EEG data. Scientists are developing algorithms capable of reliably interpreting the various characteristics of an EEG signal. These methods are used both during operations and neurological tests on patients. Epileptic fits can therefore be recognised very quickly. EEG spikes, which indicate epilepsy, can also be recorded. Researchers are currently focused on the rapid recognition of epileptic fits. "Although mathematical techniques for diagnosing epilepsy are being researched worldwide, only in very few cases can these techniques be successfully adapted to real-life conditions in hospitals," explains Kluge. If this conundrum can be cracked, then the research results can be turned into a marketable technology. The AIT's system for the automatic recognition of epilepsy from EEG recordings is being tested on over 200 patients with over 700 epileptic fits. AIT researchers have access to a total of over 15,000 hours of EEG recordings, allowing a world-leading technology to be developed. ///



/// LEO STEINER, CEO IBM AUSTRIA, ON IT STANDARDS

Mr. Steiner, what in your opinion are the biggest challenges facing the eHealth sector?

If you buy a car these days you can choose from a whole range of components and therefore tailor your future vehicle to your specific needs. Behind that, there is a chain of harmonised processes which are automatically intertwined. Each element of the supply chain

has to be geared towards the end goal. We all know how important IT is in this respect. What is less well known is that this harmonisation is only possible because standards are applied. The health sector also comprises a whole range of different actors all geared towards the same goal: patient health. It is crucial for information about each patient to be complete, and for this information to be accessible quickly and straightforwardly. In other words, everybody must be able to understand each other.

How highly do you as an international group value an application-oriented research institute like the AIT?

The AIT Austrian Institute of Technology is a key partner in terms of innovative pilot projects.

In which areas is IBM already making use of the expertise of AIT researchers?

We are currently collaborating in the area of telemonitoring in particular, but we have also been working successfully in other areas such as "smart grids" and "smart buildings" for some time already. ///

SINK OR SWIM

/// The AIT Austrian Institute of Technology is a European leader when it comes to the digital long-term preservation of our cultural heritage. The AIT's Safety & Security Department has a working group dedicated to preserving access to cultural assets in digital form. ///

THE STORAGE OF KNOWLEDGE has changed radically since the introduction of digital media. Many digital media store knowledge for a limited time only - five to seven years, on average. This has prompted researchers in the Safety & Security Department of the AIT Austrian Institute of Technology to develop systems capable of providing long-term access to digitally stored knowledge and cultural assets. The AIT is on the executive board of the new international "Open Planets Foundation". It was born from an EU project called "Planets", the idea being to promote the development of technologies which enable future generations to access our cultural heritage for years to come.

PLATFORM-INDEPENDENT LONG-TERM PRESERVATION SYSTEMS

To raise awareness for the significance of the long-term preservation of digital data and develop appropriate techniques for long-term digital storage, a four-year European research initiative was launched in 2006. It is called "Preservation and Long-term Access through Networked Services", or "Planets". Since its inception, the project has seen the development and testing of relevant services and tools for digital storage. As a result, practical and applicable solutions for long-term digital storage are now available.

The AIT's role in the research project is significant. It is making a major contribution to the evaluation of the research results. This will ultimately be to the benefit of the European countries and their economies. The "Open Planets Foundation" was founded as a not-for-profit company together with the EU Commission. The British Library is a key partner, but there are other important libraries as well as software vendors the world over who have already shown interest.

The AIT is a founder member of the "Open Planets Foundation" (OPF) and Ross King is a leading researcher in this field. King, who manages the relevant research group in AIT's Safety & Security Department, is a member of OPF's executive board. It is a crucial initiative for preserving our knowledge in companies and institutions.



Ross King: "In 30 years the data stored now will be unusable simply because there will no longer be any software applications capable of accessing it. For instance, who still has a copy of WordPerfect 1.0?"



DATA ACCESSIBILITY LESS THAN FIFTY YEARS

What at first glance seems so simple, namely preserving access to our data with a few keyboard strokes, is in fact a highly complex issue. It affects both the past and the future. Even if data can be digitally stored in the long term, the question is whether we will be able to open and read files in years to come. To read an old book, all we have to do is open it. To open a document created using an old program, you need the relevant hardware and software or an emulator.

Ross King's research group at the AIT is focused on finding solutions to this problem. One of the biggest challenges they face is the lack of awareness among institutions and people who generate and store information digitally (in the meantime, all of us). Try saving your digital photos for your grandkids now, and the family will be

sorely disappointed in fifty years' time. There simply won't be any devices around which are capable of displaying the pictures.

VIRTUAL SENILITY

Owing to the continual development and emergence of new digital formats, companies already have this problem. But it mostly passes them by. After all, there are always (old) manuals and (older) staff which the younger generations can call on for assistance. But companies are suffering a gradual loss of knowledge and inherent memory.

In order to preserve knowledge and pass it on to further generations, we need systems which are both easy to use and reliable. Companies not only have to maintain specific know-how, they also have to keep legally binding documents for extended periods.

AIT BRINGS BACK MEMORIES

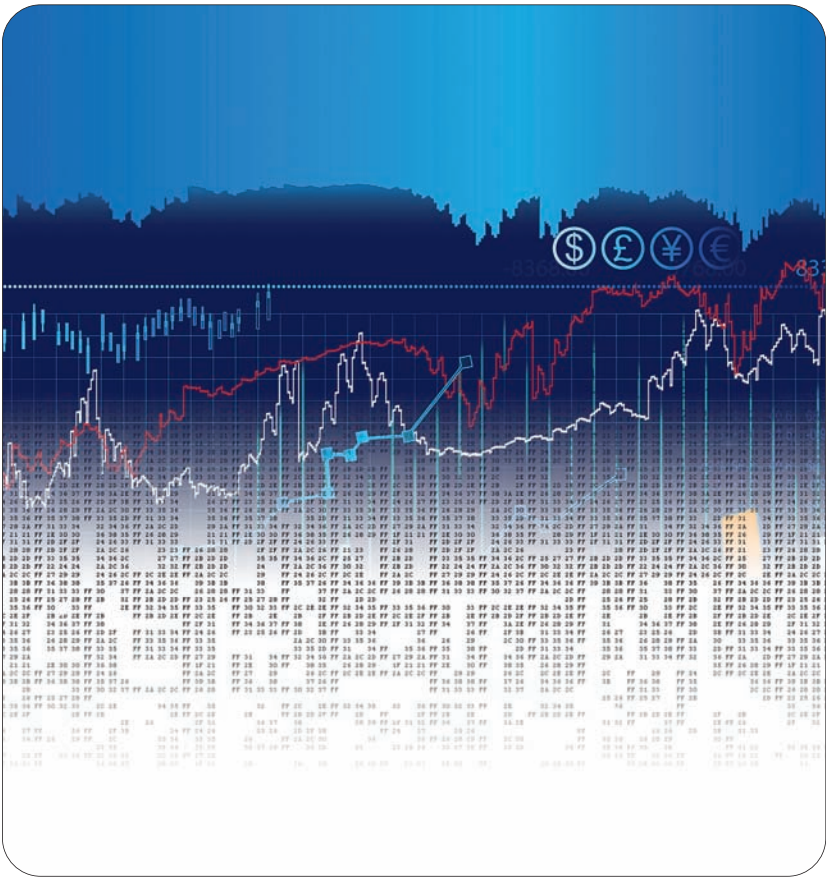
In a bid to preserve access to digitally stored data in companies and institutions while there is still time, the AIT's Safety & Security Department is involved in the FFG-funded Research Studio Digital Memory Engineering (RS-DME) project. Techniques and programs are being developed which are designed to guarantee the secure, long-term availability of digitally stored information platform-independently.

Research is split into three branches:

- 1. Workflow-based support for archiving in companies. Corporate workflows are frequently handled using document-based workflow systems. In order to ensure the long-term preservation of these processes, services are being developed which can be directly integrated with the workflow. A graphic workflow editor allows different scenarios to be created and workflows to be visualised. Existing Enterprise Content Management Systems are also being assessed in terms of their potential for compliance with digital preservation standards such as OAIS or best-practice models such as TRAC.
- 2. Support for preserving multimedia content. To be able to maintain systems with embedded media objects, research into special strategies and tools for creating, archiving and restoring multimedia content is being conducted based on metadata. RS-DME is developing a tool based on semantic Web technologies which preserves data in public or private Wikis sustainably and in the long term, while also taking into account linked resources such as documents, images and videos.
- 3. Archiving systems for SMEs. The requirements of small and medium-sized companies and private users in terms of long-term digital storage differ significantly from those of large companies and institutions. RS-DME is developing a new system specifically for this group which is designed for the automated long-term preservation of digital information. It is based on a modular service model, similar to firewall or anti-virus software. It is user-friendly and is updated automatically. Its user-friendliness belies the technological complexity of the software. Data can be fed into the system from different sources such as storage media, e-mail repositories or on-line storage spaces.

SOCIETY'S DUTY TO PRESERVE KNOWLEDGE

For over a century, archaeologists have been rummaging through the garbage of an ancient Egyptian city with a population of 20,000. They have uncovered a wealth of old documents, famous poems penned by Sappho and parts of the apocryphal Gospel according to Thomas as well as mundane scribbles. Based on the information collected, British researcher Peter Parsons has managed to put together the history of the city and the life of its people in his book entitled "City of the Sharp-nosed Fish". Life in Oxyrhynchos, which in Greek means the city of the sharp-nosed fish, was brief and tough. The vast majority died young – and with them the knowledge gathered over a generation. There was no sustainable development in Oxyrhynchos.



This ancient city is an example of how important the preservation of knowledge is in terms of the development (or stagnation) of a society. In Oxyrhynchos it apparently ended up on the garbage heap. Younger generations were unable to learn from their forefathers, who died young, forcing them to start from the beginning each time. This is reminiscent of the problems suffered by developing countries today, where development is sometimes painfully slow.

SAFETY AND SECURITY FOR OUR KNOWLEDGE

The lesson learned from the City of the Sharp-nosed Fish is that knowledge does not filter down through the generations by itself. Simple and reliable systems are crucial in this respect. Companies not only have to maintain specific know-how, they also have to keep legally binding documents for extended periods. Companies, as well as institutions, who fail to take the storage and long-term preservation of their knowledge seriously enough will one day, like Oxyrhynchos, need archaeologists to uncover their lost assets. But by then, unfortunately, they will - like Oxyrhynchos - have long been consigned to the history books. In a bid to prevent things from going that far, AIT's research group is developing tools and services designed for the long-term, digital preservation of the knowledge and know-how of companies and institutions. They only need use these AIT systems and long-term access to their memories is guaranteed. ///

"INNOVATIVE PROJECT PARTNER WITH EXTENSIVE TECHNICAL EXPERTISE"

/// Adam Farquhar, Head of Digital Library Technology at the British Library, talks about the close research partnership with Ross King's team from the Safety & Security Department of AIT. ///



The British Library is "home to the world's knowledge" and as such holds some priceless treasures. How do you go about protecting such a treasure trove of world culture?

At the British Library digital data is our daily bread. We are the custodians of national cultural and scientific documents and it is our duty to provide access to this material in our collections, irrespective of format – be it palm leaves, parchment,

paper or the latest digital formats. We recently opened a new, fully automated warehouse for print collections, where the material is stored in a low oxygen environment and can be retrieved by high-speed robots. We are involved in both large and small-scale digitisation projects in a bid to improve access to fragile material without damaging the original. We are also collecting more and more digital material in diverse formats – video, audio, ebooks and newspapers – and we even archive the UK Web.

We protect the digital bits in our collection using a specially developed Digital Library System (DLS). It allows for error-tolerant, scalable storage and guarantees the integrity of the individual digital elements it contains by using a digital signature technology with time stamp. Furthermore, it is the aim of our dedicated "Digital Preservation" work group to ensure that we not only preserve bits, but also provide useful access to content. Their work also involves assessing the potential risks to digital collections and the implementation of proactive measures to reduce them. A large part of the team's work has been helped by advanced research and technology development projects, such as the "Planets" project (Preservation and Long-term Access through Networked Services) co-funded by the EU, which includes key technology partners like the AIT Austrian Institute of Technology, for example.

How important to the British Library is research in general and research partnerships with non-university institutions in particular?

Partnerships are crucial to the British Library and allow for the smooth transition into the digital age. We are very aware that we are in the throes of a historical change process – just like any other organisation in the information sector. We have therefore actively and successfully pursued partnerships

worldwide in order to introduce innovative services and rise to the challenges of the digital age. For example, we are involved in international initiatives such as the International Internet Preservation Coalition, the World Wide Science Alliance and the international DataCite initiative, which is geared towards making access to research data via the Internet easier.

British, European and international research partnerships are, of course, crucial to our success in the digital era. European projects such as "Planets" help us to rise to the challenges of digital preservation; in "Arrow", we address issues of copyright law as well as orphan works; in "Impact", we develop techniques which allow optical character recognition (OCR) to be used for historical texts and newspapers.

In which areas are you already working together with the AIT and where do you see potential for future collaboration?

As Coordinator and Scientific Director of the "Planets" project, I have worked closely with Ross King and his team at AIT. They combined innovative thinking with extensive technical expertise. They also proved a reliable project partner who not only delivered on time but who also made sure that everyone else involved also stuck to the schedule.

From a medium-term perspective, I can identify two potential areas for future collaboration. The first is the development of next generation digital preservation technologies, which would enable us to keep up with the rapid growth in size and complexity of digital libraries – through the use of technologies such as cloud and grid computing and storage. The second area could be a collaboration where the aim is to understand how we might use Semantic Web technologies and Linked Data to create new services which are still unconceivable today. Both areas require a combination of innovation and quality assurance during development, and the AIT team already demonstrated these qualities in the "Planets" project. ///



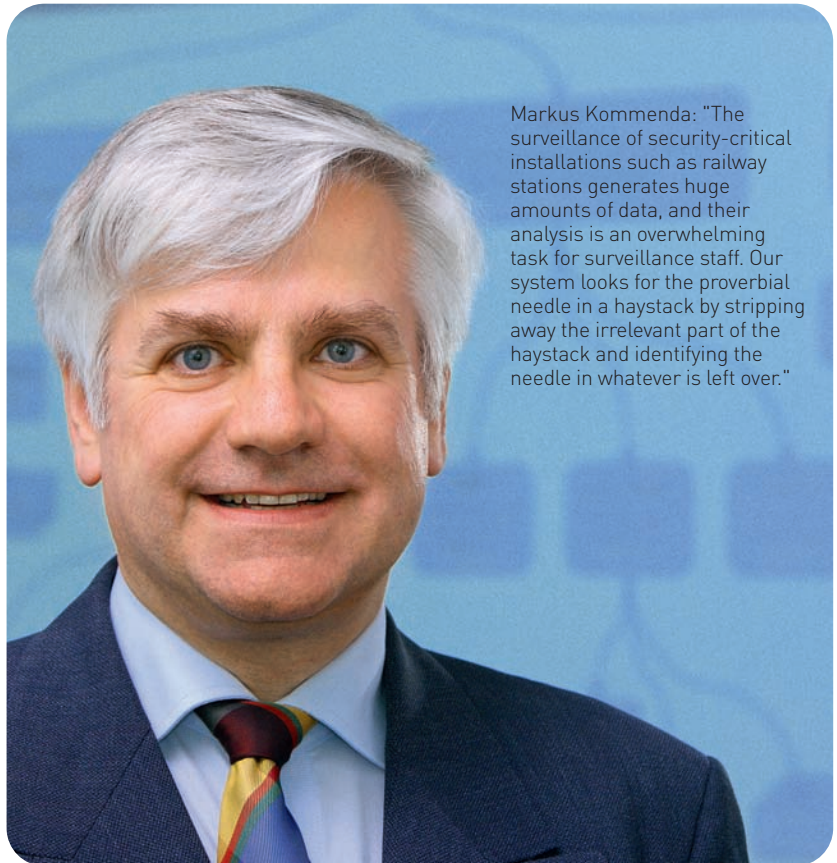
THE SHAPE OF THINGS TO COME

/// No other medium is as important in today's information society as the image – and its importance in terms of future technologies is growing. Which is why researchers in the AIT's Safety & Security Department are pushing the envelope of image processing technology. ///

THE DEVELOPMENT OF MODERN TECHNOLOGIES has led to information being exchanged more and more quickly and via an increasing number of channels. For this reason, our society has become known as the information society. The image is an important part of this revolution. We communicate via webcams and social networks which give friends access to our private photos. Virtually all mobile phones have a built-in camera these days. We get our information from the TV or online streams, work on computer monitors and watch 3D films at the cinema after a hard day's work. A single image on the Internet can reach thousands of people and trigger a worldwide response. Images have long been an integral part of key scientific areas. The X-ray revolutionised medicine. Industry uses imaging to monitor product quality. Security-critical facilities use video-based surveillance. No other medium compares in terms of the information an image can provide at a single glance. No other medium can reflect reality as accurately. We underestimate the importance of the image to future technologies at our peril. Which is why researchers in the AIT's Safety & Security Department are developing new image processing techniques. As the interface between science and industry, the AIT is not only making an important contribution to progress in science and technology, it is also painting a picture of an entire future society while cementing Austria's position as an important business location.

RESEARCH AREA 1: IMAGES MAKE OUR SURROUNDINGS MORE SECURE

A research team in the Safety & Security Department is developing smart algorithms for efficient surveillance systems. On the one hand, the aim is to evaluate archived data quickly, efficiently and with greater accuracy. On the other hand, the team is also addressing the issue of how critical situations or suspicious persons can be identified more quickly and monitored more accurately by surveillance cameras in real time. The technology is based on the rule-based search for persons or events. If surveillance staff are looking for a person wearing blue trousers and a white t-shirt, the surveillance



Markus Kommenda: "The surveillance of security-critical installations such as railway stations generates huge amounts of data, and their analysis is an overwhelming task for surveillance staff. Our system looks for the proverbial needle in a haystack by stripping away the irrelevant part of the haystack and identifying the needle in whatever is left over."

Photos: Krischanz & Zeiler, AIT Austrian Institute of Technology, Photos.com, OeBS

system only delivers images which actually display persons wearing blue trousers and white t-shirts. The more precisely the search criteria are defined, the more accurate the results. The system is capable of recognising groups of people and identifying individual persons within these groups, making it unique worldwide. The same principle is used to recognise critical events. Surveillance staff can search for "groups of fast-moving people", thereby restricting the search to pandemonium or mass panic. This technique can also be applied to searches for critical content on the Internet. If, for example, you search for a symbol which

would suggest Nazi content, this would be automatically recognised, allowing the relevant pages to be found and removed more easily.

"Tracking people via multiple cameras seems to be beyond the capabilities of existing surveillance systems," says Markus Kommenda. The system being developed by the Safety & Security Department allows multi-camera searches to be automated. A camera not only has to be able to recognise a person, it also has to be capable of determining which direction the person is heading in. This information about the person under surveillance can then be sent automatically to the "next" camera, which then takes up the baton. The individual cameras within a surveillance system therefore "communicate" with one another.

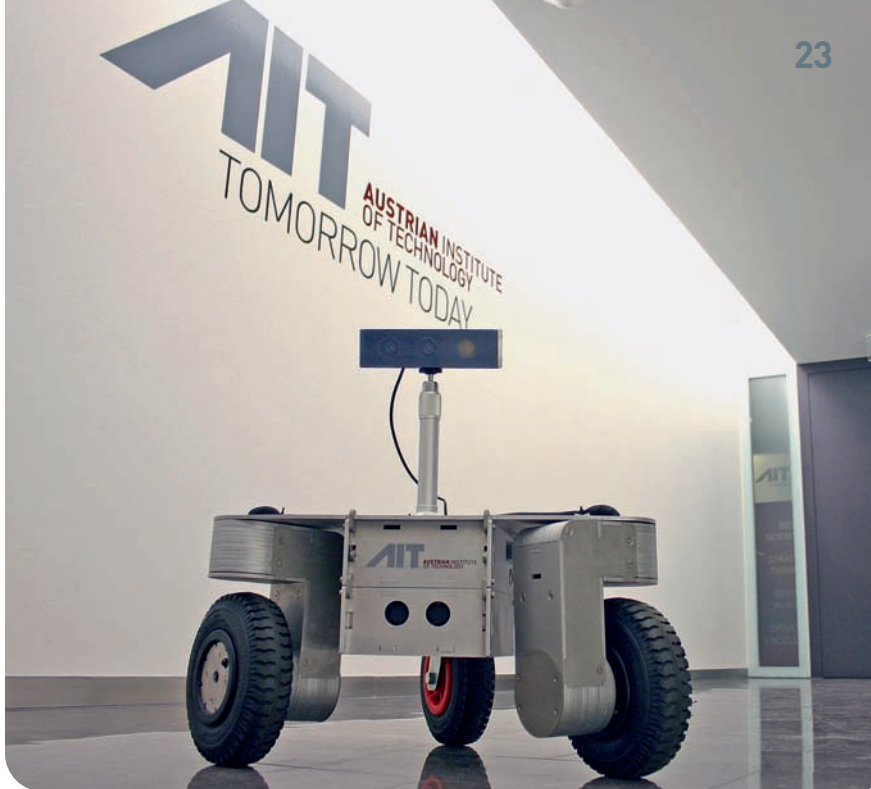
But what is the technology that enables surveillance cameras to recognise and monitor persons and events? AIT researchers are developing "background-based" technologies. These are able to distinguish between the background and foreground of an image. Movements are recognised as foreground, while non-moving objects are identified as background. The foreground and background are then separated.

For practical purposes, however, background-based systems have yet to be perfected. If there is a motionless person in the picture, for example, they will be identified as part of the background and effectively become invisible. Movements such as changing light conditions, colour fluctuations in the environment or occluded images also impact negatively on the automatic search. For this reason new systems which use additional appearance-based characteristics such as contour models are being developed. But surveillance systems are nowhere near being able to replace the human brain. And nor should they. They are merely a tool.

Imaging techniques are also used in the field of Ambient Assisted Living (AAL), which is geared towards supporting and maintaining the independence of elderly persons. These technologies are implemented in the form of a smart alarm, security and monitoring system which allows the behaviour of elderly people to be continually analysed and certain events to be recognised (e.g. falls). The cornerstone of this technology is a bio-inspired optical sensor, which allows for real-time processing as well as the automatic recognition of critical situations while still protecting personal privacy by only recognising contours and not transmitting any images.

RESEARCH AREA 2: IMAGES MEAN PROGRESS

There is a new technology which allows robots to see three-dimensionally. It has been developed by the Safety & Security Department's "Embedded 3D Vision" research team, led by Christian Zinner and Martin Humenberger. In the sixties animated television series "The Jetsons", Rosie the Robot Maid took care of the housekeeping. Half a century later, the first hi-tech helpers are no longer a thing of fiction. As part of the "robots@home" EU project, the AIT's Christian Zinner and Martin Humenberger have developed a sophisticated



and practical technology which allows robots to see in 3D, thereby cementing the AIT's leading international position.

ROBOTS ABLE TO SEE IN 3D

The technology is based on a system of two cameras which are arranged adjacently like a human pair of eyes. This is called stereo vision. The two cameras record synchronous images from different perspectives. The 3D information is produced by matching the individual pixels from the two images. "The correspondences are calculated by a special software program," explains Zinner. This software has also been developed by Zinner and Humenberger. It is called S3E and not only allows robots to see three-dimensionally, it also allows the distances to and between individual objects to be accurately calculated. "The robot is not only capable of seeing a glass, it can also grab it and lift it," says Humenberger.

This new system is not restricted to domestic robots. Industrial manufacturing processes or automobiles can also benefit. Monotonous assembly line work, for example, could in future be done by robots with integrated 3D vision systems. The technology would also prevent vehicles from straying from the road, as well as calculating the distance to other vehicles automatically. Systems like these - for calculating distances while driving in convoy or parking - already exist, but they are based on radar and ultrasonic sensors. The disadvantages include a low angular resolution and a certain susceptibility to failure if several active sensors transmit signals simultaneously. By contrast, laser scanners are simply too expensive to be viable in many areas of application. Imaging technologies promise a much more cost-effective and safe practical application of autonomous systems.

3D VISION FOR THE SMALLEST "EYES"

The biggest challenge in the implementation of this system is not only getting it to work, but also integrating it into small objects. "The calculation of depth information is very processor-intensive. But the system also has to run on small computers," explains Humenberger. Which is why the two researchers are also focusing on the optimum use of exi-

sting hardware systems: "The software we are developing works seamlessly in disparate hardware/processor capacity scenarios." It is this high level of competence which underlines the research team's leading position in the international community.

RESEARCH AREA 3: IMAGES IMPROVE PRODUCTIVITY

In collaboration with Fronius, a research team of the AIT's Safety & Security Department led by project manager Jürgen Biber is developing an innovative technique for the optical quality inspection of welding processes.

In spot welding, two metals are welded together using welding tongs. On the ends of the tongs are electrodes, which emit an electric current so that the metals are welded together. The point at which the two metals join is called the spot. When checking the quality of the weld, the diameter of the spot is the crucial criterion. As the basis for spot welding, Fronius has developed a new, improved welding technique. It is called Delta Spot and allows aluminium to be welded for the first time.

OPTICAL TOOL FOR BODYWORK

In the Delta Spot welding technique, the electrodes are protected by process belts. These increase the lifespan of the electrodes and prevent spattering during the welding process. The technique is predominantly used for body construction in the automotive industry. During the welding process, "finger prints" are left on the process belt. Based on this "by-product", AIT researchers have developed a technique for optically checking the diameter and therefore the quality of the spot. A camera has been added to the welding tongs. It produces an image of each finger print created during the welding process. Each finger print is different, complicating automatic analysis. However, using special, learning-based algorithms, similarities between the individual finger prints can be established. Because the diameter of the spots can be determined from the individual finger prints, it is possible to check the quality of the spots.

FAULT DETECTION IN ARC WELDING

Another project on the optical quality inspection of welding processes centres on arc welding. In this case, the camera is directly integrated into an oxyacetylene torch. Unlike spot welding, arc welding produces a welded joint. The camera is used to monitor the creation of this joint in real time, allowing errors in the welding process to be recognised quickly. It is also possible to generate a complete picture of the welded joint. This allows the seam to be examined retrospectively and its width to be checked.

NEW STANDARDS IN QUALITY CONTROL

With the development of these two techniques, the AIT is setting new standards in the quality control of welding processes. Previously, a finished product had to be destroy-

ed in order to check the quality of the spots or joints. The alternative was very complex ultrasonic inspection, which is extremely costly and can only be carried out manually. In both cases, only random testing could be done.

The techniques developed by the AIT now guarantee the seamless control of every spot and joint. Because the images of finger prints and joints can also be saved, companies also benefit from a complete archive for quality assurance purposes. Data on the individual spots and joints can be retrieved at any time.

RESEARCH AREA 4: IMAGES HELP IDENTIFY SOURCES OF ERROR

Be it rail tracks, bank notes or printed works: the "High Performance Image Processing" working group at the AIT is developing new techniques for the quality assurance of industrial products. "We are predominantly focused on the quality control of printed works," says Dorothea Heiss. The computer scientist is a member of the AIT's "High Performance Image Processing" working group, which conducts research into techniques for detecting faults in packaging materials and other printed works early on. The group also deals with the quality control of bank notes. The AIT is a global technology leader in this field.

GLOBAL LEADER IN TECHNOLOGY FOR OPTICAL BANK NOTE CHECKING

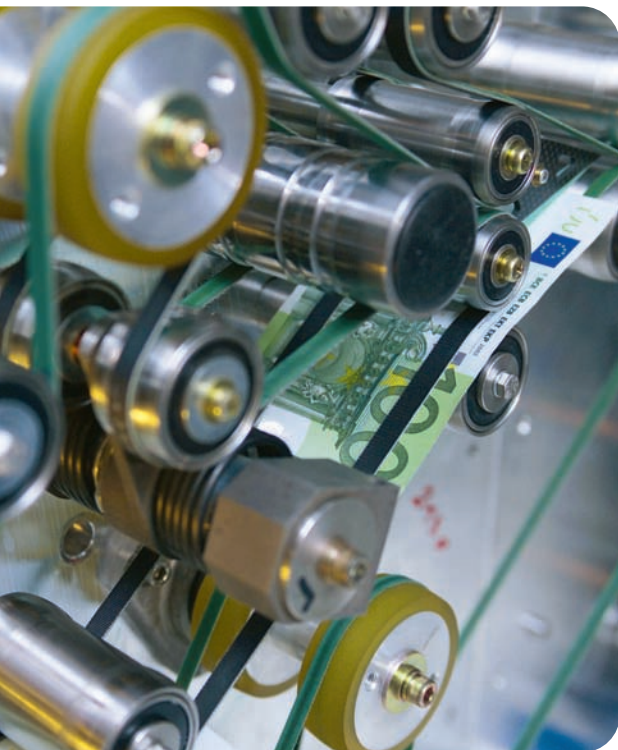
Line scan cameras developed by the AIT's Safety & Security Department are the basis for the control of printed works. A printed work is not represented as a whole, but is "scanned". The cameras are frequently mounted directly on the printing machines.

This allows ink splatter, impurities and errors to be recognised during production. But the system also allows quality control to be carried out at a later point in time and the data to be archived. Even the quality of bank notes can vary. Here, it is especially important for all of the security features such as the watermark, security thread, etc. to be absolutely perfect. "Genuine bank notes can only be distinguished from counterfeit money if all of the security features are printed to the highest quality," says Heiss. What's more, the quality of the print would also influence faith in the currency.

AUTOMATIC, COST-SAVING ERROR PREDICTION OF RAIL SURFACES

The same principle applied to the quality control of bank notes and printed works is also used in the fractINSPECT project. In collaboration with the Wiener Linien, the AIT has developed a system designed to automatically check the rail network. Until now, cracks and breaks in the rails could only be detected by specially trained trackmen. In future, it will be possible to use a colour line scan camera to automatically record and evaluate damage to the rail surface, e.g. microfissures which cannot be seen by the naked eye.





When evaluating the results, damages can be categorised. Cracks and breaks are recognised and can be distinguished from harmless changes to the rail surface, such as dirt.

Thanks to these AIT technologies, repairs can be made in good time, thereby increasing the lifespan of the tracks as well as safety during operation. If repairs can be made promptly, thus avoiding a section of track having to be replaced, significant cost savings can also be made. The system developed by the AIT will also allow the Wiener Linien to map the entire rail network for the first time during routine operation. By archiving the images, track deterioration can also be monitored.

ELIMINATING IMAGE NOISE

In a bid to eliminate the image noise generated by just about every image source, an AIT research team has developed a completely new type of filter process. It is the brainchild of the "Quantum Technologies" working group led by Michael Nölle. The process is called "Quantum Adaptive Filtering" and automatically recognises significant variations in picture quality. The filter process is able to recognise image height and depth and even distinguish between background and foreground. This allows the various image components to be handled individually. Irregularities which occur during picture scanning, for instance, are rectified without changing the structure of the image. This technique is not only useful during image processing, but also during Optical Character Recognition (OCR). If printed text is scanned, the filter is able to distinguish between "letters" and background. This allows letters and background to be filtered separately. The result – "black text on a white background" – makes it easier for the OCR software to recognise the text.

By removing noise, not only is the quality of the image improved, but less disk space is required. Depending on the format, the space required can be reduced by up to 30 percent. Given the growing volume of data (e.g. on mobile phones or the Internet), this side effect represents another revolutionary discovery in the field of image processing. ///



/// JOHANNES MILLER, EXECUTIVE DIRECTOR OESTERREICHISCHE BANKNOTEN- UND SICHERHEITSDRUCK GMBH, ON FUTURE PAYMENT MEANS

Your ABCS-2 bank note security system is world-leading. What makes the system so unique?

Our ABCS-2 system is currently the most accurate system for checking newly printed bank notes. In terms of both resolution and the possibilities for checking

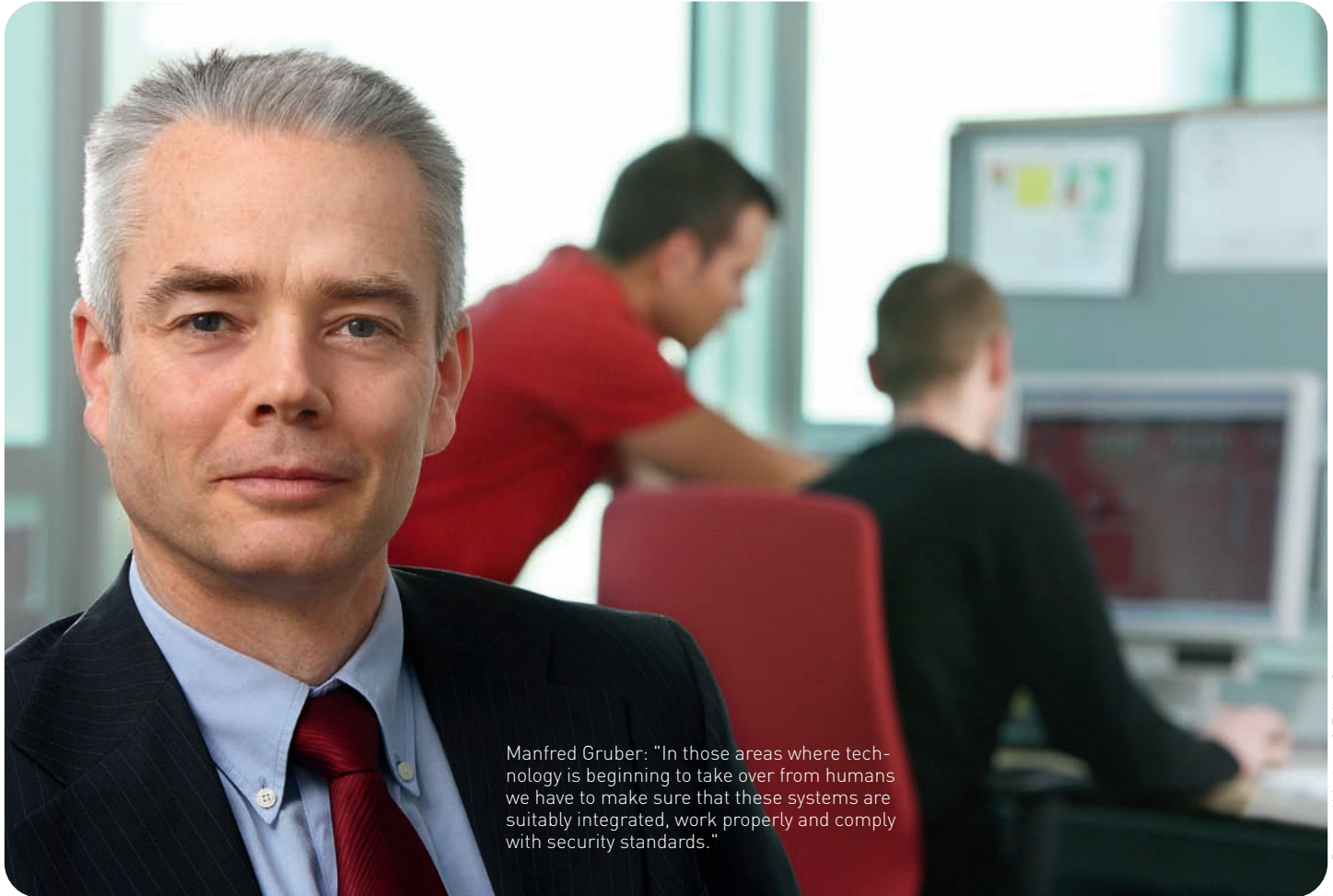
quality and security features at extremely high speeds. All relevant wavelengths in the colour spectrum as well as print quality of a resolution which sometimes even exceeds the requirements of the customer can thus be verified. During the detection process, however, huge amounts of data are generated and only the latest system architectures are capable of dealing with and processing such extreme volumes. The ABCS-2 system can be quickly adapted to any bank note by the user and therefore provides perfect control, ensuring that only bank notes that are absolutely 100% perfect are delivered to our customers.

New substrates, innovative security features – how do you envisage future means of payment?

The payment means of the future – and I am referring here to bank notes – will go even further towards satisfying the ever greater demands of the customer – central banks in particular as well as consumers in general, of course. Security will be improved and susceptibility to contamination reduced and therefore durability increased. Circulation life can be increased through the use of special substrates, depending on the requirements, e.g. particular climatic conditions. Innovative security features will make counterfeiting even more difficult. This ranges from special colour effects and printing techniques to as yet unavailable or secret features. As to whether the bank note will ever become obsolete: the bank note is part of a country's identity and culture and therefore has emotional connotations, making its disappearance unlikely for the foreseeable future. And bank notes are easy to use and secure.

In which areas do you make use of the expertise of non-university research institutes such as the AIT?

At the OeBS we use the AIT's expertise in areas where the kind of specialist knowledge which SMEs are unable to deliver for any sustained period is required. Corporate R&D departments depend on the specialised know-how of non-university research institutes in hi-tech special applications. At any rate, past experience justifies our partnership with the AIT. ///



Manfred Gruber: "In those areas where technology is beginning to take over from humans we have to make sure that these systems are suitably integrated, work properly and comply with security standards."

Photos: Krischanz & Zeiler, Göpel

INNOVATIVE TESTING TECHNIQUES FOR AUTONOMOUS SYSTEMS

/// An increasing number of security-critical tasks are being handled by intelligent control and information systems. In a bid to manage the growing complexity of these types of system, the AIT is taking innovative approaches to system validation – in future, autonomous systems will be capable of monitoring themselves. ///

Driverless cars or intelligent houses may still be a pipe dream, but autonomous systems are already being used in many areas of industrial manufacturing technology, in transport and communications, surveillance, by rescue services, the construction industry and in automotive engineering. They combine control or monitoring functions and applications in the hardware and software arena with one another and harmonise them or replace conventional electrical or mechanical systems with smarter solutions.

But as the complexity of "embedded systems" grows, so the danger of errors through control devices increases. Manufacturers and suppliers must therefore be able to prove to their customers that their products work seamlessly. "From a public perspective the emphasis is very much on the reliability, security and durability of the electronics, software and algorithms for these systems," explains Manfred Gruber, head of the "Highly Reliable Software and Systems" Research Area. His research team is focused on the automo-

tive industry and is working on techniques and tools for the development of future generations of control system and communication networks in autonomous systems. These technologies are then – in modified form – also available of course for deployment in related applications in the rail and aviation industries as well as in the field of robotics.

IN PERFECT HARMONY

The average mid-luxury vehicle today contains around 50 to 100 control devices and an increasing number of driver assist systems which, for example, notify the driver of traffic jams or a drop in tyre pressure, regulate the distance to the vehicle in front or control engine performance, speed and braking. "In those areas where technology is beginning to take over from humans we have to make sure that these systems are suitably integrated, work properly and comply with security standards." The testing of security-critical systems with complex behaviours and multidimensional sensors is, however, enormously time-consuming and labour-intensive and can account for up to 70 percent of overall costs.

As part of the "Mogentes" (Model-based Generation of Tests for Dependable Embedded Systems) EU project coordinated by Manfred Gruber, AIT researchers are collaborating with partners such as the Graz University of Technology, the ETH Zurich, Thales and the Ford Research Center, Aachen, on the development of techniques and tools for generating efficient test cases. "We are looking at areas such as error modelling, improved coverage metrics and model-based error coupling as well as model-based test case generation," explains Gruber. Models are developed based on system requirements and ideally they fully mirror the system. Tools are used to automatically generate and execute accurate test cases from the models. "Consequently, the systems are more secure and costs are dramatically reduced - we anticipate a drop in testing effort of twenty percent. The aim is," says Gruber, "to enable companies to generate test cases themselves, allowing validation to be carried out cost-effectively and the security of systems to be increased."

COMMUNICATION SYSTEMS IN NEXT GENERATION AUTONOMOUS SYSTEMS

Vehicles are equipped with disparate mechanisms which exchange data with one another. The data are exchanged via communication bus systems where overlap can occur as a result of bandwidth and reliability problems. Research involves bombarding bus systems with specific errors in order to be able to draw conclusions about system behaviour in the event of errors. Time-controlled bus systems, where reliable data transfer is ensured by the fact "that every message has a specific time slot", are used in the automotive industry, in various machines, electronic signal boxes and the aviation industry. At the AIT, these research results are put into practice cost-effectively in collaboration with Göpel

electronic GmbH, a leading vendor of test and measurement equipment. "Göpel sells innovative tools for the auto supply industry, which is equipped with technology 'powered by AIT'. Our technology is therefore indirectly responsible for the creation of new hi-tech jobs," says Manfred Gruber, commenting on the successfully implemented innovation process.

By emulating hardware functionality with software modules, the AIT is able to pursue innovative approaches to system validation. Furthermore, the system should be able to monitor itself in future.

NEW RESEARCH FIELD: SMART SENSOR FUSION

A new research field focuses on the reliability of environmental perception using different sensors as used predominantly in vehicles and autonomous systems. "With groundbreaking technology innovations, international reliability checks and tests are also carried out on these systems. We are talking here about various sensor devices such as radar, ultrasound and cameras with downstream image processing algorithms," explains the AIT researcher. "Smart Sensor Fusion allows correlations and parameters for robust and reliable application management to be derived. These algorithms also have to be tested in order to produce reliable control data for the vehicle." Robots used in the manufacturing industry are also controlled via image processing. The first projects are due to be launched soon. The ARTEMIS R3-COP (Robust & Safe Mobile Co-operative Autonomous Systems) project is dedicated to the development of new testing methods for systems which make security-critical decisions based on image sensor data.

ARTEMIS TECHNOLOGY INITIATIVE

The Safety & Security Department has been heavily involved in the ARTEMIS (Advanced Research and Technology for EMbedded Intelligence and Systems) technology initiative since its inception in 2007. ARTEMIS – a Europe-wide public-private research partnership based in Brussels – is both financed and managed by 22 European Member States, the European Commission and industry (Artemisia) and is set to invest around 2.5 - 3 billion euro in European R&D projects on Embedded Systems up to 2013. "Austria has been one of the major European players in this technological area for years and has lent its considerable support at political level to the development of ARTEMIS. It provides a platform for shaping the future of transport technology," says Manfred Gruber, underlining the importance of this international partnership for Austria in general and the AIT in particular. "ARTEMIS Austria represents an Austrian platform the primary purpose of which is to encourage knowledge and technology transfer and the networking of relevant sectors of industry. Because a genuinely useful technology and tool platform can only be created internationally." ///

STIMULATING THE DYNAMICS OF INNOVATION

/// The national and international networking of various stakeholders and actors is driving research and economic development and is a cornerstone of the Safety & Security Department. Furthermore, combining scientific findings with commercial exploitation also requires scientific excellence and very specific soft skills. ///

"THE AIT SAFETY & SECURITY DEPARTMENT has a particular responsibility at both national and international level to promote research into and the application of ICT for the benefit of society and to help shape future security research areas," says Helmut Leopold, Head of Department, commenting on the role of the Safety & Security Department as a driver of research development and cornerstone of the industrial implementation of findings in the ICT arena. These findings have already been put into practice for technology development in various areas, not just in office life or administration, but also, for example, in industrial automation, environmental management, healthcare, disaster control, public safety and the protection of critical infrastructures (e.g. public places).

MANAGING INNOVATION TOGETHER

Combining scientific findings with commercial exploitation also requires a certain amount of trust, so that any partnership between research institute and industry can function. "The key to forging successful partnerships is the ability to speak the language of industry; after all, the industry partner is the one making investments and taking decisions - also about partnerships - in a short space of time and often based on incomplete information," says Leopold. If communication remains too theoretical, the industry partner will probably fail to recognise the innovative potential. The "common" language helps to build trust. Furthermore, any new partnership requires the joint planning of a sensible roadmap and the definition of a joint innovation process which includes specific milestones and where both parties can learn. Further important points include exploitation rights versus exclusivity for the industry partner as well as the freedom of research versus the competitive position of the industry partner. The early integration of industry to prevent research from branching off in the wrong direction, the reliability of research results, the degree of maturity of the technology when handed over to industry as well as



Hans-Jörg Otto: "As a research organisation, the key to effective cooperation in R&D is the ability to speak the language of industry and manage innovation together and with trust."

the contractual detailing of the results and the business model are also sensitive areas.

A recent achievement represents the ideal template for such a process - our partnership with Göpel electronics GmbH, a leading vendor of electrical and optical test and measuring equipment for electronic components and automotive control devices which licenses and sells the technology we develop. Hans-Jörg Otto, responsible for Innovation Management and Business Development in the AIT Safety & Security Department, worked on developing the partnership for over one and a half years and its success can therefore be attributed to him. "Trust is the cornerstone of any such partnership, and there has to be

communication at both expert and management level," says Otto. "Innovation can be managed as long as communication and the exchange of information generate creativity and ideas and as long as researchers are guaranteed a certain amount of freedom. But innovative, sophisticated technology still doesn't sell itself."

"So we have to be self-critical: does what I am researching have commercial potential? Are we still heading in the right direction? On the one hand, researchers have to demonstrate that they are capable of solving the industry's respective problem, while at the same time they must not lose sight of the practicalities. At the end of the day, industry is interested in a marketable product. But we at the AIT advocate application-oriented research and develop prototypes. Industry has to take that final step to the end customer."

TECHNOLOGY PLATFORMS FOR INTERDISCIPLINARY NETWORKING

"Against the backdrop of combining scientific findings with commercial exploitation, in the context of developing generic techniques and technologies for different application sectors, we in Austria and also at European level are focusing on research areas with a dual benefit: firstly, these are areas of social relevance, secondly they provide economic benefits. And this is how we are stimulating the dynamics of innovation," says Helmut Leopold.

Through its research activities, the AIT Safety & Security Department is helping to ensure that Austrian know-how and interests are firmly anchored in European strategy. For example, the department was heavily involved in the development of the European technology platform ARTEMIS from its inception, an initiative which brings together hardware and software developers, testers and users.

In Austria a platform has also been created to unite key players such as scientists, manufacturers, system integrators and users. "It is now possible to involve users, for example from the auto supply industry, in discussions on project topics put forward by manufacturers right at the early stages," says Leopold, underlining the benefits of such platforms. The aim is to initiate joint projects and - as an information hub - to formulate national interests. "This will enable us to address key topics at EU level and develop partnerships as a result."

"In this respect the Safety & Security Department plays a pivotal role, especially within the EU technology and research community."

EPoSS (European Technology Platform for Smart Systems Integration) is another technology platform in which the department is actively involved. The platform provided incentives for the Seventh Framework Pro-

gramme such as the "Green Car" and "Electric Vehicle" initiatives. At European level the AIT is a member of EARTO (European Association for Research and Technology Organizations). "Through the Safety & Security Department we are, at European level, a key part of the Eurotech platform, to which all of the major European research organisations belong. This is where research topics in the security technology arena are being dis-



/// RALF KAHL, SALES MANAGER
AUTOMOTIVE TEST SOLUTIONS,
GÖPEL ELECTRONIC
GMBH, ON GROWING SYSTEM
COMPLEXITY

Our vehicles are becoming "smarter" - and their systems increasingly complex as a result. As a vendor of testing tools, what do you see as the challenges arising from growing system complexity?

Given the disproportionately high effort involved in the development, testing and

quality assurance of test tools, especially in relation to smaller quantities, one of our biggest challenges lies in ensuring cost-effectiveness. This also implies the creation of universally usable solutions, i.e. those which can be used by multiple customers, and the avoidance of proprietary approaches and structures. At the moment detailed OEM specifications are still necessary and these preclude any kind of universal standards during testing. At the same time, our customers' needs in terms of training, qualifications and support are also growing, of course.

What are the most important aspects of developing test procedures for communication bus networks?

Functional stability and reliability are, of course, essential. Our strength lies in the modular structure of developments. Like a set of building blocks, they offer extensibility, flexibility and individual configurability. Our standardised system interfaces for inputting test parameter data and for the further processing of test results ensure commercial viability. The emphasis is always on actual requirements and marketability.

In which areas are you already leveraging the expertise of AIT researchers and where do you see potential for future collaboration?

We are currently working together in the area of "BusScope technology"; from our perspective, potential for future collaboration lies in the area of "testing technologies for automotive network structures and bus interfaces". ///



cussed with a view to joint marketing initiatives with industry." The AIT department is also a co-founder of AARIT together with the Österreichische Computer Gesellschaft (Austrian Computer Society), the Austrian arm of the ERCIM (European Research Consortium for Informatics and Mathematics). "We are on the Editorial Board and are making a fundamental contribution to the thematic orientation of the programme. Our competence – in particular in the areas of Embedded Systems and Safety-critical Software – will thus be positioned at European level," says Helmut Leopold. The department's involvement in the ERCIM-led MUSCLE Network of Excellence (Multimedia Understanding through Semantics, Computation and Learning) also underlines its excellent connections at European level.

PLATFORMS FOR HEALTHCARE AND DISASTER CONTROL

By integrating eHealth research into healthcare platforms, healthcare and medical care processes can be seamlessly linked. The innovative eHealth technologies being developed by the Safety & Security Department are helping to establish a consistent medical care process free of temporal and organisational restrictions between doctors and patients.

The AIT's Safety & Security Department is the interface between stakeholders and users.

The cornerstone of any innovative concept such as this is the establishment of a platform of trust for collaboration between all key decision-makers – from healthcare professionals and equipment vendors to healthcare facilities

(e.g. hospitals), social insurance carriers and patients. "We are developing this platform together with doctors and social insurance carriers and are including patients so that they, too, can see the benefits," explains Helmut Leopold. "Medical insurance companies are interested in the financial savings that can be made. Doctors have to be able to recognise clear medical benefits, and the manufacturing industry as well as healthcare facilities are only prepared to invest once a concrete business model is in place. The platform also raises awareness for these issues."

Generally, the bringing together of key stakeholders such as consumers, research, industry and commerce – the KIRAS programme being one example – is a cornerstone of this approach. "This is precisely what applied research is all about. Through our findings from research and technology development, we are contributing to the transparent and efficient discussion processes of the various committees."

In the field of disaster management, the AIT's Safety & Security Department, in collaboration with the Federal Ministry for the Interior, is also doing its bit in the context of National Crisis and Disaster Protection Management and has created a platform encompassing public institutions at federal and national level as well as all relevant actors for the prevention of disasters.

Leopold: "We provide consumers in the national disaster management arena with simple, uncomplicated access to information about new research projects and technology programmes at international level."

OPEN PLANETS FOUNDATION

Through the Safety & Security Department, the AIT has managed to consolidate its leading position in Europe in the area of the digital preservation of our cultural heritage. In close collaboration with the European Commission, an initiative has even been launched to ensure the EU-wide commercial exploitation of research results and drive forward research in this area. A dedicated institution has been set up, the new international Open Planets Foundation. The AIT, also represented in the Planets (Preservation and Long-term Access through Networked Services) EU project by the Safety & Security Department, is a founder member of the Open Planets Foundation, which is dedicated to the long-term preservation of digitally stored data, and Ross King, who is in charge of the relevant research group in the Safety & Security Department, is on the board of directors.

One key research area centres on technological development in the Digital Preservation arena. Whereas paper documents can, under the right conditions, be stored for centuries, the average lifespan of a digital document is, without taking any special precautions, just five to seven years. "Given the fact that information is increasingly available in digital format only, coupled with the rapidly growing volume of digital data, the question is how we can make sure that in fifty years' time we can still access this information," says Helmut Leopold. On the one hand, there is the question of suitable storage media, on the other, appropriate operating systems and software. "We need to clarify who will access the data and how, and who can evaluate the data." In the meantime, relevant services and tools for digital storage have been developed and tested, and they are now available as practical and useable long-term storage systems.

INTERNAL NETWORKING AND KNOW-HOW TRANSFER

In the context of the repositioning of the AIT, Helmut Leopold has spent the last one and a half years strategically re-aligning the Safety & Security Department. "First, we got together with the department's 200 highly-qualified staff and defined a clear strategy on which our activities are now based," explains Leopold. The department's re-alignment was based on the one hand on a discussion of content, allowing the department to focus on its core competence in accordance with industry and market requirements. On the other hand, an innovative R&D process was implemented, which allows the department to react quickly to industry requirements and still pursue medium and long-term technology strategies.

This process puts in place three cornerstones for the successful implementation of research activities: transparency of projects and activities; optimum use of synergies and skills in the various specialist divisions of the department; assurance of constructive, creative phases based on interdisciplinary discussion. For the creative phase of this innovation process, a dedicated, modern tool based on Social Network functionality has been introduced; for the development and project management part of the innovation process, an innovative Gate Process has been put in place.

"This allows us to enable and institutionalise internal creativity, which continually feeds the structured development process with new ideas," says Leopold. The established Gate Process is guaranteed by a high-quality workflow coupled with results-driven research activities. "The new strategic orientation of our research activities and established workflows will ensure both comprehensive and efficient collaboration with universities and other research facilities as well as high-quality technology development in partnership with industry." ///

FURTHER INFORMATION: AIT – SAFETY & SECURITY DEPARTMENT



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