

**b-it**

Bonn-Aachen  
International Center for  
Information Technology

Annual Report 2005 - 2006  
**Annual Report 2005 - 2006**  
Annual Report  
2005 - 2006





Vice Minister  
Dr. Michael Stückradt



Prof. Dr. Gerhard Barth

### Foreword by the Chairman of the B-IT Foundation

The State Government of North Rhine-Westphalia has introduced a new law which gives our universities much more freedom and autonomy of decision, and thus the possibility to specialize in their areas of excellence. Founded in 2003, the Bonn-Aachen International Center for Information Technology (B-IT) has been a pioneering example of such a strive towards excellence. Its programs in applied, yet research-integrated IT education focus at international master education but also include support for specially gifted undergraduate students and for junior researchers. By now, the B-IT building has developed into a lively international education site with top students from 40 countries, but also with many important external national and international events. Placement of the first B-IT graduates in science and industry demonstrates the success of all parts of the program.

In 2006, several important research grants have further improved the scientific context in which B-IT operates. B-IT researchers take leading roles in an "excellence cluster" for mobile information and communication systems awarded within the German Excellence initiative. In addition, B-IT faculty acquired numerous additional grants from DFG and European sources, including scholarships for B-IT students. This way, many B-IT master students will have the opportunity to pursue a doctorate after their graduation. The extension of B-IT by an international doctoral program seems like a natural next step, and the state government fully supports the application of the B-IT directors and faculty for a Graduate School grant within the federal excellence initiative to fund this effort.

I would like to thank the management, faculty, students, and international advisory board and wish B-IT continued success in the future.

**Dr. Michael Stückradt**  
Vice Minister of Innovation, Science  
and Technology NRW  
Chairman, B-IT Foundation Council

### The International Advisory Council of B-IT

RWTH Aachen University, University of Bonn, Bonn-Rhein-Sieg University of Applied Sciences, have, in cooperation with the Fraunhofer Board of Management, established an International Advisory Council. Its mission is to ensure the relevance of B-IT's educational efforts for careers in the business world, to monitor B-IT's international competitiveness, and to foster B-IT's development by giving recommendations and guidelines. The rectors of the participating universities have appointed Prof. Dr. Gerhard Barth as Founding President; Barth is well known as founder of the German AI research institute DFKI, as top manager in companies such as Daimler-Chrysler, Alcatel, and Dresdner Bank, and more recently as partner in a consultancy firm. In addition, the council includes five internationally renowned persons from academia and industry:

- Prof. Dr. Gerhard Fischer, University of Colorado, Boulder
- Dirk Friebe, Nokia Research Center, Bochum
- Prof. Dr. Ossama Khatib, Robotics Lab, Stanford University, Palo Alto
- Prof. Dr. Thomas Lengauer, Max-Planck Institute for Informatics, Saarbrücken
- Prof. Dr. Hermann Maurer, Media Lab, University of Graz

In the academic year 2005-2006, the Advisory Council focused its annual meeting on discussions with the B-IT faculty members concerning their research agenda, networking with international science and industry, and educational visions. In its conclusions, the Advisory Board showed itself impressed by the enthusiasm and international standing of the B-IT faculty, and recommended deepening of perspectives in alumni management, industry involvement, and doctoral education.

# Report of the Scientific Directors

The Bonn-Aachen International Center for Information Technology (B-IT) is a pilot effort in the internationalization and acceleration of IT study programs in Germany. Supported by the B-IT Foundation since October 2002, B-IT's International Master Programs educate future leaders in areas of particular relevance for the ABC region around Aachen, Bonn and Cologne (and, of course, beyond), whereas the IPEC program provides special offerings for the brightest of the local undergraduate computer science students.

All study programs have by now reached their full capacity, with applicant quality already very good and continuously improving further, as the networking of B-IT with international top universities proceeds. In 2005-2006, the networking focus was Life Science Informatics, e.g. with a cooperation agreement with the prestigious Waseda University in Tokyo. Equally important, the last two of B-IT's nine endowed professorships were filled with Martin Hofmann-Apitius (Life Science Informatics, University of Bonn and Fraunhofer SCAI) and Albrecht Schmidt (IPEC, University of Bonn and Fraunhofer IAIS).

A major new thrust in 2005-2006 was the acquisition of third-party funding. B-IT Directors and Faculty were fortunate to obtain a number of prestigious large research grants which will further improve the research environment and scientific career prospects for B-IT students.

B-IT professors Jarke, Kowalewski and Spaniol serve on the steering board of UMIC, an excellence cluster on ultra highspeed mobile information and communication systems awarded within the German national excellence initiative. Several other B-IT faculty are also involved in UMIC, and in both other clusters awarded in NRW, one related to mathematics, the other to production technology. In addition, B-IT faculty participate in a new Collaborative Research Center (SFB) in Life Science Informatics and a new Research Training Group (GRK) on Algorithmic Synthesis, as well as in several large projects funded by the European Union, the German Ministry of Research, and Industry.



*B-IT main building*

Another important direction is third-party funding for teaching and continuing education. In addition to the European Erasmus-Mundus scholarship program reported last year, further scholarships could be acquired. However, the most important strategic step we are working on is the establishment of a B-IT Doctoral Program; it is designed not only to offer opportunities for our best master graduates, but also to improve significantly the structure and networking of doctoral studies in applied informatics for all B-IT partners.

Overall, we believe that B-IT has made significant further progress though much remains to be done. We would like to extend our cordial thanks to the B-IT Foundation Council led by Chairman Vice Minister Michael Stückradt and Secretary Hans Stender, to the B-IT Advisory Board under the able leadership of Founding President Gerhard Barth, to the B-IT Faculty and especially the study coordinators Jürgen Bajorath and Otto Spaniol, to our assistant directors Alexandra Reitelmann, Jürgen Rapp, Christoph Quix, Stefan Lüttringhaus-Kappel, and Thomas Bode, but most of all to the B-IT students for their enthusiasm and excellent cooperation.

**Armin B. Cremers, University of Bonn**  
**Matthias Jarke,**  
**RWTH Aachen University and Fraunhofer FIT**  
**Kurt-Ulrich Witt,**  
**Bonn-Rhein-Sieg University of Applied Sciences**

## B-IT in Profile



Prof. Dr. Armin B. Cremers



Prof. Dr. Matthias Jarke



Prof. Dr. Kurt-Ulrich Witt

The southwest of North Rhine-Westphalia is one of the largest, most vibrant locations in the European media and telecom industry. It is also one of the most innovative and fast-growing biotech regions in Germany, and there is much interest in the emerging fields of mechatronics and robotics. To make it the optimal place to study for professional work in these fields, the Bonn-Aachen International Center for Information Technology (B-IT) has been established as a joint venture of RWTH Aachen University, University of Bonn, Bonn-Rhein-Sieg University of Applied Science and the research institutes of the Fraunhofer Institute Center Birlinghoven Castle.

B-IT offers highly selective International Master Programs in Applied IT, as well as summer / winter schools for qualified undergraduate computer science students. Most courses take place in the beautiful B-IT building next to the former office of the German Chancellor on the banks of the River Rhine in Bonn. Admission to the B-IT Master Programs is linked to, and conditional upon, placement in research lab courses at the participating Fraunhofer institutes. Students in good standing are offered financial support during these lab courses.

The B-IT Universities Institute offers English language Master of Science (M.Sc.) programs in Media Informatics and Life Science Informatics, whereas the University of Applied Sciences offers a Master Program in Autonomous Systems. The Master Programs prepare students for successful international careers that require technical excellence and leadership, creativity and the ability to innovate. B-IT master programs are distinguished by their international orientation

(structured according to the European ECTS standard), their focus on IT competence, and the deep integration of teaching and research. They include a significant share of research lab courses in the participating Fraunhofer institutes.

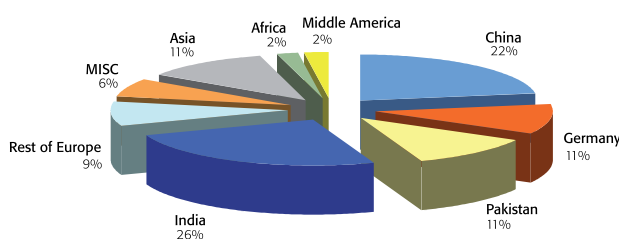
A second goal of B-IT is the optimization and acceleration of existing undergraduate computer science curricula at University of Bonn and RWTH Aachen University for selected top students. B-IT's International Program of Excellence (IPEC) pursues this goal by compact course modules delivered in summer and winter schools during the semester breaks.

B-IT is financially supported by a 56 Mio. Euro Foundation initiated through the Bonn-Berlin program of the German federal government, as well as by matching federal project funds and NRW state funds. The B-IT Foundation was officially set up in October 2002, and a cooperation treaty was signed by the Rectors of the participating universities and the Fraunhofer Board of Directors.

For the participating universities, the B-IT programs have also helped pave the way towards a smooth transition from the traditional German diploma system to the Bachelor-Master system following the Bologna accord; the B-IT master programs were the first to be accredited within the participating universities in 2004-2005. The success of the B-IT programs is also demonstrated by a very good placement record for the first groups of master graduates, both in science and industry.

The academic year 2005-2006 was the third year of full-scale B-IT operation, and the first fully conducted within the beautiful B-IT building on the Rhine River next to the new United Nations Campus in Bonn-Bad Godesberg. The reliable availability of this attractive facility enabled us to step up significantly the number of national and international events hosted by B-IT. Such events range from highly visible student

Home Countries of B-IT Students





events to scientific conferences on topics such as Grid Computing, Media Informatics, or Universal Accessibility. B-IT even participated actively in Bonn's famous annual Beethoven Festival, with a demonstration of the conducting system developed by B-IT professor Jan Borchers. Several events were part of Germany's Science Year 2006, the Year of Informatics, announced by the Federal Ministry of Research and coordinated by the German Informatics society (GI) under the presidency of B-IT Director Matthias Jarke. For example, B-IT partners and students participated in the RoboCup World Championships in Bremen, one team becoming world champion in the homecare robot category.



*DLF author M. Kloibert discussed IT trends in a nationally broadcasted event of the Informatics Year with Professors B. Korte, Th. Lengauer, M. Baur, M. Jarke, W. Brauer, and IT entrepreneur J. Haas, held in the Arithmeum museum Bonn.*



## Officers

### Founding Scientific Directors

*Prof. Dr. Armin B. Cremers,*  
University of Bonn  
*Prof. Dr. Matthias Jarke,*  
RWTH Aachen University  
*Prof. Dr. Kurt-Ulrich Witt,*  
Bonn-Rhein-Sieg University of Applied Sciences

### Assistant Directors

*Dr. Jürgen Rapp, Dr. Christoph Quix,*  
RWTH Aachen University  
*Dr. Stefan Lüttringhaus-Kappel,*  
*Dr. Thomas Bode, Dr. Alexandra Reitelmann,*  
University of Bonn

### Coordinators/Advisors B-IT Study Programs:

*Prof. Dr. Otto Spaniol*  
(RWTH Aachen University),  
Media Informatics  
*Prof. Dr. Jürgen Bajorath* (University of Bonn),  
Life Science Informatics

### International Advisory Council

*Prof. Dr. Gerhard Barth,*  
Founding President

### B-IT Foundation

*Dr. Michael Stückradt* (Chairman)  
Vice Minister, North Rhine-Westphalian Ministry  
of Innovation, Science and Research NRW  
*Hans Stender* (Secretary)  
Chancellor, Bonn-Rhein-Sieg University of  
Applied Sciences  
*MinDir Dr. Hermann Müller-Solger*  
Federal Ministry of Research and Education  
*Dr. Ulrich Buller*  
Board of Directors, Fraunhofer-Gesellschaft  
*Bärbel Dieckmann*  
Mayor, City of Bonn  
*Frithjof Kühn*  
County Chairman, Rhein-Sieg-Kreis  
*Prof. Dr. Burkhard Rauhut*  
Rector, RWTH Aachen University  
*Prof. Dr. Matthias Winiger*  
Rector, University of Bonn  
*Prof. Dr. Wulf Fischer*  
Founding rector, Bonn-Rhein-Sieg  
University of Applied Sciences  
*Dr. Ernst Franceschini*  
President, Bonn / Rhein-Sieg Chamber  
of Commerce

## Events and Visits



From left to right: Ms Springmann, Waseda office Germany, Professor Asahi and Professor Cremers at the Waseda Bonn Meeting on February 28, 2006 in B-IT.

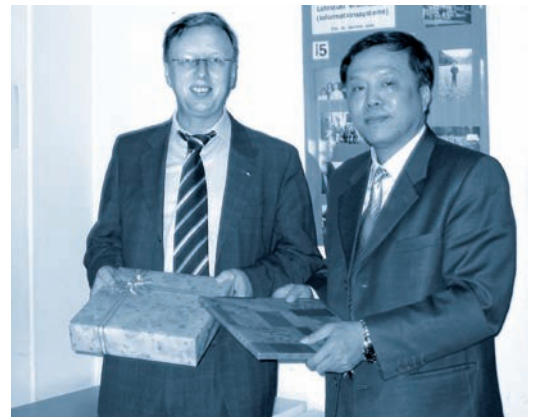
### B-IT co-operates with the Advanced Science and Medical Center Waseda in Life Science Informatics

B-IT co-operates with the Advanced Science Center and Medical Care Waseda (ASMeW), a Super Center of Excellence (SOE) of Waseda University. This co-operation takes place in the context of a wider framework of co-operation between centers of excellence of Waseda University and the University of Bonn. Waseda University participates with the Advanced Science Center and Medical Care, represented by Professor Asahi, and the University of Bonn with its Centers of Excellence B-IT and LIMES (Life and Medical Sciences Bonn). The co-operation encompasses besides drug discovery and design, tissue engineering, immune modulation, marine bacteria and muscle biology. B-IT Professors Jürgen Bajorath, Martin Hofmann-Apitius and Professor Thomas Berlage, vice head of the board of examiners of Master Program of Life Science Informatics and B-IT partner Fraunhofer FIT, will co-operate with Professor Ozaki from ASMeW in the area of drug design. The co-operation started with a meeting in February 28, 2006 in B-IT where potential fields of interests

and co-operation were identified. It was followed by a joint workshop on July 21, 22 also held at B-IT where areas of collaboration were specified and continued with a gathering on November 6-7, 2006 in Waseda University in which first steps of the collaborative research projects were defined. Besides research, this co-operation will contain an exchange program for graduate and master thesis students of Life Science Informatics.

### Cooperation with Jiangsu Province Strengthened

Pursuant to the cooperation treaty between NRW and Jiangsu Province, China, a delegation of the Jiangsu department of education visited B-IT partners in December 2005. Questions of teaching, research, and university administration in general were discussed as well as details of B-IT master student candidate pre-selection and study organization. Students from Jiangsu have been quite successful at B-IT, including at least one Erasmus-Mundus scholarship award.



Vice Minister Zhang and Professor Jarke.

Professor Cremers answered in April 2-5, 2006 a visit to B-IT by scientists from the Nanjing University of Science and Technology last year. Professor Cremers gave a lecture on "The B-IT International Program of Excellence (IPEC) Schedule", detailing research areas at B-IT suit-

able for graduate students exchange. Dr. Günter Kniesel presented an example from practice with the practical "eXtreme Programming", held within the B-IT Summer and Winter Schools. It was agreed that a Summer School following the model of B-IT summer school will be held in the Department of Computer Science at Nanjing University of Science and Technology organized by B-IT and with requested support of DAAD (German Academic Exchange Service).

### **B-IT hosts Informatiktage 2006**

Informatiktage, organized by the Gesellschaft für Informatik e.V. (Informatics Society), is the most important annual meeting of top Computer Science students in the German-speaking countries. Informatiktage 2006 was held March, 31 - April, 1, 2006 at B-IT. Workshops and keynote lectures provided the students with wide view on academic and industrial research. Main lectures addressed Bioinformatics (Edgar Wingender, Biobase AG), MP3 Surround Audio Coding and its Applications (Harald Popp, Fraunhofer IIS), and the current debate Bachelor or Master Programs – progress or step backwards (Gottfried Vossen, University of Münster). In workshops, students discussed their activities in topics such as Software Architectures, Service-Oriented Computing, Computer Systems, and Business Intelligence, with peers, senior researchers and industry representatives.

### **First German Meeting for the Advancement of Health in University Clinics held in B-IT**

The first German Meeting for the Advancement of Health in University Clinics (1. Fachtagung zur Gesundheitsförderung in Universitätskliniken) held in B-IT, co-organized by B-IT. This gathering brought together experts from the field of university clinics with a focus on the promotion of health among health professionals in university clinics who often work in very stressful circum-

stances. It is widely known that the promotion of health among health professionals could considerably be improved. The conference participants discussed possible approaches with regard to the more and more limited financial resources in this context.



*First German Meeting for the Advancement of Health in University Clinics held in B-IT.*

### **JuniorAkademie NRW 2006**

The JuniorAkademie NRW is a forum in North Rhine-Westphalia foster gifted children in North Rhine-Westphalia. The Academy offers courses and seminars supplementing the school activities of gifted and highly gifted children. On June 29, 2006 a course in robotics with a focus on autonomous robots and cryptography was held in and co-organized by B-IT within JuniorAkademie NRW 2006. B-IT is engaged in the advancement of Computer Science, also with regard to gifted and interested school children.

## Master Program in Media Informatics



Prof. Dr. Jan Borchers,  
Media Computing



Prof. Dr. Thomas Rose,  
Media Processes

Computer scientists with an applied focus have been in great demand in the past, and this is expected to continue for the foreseeable future. Graduates of the Master Program in Media Informatics will be well-prepared for the challenges faced when working in computer systems engineering and for creative work with audio-visual media. The Aachen – Bonn – Cologne region is home to many prospective employers, including global players such as Philips, Microsoft, Telekom, Vodafone, Bertelsmann Group, as well as many television stations including RTL, WDR etc.

While a Bachelor degree in Computer Science typically qualifies to participate in large software projects, the Master degree provides the qualifications for project leadership. Graduates of the program in Media Informatics can be expected to be technically innovative, to work as system architects, and to manage large projects. Students who excel during their master program will also have the necessary qualification to pursue a doctoral degree in Germany or abroad. The DFG Research Training Group “Software for Mobile Communication Systems” and the new Excellence Research Cluster “Ultra-High-speed Mobile Information and Communication (UMIC)” offer an exceptional research environment for the students.

The Master Program in Media Informatics educates the students to successfully meet the novel technical and economic challenges at the intersection of computer science, software engineering, next-generation communication systems, and the media. It is offered as a joint program of RWTH Aachen University and University of Bonn. The program is characterized by a significant portion of lab courses embedded in research of the participating Fraunhofer Institutes for Applied Information Technology FIT and for Intelligent Analysis and Information Systems IAIS. The degree is conferred by RWTH Aachen University. Cooperation partners from industry and research, including the DFG-funded Collaborative Research Center “Media and Cultural

Communication”, contribute to a rich teaching program. The course contents are structured according to the ECTS (European Credit Transfer System) and consist of three main blocks:

- Computer Science and its mathematical foundations;
- Multimedia Technology;
- Fundamentals of Media Science and business.

Major topics include: digital interactive media, internet infrastructures, management of information, communication and security, knowledge management, visualization, and virtual engineering on the basis of augmented reality. The program also includes methodological aspects of designing media informatics systems from the perspectives of software engineering, usability, media design, and business requirements.

Recent master thesis topics include:

Fahad Aijaz: *Implementation and Performance Analysis of a UDP Binding for SOAP*

Kamal Barakat: *Tracking with Ultrasonic Model Recognition, an Approach towards Ultrasonic Vision*

Mohammed Abul Bashar: *Developing an Interactive Software Visualization and Navigation Framework for Eclipse*

Robina Brintha Ephram: *Incorporating E-Accessibility in the Workflow and Design Process of Content Management Systems*

Avinash Jain: *A Multimodal Digital Map System with Mutual Disambiguation*

The incoming classes of fall 2005 and 2006 comprise 39 new students each, from a total of 26 countries. In 2006, seven new students, pre-selected from over 1.500 applicants, were awarded the prestigious Erasmus-Mundus scholarship within the European Master of Informatics program we are conducting jointly with the universities of Edinburgh (UK) and Trento (Italy). The first two Erasmus-Mundus scholarship students, awarded in 2004, finished their stay in Edinburgh and are finishing their Master Theses.





Visitors make extensive use of testing "Personal Orchestra".

### B-IT contributes to International Beethovenfest Bonn

B-IT participated on September 14, 2006 in Beethovenfest 2006 with the interactive presentation "Personal Orchestra" held by B-IT Professor Dr. Jan Oliver Borchers. "Personal Orchestra" is a computer-based, interactive conducting system, giving the user the opportunity to conduct the Vienna Philharmonic Orchestra. It has been developed by B-IT Professor Dr. Jan Oliver Borchers, chair of the Media Computing Group at B-IT. Professor Borchers explained the system first. After the lecture the audience was invited to test "Personal Orchestra". The system had an enormous acclaim by the audience, making extensive use of testing it. Composer Michael Denhoff attended the event, too, tried the system and was impressed.



Composer Michael Denhoff (left in the front) and Professor Borchers (right in the front) discuss the features of "Personal Orchestra".

### Excellence cluster UMIC

UMIC is a five-year, 35 M€ excellence cluster awarded to RWTH Aachen University as part of the German excellence initiative. The interdisciplinary design of Ultra high-speed Mobile Information and Communication systems (UMIC) should provide an order of magnitude improvement of the perceived quality of service. Concepts and demonstrators for smart, mobile, broadband, low-cost systems will be developed which support the demanding applications of the next-decade mobile Internet. The required tremendous leap in innovation can only be achieved by a truly cross-disciplinary approach, which brings together the necessary disciplines ranging from computer science via information theory and communications engineering to complex system-on-chip design. UMIC is coordinated by Professors Gerd Ascheid and Otto Spaniol.

Within UMIC, the **Mobile Applications and Services area** (coordinator: M. Jarke) has its focus on Mobile Services, Mobile Multimedia Processing and Peer-to-peer Mobile Information Processing. The area **Wireless Transport Platform** (B. Walke) investigates mobile devices and wireless network architectures, adaptive re-configurability at the air interface, including multi-hop capabilities, and balancing between conflicting requirements concerning bit-rates, radio coverage, processing power, and power consumption. The area **RF Subsystem and SoC Design** (T. Noll) develops advanced integrated analog and digital circuits under the conflicting regimes of flexibility and energy efficiency. UMIC will also require **cross-disciplinary methods and tools** (S. Kowalewski) for analyzing performance, reliability, security, and energy efficiency.

## Master Program in Life Science Informatics



Prof. Dr. Jürgen Bajorath,  
Life Science Informatics



Prof. Dr. Martin Hofmann-  
Apitius

Martin Hofmann-Apitius has been appointed Professor in the field of Life Science Informatics at B-IT in September 2006. He earned his PhD at the University of Tübingen in 1991. Afterwards he worked at Institute for Molecular Pathology (IMP) in Vienna and the German Cancer Research Center. In 1998 he changed to LION Bioscience AG. There he expanded his research activities to the area of applied Life Science Informatics. Today he heads the Life Science Informatics Department of Fraunhofer Institute SCAI. His scientific interests lie in Information Extraction / Semantic Text Analysis, Applied Chemoinformatics, and Semantic Datagrid / Grid Infrastructure.

The Master Program in Life Science Informatics (LSI) is offered by the University of Bonn and RWTH Aachen University in cooperation with the Fraunhofer Institutes of Scientific Computing (SCAI) and Applied IT (FIT). The degree is conferred by the University of Bonn. This interdisciplinary program educates the participants to successfully master the novel technical and economic challenges at the crossroads of biotechnology, medicine, pharmaceuticals and computer science. The curriculum consists of three main blocks:

- Computer Science and mathematics for life scientists;
- Basic principles of Life Science Informatics;
- Biology of the cell and systems biology.

Major topics include biomedical database systems, data mining and machine learning, statistical genetics, drug design, medical imaging and visualization, computational neuroscience, computational modelling of regulatory and metabolic networks, cheminformatics, bioinformatics, molecular modelling, molecular biology, pharmaceutical chemistry, biotechnology and systems biology. The program emphasizes a profound understanding of biological structures (such as proteins, nucleic acids, genes, metabolic, neural networks and organisms) as well as the appropriate application of methods of computer science to this field. It also includes training designed to sensitize students to the ethical implications of emerging biotechnologies. This combination will enable the successful students to understand biological or medical problems and to find appropriate and valid solutions that bioinformatics can offer.

The program is characterized by a significant share of research lab courses embedded in both basic and applied research of the participating Fraunhofer Institutes FIT and SCAI as well in labs of CEMBIO (Center for Molecular Biology) and LIMES (Life and Medical Sciences Research Bio-

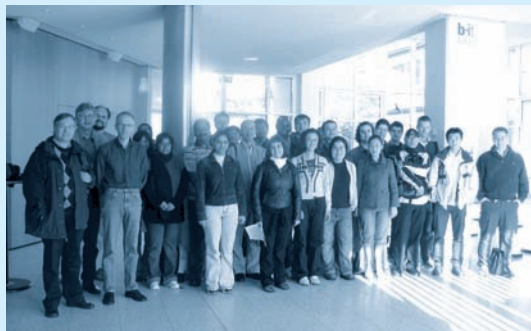
center Bonn). The final six months of the program are dedicated to the master thesis which can be done in cooperation with industry. Each student is assigned a professor as personal mentor.

Computer scientists with an applied focus in biosciences as well as biologists with a strong background in computer science have been in great demand in the last few years, and this is expected to continue in the foreseeable future. Graduates of the program are well prepared for the typical professional tasks in applied data analysis and data modelling, in industrial functional genomics, drug design and pharmacology. The Aachen – Bonn – Cologne – Düsseldorf region (ABCD region) is home to many prospective employers, including global players as well as highly specialized medium-sized companies.

Several of the 2005 incoming students soon received offers for their Master Theses, another student has even received two offers for it, after only completing her first year. More than half of the LSI students selected in fall 2005 have now successfully completed their Master Theses, the other half is currently beginning their Master Thesis or is working on it and will complete it in 2007. One of the graduated students has already been accepted to PhD studies. Another student carried out her Master Thesis in co-operation with the Cologne University Bioinformatics Center (CUBIC). Two more students currently work on their Master Theses in co-operation with CUBIC. Another student did his Master Thesis at CEMBIO (the Center of Molecular Biotechnology of the University of Bonn). A further student was invited to a six month practical at the European Bioinformatics Institute in Cambridge, UK.

Selected from 67 applications, 19 new LSI-students from 10 countries started Life Science Informatics studies in October 2006.

## PharmaGrid



*Incoming LSI class of 2006 meets B-IT faculty.*

With its geographic distribution, B-IT constitutes a challenge for scientific collaboration between the participating Universities in Bonn and Aachen, the University of Applied Sciences in Sankt Augustin and the Fraunhofer institutes at the Birlinghoven Campus. Therefore, the eScience vision of using Grid Computing to enable collaborative work and large scale in silico science was very appealing to a group of B-IT scientists responsible for the Life Science Informatics curriculum. The idea was to establish a regional, distributed scientific computing infrastructure – a grid – which supports the sharing of services (analysis tools; databases) relevant for computational biology, computational pharmacology, medical image analysis and unstructured information management.

PharmaGRID will make use of the “D-GRID middleware”, a distributed computing operating system currently developed in the German eScience project D-GRID. This operating system is responsible for user authentication, covers security aspects and provides the framework for the distribution of compute jobs. It also provides the basic functionalities to access services and to assemble them in scientific workflows.

The specific problem solving capability of PharmaGRID comes with the life science informatics services that we will implement. We are aiming at providing workflows for medical imaging data analysis (e.g. computer tomography image analysis); gene expression analysis (microarray [sometimes called “Gen-Chips”]) data storage and data analysis) and unstructured information management (so-called “text mining”; which basically means that we teach the computers to read texts and to extract the essential information from texts; e.g. patent literature or scientific journals).

Computer scientists will be able to share their compute resources (storage as well as CPU power); facilitating large scale in silico experimentation. Biologists will be able to store their valuable gene expression data in a distributed database; through sharing of data they will have a much improved basis for comparative gene expression studies. Distributed text mining will enable scientists in academia and pharma companies to extract relevant information (e.g. “all chemical core structures and their combinatorial variation that are covered by patents on non-steroidal inhibitors”) from patents, journal publications and the internet. The PharmaGRID project draft proposal was submitted in the middle of this year; it has been evaluated by international experts in the field and was invited to submit a full grant application. We are excited about the perspectives PharmaGRID will add to the current collaborative activities in the life science informatics curriculum of B-IT; making eScience in the Bonn-Aachen region a matter of fact.

## International Program of Excellence in Computer Science



*Prof. Dr. Albrecht Schmidt*

Albrecht Schmidt studied computer science in Ulm and Manchester and he worked as a researcher at the University of Karlsruhe and at Lancaster University. There he completed in 2003 his PhD thesis on the topic of "Ubiquitous Computing – Computing in Context". Before he became professor at the B-IT-Center he headed the "Embedded Interaction Research Group" at the Ludwig-Maximilians University in Munich. His teaching and research interests are in media informatics and in particular in the area of user interface engineering.



*Prof. Dr. Joachim von zur Gathen, Computer Security*



*Prof. Dr. Stefan Kowalewski, Embedded Systems*

The International Program of Excellence in Computer Science (IPEC) at B-IT offers compact courses primarily during the semester break and at the highest educational level. This results in faster studies and advanced quality in selected subject areas. These courses apply to a limited number of highly qualified students of the University of Bonn, the RWTH Aachen University and, in the future, other German or foreign universities.

Undergraduate IPEC courses are planned in a way that the time required for the bachelor degree will be reduced up to one year. Additionally there are cross-cutting courses that accelerate the master studies at the B-IT as well as regular summer and winter schools that are designated for selected topics of computer science. These courses are held in cooperation with international guest scientists. Applications of foreign students are welcome.

The expected impact of the Program of Excellence is not limited to a significant acceleration of undergraduate and graduate studies in conjunction with an international visibility. It also brings together outstanding students with internationally noted scientists and with fellow students from abroad and activates new forms of encouraging competition among students. The IPEC courses usually comprise a mix of lecture classes, seminars, and lab courses, such that students can make best use of the compressed time schedule.

The IPEC courses usually comprise a mix of lecture classes, seminars, and lab courses, such that students can make best use of the compressed time schedule. A full schedule of

over 20 courses was offered during the semester breaks of the academic year 2005-2006. In particular, the introduction of a compact Foundational Theory class offered to incoming master students with certain gaps in their theoretical computer science background proved an important and highly successful innovation. This compact course is taught jointly by faculty from Bonn University and RWTH Aachen University during each summer break. In the fall of 2006, the last IPEC core faculty position is being filled with Prof. Dr. Albrecht Schmitz who joins B-IT from the University of Munich. He complements the existing groups on IT security and on embedded software systems headed by Professors von zur Gathen and Kowalewski.

In addition, a number of IPEC events for junior researchers were held at B-IT and in partner locations, usually embedded in international research networks. As the perhaps most prominent example, B-IT hosted the CoreGRID Summer School 2006, July 24-28, 2006. CoreGRID is a European "Network of Excellence" (NoE) funded by the European Commission's 6th Framework Program. The network aims at strengthening and advancing scientific and technological excellence in the area of Grid and Peer-to-Peer technologies. The Summer School in B-IT offered theory courses as well as practical work sessions. The main objective was to introduce researchers and students to the concept of GRID and to practice some existing tools for deploying GRID systems and applications. Additionally, there are two main topics in the lectures this year. Main topics focused on Resource Management in Grids and Life Science Grid Applications.



## Schüler-Krypto



*About 130 school students joined the fifth Schüler-Krypto. They came from Köln, Bergisch-Gladbach, Andernach, and places near Bonn.*

On Friday, 17 February 2006, 130 high school students, as well as 6 teachers and 4 observers met for the fifth Schüler-Krypto to learn at B-IT on secret messages, encryption and decryption.

After a one hour introduction to the topic by Prof. von zur Gathen and Michael Nüsken the students got to the nitty-gritty. Everybody was asked to take up the role of James Bond and program RSA on the laptop built-in to Bond's BMW Z8. We used MuPAD on it, a computer algebra system which among many other things is capable of calculating with arbitrarily large numbers. After lunch everybody decrypted answers from Money Penny, set up a public-key infrastructure and exchanged encrypted messages with each other. As a sidetrack, in a game-like setting the students could experimentally find out how the main step in the encryption and decryption of RSA, namely the modular exponentiation, can be executed in a jiffy. And finally everybody could take home her personal visual cryptogram.

A teacher who came from Odenthal with four students wrote: "My students and I really liked this event. And maybe you know from your own time at school that a lot must happen to make a student tell so positively about a school event. I think that my students have learned a lot on the topic and I experienced some new teaching methods. In particular, I will embed the addition chain game in my own courses. Many thanks for this and a lot of other new insights."

## crypt@B-IT

This Summer School on Cryptography offered undergraduate and graduate students and researchers the opportunity to crypt@B-IT. It provided acquaintance and interaction in an intellectually stimulating and informal atmosphere in pleasant surroundings.

The one-week Summer School crypt@B-IT 2006 took place 17-21 July 2006 in the B-IT building. It explored some fundamental areas of cryptography:

- theoretical security notions,
- lattices in cryptology,
- group cryptography,
- the Enigma crypto machine from World War II.

In addition, there were tutorials and hands-on exercises on topics related to the lectures, including an exhibit of an actual Enigma machine. The intended audience were undergraduate and graduate students as well as postdocs and researchers who work in the area or at least have a basic knowledge.

### Lecturers

- Professors Rackoff, von zur Gathen, Nguyen
- Joachim von zur Gathen, b-it Bonn,
- Phong Nguyen, ENS Paris,
- Frank Niedermeyer, BSI Bonn,
- Charles Rackoff, University of Toronto, and
- the members of the cosec group.



*The crypt@b-it participants.*



*Frank Niedermeyer and an original Enigma machine.*

## Master Program in Autonomous Systems



Prof. Dr. Gerhard Kraetzschmar,  
Educational Robotics



Prof. Dr. Paul-Gerhard Plöger,  
Autonomous Systems



Prof. Dr. Erwin Prassler,  
Robot Planning

The Master Program in Autonomous Systems is offered by the B-IT Applied Science Institute (b-itAS) in the Department of Computer Science at the Bonn-Rhein-Sieg University of Applied Sciences. b-itAS works closely with the Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS) in implementing the program, which started in winter 2002. It is managed by three professors (Kraetzschmar, Plöger, Prassler) and two teaching and research assistants (Nowak, Hartanto). Additional staff is being recruited for our European research projects.

Students get a solid theoretical background in Autonomous Systems. Examples of lectures are Control and Systems Theory, Hardware-Software Co-design of Embedded Systems, Autonomous Mobile Robots, Learning and Adaptivity, Robot Manipulation, and Probabilistic Reasoning. The students may specialize in fields like Computer Vision, System Design, Sensors and Modeling, Navigation or Manipulation. The courses are combined with research projects at Fraunhofer IAIS. The students learn to apply and extend their theoretical knowledge by building real systems. In 2006 this program has been fully accredited by ASIIN.

B-IT Autonomous Systems accepts students twice a year. In the academic year 2005/2006, a total of 43 students from 12 countries were admitted. 11 students have completed their degree in this year, summing up to 17 graduates in total so far.

Among the finished Master Theses are:

Ali Uygur Küçükemre: *Echo State Networks for Adaptive Filtering*

Srikanth Reddy Mudireddy: *Evolutionary Neural Network Controller for Two-Dimensional Pole Balancer with Obstacle Avoidance*

Saravanaperumal Ponnambalam: *Exploiting and Merging of Instruction Level Parallelism and Data Level Parallelism using the C64X and C67X VLIW/SIMD DSPs*

Jayasimha Heragu: *Vision Based Robotic Arm control using Affordances*

Sunkara Chandrasekhar: *Synchronous Programming for Robot Control Architectures*

Seven conference paper submissions resulted from this work, another nine theses are ongoing.

The three professors of the Autonomous Systems Program are actively involved in many scientific activities, including memberships in technical committees of IEEE, the RoboCup Federation trustee board, and numerous program committees of scientific conferences and workshops.



The university's RoboCup team, led by Prof. Paul Plöger and Walter Nowak, performed in several local, national and international events and actively promoted the Master Program to a broad audience. The picture was taken during a tournament in Magdeburg where the team was invited by Deutsche Forschungsgemeinschaft DFG.

## European research activities in Autonomous Systems

The B-IT Laboratory for Autonomous Intelligent Robots (AIR Lab) at the University of Applied Sciences has recently received two grants from the European Commission to participate in two strategic research activities, one in the field of learning in embodied systems (basic research activity) and one in the field of robot architectures and standards (coordinated action).

### XPERO: Learning by Experimentation

While it is unquestionable that learning is a fundamental aspect of cognition, it is still a rather challenging endeavor to understand or model “learning” and the underlying mechanisms which enable intelligent creatures – not only humans – to develop complex cognitive skills and understand and manipulate the surrounding world to their own benefit. The European project XPERO proposes to approach this problem by developing a methodology for learning by experimentation. The overall objective of XPERO is to develop an embodied cognitive system, which is able to conduct experiments in the real world in order to gain new insights about the world and the objects therein and to develop and improve its own cognitive skills and overall performance.

Enabling an embodied cognitive agent (robot for short) to design and conduct experiments in a natural real world setting and to extract new insights is more than just adding another feature to a technical system. The ability to conduct experiments in the real world and extract new knowledge and insights pushes open the door to a new quality of embodied systems, namely to potentially open-ended autonomous learning. This ability enables the robot to grow in an unlimited fashion its cognitive capacity and its performance to accomplish meaningful tasks in

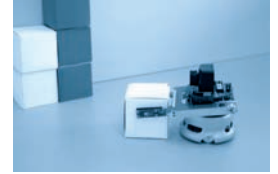
the real world. Limitations are only set by the surrounding world and its own physical capabilities and not by the availability of a teacher or learning material.

Members of the XPERO consortium, which officially took up its work on April 1st, 2006 are the AIR Lab at B-IT / University of Applied Sciences Bonn-Rhein-Sieg, Fraunhofer Institute for Intelligent Analysis and Information Systems, Technical University of Vienna, University of Verona, University of Ljubljana and American University of Paris. XPERO is coordinated by B-IT Professor Erwin Prassler.

### RoSTA: Robot Standards and Architectures

The objective of this proposal is to proactively take the initiative on the definition of formal standards and the establishment of de facto standards in the field of robotics, especially service robotics. The proposal does not aim at a broad coverage of topics, which might lend themselves towards a standardization. Rather we propose to take the initiative in the formulation of standards in a very few, selected key topics which have the highest possible impact. We focus on creation of a glossary / ontology for mobile manipulation and service robots, specification of a reference architecture for mobile manipulation and service robots, specification of a middleware for mobile manipulation and service robots, and formulation of benchmarks (of components, methods, middleware and architectures) for mobile manipulation and service robots.

In RoSta the B-IT/AIR Lab cooperates with Fraunhofer IPA in Stuttgart, University of Lund in Sweden, University of Verona, Italy, Sagem DS, France, Gesellschaft für Produktionssysteme GPS in Stuttgart and EUnited Robotics, the European Robotics Association. RoSta will officially commence on January 1st, 2007.



## B-IT Universities Institute

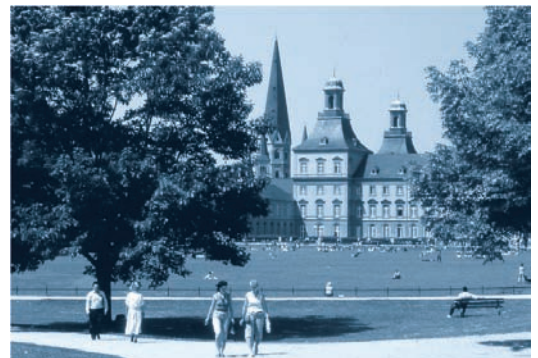
ABC – three letters that stand for a veritable “magic triangle”: the region between Aachen, Bonn and Cologne, which is not only economically strong, but also a leader in science, education and research. The large number of research establishments based here make the area one of Europe’s biggest and most important science landscapes. Almost 10 per cent of all German students – around 130,000 people – are studying at the Rheinisch-Westfälische Technische Hochschule in Aachen, the Rheinische Friedrich-Wilhelms-Universität Bonn and the Universität zu Köln, which together constitute one of the most important higher education locations in Europe. The three ABC institutions are closely linked and collaborate in many fields of teaching and research.

### University of Bonn

The University of Bonn is a research-oriented university with currently 30.000 students. Its research tradition of 200 years is closely linked to the names of Hermann von Helmholtz, Heinrich Hertz and Friedrich August Kekulé who carried out seminal work at the University of Bonn. This strong academic tradition has been continued until present with the more recent Nobel laureates Wolfgang Paul and Reinhard Selten. Bonn cooperates with numerous other universities and research institutions around the globe. The specializations it has developed enjoy worldwide recognition. More than 5,000 students from 130 countries are enrolled in Bonn. Their presence underlines the international character of the university and enriches both academic and social life in Bonn. Living up to its long tradition as a classical university with a full range of academic disciplines, the University of Bonn offers nearly a hundred different first degree programs. Students can choose from a wide and modern spectrum of subjects that allows a multiplicity of combinations.

### RWTH Aachen University

RWTH Aachen University was founded as a Polytechnic in 1870 with considerable support from local industry. In 1948 it was established as Rheinisch-Westfälische Technische Hochschule Aachen (RWTH), the Institute of Technology of the State of North Rhine-Westphalia. Today, RWTH is one of the most renowned technical universities in Europe, with around 30,000 students, of which more than the half are enrolled in engineering. More than 4,000 international students are enrolled, including around 900 Asian students. RWTH offers more than 65 first degree programs in Science, Engineering, Economics, Medicine and Arts and more than 20 graduate programs in Science and Engineering. The specific strength of RWTH’s engineering education is the combination of education and advanced research. RWTH’s engineering departments closely cooperate with national and international industries. Most of the engineering professors at RWTH held positions in industry before they became RWTH faculty members. The RWTH master programs educate engineers who are keen to engage in R & D, innovation, and entrepreneurship.



*The spacious Hofgartenwiese is a major summer attraction on the University of Bonn campus*





Entrance of Birlinghoven Castle

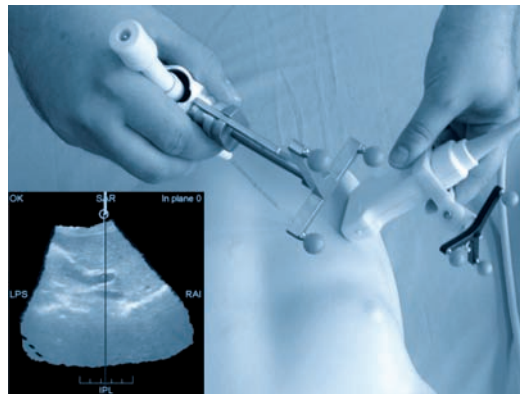
The Birlinghoven Castle campus has for almost 35 years been one of the largest and most influential computer science research sites in Germany. Since 2001, it is a member of the Fraunhofer Society of Applied Research. Today about 500 researchers work in the IZB institutes. That represents a quarter of the Fraunhofer ICT Group, Europe's largest IT research organization. The institutes collaborate closely with the European ERCIM network of national IT research centers as well as with leading research establishments in the USA, Eastern Europe and Asia. The campus also hosts one of the best-equipped Computer Science research libraries in Germany. Three IZB institutes contribute to the B-IT master programs Media Informatics and Life Science Informatics:

### Fraunhofer FIT

Fraunhofer FIT investigates human-centered computing in a business or engineering process context. The usability and usefulness of information and cooperation systems is optimized in their interplay between human work practice, organization and process. In Life Science Informatics the institute focuses on protein analysis, visual support for navigation in micro surgery, and assistive information technology. In Media Informatics innovative information visualization systems, mixed and augmented reality environments for industrial planning, pervasive gaming applications, and value chains for public-sector information services are main research topics.



Virus hunters in "Epidemic Menace", a pervasive game developed in the European "Integrated Project on Pervasive Games – IPerG", working with Fraunhofer FIT's Augmented Reality environment.



Fraunhofer FIT develops innovative tools for gentle liver surgery based on image-guided planning and intra-operative navigation.

### Fraunhofer SCAI

Computer simulation in product and system development by means of mathematical methods and models helps to keep development time and costs low. The Fraunhofer Institute for Algorithms and Scientific Computing SCAI offers a wide spectrum of mathematical and IT methods and software developments geared to specific customers' wishes to solve not only application problems in industry but also problems in natural and engineering sciences. The research fields include simulation engineering, numerical software, optimization, bioinformatics, and web-based applications.

## B-IT Applied Science Institute

### Bonn-Rhein-Sieg University of Applied Sciences

Founded in 1995, the Bonn-Rhein-Sieg University of Applied Sciences significantly extends the range of applied research and teaching in the greater Bonn area. It specializes in business administration, natural sciences, engineering and computer science, strongly encouraging cooperation with industrial partners and a focus on use-driven and interdisciplinary research and teaching.

The three campuses at Sankt Augustin, Rheinbach and Hennef are well equipped with modern laboratories, studios, workshops and facilities for cooperative research. By 2005, the six departments will accommodate more than 4.500 students and about 120 faculty members.

The Department of Computer Science offers a Bachelor and a Master program in Computer Science and in cooperation with the Departments of Business Administration a Bachelor program in Business Information Systems. The Master program Autonomous Systems is offered by the b-it Applied Science Institute, a cooperation between the Department of Computer Science and the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS.



*Campus of the Bonn-Rhein-Sieg University of Applied Sciences*

### Fraunhofer IAIS

Fraunhofer IAIS develops solutions that, by their intelligence, enable humans to take better decisions and that, by their autonomy, relieve humans in general and in particular extend the range of human actions. Knowledge computing and autonomous robots are the two core areas of the institute which have a history reaching back to 1998. Recently the IMK and AIS institutes merged and formed the joint institute IAIS.

One focal point of IAIS is to develop business intelligence solutions for integrated analysis of databases, multimedia-, text-, web- and geo-data (visualization, extraction of information, data mining) to support better decision-making. Logistics companies and one of the major European retail groups use IAIS systems for interactive support of location analysis and marketing campaigns. IAIS software simplifies generating and sharing ideas in small teams and large groups, e.g., for citizen participation in urban planning. Complex systems are modeled in IAIS with multi-agent systems that have been developed in telematics applications. In the field of autonomous robots, IAIS develops sensor-based, robust wheel-driven and walking mobile robots.

The institute is a leader in the research on sensor fusion of 3D laser-scanner data for the exploration of unknown environments. In addition to supporting explorative tasks, robots can be valuable educational tools: They combine solutions from mechatronics, computer science, and electronics that are major elements of engineering curricula. Here, IAIS provides its own robotic systems and related courses. Real-time simulation and control of non-linear systems, intelligent control systems as well as hard- and software integration round out the competence profile of the institute.

## General Admission Requirements

- A first university-level degree (B.Sc., B.Eng.), as specified for the individual programs, with grades well above average is required. The Graduate Record Examination (GRE) is strongly recommended;
- All courses are held in English, thus fluency in English is vital. It is evaluated on the basis of TOEFL 550 paper-based, 213 computer-based, or IELTS 6.0;
- Working knowledge of German is necessary to take up some of the culture that the Aachen – Bonn – Cologne region has developed over the last 2,000 years. A basic German language course must be completed until the end of the third semester.
- Admission is coupled to placement in the Fraunhofer lab courses and therefore strictly limited. Application deadline has been March 1 for Fall admission but may change from year to year; check [www.bit-center.de](http://www.bit-center.de) for current admission details.

## Fees and Finances

Tuition fee is normally 650 Euro per semester. In addition, a Student Union fee of 145 Euro per semester covers student activities, subsidized meals, and free public transportation in the region.

A student's monthly expenses, including study material, will be about 650 Euro. B-IT does not offer formal scholarships but several student assistantships are available on a competitive basis. For information on funding from German sources please contact the DAAD – German Academic Exchange Service [www.daad.de](http://www.daad.de).

## Studying in Bonn

Most of the teaching in B-IT is concentrated in Bonn and its eastern neighbor, Sankt Augustin. Newcomers to Bonn soon grow very fond of the city – a fact confirmed by thousands of students and academics, German and foreign, who have come here to learn, teach or research. Since the German Bundestag moved its seat and parts of the Federal Government to Berlin in 1999, Bonn attracted a number of international organizations, especially United Nations bodies, and some major corporations. Among others, Deutsche Telekom and Deutsche Post have their headquarters there. Now Bonn is evolving into an internationally recognized science region – with the university as one of the dynamic forces driving this change. In addition, Bonn offers a wide variety of attractions and amenities. The city's most famous son, Ludwig van Beethoven, is the star attraction of a lively and varied arts and culture scene. The city boasts an opera house, several theatres, concert halls and other venues, as well as a range of fascinating museums.





Görresstrasse 13  
53113 Bonn  
Germany

### **Founding Directors**

Prof. Dr. Armin B. Cremers  
University of Bonn

Prof. Dr. Matthias Jarke  
RWTH Aachen University  
Fraunhofer FIT

Prof. Dr. Kurt-Ulrich Witt, Bonn-Rhein-Sieg  
University of Applied Sciences

### **Media Informatics**

[msc-mi@b-it-center.de](mailto:msc-mi@b-it-center.de)

### **Life Science Informatics**

[msc-lsi@b-it-center.de](mailto:msc-lsi@b-it-center.de)

### **Autonomous Systems**

[msc-as@b-it-center.de](mailto:msc-as@b-it-center.de)

### **Imprint**

*Editors*

B-IT Founding Directors

*Grafic Design*

Simone Pollak

*Printing*

Daemisch Mohr, Siegburg

© 2006

Bonn-Aachen International Center for  
Information Technology