



Deep Learning – DFKI & NVIDIA  
DFKI at the 10th National IT Summit  
Robots on a Journey



## 10th National IT Summit in Saarland

November 16 & 17, 2016

### Outstanding Computer Science

DFKI

*Smart Parking  
Smart Shopping  
Smart Home*

TOUR 1

### Digital Education for all!

Digital Teaching and  
the Lifelong Learning Curve

University Campus,  
10 a.m. – 3 p.m.

*Anticipative Textbooks  
SmartLEGO® Factory*

TOUR 8

Selected IT Summit  
Tours & Events  
with DFKI Involvement

**Nov. 16, 2016**

10:30 a.m. – 12:30 p.m.

TOUR 3

### Digital Business Network

Scheer-Tower

*Smart Energy*

TOUR 6

### Humans as Process Engineers

Visualization of Digital Processes

HBKsaar

*Media Informatics*

TOUR 4

### Digitization in Manufacturing

ZeMA

*SmartF-IT*

TOUR 5

### Predictive Analytics Steel Production 4.0

Saarstahl

*iPRODUCT*

[dfki.de/aktuelles/it-gipfel](http://dfki.de/aktuelles/it-gipfel)

Information & Registration  
for the IT Summit Tours  
[it-gipfel.saarland](http://it-gipfel.saarland)



# National IT Summit

## Saarbrücken 2016

## Digital Education, INDUSTRIE 4.0, and Smart Living DFKI at the 10th National IT Summit, Nov. 16 & 17, 2016

*This year, Saarland is hosting the Federal German government's 10th National IT Summit. Federal Chancellor Angela Merkel and a large number of cabinet ministers will be joined by nearly 1,000 representatives from government, business, research, and social organizations in Saarbrücken. In the main program on Nov. 17, Prof. Wolfgang Wahlster will discuss the opportunities of digitization with Google CEO Sundar Pichai and Timotheus Höttges, Chairman of the Board at Deutsche Telekom.*

► The National IT Summit is the government's key platform for the shaping and implementation of the "Digital Agenda" strategy launched in 2014. The featured topic of the 10th National IT Summit in Saarbrücken is "Digital Education" with the focus on "Learning and living in a digital world." DFKI is participating in key IT summit events with an app for traffic accident recording and with APPsist. This intelligent knowledge and assistance system for production and training for INDUSTRIE 4.0 is one of the stations on the tour of exhibits for Chancellor Merkel and Sigmar Gabriel, Federal Minister for Economic Affairs and Energy.

APPsist will support assembly workers to perform more complex tasks at the workplaces of the future. APPsist knows the status of the production plant and stores the profile of each worker. For example, when there is an equipment failure, the worker receives an appropriate message and the exact information – tailored to individual ability and know-how – necessary to resolve the problem. APPsist empowers people to operate machinery and equipment better and faster, which results in an increase in productivity and a better trained work force.

DFKI staff is involved in many discussion panels, seminar forums, and presentations. In addition, DFKI is providing six of the IT Summit tours: Live systems demonstrate Smart Parking, Smart Shopping, Smart Home, predictive analytics in production and business processes for steel production, an interactive physics textbook, and an intelligent LEGO® Factory.

Also, introduced to the public for the first time at the IT Summit is the VU-App, a project for the mobile reporting of traffic accidents for the Saarland Police. Besides DFKI, other participants include the State Ministry for the Interior and Sport, the Saarland Police, the Police Inspectorate of Saarlouis, Microsoft Deutschland, icomedias, Accenture Deutschland, and Avanade Deutschland. The VU-App project is designed to provide some administrative relief to the workforce by the end of the year. In the context of accident reporting, researchers are investigating optimization potential through the use of mobile phones. The mobile solutions being developed are tested in police operations and analyzed for further possibilities using current AI technologies.

*"I believe that as an anniversary year this 10th IT Summit should show an even stronger profile compared to past IT Summits. The second round of digitization is underway and the presence of the Internet of Things and Services is being felt in every part of the economy, in particular, in our factories, our vehicles, and other top German exports. We now have a new opportunity that absolutely must be exploited."*

*Prof. Dr. Wolfgang Wahlster,  
Chairperson of the Executive Board  
and Scientific Director of DFKI.*

MORE INFORMATION

[www.it-gipfel.saarland](http://www.it-gipfel.saarland)

# National IT Summit

Saarbrücken 2016

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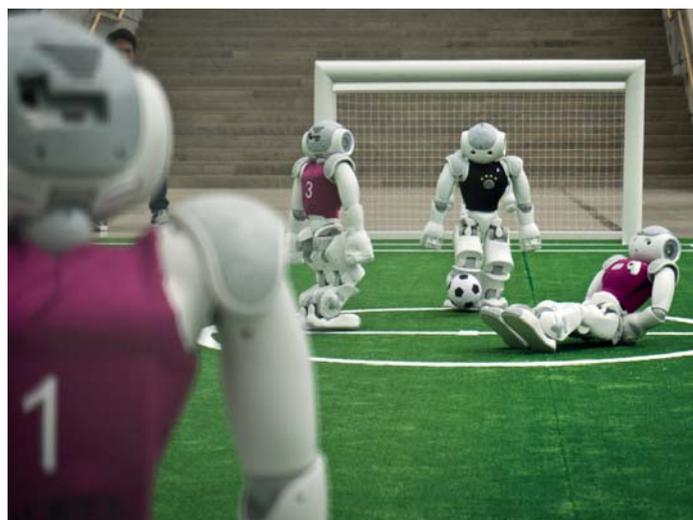
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## ForgetIT – Managed Forgetting, Contextualized Remembering, and Synergistic Archiving



In April 2016, the final review of the European research project ForgetIT (*Concise Preservation by Combining Managed Forgetting and Contextualized Remembering*) was convened in Luxembourg. Project partners DFKI and dkd Internet Service succeeded in implementing the project technologies in practical situations using the application scenarios of Personal Preservation and Organizational Preservation. After the extensive research results were considered, the ForgetIT consortium was awarded the highest rating for an EU project: "Excellent."

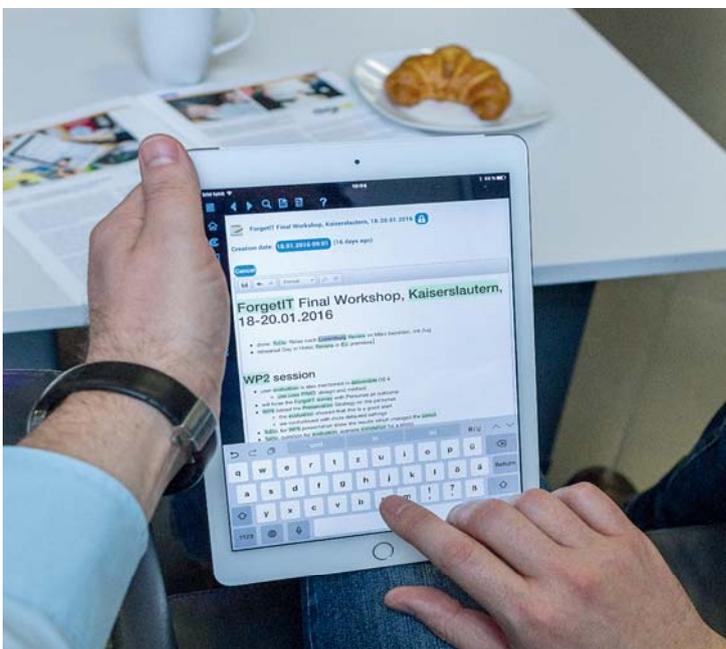
► **ForgetIT** focused on the removal of obstacles to automated, long term archiving in businesses as well as for private home use. Eleven European partners, including DFKI Competence Center "Virtual Office of the Future," created solutions to implement digital forgetting in information systems that can collect relevant resources and eventually enter additional context into an archive without human intervention.

Based on the positive attributes of the human brain to forget such as hiding details and associative memories, an evaluation of the data from office work, information processing, and the mental model of humans can lead to the implementation of managed forgetting.

At the project review, DFKI had recourse to its own knowledge management system, in use daily on the basis of Semantic Desktop to show how all three project topics – Managed Forgetting, Contextual Remembering, and Synergistic Preservation – have been implemented in a running system:

- Managed Forgetting – by hiding or swapping out information that is no longer used or relevant.
- Contextualized Remembering – via a self-writing employee diary and the Knowledge Management Group.
- Advanced archiving automated for work knowledge and world knowledge (Digital Preservation System - DSpace).

This preliminary work has led to the successful creation of a tandem project with the University of Hannover (Dr. Niederée) and the University of Trier



A personal information model helps users manage their knowledge sources.

(Chair for General Psychology and Methodology, Prof. Dr. Frings) in the priority research program "Intentional Forgetting in Organizations" of the German Research Foundation, DFG (*Deutsche Forschungsgemeinschaft*). This priority program includes an interdisciplinary study of the mechanisms of forgetting as a performance adjustment for organizations in an environment of constantly increasing volumes of information.

The new managed forgetting project ("Sustaining grassroots organizational memories: Foundations and methods of managed forgetting for knowledge workers") will continue the work of forgetting on the basis of semantic desktops in a Personal Information Model (PIMO) for individuals. In particular, evidence and methods of forgetting for groups will be examined, implemented in batches in PIMO, and evaluated in cognitive psychology experiments.

### Project partners

- Centre for Research and Technology Hellas
- DFKI
- dkd Internet Service GmbH
- EURIX S.r.l.
- Gottfried Wilhelm Leibniz University, Hannover
- IBM Israel - Science and Technology Ltd.
- Luleå Tekniska Universitet
- The Chancellor, Masters and Scholars of the University of Oxford
- The University of Edinburgh
- The University of Sheffield
- Turk Telekomunikasyon AS

**Project volume:** 9.1 million euros

**Project period:** Feb. 1, 2013 - Jan. 31, 2016



Funded by the EC within the 7<sup>th</sup> Framework Program under the research goal "Digital Preservation" (GA 600826)

More detailed information about the overall system and the developed applications is provided at:

<https://pimo.opendfki.de/wp9-pilot>

### MORE INFORMATION

[www.forgetit-project.eu](http://www.forgetit-project.eu)

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**NVIDIA-CEO Jen-Hsun Huang at GTC 2016:**  
 “The worlds best AI-research institutions have to work with the best technology”.  
 Photo: NVIDIA

## Pioneering Research in the Field of Deep Learning – DFKI Chosen as Part of the NVIDIA AI Lab Program

*Deep Learning is the branch currently producing impressive breakthroughs in Artificial Intelligence (AI), especially in the field of pattern recognition. This requires powerful processors that enable the training of complex neuronal networks with large volumes of data. NVIDIA, a pioneer in the field of high performance acceleration processors, and the German Research Center for Artificial Intelligence (DFKI) have announced the expansion of their cooperation as a part of the NVIDIA AI Lab program, a cutting edge research program in the area of innovative Deep Learning methods.*

► “All oft the worlds most important AI laboratories must have access to the most capable instrument of AI research that the world has ever known. (...) Today we are super proud, super exited to announce that German Research Center for Artificial Intelligence and IDSIA are the two designated research centers of the NVIDIA AI Lab here in Europe.” With these words NVIDIA CEO Jen-Hsun Huang announced the collaboration as a part of NVIDIA’s AI Lab program in his keynote address at the GPU Technology Conference in Amsterdam on September 28, 2016. DFKI, along with Swiss AI Lab IDSIA, is the first research institute in Europe to announce a deep learning collaboration with NVIDIA. The company also works closely in this area with Stanford, Berkeley, OpenAI, and the Korean GINM. The funding for DFKI in the next four years is including a DGX-1 supercomputer. The expanded cooperation comes as a result of the existing close partnership with the DFKI Deep Learning Competence Center.

DFKI was selected in June 2016 because of its outstanding research results in the area of text, image, video, and social media analysis as a GPU Research Center by NVIDIA. NVIDIA’s goal in this collaboration is to promote the pioneering work of AI researchers at the world’s leading institutes and broaden the exchanges among the leading scientists in the area of Deep Learning.

Jaap Zuiderveld, NVIDIA Vice President of Sales and Marketing EMEA: “NVIDIA is proud and delighted to collaborate with DFKI in their work to advance the field of artificial intelligence. We have committed to funding joint research projects and providing the institution with a grant of our state-of-the-art AI computing platform, the NVIDIA DGX-1. We are also supporting opportunities for faculty and students to work at NVIDIA to shape the future of AI computing platforms.”

DFKI-CEO Prof. Dr. Wolfgang Wahlster: “The more hidden layers a Deep Learning network has, the better its ability to extract and detect more complex relationships and subtle characteristics in the data. However, the necessary processing power dramatically increases with each level. The teamwork with NVIDIA helps us to develop AI solutions for the next generation of autonomous systems, human-robot teams, and real-time controls for Industrie 4.0.”

Dr. Damian Borth, a research scientist from Knowledge Management department and head of the Deep Learning Competence Center at DFKI said, “Our goal is to shape the leading edge research in the area of machine learning, in compliance with the social relevance and responsibilities of AI. As the inventor of GPU and a pioneer in the Deep Learning revolution, NVIDIA is the perfect partner.”

Prof. Dr. Andreas Dengel, head of DFKI’s Department of Knowledge Management said, “The proverb ‘every kettle finds its lid’ applies to the cooperation between NVIDIA and DFKI. By collaborating with NVIDIA, DFKI has been given access to the best AI computers. These will further boost the development efforts in our projects involving innovative network architectures and will enable more efficient and effective processing of the huge volumes of multimedia data.”

### MORE INFORMATION

- 🌐 <http://dl.dfki.de>
- 🌐 [www.nvidia.de/object/deep-learning-de](http://www.nvidia.de/object/deep-learning-de)

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## Shaping the Future of Wearables With EASY-IMP

*New methods and development platforms for products and services in the area of intelligent clothing and body-worn sensors*

► Over the past three years, an interdisciplinary team in the EU Project EASY-IMP (Collaborative Development of Intelligent Wearable Meta-Products in the Cloud) has explored functional and accessible tools and technologies that could be used to develop new applications in the area of meta products for wearables.

A typical meta product is a smartphone. It represents an all-purpose platform that can be customized for a wide variety of uses by downloading apps. The aim of EASY-IMP is to transfer this concept to intelligent clothing. A new meta product is created by integrating selectable sensors into the fabric. The garment is configured via a smartphone to record vital data and movement data for use in connection with a personal services app. Depending on the functional range of the application, it can be used to realize various purposes. For example, this may be a personal fitness trainer or another assistant for functional rehabilitation. In addition, the system is connected to cloud-services, so data can be easily shared and used, for example, in social networks.

In EASY-IMP, DFKI's department of Augmented Vision had the challenge to connect sensors with mobile devices that evaluate the sensor data and to design the user interfaces for smartphones. Researchers and engineers in Kaiserslautern are programming software that optimizes and evaluates the clothing equipped with sensors in a virtual environment.

"One of the main goals of this project is to create synergies between research and industry partners," said Project coordinator and department head Prof. Didier Stricker. "EASY-IMP is making the technologies market ready and accessible to SMEs – also to companies that are not members of the consortium."

From the beginning, EASY-IMP has relied on interdisciplinary expertise and a collaborative working style: All participating firms, designers, sensor manufacturers, software developers, and experts

(trainers, physicians, and game developers) have defined the production planning, service integration, and range of new products and applications in a joint development process. These specifications include the optional designs, installable components, and the selectable materials and sensors.

Early in the project, the EASY-IMP consortium set up certain sample scenarios and developed suitable demonstrators. One very successful example in the field of medicine is the EASY-IMP cardio-rehabilitation pilot that assists people recovering from heart disease. One of the key reasons the device received approval for use in hospitals was because the platform complies with the highest standards of security for managing personal and medical data.

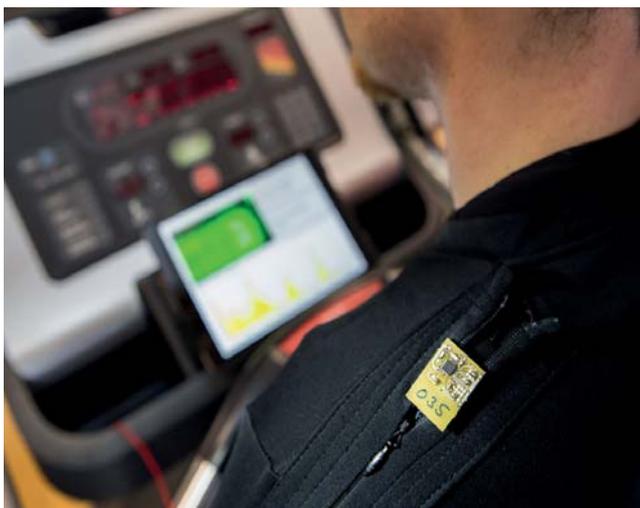
### Project partners

- Athens Technology Center S.A.
- ATOS SPAIN SA
- DFKI (Project coordination)
- Federation of the European Sporting Goods Industry (FESI)
- Hypercliq Limited Partnership
- Interactive Wear AG
- Institute of Biomechanics of Valencia
- nuubo Wearable Medical Technologies
- Sylvia Lawry Centre for MS Research e.V.
- The Human Motion Institute
- Timocco Ltd
- Université Lumière Lyon 2
- University Rehabilitation Institute, Republic of Slovenia

**Project period:** Sept. 1, 2013 - Aug. 31, 2016



Funded by the European Community within the 7<sup>th</sup> Framework Program



Personalized apps use movement and vital data from sensors in a function shirt.

### MORE INFORMATION

<https://easy-imp.eu>

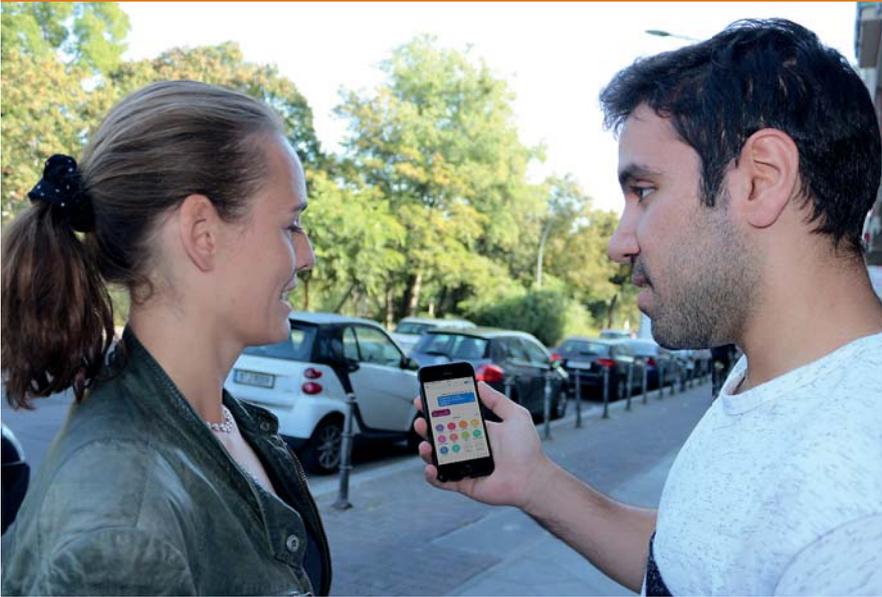
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## Fahum Means Understanding – an Emergency Assistance and Integration App for Refugees

Most attempts to communicate with immigrants who do not speak German or English end in pointing and gesturing, and – in frustration. In response, the German Research Center for Artificial Intelligence (DFKI), in cooperation with its spin-off company Yocoy developed the “Fahum” app (Arabic for “understanding”), which enables immigrants from Arabic countries to have a dialog, for example, with authorities or on the street, or when shopping. The app is available to be downloaded for free.

► Unlike Google Translator, the relevant dialog is guaranteed to be correctly translated – thanks to the “Always Correct Translation” technology (ACT®) from Yocoy. Specifically, the translations are not word for word. Rather, Fahum provides flexible dialog building blocks that permit the participants to enter their concerns, questions, and information in their own language and subsequently, to receive the answers in that language – in written or spoken form. The app also includes many links to important Arabic language information sources for refugees, which are posted online at the Fahum website.

The dialogs are expanded via lexica and the possibility to take and integrate pictures. The developers place great emphasis on the intonation, precisely because inadequate translation provokes many misunderstandings. The dialogs can be played as a language file, making the system very attractive and also appropriate for language learning.

Syrian students, refugees, and other native speakers have volunteered to assist with the content, choice of topics, and translations. The appealing design was created by the creative team at the Berlin company, Eatch Interactive.

The Technologiestiftung Berlin (Technology Foundation) and Rotary Club Hamburg-Wald-dörfer contributed to the development of the app. The aim is now to ensure maximum awareness of the app so that refugees can get the help and relief necessary to overcome the language barrier. Additional support is also needed to expand the dialogs and to make the app available in other languages like Urdu, Paschtu, and Farsi. Fahum is available for free download now in the App Stores for Android and iOS.

### MORE INFORMATION

[www.fahum.de](http://www.fahum.de)

DOWNLOAD AT GOOGLE PLAY



DOWNLOAD AT APPLE ITUNES



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## Mittelstand 4.0 Competence Center Kaiserslautern

The search for customer oriented solutions, small lot sizes, and short delivery times is posing ever greater challenges, particularly, for small and medium sized enterprises (German: *Mittelstand*). The term "Industrie 4.0" is now established as a synonym for the production and working world of tomorrow. Characterized by increasing networking and digitization across all links in the value adding chain, it is intended to continue strengthening the competitiveness of manufacturing companies.

► In the context of the government funding initiative "*Mittelstand Digital*", SMEs in particular are to be supported in their efforts at digitization, networking, and implementation of Industrie 4.0 applications. The Federal Ministry for Economic Affairs and Energy (BMWi) is presently creating a nationwide network of competence centers for SME 4.0.

**Mittelstand 4.0 Competence Center Kaiserslautern** was established in the spring of 2016. Its focus is on SMEs and the trades in the states of Rhineland-Palatinate and Saarland as it provides solutions and assistance in socio-technical system design, automation, and product development.

**i** Mittelstand 4.0 Competence Center Kaiserslautern is supported by the four partners technology initiative *SmartFactory*<sup>KL</sup> e.V., DFKI (Research department Innovative Factory Systems & Institute for Information Systems - IWi at DFKI), The University of Kaiserslautern (Department of Strategy, Innovation, and Cooperation and the Department of Virtual Product Development) in addition to the Institute of Technology and Labor (ITA).



**Dr.-Ing. Mathias Schmitt, Head of Competence Center for SME 4.0 - Kaiserslautern.**

Photo: M. Schäfer/SmartFactory<sup>KL</sup>

### Interview with Dr. Mathias Schmitt

#### What is your initial balance after the first 6 months of operation?

Very good. Our series of information events about Industrie 4.0 was well received by members of the *Mittelstand* in the region. With four strong partners, we are able to offer a variety of topics, from production methods to employee training, even to include business models.

#### What is your range of services?

In addition to providing the information at our info-events, we also perform practical services. We assist the *Mittelstand* with staff training, implementation workshops, and in the management of actual implementation projects.

#### What comes next?

Autumn is the time for readiness checks. We have created an online test where businesses can determine their status in terms of Industrie 4.0. We evaluate the results and work with the participants to create customized development options.

Supported by:

Mittelstand-  
Digital



on the basis of a decision  
by the German Bundestag

### MORE INFORMATION

🌐 [www.komz-kl.de](http://www.komz-kl.de)

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Small and medium sized companies obtain information on opportunities of Industrie 4.0 and digitization at the Mittelstand 4.0 Competence Center Kaiserslautern.  
Photo: SmartFactory<sup>KL</sup>/DFKI

## SmartFactory<sup>KL</sup> and DFKI Presence at SPS IPC Drives

► At Europe's leading trade fair for electric automation, SPS IPC Drives, *SmartFactory<sup>KL</sup>* and DFKI will present a broad range of competence in the area of Industrie 4.0. "In the advanced development of agile factory systems and human-machine interaction, we see great opportunities for the successful transfer of our Industrie 4.0 technologies to the manufacturing enterprises," remarked Prof. Dr. Detlef Zühlke, head of DFKI's Innovative Factory Systems and Chairman of the Executive Board of the *SmartFactory<sup>KL</sup>* technology initiative.

This year, the focus will be on three demonstrators, ideally suited to enable the presentation of various aspects of Industrie 4.0.

### Scalable Automation

The manufacture of customized products under cost effective conditions with fast delivery times is already a reality thanks to Industrie 4.0. The likelihood of sharp order fluctuation demands a compromise between high output rates and low unit costs in addition to flexible operating costs.

Taking this situation into account, *SmartFactory<sup>KL</sup>* and the department of Innovative Factory System at DFKI developed a mobile demonstrator that shows the future technologies of manufacturing today: Specifically, the integration of humans through scalable automation, control and communication of individual production elements via cyber-physical systems, and the extension of the plant through standard interfaces. Together they produce customized modules in flexible quantities.

### Knowledge Transfer on the Shop Floor

The research project *AmbiWise* concerns a mobile, context-sensitive human-machine interface (HMI) for optimized, routine knowledge transfer. The assistance and collaboration system developed

sps ipc drives



27<sup>th</sup> International Exhibition  
for Electric Automation  
Systems and Components  
Nuremberg, Germany, 22–24 November 2016

Hall 10, Stand 540

in the project enables the mobile and location-independent transfer of knowledge throughout the enterprise. The exhibition features the system demonstrator which shows how videos of maintenance tasks self-produced by an employee could be used as tutorials for new colleagues. More information about *AmbiWise* is provided on page 12.

### Complex Networks in Production

The third demonstrator is a module built by partner Bosch Rexroth and part of the larger Industrie 4.0 demonstrator at the *SmartFactory<sup>KL</sup>*. Horizontal and vertical networks are enabled using open interfaces: These include, for example, comprehensive access via a smart-device – from initial commissioning to operations and diagnosis for integrating IT processes in production.

SPS IPC Drives is open to the public from November 22-24, in Nuremberg. 2016 marks the 27<sup>th</sup> iteration of the trade fair. In 2015, nearly 1,700 exhibitors and about 65,000 visitors attended.

### MORE INFORMATION

🌐 [www.smartfactory.de](http://www.smartfactory.de)

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The mobile demonstrator shows the future of manufacturing.

Photo: *SmartFactory<sup>KL</sup>*/DFKI



Using the AmbiWise system to document a maintenance activity.  
Photo: Schaeffler Technologies AG & Co. KG



Apprentice training on AmbiWise at a workstation at the Mercedes-Benz plant in Wörth.  
Photo: Daimler AG

## Assistance and Knowledge Services for Production Environments – Project AmbiWise



► Knowledge exchange and retention pose great challenges to globally operating companies. The introduction of Industrie 4.0 concepts has increased the complexity of the requirements placed on the employees in the production processes. To come to grips with the greater need for training, companies rely on greater integration of training measures in the work processes.

The **AmbiWise** project (Mobile, context-sensitive, human-machine interfaces (HMI) for optimized, routine knowledge transfer) aims to develop an assistance and collaboration system. It serves to encourage a culture of knowledge sharing participation at a company. The project focuses on industrial assembly and maintenance processes. The challenge for the efficient use of knowledge in complex assembly processes with multiple selectable options is to store current, structured knowledge and make it available locally. AmbiWise satisfies this requirement by digitizing the training content and providing access via mobile devices, directly on the assembly line where it can then be used and edited.

Until now, training content has been location dependent, usually at stationary terminals located some distance away from the assembly line. Mobile, context sensitive and intuitive human-machine interfaces (HMI) now allow the knowledge to be captured at the site of the activity in a standardized form and then, edited and enriched with multimedia content. The images, ego perspective training

videos, or instructions via Augmented Reality facilitate employee training and aid in retention of the material. The knowledge can be intuitively retrieved by colleagues via QR codes, iBeacons, or voice on site.

Remember, the challenge for the efficient use of knowledge in complex assembly processes with multiple selectable options is keeping the knowledge up to date and ensuring that it is locally accessible. AmbiWise solved the former by digitizing the assembly standards and providing a way to access them by means of a mobile device directly on the assembly line. It is relatively simple for employees to suggest improvements to the production standards and, for example, illustrate these using photos. In addition, a self-training scenario has been implemented.

To satisfy the latter, AmbiWise can be used for the multimedia presentation of complex maintenance activities. This enables the use of video recordings, for example, using Google Glasses from the ego perspective. Quality control of the videos is assured through a user evaluation and comment function.

**i** Consortium partners are: Infoman (lead manager), DFKI's department of Innovative Factory Systems, Beuth University of Applied Sciences Berlin, Semantic Edge, and the Institute for Technology and Labor (ITA). Project funding received for a three-year term (2014–2016) and provided by the Federal Ministry of Education and Research (BMBF). The developed system has already undergone successful testing at five partner locations of Daimler Trucks und Schaeffler Technologies.



Mercedes-Benz plant Mannheim: Final assembly of the latest generation of the heavy duty engine, OM 471.  
Photo: Daimler AG

### MORE INFORMATION

[www.ambiwis.de](http://www.ambiwis.de)

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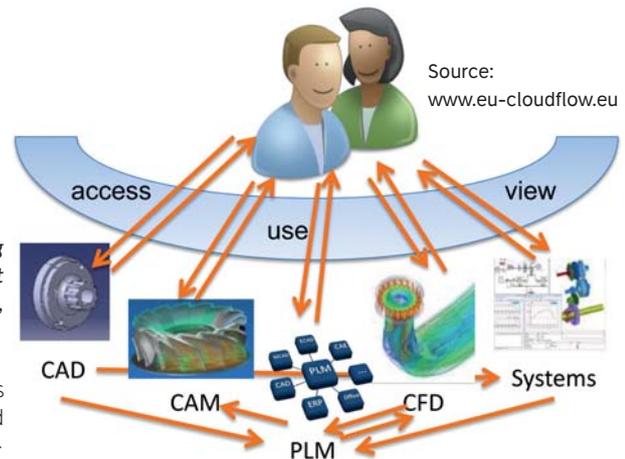
## Efficient Engineering Workflows for SMEs – Successful Ending to Project “CloudFlow”

How can the small and medium-sized enterprises (SMEs) easily manage their engineering workflows and still remain cost effective? This issue was the topic of an EU funded project with DFKI participation named “Engineering Workflows in the Cloud,” or in short form, “CloudFlow.” Launched in 2013, it came to a successful conclusion in October 2016.

► In cooperation with diverse software providers, numerous engineering services were made available in the Cloud. DFKI provided a workflow editor, which allowed the participating software companies to integrate their services, for example, software components for CAD modeling, simulation, and visualization. Ultimately, the separate services could be combined to form complete engineering workflows.

Users access the cloud via an online portal, which lets the end user retrieve the various workflows. The major advantage for the SMEs is that there is no requirement to purchase a complete software license or the necessary IT hardware either. The user runs project-related engineering services and workflows and pays only for the software components used.

In the follow-on EU project CAxMan, which started one year ago, the CloudFlow infrastructure is being used for additive manufacturing, for example, with industrial machinery actively integrated in the workflow. The 3D printers are good examples. The print data is obtained from the cloud with the aid of the workflow manager after being transferred from a 3D scanner to the web portal and evaluated in a defined workflow.



The user can select from engineering services and workflows on a case by case basis and gains access via an online portal.

### MORE INFORMATION

🌐 [www.eu-cloudflow.eu](http://www.eu-cloudflow.eu)

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## Apps in Production

Intelligent, embedded information and communication technologies (ICT) are progressively finding their way into the smart factory. They are networked with each other and with the Internet. Integrated, and increasingly smarter field devices are capable of taking over independent control tasks.

► These smart devices come equipped with their own storage memory and computing power, so specific software applications can run on them directly. Because these are modular components, they can easily be replaced or extended.

The App-Framework developed at DFKI is a hardware independent and vendor independent tool. It enables the apps to run directly as well providing access to process-related components. The apps can be installed and operated with minimal interactive effort by the user on a field device from an industrial App-Store. Conventional tablets and smartphones are used for the interactions with the respective system components.

The feasibility has been demonstrated in the SmartFactory<sup>KL</sup> using a demonstration scenario that filled orders for colored chocolate candies in customer-specific quantities. To begin initial operations of the various field devices, the apps were downloaded, installed, and configured directly on the cyber-physical systems (CPS). Additional field device functionalities can also be downloaded in the form of apps.

“Apps in Production – The development and realization of an app-framework for the dynamic deployment and expansion of functions for industrial field devices” is a research project funded by the Rhineland Palatinate Foundation for Innovation (Stiftung Rheinland-Pfalz).



Demonstrator shows the App-Framework supporting a separator function.

### MORE INFORMATION

🌐 [www.dfki.de/ifs](http://www.dfki.de/ifs)

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## German Federal President Gauck and Diplomatic Corps Visit DFKI

*Artificial Intelligence, its current trends, and its role in future technological and social development were the focus of the visit by German President Gauck and members of the diplomatic corps. The live systems included in the tour showed the ongoing trends in information systems, including the digitalization of working and living environments by the Internet of Things, virtual worlds, and the cooperation of humans and robots in the factory of the future.*

► On May 2, 2016 German President Gauck visited DFKI in Saarbrücken along with about 30 foreign ambassadors assigned to Germany; the group included the Apostolic Nuncio Nikola Eterović and Saarland's Minister President Annegret Kramp-Karrenbauer. The visit took place as part of the traditional information and orientation tour of the president and the ambassadors, which this year had the state of Saarland as its focus. Each year since 1996, the German president has invited the heads of missions and other international organizations to join him as he tours one of the 16 Federal German states. The purpose is to introduce Germany and the variety of its regions to the foreign diplomats. Prof. Dr. Wolfgang Wahlster, DFKI Technical and Scientific Managing Director, CEO and Dr. Walter Olthoff, CFO of DFKI greeted the president as the group arrived at DFKI.

DFKI staff and PhD candidates presented systems and concepts for future scenarios in the retail trade, human-robot collaboration scenarios, location-independent visualization and presentation technologies, an integrated system for the identification, analysis, and projection of the processes involved in human motion sequences, and even an Industrie 4.0 production process using a miniature factory constructed of LEGO building blocks.

Prof. Wahlster discussed the commercial and social perspectives of AI. In a short presentation, he addressed the current state of language technologies, which have found application in the voice dialog systems routinely used in mobile phones. He also mentioned the continued development of Industrie 4.0, which is now benefiting factories as a new generation of robots cooperates with humans on mixed teams. Wahlster highlighted the role of Saarland as a “hotspot” for the rapid implementation of advanced research in practical industrial applications, for example, in the steel industry or automotive sector. The role of Artificial Intelligence is to assist people in all areas of life. Humans still remain superior to AI in the areas of sensorimotorics, emotional, and social intelligence, said Prof. Wahlster.

“We are very proud that President Gauck has honored us with his visit to DFKI as a stop on the information and orientation tour for the foreign diplomatic corps. We view this as an expression of appreciation for the work of DFKI and our position as a Center of Excellence and innovation incubator in research and industrial environments.”

Prof. Dr. Wolfgang Wahlster,  
CEO and Scientific Director of DFKI



Mehdi Moniri presents the Eyebots demonstrator as example of human-robot collaboration.



Presentation of model-based production in the SmartLEGO® mini-factory.

### The system demonstrators in focus

#### The Future of trade, the Future of Shopping

The Innovative Retail Lab (IRL), a DFKI research collaboration with GLOBUS SB Warenhaus Holding, offers a visionary view of the retail trade of the future. Using a section of a super market as an illustrative example, systems show how the increasing information needs of future customers can be addressed. Natural forms of interaction – for example, pointing gestures – are recognized and supported by intuitive assistance systems. The core vision of IRL is the development of such intelligent assistance systems for customers and staff. IRL was welcomed into the Federal President's "List of Selected Places in the Land of Ideas" in 2009. [www.innovative-retail.de](http://www.innovative-retail.de)

#### Human-Robot Interaction & Industrie 4.0 – EyeBots

The EyeBots demonstrator shows how humans and robots can work together as a mixed team. In the scenario presented, two people work together with a customizable and trainable robot to perform a task. The user can interact with the robot simply by pointing at the target object by hand or just by looking at it. The robot understands the instruction and passes the required object. <http://madmacs.dfki.de>

#### Display as a Service – Unlimited Pixel Transport

Display as a Service (DaaS) ensures greater flexibility: Using a standard network, DaaS can connect displays of various sizes and resolutions to create one huge display wall that can be controlled from any number of different devices. DaaS replaces the dedicated cable connections with a thin layer of software and a generic data network. The concept opens up entirely new forms of design and control and new community experiences in visual cooperation. The technology is demonstrated using a virtual 3-D model of the reconstructed historic fortress of Saarlouis. [www.daas.tv](http://www.daas.tv)

#### Climbtrack – Assistance System for Climbing Enthusiasts

Climbtrack is a live presentation on a climbing wall. The concept: Climbtrack takes innovative ideas from the field of human-machine interaction and makes them useful for the sport of climbing. The system identifies the climbing face and projects stored climbing

routes and life size overlays of previously recorded actions taken by the athletes to provide a detailed video analysis. Climbtrack was awarded the "CeBIT Innovation Award 2016."

<http://climbtrack.com>

#### Business Process Management Meets Industrie 4.0 – Model-based Production in an Intelligent LEGO® Plant

The SmartLEGO® Factory uses an innovative scenario to demonstrate the use of business process management methods for Industrie 4.0. A LEGO tractor is produced in several different options. The flexible, always-adaptable manufacturing process is based on descriptive production and product models. Using RefMod-Miner, a research demonstrator built at DFKI for the analysis of business processes and the development of reference models, the complete value creation chain can be visualized and analyzed in real time. In this way, errors can be prevented in advance and a proactive response can be initiated to handle potential problems.

<http://refmod-miner.dfki.de>



Prof. Wahlster, President Gauck

## Another Successful Year as Team B-Human Dominates Robot Soccer

*Five-time World Champion and eight-time European Champion – quite an impressive record for robot soccer team B-Human, which has competed in the Standard Platform League of the RoboCup since 2009. Again in 2016, the joint team, of Bremen University and DFKI's department of Cyber-Physical Systems headed by Prof. Dr. Rolf Drechsler, was able to bring both titles to Bremen.*

► At the RoboCup in Leipzig from June 30 to July 3 this year, B-Human re-captured the world championship trophy after three years. In the exciting final match against Team UT Austin Villa, the team from Bremen prevailed in the “1.3 meter” penalty kicks. The most valuable team player of the tournament title also went to B-Human. The Bremen team continued its winning ways at the RoboCup European Open, from March 30 to April 3, played in Eindhoven, Netherlands. They beat the Nao-Team HTWK from Leipzig with a score of 5:0 in the final match. The successful team now has a record of eight years of undefeated competition at the European level of play.

For students at Bremen University – currently 21 in number – B-Human is a study project in application-oriented software development, which allows them to work intensively and independently over several semesters with self-generated challenges concerning robot soccer. The participation in the RoboCup German Open and RoboCup World Championships are integral elements of the project. To enable the Nao robots to play autonomously on the playing field, they have to run on their own and fully perceive their surroundings. The students have to equip them for these skills with self-programmed software. Furthermore, these abilities have to be well coordinated among the team members: In practice, while it may be advantageous to build a robot that forms frequent impressions of its environment, it may also be more of a hindrance when it comes to running when the heavy head is constantly rotating.

The experienced Bremen researchers traditionally release their software following each world championship, which facilitates the entry of new teams in the Standard Platform League.

The robot teams have to face new challenges each year to prepare for the distant goal of RoboCup 2050, when they hope to compete and win against the reigning human soccer world champions. In 2016, for example, these problems included being able to recognize the referee's whistle and the use of a black and white ball, as used in regular soccer – although in a miniature format. Because the field markings and goal posts are also white, the Naos have a much more difficult time recognizing the ball.

After the game is before the game: The victorious year 2016 is not yet over and the team from Bremen is already preparing for next year's tournaments – the RoboCup German Open is scheduled for early May 2017 in Magdeburg; and Nagoya, Japan is hosting the World Championships at the end of July. The key challenge then will be robot mobility on artificial turf, which implies a complete re-design of how the robots run.

### MORE INFORMATION

🌐 [www.b-human.de](http://www.b-human.de)

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On the winner's stand: B-Human celebrates winning the World Championship.

Photo: Judith Müller



Uwe Beckmeyer, Prof. Wolfgang Wahlster, Prof. Eva Quante-Brandt, Dr. Carsten Sieling, Prof. Frank Kirchner and Prof. Rolf Drechsler (l. to r.)



Prof. Frank Kirchner (right) explains the Mantis robot to Prof. Eva Quante-Brandt and Uwe Beckmeyer

## DFKI-Bremen – A Success Model Celebrates Ten Years

► In 2016, DFKI-Bremen can look back at ten years of successful research. At the anniversary celebration on June 13, many guests from the business, scientific, and government communities took part in celebrating the Bremen success model. “DFKI is, for Bremen, a prime example of successful structural change: Many highly qualified jobs are associated with the establishment of this first class research institute. The institute has attracted numerous distinguished researchers from around world and DFKI contributes through its many projects to furthering the image of Bremen as a center for aerospace and high-tech,” said Bremen Mayor Dr. Carsten Sieling in his opening remarks.

Prof. Dr. Eva Quante-Brandt, Senator for Science, Health, and Consumer Protection for the Free Hanseatic City of Bremen accented the major significance to the region in her speech: “Because of its record of excellent research and successful transfers to the economy over the past 10 years, DFKI has significantly contributed to the attractiveness of Bremen as a center of higher education and research, which has also further benefited as a result of the excellence initiative.” She added, “The State of Bremen would continue to support DFKI in its future expansion plans.” Guest speakers and well-wishers at the anniversary celebration also included Uwe Beckmeyer, Parliamentary State Secretary in the Federal Ministry for Economic Affairs and Energy as well as federal government Coordinator for the Maritime Industry, and Dr. Walter Dörhage, former head of the department of Research and Higher Education in the Senate for Science, Health, and Consumer Protection.

On February 27, 2006, DFKI used funding supplied by the State of Bremen and the Federal Ministry of Education and Research (BMBF) to establish a laboratory in the Hanseatic City, initially to conduct research in the Robotics Innovation Center (RIC) and Secure Cognitive Systems. The latter department has been headed by Prof. Dr. Rolf Drechsler since 2011 under the new name Cyber-Physical Systems. In that same year, the RIC was expanded by a branch office in Osnabrück, which is currently headed by Prof. Dr. Joachim Hertzberg.

Today, DFKI-Bremen employs about 130 people from around the world with the additional support of more than 80 student research assistants. They are developing next generation robot systems that autonomously solve complex problems and the secure embedded systems that increasingly define the devices we use every day. In these areas, DFKI works very closely with Bremen University.

The outstanding facilities with labs, workshops, and test facilities enable research of the highest quality and contribute significantly to the success of DFKI-Bremen. In the Maritime Exploration Hall, unique in Europe, and the Space Exploration Hall robot are tested under realistic and controlled conditions. At the Bremen Ambient Assisted Living Lab (BAALL), DFKI scientists have the use of a living laboratory where they are developing networked assistance systems for the Smart Home.

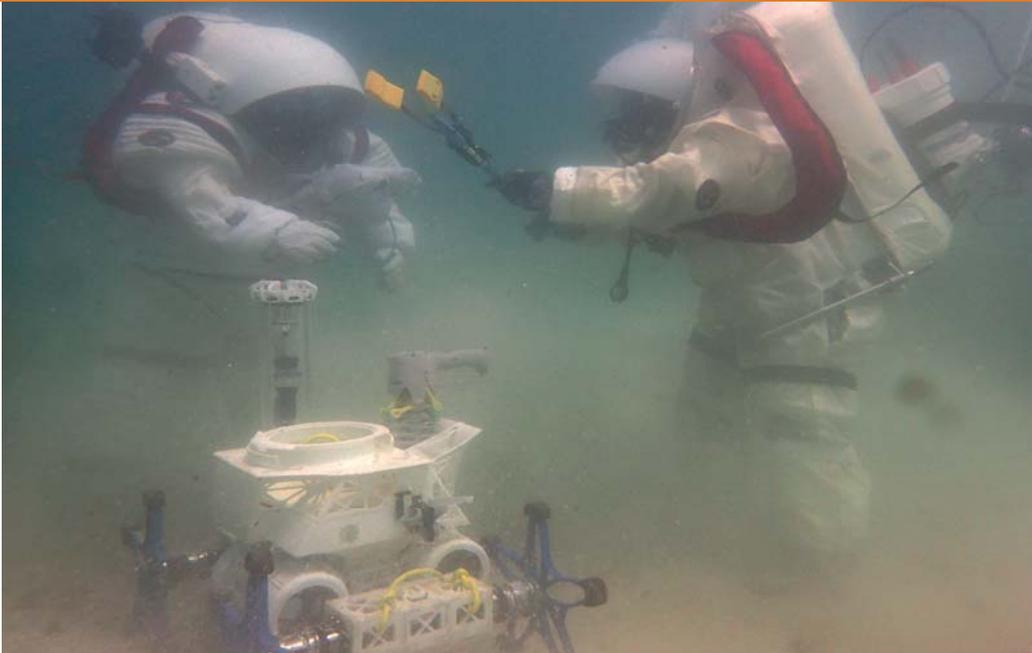
An important pillar of success are the national and international collaborations, for example, with the Brazilian Institute of Robotics (BIR), which was modeled after DFKI.

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**Underwater team work: Astronaut and Micro-Rover test their ability to cooperate in the Mediterranean.**

Photo: COMEX

## Robots on a Journey – Research and Testing Under Realistic Conditions

Generally, research and development at the DFKI Robotics Innovation Center (RIC) takes place at the workstations and in the numerous labs and test facilities available to the department – for example, in the Maritime Exploration Hall built to hold 3.4 million liters in a saltwater pool or the Space Exploration Hall – where recently developed systems are tested under realistic conditions. In addition, scientists use every opportunity to test their technologies "away from home" in places where they could actually be employed or where the prevailing conditions closely approximate the intended deployment environments. Specifically, DFKI scientists participated in several expeditions in 2016, which led them around the globe.

### ROBEX Expeditions in the Baltic Sea and Along the Pacific Coastline of Canada

► Several expeditions were organized under the flag of the Helmholtz-Alliance as Robotic Exploration under Extreme Conditions – ROBEX. In this context, the scientists from DFKI worked with other German research institutes on the robotic technologies for extreme environmental conditions, for example, those encountered in the deep seas.

In April, some staff of the project partners joined the crew of the research vessel ALKOR to test the MANSIO-VIATOR developed by GEOMAR Helmholtz Center for Oceanic Research in Geltinger Bay on the coast of the Baltic Sea. It consists of a stationary support system called the "lander" and a mobile underwater "crawler," a kind of tracked vehicle capable of exploring a designated terrain autonomously and mapping it on the basis of sensor data. The lander transports the crawler to the seabed where it then serves as a "garage" and docking station. The vehicle returns to the station to transfer the data it gathers and to recharge its batteries. The field testing in the Baltic enabled researchers for the first time to successfully demonstrate autonomous docking at a depth of ten meters – thanks to intelligent algorithms developed at RIC. In May, another research expedition led the ROBEX partners to the west coast of Canada. The deep sea crawler Wally from Jacobs University in Bremen was

outfitted with a laser scanning system developed at RIC and lowered to a depth of 870 meters where it mapped the sea floor with a resolution of one millimeter. The results help researchers examine deposits of methane hydrate on the seabed – a promising new source of energy for the future.

The hydrate forms small mounds on the seabed that change form and size over time – even minimal changes can be detected with the aid of the laser scans. Each scan creates a 3-D model of the surroundings, which enables the crawler to navigate autonomously throughout this mapped area. Wally is scheduled to remain for some time on the sea floor off the Canadian Pacific coast busily performing data collection for the open data project NEPTUNE Canada, where it can be used by scientists all around the globe.



**View of the deep sea: using the laser scan system, crawler Wally can detect the details of its surroundings.**

### From the Semi-desert Region of Spain to the Mediterranean Port of Marseilles

► The EU project MOONWALK focused on two large simulation campaigns, conducted by RIC researchers from April to June, initially in the Spanish semi-desert near Río Tinto and then in the Mediterranean near the French port of Marseilles. In accord with the now-completed project, DFKI, together with international partners, studied how the cooperation between astronauts and robots could function successfully on other planets.

In the first campaign, researchers tested the interactions of astronauts with the micro-rover YEMO developed at RIC. The location, a former surface mining area, provided geochemical characteristics very similar to the surface of Mars. Together this unusual pair explored the area, performing measurements and taking soil samples. The rover advanced through potentially dangerous terrain for humans like inside caves and climbed steep inclines when encountered. The robot is controlled via gestures from the astronauts, which produce specific commands that are then transmitted to YEMO. The second simulation required astronaut and rover to dive underwater in the Mediterranean gulf near Marseilles. Underwater testing simulated the effects of low gravity on moon missions, which could adversely affect the interaction between humans and machines.

### Mars Simulation in the Desert Landscape of the US State of Utah

► The next expedition for the RIC researchers is to kick-off in October: The aim of the German Aerospace Center (DLR) Project FT-Utah (Field Trials Utah) is to field test, in the semi-arid region of Utah (western USA), the interactive cooperation of multiple robot systems under conditions similar to those on Mars. The systems, the SherpaTT walking rover and the micro-rover Coyote III, already began their journey in early September when they were containerized for the Atlantic crossing.

The four-week long test schedule focuses on the simulation of a "Sample-Return Mission," which requires soil samples of the Martian surface to be collected and returned to Earth for the purpose of analysis. The two rovers constitute a logistics chain: The task of SherpaTT is to explore the environment and to take soil samples using its manipulator arm. The smaller Coyote III performs the role of a shuttle, which collects the samples and transports them back to the landing station. The mission control is accomplished remotely in phases via satellite link through a control station constructed at RIC in Bremen.



In contrast to an astronaut, steep inclines are no problem for Yemo.

Photo: COMEX

The station allows a human operator supported by a portable torso exoskeleton to directly engage and control the robot in the mission many thousands of kilometers away. The results of the field tests flow into the DFKI Project, TransTerra.

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The remote, rocky desert landscape in Utah provides optimal conditions for a Mars surface simulation.



Photo: Convent

## DFKI and the Smart Data Forum Participate in Nation-Wide Digitization Initiative for Small and Medium Sized Enterprises



The kick-off event "Smarter Mittelstand" marked the launch of the nation-wide digitization initiative in Darmstadt on May 19, 2016. Sponsored by the Federal Ministry for Economic Affairs and Energy (BMWi) and managed by DFKI, the Smart Data Forum is a partner in a series of events jointly initiated by the business magazine "Impulse," conference organizer "Convent," the ZEIT Publishing Group, and DFKI.

► Companies can learn about topics like Industrie 4.0, Big Data, and data security as well as the latest trends in digitization at six roadshow stations throughout Germany. The Smart Data Forum participation includes a separate exhibit booth and a workshop on the federal support services and funding programs available to SMEs.

Additionally, the Forum introduces selected projects from the BMWi programs Smart Data and Smart Service World and the "Trusted Cloud" seal of approval. The roadshows are complemented by the Mittelstand 4.0 Competence Centers that provide practical support and training on the topic of digitization.

State Secretary Brigitte Zypries delivered the welcome remarks to approximately 500 registered guests in Darmstadt, and encouraged them to view digitization as an opportunity and to take advantage of the various support programs being offered. "We want to ensure that German companies retain their competitiveness in the future," said Zypries.

In parallel, Smart Data Forum conducted a survey among the visitors to determine how the SME information booth could be improved relative to existing funding opportunities. The Forum wants to close these gaps. Forum activities are designed to create more visibility for smart data technologies "Made in Germany," and their practical uses in optimizing business processes. At the same time, the Forum's overview of the programs, initiatives, and support services facilitates understanding and access in this subject area.

After three sold-out events in Darmstadt, Dresden, and Karlsruhe during the first half of the year, the Roadshow series moved on to Bremen on September 7, and heads for Dortmund on October 25, 2016. Forum services also met with great interest in the Hanseatic City – at the stand visitors could try working with smart data glasses, learn more about Cloud platforms, or inquire about specific consulting services in their region. The final iteration of the Roadshow will be offered on November 7, in Nuremberg, where two Smart Data projects with DFKI participation will be presented: namely, Smart Data Web and Smart Data for Mobility (SD4M).



Aljoscha Burchardt, DFKI Language Technology Lab and Jack Thoms talking with Brigitte Zypries and Volker Genetzky, BMWi.

Photo: Smart Data Forum

### MORE INFORMATION

- 🌐 [www.convent.de/smn](http://www.convent.de/smn)
- 🌐 [www.smarter-mittelstand.de](http://www.smarter-mittelstand.de)

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## State Secretary Zypries Opens Smart Data Forum in Berlin

*Smart Data Forum, sponsored by BMWi and managed by DFKI, is a knowledge platform and conference venue for topics related to the digital transformation of the economy and, at the same time, a showroom for the digital technologies from Germany.*

► Brigitte Zypries, Parliamentary State Secretary in the Federal Ministry for Economic Affairs and Energy (BMWi), welcomed more than 160 guests to the official opening of the Smart Data Forum on June 20, 2016: "I am very pleased that we have created the Smart Data Forum, a meeting place for interested parties from the business, scientific, and government communities and, additionally, a place where the innovative digital technologies 'Made in Germany' can be experienced first-hand. The Forum is expected to bring more transparency to the field of Big Data technologies. Such an address is vital, in particular, for SMEs. This is where they can learn how to exploit digital data or create new business models, appropriate to assist them in transitioning their expertise and innovative production engineering to the digital age."

### Germany – Excellence in Big Data

Subsequently, under the motto "Germany - Excellence in Big Data," a panel of experts discussed Germany's unique digital competencies and strengths as well as the challenges posed by increasing digitization. Panel members included: Dr. Andreas Goerdeler, BMWi, Ingo Ruhmann, BMBF, Dr. Bernhard Rohleder, Bitkom, Prof. Dr. Volker Markl, DFKI, and Patrick Bunk, ubermetrics. The festive occasion was also the venue for announcing a new report of the same name to the public. The English language publication was prepared by Bitkom in cooperation with the Smart Data Forum and Germany Trade & Invest and provides the current overview of Germany's excellent standing in the world as a center for research, technology and innovative projects in the area of Big/Smart Data.

The aim of the publication is to increase Germany's international visibility as a digital technology leader. It presents the major research focus and projects as well as the strategies, products, and services of more than 30 research organizations, more than 60 technology providers, and more than 40 users. For decision-makers in Germany, the publication provides comprehensive information about potential partners for development projects or service providers for implementing digitization strategies. Smart Data Forum operates at both national and international levels. International roadshows – including the USA, Middle East, and Asia – develop new partnerships and present innovative research projects, technologies and products from Germany.

### Smart Data Forum as networking platform

The Smart Data Forum managed by DFKI is a knowledge, demonstration, and networking platform for smart data technologies and actors in Germany.

The exhibit space at the Fraunhofer Heinrich-Hertz Institute in Berlin presents outstanding projects and firms – including projects from the BMWi technology programs Smart Data – Innovation from Data, the Berlin Big Data Center, and the Smart Data Innovation Lab, a platform encouraging more visibility and networking for their research.



### MORE INFORMATION

🌐 [www.smartdataforum.de](http://www.smartdataforum.de)  
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**Brigitte Zypries delivers opening remarks at Smart Data Forum.**

Photo: Arne Gerstädt/Smart Data Forum



ZEIT CONFERENCE in Radial System V on the Spree River.

Photo: Phil Dera/DIE ZEIT

## 60 Years of AI – Major ZEIT CONFERENCE in Berlin

*Under the motto: “Humans – Machines – Metamorphosis” international researchers in the field of Artificial Intelligence convened on September 2, 2016 in Berlin, at “Radial System V” directly on the Spree River where they spent the day addressing the controversy over the potential of AI for the digital economy and society.*

► The birth of Artificial Intelligence as a special academic subject area is considered to be Dartmouth Conference of July 13, 1956. DIE ZEIT, in cooperation with SAP and DFKI, organized on the occasion of the 60th anniversary the ZEIT CONFERENCE on Artificial Intelligence: the controversy over the potential of AI for the digital economy and society.

Prof. Wahlster introduced the subject of Artificial Intelligence in the keynote presentation “60 Years AI: Computers with hands and feet, eyes, ears, and a bit of common sense” and defined the now familiar term in this way: “Artificial Intelligence enables the digitization of cognitive output, which had previously been the exclusive realm of human intelligence.” The Chairperson of the Executive Board and Scientific Director of DFKI identified four phases of AI development since 1956. Accordingly, researchers attempted in the beginning to apply a single method to implement a “general problem solver,” before concentrating in the next phase on knowledge-based systems. The third phase began with the increasing capacity of the Internet to provide huge volumes of bulk data.

“In the current and fourth phase of cognitive AI systems the research focus is on hybrid approaches: such as linking generic knowledge with learning via training data – that is, a combination of methods of the second and third generations,” said Prof. Wahlster. “In this boom phase of AI, a new generation of autonomous systems are being developed that are capable of independently

accomplishing the tasks assigned by an operator, without the need for external controls.”

The public’s fascination with this topic was palpable during the conference. The audiences at the various panel discussions directed knowledgeable questions to the panel of experts, which included Prof. Dr. Frank Kirchner and Prof. Dr. Gesche Joost from DFKI.

### MORE INFORMATION AND PROGRAM DOWNLOAD

<http://convent.de/de/archiv/zeit-events/zeit-konferenz-kuenstliche-intelligenz>



Prof. Wolfgang Wahlster delivering the opening remarks.

Photo: Phil Dera/DIE ZEIT



Algirdas Saudargas (MEP) delivering the keynote address.



Georg Rehm (DFKI, Secretary General of META-NET) officially opening META-FORUM 2016.

## META-FORUM 2016 in Lisbon

*META-FORUM is an international conference series on language technologies for a multilingual Europe. Past events have been held in Brussels, Budapest, Berlin, and Riga. META-FORUM 2016 took place on July 4-5, 2016 in Lisbon, Portugal. The conference organizer is DFKI's Department of Language Technologies – sponsored by META-NET and the EU Project CRACKER. The key topics are the strategies and technology solutions for the multilingual, digital single market.*

► The opening remarks by Algirdas Saudargas (Member of the European Parliament, Lithuania) emphasized the importance of technology for overcoming the language barriers, which is of immense relevance economically, in particular, for languages with few speakers. The Parliament is preparing – with the support of META-NET – a study intended to illuminate this exciting field in more detail. In the session on the European information economy, Milan Petkovic (Philips, TU Eindhoven; Vice President of BDVA) presented the current status of the Big Data Value Association (BDVA). Georg Rehm outlined the updated version of a strategy paper for the multilingual digital single market in the final conference presentation. The aim is to find synergies and better coordinate the strategic planning of the European big-data community and the European language technology community.

The first keynote speaker was Ryan McDonald (Google), who discussed the challenging technological aspects of a multilingual Europe. In the second keynote address delivered at the conclusion of the conference, Declan Groves (Microsoft) presented thoughts on how machine translation could be employed for customer communications. Many European researchers reported in the plenary sessions and in two poster sessions on their latest findings and success stories from current Research and Innovation projects. A panel discussion session, featuring representatives of the European Initiatives CLARIN, META-SHARE, and ELRA/ELDA, addressed technologies, services and their application in European platforms. A second discussion brought together representatives of the various European language communities as organized in the EFNIL and NPLD associations and demonstrated their solidarity in the form of a joint position paper regarding the development of language technologies for all European languages. The coveted META Prize this year was awarded to the research network "InterACT," initiated by Alex Waibel from Karlsruhe Institute for Technology (KIT) and Carnegie Mellon University (CMU), who accepted the award in person. The SyntaxNet (Slav Petrov, Google) system and the Universal Dependencies/Universal Treebanks Initiative (Joakim Nivre, University of Uppsala) were both honored with the META Seal of Recognition.

META-NET is a Network of Excellence consisting of 60 research centers in 34 countries and the host of Multilingual Europe Technology Alliance (META) – an open alliance of language technology programmers and users in research, industry, public admin-

istration, and other information society stakeholders. The Alliance was established in 2010 and now has a membership of approximately 800 companies and institutions in more than 60 countries.



Hans Uszkoreit (DFKI, honorary chairperson of META-NET) and Alex Waibel (KIT, CMU) contributing to the panel discussion

### MORE INFORMATION

- 🌐 [www.meta-forum.eu](http://www.meta-forum.eu)
- 🌐 [www.meta-net.eu](http://www.meta-net.eu)
- 🌐 [www.cracker-project.eu](http://www.cracker-project.eu)
- 🌐 [www.cracking-the-language-barrier.eu](http://www.cracking-the-language-barrier.eu)

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## ELRC Connects the Languages of Europe

*Language and linguistic diversity are at the center of European culture, trade, and cooperation. We work, study, travel, live, and transact business across national and geographical boundaries. The European digital single market is, in essence, multilingual.*

► European language diversity is a hurdle when it impedes the exchange of information or access to public services in the European trading and job markets. Adequate technological support must break down the existing language barriers in everyday public life while preserving the European language diversity.

### CEF.AT – Platform for machine translation

To enable public officials to provide citizens and enterprises information in the language of their choice all across Europe, the EU Commission launched a machine translation platform. The Connecting Europe Facility (CEF.AT) is a translation platform for use, particularly, in the areas consumer rights, health, public procurements, social security, and culture. To adapt CEF.AT to the needs of the respective public institutions in Europe, the system requires appropriate sample texts to train for and learn these application scenarios.

### DFKI coordinates the collection of language files

The aim of ELRC (European Language Resource Coordination) is the collection, preparation, and provision of the required language and translation files from and for public institutions in 30 European countries. DFKI assumes lead management of the consortium composed of well-respected European partners like the Evaluations and Language Resources Distribution Agency (ELDA), the Institute for Language and Speech Processing (ILSP), and language technology company Tilde. The intent is to use the most extensive collection of language files in the world to align CEF.AT with the daily

needs of public service providers in all EU member states, Island, and Norway and, in this way, make multilingual services available to citizens, enterprises, and European administrative authorities.

ELRC not only closes existing gaps between the EU's machine translation systems and the requirements of national institutions, it also supports the preservation of the national languages used every day in Europe. To accomplish this aim, the ELRC initiative requires the largest possible collection of data. Authorities and public institutions can expand the data base for the CEF.AT platform by contributing content in one or more languages in a digitally editable format. All are invited to provide official reports and publications, online content, brochures, terminologies and glossaries and even, ideally, translation memories in TMX format as training material and to support the European effort to improve the type, number, and quality of machine translated documents.

### MORE INFORMATION

🌐 [www.lr-coordination.eu](http://www.lr-coordination.eu)

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Photo: lr-coordination.eu

## Situation Adaptive Assistance Systems for Industrie 4.0 – SmartF-IT Research Successfully Closed Out

*Assistance systems for industrial manufacturing help to ensure efficient work, flexibility, and the digitization of the production processes. They adapt to the dynamic requirements of production lines that handle many options and enable a fast response to changes in the production goals. The SmartF-IT project implemented prototype situation-adaptive assistance systems for Industrie 4.0.*

► The partners in the consortium (a federally funded project by the Ministry of Education and Research, BMBF), convened at the Center for Mechatronics and Automation (ZEMA) for the final project review on May 30, 2016 in Saarbrücken. DFKI presented a worker guidance system and a system for dynamic workforce scheduling. As an example, the assembly of a steam oven from Miele was also demonstrated.

The SmartF-IT worker guidance system shows the individual assembly steps in the appropriate order for the various product options and guides the worker to a suitable assembly environment. The situation-adaptive, self-directed system for material logistics provides the worker with suitable components and tools. An advanced guided-picking system supports the worker in quickly changing to another option when dealing with changing parts lists and work plans. SmartF-IT takes an approach that allows flexible arrangement of parts in the work environment E-Ink displays on the parts containers signal, independent of the position of the container, what component part is to be used in a specific assembly activity. Alternatively, by using a depth imaging camera in connection with visual markers, the correct picking container can be identified and marked.

The innovative module developed at DFKI for worker scheduling in Industrie 4.0 is deemed to be exceptionally promising. The Anytime-Optimization system for dynamic balancing adjusts the planning of the worker's job sequences in real time to the different product options or equipment types. This enables the flexible assembly of even the smallest run quantities without having to reprogram any of the production plans. The innovative approach has already been successfully introduced at Industrie 2016, the Hannover Messe trade fair.

The system accesses the domain knowledge to master the complexity of the optimization problem for dynamic balancing. This knowledge is derived from the semantic factory memory for production and employees. To achieve an optimal line capacity, employees must be assigned different tasks during production. Intelligent control concepts like dynamic balancing optimize not only the production, but also the detailed planning of even the smallest batch.

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The efficient variability of the production processes is one of the key challenges of the fourth industrial revolution. The development of a comprehensive software architecture for Industrie 4.0 production processes is the aim of the BMBF research project "Basis system Industrie 4.0 (BaSys 4.0)," which is based on the findings of the SmartF-IT project (more information page 26).

### Project partners

- BMW Group
- Bosch Rexroth AG, Homburg
- Bosch Rexroth AG, Stuttgart
- DFKI (project coordination)
- fortiss GmbH
- imperial-Werke oHG, Bünde plant
- PLATOS GmbH
- Robert Bosch GmbH
- TU Darmstadt (DiK)
- TU Darmstadt (IAD)
- Center for Mechatronics and Automation (ZeMA) gGmbH

**Project volume:** 12 million euros

**Project period:** June 1, 2013 - Aug. 31, 2016

### MORE INFORMATION

[www.smartf-it-projekt.de](http://www.smartf-it-projekt.de)

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At the SmartF-IT close out review, a Miele steam oven on an assembly trolley following a flexible production route was demonstrated.



The BaSys 4.0 research project launched on July 1, 2016.

Photo: Fraunhofer

## DFKI Develops Planning and Assistance Services in Project BaSys 4.0

*Industrie 4.0 is finding its way into the economy. Successful positioning requires companies to increasingly turn to digitization and networking. This enables products to be supplied in more variants more profitably with lower volumes – for individual product lines down to a batch size of one.*

► Global competition demands that companies lower their production costs. To defend their current competitive edge from global competition, faster, more cost effective, and higher quality production is necessary. On the other hand, many companies constantly face costly adaptations for the increasingly complex value-adding processes required for the expanded networking of production units in Industrie 4.0.

The aim of the Federal Ministry of Education and Research (BMBF) funded project “Basissystem Industrie 4.0 (BaSys 4.0)” is to develop a comprehensive software architecture, which efficiently supports this transformation in the production processes via extensive integration of the IT components in the production plant. An integrated process map with all data provided via a common interface is required to enable highly versatile process planning in real time. All service and production process data must be available in a standard format, expandable at any time.

BaSys 4.0 is creating the basic structured software architecture and generic IT components to connect the engineering controls of the separate components in a production plant, enabling the integration of complex production processes into one, comprehensive production system. This effort guarantees the IT-Basis for flexible, dynamic, and adaptable production.

The users will benefit in a variety of ways from BaSys 4.0. The machinery and equipment in the manufacturing processes as well as the supply chain for new products can be quickly adapted. The declining costs make it economical to produce small series products while providing greater opportunity to small, innovative enterprises. The significantly simplified management of complex production processes helps to maintain and expand the competitiveness of the manufacturing sector.

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**BaSys 4.0**



DFKI's research department for Intelligent User Interfaces is involved in BaSys 4.0. The findings from the recently completed SmartF-IT project, which focused on the design of adaptive cyber-physical IT systems at all production levels, now form the starting point for DFKI's work on this new collaborative project. The team at DFKI-Saarbrücken performs the information and service modeling for the integrated tool chain and a services-oriented communications middleware that, taken together, represent the basis for the planning and assistance services for production lines.

### Project partners

ABB Ltd., Bosch Rexroth AG, DFKI, Eclipse Foundation, Festo AG & Co. KG, FORTISS GmbH, Fraunhofer Institute for Experimental Software Engineering – IESE (project coordination), ITQ GmbH, KUKA Roboter GmbH, PSI Automotive & Industry GmbH, RWTH Aachen University, Robert Bosch GmbH, SMS Group GmbH, SYSGO AG, ZF Friedrichshafen AG

**Project volume:** 12 million euros

**Project period:** July 1, 2016 - June 30, 2019

### MORE INFORMATION

[www.iese.fraunhofer.de](http://www.iese.fraunhofer.de)

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## German-Czech Innovation Lab Opened for Human-Robot Cooperation in Industrie 4.0

*Chancellor Dr. Angela Merkel and Czech Minister President Bohuslav Sobotka announced today in Prague that Germany and The Czech Republic are intensifying their cooperation on Industrie 4.0 and are working closely together to research new opportunities in human-robot collaboration (MRK 4.0). A letter of agreement was signed between the two national Centers of Excellence, the Czech CIIRC and the German DFKI. As part of the state visit, the Innovation Lab MRK 4.0 was launched in Saarbrücken and Prague. The initial technical equipment is funded by the German Federal Ministry of Education and Research (BMBF) with 1 million euros.*

► On August 24, 2016, Chancellor Dr. Angela Merkel visited the Czech Republic and met with Minister President Bohuslav Sobotka and the President of the Czech Republic Miloš Zeman. Prof. Dr. Wolfgang Wahlster, CEO of DFKI and one of the early fathers of Industrie 4.0, presented the cooperation project to the Federal Chancellor and her hosts in Prague: “The word ‘robot’ comes from the Czech language and I coined the German term “Industrie 4.0” in 2011 together with my colleagues Kagermann and Lukas. The innovation lab for human-robot collaboration, MRK 4.0 now brings both concepts together and shows small and medium sized companies how new methods in human-computer interaction can enable practical collaboration between factory workers and robots as both countries become leading markets and lead suppliers for Industrie 4.0.”

The aim of the MRK 4.0 Innovation lab is to conduct specific testing of human-robot collaboration and realize applications for Industrie 4.0. MRK 4.0 is oriented on the guiding principle of “combining human characteristics such as creativity and empathy with the accuracy, power, and inexhaustible repetition possible with machines. Imagine learning machines that adapt to humans and their individ-

ual abilities and requirements.” (Source: “Innovative Potential of human-machine interaction” acatech-Impuls, 2016)

The concept of the MRK 4.0 innovation lab provides German and Czech scientists with an opportunity to work together on solutions in the area of human-machine interaction. The effort of the innovation lab is not concerned with the development of new kinds of robots, rather exclusively with the interactions of human-robot teams. The lab in Saarbrücken is funded by the Federal Ministry of Education and Research (BMBF) with a total of 1 million euros.

To realize the flexible manufacture of customized products characteristic of Industrie 4.0, the innovation lab is creating a heterogeneous environment, in which human-robot collaboration can be tested and implemented in various scenarios. This work includes the use of capability modeling to identify the appropriate robotic systems to match the production tasks and the skills and abilities of the employees.

In cooperation with CIIRC, MRK 4.0 provides the ideal platform for national and European collaborative research projects to develop the next generation innovative HRC for Industrie 4.0 applications.

### MORE INFORMATION

- 🌐 [www.ciirc.cvut.cz](http://www.ciirc.cvut.cz)
- 🌐 [www.tradr-project.eu](http://www.tradr-project.eu)
- 🌐 [www.acatech.de](http://www.acatech.de)



Photo: Michal Dolezal / CTK

Chancellor Angela Merkel, Minister President Bohuslav Sobotka, Prof. Wahlster, and Prof. Marik at the signing ceremony for the cooperation agreement.

## Successful use of TRADR Robot Technology in Amatrice Earthquake

*In response to the devastating earthquake in Amatrice, Italy, a team from the European research project "TRADR" sent two ground robots and three drones to assist in the local rescue efforts on September 1, 2016.*

► Rescue forces have to be ready at any time to deploy quickly in the event of a disaster and must personally be capable of withstanding the highest stress. The use of robots as real team members can aid human workers in the execution of dangerous tasks and reduce their workloads.

Italian rescue forces from Vigili del Fuoco asked the team from the European research project TRADR (Long term human-robot Teaming for Robot Assisted Disaster Response) to create 3D-textured models of the San Francesco Basilika and the Saint Agostino Church. Both buildings were severely damaged and posed an extreme danger of collapse. The 3D models were to deliver indications of where to place the supports that could prevent further destruction of the buildings and protect the valuable works of art inside.

Two UGVs (Unmanned Ground Vehicle) without visual contact were remotely controlled via tele-operations and, in partial communication with one another, entered the San Francesco Basilika. At times, one robot focused on the other, to permit it to maneuver in the very restricted and cluttered space with only a very low bandwidth connection to the control unit.



**Semi-autonomous ground and air robots exploring the terrain.**

Photo: tradr-project.eu

The deployed robots used algorithms for environmental perception, incl. victim identification and terrain perception by means of various methods, for example, proprioceptive sensors, which were prepared at the Czech Institute of Informatics, Robotics and Cybernetics (CIIRC). Together with DFKI, CIIRC is a cooperation partner in the recently established German-Czech Innovation Lab for the investigation of new opportunities of human-robot collaboration (HRC 4.0) located in Prague and Saarbrücken (see page 27).



**One UAV flies inside the Saint Agostino Church (red circle). Two different UAVs provide a view for maneuvering (one in the yellow circle, the other supplies this image).**

Photo: tradr-project.eu

In terms of the mission, the robots were able to gather sufficient data for very high quality 3D models. The key success factors for the operation were the TRADR team reaching the disaster area within 48 hours after receiving the call and the problem-free cooperation between the local rescue forces and the TRADR project team.

Through a variety of synchronous and asynchronous exploratory missions, the TRADR robots supported the disaster management teams in gradually gaining an overall view of the surroundings and the extent of the catastrophe.

TRADR develops innovative technologies for combined human-robot teams for employment in medium and large disaster scenarios. Such scenarios envision semi-autonomous ground and air robots working together with human task forces to explore and monitor the area, collect visual information, and take physical samples.



The TRADR project is sponsored by the European Union under the 7th EU framework program for research. Twelve partners, including three fire departments are collaborating in the TRADR project. Project coordinator is DFKI.

**MORE INFORMATION**

[www.tradr-project.eu](http://www.tradr-project.eu)

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## DFKI Participants Presented IT Research Projects at the 3rd Software Campus Summit in Berlin

The participants in the third round of the Software Campus training program for IT industry leaders presented overviews of their projects on August 8, 2016. The participating staff from DFKI Kaiserslautern and DFKI Saarbrücken included Sven Hertling, Frederic Kerber, Sönke Knoch, Julian Krumeich, Pascal Lessel, and Quan Nguyen. Each participant implemented a project in collaboration with their industry partners and received funding from the Federal Ministry of Education and Research (BMBF) of up to 100,000 euros.

► It was the final presentation of results for two of the DFKI participants in the program. Frederic Kerber from DFKI's department of Intelligent User Interfaces presented an adaptive information and support system for maintenance staff that adapts to the work en-

vironment to the special requirements of the worker and the current situation. The Robert Bosch Company was his industry partner. Julian Krumeich from the Institute for Information Systems at DFKI, with his research findings on event-based forecasting of business processes showed how companies may be enabled to proactively respond to internal and external business events. Software AG supports and accompanies the project.

**MORE INFORMATION**

[www.softwarecampus.de](http://www.softwarecampus.de)



(r. to l.) Dr. Bub, Managing Director of EIT ICT Labs Germany, Dr. Schöning, Head of Research at Software AG, and Prof. Wahlster, honoring the successful graduates of the program.

Photo: Daniel Reinhardt

## DFKI Develops Highly Efficient Simulation System for Biomechanical Systems

*Severe injuries to the lower limbs require individual treatment, which often leaves the medical staff with a difficult decision. The research project "Individualized Implants and Prosthetics for the lower Extremities" (IIP-EXTREM) started on June 1, 2016 with the aim to objectively and technically support such decisions. The Federal Ministry of Education and Research (BMBF) sponsors the project as part of the "Individual Medical Technologies" initiative.*

► One aim of IIP-EXTREM is the reconstruction of limbs using individual or standardized implants. Based on CT or MRI scans, the powerful simulation software helps to determine the optimal placement of the fractured bones for healing, support decisions about the appropriate implants for stabilization during the healing period, and finally, to prepare the designs for the required customized implants. When a severe injury leaves no choice other than amputation, simulation software can model an exact fitting and highly capable prosthesis from the CT or MRI scans. In a virtual fitting, the shaft is tested in different stress situations before it is produced. The implant or prosthesis shaft is then approved for manufacture in a modern additive metal production process.

Efficient simulation and additive production processes streamline the treatment process and avoid the high costs of multiple fittings. Patients and the healthcare systems benefit as this strengthens the market position of German medical technology firms and jobs are secured.

DFKI's Department of Agents and Simulated Reality, managed by Prof. Philipp Slusallek, works with a team from the department of Mechanical Engineering at Saarland University to develop a highly efficient simulation environment for biomechanical systems. The system uses an arrangement of clinical CT data on a regular grid without explicit topology or matrix display to enable an extremely memory-efficient representation of the mechanical problem.



**3-D reconstruction of a bone implant system for a tibia fracture.**

To solve the resulting finite-difference equation, DFKI applies algorithmic processes on the basis of state of the art, highly parallel graphic processor units (GPUs). Project Leader Dr. Tim Dahmen said, "Mechanical simulations based on Finite-Element or Finite-Differences have been established for decades, especially, in mechanical engineering. We usually deal with data from CAD software, which assumes a large variety of structural shapes (topologies).

In this application, however, all of the original source data comes from a clinical CT device and is arranged as volume data on a regular grid. We can exploit this circumstance when we achieve a performance that allows us to simulate the problem to the clinically required resolution on modest hardware."

In addition to the algorithmic effort, DFKI takes on the role of integration partner and creates the software prototypes that can map the entire process chain - from uploading the CT data sets to the simulation to the manufacture of the implants.

### Project partners

- DFKI
- Chair for Orthopedics and Trauma Surgery, University of Witten/Herdecke (UW/H)
- Chair for Mechanical Engineering, Saarland University
- Karl Leibinger Medizintechnik GmbH & Co. KG
- Ottobock HealthCare (project coordination)

### MORE INFORMATION

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Federal Ministry  
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and Research



Integrated, sensor-controlled, environment recognition in traffic.

## Safer Streets Through Parallel Environment Recognition Systems

*Cars of the future will be equipped with various sensors that enable them to detect the details of their surroundings. This implies a challenge for scientists and auto manufacturers when it comes to the storage, processing, and use of the huge volumes of generated data. In the FASIS project, DFKI is collaborating with Audi, Ingolstadt University (THI), and BFFT Automotive Engineering to develop new kinds of algorithms for parallel environment recognition that will increase driving safety.*

► The methodology developed in FASIS will lead to specific applications in cars and, in principle, is applicable for both of the big automotive industry topics of the future – comprehensive driver assistance and autonomous driving. The current focus of the project is on driver assistance applications in the area of passive vehicle safety.

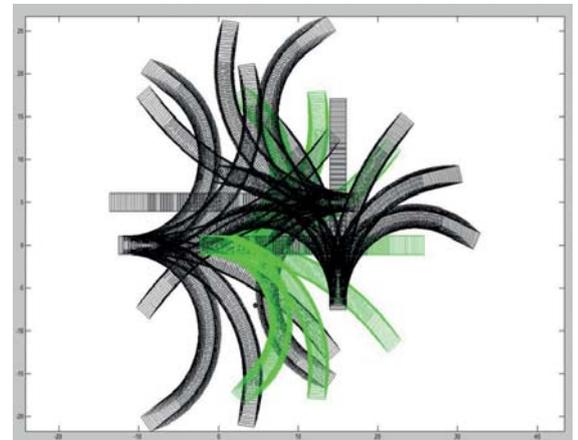
Vehicles today, with increasing frequency, are already being equipped with embedded systems with greater computing power, which enables, for example, the first infotainment applications. In the first phase of project FASIS, researchers are evaluating how to optimally exploit the increased computing power of the new multi- and many-core systems within the context of parallel environment recognition.

This includes computing an object's path of motion, for example, other cars, pedestrians, or bicyclists to determine whether it could lead to an accident and how this could be automatically avoided without any action being required on the part of the driver. The developed algorithm successfully manages to parallel process the generated data and computes the results in real time.

In a second phase of the project, ongoing since March 2016, the focus is on improving the performance in this area. The researchers at THI are working on expanding the algorithm for a wider view of the road ahead. The team at DFKI's department of Agents and Simulated Reality, managed by Prof. Dr. Philipp Slusallek, is focused on using the currently embedded graphics processor Tegra X1 from NVIDIA and optimizing the algorithm for the new architecture. After comprehensive testing, project partner BFFT will attempt to integrate the system in a vehicle. The compiler-framework AnyDSL plays a key role in this task. It enables significant improvements in processing the wealth of data, while guaranteeing parallelism and real time results.

AnyDSL is attracting maximum attention at international conferences and is finding its way into industrial applications. It took the Best Paper Award at the 14th International Conference on Generative Programming: Concepts & Experience

(GPCE 2015). At the NVIDIA GPU Technology Conference (GTC) 2016, Dr. Christoph Lauer (Audi), and Dr. Richard Membarth (DFKI) presented the project, which supports exactly the theme of the conference.



Combination of different paths of motion.

### MORE INFORMATION

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## Artificial Intelligence for Agriculture – DFKI Opens Competence Center for Smart Agriculture Technologies (CC-SaAT)

DFKI combined its extensive capabilities and innovative technologies to create the new, cross departmental Competence Center for Smart Agriculture Technologies (CC-SaAT), which began operations in July 2016 to serve the agricultural sector. It is designed as a development and collaboration platform, as well as a central point of contact for commercial and scientific partners.

► Numerous agricultural challenges can be mastered with the aid of innovative AI technologies. This includes the various work processes along the entire value chain, from the growing field to the consumer. Artificial Intelligence provides technologies that support people, for example, the cooperative planning and control of equipment in complex and dynamic structures. The focus of CC-SaAT, in particular, is on networking and communication technologies, autonomous controls, and robotics as well as geo-referencing smart services, automated Big Data analysis, and Deep Learning.

The competence center bundles the know-how from all DFKI research departments, creating innovative AI technologies in collaborative projects with partners from industry and research. CC-SaAT performs national and European research projects as well as direct contract work for industry customers. The application-oriented performance range of this competence center includes customized development of intelligent software packages, technology transfer of international award winning research, innovation consulting and scientific support, and preparation of market studies and feasibility studies.

The range of agricultural applications is very broad. In the future, CC-SaAT activities will encompass the entire spectrum, from farming and animal husbandry, gardening and forestry, to viticulture and fisheries. Located in Osnabrück, CC-SaAT is co-managed by Dr. Stefan Stiene and Dr. Ansgar

Bernardi. Both have many years of experience in the field of computer-based agricultural technologies.

### MORE INFORMATION

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Innovative service systems for agriculture.

Photo: Budimir Jevtic/Shutterstock.com

## ► DFKI INTERVIEW – DR. STEFAN STIENE

Photo: Elena Scholz, Osnabrück University



**Dr. Stefan Stiene** joined DFKI in 2011 at the Robotics Innovation Center (RIC) in Osnabrück.

*He is the team leader at RIC for the RIC Planning and Perception research area and, since July 2016, has co-managed the DFKI Competence Center Smart Agriculture Technologies (CC-SaAT), together with Dr. Ansgar Bernardi.*

### 🎙️ What is the application potential of your research?

The technologies being developed in the fields of AI and Robotics have a very broad spectrum of application. For example, at RIC in Osnabrück we are using methods of semantic object recognition in automation of quality control at the shipbuilding company MEYER WERFT and for the environmental monitoring of a storage warehouse filler at an agricultural equipment manufacturer. One application area with enormous potential is human-robot cooperation in Industrie 4.0-based production. My domain is agribusiness. We are developing intelligent assistance systems for farm machinery, researching farming robots, and decentralized data management.

### 🎙️ When did your interest in Artificial Intelligence begin and how have AI processes changed since that time?

My first contact with AI and robotics was 11 years ago during my Master's degree program. I was immediately fascinated by this subject and decided, then and there, to pursue it. My field of research since then has been largely shaped by the increased use of Robot Operating Systems (ROS) and new, cost effective 3D-sensor technologies. This trend has resulted in many researchers addressing the semantic analysis of 3D data and its integration in robot systems. The gap between top-down AI methods and bottom-up robot controls has been substantially narrowed.

### 🎙️ What are the greatest challenges and opportunities for AI systems?

As I see it, the greatest challenge is to convey to the public that AI systems can support people in their creative and productive output and pose no threat to them or their jobs. People are and will remain at the center of our efforts and new AI tools will be there to assist them in the future. The challenges are to reassure all people concerning their fear of the complexity of Artificial Intelligence and not to neglect the parallel, integrated user training.

### 🎙️ What do you enjoy doing when you are not working as a research scientist?

I achieve a balance from work with my family and from working outside in the yard. I really enjoy woodworking. The next projects will be handmade yard chairs and a raised bed for my vegetable garden.

### 🎙️ Are there parallels with your professional activities?

equipment. When observing the seasonal cultivation process, I have to ask myself if I could have planned it the same way on my computer. My circle of friends includes several farmers, so I am surrounded all the time by my main area of application – agriculture! I think it is important for scientists to learn the ropes in their application areas, otherwise they run the risk of doing research in an ivory tower.

### 🎙️ What are your current projects?

In addition to project acquisition, I also fulfill my team leader responsibilities and, as manager, try to contribute as much as possible to the content of the CC-SaAT Center of Excellence.

#### CONTACT

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## Science Minister Wanka Visits mobisaar

On July 26, 2016, as part of the annual summer tour, Prof. Dr. Johanna Wanka, Federal Minister for Education and Research (BMBF) paid a visit to the mobisaar project at the Saarbahn firm in Saarbrücken. The tour is organized under the motto "The future life of old age" and includes selected research sites all across Germany.

► The aim of "mobisaar – Mobility for All" is to reduce the barriers to mobility in public transport and to enable people with impaired mobility and the elderly to participate in using public services. mobisaar is funded by the Federal Ministry of Education and Research (BMBF).

"Life also goes on outside of your own four walls," said the Minister in her welcome remarks. "Only those who can move about safely and freely can cultivate social contacts and take advantage of opportunities in their surroundings." Anke Rehlinger, the Saarland Minister of Economic Affairs, also praised the project for its "contribution to maintaining the quality of life."

mobisaar provides barrier-free route planning for the use of public transportation. To this end, information about the stops, schedules, buses, and sidewalks is evaluated in real time, bundled, and provided via a hotline and a smartphone app. To travel longer distances using different modes of transportation, the service point assigns volunteer guides, who assist in operating the ticket machines and help the customer get on or off, or to transfer to and from the vehicles. Sometimes the guide will even accompany the customer from the home to the shopping center, the doctor's office, or to the bank. The services tested in the current project in downtown Saarbrücken will be successively expanded now throughout the state.

Dr. Jan Alexandersson, head of the DFKI Competence Center for Ambient Assisted Living (CCAAL), made a presentation of the User Centered Design method and its implementation in the mobisaar project. The core aspect of this socio-technical research is the development of interfaces, in cooperation with and based on the real needs of users.

So far, 120 people have taken advantage of the service and the growing number of senior citizens is expected to bring an increase in demand. Saarland is effected to a greater extent than other regions by demographic trends. The development poses a double challenge to the local public transport services.



The mobisaar service center provides volunteer guides.

Photo: mobisaar



As the customer structure changes substantially and demand drops, it will become increasingly difficult to provide service to the rural areas, especially, when combined with the lower public subsidies expected as a result of efforts to reduce the debt. mobisaar is intended to contribute greatly to the improving the mobility opportunities for seniors and the handicapped.

### MORE INFORMATION

[www.mobisaar.de](http://www.mobisaar.de)

### CONTACT

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Federal Minister Johanna Wanka, Ralf Latz, Mayor of Saarbrücken, and Saarland's Economics Minister Anke Rehlinger during their visit to mobisaar.

### About mobisaar

mobisaar was selected along with four other projects by the Federal Ministry of Education and Research (BMBF) from a pool of 140 submissions in the Innova-Komm competition ("Innovation for communities and regions in times of demographic change"). The total project funding amount is 8.09 million euros. The BMBF share of the funding is 59% (approx. 4.8 million. euros).

### Project partners

- B2M Software GmbH
- DFKI
- Ecumenical Welfare Mission
- Institute for Social Economic Research, ISO
- Neue Arbeit Saar gGmbH (NAS)  
(church sponsored jobs training program)
- PRO EHRENAMT e. V. (State working group)
- Saarbahn GmbH (project coordination)
- Saarland Transportation Association, SaarVV
- Sozialverband VdK Saarland e. V.  
(socio-political organization)



## DFKI Service Offering

As an internationally renowned Center of Excellence for innovative software systems based on Artificial Intelligence (AI) methods, DFKI is offering the following services with more than 25 years of experience in basic and applied R&D

- ▶ Technology transfer of the award-winning research results of DFKI
- ▶ Innovation coaching and start-up consulting in the public-private partnership sector
- ▶ Individual design, development and implementation of innovative application solutions
- ▶ Market studies, expert surveys, feasibility analysis and empirical user studies
- ▶ Component development with AI-functionality, enhancing the performance of complex software systems
- ▶ Scientific advice on the selection and implementation of complex software solutions
- ▶ Customization, implementation, deployment and maintenance of DFKI AI-solutions
- ▶ Scientific evaluation and benchmarking of software solutions
- ▶ Application-oriented basic research
- ▶ Independent assessment of IT-security and privacy
- ▶ Technology workshops, training and practice
- ▶ Scientific monitoring of data collections and their evaluation
- ▶ Business engineering: Process analysis and development
- ▶ Innovation coaching and turnaround management
- ▶ Strategic and technical due diligence consulting for companies in the ICT sector
- ▶ Technical and organizational support for the standardization in the IT sector (Including W3C, ISO)
- ▶ Design, construction and operation of Living Labs

### Prof. Dr. Rolf Drechsler Participates in New DFG Special Research Topic "Farbige Zustände"

The Working Group for Computer Architecture (AGRA) at Bremen University directed by Prof. Dr. Rolf Drechsler is participating in the Collaborative Research Center "From colored states to evolutionary structural materials." The German Research Foundation (DFG) funded the new initiative with just under 10 million euros in May 2016.

The center aims to develop new methods of material development. To this end, approaches from the fields of biomedical and chemical research will be applied to the development of metallic structural materials. The research team is an interdisciplinary one and combines expertise from the areas of process engineering, production engineering, material technology, computer science, mathematics as well as planning and logistics. AGRA is responsible for the predictive function and the heuristic, statistical, and analytical test planning.

### Open House at DFKI in Bremen

Robots that can swim, crawl, or work as a team, intelligent overalls that protect the wearer against harmful posture and an autonomous drive electric car that can park sideways and diagonally – all this and much more awaited the more than 1,100 visitors to the Open House at DFKI Bremen on June 14, 2016. The northernmost of the DFKI locations invited the public to take a look behind the curtains of Bremen's labs and test facilities of Robotics Innovation Center and Cyber-physical Systems department to experience the ongoing research up close.

### Best Report Award to Institute for Information Systems at the 12th International Business Process Incubator (BPI)

In connection with the Business Process Management Conference in Rio de Janeiro, a paper by Sharam Dadashnia, Tim Niesen, Philip Hake, Peter Fettke, and Nijat Mehdiyev was chosen for the "Best Report Award" at BPI'16.

The case study documents the results of various process-mining analyses (clustering, discovery) of the real data set for users of the website of a Dutch employment agency and describes the use of a Deep Learning approach for this task. Among the key results was the identification of frequently occurring usage patterns on the basis of historical, interactive user data and the subsequent suggested actions to improve the website.

### Prof. Wahlster on Digitization Council in the Office of Saarland's Minister President



Photo: www.saarland.de

The comprehensive digitization of processes is an exponentially growing phenomenon and offers opportunities for society, science, and the economy. To ensure that current and medium-term perspectives are better integrated in the political decision making process, state minister president Annegret Kramp-Karrenbauer created the Digitization Council, a strategic advisory body. The personal advisory body to the minister president is composed of seven members, all of whom have some private or professional connection to Saarland.

(l. to r.) Eva-Maria Welskop-Deffaa (verdi), Prof. August-Wilhelm Scheer (Scheer Group), Michael Hankel (ZF), Minister President Annegret Kramp-Karrenbauer, Annette Kroeber-Riel (Google), Prof. Wolfgang Wahlster, Dr. Ferri Abholhassan (T-Systems), Thomas Birr (RWE)

## International Conference on Mobile Computing and Ubiquitous Networking (ICMU) at DFKI Kaiserslautern

The "International Conference on Mobile Computing and Ubiquitous Networking (ICMU) was hosted by DFKI Kaiserslautern on June 4-6, 2016. Researchers and developers in the field of mobile communications apps and "all-purpose" systems (so called Ubiquitous Computing) met at the 3-day event in southwestern Germany. Conference chairpersons Prof. Dr. Andreas Dengel, spokesperson for DFKI Kaiserslautern, and Prof. Miki Yamamoto of Kansai University, Japan welcomed about 60 scientists and industry representatives from around the world. The special conference focus was on the sensor networks surrounding humans in addition to device networking and communications. Initiated in Japan, the conference took place in Germany for the first time this year and marked the ninth iteration of the annual event.

**More information**  
[www.icmu.org/icmu2016](http://www.icmu.org/icmu2016)



## "Our Future With Artificial Intelligence" – TEDx-Talk by Dr. Damian Borth

At the TEDx-Talks 2016 in Stuttgart on 9 September, Dr. Damian Borth presented future perspectives for Artificial Intelligence under the motto "(e)Motion." In the 18-minute TED format presentation, the head of the DFKI Center of Excellence for Deep Learning (<http://dl.dfki.de>), explained how machines learn by example and what role learning algorithms may play in the future.

TEDx-Talks are local TED Conference events that have the aim of providing a forum for the exchange of innovative ideas and approaches and for inspiring others. Under the TEDx event motto "Ideas worth spreading," thinkers and operators from the world of research, business, and culture present short inspirational talks on subjects with global relevance.



## Keynote at Manufacturing Leadership Summit 2016

More than 200 managers from industry came together for the topic "Manufacturing: The New Rules of Leadership" in Carlsbad, California, USA. Prof. Dr. Detlef Zühlke, department head for Innovative Factory Systems at DFKI and CEO of SmartFactoryKL, argued for the expansion of worldwide standards in his keynote address. Such standards are indispensable for implementing Industrie 4.0 applications. The participants discussed the digital transition and the consequences for all participants at the conference from June 6-9, 2016.

**Prof. Dr. Detlef Zühlke**

## Prof. Dr. Frank Kirchner Named as Professor in Brazil

Prof. Dr. Frank Kirchner, head of DFKI's Robotics Innovation Center, was named "Associated Professor" on the Scientific Faculty of the "Universidade de CIMATEC em SENAI BAHIA" in Brazil last April 2016. The certificate was presented personally on June 15, 2016 by Dr. Daniel da Silva Motta, Servico Nacional de Aprendizagem Industrial (SENAI) in Bremen. His future duties as an "Associated Professor" will include, in particular, sponsorship of PhD candidates.

**Prof. Dr. Frank Kirchner and Dr. Daniel da Silva Motta (SENAI)**





Kaiserslautern Site



Saarbrücken Site



Bremen Site



Project Office Berlin

## German Research Center for Artificial Intelligence

### Company Profile

#### ► Established

1988, non-profit organization (public-private partnership)

#### ► Executive Board

- ▷ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster, CEO
- ▷ Dr. Walter Olthoff, CFO

#### ► Supervisory Board

- ▷ Prof. Dr. h.c. Hans-Albert Aukes, Chair
- ▷ Dr. Susanne Reichrath, Representative of Saarland's Minister President for Higher Education, Science and Technology, Vice Chair

#### ► Locations

Kaiserslautern (registered office), Saarbrücken, Bremen, Berlin (project office). Further operating sites in Osnabrück and St. Wendel

#### ► Shareholders

Airbus Group, BMW AG, CLAAS KGaA mbH, Deutsche Messe AG, Deutsche Post AG, Deutsche Telekom AG, Empolis Information Management GmbH, Fraunhofer Gesellschaft e.V., Google Inc., HARTING AG & Co. KG, Intel Corporation, John Deere GmbH & Co. KG, KIBG GmbH, Microsoft Deutschland GmbH, Nuance Communications Deutschland GmbH, RICOH Company Ltd., Robert Bosch GmbH, SAP SE, Software AG, University of Kaiserslautern, Bremen University, Saarland University, Volkswagen AG, VSE AG

#### ► Equity Holding

GraphicsMedia.net GmbH, Kaiserslautern – Ground Truth Robotics GmbH, Bremen – SemVox GmbH, Saarbrücken – Yocoy Technologies GmbH, Berlin

#### ► Key Figures 2015

- ▷ Annual Budget: 42,5 Mio. Euro
- ▷ Total Assets: 115,9 Mio. Euro
- ▷ Professional staff: 491
- ▷ Graduate student staff: 366

### Intelligent Solutions for the Knowledge Society

► The German Research Center for Artificial Intelligence (DFKI) was founded in 1988 as a non-profit public-private partnership. It has research facilities in Kaiserslautern, Saarbrücken and Bremen, a project office in Berlin, and branch offices in Osnabrück and St. Wendel. In the field of innovative commercial software technology using Artificial Intelligence, DFKI is the leading research center in Germany.

Based on application oriented basic research, DFKI develops product functions, prototypes and patentable solutions in the field of information and communication technology. Research and development projects are conducted in eighteen research departments and research groups, ten competence centers and seven living labs. Funding is received from government agencies like the European Union, the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Affairs and Energy (BMWi), the German Federal States and the German Research Foundation (DFG), as well as from cooperation with industrial partners. Twice a year, a committee of internationally renowned experts (Scientific Advisory Board) audits the progress and results of state-funded projects. In addition, BMBF evaluates DFKI regularly. The most recent assessment was again very successfully concluded in 2010.

Apart from the state governments of Rhineland-Palatinate, Saarland and Bremen, numerous renowned German and international high-tech companies from a wide range of industrial sectors are represented on the DFKI supervisory board. The DFKI model of a non-profit public-private partnership (ppp) is nationally and internationally considered a blueprint for corporate structure in the field of top-level research.

DFKI is actively involved in numerous organizations representing and continuously advancing Germany as an excellent location for cutting-edge research and technology. Far beyond the country's borders DFKI enjoys an excellent reputation for its academic training of young scientists. At present, 491 highly qualified researchers, administrators and 366 graduate students from more than 60 countries are contributing to more than 240 DFKI research projects. DFKI serves as a stepping stone to leading positions in industry and successful careers as founders of spin-off companies. Over the years, 98 staff members have been appointed professors at universities in Germany and abroad.

### CONTACT

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## Research & Development

### ► Research Departments and Research Groups

#### Kaiserslautern Site

- ▷ Prof. Dr. Prof. h.c. Andreas Dengel:  
Knowledge Management
- ▷ Prof. Dr. Paul Lukowicz:  
Embedded Intelligence
- ▷ Prof. Dr.-Ing. Hans Schotten:  
Intelligent Networks
- ▷ Prof. Dr. Didier Stricker:  
Augmented Vision
- ▷ Prof. Dr.-Ing. Dr. h.c. Detlef Zühlke:  
Innovative Factory Systems

#### Saarbrücken Site

- ▷ Prof. Dr. Josef van Genabith:  
Multilingual Technologies
- ▷ Prof. Dr. Antonio Krüger:  
Innovative Retail Laboratory, St. Wendel
- ▷ Prof. Dr. Peter Loos:  
Institute for Information Systems
- ▷ Prof. Dr.-Ing. Wolfgang Maaß:  
Smart Service Engineering
- ▷ Prof. Dr. Philipp Slusallek:  
Agents and Simulated Reality
- ▷ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster:  
Intelligent User Interfaces

#### Standort Bremen

- ▷ Prof. Dr. Rolf Drechsler:  
Cyber-Physical Systems
- ▷ Prof. Dr. Frank Kirchner:  
Robotics Innovation Center (RIC)
- ▷ Prof. Dr. Joachim Hertzberg:  
Plan-Based Robot Control,  
RIC Branch Office Osnabrück

#### Project Office Berlin

- ▷ Prof. Dr. Christoph Igel:  
Educational Technology Lab
- ▷ Prof. Dr. Gesche Joost:  
Interactive Textiles
- ▷ Prof. Dr. Volker Markl:  
Intelligent Analytics for Massive Data
- ▷ Prof. Dr. Hans Uszkoreit:  
Language Technology

### ► Living Labs

#### Testing, evaluation, and demonstration of innovative technologies in comprehensive application scenarios

Advanced Driver Assistance Systems Living Lab, Bremen Ambient Assisted Living Lab, Innovative Retail Lab, Robotics Exploration Lab, Smart City Living Lab, Smart Factory, Smart Office Space

### ► Competence Centers

#### Coordination of research activities in particular areas

Ambient Assisted Living, Case-Based Reasoning, Deep Learning, Multimedia Analysis & Data Mining, Language Technology, Semantic Web, Safe and Secure Systems, Smart Agriculture Technologies, Virtual Office of the Future, Wearable AI

## Scientific Excellence and Transfer

### ► International Scientific Advisory Board Bi-annual evaluation of publically funded projects

- ▷ Prof. Dr. Markus Gross, Eidgenössische Technische Hochschule Zürich (ETH), Switzerland, Chairman

### ► Leading-Edge Research

#### DFKI is the only German institute for computer science to participate in each of the three leading-edge research clusters

- ▷ Cluster of Excellence “Multimodal Computing and Interaction”
- ▷ Leading-Edge Cluster “Software Innovations for the Digital Enterprise” funded by BMBF
- ▷ European Institute of Innovation and Technology (EIT Digital)

### ► Networks of Excellence

At present, DFKI is a coordinator or core partner in four European Networks of Excellence

### ► Promoting Young Talent

DFKI is a founding member and core partner of the Academy Cube and the Software Campus to promote managerial talent in the IT industry

### ► Academic Chairs

98 former staff members have been appointed professors at universities in Germany and abroad

### ► Spin-offs

76 spin-off companies have created more than 2,500 highly skilled jobs

## Committees and Academies

### DFKI is represented by its scientific directors on numerous committees and academies

### ► Scientific and Government Committees

Advisory Board of the Future Internet Public-Private Partnership Programme of the European Union (FI-PPP), Big Data Value Association, Brazilian Institute of Robotics (BIR), Center of Innovation Program of the Japanese Ministry of Education (COI), Feldafinger Kreis, Management Board of the International Computer Science Institute in Berkeley, Münchner Kreis, National Institute of Informatics (NII, Tokio), Program Committee of the National Aeronautics and Space Research Centre DLR, Research Alliance of the German Federal Government, Steering Committee of the German Informatics Society (GI), and others

### ► Business Committees

Deep Sea Mining Alliance (DSMA), Governance Board of the Intel Visual Computing Institute, and others

### ► Scientific Academies

Academy of Sciences and Literature, Berlin-Brandenburg Academy of Sciences, European Academy of Sciences, German National Academy of Sciences Leopoldina, National Academy of Science and Engineering, Royal Swedish Academy of Sciences, and others

# Intelligent Solutions for the Knowledge Society

- ▶ INDUSTRIE 4.0 and Innovative Factory Systems
- ▶ Smart Data – Intelligent Analytics for Massive Data
- ▶ Wearable Computing and Interactive Textiles
- ▶ Knowledge Management and Document Analysis
- ▶ Virtual Worlds and 3D Internet
- ▶ Educational Technologies
- ▶ Development of Provably Correct Software
- ▶ Smart City Technologies and Intelligent Networks
- ▶ Information Extraction and Intelligent Web Retrieval
- ▶ Deep Learning
- ▶ Multiagent Systems and Agent Technology
- ▶ Multimodal User Interfaces and Language Understanding
- ▶ Visual Computing and Augmented Vision
- ▶ Mobile Robotic Systems
- ▶ Shopping Assistance and Intelligent Logistics
- ▶ Semantic Product Memories
- ▶ Safe and Secure Cognitive Systems and Intelligent Security Solutions
- ▶ Ambient Intelligence und Assisted Living
- ▶ Driver Assistance Systems and Car2X Communications
- ▶ Cyber-physical Systems
- ▶ Multilingual Technologies



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