



## ANNUAL REPORT 2019

### INNOVATIONS FROM DATA

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## INNOVATIONS FROM DATA

At the Fraunhofer Institute for Software and Systems Engineering ISST, we conduct research for the digital transformation of industry and society as well as the transfer of knowledge from research to practice.

We develop digital business and system solutions for healthcare, logistics, and the data economy.

### WHAT WE OFFER

Consulting, conceptual design, and implementation of data strategies, consultancy and development for data management, software architectures, and digital business models. Digital maturity surveys, development and application of data processing methods, among other things based on artificial intelligence.

Our experts research the value and sovereign handling of data. We develop solutions for data management and the establishment of data architectures. In cooperation with our industry customers and as political advisers, we are establishing an aggregate framework for the secure, controllable use of data across company boundaries with International Data Spaces.

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# OUR INSTITUTE



# DATA ECOSYSTEMS: COOPERATION BASED ON THE EXAMPLE OF NATURE

## INCUBATORS FOR INNOVATIONS FROM DATA

Water, light, flora, and fauna: The perfect interplay of all these factors in a natural ecosystem is an excellent model for highly modern value chains in the economy. Just as nature needs to find a balance between the interests of all participants in an ecosystem, the interests of all data providers and data users have to be harmonized for the best possible results in the digitized economy. Data are valuable as raw materials because they contain information and knowledge. And because they can be used to jointly create services and products in a network of partners that cannot be offered by any partner on their own.

## ESTABLISHING RULES FOR USING DATA AS AN ECONOMIC GROWTH FACTOR

This premise is particularly relevant in data-intensive fields such as artificial intelligence (AI) solutions. With the International Data Spaces architecture, Fraunhofer ISST along with its research partners is creating a framework for the controlled sharing and sovereign handling of data. International Data Spaces (certified DIN SPEC 27070) can therefore be considered a blueprint for successful data ecosystems.

We at Fraunhofer ISST establish functioning, lasting data ecosystems for our customers and assist with integration into existing processes. We establish rules, architectures, and technologies to maintain balance in the data ecosystem for all participating players. We research your digital success for tomorrow – and help you shape it today.

More information in the ISST Report  
»Data Ecosystems – Conceptual  
Foundations, Constituents  
and Recommendations for Action«  
under <https://s.fhg.de/Q56>



# OUR INSTITUTE



# PLATFORM ECONOMY MADE IN EUROPE: THE INTERNATIONAL DATA SPACES AND GAIA-X INITIATIVES

As data are increasingly defining our private lives and day-to-day work, they also have their own value. Last year the data of one Facebook user were valued at about 260 euros. The rapid advance of digitization poses a challenge but also constitutes an opportunity, especially for companies.

While German and European industry owns a wealth of data (such as process data as well as machine and facility usage data), the associated innovation potential and benefits remain unrealized. Reasons include a lack of control over the use and application of one's own data (data sovereignty), the inability to exchange data between various systems (interoperability), inadequate capabilities of companies to use their own data (data readiness), and the large number of multilateral platforms and ecosystems in Germany and Europe.

## GAIA-X DATA INFRASTRUCTURE PUTS DATA AND CLOUD SOVEREIGNTY WITHIN REACH OF COMPANIES

The platform economy is changing business models – even successful ones. It is therefore extremely important for companies to take part in this development. But instead of actively shaping the platforms and using them for their own benefit, many remain mere spectators. Many companies are concerned about their intellectual property on platforms. In fact, the cloud solutions of American companies are not protected against access by government institutions due to provisions such as those of the American Cloud Act. This is another reason why the European Union should develop alternative concepts to the platforms offered by American and Asian providers. The GAIA-X and International Data Spaces initiatives are important steps because they represent European values, and because users retain control over the shared data. Increasing dependency on the digital services of US and Asian providers is threatening entire branches of industry and commercial sectors in Europe. International trade conflicts are also intensifying the need to establish resilient, European, knowledge-based value creation. This is another reason why Germany and Europe need to realign their economic and innovation policies in order to develop a common data ecosystem.

More information about International Data Spaces is available at:

[www.dataspaces.fraunhofer.de](http://www.dataspaces.fraunhofer.de)  
(Research)  
[www.internationaldataspaces.org](http://www.internationaldataspaces.org)  
(User Association)



# OUR INSTITUTE

**Fraunhofer ISST** @FraunhoferISST · 29. Okt. 2019  
 #DigitalLifeJourney - Datensouveränität für die Bürgerinnen und Bürger in Deutschland und Europa. Ein wichtiges Anliegen auch von Kanzlerin Angela Merkel auf dem #DigitalGipfel19



1    18    33

Fraunhofer ISST hat retweetet  
**Thorsten Huelsmann** @HuelsmannT · 29. Okt. 2019  
 On the kick-off to #GaiaX @AnjaKarliczek from @BMBF\_Bund clarifies that with @ids\_association, launched by @DrBorisOtto of @FraunhoferISST among others, the first step has already gone (at) #DigitalSummit2019 #DigitalSummit19 t1p.de/nk0r



**Fraunhofer IUK** @Fraunhofer\_IUK · 29. Okt. 2019  
 Zum Startschuss zu #GaiaX stellt @AnjaKarliczek vom @BMBF\_Bund klar, dass mit den @ids\_association, von @DrBorisOtto und dem @FraunhoferISST ins Leben gerufen, der erste Schritt schon gegangen ist (an) #Digitalgipfel2019 #DigitalGipfel19



**Fraunhofer ISST** @FraunhoferISST · 29. Okt. 2019  
 Wenn es die #DigitalLifeJourney gibt, will @AnjaKarliczek @BMBF\_Bund die erste Nutzerin sein. Sie informierte sich heute mit @Achim\_Berg auf dem #DigitalGipfel19 zum DLJ. #FraunhoferKI s.fhg.de/VWp



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**Fraunhofer ISST** @FraunhoferISST · 28. Okt. 2019  
 „Wir sitzen auf einem Datenschatz. Wir haben den Rohstoff für die Zukunft in unseren Händen und müssen ihn nach unseren Regeln nutzen“, sagt @DrBorisOtto auf dem #DigitalGipfel19. #FraunhoferKI @BMW\_Bund



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#DigitalGipfel19



# HIGHLIGHT 2019: "DIGITAL LIFE JOURNEY" AT THE DIGITAL SUMMIT

Home game for Fraunhofer ISST at this year's "#DigitalGipfel19" federal government digital summit – both in terms of the location and content, because the summit held on October 28 and 29, 2019 at the Westfalenhallen in Dortmund, home to the institute, directly addressed the research focal point of Fraunhofer ISST with its "Digital Platforms" theme.

## "DIGITAL LIFE JOURNEY" EXHIBIT: DIGITAL SOVEREIGNTY IN THE HAND OF INDIVIDUAL CITIZENS

Fraunhofer ISST presented its Digital Life Journey exhibit for the first time at the summit. The exhibit's vision is "Your data at your own fingertips". It makes data sovereignty tangible for everyone with an app that gives control over their own data back to the individual: You consciously decide what personal data to share with what company, and how you want to participate in business models that are based on personal data. To implement this approach, the Digital Life Journey uses the results of the International Data Spaces initiative, which aims to establish an international standard for data sovereignty. It transports the idea of the platform economy into the personal living environment of an individual who, in their different roles (for example as an employee, citizen, traffic participant), moves about in various data spaces and has great interest in the economical and secure convergence of their data.

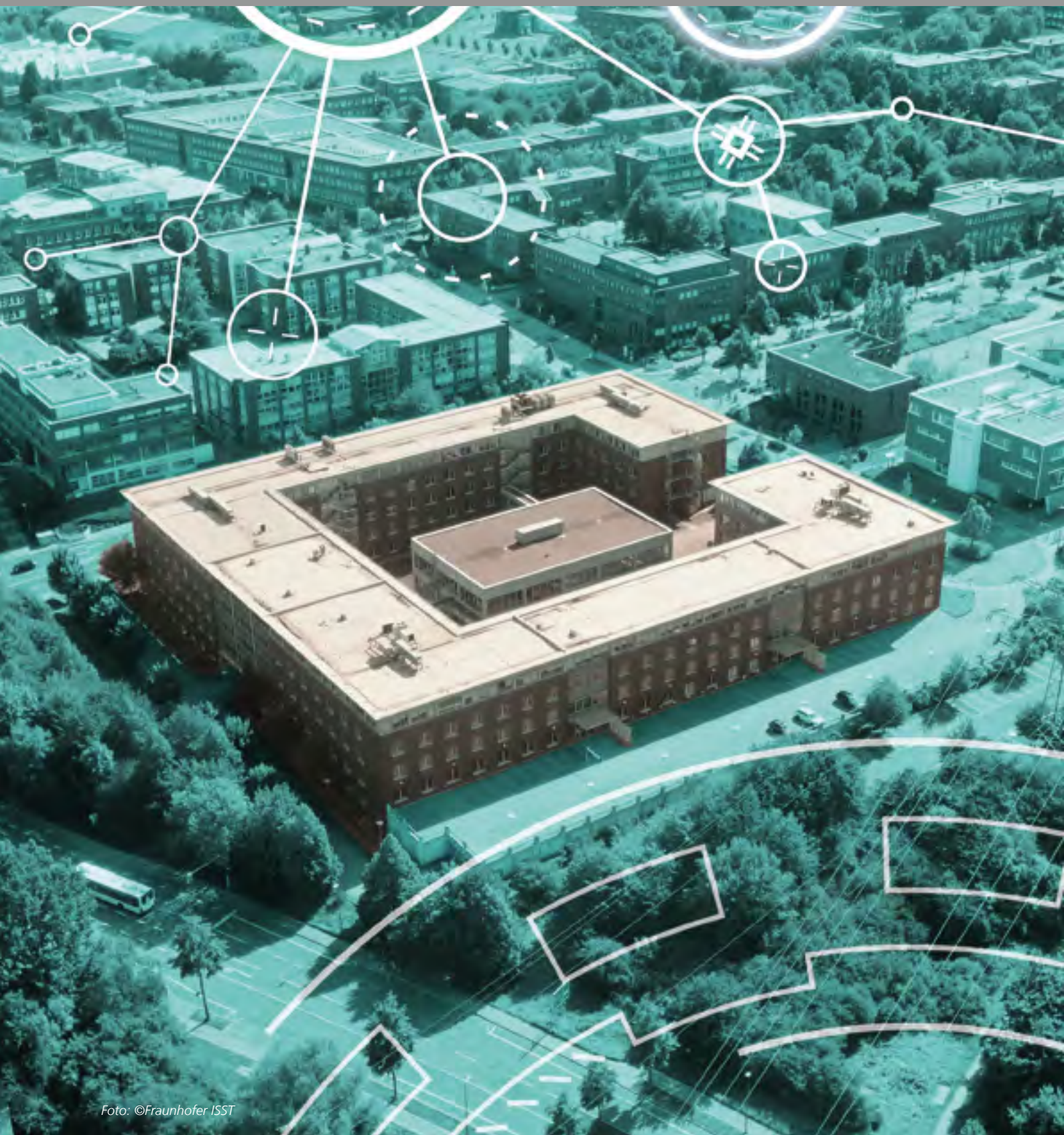
Fraunhofer ISST not only works with technology partners in this project but also with experts for topics such as data ethics and corporate social responsibility. For platform economy companies in Germany, the Digital Life Journey offers possibilities for implementing data-driven business models in the interest of citizens for the first time.

Federal Chancellor Dr. Angela Merkel, who visited the exhibit, is convinced that an own solution that returns sovereignty over their own data to each citizen would suit Europe well. Anja Karliczek, Federal Minister of Education and Research, offered to become a beta user as soon as the solution is ready to use.

More information about the  
Digital Life Journey at:  
[www.digitallifejourney.de](http://www.digitallifejourney.de)



# OUR INSTITUTE



## INSTITUTE MANAGEMENT



**Prof. Dr.-Ing. Boris Otto**  
Executive Director

Prof. Boris Otto (born in Hamburg, Germany in 1971) became the executive director of the Fraunhofer Institute for Software and Systems Engineering ISST in Dortmund on January 1, 2017. Since September of 2013, he has held the Chair for Industrial Information Management (until August 31, 2018 the Audi Foundation Chair for Supply Net Order Management) at the LogistikCampus of TU Dortmund.

After studying industrial engineering in Hamburg, Otto did his doctorate at the University of Stuttgart under Prof. Hans-Jörg Bullinger, former president of the Fraunhofer-Gesellschaft. He habilitated at the University of St. Gallen's Institute of Information Management, where he founded and managed the Corporate Data Quality competence center. His career path also included PricewaterhouseCoopers, SAP, and the Fraunhofer Institute for Industrial

Engineering IAO. Furthermore, Otto was a Research Fellow at the Center for Digital Strategies, Tuck School of Business at Dartmouth College in New Hampshire, USA. He joined Fraunhofer ISST in 2014 with the founding of the Fraunhofer Innovation Center for Logistics and IT (FILIT).

Otto's research focuses on the fields of industrial information management, business and logistics networks, and methods for the design of digital business solutions.



**Prof. Dr. Jakob Rehof**  
Director

Prof. Jakob Rehof (born in Denmark in 1960) has been the director of Fraunhofer ISST since 2006. Aside from studying computer science and mathematics at the University of Copenhagen and earning a doctorate in information science, he studied the classics (ancient Greek and Latin) and philosophy.

After several years in project management at Microsoft Research Labs in Redmond, USA, Rehof mainly dedicated his time at Fraunhofer ISST to networked and distributed software systems, cloud computing, the composition of software services, information logistics, workflow management, and the specification and implementation of business processes. As director of a Fraunhofer Institute, he is also a university professor: He holds the Chair for Software Engineering at TU Dortmund University.



# OUR INSTITUTE

## INSTITUTE IN NUMBERS

Together with companies, the Fraunhofer Institute for Software and Systems Engineering ISST identifies the strategic value of your data and makes it usable – from data preparation to the development of new business models, we offer complete system solutions for your company.

Our experts explore the value of and the confident handling of data for logistics, healthcare and data management. We develop solutions for data management and the development of data architectures. Together with our customers from the business world and as consultants to the political sector, we create the overall economic framework for secure and controllable data use across company boundaries with the "International Data Spaces".

We see the promotion and training of young scientists as one of our most important tasks. At the end of 2019, the Fraunhofer ISST employed 95 people. Some of them are permanent employees, others are students and trainees.

The total operating and investment budget amounted to 5.5 million euros. Personnel costs account for 74 percent of this amount. In fiscal year 2019, the Fraunhofer ISST had revenues from research and industry amounting to 4.4 million euros. In addition, the Fraunhofer-Gesellschaft provides institutional funding of 1.9 million euros.

|  | 2017           | 2018           | 2019           |
|--|----------------|----------------|----------------|
| Cost [million EUR]                         | 3,663          | 4,726          | 5,518          |
| Personnel costs [%]                        | 73             | 71             | 74             |
| Industry and public revenues [EUR million] | 2,692          | 3,347          | 4,455          |
| Institutional funding [million EUR]        | 0,971          | 1,380          | 1,9            |
| <b>Operating budget [EUR]</b>              | <b>179 300</b> | <b>294 400</b> | <b>119 900</b> |



# ADVISORY BOARD

Fraunhofer ISST's advisory board is comprised of representatives from industry, science and public administration.

**Paul Schwefer**

Management Consultant, Fair Sourcing, Hannover, chair of the advisory board

**Dr. Reinhold Achatz**

Chief Technology Officer der thyssenkrupp AG und Head of corporate function technology, innovation & sustainability der thyssenkrupp AG, Essen

**Guido Baranowski**

Chief Executive Officer of TechnologieZentrum Dortmund, Dortmund

**Prof. Dr. Volker Gruhn**

Chair for software engineering at the university of Duisburg-Essen and chair of the supervisory board for adesso SE, Dortmund

**Prof. Fritz Henglein**

Head of algorithms and programming languages, director of hiperfit research center, department of computer science, university of Copenhagen, Dänemark

**Katrin Hinne-Mohrmann**

Vice President practice transport and logistics, Deutsche Bahn AG, Berlin

**Fabian von Kuenheim**

Kuenheim Familiaris GmbH, Stuttgart

**Prof. Christine Legner**

Head of the information systems department, université de Lausanne, Lausanne

**Volker Lowitsch**

Head of the IT business area – management at Aachen university hospital, and chair of the Verein Elektronische FallAkte e. V., Aachen

**Dietmar Pawlik**

Commercial manager of Städtisches Klinikum München GmbH, Munich

**Michael Schmelmer**

Member of company management at C.H. Boehringer Sohn AG & Co. KG, Ingelheim am Rhein

**Eva Schultze**

Head of global master data management quality & regulatory affairs, Drägerwerk AG & Co. KGaA, Lübeck

**Björn Stammer**

Head of logistics (ND-L), Nestlé Deutschland AG, Frankfurt am Main

**Dr. Frank Wille**

Managing Partner of HYBETA GmbH, Münster



# OUR INSTITUTE

## #DATA\_RSR — THE VLOG OF EXECUTIVE DIRECTOR PROF. DR.-ING. BORIS OTTO

### HOW ARE INNOVATIONS CREATED FROM DATA?

In his concise, informative, and substantiated data researchers video blog (vlog), Prof. Boris Otto examines current digitization topics. Prof. Otto is in demand as an expert for digitization and artificial intelligence, and also advises the federal government on its digitization strategy. His research focuses on industrial information management, business and logistics networks, and methods for the design of digital business models. Within the Fraunhofer-Gesellschaft, he is the head of International Data Spaces aimed at the standardized and sovereign exchange of data between companies.

#### OVERVIEW OF 2019 VLOGS:

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#### #4: GAIA-X – data security and sovereignty (10/2019)

#GAIA-X #DataSovereignty #International Data Spaces

GAIA-X creates a networked data infrastructure for citizens and companies in Germany, Europe, and the world.

- But what is GAIA-X?
- Why do we need it?
- And what does GAIA-X have to do with the International Data Spaces initiative?

Prof. Dr.-Ing. Boris Otto, director of the Fraunhofer Institute for Software and Systems Engineering ISST, answers these three questions in the current data researchers vlog.

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#### #3: Ecosystems defined (07/2019)

#Data\_RSR #DataValue #DataEconomy #Ecosystems  
one of the intensively discussed terms of digitization: "ecosystems".

- But what does it mean?
- What is the difference between ecosystems and "classic" company networks?

Prof. Boris Otto answers these questions in vlog #3: Innovations are increasingly being realized in economic ecosystems, in which various members such as companies, re-search organizations, intermediaries (such as electronic marketplaces), government agencies, customers, and competitors band together to jointly attain innovative value propositions.

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## #2: The digital twin (05/2019)

#Data\_RSR #DataValue #DataEconomy

- The digital twin as a key prerequisite for the success of industry 4.0.
- What is a digital twin?
- How does it work?
- What makes it so important for industry 4.0?

Prof. Boris Otto examines these and many other questions in data researchers vlog #2: As a product of a conceptual nature in its creation that is based on data, information, and data models, the digital twin is not an entirely new concept but nevertheless one that is steadily gaining importance. It ensures/guarantees interoperability between various players as a basis, among other things for semantic functions.

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## #1: The value of data (03/2019)

#Data\_RSR #DataValue #DataEconomy

- What is the value of data?
- How can the value of data be quantified and measured?

Those are key questions for companies in the age of digitization. The same three parameters can be used to determine the value of data as for other assets:

- What costs were incurred?
- What is the utility value of the data?
- Who is the buyer and what are they willing to pay?



You will find all videos in our vlog series [here](#) and on the Fraunhofer ISST [YouTube-channel](#).

# OUR BUSINESS UNITS

Knowledge of industry-specific particularities is indispensable for the design of innovative system solutions. The challenges of current development trends can only be overcome with the expertise of various disciplines. Fraunhofer ISST therefore bundles its expertise in three business units. With this structure, we quickly identify appropriate solutions for companies to improve their competitiveness and develop new business models.







LOGISTICS

HEALTHCARE

# OUR BUSINESS UNITS



# DATA ECONOMY: THE VALUE OF YOUR DATA – NEW BUSINESS MODELS AND SERVICES



We bundle our expertise in the examination of data as an asset in the data economy business unit. From disruptive business models based on data to the digital transformation of existing processes – we develop appropriate solutions for the targeted monetization of company data. We cover all technology and organizational matters for the entire data life cycle – from the concept to practical implementation.

## OUR EXPERTISE

- Data-driven business models – innovative conception, design and calculation to monetise your data
- Data marketplaces – advice and assistance in selecting suitable data marketplaces and monetization options for your data
- Data analysis and artificial intelligence – development, application and visualization of findings from your data using the latest artificial intelligence models and methods
- Data engineering and data flow orchestration – consulting, selection and implementation of suitable technologies and tools for targeted data processing
- Data management – consulting and design of individual data strategies, as well as the implementation of data governance structures and improvement of data quality
- Software development – implementation of front- and backend applications for the web, desktop or mobile devices

## OUR CLAIM

To simplify and where possible automate the complex process of data management for our customers. In the interplay between innovation, change processes, and costs, we thereby make a lasting, effective contribution to the digital transformation of our customers in various sectors.



# OUR BUSINESS UNITS

THREE QUESTIONS FOR ...

MARKUS SPIEKERMANN,  
HEAD OF DATA ECONOMY DEPARTMENT



# DATA ECONOMY

## WHAT CHALLENGES ARE COMPANIES FACING IN TERMS OF DIGITIZATION?

**Spiekermann:** In the course of the digital transformation, companies are increasingly confronted by the challenge that external data are needed for new, data-driven business models and services. Data ecosystems, platforms, and marketplaces are being established for this purpose, but their rules, processes, and economic potential often remain unclear. The task going forward is to shape this change and adapt internal structures to the new conditions. Here the data economy department has the appropriate methods and tools along with the required expertise.

## WHAT REMAINS TO BE DONE BEFORE COMPANIES CAN USE SOVEREIGN AND SECURE DATA INFRASTRUCTURES SUCH AS GAIA-X?

**Spiekermann:** The secure and trusted exchange of data requires common rules that can be represented and comprehended, both organizationally and through technology. Early adopters, organized in various initiatives and user groups, are designing and implementing the appropriate infrastructures and reference models to accomplish this. These infrastructures are not yet ready to use out of the box. With the founding of operating companies for GAIA-X and International Data Spaces, this is made possible, making the urgently needed infrastructure available to companies in general so they can participate in the data economy.

## HOW DIGITAL WILL THE ECONOMY BE IN 20 YEARS?

**Spiekermann:** 13 years ago, nobody thought it would once be possible to surf the Internet with the swipe of a finger on a mobile device. Ten years ago, nobody thought we would be watching the latest movies and series while traveling anywhere in the world. And above all, nobody expected 20 years ago that, among the ten highest-valued companies in the world, seven companies would offer digital business models and thereby define the data economy. So nobody can say what the future holds. In my opinion, the current transformation is still mainly focused on the B2C sector, so that the B2B and B2B2C sectors will follow in the next 20 years.



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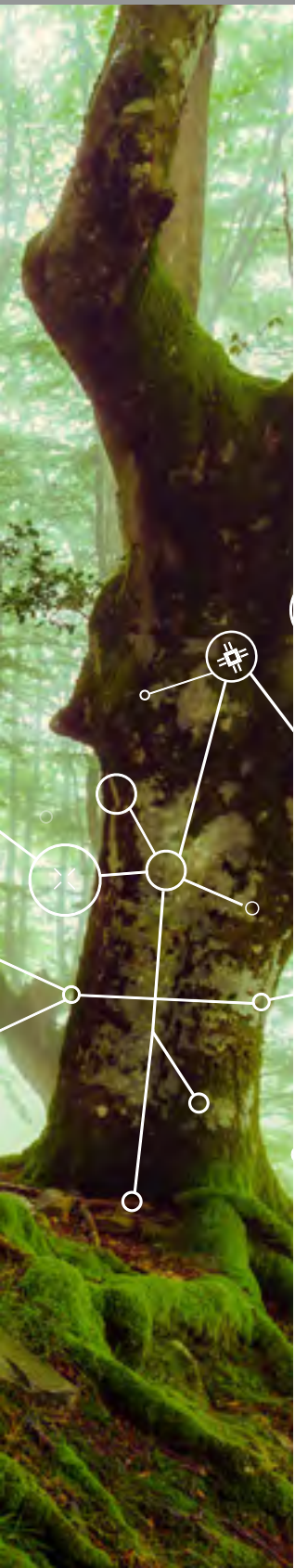
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# OUR BUSINESS UNITS



# LOGISTICS: PROCESS OPTIMIZATION WITH TRANSPARENCY AND THE FUNCTIONAL FLOW OF DATA



With our digital solutions in the logistics business unit, we assist companies on the way to streamlined, responsive, and forward-looking business processes – independent, future-oriented, and always in pace with the times. We accompany concrete business digitization initiatives from the layout to the conceptual design to the implementation of prototypes.

## OUR EXPERTISE

- Data sovereignty – development of concepts and technologies for data sovereignty
- Industrial data management – development of strategies and concepts for data management in industrial processes
- Software architectures – conceptual design and setup of software architectures for companies
- Development of software solutions – tailored to meet your individual needs
- Information mapping and semantics – capture and integration of various data formats and sources
- Digital business models and data analysis – development of business models from existing datasets
- Monitoring of system states and analysis and prediction of process events

## OUR CLAIM

Increasingly large volumes of movement and process data are available in production, waiting to be processed and used. At the same time, logistics no longer just networks the world physically through the flow of goods today but also digitally. Providing the right information at the right time in the right place is the key. We aim to further improve complex production and logistics processes and to develop new solutions. In the conflict between time, quality, and cost parameters, we make a lasting contribution to the success of our customers in:

- Demand and capacity management
- Customer order processing
- Management of the industry 4.0 transformation process



# OUR BUSINESS UNITS

THREE QUESTIONS FOR ...

DR. JÜRGEN SCHMELTING,  
HEAD OF LOGISTICS DEPARTMENT





# LOGISTICS

## WHAT ARE THE CHALLENGES FACED BY LOGISTICS AND PRODUCTION COMPANIES IN TERMS OF DIGITIZATION?

**Schmelting:** There are two key challenges: In one case, the data from production and logistics processes already exist, but are not used or managed consistently. In the other case, there are no data yet, for example because the train of machines or the facilities have grown over time and older elements do not contain any digital components. Retrofit solutions with corresponding sensors are needed here to give digital capabilities to all facilities or machines. A lot also remains to be done in the documentation of processes from order taking to fulfillment in terms of interoperability.

## THE CORONA PANDEMIC HAS SHOWN HOW QUICKLY PRODUCTION LINES CAN COME TO A STANDSTILL IN THIS COUNTRY WHEN DELIVERIES FROM ABROAD STOP. WHAT CONTRIBUTION CAN DIGITIZATION MAKE IN THIS CONTEXT?

**Schmelting:** A considerable one. Shutting down production is comparatively simple. Restarting production is the bigger challenge by far. Due to the structuring of the world with global value chains, companies have partners in their network, some of which are still under lock-down. This complicates production processes because shortfalls can still occur. Since the situation is constantly changing, digital transparency between partners regarding their current production status is highly beneficial. Solutions like our shared digital twin make an important contribution here, allowing data to be shared securely and efficiently in a digital twin. This makes it possible to adapt production processes along with demand and capacity management as a whole to current general conditions more quickly and effectively.

## HOW WILL LOGISTICS AND PRODUCTION COMPANIES BE OPERATING IN 20 YEARS?

**Schmelting:** Much more digitized. Today's island solutions will gradually become more interconnected, forming end-to-end process chains. Ultimately this could lead to logistics no longer being perceived as an expert function because all processes can be automated or even become autonomous. Then the focus will be on the maintenance and further development of digital assistance systems.



### CONTACT:

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# OUR BUSINESS UNITS



# HEALTHCARE: YOUR PARTNER FOR DIGITALLY ASSISTED HEALTHCARE

We bundle our expertise in the research and development of software technology for digital and data-driven healthcare of the future in the healthcare business unit, with a focus on people.

## OUR EXPERTISE

- Assisting and advising healthcare organizations and companies in the introduction of data and digitization strategies
- Implementing complex data processing systems, for example artificial intelligence, complex event processing
- Software implementation, for example apps or augmented reality/virtual reality applications, under consideration of international standards (IHE, HL7) and regulatory requirements (MDR)
- Conceptual design of complex infrastructures, such as interaction with the telematics infrastructure, and preparation of technical data protection concepts

## OUR CLAIM

The human factor continues to take center stage in healthcare for the future. Digital solutions have to be aligned with the needs of all players, whether they are patients or doctors. Through the interplay of various technology fields, we develop corresponding individual solutions for concrete issues of healthcare organizations (hospitals, networks of medical professionals, payers), healthcare IT, and the life sciences industry (pharmaceuticals, medical engineering).

We are strong in both research and development thanks to cooperation based on mutual trust with external partners, for example in the areas of digital expertise and digital ethics. Solutions are created that improve the effectiveness and efficiency of administration and care processes, enable the individualization of therapies based on data, and make people and machines partners in healthcare. More than 15 years of experience and networking with political players in self-administration underscores our strength.



# OUR BUSINESS UNITS

THREE QUESTIONS FOR ...

DR. SVEN MEISTER,  
HEAD OF HEALTHCARE DEPARTMENT



# HEALTHCARE

## AGAINST THE BACKGROUND OF CORONA: WHAT DOES THE HEALTHCARE SECTOR NEED TO BE BETTER EQUIPPED FOR CHALLENGES SUCH AS THIS PANDEMIC IN THE FUTURE?

**Meister:** We need more digital structures in healthcare that enable communication, and greater acceptance of digital solutions, for instance by incorporating them into medical curricula. Only if we can use technologies such as video consultations in the next pandemic will we have realized additional value. We also have to give citizens sovereignty over their own data, for example so they can easily consent to donating their data for research.

## WHY IS DIGITIZATION CONSULTING IN HEALTHCARE SO IMPORTANT?

**Meister:** The healthcare sector still has a backlog in this area. While this has the advantage that we can utilize best practices from other areas, they have to be adapted for the special challenges in healthcare, such as the legal framework. We at Fraunhofer ISST as a neutral instance can help with process evaluation and optimization.

## HOW DIGITAL WILL HEALTHCARE BE IN 20 YEARS?

**Meister:** Digitization has gathered speed in healthcare, especially over the last two years. I do not expect nor hope for us to be treated by robots in 20 years. We have to design technologies to assist with healthcare from person to person. Rather than digital healthcare, I see digitally assisted healthcare in our future.



### CONTACT:

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# OUR NETWORK

## SCIENTIFIC EXPERTISE

As an institute of the Fraunhofer-Gesellschaft, we operate at the intersection of science and industry. Fundamental research by universities provides us with important impulses for the practical transfer to industry applications. The following chairs and professorships form the core of our scientific network:

**Prof. Dr.-Ing. Boris Otto**

Executive director of the Fraunhofer Institute for Software and Systems Engineering ISST and holder of the chair for industrial information management at TU Dortmund university

**Prof. Dr. Jakob Rehof**

Director of the Fraunhofer Institute for Software and Systems Engineering ISST and holder of the chair xiv for software engineering at TU Dortmund university

**Prof. Dr.-Ing. Jan Cirullies**

Professor of business administration (notably supply chain management and digital logistics) at the Dortmund university of applied sciences and head of the data management in logistics area of expertise

**Prof. Dr. Falk Howar**

Professor for software engineering at TU Dortmund university

**Prof. Dr. Wolfgang Deiters**

Professor for user-oriented health technologies at the university of health sciences in Bochum (hsg Bochum)

**Prof. Dr. Jan Jürjens**

Director research projects at Fraunhofer ISST and head of the institute for software technology at the university of Koblenz

**Prof. Dr.-Ing. Christian Schwede**

Professor for big data analytics at the Bielefeld university of applied sciences and head of the artificial intelligence in logistics area of expertise



## MEMBERSHIPS

- Federal association for information technology, telecommunications and new media (BITKOM)
- HL7 Benutzergruppe in Deutschland e. V.
- International Data Spaces Association
- Health management network on the Ruhr (MedEcon Ruhr e.V.)
- networker NRW e. V.
- WINDO e. V.
- Wissenschaftsforum Ruhr e. V.

## NETWORKS WITHIN THE FRAUNHOFER-GESELLSCHAFT

- Fraunhofer information and communication technology group ([iuk.fraunhofer.de/en](http://iuk.fraunhofer.de/en))
- Fraunhofer ambient allianz ambient assisted living (AAL) ([aal.fraunhofer.de/en](http://aal.fraunhofer.de/en))
- Fraunhofer ambient allianz cloud Computing ([cloud.fraunhofer.de/en](http://cloud.fraunhofer.de/en))
- Fraunhofer ambient allianz big data and artificial intelligence ([bigdata.fraunhofer.de/en](http://bigdata.fraunhofer.de/en))
- Fraunhofer cluster of excellence cognitive internet technologies ([cit.fraunhofer.de/en](http://cit.fraunhofer.de/en))
- Fraunhofer academy ([academy.fraunhofer.de/en](http://academy.fraunhofer.de/en))



# PUBLICATIONS

The transfer of knowledge is an important task in applied research at Fraunhofer ISST. Fraunhofer ISST employees contribute to scientific journals and trade publications. Conference contributions, studies, and white papers of our scientists are published as well. You will find these scientific publications here:

Afrin, R., Sadi, M.S. and J. Jürjens, 2019. An Efficient Soft Error Tolerant Approach to Enhance Reliability of TCAM. In: 1st International Conference on Advances in Science, Engineering and Robotics Technology. 2019, Art. No. 8934636. DOI: 10.1109/ICASERT.2019.8934636

Ahmadian, A. S., Strüber, D. and J. Jürjens, 2019. Privacy-Enhanced System Design Modeling Based on Privacy Features. In: Proceedings of the 34th Annual ACM Symposium on Applied Computing. 2019, Limassol, Cyprus, April 08-12, 2019.

Bessai, J., Rehof, J. and B. Düdder, 2019. Fast Verified BCD Subtyping. In: Lecture Notes in Computer Science. Volume 11200, 2019, P. 356-371.

Buchkremer, R. and others, 2019. The Application of Artificial Intelligence Technologies as a Substitute for Reading and to Support and Enhance the Authoring of Scientific Review Articles. In: IEEE Access. Volume 7 2019, P. 65263-65276. DOI 10.1109/ACCESS.2019.2917719

Bürger, J. and others, 2019. A framework for semi-automated co-evolution of security knowledge and system models (Summary). In: Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft für Informatik (GI). 2019, P. 292, P. 179-180. DOI: 10.18420/se2019-57

Dudenhefner, A. and J. Rehof, 2019. Undecidability of Intersection Type Inhabitation at Rank 3 and its Formalization. In: Fundamenta Informaticae. Volume 170, Issue 1-3, 2019, P. 93-110.

Grambau, J., Hitzges, A. and B. Otto, 2019. Reference Architecture framework for enhanced social media data analytics for Predictive Maintenance models. In: 25th IEEE International

Conference on Engineering, Technology and Innovation, ICE/ITMC. 2019

Hermann, M., Bücken, I. and B. Otto, 2019. Industrie 4.0 process transformation: findings from a case study in automotive logistics. In: Journal of Manufacturing Technology Management. 2019. DOI: 10.1108/JMTM-08-2018-0274

Houta, S., Ameler, T. and R. Surges, 2019. Use of HL7 FHIR to structure data in epilepsy self-management applications. In: International Conference on Wireless and Mobile Computing, Networking and Communications. 2019, Art. Nr. 8923179, P. 111-115. DOI: 10.1109/WiMOB.2019.8923179

Howar, F., Jabbour, F. and M. Mues, 2019. JConstraints: A Library for Working with Logic Expressions in Java. In: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). 11200, 2019, P. 310-325. DOI: 10.1007/978-3-030-22348-9\_19

Howar, F., Jonsson, B. and F. W. Vaandrager, 2019. Combining Black-Box and White-Box Techniques for Learning Register Automata. In: Computing and Software Science. 2019, P. 563-588.

Jarke, M., Otto, B. and S. Ram, 2019. Data Sovereignty and Data Space Ecosystems. In: Business and Information Systems Engineering. 61 (5), 2019, P. 549-550. DOI: 10.1007/s12599-019-00614-2

Jasper, M. and others, 2019. RERS 2019: Combining Synthesis with Real-World Models. In: TACAS. (3), 2019, P. 101-115.

Jürjens, J. and others, 2019. Maintaining Security in Software Evolution. In: Managed Software Evolution. 2019, P. 207-253





- Lohr, M. and others, 2019. Ensuring genuineness for selectively disclosed confidential data using distributed ledgers: Applications to rail wayside monitoring. In: Proceedings - 2019 2nd IEEE International Conference on Blockchain. 2019, Art. no. 8946253, P. 477-482. DOI: 10.1109/Blockchain.2019.00072
- Meister, S., Burmann, A. and W. Deiters, 2019. Digital Health Innovation Engineering: Enabling Digital Transformation in Healthcare: Introduction of an Overall Tracking and Tracing at the Super Hospital Aarhus Denmark. In: Digitalization Cases. 2019, P. 329-341
- Moetz, A.; Stylos-Duesmann, P. and B. Otto, 2019. Schedule instability in automotive production networks: The Development of a network-oriented resequencing method. In: IFAC-PapersOnLine. 52 (13), 2019, P. 2810-2815. DOI: 10.1016/j.ifacol.2019.11.634
- Otto, B., 2019. Interview with Reinhold Achatz on "Data Sovereignty and Data Eco-systems". In: Business and Information Systems Engineering. 61 (5), 2019, P. 635-636. DOI: 10.1007/s12599-019-00609-z
- Otto, B. and M. Jarke, 2019. Designing a multi-sided data platform: findings from the International Data Spaces case. In: Electronic Markets. 29 (4), 2019, P. 561-580. DOI: 10.1007/s12525-019-00362-x
- Peldszus, S. and others, 2019. Secure Data-Flow Compliance Checks between Models and Code Based on Automated Mappings. In: Proceedings - 2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems – MODELS. 2019, Art. No. 8906984, P. 23-33. DOI: 10.1109/MODELS.2019.00-18
- Pikus, Y. and others, 2019. Semi-automatic ontology-driven development documentation generating documents from RDF data and DITA templates. In: Proceedings of the ACM Symposium on Applied Computing. Part F147772, 2019, P. 2293-2302. DOI: 10.1145/3297280.3297508
- Ramadan, Q. and others, 2019. Explaining Algorithmic Decisions with respect to Fairness. In: Becker, S., Bogicevic, I., Herzwurm, G. & Wagner, S. (Hrsg.), Software Engineering and Software Management. 2019. Bonn: Gesellschaft für Informatik e.V., P. 161-162. DOI: 10.18420/se2019-50
- Schmelting, J., 2019. Produktions-Controlling im Übergang zur Digitalisierung. Dis-ertation, 2019
- Spiekermann, M.: Data Marketplaces: Trends and Monetisation of Data Goods. In: Intereconomics. 54 (4), 2019, P. 208-216. DOI: 10.1007/s10272-019-0826-z
- Tebernum, D., Altendeitering, M. and S. Atamantschuk, 2019. An approach towards a native voice control system for the web. In: WMSCI 2019 - 23rd World Multi-Conference on Systemics, Cybernetics and Informatics. Proceedings 1, 2019, P. 59-64.
- Zrenner, J. and others, 2019. Usage control architecture options for data sovereignty in business ecosystems. In: Journal of Enterprise Information Management. 32 (3), 2019, P. 477-495. DOI: 10.1108/JEIM-03-2018-0058



# PUBLICATIONS

## POSITION PAPER

### ECOSYSTEMS FOR DATA AND ARTIFICIAL INTELLIGENCE

Conception of a sovereign data infrastructure and analysis of potentials through ecosystems in artificial intelligence use cases of different domains.

A joint position paper of Fraunhofer IAO and Fraunhofer ISST

#### PARTICIPATING INSTITUTS

- Fraunhofer Institute for Applied and Integrated Security AISEC
- Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS
- Fraunhofer Institute for Industrial Engineering IAO
- Fraunhofer Institute for Experimental Software Engineering IESE
- Fraunhofer Institute for Material Flow and Logistics IML
- Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB
- Fraunhofer Institute for Software and Systems Engineering ISST

This position paper describes the potential of ecosystems for data and artificial intelligence (AI). It focuses on strategies for the implementation of AI at national and international level as well as challenges and opportunities for Germany as a business location. On behalf of the priority strategic initiative "cognitive systems, artificial intelligence and data sovereignty" of the Fraunhofer-Gesellschaft.



In order to present the necessity and benefits of such a data ecosystem in a more understandable way, Fraunhofer projects from different business areas are presented and the added value of an ecosystem in the respective project is worked out. Based on the results, recommendations for future action are derived.

You can download the position paper [here](#).



# EVENTS

The Fraunhofer ISST regularly informs about current research and project results at events and trade fairs. Here is a selection of our event participations in 2019:

## LOGIMAT – TRADE FAIR FOR INTRA-LOGISTICS SOLUTIONS AND PROCESS MANAGEMENT

- Exhibit "Realtime IoT Analytics" (RIOTANA®)
- February 19 to 21, 2019
- Stuttgart trade fair center

## IDS HIGH LEVEL STAKEHOLDER MEETING

- Presentation of the International Data Spaces to key figures from business and politics
- February 22, 2019
- Fraunhofer-Forum, Berlin

## HANNOVER FAIR

- Data ecosystems based on the reference architecture of the "International Data Spaces"
- Cooperation partner: Telekom data intelligence hub
- April 1 to 5, 2019
- Hanover trade fair

## DMEA – TRADE FAIR AND CONGRESS FOR DIGITAL HEALTHCARE

- Exhibit data-driven medicine on top of EFA, digital hospital, SMITH (smart medical information technology for healthcare)
- April 9 to 11, 2019
- Trade fair center Berlin

## TRANSPORT LOGISTIC

- Exhibit "Realtime IoT Analytics" (RIOTANA®)
- June 4 to 7, 2019
- Trade fair center Munich

## SMITH CONGRESS 2019: NEW HORIZONS IN DIGITAL HEALTH

- Presentation of the research work of the Fraunhofer ISST in the business field healthcare
- September 17 to 18, 2019
- Berlin

## DIGITAL SUMMIT 2019: DIGITAL PLATFORMS

- Exhibit "Digital Life Journey"
- October 28 and 29, 2019
- Westfalenhallen, Dortmund

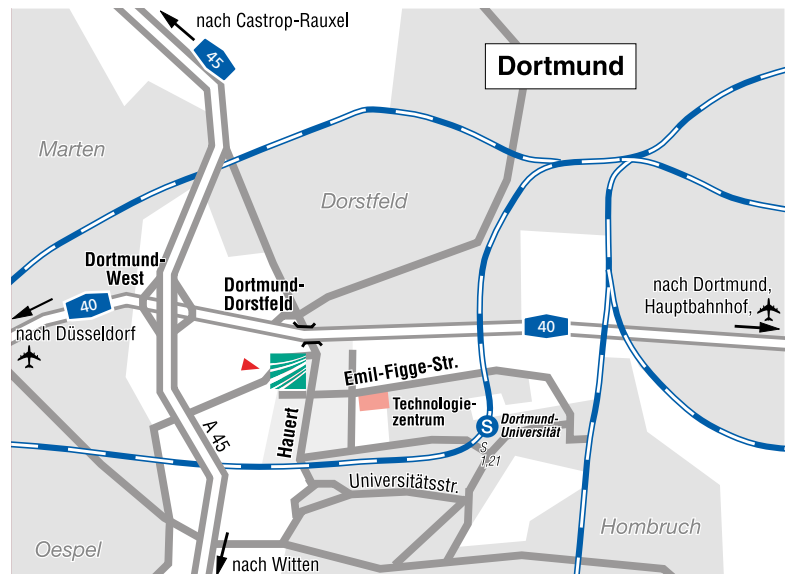


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## BY CAR

Motorway A40 / federal road B1, exit Dortmund-Dorstfeld, Universität.

Driving towards Dortmund: at the first traffic light turn left into the street "Hauert" (direction Technologie-Zentrum), at the next traffic light turn right into the Emil-Figge-Straße (dead end).

Coming from Dortmund: at the first traffic light turn right into the street "Hauert" (direction Technologie-Zentrum), pass under the bridge, at the second traffic light turn right into the Emil-Figge-Straße (dead end).

## BY RAIL

From Dortmund main station take the S-Bahn S1 in the direction of Düsseldorf to Dortmund-Universität, from there it is a 15-minute walk or take the H-Bahn to the stop Technologiepark / Technologiezentrum.

## BY PLANE

From Dortmund-Wickede airport, take the bus to Dortmund main station, then: see Rail; by taxi from the airport about 25 minutes.

From Düsseldorf airport take the S-Bahn S1 in the direction of Dortmund to the Dortmund-Universität stop; by taxi from the airport approx. 60 minutes.



# IMPRINT

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