Department of Informatics
Preface

multum, non multa

This is the second biennial report of the Department of Informatics (IFI) at Clausthal University of Technology (TUC): It covers the years 2006 and 2007. The department has undergone a phase of consolidation, but is still growing. Three new colleagues joined us (to fill the positions of (1) Collaborative Systems and Computer Supported Collaborative Work, (2) Software Engineering, and (3) Databases and Information Systems), the number of scientific staff went up from 20 to 38, two more professorial positions are planned in the coming year, and another two in the long run. Currently, our department has almost 60 members.

The number of publications went up from 208 (in 2004/2005) to 243 (2006/2007). We noticed even more increases in the number of Diploma theses (from 65 to 95), the memberships on PC’s and other boards (from 109 to 150), and an enormous increase in the overall funding (from 125,000 EURO to 912,000 EURO).

The last two years have seen two main important developments and achievements that will keep us busy in the future:

1. The introduction and accreditation of Bachelor and Master programmes,
2. the NTH (Niedersächsische Technische Hochschule) process in Lower Saxony.

In addition, in 2007, the way has been paved for (1) the multi-million Euro project IT-Eco-Systems within the NTH (for which our department has the lead role), and (2) the planned Centre of Simulation Sciences, together with Göttingen University, which also involves other disciplines (mathematics, physics, and engineering), and for which, again, TUC has the lead role. The IT-Eco-Systems project is a joint effort of the departments of informatics in Clausthal, Hannover, and Braunschweig and has already led to closer collaborations of several groups.

As one of the smaller departments of informatics in Germany, we have to focus on our strengths and concentrate on a few areas that fit well with other engineering disciplines in our faculty (and university) and are complementary to other departments of informatics in the NTH. We believe this will be achieved with the IT-Eco-Systems project and the planned Centre of Simulation Sciences.

I wish to thank all staff members, the executive committee of TUC (“Präsidium”) and the administration for their help in strengthening our department. A special thank you goes to Prof. Dr. Detlef Schmid (Karlsruhe), head of the scientific commission of Lower Saxony, for his unwavering help on numerous occasions.

As I will serve as Dean of our faculty from April 2008 on, I would like to ask all staff members to support the new Head of Department with the same confidence and trust that I received in the last four years.

March 2008
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1 The Department of Informatics

1.1 Overview

Over the past forty years, computer science has been changing our society and our daily lives like no other research discipline. The pace of this change is continually increasing, and computer systems are getting more complex and more difficult to understand, to design, and to control. In order to be able to master this complexity and to maintain Germany’s competitiveness in a global race for innovation and market shares, young computer scientists need to be educated with the techniques of professional computer science to *understand, analyze, design,* and *build* complex computer-based applications. *To make an important contribution to this endeavour is the educational mission of the Department of Informatics at Clausthal University of Technology.*

We offer young people high-quality courses in the core disciplines of computer science, such as business information technology, communication, and distributed systems, computer engineering, computer graphics, computer supported collaborative work, database systems, software engineering, theoretical computer science, and computational intelligence. Our research groups carry out basic and applied research in five strategic areas with international visibility and reputation: (1) *Foundations of computer science,* (2) *complex distributed and embedded systems,* (3) *human-centered computing,* (4) *business information technology and information systems,* and (5) *computer engineering.* This reflects the strategic direction of computer science in Clausthal: To exploit and deepen the synergies with engineering sciences and economics.

This biennial report documents the development of the department over the years 2006 and 2007, a period which has been characterized by continuing the stabilization of the department started in 2004: Continuing the processes of expansion, organizational change, and scientific re-alignment. We are happy to report that excellent progress has been made during this period towards shaping the scientific and educational profile of the department. A new challenge and opportunity for the department (which most of us did not expect to be implemented so soon) was initiated in 2007: The process of creating a Niedersächsische Technische Hochschule (NTH), a virtual university project co-executed by the three Universities of Clausthal, Braunschweig, and Hannover. As we report below, the Department of Informatics has decided to play an active, leading role in this project. By doing so, our hope is to leverage our potential together with that of our neighboring universities, to become major players in the German university system, and to improve our capability to compete with leading national and international research bodies in the quest for research funding.
1.1.1 History

Founded in 1982, the Department of Informatics at Clausthal University of Technology is looking back to a twenty-five year tradition in education and research. From 1984 to 2006 the department ran a Diploma programme in computer science. Since the mid-nineties, this was supplemented by a Diploma programme in business information systems (Wirtschaftsinformatik).

The department went through a very difficult period during the late nineties and early two-thousands: It was understaffed and had to serve a large number of students. Finally, a strategic decision was made in 2002/03 by the federal state of Lower Saxony and the executive management of our university to establish computer science as one of the core technological backbones of Clausthal University of Technology. This resulted in plans to increase the academic headcount to the size recommended by the German Association of Computer Science (Gesellschaft für Informatik).

As a consequence of this innovative decision, between 2003 and now, the department has undergone a period of fundamental change, characterized by the retirement of four colleagues, and the successful appointment of eight new professors. At the time of writing this report, two more professorial job openings have been advertised and the appointment process for these is underway.

In 2006, the department joined the European Bologna process by starting the transition from the German Diploma programme to the Bachelor/Master scheme. Today, the department offers a B.Sc. Informatik/Wirtschaftsinformatik (a Bachelor programme providing a joint foundation for students of computer science and business information technology), and M.Sc. programmes in computer science and in business information systems.

1.1.2 Current Situation

The current situation of the department is characterized by continuing organizational growth and the modernization of the educational concept. In addition, as we spell out below, the emergence of the NTH at the political horizon is foreboding further need for action and further changes far beyond the Department of Informatics. We feel that today the department is well set to actively participate in these actions, to master the changes, and to benefit from their effects.
1.1 Overview

Organizational Growth

Since the end of 2005, three new professors have been appointed: Prof. Dr. Niels Pinkwart (Collaboration Systems and Computer Supported Cooperative Work, since September 2006), Prof. Dr. Andreas Rausch (Software Systems Engineering, since January 2007), and, our latest new colleague, Prof. Dr. Sven Hartmann (Databases and Information Systems, since January 2008). While four professors had retired in the preceding reporting period, there were no leaves or retirements in 2006/07.

During the reporting period, the number of research staff grew from 20 to 29 (without professors). The department is also supported by four technicians and two trainees as well as six secretaries.

Modernization of the Educational Concept

A major achievement in the reporting period was the successful preparation and accreditation of the new Bachelor/Master programme in the context of the European-wide harmonization of university education systems, the Bologna process. Within the past two years, we were able to create attractive new Bachelor and Master programmes in the areas of computer science and business information technology to replace the Diploma programmes (see Section 2.2 for details).

In undergraduate education, the new B.Sc. Informatik/Wirtschaftsinformatik (computer science / business information systems) offers students a high quality foundation in computer science, mathematics, economy, and engineering. Based on this solid scientific underpinning, students can choose between two general directions:

- Computer Science and Engineering,
- Business Information Technology.

Within each direction, students can individually choose their specialization to prepare for different graduate programmes. This unique combination of computer science, computer engineering, and business information technology in a single programme allows students to choose their study direction only after one year; we are confident that having this possibility as well as the chance to switch between the directions easily in the first phase of studying improves the quality of decisions and reduces the number of students withdrawing early from university.
Our research-oriented Master programmes in computer science and business information systems build on these undergraduate courses. A unique feature of the Master programme *Business Information Systems* at Clausthal University of Technology is the possibility to specialize in the area of *Energy Management*. It focuses on IT-based scheduling, configuration, administration, and optimization of processes and systems for raw materials management, energy production, and distribution, addressing economic and technical aspects alike. Benefitting from both the professional and geographical proximity of the *Energieforschungszentrum Niedersachsen* (Research Centre for Energy of Lower Saxony) which is currently being established nearby in the town of Goslar, this Master Programme provides bright academic and industrial job prospects in a fascinating and essential future research area.

In addition, the department will contribute to the interdisciplinary B.Sc. programmes in *Applied Mathematics and Technical Economics* and to the interdisciplinary Master programmes in *Operations Research, Computer Science and Engineering*, and *Information Engineering (Informationstechnik)*.

### Scientific Re-Alignment

The ongoing selection and appointment of professorial staff, supported by the *Wissenschaftliche Kommission Niedersachsen* (WKN), and, in particular, by the chair of WKN, Prof. Dr. Detlef Schmid (Karlsruhe), has been conducted to sharpen and re-align the scientific profile of computer science at Clausthal University of Technology, with the objective to scientific excellence and the ability to compete in selected research domains.

To monitor the success of these activities, the WKN has performed an intermediate evaluation of the research activities of the computer science departments of universities in Lower Saxony in 2005. The results of this evaluation, which were made available to the department in early 2006, indicate that the efforts of the department (with the support of university management) are definitely leading in the right direction: The WKN reviewers attest “a remarkably good development” to the Department of Informatics, state that “the build-up of computer science in Clausthal and the filling of vacancies has been a success, against the reviewers’ expectations”, and come to the conclusion that “the development taken forward in Clausthal is impressive”.

Figure 1-1 shows today’s organization of the department in terms of research areas, as per the end of 2007. It shows that each of the five main research areas provides a unique scientific core, but also that there are strong areas of synergy between them.

An important indicator for the improving situation and successful scientific alignment are the number of scientific publications as well as memberships of researchers of the department in international programme committees.
Figure 1-1 Research areas of the Department of Informatics.

Figure 1-2 illustrates the development of the number scientific papers published by members of the department in books, international journals, conferences, and workshops between 2004 and 2007. It shows an overall increase of the department’s publication rate from 208 in the 2004/2005 reporting period to 243 in 2006/2007.

In the current climate of industrializing universities and focusing resources to “elites”, the acquisition of external funds is gaining importance as a key performance indicator for research. Figure 1-3 shows the development of funding income, broken down into two types of funds:

- Funding from national (e.g., BMBF, DFG) and international agencies (e.g., EC) as well as industry funding (“Drittmittel”)
- Additional funding acquired from the federal government of Lower Saxony, e.g., for e-Learning activities and innovation projects (“Sondermittel”).

The chart shows a very positive development of funding, even if per-capita funding is still somewhat below average for German computer science faculties, and further attention needs to be given to increasing it.
**Figure 1-2 Scientific publications of the department (2004–2007).**

**Figure 1-3 Funding acquisition of the department (2002–2007).**
Finally, it should be mentioned that the department has been active in numerous national and international cooperations in education and research, which led and will lead to new scientific results and funding prospects. In the area of scientific education, the collaboration with other universities within Lower Saxony in the ELAN programme is worth mentioning (see also Chapter 2) as well as our comprehensive involvement in the ERASMUS programme.

In research, we would like to point out three collaboration activities that stand for many others.

- **NTH School for IT Ecosystems**: The first is the preparation of a proposal for an *NTH School for IT Ecosystems* which has been jointly assembled by the Departments of Informatics of the three NTH universities Clausthal, Braunschweig, and Hannover, and which – once granted – will create a hub for excellent research in computer science at the NTH over the years to come. Clausthal University of Technology will take the lead in this initiative.

- **Centre of Simulation Sciences**: The second is the planned *Centre of Simulation Sciences*, for which a joint proposal with Göttingen University is currently under review. This interdisciplinary centre will also host mathematics, physics, engineering, and application sciences; Clausthal University of Technology has the lead role within the proposal.

- **Exzellenz-Initiative Profil und Kooperation**: Finally, the third collaborative activity we would like to mention is the successful application of Clausthal University of Technology and the FH Nordhausen in the “Exzellenz-Initiative Profil und Kooperation” for small and medium-sized universities (following a call for proposals by the *Stifterverband für die Deutsche Wissenschaft* and the *Heinz-Nixdorf Stiftung*), to be funded in 2008/09. The successful application in the “small” excellence initiative was mainly driven by the Departments of Informatics at Clausthal University of Technology.

### 1.1.3 Future Directions

The near future will bring a number of organizational and technical challenges for the department, which need to be mastered in order to ensure sustainable success:

- The current phase of growth needs to be followed by a phase of stabilization, in which the management processes as well as the supporting information and communication infrastructure needs to adapt to the fact that the department size has doubled within a few years. In addition, the remaining professorial vacancies in *Distributed Systems* and *Human-Centered Information Systems* need to be successfully filled by appointing high-quality candidates.
The introduction of the B.Sc./M.Sc. scheme to replace the well established Diploma programmes has inevitably created a disruption. In conjunction with a number of additional factors, such as the introduction of tuition fees in 2006, a general drop in the number of computer science students in Germany, and the increased national competition for students created by the German national government’s elite programme, there has been a drop in the number of computer science students over the past two years (from 628 in Winter 2005 to 480 in Winter 2007\(^1\)). Having gone through this transition period, with a set of modern curricula being in place now (see Chapter 2 for details), our primary focus is set on attracting excellent national and international students. Being a small university, we can achieve this by playing to our strengths to attract students by providing tailored and attractive offerings (such as the focus on areas like complex systems, or energy management), a healthy research-oriented environment, and an excellent supervision and mentoring programme, thus bundling and advertising the key advantages of a small university.

The process of growing together with our neighbour universities in Braunschweig and Hannover will lead to further opportunities (such as the above-mentioned School for IT Ecosystems), but also to organizational challenges such as establishing lightweight joint faculty structures. While our department seems in a good shape right now to exploit the opportunities and master the challenges, we will need to constantly sharpen and elaborate our vision of a modern department of informatics, attract excellent researchers, and maintain a productive and creative environment for doing high-quality research.

1.2 Staff

At the end of 2007 the department consisted of eight professors (permanent staff) including Prof. Dr. Hartmann who was appointed in December 2007 but started his work in Clausthal in January 2008, two apl. professors (außerplanmäßiger Professoren), two assistant professors (Juniorprofessoren), and three lecturers (on a temporary basis). In addition, Prof. Dr. Christian Siemers will be appointed from 1. April 2008 on to fill the vacant professorship of Communication and Distributed Systems (part-time, for the near future). For more detailed and recent information, please visit http://www.in.tu-clausthal.de/personen/.

\(^1\) Figures include computer science, business information systems, and information engineering programmes
Professors

- Prof. Dr. Jürgen Dix
  *Theoretical Computer Science and Computational Intelligence*

- Prof. Dr. Barbara Hammer
  *Theoretical Foundations of Computer Science*

- Prof. Dr. Sven Hartmann (since 01/2008)
  *Databases and Information Systems*

- Junior-Prof. Dr. Kai Hormann
  *Computer Graphics*

- apl. Prof. Dr. Günter Kemnitz
  *Hardware-Design and Robotics*

- Prof. Dr. Jörg Müller
  *Business Information Systems and Technologies*

- Junior-Prof. Dr. Niels Pinkwart (since 09/2006)
  *Collaboration Systems and CSCW (Computer Supported Cooperative Work)*

- Prof. Dr. Andreas Rausch (since 02/2007)
  *Software Systems Engineering*

- apl. Prof. Dr. Matthias Reuter (CUTEC)
  *Modelling andSimulation*

- Prof. Dr. Harald Richter
  *Computer Networks*

- Prof. Dr. Christian Siemers (50%, since 04/2008)
  *Databases and Information Systems*

- Prof. Dr. Gabriel Zachmann
  *Multimedia*

Lecturers

- Dipl.-Winf. Martina Kratzsch, Deutsche Post
  *Project Management*

- PD Dr. Helmut Lessing (CUTEC)
  *Computer Science in Environmental Studies*

- Dr. Frank Padberg (until 09/2006)
  *Software Engineering*, temporary substitute for the vacant chair

- Prof. Dr. Christian Siemers (FH Nordhausen, until 03/2008)
  *Embedded and Distributed Systems*

Former Professors

- Prof. Dr. Klaus Ecker (until 3/2005)
  *Applied Computer Science*
• Prof. Dr. Torsten Grust (2/2005—5/2005)  
  *Databases*

• Prof. Dr. Gerhard Joubert (until 9/2003)  
  *Practical Computer Science*

• Prof. Dr. Ingbert Kupka (until 3/2004)  
  *Theoretical Computer Science*

• Prof. Dr. Wilfried Lex (until 9/2004)  
  *Mathematical Foundations of Computer Science*

## 1.3 Organization

- **Head of department (Institutsdirektor)**
  - Prof. Dr. Jürgen Dix (10/2004 — 03/2008)
  - Prof. Dr. Jörg Müller (since 04/2008)

- **Board of trustees (Direktorium)**
  - Prof. Dr. Jürgen Dix, Prof. Dr. Barbara Hammer, Prof. Dr. Jörg Müller (04/2005 — 03/2008)
  - Prof. Dr. Barbara Hammer, Prof. Dr. Jörg Müller, Prof. Dr. Gabriel Zachmann (since 04/2008)

- **Technical staff (permanent)**
  - Dipl.-Ing. (FH) Thomas Bravin
  - Jörn Körner
  - Dipl.-Geophys. Klaus Eulner
  - Björn Drude (since 01/2008)

- **Technical staff (trainees)**
  - Marko Kaeming (until 07/2006)
  - Maximilian Quellmalz (until 09/2006)
  - Claus Reinke (until 07/2007)
  - Peter Platzdasch (since 08/2006)
  - Adem-Deniz Yavuz (since 08/2007)

- **Secretarial staff (permanent)**
  - Andrea Behfeld (since 06/2007)
  - Stefanie Cronjäger
  - Christine Kammann
  - Sandra Karpenstein
1.3 Organization

- Annett Panterodt (since 03/2006)
- Anita Seiz-Uhlig

1.3.1 Mentoring Programme

Since the winter term 2005/2006, the department has been providing a mentoring programme for first-year students in computer science that helps to get accustomed to the new environment. Divided into groups of 5 to 10 students, they meet once a week in order to discuss the pitfalls and problems of daily university life.

Each group is coordinated and led by an experienced sophomore student that not only helps by giving practical advice but also takes them on a tour to the local night life and cultural activities. In addition, each group is supervised by one of the professors to help build a familiar atmosphere and to act as a confidant in case of problems.

For more information, see [http://www.in.tu-clausthal.de/studium/mentorenprogramm/](http://www.in.tu-clausthal.de/studium/mentorenprogramm/)

1.3.2 Colloquium Series

The colloquium series was initiated in the winter term 2004/2005 and serves as a communication platform for interchanging ideas between the different fields of computer science and related areas. It is a forum for our graduate and postgraduate students to get into contact with internationally renown scientists and to initiate short term stays abroad, e.g., within the scope of a Master’s thesis. Therefore, we invite speakers from all over the world to present their recent scientific advances and to discuss possible cooperations on future joint projects. In the reporting period, 38 guest researchers visited our department and presented their work in the colloquium series.

- Summer 2006
  - PD Dr. Pedro José Marrón (27.04.2006)  
    _Adaptation and Cross-Layer support for Self-Configuring Sensor Networks_
  - Dr. Franziska Klügl-Frohnmeyer (27.04.2006)  
    _Agentenbasierte Simulation komplexer verteilter Systeme_
  - Dr. Peter Langendörfer (27.04.2006)  
    _Privatsphäre im mobilen Internet: Von Versprechungen zum Schutz_
  - Dr. Martin Gaedke (27.04.2006)  
    _Föderation – Kommunikation mit dem Unbekannten_
  - Dr. Gerhard Weiss (28.04.2006)  
    _Kommunikationssemantik für Agentensysteme_
- Dr. Gero Mühl (28.04.2006)
  Eine Selbstorganisierende Infrastruktur für Publish/Subscribe-Systeme

- Dr. Ramin Yahyapour (28.04.2006)
  Effizientes Ressourcen-Management in Grid Systemen

- Dr. Niels Pinkwart (19.05.2006)
  Graphbasierte Modelle als Kooperationswerkzeug

- Dr. Andreas Wombacher (19.05.2006)
  Ein Interoperabilitätskriterium für zustandsbehafteten Dienste

- Dr. Roland Müller (19.05.2006)
  Integration und Konsistenzprüfung von verteilen, unscharfen Daten – Ein Fuzzy Logik basierter Ansatz

- PD Dr. Thomas Villmann (12.06.2006)
  Information Optimum Vector Quantization

- Prof. Dr. Ulrich Reif (12.06.2006)
  Analyse des Vierpunkt-Schemas

- Dr. Johannes Maria Zaha (15.06.2006)
  Lett's Dance: Eine Sprache zur Modellierung von Interaktionen in Service-basierten Umgebungen

- Dr. Sebastian Sardina (22.06.2006)
  Hierarchical Planning in BDI Agent Programming Languages: A Formal Approach

- Prof. Dr. Andreas Kolb (26.06.2006)
  Einsatzpotentiale der PMD Technologie für Computer-Graphik und Computer-Vision

- Prof. Dr. Ilkka Niemelä (04.07.2006)
  Bounded Model Checking using Answer Set

- Dipl.-Inf. Thomas Knothe (11.07.2006)
  Geschäftsprozessmodelle für das Unternehmensmanagement in der Anwendung

- Dr. Martin Lauer (18.07.2006)
  Weltmeister werden! Wie Roboter Fußball spielen lernen

Winter 2006/2007

- Prof. Guillermo Simari (14.09.2006)
  Fundamentals of Defeasible Reasoning and Argumentation

- Prof. Alexander Smirnov (19.09.2006)
  Context-Driven Driven Methodology for Operational Decision Making in Network-Centric Environment
1.3 Organization

- Dr. Benjamin Hirsch (13.11.2006)
  *Agents and Service Oriented Architectures*

- Sebastian Bader (12.12.2006)
  *Logische Programme und Neuronale Netze: “The Core Method”*

- Dr. Marina DeVos (15.01.2007)
  *TOAST: Applying Answer Set Programming to Superoptimisation*

- Prof. Dr. Georg Umlauf (29.01.2007)
  *Image and Video-Stream Encoding Using Near-Optimal Triangulations*

- Jacek Malec (30.01.2007)
  *Active Logics – an Overview*

- Junior-Prof. Dr. Thomas Barth (13.03.2007)
  *Verteilte, Service-orientierte Unterstützung wissensintensiver Prozesse auf Basis von PDM/PLM*

**Summer 2007**

- Dr. Yingqian Zhang (25.04.2007)
  *Cooperative and Selfish Task Allocation in Agent Social Networks*

- Dr. Dirk Draheim (14.05.2007)
  *Dialoque Specification in a Service-Oriented Architecture*

- Prof. Dr. Konrad Polthier (13.06.2007)
  *Global Parameterization of Surface Meshes using Branched Coverings*

- Dipl.-Inf. Thomas Knothe (10.07.2007)
  *Unternehmensmodellierung in der Praxis*

- Dr. Gerald Weber (07.08.2007)
  *Integrierte Zustandsmodellierung und Datenmodellierung*

**Winter 2007/2008**

- Banchar Arnonkijpanich (09.11.2007)
  *Adaptive Second Order Self-Organizing Mapping for Pattern Representation and SOM Based Local Inverse Mapping for Parameter Estimation*

- Dr. Elmar Dorner (12.11.2007)
  *Insights in SAP Research and a Glimpse on the “Semantic” Research Work*

- Dr. Frank-Michael Schleiß and PD Thomas Villmann (27.11.2007)
  *Fuzzy Classification and Visualization of Proteomic Spectra*

- Prof. Dr. Stefan Müller (16.01.2008)
  *Das RBG-Wunder*

- Prof. Guillermo Simari (25.01.2008)
  *On the Interplay of Defeasible Reasoning and Partial Order Planning*
1.3.3 Graduate and Postgraduate Seminar

In the Graduate and Postgraduate Seminar, our graduate and postgraduate students report on their recent scientific achievements. So far, we have had the following talks:

- **Summer 2006**
  - Ralf Bruder (28.04.2006)  
    *Real-Time Image Warping*, supervised by Prof. Dr. Hormann.
  - Nils Bulling (05.05.2006)  
    *Modale Logiken für Spiele, Zeit und Glauben*, supervised by Prof. Dr. Dix.
  - Detlef Jantz (01.06.2006)  
    *Eine Prozessorarchitektur für mehr Softwarezuverlässigkeit*, supervised by Prof. Dr. Siemers.
  - Jan Winhuysen (06.06.2006)  
    *Entwurf und Implementierung eines Werkzeugs zur statischen Analyse von Java Bytecode*, supervised by Prof. Dr. Dix.
  - Rene Weller (08.06.2006)  
    *Kinetic Bounding Volume Hierarchies for Deformable Objects*, supervised by Prof. Dr. Zachmann.
  - Morris Timm (22.06.2006)  
    *3D-Scannen und Objektrekonstruktion*, supervised by Prof. Dr. Hormann.
  - Tim Winkler (22.06.2006)  
    *Aufnahme und Animation von Punktwolken*, supervised by Prof. Dr. Hormann.
  - Sascha Lützel (29.06.2006)  
    *Die Adaptierung des retargierbaren Little-C-Compilers zur Erzeugung von Binärcode für die Protection Enhanced Risc Maschine (PERM)*, supervised by Prof. Dr. Siemers.
Winter 2006/2007

- Ronny Kramer (09.11.2006)
  Interessenerfassung zur Personalisierung von Touren mit mobilen Informationssystemen und deren Auswirkungen auf das Verhalten von Touristen, supervised by Prof. Dr. Müller.

- Patrick Stiefel (22.02.2007)
  A Peer-To-Peer (P2P) Based Product Collaboration Platform (PCP) Supporting Decentral Collaborative Product Development, supervised by Prof. Dr. Müller.

- Marcel Wille (22.02.2007)
  CarRing II: A Real-Time Computer Network as Successor of Flexray?, supervised by Prof. Dr. Richter.

- Peter Novák (22.02.2007)
  Programming Languages for Cognitive Agents, supervised by Prof. Dr. Dix.

- Björn Schindler (02.03.2007)
  Modellierung des CarRing II-Netzwerks und Implementierung der OSI-Schichten 1 und 2a im Network Simulator 2, supervised by Prof. Dr. Richter.

- Tim Winkler (20.03.2007)
  Conformal Remeshing, supervised by Prof. Dr. Hormann.

- Dietmar Sommerfeld (20.03.2007)
  Daten- und Workflow-Management in MediGRID, supervised by Prof. Dr. Richter.

- Nils Bulling (20.03.2007)
  Agents, Beliefs, and Plausible Behavior in a Temporal Setting, supervised by Prof. Dr. Dix.

Summer 2007

- Janko Heilgeist (15.05.2007)
  Distributed Meta-Scheduling, supervised by Prof. Dr. Richter.

- Markus Melato (15.05.2007)
  Rekonstruktion von 3D Oberflächen mittels neuronaler Verfahren, supervised by Prof. Dr. Hormann.

- Dirk Niebuhr (15.05.2007)
  Concepts for Dynamic Wiring of Components, supervised by Prof. Dr. Rausch.

- Christian Reimann (22.05.2007)
  Generierung natürlicher Sprache mittels Merge Neural Gas, supervised by Prof. Dr. Hammer.
• Maik Fröchtenicht (22.05.2007)
  Optische Flussschätzung mit einem Zellenautomaten: Simulation der
  Algorithmen und Ergebnisvisualisierung auf dem PC, supervised by
  apl. Prof. Dr. Kemnitz.

• Martin Schulze (30.05.2007)
  Visualisierung von hierarchischen Prozessabläufen am Beispiel der Plan-
  nungssoftware eM-Planner, supervised by Prof. Dr. Müller.

• Matthias Brückner (30.05.2007)
  Spezifikation des automatisierten SWIFT-Bestätigungsabgleichs unter SAP-
  Treasury am Beispiel einer Treasury Plattform der Volkswagen AG, super-
  vised by Prof. Dr. Müller.

• Patrick Marahrens (30.05.2007)
  Skill-Management: Entwurf eines Anforderungskataloges zur Evaluierung
  einer Softwarelösung für eine IT-Unternehmensberatung, supervised by
  Prof. Dr. Müller.

• Michael Lesniak (24.07.2007)
  Communication over Conflicts in Distributed, Evolving Ontologies, supervised by
  Prof. Dr. Dix.

• Xavier Queralt (24.07.2007)
  Model Checking of Rational Behaviour of Agents, supervised by
  Prof. Dr. Dix.

• Moises Perez (24.07.2007)
  Theory and Practice of the Motorola MCU 12 Microcontroller – Description
  and Code Examples, supervised by Prof. Dr. Richter.

• Marco Baye (07.09.2007)
  Entwicklung eines Device-Treibers und Reglers für die Motoren und das
  Lenkrad am Steer-by-Wire-Teststand, supervised by Prof. Dr. Richter.

• Thomas Dokters (12.09.2007)
  Konzeption und Implementierung einer Schnittstelle zur Integration von PLM-
  Teilsystemen auf DX-Basis in die Product Collaboration Platform, super-
  vised by Prof. Dr. Müller.

Winter 2007/2008

• Wilhelm Hannemann (05.10.2007)
  Auflösungsverbesserung von Tiefenbildern durch registrierte Farbbilder, super-
  vised by Prof. Dr. Hormann.

• Christian Bartelt (16.11.2007)
  Zusammenführung von unabhängig weiterentwickelten Modellversionen, super-
  vised by Prof. Dr. Rausch.
1.3 Organization

- Holger Klus (16.11.2007)
  *Einfluss von Kontextinformation auf die Verschaltung von Komponenten-Instanzen in dynamiisch-adaptiven Systemen*, supervised by Prof. Dr. Rausch.

- Daniel Mohr (16.11.2007)
  *Segmentation of Distinct Homogeneous Color Regions in Images*, supervised by Prof. Dr. Zachmann.

- Martin Ahke und Marco Fiedler (19.11.2007)

- Jana Wackerow (19.11.2007)
  *Design und Realisierung des Business Process Monitoring für den Applikationsbetrieb auf Basis SAP Exchange Infrastructure am Beispiel einer Treasury Plattform der Volkswagen AG*, supervised by Prof. Dr. Müller.

- Sara Bessling (19.11.2007)
  *Modellgetriebene Integration ausführbarer Produktenwicklungsprozesse in einer dezentralen Kollaborationsplattform*, supervised by Prof. Dr. Müller.

- Harald Klein (18.12.2007)
  *Collaboration Processes of Enterprises – Modelling and Formalization*, supervised by Prof. Dr. Müller.

- Hannes Olivier (08.01.2008)
  *Computer Supported Collaborative Work mit Multiversen*, supervised by Prof. Dr. Pinkwart.

- Alexander Hasenfuss (08.01.2008)
  *Magnification Control in Relational Neural Gas*, supervised by Prof. Dr. Hammer.

- Tristan Behrens (08.01.2008)
  *Model Checking with Logic Based Petri Nets*, supervised by Prof. Dr. Dix.

For more information, see [http://www.in.tu-clausthal.de/studium/diplomanden-und-doktorandenseminar/](http://www.in.tu-clausthal.de/studium/diplomanden-und-doktorandenseminar/).
1.3.4 **Technical Report Series**

The department’s Technical Report Series (ISSN: 1860-8477) was started in 2005 and publishes recent scientific results, either as preliminary version of articles under submission or in print, or as extended versions of workshop proceedings papers. The papers are expected to be written in English and undergo an internal review process. The review board consists of the current and the retired professors of the department. The Editor-in-Chief of the series is Prof. Dr. J. Dix.

For more information, see [http://www.in.tu-clausthal.de/forschung/technical-reports/](http://www.in.tu-clausthal.de/forschung/technical-reports/).

Technical reports in 2006/2007:


1.3 Organization

[Ifl-06-10] Wojciech Jamroga and Jürgen Dix. Model checking abilities under incomplete information is indeed $\Delta^P_2$-complete. Technical Report IfI-06-10, Clausthal University of Technology, October 2006.


[Ifl-06-12] Peter Novák and Jürgen Dix. Adding structure to agent programming languages. Technical Report IfI-06-12, Clausthal University of Technology, November 2006.


[Ifl-07-03] Jacek Blazewicz, Klaus Ecker, and Barbara Hammer, editors. ICOLE-2007, German-Polish Workshop on Computational Biology, Scheduling and Machine Learning, Technical Report IfI-07-03, Clausthal University of Technology, June 2007.


1.4 Other Events

1.4.1 Nacht der Informatik

In the summer of 2007, the department participated in the Informatics Night that was celebrated at universities all over Germany as part of the Informatics Year 2007. The many visitors of this event participated in several activities related to the department’s ongoing research activities, among them:

- taking a dive in our full size virtual aquarium,
- catching virtual balls with a cyberglove,
1.4 Other Events

- digitizing real world objects with a 3D scanner,
- interacting with our robots.

Besides these serious applications, we also organized an interactive game show with live transmission among our ELAN partners, an internet café, a LAN party, and further entertained the visitors with live music, food, and drinks.

Figure 1-4 Nacht der Informatik.

1.4.2 Apl. Professorship

Dr. Matthias Reuter has been awarded the degree of außerplanmäßiger Professor (apl. Prof.) for his continuous lecturing at our department since his habilitation.

Apl. Prof. Dr. Matthias Reuter did his habilitation in 2002 at our department and is employed at CUTEC, where he holds the position of an Abteilungsleiter. He is an associated member of the Computational Intelligence Group: his research centres around applications of neural nets and fuzzy reasoning in various areas.
1.4.3 Junior Professorship Evaluation

In September 2007, we had the pleasure to attend a ceremony at the President’s office held on the occasion of the successful mid-term evaluation of our colleague, Prof. Dr. Kai Hormann. After three years of a successful career both as a scientist and a university lecturer, his contract has been renewed for another three years, and we are all looking forward to our continued collaboration.

All of Prof. Hormann’s evaluations were not only positive, they were excellent in all respects: This was explicitly mentioned in his overall evaluation report. Kai is also engaged in several management tasks of the Department and very popular among students and colleagues alike.

1.5 Guests at our Department

- 21 June – 28 June 2006:
  Dr. Sebastian Sardina, RMIT University Melbourne, Australia. Guest of the Computational Intelligence Group.

- 3 July – 10 July 2006:
  Prof. Ilkka Niemelä, Helsinki University of Technology, Finland. Guest of the Computational Intelligence Group.

- 28 July 2006 – 5 August 2006:
  Prof. Dr. Nira Dyn, Tel Aviv University, Israel. Guest of the Computer Graphics Group.

- 28 July 2006 – 5 August 2006:
1.5 Guests at our Department

Figure 1-6 The President of Clausthal University of Technology, Prof. Dr. Edmund Brandt (right), congratulating Prof. Dr. Kai Hormann and his wife, Dott.ssa Margherita Bandirali.

☐ 14 September – 21 September 2006:
   Prof. Guillermo Simari, Universidad Nacional del Sur, Bahia Blanca, Argentina. Guest of the Computational Intelligence Group.

☐ 21 June – 21 July 2007:
   Sergio Gomez, Universidad Nacional del Sur, Bahia Blanca, Argentina. Guest of the Computational Intelligence Group.

☐ 8 September – 23 September 2007:
   Dr. Carlos Chesnevar, Universidad Nacional del Sur, Bahia Blanca, Argentina. Guest of the Computational Intelligence Group.

☐ 15 October 2007 – 19 October 2007:

☐ 17 November 2006 – 1 December 2006:
   Andreas Raabe, Bonn University, Germany. Guest of the Computer Graphics Group.

☐ 26 November – 29 November 2007:
   Dr. Frank-Michael Schleiff and PD Thomas Villmann, Universität Leipzig, Germany. Guest of the Computational Intelligence Group.
2 Academic Programmes

2.1 Overview

Choosing to study at the Department of Informatics at Clausthal University of Technology means choosing to study off the beaten tracks offered by most of the major German universities. Overcrowded lecture halls and anonymous mass education are unknown to our students who benefit from an optimal 35:1 student/lecturer-ratio. With more than 20% female students we have one of the best balanced gender ratios in computer science in Germany. In addition the department has an international flair due to the large percentage of foreign students (40%) and due to the worldwide collaborations in terms of student exchange programmes (29 partner universities in Europe) and ongoing research activities. Our students further enjoy the beautiful landscape of the Harz mountains as a perfect setting for recreational and sports activities, or simply to counterbalance their intensive studies. All these aspects make Clausthal in general and the Department of Informatics in particular a distinguished place.

The Department of Informatics currently has about 500 students (more than 15% of the total number of students in Clausthal) inscribed, in one Bachelor and two Diploma programmes\(^2\). Following the Bologna-process, the Bachelor programme has already replaced the Diploma programmes on the undergraduate level, and we are currently in the process of establishing two Master programmes that will eventually replace the Diploma programmes on the graduate level. In addition, the Department significantly contributes to other programmes, especially in the mathematical and engineering sciences, by offering introductory and programming courses on the Bachelor level as well as advanced courses on the Master level.

\(^2\) Here we also count the students inscribed in the Diploma Programme Informationstechnik, which is a joint programme run by our department as well as the engineering department: Both belong to the same faculty and in official statistics, the number of students is divided and counted for both departments.
2.2 Study Programmes

2.2.1 B.Sc. Programme

From the beginning of the winter semester 2006/2007 on, our new Bachelor programme B.Sc. Computer Science/Business Information Systems has replaced the existing Diploma programmes on the undergraduate level. With currently 96 students (among them, 41 first year students), the Bachelor programme has had a successful start and the fact that 2/3 of the students are foreigners proves that it is internationally attractive. Our Bachelor programme can be started in either the winter or the summer semester.

In accordance with the European-wide Bologna process for harmonization of university education systems, this programme leads to the B.Sc. vocational qualification after a standard period of six semesters of study. Upon completion, it can be followed on by one of our two Master programmes, which require a further four semesters of study.

During the Bachelor programme the students are familiarized with the fundamentals of computer science, mathematics, and one chosen subject of application or main focus, for which there are three options:

- Computer Science,
- Business Information Systems,
- Computer Engineering.

The programme has a modular course structure. The first year of study consists of compulsory courses which provide the student with the necessary fundamental knowledge. In the second and third year, studies consist of different compulsory courses, depending on the chosen main focuses which communicate further fundamental knowledge and a specialization in specific areas is reached by an individual combination of elective courses. The programme is completed by writing a Bachelor’s thesis.

A detailed list of compulsory and elective courses as well as other information can be found at [http://www.in.tu-clausthal.de/studium/studiengaenge/smallbsc-informatik-wirtschaftsinformatiksmall/](http://www.in.tu-clausthal.de/studium/studiengaenge/smallbsc-informatik-wirtschaftsinformatiksmall/).

2.2.2 M.Sc. Programmes

From the beginning of the winter semester 2007/08 on, two Master programmes in Computer Science and Business Information Systems are offered by the Department of Informatics.
The Master programmes require 4 semesters of study and build on our Bachelor programme in Computer Science/Business Information Systems. The Master programmes enable our students to choose a main focus that will communicate an advanced and specialized knowledge in one of the following fields:

- Human-Centred Computing,
- Parallel, Distributed, and Networked Computation,
- Computer Engineering,
- Business Information Systems,
- Energy Management.

As well as participating in lectures, the students will be guided towards producing scientific work within seminars and lab sessions. In the final stage of the programme the students are required to write a research oriented Master’s thesis.

More information can be found at
http://www.in.tu-clausthal.de/en/studium/studiengaenge/mscinformatik/ and

2.2.3 Diploma Programmes

With currently 123 students (among them, 44 foreigners) in our Diploma programme Computer Science and 159 students (among them, 64 foreigners) in our Diploma programme Business Information Systems, they still constitute the Department’s main teaching focus.

The aim of both programmes is to educate young academics with a broad knowledge in computer science, a thorough mathematical background, and optionally with a solid background in economics. They shall not only learn the necessary tools (i.e., programming languages) for developing algorithmic solutions, but moreover have the ability to analyse problems in a structured way and to apply the solutions. Equipped with these abilities they are fit for the market with a wide range of job opportunities.

The first two years of this programme are characterized by a thorough introduction to the foundations of computer science as well as the essential background in mathematics. Next to the standard beginner’s courses the students attend courses that familiarize them with the most common programming languages (C/C++, Java, Prolog, assembler) as well as a lab course on electrical circuits. A seminar course and lectures in a self-chosen minor subject are also obligatory.
Starting with the third year, the students are then offered advanced courses on specialized subjects in attractive fields of computer science as well as modern information and communication technologies. Besides these lecture courses, we organize interesting seminars, project groups, and lab courses, and offer a wide selection of Diploma theses for the students to choose from. The programme is usually completed after four to five years. For students of the Diploma programme *Business Information Systems*, some of the courses are replaced by special lectures on business information systems and economics.

More information can be found at [http://www.in.tu-clausthal.de/studium/studiengaenge/informatik/](http://www.in.tu-clausthal.de/studium/studiengaenge/informatik/) and [http://www.in.tu-clausthal.de/studium/studiengaenge/wirtschaftsinformatik/](http://www.in.tu-clausthal.de/studium/studiengaenge/wirtschaftsinformatik/).

### 2.2.4 Ph.D. Programme

We currently have more than 30 young academics inscribed as Ph.D. students. Under the supervision of one of the department’s professors, they perform innovative research and present their results at international conferences. In addition, they assist the teaching staff by organizing exercise courses and seminars and co-supervising study and Diploma theses.

The Ph.D. studies usually last three to five years and are completed by submitting and defending a dissertation. Within the last two years we had the pleasure to graduate six students (cf. Section 4.6 on page 166):

- Dr. Sabine Bostelmann: *Computing with Activities*
- Dr. Andreas Brüning: *Kontinuierliche und multi-distributive Erweiterung von Estimation of Distribution Algorithms*
- Dr. Ulrich Frank: *High Level Design of Consumer Multimedia Information Systems within the Framework of Long Term Use and Technology Trends*
- Dr. Christian Heller: *Ganzheitliches evolutionäres Wissensmanagement zur Effizienzsteigerung im frühen Produktentstehungsprozess am Beispiel der Automobilindustrie*
- Dr. Frank-Michael Schleif: *Prototype based Machine Learning for Clinical Proteomics*
- Dr. Silke Schomann: *Adaptive Resource Management in Distributed Real-Time Systems with Continuous Mode Changes*
2.3 eLearning

According to an agreement between the Departments of Informatics at Clausthal University of Technology and the University of Göttingen from September 2002, we developed and maintain a common course schedule. These activities are part of the “eLearning Academic Network Niedersachsen” (ELAN).

For more than four years now we have been exporting and importing lectures between both universities, using sophisticated multimedia-based technology that not only allows the students to watch and listen to the remote lecturer and see the slides but also to interactively ask questions.

Carefully designed polls among the audience reveal that the students accept this kind of virtual lectures as long as the lecturer commutes between the universities, so that all students enjoy his or her physical presence.

The department also participates in the latest ELAN-funded project named ATLANTIS, a collaboration of the chairs for business information systems of the universities of Braunschweig, Clausthal, Göttingen, Hannover, Oldenburg, and Osnabrück. The objective of this project is to set common principles for the curricula of the introductory courses in business information technology and to exchange courses on the Bachelor level based on internet technology.

For more information, we refer to [http://www.elan-niedersachsen.de/index.php?id=582](http://www.elan-niedersachsen.de/index.php?id=582).

2.4 International Collaborations

At the Department of Informatics we encourage the students to experience the international character of computer science by participating in a foreign exchange study programme. In close collaboration with the International Office, we offer to study as part of the SOCRATES/ERASMUS programme at the following universities (see also Figure 2-1):

- Varna University of Technology, Bulgaria
- Helsinki University of Technology, Finland
- Université Catholique de Lille, France
- Université de Metz, France
- Université Pierre et Marie Curie a Paris, France
- University of Durham, UK
- Reykjavik University, Iceland
- Università degli Studi dell’Aquila, Italy
- Università della Calabria, Italy
- University of Trento, Italy
Figure 2-1 Overview of our SOCRATES/ERASMUS partner universities.

- University of Malta, Malta
- Rijksuniversiteit Groningen, Netherlands
- Bergen University College, Norway
- Buskerud University College, Norway
- Gdansk University of Technology, Poland
- Jan Długosz University in Częstochowa, Poland
- Universidade Nova de Lisboa, Portugal
- Universitatea Alba Iulia, Romania
- Universitatea din Petrosani, Romania
- Linköping University, Sweden
- Comenius University in Bratislava, Slovakia
- University of Lleida, Spain
- Universidad Rey Juan Carlos, Spain
- Universidad Politécnica de Madrid, Spain
- Universidad de Alcalá, Spain
- Izmir University of Economics, Turkey
- Budapest University of Technology and Economics, Hungary
- University of Cyprus, Cyprus
2.5 Further Activities

Besides the academic activities for our current students we also regularly organize events targeting at our prospective students.

2.5.1 Summer Seminar

Every year during a summer weekend in June or July, the Department of Informatics invites high school students in their last or second-last year from all-over the country to Clausthal to participate in an informative two-day seminar.

In collaboration with the university’s Office for Public Relations (many thanks to Jochen Brinkmann for organizing this event) we offer an interesting programme to inform about and advertise our study programmes. After a general introduction that features the key facts on studying in Clausthal in general and at the Department of Informatics in particular, the professors give down-to-earth overviews of some of their special fields and invited alumni as well as advanced graduate students illustrate the students’ perspective.

The meeting is rounded off by a barbecue party on the evening of the first day.

For more information, we refer to http://www.in.tu-clausthal.de/en/fuer-schueler/schuelerseminar/.

2.5.2 School Information Days

Once a year in springtime, we also address the even younger prospective students from nearby high schools. Since 1981, the annual university-wide school information days are an inherent part of the university information programme. On two days, more than 1000 students from about 30 high schools in Lower Saxony and Saxony-Anhalt visit the university and its departments. It is a good chance for prospective students to familiarize themselves with the city of Clausthal, the university, study programmes, and future job prospects. The students visit the different departments in small groups of 20 to 25 students, each guided by a student of Clausthal University of Technology.

As part of the school information days, the Department of Informatics welcomes more than 10 groups on both days. Within one and a half hours, we provide general information about computer science in Clausthal and life at the university, and we answer questions regarding the university and our study programmes. After the general introduction we offer interesting talks, spectacular presentations, and hands-on experiments, e.g.,

Robotics presentation,
Development of a peer-to-peer chat,
Database experiments,
Research topics in Computer Graphics, and
Virtual Reality.

Every year, some of the first-year students at Clausthal University of Technology are former participants of the school information days, underlining the success of this event.

For more information, we refer to 
http://www.wissenschaft-erleben.de/schuelerinfotage/.

2.5.3 Girls’ Day

Moreover, the department participates in an annual event organized by the Equal Opportunities Office since fall 1995 that particularly addresses female pupils and aims at getting them interested in studying engineering or sciences at Clausthal University of Technology. During one week, about 20 to 25 pupils from all-over Germany attend regular university lectures, take part in 2-hour practical exercises, get into contact with both students and lectures, and visit a number of institutes. Moreover, they participate in several leisure activities.

For more information, we refer to
http://www.gb.tu-clausthal.de/schnupperstudium/.

2.6 Lecturing

In this section we list all the lecture courses, seminars, and labs from summer term 2006 until winter term 2007/2008. For each course we denote by \((x, y, z)\) the weekly hours: \(x\) denotes lecture hours, \(y\) exercise hours, and \(z\) lab hours or seminar hours.

For more detailed information about all courses, we refer to the online university course catalogue at
https://qis.tu-clausthal.de.

2.6.1 Grundstudium/Bachelor

SS 06: Courses and Seminars

- Informatik II (4, 2, 0)
  Zachmann
- Informatik IV (3, 1, 0)
  Richter and Guerrouat
2.6 Lecturing

- Einführung in die Elektronik (Technische Informatik) (3, 1, 0)
  Kemnitz and Giesemann

- Technisches Grundpraktikum (0, 0, 1)
  Kemnitz and Asam

- Anwendungssysteme (3, 0, 0)
  Padberg, Schomann, and Behrens

- Wirtschaftsinformatik II (3, 1, 0)
  Müller and Melato

- Programmierkurs II/Mikrorechner (2, 0, 0)
  Kemnitz and Jantz

- Neural Computation (3, 1, 0)
  Hammer and Hasenfuss

- Proseminar Applications of AI (0, 0, 2)
  Dix

- Proseminar Modern Heuristics (0, 0, 2)
  Hammer and Hasenfuss

**WS 06/07:** Courses and Seminars

- Informatik I (4, 2, 0)
  Pinkwart and Mohr

- Informatik III (3, 1, 0)
  Dix and Bulling

- Werkzeuge der Informatik (2, 2, 0)
  Dix, Hammer, Hormann, Müller, Richter, and Zachmann

- Rechnertechnologie/Rechnergestützter Entwurf digitaler Schaltungen (2, 1, 2) Kemnitz

- Technisches Grundpraktikum (0, 0, 1)
  Kemnitz

- Wirtschaftsinformatik I (3, 1, 0)
  Müller and Stiefel

- Grundlagen der Programmierung (Programmierkurs I) (2, 1, 0)
  Pinkwart and Melato

- Programmierpraktikum (0, 0, 4)
  Behrens and Novák

- Proseminar Digitale Bildverarbeitung (0, 0, 2)
  Tadjine

- Proseminar Data Mining (0, 0, 2)
  Hammer and Hasenfuss
SS 07: Courses and Seminars

- Informatik II (4, 2, 0)
  Rausch, Appel, and Deynet
- Informatik IV (3, 1, 0)
  Richter and Asam
- Einführung in die Elektronik (Technische Informatik) (3, 1, 0)
  Kemnitz, Giesemann, and Jantz
- Technisches Grundpraktikum (0, 0, 1)
  Kemnitz and Jantz
- Wirtschaftsinformatik II/Modellierung von Informationssystemen (3, 1, 0)
  Müller and Melato
- Programmierkurs/Programmierkurs I (2, 1, 0)
  Rausch, Appel, and Klus
- Programmierkurs II (2, 0, 0)
  Kemnitz
- Einführung in die Mobellbildung und Simulation von Systemen (3, 1, 0)
  Reuter
- Neural Computation (3, 1, 0)
  Hammer and Hasenfuss
- Softwaretechnik II (3, 1, 0)
  Rausch, Fischer, and Herold
- Verteilte und kooperative Systeme (2, 1, 0)
  Pinkwart and Olivier
- Rechnernetze II (3, 1, 0)
  Richter and Wille
- Mobilkommunikation I (2, 0, 0)
  Hogrefe and Wille (eLearning import)
- Proseminar Ausgewählte Kapitel der KI (0, 0, 2)
  Dix
- Proseminar Computergraphik (0, 0, 2)
  Hormann

WS 07/08: Courses and Seminars

- Informatik I (4, 2, 0)
  Rausch, Appel, and Deiters
- Informatik III (3, 1, 0)
  Hammer and Hasenfuss
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credits</th>
<th>Lecturers</th>
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<tbody>
<tr>
<td>Werkzeuge der Informatik (2, 2, 0)</td>
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<td>Dix, Hammer, Hormann, Müller, Richter, and Zachmann</td>
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<tr>
<td>Werkzeuge der Informatik für Physiker (2, 2, 0)</td>
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<td>Dix, Hammer, Hormann, Müller, Richter, and Zachmann</td>
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<td>Elektronik I (3, 2, 0)</td>
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<td>Kemnitz and Giesemann</td>
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<td>Einführung in die Wirtschaftsinformatik (3, 1, 0)</td>
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<td>Müller and Stiefel</td>
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<tr>
<td>Wirtschaftsinformatik III: Integrierte Anwendungssysteme (3, 1, 0)</td>
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<td>Müller and Hornung</td>
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<tr>
<td>Grundlagen der Programmierung (2, 1, 0)</td>
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<td>Pinkwart and Olivier</td>
</tr>
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<td>Programmierpraktikum (0, 0, 4)</td>
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<td>Rausch, Appel, and Niebuhr</td>
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<tr>
<td>Softcomputing (3, 1, 0)</td>
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<td>Hammer and Hasenfuss</td>
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<tr>
<td>Virtuelle Realität und Simulation (3, 1, 0)</td>
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<td>Zachmann</td>
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<tr>
<td>ATLANTIS: Anwendungssysteme in Industrieunternehmen (3, 1, 0)</td>
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<td>Hahn and Foalem (eLearning import)</td>
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<td>ATLANTIS: Business Intelligence (3, 1, 0)</td>
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<td>Mattfeld and Foalem (eLearning import)</td>
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<td>ATLANTIS: Mobile Business (3, 1, 0)</td>
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<td>Breitner and Foalem (eLearning import)</td>
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<td>ATLANTIS: Informationsverarbeitung in Dienstleistungsbetrieben (3, 1, 0)</td>
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<td>Schumann and Foalem (eLearning import)</td>
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<td>Modellbildung und Simulation (3, 1, 0)</td>
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<td>Reuter</td>
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<td>Embedded Systems I (3, 1, 0)</td>
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<td>Siemers</td>
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<td>Einführung in die Computergraphik/Computergraphik I (3, 1, 0)</td>
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<td>Zachmann</td>
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<td>Datenbanken I (3, 1, 0)</td>
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Praktikum Mikrorechner (0, 0, 2)
Kemnitz

Praktikum Digitaler Schaltungsentwurf II (0, 0, 2)
Kemnitz

Praktikum Elektronik I (0, 0, 2)
Kemnitz

Fortgeschrittenprojekt Concurrent Computing (0, 0, 6)
Rausch and Richter

Softwaretechnikpraktikum Informationstechnik (0, 0, 2)
Kemnitz

### 2.6.2 Hauptstudium/Master

**SS 06:** Courses and Seminars

- Computergraphik II (3, 1, 0)
  Hormann and Ponchio

- Digitale Bildverarbeitung (3, 1, 0)
  Tadjine

- Empirische Softwaretechnik (3, 1, 0)
  Padberg

- Modellbildung und Simulation (3, 1, 0)
  Reuter

- Semistructured Data and XML (3, 1, 0)
  May and Sommerfeld (eLearning import)

- Rechnernetze II (3, 1, 0)
  Richter and Wille

- Mobilkommunikation I (2, 0, 0)
  Hogrefe and Wille (eLearning import)

- Künstliche Intelligenz (3, 1, 0)
  Dix, Jamroga, and Bulling

- Wirtschaftsinformatik IV (3, 1, 0)
  Müller and Stiefel

- Informationsverarbeitung in Industriebetrieben (2, 2, 0)
  Schumann and Sommerfeld (eLearning import)

- Management der Informationssysteme (2, 2, 0)
  Schumann and Sommerfeld (eLearning import)

- Projektseminar Wirtschaftsinformatik (0, 0, 4)
  Müller and Hornung
2.6 Lecturing

- Projektseminar Simulation komplexer Systeme (0, 0, 4)
  Lessing and Görmer
- Hauptseminar Embedded Systems Engineering (0, 0, 2)
  Siemers and Jantz
- Hauptseminar Multimedia (0, 0, 2)
  Tadjine
- Hauptseminar Automatisierte Planung (0, 0, 2)
  Dix
- Hauptseminar Anwendungen neuronaler Netze in Entscheidungshilfesystemen (0, 0, 2)
  Reuter
- Hauptseminar Kamera-basiertes Hand-Tracking (0, 0, 2)
  Zachmann
- Seminar Ausgewählte Kapitel des Software Engineerings (0, 0, 2)
  Geisler
- Softwaretechnik-Praktikum (0, 0, 3)
  Kemnitz
- Schwerpunktpрактикуm Technische Informatik (0, 0, 3)
  Kemnitz and Richter
- Schwerpunktpрактикум Theoretische Informatik (0, 0, 3)
  Hammer
- Schwerpunktpрактикум Praktische Informatik (0, 0, 3)
  Grust, Hammer, and Hormann
- Schwerpunktpрактикум Lebendige 3D-Welten (0, 0, 3)
  Hormann, Zachmann, and Weller
- Projektgruppe Maschinelles Lernen (0, 0, 3)
  Hammer
- Projektgruppe Datenbanken- und Informationssysteme (0, 0, 2)
  Hasenfuss and Wille
- Projektgruppe Computational Intelligence (0, 0, 3)
  Dix, Novák, and Janroga
- Projektgruppe Multi-Agentensysteme (0, 0, 2)
  Dix and Novák
- Projektgruppe Hardwareentwurf und Robotik (0, 0, 2)
  Kemnitz
- Projektgruppe Wirtschaftsinformatik (0, 0, 2)
  Müller
WS 06/07: Courses and Seminars

- Industrielle Anwendungen Softcomputing basierter Methoden (3, 1, 0)  
  Reuter
- Umweltinformatik (2, 0, 0)  
  Lessing and Görmer
- Einführung in die Computerpraphik/Computergraphik I (3, 1, 0)  
  Zachmann
- Geometrische Modellierung (3, 1, 0)  
  Hormann and Winkler
- Multimedia (2, 0, 0)  
  Tadjine
- Datenbanken I (3, 1, 0)  
  May and Sommerfeld (eLearning import)
- Rechnerarchitektur I (3, 1, 0)  
  Richter and Wille
- Rechnernetze I (3, 1, 0)  
  Richter and Sommerfeld
- Mobilkommunikation II (2, 0, 0)  
  Hogrefe and Wille (eLearning import)
- Embedded Systems Engineering (3, 1, 0)  
  Siemers and Jantz
- Multiagentensysteme/Algortihmentheorie (3, 1, 0)  
  Dix and Jamroga
- Softcomputing (3, 1, 0)  
  Hammer and Hasenfuss
- Informationsverarbeitung in Dienstleistungsbetrieben (2, 2, 0)  
  Schumann and Sommerfeld (eLearning import)
- Wirtschaftsinformatik III: Integrierte Anwendungssysteme (2, 2, 0)  
  Müller and Hornung
- Internetökonomie (2, 2, 0)  
  Hagenhoff and Sommerfeld (eLearning import)
- Hauptseminar Aktuelle Themen in der Computergraphik (0, 0, 2)  
  Zachmann
- Hauptseminar Systemprozesstechnik (0, 0, 2)  
  Lessing and Görmer
- Hauptseminar Self-Organizing Maps (0, 0, 2)  
  Hammer and Hasenfuss
2.6 Lecturing

- Softwarepraktikum Informationstechnik (0, 0, 4)
  Kemnitz
- Schwerpunktpraktikum Lebendige 3D-Welten (0, 0, 3)
  Hormann, Zachmann, Weller, and Winkler

SS 07: Courses and Seminars

- Besondere Themen der Rechnerarchitektur (3, 1, 0)
  Siemers
- Bioinformatik (3, 1, 0)
  Hammer and Hasenfuss
- Computergraphik II (3, 1, 0)
  Zachmann
- Geometry Processing (3, 1, 0)
  Hormann and Winkler
- Mensch-Maschine-Kommunikation/Ergonomie und Mensch-Maschine-Schnittstellen (3, 1, 0)
  Reuter
- Wirtschaftsinformatik IV (3, 1, 0)
  Müller and Stiefel
- Projektmanagement (2, 0, 0)
  Kratzsch
- Künstliche Intelligenz/Einführung in die KI (3, 1, 0)
  Dix, Bulling, and Jamroga
- Hauptseminar Computer-vision-basiertes Tracking (0, 0, 2)
  Zachmann
- Hauptseminar Bioinformatik/Scheduling/Maschinelles Lernen (0, 0, 2)
  Ecker and Hammer
- Projektseminar/Fortgeschrittenenprojekt Wirtschaftsinformatik (0, 0, 4)
  Müller and Pinkwart
- Projektseminar Simulation komplexer Systeme (0, 0, 4)
  Lessing and Görmer
- Oberseminar Technische Informatik (0, 0, 2)
  Kemnitz
- Oberseminar Aktuelle Forschung in der KI (0, 0, 2)
  Dix
- Praktikum Programmierung einer virtuellen Umgebung für die Powerwall (0, 0, 2)
  Hormann, Zachmann, Weller, and Winkler
WS 07/08: Courses and Seminars

- Mobilkommunikation II (2, 0, 0)
  Hogrefe and Wille (eLearning import)

- Rechnernetze II (3, 1, 0)
  Richter and Wille

- Komplexitätstheorie (3, 1, 0)
  Dix and Bulling

- Modellbasierte Softwareentwicklung (3, 1, 0)
  Rausch, Bartelt, Herold, and Niebuhr

- Umweltinformatik (3, 1, 0)
  Lessing and Görmer

- Softwaretechnik I (3, 1, 0)
  Rausch, Deynet, and Fischer

- Hauptseminar Systemprozesstechnik (0, 0, 2)
  Lessing and Görmer

- Hauptseminar Computergraphik (0, 0, 2)
  Hormann

- Hauptseminar Wirtschaftsinformatik (0, 0, 2)
  Müller and Pinkwart

- Oberseminar Wirtschaftsinformatik (0, 0, 2)
  Müller and Pinkwart

- Oberseminar Aktuelle Forschung in der KI (0, 0, 2)
  Dix

- Oberseminar Aktuelle Forschung in der Computergraphik (0, 0, 2)
  Zachmann

- Projektseminar/Fortgeschrittenenprojekt Wirtschaftsinformatik (0, 0, 4)
  Müller and Pinkwart

- Fortgeschrittenprojekt Computergraphik (0, 0, 4)
  Hormann and Zachmann

- Praktikum Digitaler Schaltungsentwurf II (0, 0, 4)
  Kemnitz
3 Research Groups

In this section we present all 8 research groups that are currently active in our department. Each group consists of one or two professors, a number of scientific employees and, in some cases, additional scholars or associated members. Currently, the chairs for Distributed Systems and Human Centred Information systems are vacant but we expect them to be filled in 2008/2009.

Our most recent colleague, Prof. Dr. Hartmann started in January 2008. We have therefore only mentioned him below. He is currently recruiting his staff and building a research group. A more detailed description will follow in the next report.

Currently we have 56 active projects in our department. Here we define a project as a particular line of research that is either funded or has at least two refereed publications in the period 2006-2008. In most cases, however, our projects are both funded and have (at least) two publications.

3.1 Business Information Technology

3.1.1 Overview

Leaders Prof. Dr. Jörg P. Müller
                      Prof. Dr. Niels Pinkwart (Juniorprofessor, since 02/2007)

Secretary Stefanie Cronjäger

Scientific Employees
Dipl.-Wirt.-Inf. Thomas Dokters (since 10/2007)
Dipl.-Wirt.-Inf. Alexander Hornung
Dipl.-Inf. Markus Melato (until 11/2007)
Dipl.-Inf. Hannes Olivier, MSc (since 02/2007)
Dipl.-Wirt.-Inf. Patrick Stiefel

External Ph.D. students
Dipl.-Inf. Udo Bartlang, Siemens Corporate Technology, München
Dipl.-Inf. (FH) Matthias Born, SAP AG Research, Karlsruhe
Dipl.-Inf. Christoph Gerdes, Siemens Corporate Technology, München
Dipl.-Inf. Fabian Stäber, Siemens Corporate Technology, München
Dipl.-Inf. Simon Paradies, Siemens Corporate Technology, München
Dipl.-Wirt.-Inf. Tanju Bulut, Ideal Versicherungen, Berlin

3.1.2 Research Agenda

The business information technology unit consists of two subgroups.
The group “Collaboration Systems and CSCW (Computer Supported Cooperative Work)”, led by Niels Pinkwart, focuses on the design of digital media and technologies to support human co-operation, communication, and social interaction. We investigate collaborative systems from a variety of perspectives, including their conceptual design, software architectures, user interfaces, and (last not least) usage by humans in their work, learning or leisure context. In our research, we adopt an interdisciplinary approach which is rooted in Computer Science and Information Technology, but also includes methods from Cognitive and Social Sciences. A specific focus of our research is set on applications in the domain of educational technology, particularly on distributed and collaborative software systems which provide intelligent support to students in order to help them learning.

The main research focus of the “Mobile and Enterprise Computing” group, led by Jörg P. Müller, is on developing models, architectures, and methods for distributed and decentral management and coordination of business IT systems. Our overall objective is to advance Enterprise interoperability by developing, extending and combining research results and technologies in areas such as Enterprise modelling, service-oriented architecture, Peer-to-Peer computing, autonomous agents and multiagent systems, the Internet of Things, and Semantic Web, and to validate these research results and technologies in business domains such as Enterprise collaboration, supply network management, and product life-cycle management.

See the group’s homepage at: http://www.in.tu-clausthal.de/de/abteilungen/winf/willkommen/

### 3.1.3 Supervised Theses


3.1.4 Projects

Project 1: P2P Business Resource Management

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partners
Dr. Thomas Friese, Siemens AG Medical Systems, Erlangen, DE
Dr. Klaus Fischer, DFKI GmbH, Saarbrücken, DE
Prof. Arne Berre, Sintef, Oslo, NO
Brian Elvesæter, Sintef, Oslo, NO
Alan Powell, IBM UK, Hearsley, UK
Dr. Xabier Larrucea, European Software Institute (ESI), Bilbao, ES

Funding
EU-Project (FP6)
320,000€ (of 14,400,000€ total)

Duration
02/2004 – 02/2006

Project Description
In the project A6 (Model-driven and Adaptable Interoperability Architectures) of the European IP ATHENA, we have developed the Business Resource Management Framework (BRMF), a novel peer-to-peer based middleware framework for decentralized management of business resources. The design of the BRMF follows a layered approach building on a general purpose, industry grade P2P middleware - the Resource Management Framework (RMF) developed by Siemens AG. While the RMF offers basic services on arbitrary XML resources, such as publish, search, subscribe for change notification, it is not specifically designed to support web service based business applications in general. This work was carried out at and in cooperation with Siemens AG Corporate Technology.
3.1 Business Information Technology

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Project Homepage
http://www.athena-ip.org

Project 2: Model-Driven Engineering of Executable Cross-Enterprise Business Processes

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partners
Ulrike Greiner, SAP Research, Karlsruhe, DE (Main Leader)
Prof. Bernhard Bauer, Universität Augsburg, DE
Stephan Roser, Universität Augsburg, DE
Alan Powell, IBM UK, Hearsley, UK
Jörg Ziemann, DFKI GmbH, Saarbrücken, DE

Funding
EU-Project (FP6)
192.000€ (of 14.400.000€ total)

Duration
02/2004 – 03/2007

Project Description
In the projects A2 (Cross-Enterprise Business Processes) and A7 (Business Documents and Protocols) of the ATHENA European Integrated Project, we have been investigating methods, models, and methodologies to construct (semi-automatically) executable cross-enterprise business processes starting from business-level descriptions of processes (e.g., using an extension of ARIS EPCs). Our approach has been based on the model-driven development paradigm, best known from the OMG’s Model-Driven Architecture (MDA(TM)). For this purpose, we have developed a set of transformations to map an ARIS EPC describing a cross-enterprise business process at the Computation-Independent Level into the UML-based PIM4SOA (Platform-Independent Model for Service-Oriented Architectures) representation developed in the ATHENA project. This work was carried out at and in cooperation with Siemens AG Corporate Technology.
References
[Roser et al., 2006] (Page 159),
[Bauer et al., 2006] (Page 149)

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Project Homepage
http://www.athena-ip.org

Project 3: Concepts and Models for Enterprise Interoperability

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partners
Dr. Gerd Völksen, Siemens AG Corporate Technology, Information and Communications, München, DE (Main Leader)
Dipl.-Inf. Udo Bartlang, Siemens AG Corporate Technology, Information and Communications, München, DE

Funding
Siemens AG
40,000€ (of 40,000€ total)

Duration
01/2006 – 04/2007
3.1 Business Information Technology

**Project Description**
The objective of this consulting project is to explore benefits, benefits and potential trade-offs of peer-to-peer architectural approaches for different collaborative business application scenarios. In particular, a demonstrator was built to address a multi-tier OEM-supplier relationship in the automotive sector, and how different information and communication architectures (client-server web services versus peer-to-peer) could be combined to suitable support loosely coupled business interactions during the early phases of the product lifecycle. This research was carried out within the ATHENA IP.

![Diagram of supplier relationships]

**References**
[Stäber et al., 2006] (Page 161),
[Doumeingts et al., 2007] (Page 142),
[Gonçalves et al., 2007] (Page 142)

**Contact E-Mail**
joerg.mueller@tu-clausthal.de

**Project Homepages**
http://winf.in.tu-clausthal.de
http://www.ct.siemens.com

**Project 4: ATLANTIS: Academic Teaching and LeArning NeTwork in Information Systems**

**Project Members**
Prof. Dr. Jörg P. Müller (Leader)
Dipl.-Winf. Olivier Foalem (Project Staff)

**Partners**
Prof. Dr. Uwe Hoppe, Universität Oldenburg, DE (Main Leader)
Prof. Dr. Jürgen Dix, TU Clausthal, DE
Prof. Dr. Dirk Mattfeld, TU Braunschweig, DE
Prof. Dr. Michael Breitner, Universität Hannover, DE
Prof. Dr. Matthias Schumann, Universität Göttingen, DE
Funding
Federal government of Lower Saxony
54,000€ (of 440,000€ total)

Duration
04/2007 – 03/2009

Project Description
The goal of ATLANTIS is to create collaborative eLearning portal and to produce high-quality eLearning content to enhance the Bachelor-level course offerings in and across the partners providing study programmes in the area of business information systems across the federal state of Lower Saxony.

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Project Homepage
http://elan-niedersachsen.de/index.php?id=581

Project 5: Methodology and Service Layer Components for Decentralized Applications

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partners
Dipl.-Inf. Fabian Stäber, Siemens AG Corporate Technology, Information and Communications, München
Gerald Kunzmann, TU München, München, DE

Duration
01/2006 – 12/2008

Project Description
While the concept of decentralization in distributed systems is relatively old, it has been drawing increased attention since the rise of peer-to-peer systems in 2000. A significant number of research results has been published, enabling self-organization, scalability, and resilience. However, the adoption of these results in industry is still limited. One reason is that there is no methodology available that helps industrial application developers to transfer these results to their domains.
The objectives of this work are twofold: Firstly, an architecture for decentralized applications is introduced. Based on this architecture, a methodology is presented that supports application developers in benefiting from state-of-the-art decentralization in their fields of application, and in identifying requirements that have not yet been addressed in related work. Secondly, the architecture and methodology are applied to three industrial application scenarios; for each of these scenarios, the open requirements are identified and new service components are developed, extending the state of the art and enabling the use of decentralized infrastructures.

References
[Stäber and Müller, 2007] (Page 161),
[Stäber et al., 2007a] (Page 161)

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joerg.mueller@tu-clausthal.de

Project Homepage

Project 6: Adaptive Techniques for Advanced Content Management in Distributed Systems

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partner
Udo Bartlang, Siemens AG Corporate Technology, Information and Communications, München, DE

Duration
01/2006 – 12/2008
**Project Description**

This research investigates the applicability of peer-to-peer overlay networks for distributed management of digital content. Structured peer-to-peer overlay protocols based on Distributed Hashtables (DHT) are characterized by their inherent high scalability and resilience against node failures. Combined with additional replication strategies such systems promise high data availability. However, regarding atomic operations replication comes at the cost of maintaining consistency. Thus, most DHT-based systems either focus on immutable data resources or they reinvent the wheel for their storage needs strictly focussing on mutable data. However, they lack a generic but efficient solution to enable flexible consistent data operations for replicated data trimmed for such a highly concurrent and fluctuating environment.

On result of this work is DhtFlex, a fault-tolerant distributed algorithm tailored for the needs of a DHT and optimized for the consistent management of replicated data resources. DhtFlex is supposed to serve as a generic building block to any underlying structured peer-to-peer Overlay. It imposes an annotated resource concept to typify replicated data. DhtFlex enables efficient support for immutable as well as for optimized atomic operations on mutable data resources.

**References**

[Stäber et al., 2007b] (Page 161), [Stäber et al., 2007a] (Page 161), [Bartlang et al., 2007] (Page 149)

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joerg.mueller@tu-clausthal.de

**Project Homepage**

Project 7: Agent-Oriented Software Engineering and P2P Resource Management

Project Member
Prof. Dr. Jörg P. Müller (Leader)

Partners
Prof. Dr. Bernhard Bauer, Universität Augsburg, DE
Dr. Klaus Fischer, DFKI GmbH, Saarbrücken, DE
Fabian Stäber, Siemens AG Corporate Technology, Information and Communications, München, DE

Duration
since 01/2004

Project Description
The objective of this research is to develop models and methodologies for agent-oriented engineering of business software artifacts. In particular, we have been examined application of the AgentUML extension of the Unified Modeling Language to model web-service based business systems. In addition, we have investigated how agent concepts and peer-to-peer protocols (in particular those based on Distributed HashTables) can be combined to model and deploy executable business processes in distributed and robust fashion. Another topic of interest in this collaboration is the relationship between peer-to-peer based resource management and knowledge based agents designed using the Belief, Desire, Intention (BDI) paradigm.
References

[Müller and Zambonelli, 2006] (Page 142),
[Müller et al., 2006] (Page 144),
[Fischer et al., 2007] (Page 143),
[Kahl et al., 2007] (Page 155)

Contact E-Mail

joerg.mueller@tu-clausthal.de

Project Homepage

http://winf.in.tu-clausthal.de

Project 8: Ubiquitous Computing and Supply Chain Management

Project Members

Prof. Dr. Jörg P. Müller (Leader)
Dipl.-Winf. Alexander Hornung (Project Staff)

Partners

Prof. Dr. Brahim Chaib-Draa, Laval University, CA
Dr. Roland Zimmermann, Bissantz & Company GmbH, Nürnberg, DE

Duration

since 01/2004

Project Description

In this ongoing work, we consider the impact of adaptive mechanisms and ubiquitous computing technologies on future computer-supported supply chain management systems. In a collaboration with Siemens, we developed a multiagent architecture and algorithms for collaborative learning in distributed and heterogeneous business systems, where the participating agents have local, incomplete knowledge used to make predictions about parameters of a business transaction. We proposed two collaborative learning strategies which differ in the nature and amount of information that is exchanged during collaboration, and which are hence suitable for different organisational settings. The first algorithm relies on the exchange of information about a transaction instance, whereas the second algorithm uses qualitative information provided by individual agents, such as the results of predictions from the agent’s local perspective. We applied the architecture and strategies to a distributed supply chain prediction problem. Experiments run on a large real-world order data set indicate that our approach effectively improves the learning performance based on limited additional communication between the participating agents. Recent research is investigating ubiquitous computing methods to enable context-aware supply chain event management and ambient-enabled information management in production-to-maintenance processes.
3.1 Business Information Technology

References
[Chaib-Draa and Müller, 2006a] (Page 141),
[Chaib-Draa and Müller, 2006b] (Page 143),
[Zimmermann and Müller, 2006] (Page 163)

Contact E-Mail
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Project Homepage
http://www.in.tu-clausthal.de/abteilungen/winf/projekte/
context-aware-supply-chain-event-management/

Project 9: Architecture, Methods and Tools for Decentral and Collaborative Product Development

Project Members
Dipl.-Winf. Patrick Stiefel (Leader)
Dipl.-Winf. Thomas Dokters (Project Staff)

Partners
Prof. Dr. Jörg P. Müller, TU Clausthal, Germany (Main Leader)
J.Prof. Dr. Thomas Barth, Universität Siegen, Germany

Duration
since 07/2005

Project Description
In the context of model-driven software development (MDSD) we investigate new models, methods and tools for evaluating and using the concept of a peer to peer (P2P) based software architecture for integrated and collaborative product engineering.
We argue that distributed and cross-enterprise product lifecycle management can benefit from the availability of decentrally managed product model repositories. Our work, while driven by business level issues such as supporting the emergence of organizations, partnerships, and processes for collaborative and cross-enterprise PLM, focuses on aspects of ICT level interoperability. It aims at enabling loosely coupled interaction between changing partners in a decentral environment, where traditional hierarchical client-server based architecture may not be applicable.

References
[Stiefel and Müller, 2006] (Page 161),
[Stiefel and Müller, 2007] (Page 162)

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patrick.stiefel@tu-clausthal.de

Project Homepage
http://plm.in.tu-clausthal.de

Project 10: CoChemEx: Supporting Conceptual Learning in Chemistry through Collaboration and Adaptive Online Support

Project Member
Prof. Dr. Niels Pinkwart

Partners
Dr. Bruce McLaren, DFKI, Saarbrücken, Germany (Main Leader)
Prof. Dr. Andreas Harrer, Catholic University of Eichstätt, Germany
Dr. Nikol Rummel, University of Freiburg, Germany
 Prof. Dr. Hans Spada, University of Freiburg, Germany
3.1 Business Information Technology

**Funding**

Pittsburgh Science of Learning Center
1.000€ (of 126.390€ total)

**Duration**


**Project Description**

This project tests the hypothesis that a computer-supported collaborative learning system can help students improve their conceptual understanding of chemistry. The goal is to help students actively process the material they encounter, moving them away from the mechanical, algorithmic approach taken by many chemistry students.

**References**

[McLaren et al., 2007] (Page 156)

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**Project 11: Hypothesis Formation and Testing in an Interpretive Domain**

**Project Member**

Prof. Dr. Niels Pinkwart

**Partners**

Prof. Dr. Kevin Ashley, University of Pittsburgh, USA (Main Leader)
Dr. Vincent Aleven, Carnegie Mellon University, USA (Leader)
Collin Lynch, University of Pittsburgh, USA

**Funding**

NSF
5.000€ (of 486.348€ total)

**Duration**

09/2004 – 08/2008

**Project Description**

The aims of this project are to (1) design and evaluate an Artificial Intelligence (AI) cognitive model of framing and testing hypotheses in an interpretive domain, legal reasoning, and (2) incorporate the model in an intelligent tutoring system (ITS) to teach law students the process. The project builds upon two recent developments: a newly invented means to frame and evaluate hypotheses predicting the outcomes of new cases based on an AI database of existing precedents, and a convenient, on-line corpus of U.S. Supreme Court oral arguments in aural and written form, including many concrete examples of legal hypothesis framing and testing.
References

[Pinkwart et al., 2006a] (Page 157),
[Pinkwart et al., 2006c] (Page 158),
[Lynch et al., 2006] (Page 156),
[Aleven et al., 2006b] (Page 149),
[Pinkwart et al., 2006b] (Page 157),
[Pinkwart et al., 2007b] (Page 158),
[Pinkwart et al., 2007a] (Page 158),
[Lynch et al., 2007] (Page 156),
[Ashley et al., 2007] (Page 149)

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3.1.5 Scientific Activities

Person Prof. Dr. Jörg P. Müller

☐ Editorial Board Memberships

  See [http://www.springerlink.com/content/1573-7454/](http://www.springerlink.com/content/1573-7454/)

- Associate Editor of *International Journal of Agent-Oriented Software Engineering*, Inderscience Publishers (since 2004).

☐ Organization of Conferences and Workshops

- Programme Co-Chair (with Gerard Morel)
  See [http://www.i-esa.org/i-esa2006](http://www.i-esa.org/i-esa2006)

- Co-Chair (with Paolo Petta)
  AT2AI-5: *5th International Symposium From Agent Theory to Agent Implementation*, Wien, Austria, April 2006.

- Co-Chair (with Klaus Fischer, Arne Berre)
  See [http://www-ags.dfki.uni-sb.de/~kuf/atop/index_2006.htm](http://www-ags.dfki.uni-sb.de/~kuf/atop/index_2006.htm)
• Track Co-Chair (with Bernhard Bauer)
  WI ’07: Conference Track on Business Applications of Multiagent Systems
  at 8. Internationale Tagung Wirtschaftsinformatik, Karlsruhe, Germany,
  February 2007.
  See http://www.aifb.uni-karlsruhe.de/Forschungsgruppen/BIK/
  wi2007/tracks/MultiAgenten.htm

• Programme Co-Chair (with Kai Mertins)
  IESA 2007: 3rd International Conference on Interoperability of Enterprise
  See http://www.i-esa.org/i-esa2007

• Programme Co-Chair (with Paolo Petta)
  MATES 2007: 5th German Conference on Multiagent System Technologies,
  Leipzig, Germany, September 2007.
  See http://winf.in.tu-clausthal.de/mates07/

☐ PC-member of Conferences and Workshops

• AAMAS ’06: 5th International Conference on Autonomous Agents and Multi-
  See http://www.aamas-conference.org

• ICAC 2006: 3rd IEEE Conference on Autonomic Computing, Dublin, Ireland,
  June 2006.
  See http://www.caip.rutgers.edu/icac2006/

• MATES 2006: 4th German Conference on Multiagent Systems Technologies,
  Erfurt, Germany, September 2006.
  See http://www.dfki.de/MATES/

• CoopIS 2006: 14th International Conference on Cooperative Information
  Systems, Montpellier, France, November 2006.

• GI-IWP 2006: 2. GI-Tagung Informations- und Wissensdrehscheibe Produk-
  datenmanagement, Siegen, Germany, November 2006.
  See http://www-winfo.uni-siegen.de/iwpdm06

• SSCG 2006: Wissenschaftliches Symposium Softwareagenten und Soft
  Computing im Geschäftsprozessmanagement, Ilmenau, Germany, November 2006.
  See http://wcms1.rz.tu-ilmenau.de/fakww/index.php?id=1937

• EUMAS 2006: Fourth European Workshop on Multi-Agent Systems, Lisbon,
  Portugal, December 2006.
  See http://eumas06.di.fc.ul.pt/


• AISADM-07: International Workshop on Autonomous Intelligent Systems: Agents and Data Mining, St. Petersburg, Russia, June 2007. See http://space.iaas.spb.su/ais07/


• AI4AMI-07: International Workshop on Artificial Intelligence Methods for Ambient Intelligence, Darmstadt, Germany, November 2007. See http://www.wi2.uni-trier.de/~bergmann/AI4AMi07/


☐ Steering Committees


• Advisory Board of EUMAS: European Workshop on Multi-Agent Systems (since 2006). See http://www.eumas.org

☐ Evaluator


Person  Prof Dr. Niels Pinkwart

Organization of Conferences and Workshops

- Co-Chair (with Vincent Aleven, Kevin Ashley and Collin Lynch)
  Workshop on Intelligent Tutoring Systems for Ill-Defined Domains within ITS2006, Jhongli, Taiwan, June 2006.
  See http://www.cs.cmu.edu/~hypoform/its-workshop

- Co-Chair (with Vincent Aleven, Kevin Ashley and Collin Lynch)
  See http://www.cs.pitt.edu/~collinl/AIED07/

PC-member of Conferences and Workshops

  See http://www.worldses.org/conferences/2006/lisbon/diweb/

  See http://www.wseas.org/conferences/2006/tenerife/edu

  See http://www.wseas.org/conferences/2007/greece/education

  See http://compsci.wssu.edu/iis/swel/SWEL07/swel07-aied07.html

  See http://www.icce2007.info

Evaluator

- Project Evaluator.

3.1.6 Highlights

In 2006

- Niels Pinkwart and his colleagues Vincent Aleven, Kevin Ashley, and Collin Lynch win the Best Paper Award at the 4th eLearning Conference of the German Computer Science Society (DELCI 2006) for their paper “Schwachstelleermittlung und Rückmeldungsprinzipen in einem intelligenten Tutorensystem für juristische Argumentation”.

• Jörg P. Müller and his students Udo Bartlang and Fabian Stäber win the Best Paper Award at the 16th eChallenges Conference (eChallenges 2006, Barcelona, Spain, October 2006) for their paper “Using Onion Routing to Secure Peer-to-Peer Supported Business Collaboration”.

In 2007

• The DFG awards a travel grant to Niels Pinkwart in order to support his attendance of the 13th International Conference on Artificial Intelligence in Education (AIED 2007) and his presentation of the paper “Evaluating Legal Argument Instruction with Graphical Representations Using LARGO” (co-authored with Vincent Aleven, Kevin Ashley and Collin Lynch).

3.2  Computational Intelligence

3.2.1  Overview

Leaders  Prof. Dr. Jürgen Dix
          Prof. Dr. Barbara Hammer

Associated Member  apl. Prof. Dr. Matthias Reuter (CUTEC)

Secretary  Anita Seiz-Uhlig

Scientific Employees  Dipl.-Inf. Tristan Behrens (since 04/2006)
          Dr. Sabine Bostelmann (until 08/2006)
          Dr. Andreas Brüning (until 01/2006)
          Dipl.-Inf. Nils Bulling (since 04/2006)
          Dipl.-Inf. Alexander Hasenfuss
          Dr. Wojciech Jamroga
          Mgr. Peter Novák
          Dr. Yingqian Zhang (0,5 BAT IIa, until 04/2006)

Associated Members  Dipl.-Päd. Sabine Berens (CUTEC, since 06/2007)
          Dipl.-Inf. Sven Birkenfeld (CUTEC, since 09/2006)
          Dipl.-Inf. Steffen Harneit (CUTEC)

Scholars  M.Sc. Banchar Arnonkijpanich (since 12/2007)
          M.Sc. Juan Carlos Acosta Guadarrama

3.2.2  Research Agenda

Our research focuses mainly on computational logic (deductive databases, answer set programming, nonmonotonic reasoning), multi-agent reasoning (logics in agency, rational agents, programming agents), artificial intelligence (automated theorem proving, verification, data mining, planning), softcomputing (neural networks, ant algorithms, evolutionary algorithms), machine learning and pattern recognition (neural networks, hybrid systems for structured data, industrial applications), and data mining (self organizing maps, clustering, unsupervised and semi-supervised data processing).

See the group's homepage at: http://cig.in.tu-clausthal.de/

3.2.3  Supervised Theses


3.2.4 Projects

Project 12: Model Checking with Logic Based Petri Nets

Project Members
Prof. Dr. Jürgen Dix (Leader)
Dipl.-Inf. Tristan Behrens

Duration
since 01/2007

Project Description
We introduce a class of Petri nets, simple logic Petri nets (SLPN), that are based on logical expressions. We show how this type of nets can be efficiently mapped into logic programs with negation: the corresponding answer sets describe interleaved executions of the underlying nets. The absence of an answer set indicates a deadlock situation. We also show how to correctly model and specify AgentSpeak agents and multi-agent systems with SLPN’s. This allows us to solve the task of model checking AgentSpeak multi-agent systems by computing answer sets of the obtained logic program with any ASP system.

References
[Behrens and Dix, 2007a] (Page 150),
[Behrens and Dix, 2007b] (Page 150)

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Project 13: A Language for Beliefs and Knowledge Representation

Project Members
Prof. Dr. Jürgen Dix (Leader)
Mag.-Inf. Juan Guadarrama
Dr. Wojciech Jamroga

Partner
Prof. Dr. Mauricio Osorio, University of Puebla, Mexico

Funding
PhD project, Conacyt (Mexican Government)
30.000€ (of 30.000€ total)

Duration
01/2005 – 04/2008

Project Description
In this project, preliminary specifications of a formal logic programming language for beliefs and knowledge representation are studied by means of a society of intelligent agents, based on the strong theoretical basis of epistemology and intuitionistic logic. We describe its general structure and propose how one can update beliefs so that they become knowledge as new pieces of information appear. Possible future applications towards a conscious autonomous agent are also discussed.

References
[Acosta Guadarrama et al., 2006] (Page 148),
[Guadarrama, 2007a] (Page 152)

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dix@tu-clausthal.de

Project Homepage
http://cig.in.tu-clausthal.de/index.php?id=clbe07

Project 14: Modular BDI Architecture and Agent Oriented Programming

Project Members
Prof. Dr. Jürgen Dix (Leader)
Mag.-Inf. Peter Novák

Funding
AAMAS and ERASMUS
1.400€ (of 1.400€ total)

Duration
since 11/2004
Project Description

One of the main challenges in agent-oriented programming is the design of specialized programming languages for single agent development. They should provide transparent interfaces to existing mainstream programming languages for easy integration with external code and legacy software. In this project we work towards a practical programming language with underlying architecture which suits the requirements mentioned above. Our previously developed architecture will serve us as a basis for the development of an experimental programming language and implementation of an interpreter for it, based on a plug-in design.

Agent program:

\[
\text{when believes goals}([\text{Obj}]) \text{ } \text{and} \text{ } \text{believes brain}([\text{Obj}, \text{Dir}]) \text{ } \text{and} \text{ } \text{query map}([\text{Obj}, \text{Dir}]) \text{ } \text{then act body}([\text{Dir}]) \text{ } \text{end}
\]

References

[Novák and Dix, 2006b] (Page 157),
[Novák and Dix, 2007] (Page 157)

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dix@tu-clausthal.de

Project 15: A Simulation Platform for Multi-Agent Systems

Project Members

Prof. Dr. Jürgen Dix (Leader)
Mag. Inf. Peter Novák (Leader)

Partner

Dr. Mehdi Dastani, Utrecht University, The Netherlands

Duration

since 01/2005
**Project Description**

Since 2005, we are organising a yearly agent contest. This competition is an attempt to stimulate research in the area of multi-agent programming by (1) identifying key problems, and (2) collecting suitable benchmarks. These can serve as milestones for testing agent-oriented programming languages, platforms and tools. The simulation platform we have developed and which is constantly improved, makes it possible to test agent systems in a fair way.

**References**

[Dastani et al., 2006a] (Page 150),
[Dastani et al., 2007a] (Page 151)

**Contact E-Mail**

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**Project Homepages**

http://cig.in.tu-clausthal.de/index.php?id=agentcontest07
http://cig.in.tu-clausthal.de/CLIMAContest/

**Project 16: IPMasAr: Modelling Inference and Preferences in Multiagent Systems through Argumentation**

**Project Members**

Prof. Dr. Jürgen Dix (Leader)
Dipl.-Inf. Nils Bulling
Dr. Wojciech Jamroga

**Partners**

Prof. Dr. Carlos Chesnevar, University of Bahia Blanca, Argentina (Leader)
Prof. Dr. Frieder Stolzenburg, Fachhochschule Wernigerode, Germany
**Funding**
DAAD (PPP, PROALAR 415-proalar/po-D/06/33815)
7,500€ (of 15,000€ total)

**Duration**
01/2007 – 12/2008

**Project Description**
The main goal of this project is computational modelling of inference processes and preference handling in multiagent systems, captured through different extensions of Defeasible Logic Programming (DeLP), a logic programming language that allows to model argumentative reasoning. DeLP has been successfully used in real-world applications, but its applicability is limited in a multiagent setting. The proposed model would allow to solve new problems in distributed settings by coordinating autonomous intelligent agents which would reason by means of argument-based inference.

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**Project Homepage**
http://cig.in.tu-clausthal.de/index.php?id=clarg07

**Project 17: Programming Multiagent Systems**

**Project Members**
Prof. Dr. Jürgen Dix (Leader)
Mag.-Inf. Peter Novák

**Partners**
Prof. Dr. Amal El Fallah Seghrouchni, Universite Paris 6, France
Dr. Rafael Bordini, University of Durham, UK
Dr. Mehdi Dastani, Utrecht University, The Netherlands

**Duration**
since 2002
3.2 Computational Intelligence

Project Description
After setting up a workshop series on programming Multi-Agent Systems (ProMAS), we are actively engaged in developing, comparing and applying theoretical frameworks for agent systems. We started a ProMAS working group within Agentlink III, and have put together a book about the most promising approaches. A second book is on its way. We have also organised a Dagstuhl seminar in 2001 and will organise another one in 2008.

References
[Bordini et al., 2006b] (Page 141),
[Bordini et al., 2007b] (Page 141)

Contact E-Mail
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Project Homepages
http://cig.in.tu-clausthal.de/projects/programming
http://www.cs.uu.nl/ProMAS/

Project 18: A General Framework for Reasoning about Plausible Behavior and Rational Agents

Project Members
Dr. Wojciech Jamroga (Leader)
Prof. Dr. Jürgen Dix (Leader)
Dipl.-Inf. Nils Bulling

Funding
DFG and IFAAMAS
1.600€ (of 1.600€ total)

Project Description
We aim at a logic that would allow to study strategies, time, knowledge, and plausible/rational behavior under both perfect and imperfect information. To this end, we study extensions of temporal and strategic logics with the notion of plausibility and/or rationality, and various logical characterizations of these notions.
References
[Bulling and Jamroga, 2007a] (Page 150),
[Jamroga and Bulling, 2007a] (Page 155),
[Jamroga and Bulling, 2007c] (Page 155),
[Bulling and Jamroga, 2007b] (Page 150)

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Project 19: Survivability in Multiagent Systems

Project Members
Prof. Dr. Jürgen Dix (Leader)
Dr. Yingqian Zhang

Partners
Prof. Dr. Sarit Kraus, Bar-Ilan University, Israel
Prof. Dr. VS Subrahmanian, University of Maryland at College Park, US

Funding
PhD project (Manchester), EPSRC
90,000€ (of 90,000€ total)

Duration
2002 – 2006
3.2 Computational Intelligence

Project Description
The aim of this project is to maximally ensure that a multiagent system is robust and resilient against failures in dynamic environment. Based on the idea of agent replication, we built a probabilistic survivability model. Three distributed models and algorithms have been introduced which can re-deploy agents when there is a need to re-evaluate the survivability of the MAS. Furthermore, we have proposed various centralised algorithms to compute the survivability of a given agent deployment. We have implemented and tested the proposed algorithms and reported on the advantages and disadvantages of them in different environmental settings.

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Project Homepage
http://cig.in.tu-clausthal.de/projects/survivability

Project 20: Clustering Proximities

Project Members
Prof. Dr. Barbara Hammer
Dipl.-Inf. Alexander Hasenfuss

Partner
Dr. Fabrice Rossi, INRIA Rocquencourt, Fance

Duration
since 01/2007

Project Description
Clustering and data visualization constitute important problems which occur in all areas of data analysis such as text and web mining, biomedical applications, evaluation of sensor data, etc. Prototype-based methods such as the self-organizing map or neural gas offer robust, flexible and efficient methods with numerous successful applications. The original approaches, however, have been proposed for standard Euclidean data only, and they cannot be applied to more general possibly non-Euclidean metric structures such as alignment distances or compression metric.

We developed relational clustering which extends SOM and NG towards data given by a general proximity matrix. The method is equivalent to the standard Euclidean one if a kernel-embedding of data into a Euclidean feature space exists. Otherwise, the method provably converges to a (possibly local) optimum of the relational dual cost function for every nonsingular symmetric matrix. Unlike standard SOM and NG, the method shows quadratic complexity which can be reduced to linear complexity by using approximations. A publication in this context has obtained the best paper award at KI 2007.
References
[Rossi et al., 2007] (Page 159),
[Hammer et al., 2007d] (Page 153),
[Hasenfuss and Hammer, 2007] (Page 154),
[Hammer and Hasenfuss, 2007a] (Page 152),
[Hasenfuss et al., 2007] (Page 154)

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Project 21: Generalization Ability and Matrix Learning in Prototype-Based Classification

Project Member
Prof. Dr. Barbara Hammer

Partner
Dr. Michael Biehl, University of Groningen, The Netherlands

Duration
since 01/2006

Project Description
Prototype-based classification offers intuitive and powerful machine learning tools, which is particularly interesting for interdisciplinary applications due to easy interpretability of the results. Research has been conducted to exactly investigate the learning behavior of popular heuristic learning rules in relevant model situations by means of statistical physics.
Further, extended learning rules have been developed which are based on a clear mathematical objective and which allow a general matrix adaptation, taking relevance weighting as well as correlations into account. Interestingly, learning theoretical generalization bounds can be derived which show that the method can be interpreted as large margin optimization.

References

[Schneider et al., 2007] (Page 160),
[Witoelar et al., 2007] (Page 163),
[Schneider et al., 2006] (Page 160),
[Witolaer et al., 2006] (Page 163),
[Biehl et al., 2007] (Page 144)

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Project 22: Applications of Softcomputing Techniques in Biomedical Domains

Project Members

Prof. Dr. Barbara Hammer
Dipl.-Inf. Alexander Hasenfuss

Partners

Dr. Michael Biehl, University of Groningen, The Netherlands
Dr. Thomas Villmann, University of Leipzig, Germany
Dr. Frank-Michael Schleif, University of Leipzig, Germany
Dr. Marc Strickert, IPK Gatersleben, Germany
Dr. Peter Tino, University of Birmingham, UK

Duration

since 01/2005
**Project Description**

The amount of electronic data in biomedical domains such as medical images, mass spectrometric profiles, or SNP data are dramatically increasing so that automated data mining tools constitute an indispensible technique in these domains. The application domain puts particular challenges on machine learning methods such as extremely high dimensionality and only sparse data, imbalanced class distributions, etc. We developed a variety of highly flexible classification and data inspection tools which have been applied to diverse areas including proteomic profiling and microarray analysis. In this context, two (partially funded) seminars (a Dagstuhl seminar and a MPIPKS seminar) gathering together experts in related fields were co-organized by Prof. Hammer.

![Image of spectra](image-url)

**References**

[Schleif et al., 2007b] (Page 160),
[Tino et al., 2007] (Page 144),
[Schneider et al., 2007] (Page 160),
[Schleif et al., 2007c] (Page 160),
[Villmann et al., 2007a] (Page 162),
[Hammer et al., 2007a] (Page 153)

**Contact E-Mail**

barbara.hammer@tu-clausthal.de

**Project 23: Humanitarian Demining**

**Project Members**

apl. Prof. Dr. Matthias Reuter (Leader)
Dipl.-Inf. Seffen Harneit (Project Staff)
Dipl.-Geo. Berta Rosendo
3.2 Computational Intelligence

**Partners**

Prof. Dr. Andreas Kirsch, Universität Karlsruhe (TH), Germany  
Dr. Thomas Wonik, Institut für Geowissenschaftliche Gemeinschaftsaufgaben (GGA), Hannover, Germany  
Dipl.-Geophys. Andreas Donat, Universität zu Köln, Germany  
Prof. Dr. Hartmut Ewald, Universität Rostock, Germany  
Dipl.-Phys. Hartmut Eigenbrod, Fraunhofer-Gesellschaft (FhG), Stuttgart, Germany

**Funding**

BMBF  
754.000€ (of 4.200.000€ total)

**Duration**

04/2004 – 03/2007

**Project Description**

Anti-personnel land mines are one of the war legacies with the most serious consequences for the population and industries of countries which have been at war. Therefore the improvement of metal detectors for humanitarian demining is still an area of major interest for these countries. In this project, special software applications for metal detectors were presented which minimize the false alarm rate by using noise reduction methods, and enable identification of mines by means of self-learning algorithms, such as neural networks and vector supporting machines (CI methods). The major advantage of these methods stems from the fact that geologically and meteorologically based anomalies of the soil structure can be identified as non-relevant information, incomplete data sets can be completed, and system parameters, hidden up to now, can be identified. As our investigations demonstrate, our system allows to calculate the position and depth of the mines, identify mine-like structures, and deal with effects caused by the soil structure.
Project 24: Predictive Control of Waste Incinerator

Project Members
apl. Prof. Dr. Matthias Reuter (Leader)
Dipl.-Inf. Sven Birkenfeld (Project Staff)

Partner
Dr.-Ing. Stefan Vodegel, CUETC-Institut GmbH, Clausthal, Germany

Funding
AIF (Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" e.V.)
174.000€ (of 360.000€ total)

Duration
01/2006 – 12/2008

Project Description
With help of neural nets, a waste incinerator is controlled in a predictive way. As the implicit model of the waste incinerator we use a closed SOM, whose activities are decoded by a downstream feed-forward net. In consequence, the predictive values of the control can be calculated. This is a new approach in the area modelling and simulation; in particular, it is the first industrial application of the theory of Computing with Activities.
3.2 Computational Intelligence

Project 25: Detectino

Project Members
apl. Prof. Dr. Matthias Reuter (Leader)
Dipl.-Inf. Steffen Harneit (Project Staff)

Partners
Dr. Thomas Wonik, Institut für Geowissenschaftliche Gemeinschaftsaufgaben (GGA), Hannover, Germany
Dirk Bettels, Infrastrukturbau, Hannover, Germany
Markus Lämmerhirt, Prokasso, Karlsruhe, Germany

Funding
N-Bank, VHG Versicherungen
479.000€ (of 1.400.000€ total)

Duration
01/2007 – 12/2009

Project Description
Project Detectino includes the development of a robotic system which will search pipes and cables automatically in urban and non-urban areas. Empowered by neural nets and new kinds of image processing methods the system DETECTINO will be able to plot the subgrade by making it “diaphanous”.

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Project 26: Strategic Abilities under Imperfect Information: Modeling, Reasoning and Verification

Project Member
Dr. Wojciech Jamroga (Leader)

Partner
Dr. Thomas Ågotnes, Bergen University College, Norway

Funding
DFG
750€ (of 750€ total)

Duration
since 07/2005
**Project Description**

We propose a non-standard interpretation of Alternating-time Temporal Logic with imperfect information, for which no commonly accepted semantics has been proposed yet. Rather than changing the semantic structures, we generalize the usual interpretation of formulae in single states to sets of states. We propose a new epistemic operator for “practical” or “constructive” knowledge, and we show that the new logic (which we call Constructive Strategic Logic) is strictly more expressive than most existing solutions, while it retains the same model checking complexity.

We also propose a new class of representations that can be used for modeling (and model checking) temporal, strategic and epistemic properties of agents and their teams. Our representations borrow the main ideas from interpreted systems of Halpern, Fagin et al.; however, they are also modular and compact. Surprisingly, our complexity results suggest that model checking strategic abilities under imperfect information can be computationally cheaper than checking the perfect information case.

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**References**

[Jamroga and Ågotnes, 2006a] (Page 154),
[Jamroga and Ågotnes, 2007a] (Page 146),
[Jamroga and Ågotnes, 2007b] (Page 154)

**Contact E-Mail**

wjamroga@in.tu-clausthal.de
3.2.5 Scientific Activities

Person  Prof. Dr. Jürgen Dix

☐ Editorial Board Memberships

  See http://www.springerlink.com/content/1573-7470/

- Editorial Board of *Journal of Applied Logic*, Elsevier (since 2003).
  See http://www.elsevier.com/wps/product/cws_home/672712

- Editor-in-Chief of *IfI Technical Report Series*, Department of Informatics, TU Clausthal (since 2005).
  See http://www.in.tu-clausthal.de/forschung/technical-reports/


  See http://journals.cambridge.org/action/displayJournal?jid=TLP

  See http://www.jair.org/

  See http://www.ijop.org/

☐ Organization of Conferences and Workshops

- Co-Chair (with Stephen Hegner)
  See http://foiks.massey.ac.nz/foiks06/

- Co-Chair (with Anthony Hunter)
  *NMR '06: Eleventh International Workshop on Non-Monotonic Reasoning*, Lake District, United Kingdom, May 2006.
  See http://www.cs.ucl.ac.uk/staff/a.hunter/nmr/

- Co-Chair (with Mehdi Dastani and Peter Novák)
  See http://cig.in.tu-clausthal.de/CLIMAContest/
• Co-Chair (with Rafael Bordini, Mehdi Dastani and Amal El Fallah Segrouchni)
  See http://www.cs.uu.nl/ProMAS/2006/

• Co-Chair (with Mehdi Dastani and Peter Novák)
  See http://cig.in.tu-clausthal.de/index.php?id=agentcontest07

☐ PC-member of Conferences and Workshops

  See http://www.kr.tuwien.ac.at/wlp06/

  See http://foiks.massey.ac.nz/foiks06/

• AAMAS ’06: Fifth International Joint Conference on Autonomous Agents and Multiagent Systems, Hakodate, Japan, May 2006.
  See http://www.fun.ac.jp/aamas2006/main.html

• CLIMA ’06: Sixth Workshop on Computational Logic in Multi-Agent Systems, Hakodate, Japan, May 2006.
  See http://research.nii.ac.jp/climaVII/index.html

• ECAI 2006: The 17th European Conference on Artificial Intelligence, Riva del Garda, Italy, August 2006.
  See http://ecai2006.itc.it/cda/aree/index.php

• JELIA ’06: 10th European Conference on Logics in Artificial Intelligence, Liverpool, United Kingdom, September 2006.
  See http://www.csc.liv.ac.uk/~jelia/

• CACIC ’06: XII Argentine Congress on Computer Science, Potrero de los Funes, San Luis, Argentina, October 2006.
  See http://www.cacic2006.unsl.edu.ar/home.htm

• CIC ’06: 15th International Conference on Computing, Mexico City, Mexico, November 2006.
  See http://magno-congreso.cic.ipn.mx/CIC-2006/

  See http://2006.ruleml.org/
3.2 Computational Intelligence

- **MICAI ’06**: Mexican International Conference on Artificial Intelligence, Monterrey, Mexico, December 2006. See [http://www.MICAI.org/](http://www.MICAI.org/)
- **ARGNMR ’07**: Argumentation and Nonmonotonic Reasoning, Tempe, AZ, USA, May 2007. See [http://lia.deis.unibo.it/conf/ArgNMR/](http://lia.deis.unibo.it/conf/ArgNMR/)
- **FAInt ’07**: Workshop on Foundations of Artificial Intelligence at KI ’07, Osnabrück, Germany, September 2007. See [http://logic.aifb.uni-karlsruhe.de/wiki/FAInt-07](http://logic.aifb.uni-karlsruhe.de/wiki/FAInt-07)
- **MATES ’07**: Fifth German Conference on Multiagent System Technologies, Leipzig, Germany, September 2007. See [http://winf.in.tu-clausthal.de/mates07/](http://winf.in.tu-clausthal.de/mates07/)
- **KBR at KI ’07**: Workshop on Dynamics of Knowledge and Belief Representation, Osnabrück, Germany, September 2007. See [http://www.informatik.fernuni-hagen.de/pi8/dynamics07/](http://www.informatik.fernuni-hagen.de/pi8/dynamics07/)

• The First International Workshop on Unified Data Mining Engine: Addressing Challenges (UDME 2007), Montreal, Canada, October 2007. See http://www.oopsla.org/oopsla2007/


☐ Steering Committees

• Founding Member of CLIMA: Computational Logic in Multi-Agent Systems (since 2002). See http://centria.di.fct.unl.pt/~clima/

• Founding Member of ProMAS: International Workshop on Programming Multiagent Systems Languages and Tools (since 2003). See http://www.cs.uu.nl/ProMAS/

3.2 Computational Intelligence

Evaluator

- External Examiner (Erstgutachter).
  See [http://www.cs.bath.ac.uk/department/](http://www.cs.bath.ac.uk/department/).

- Expert Evaluator.

  See [http://www.epsrc.uk](http://www.epsrc.uk).

- Expert Evaluator.
  *IWT: Research funding and innovation stimulation agency of the Flanders government*, Belgium, 2007.

- EU Framework 6, Expert evaluator.

- EU Framework 7, Expert evaluator.

- EU Framework 6, Expert evaluator.

Invitations/Visiting Professorships

- Invited Talk.
  *Model Checking in Variants of ATL*.
  Dept. of CS, University of Bath, United Kingdom, May 2006.

- Invited Talk.
  *The second CLIMA-Contest*.
  See [http://cig.in.tu-clausthal.de/contest.html](http://cig.in.tu-clausthal.de/contest.html).

- Invited Lecturer.
  *Modeling the Dynamics of Knowledge. Two Traditions: Logic Programming vs. Modal Logic*.
  ESSLLI ’07: European Summer School on Logic, Language and Information, Dublin, Ireland, August 2007.
• Invited Lecturer.
  *Modal Logics for Multi-Agent Systems.*
  EASSS ’06: European Agent Systems Summer School, Annecy, France, July 2006.

• Invited Lecturer.
  *Modal Logics for Multi-Agent Systems.*
  EASSS ’07: European Agent Systems Summer School, Durham, United Kingdom, August 2007.

• Visiting Professor.
  Université Pierre et Marie Curie, LIP 6, Paris, France, March 2007.

• Invited Talk.
  *Model Checking Abilities of Agents: A Closer Look.*

• Invited Talk.
  *Heterogenous Temporal Probabilistic Programs.*

• Invited Talk.
  *What Can Agents Achieve in Multi-Agent Systems?*
  Dept. of CS, University of Dortmund, Germany, March 2007.
  See [http://ls6-www.informatik.uni-dortmund.de/](http://ls6-www.informatik.uni-dortmund.de/).

**Person**  Prof. Dr. Barbara Hammer

**Editorial Board Memberships**

• Editorial Board of *Neurocomputing*, Elsevier (since 2003).

• Editorial Board of *Neural Processing Letters*, Springer (since 2007).
  See [http://http://www.springerlink.com/content/100321/](http://www.springerlink.com/content/100321/)

**Organization of Conferences and Workshops**

• Co-Chair (with Michael Biehl, Michel Verleysen, Thomas Villmann)
  See [http://www.dagstuhl.de/en/program/calendar/semhp/?semid=29455](http://www.dagstuhl.de/en/program/calendar/semhp/?semid=29455)
Co-Chair (with Michael Biehl, Wolfgang Kinzel)

MPIPKS-Seminar: From Statistical Physics to Computer Science: Analysis of Biological and Medical Data, MPI Physik komplexer Systeme, Dresden, Germany, October 2007.

See http://www.mpiipks-dresden.mpg.de/pages/veranstaltungen/frames_veranstalt.html

PC-member of Conferences and Workshops

- ESANN 2006, Bruges, Belgium, April 2006.
  See http://www.dice.ucl.ac.be/esann/

- ANNPR 2006, Ulm, Germany, August 2006.
  See http://www.informatik.uni-ulm.de/ni/ANNPR06/

- Workshop on Neural Symbolic Integration ’06, Riva del Garda, Italy, August 2006.
  See http://www.neural-symbolic.org/NeSy06/

- Workshop on Neural Symbolic Integration ’07, Hyderabad, India, January 2007.
  See http://www.neural-symbolic.org/NeSy07/

  See http://www.dice.ucl.ac.be/esann/

  See http://www.ieee-ssci.org/


- Computational Intelligence 2007, Banff, Alberta, Canada, July 2007.
  See http://www.iasted.org/conferences/home-574.html

  See http://www.iasted.org/conferences/home-584.html

  See http://www.ki2007.uos.de/

- Workshop on Self-Organizing Maps 2007, Bielefeld, Germany, September 2007.
  See http://www.techfak.uni-bielefeld.de/wsom07/

  See http://cis2007.hit.edu.cn/

  See http://www.ittc.ku.edu/MLBB/
Evaluator

- Member.  
  PhD committee, Rijksuniversiteit Groningen, Netherlands, 2006.
- Member.  
  Habilitation committee, Klagenfurt University, Austria, 2007.

Invited Talks

- Invited Talk.  
  Recent Developments for Prototype-Based Systems,  
  Universität Lübeck, Germany, 2007.
- Invited Talk.  
  Recent Advances in Prototype Based Clustering and Classification,  
- Invited Talk.  
  New Developments for Recurrent Neural Systems,  
  Graduate School Mathematical Analysis of Evolution, Information and Complexity, University of Ulm, Germany, 2007.
- Invited Talk.  
  Clustering and Visualization of Relational Data,  
  Dagstuhl seminar on Statistical relational machine learning, Germany, 2007.
- Invited Lecturer.  
  Neuroinformatics,  
- Invited Lecturer.  
  Prototype Based Classification and Clustering,  
  Doctorate course, Univ. Louvain la Neuve, France, 2007.
- Invited talk.  
  Clinical Proteomics beyond Combinatorial Optimization,  
  Symposium on Combinatorial optimization and applications in honor of Peter Brucker, Osnabrück, Germany, 2007.
- Invited talk.  
  Recent Advances in Clustering,  
- Invited talk.  
  Maschinelles Lernen für Strukturen,  
  Informatik, Universität Freiburg, Germany, 2007.
- Invited talk.  
  Quo vadis Informatik? Maschinelles Lernen,  
  Dagstuhl Perspektiven-Seminar Quo vadis Informatik, Germany, 2006.
• Invited talk.

*Machine Learning using Prototype-based Methods*,

**Person** apl. Prof. Dr. Matthias Reuter

- **Editorial Board Memberships**
    See [http://www.systemsjournal.org/](http://www.systemsjournal.org/)

- **Organization of Conferences and Workshops**
  - Chair
    See [http://www.wacong.org/](http://www.wacong.org/)

- **PC-member of Conferences and Workshops**
    See [http://www.u-bourgogne.fr/SITIS/07/](http://www.u-bourgogne.fr/SITIS/07/)

**Person** Dr. Wojciech Jamroga

- **PC-member of Conferences and Workshops**
  - *7th Conference on Logic and the Foundations of Game and Decision Theory LOFT ’06*, Liverpool, United Kingdom, July 2006.
    See [http://www.csc.liv.ac.uk/loft06/](http://www.csc.liv.ac.uk/loft06/)
    See [http://ecai2006.itc.it/cda/aree/index.php](http://ecai2006.itc.it/cda/aree/index.php)


**Invited Talks/Invited Lectures**

- Invited Talk. 

- Invited Talk. 

- Invited Lecturer. 

- Invited Lecturer. 

- Invited Talk. 
3.2 Computational Intelligence

- Invited Talk.  
  *Modular Interpreted Systems.*  
  Institute of Computer Science, Polish Academy of Sciences, Warsaw, Poland, January 2007.  

- Invited Talk.  
  *ATL and Properties of Rational Agents.*  
  Institute of Computer Science, Polish Academy of Sciences, Warsaw, Poland, April 2007.  

- Invited Talk.  
  *Reasoning about Rational Agents: ATL with Plausibility.*  
  Individual and Collective Reasoning Group, University of Luxembourg, June 2007.  
  See [http://icr.uni.lu/](http://icr.uni.lu/).

- Invited Lecturer.  
  *Modeling the Dynamics of Knowledge. Two Traditions: Logic Programming vs. Modal Logic.*  
  ESSLLI ’07: European Summer School on Logic, Language and Information, Dublin, Ireland, August 2007.  

- Invited Lecturer.  
  *Modal Logics for Multi-Agent Systems.*  
  EASSS ’07: European Agent Systems Summer School, Durham, United Kingdom, August 2007.  

**Person** Dr. Yingqian Zhang

- PC-member of Conferences and Workshops
3.2.6 Highlights

In 2006

- Barbara Hammer has been invited as a speaker in the session *Machine Learning* of the 3rd Japanese-German *Frontiers of Science* Symposium, organized by the Alexander von Humboldt Foundation and the Japan Society for the Promotion of Science. Overall, 12 German and 12 Japanese scientists have been invited to present their research at the cutting edge of different disciplines to a diverse audience.

- Jürgen Dix has been invited to serve as a member of the EPSRC Peer Review College during the period 2006-2009. See [http://www.epsrc.ac.uk/college](http://www.epsrc.ac.uk/college).

In 2007

- Jürgen Dix has been invited for a guest professorship at Paris 6 for one month (March 2007).

- Jürgen Dix is an Expert Evaluator in the European Commission’s 7th Research Framework Programme, Strategic Objective 4.2 (Intelligent Content and Semantics) of the first Information and Communication Technologies (ICT) Call, and a Project Evaluator for the 6th Research Framework IST Programme.

- Matthias Reuter is awarded the title of *außerplanmässiger Professor* for his continuous lecturing and his work done here in Clausthal since his habilitation.

- Matthias Reuter receives the award *Technologiepreis der wehrtechnischen Industrie* for his research on the detection of land-mines using computer-based, self-adaptive methods. He shares the prize of 20.000 EUR with Wolfgang Schade.

- Barbara Hammer participates as invited attendee in the 4th Japanese-German *Frontiers of Science* Symposium in Japan. She is also invited by the German Humboldt Foundation to coorganize a session in the area of computer science and mathematics at the Japanese-German *Frontiers of Science* Conference 2008 in Germany.

- The paper “Relational Neural Gas” by Barbara Hammer and Alexander Hasenfuss wins the best paper award at KI’07.

- Barbara Hammer is shortlisted (3rd) in the selection process for the W3 professorship *Machine Learning* at Freiburg University.

Visitors:

- 21 June – 28 June 2006: Dr. Sebastian Sardina, RMIT University Melbourne, Australia.
• 3 July – 10 July 2006:
  Prof. Ilkka Niemelä, Helsinki University of Technology, Finland.

• 14 September – 21 September 2006:
  Prof. Guillermo Simari, Universidad Nacional del Sur, Bahia Blanca, Argentina.

• 21 June – 21 July 2007:
  Sergio Gomez, Universidad Nacional del Sur, Bahia Blanca, Argentina.

• 8 September – 23 September 2007:
  Dr. Carlos Chesnevar, Universidad Nacional del Sur, Bahia Blanca, Argentina.

• 26 November – 29 November 2007:
  Dr. Frank-Michael Schleiff and PD Thomas Villmann, Universität Leipzig, Germany.
3.3 Computer Graphics

3.3.1 Overview

**Leaders**
Prof. Dr. Kai Hormann (Juniorprofessor)
Prof. Dr. Gabriel Zachmann

**Secretary**
Stefanie Cronjäger

**Scientific Employees**
Dipl.-Inf. Daniel Mohr (since 03/2006)
Dipl.-Inf. René Weller
Dipl.-Inf. Tim Winkler (since 05/2006)

3.3.2 Research Agenda

Computer Graphics deals with all aspects of three-dimensional graphical objects drawing from computer science, mathematics, and other sciences. Graphical objects can represent anything from real-world objects, hypothetical objects, data, etc. Computer Graphics is the science of modelling, simulating, visualizing, and interacting with these objects and complete virtual environments built from them.

The Computer Graphics Group focuses mainly on geometric modelling (parameterization, reconstruction), virtual reality (natural interaction), rendering (real-time rendering of complex scenes), acceleration data structures (bounding volume hierarchies, collision detection), and scientific visualization (immersive visualization). The graphics lab is equipped with modern devices that support our research activities (3D scanner, cyberglove, head-mounted display, tracking system, cameras, etc.).

For more information, please visit the group’s homepage at: http://cg.in.tu-clausthal.de.

3.3.3 Supervised Theses


3.3.4 Projects

Project 27: Free-Viewpoint Video using Depth Cameras

Project Members
Prof. Dr. Kai Hormann (Leader)
Dipl.-Inf. Tim Winkler (Project Staff)

Partners
Prof. Dr. Craig Gotsman, Technion, Haifa, Israel (Leader)
Alexander Bogomjakov, Technion, Haifa, Israel

Funding
Volkswagen Foundation (Niedersächsisches Vorab)
103.000€ (of 225.000€ total)

Duration
01/2006 – 12/2008

Project Description
The main objective of this project is to build an end-to-end software system that will take the output of a small number of static depth cameras, and use this to enable the user to roam the scene with a virtual camera. The user will see high-quality images corresponding to the virtual camera position. This technology has many applications in the entertainment, gaming and medical industries.

Contact E-Mail
kai.hormann@tu-clausthal.de
Project 28: Generalized Barycentric Coordinates

Project Member
Prof. Dr. Kai Hormann

Partner
Prof. Dr. Michael S. Floater, University of Oslo, Norway

Duration
since 01/2004

Project Description
Barycentric coordinates for triangles are commonly used in computer graphics, geometric modelling, and other computational sciences, because they provide a convenient way to linearly interpolate data that is given at the corners of a triangle. In this project, we aim at extending the concept of barycentric coordinates to polygons with more than three vertices. We show that the mean value coordinates are the only known barycentric coordinates so far, that they are well-defined for arbitrary planar polygons without self-intersections. Besides many other important properties, these coordinate functions are smooth and allow an efficient and robust implementation. They are particularly useful for interpolating data that is given at the vertices of the polygons and we present several examples of their application to common problems in computer graphics and geometric modelling.

References
[Hormann and Floater, 2006] (Page 146),
[Floater et al., 2006] (Page 145),
[Floater and Hormann, 2007] (Page 145)

Contact E-Mail
kai.hormann@tu-clausthal.de

Project Homepage
http://www.in.tu-clausthal.de/~hormann/barycentric
Project 29: **Subdivision of Curves and Surfaces**

**Project Member**

Prof. Dr. Kai Hormann

**Partners**

Prof. Dr. Nira Dyn, Tel Aviv University, Israel
Prof. Dr. Michael S. Floater, University of Oslo, Norway
Dr. Malcolm Sabin, University of Cambridge, UK

**Duration**

since 07/2005

**Project Description**

Subdivision is the process of iteratively refining an initial control polygon or a control mesh into finer and finer polygons or meshes, such that the limit is a smooth curve or surface. One of the most famous schemes for curves is the interpolating 4-point scheme that is based on local cubic interpolants. We used the idea of local cubic sampling to create a dual 4-point scheme, which is only approximating but has higher smoothness. Remarkably, both schemes turn out to be the first two members of a whole family of schemes, all with cubic precision. In this project we further investigate the reproduction properties of subdivision schemes and also consider nonlinear variants.

**References**

[Dyn et al., 2007a] (Page 164),
[Dyn et al., 2007b] (Page 164)

**Contact E-Mail**

kai.hormann@tu-clausthal.de

Project 30: **Surface Parameterization and Reconstruction**

**Project Members**

Prof. Dr. Kai Hormann
Dipl.-Inf. Markus Melato

**Partners**

Prof. Dr. Alla Sheffer, University of British Columbia, Vancouver, Canada
Dr. Bruno Lévy, LORIA/INRIA Lorraine, Nancy, France
3.3 Computer Graphics

Duration
since 01/2006

Project Description
A parameterization of a surface can be viewed as a one-to-one mapping from a suitable domain to the surface. In general, the parameter domain itself will be a surface and so constructing a parameterization means mapping one surface into another. In this project we aim at studying and comparing existing methods as well as developing new techniques, each tailored to a specific problem. In particular, we focus on the applications of parameterization in computer graphics which include texture mapping, remeshing, and surface triangulation.

References
[Hormann et al., 2007] (Page 154),
[Melato et al., 2007] (Page 165)

Contact E-Mail
kai.hormann@tu-clausthal.de

Project Homepage
http://www.in.tu-clausthal.de/~hormann/parameterization

Project 31: Multiresolution of Gigantic Meshes

Project Members
Prof. Dr. Kai Hormann
Mag.-Math. Federico Ponchio

Partner
Dr. Paolo Cignoni, CNR, ISTI, Pisa, Italy

Duration
**Project Description**

The use of multiresolution techniques enables to process data as triangle meshes extremely efficiently. In this project, we pursue a strategy that is based on the idea of using triangle patches as the multiresolution primitive. Working efficiently with triangle patches and huge models requires a profound reorganization of data structures and algorithms. We have already applied our algorithms to the special case of terrain data and general 3D meshes and are currently working on a generalization to 4-dimensional data that is used to describe physical simulations. Besides the more complicated data structures and data handling, this also required to find a good strategy for visualizing the result using hardware supported features of the GPU.

**References**

[Dellepiane et al., 2007] (Page 151), and


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kai.hormann@tu-clausthal.de

**Project 32: Natural Interaction in Virtual Environments**

**Project Members**

Prof. Dr. Gabriel Zachmann (Leader)
Dipl.-Inf. Rene Weller (Project Staff)

**Funding**

DFG grant ZA292/1-2
30.000€ (of 300.000€ total)

**Duration**

07/2003 – 07/2009
Project Description

Virtual reality (VR) promised to allow users to experience and work with three-dimensional computer-simulated environments just like with the real world. Currently, VR offers a lot of efficient and more or less intuitive interaction paradigms.

However, users still cannot interact with virtual environments in a way they are used to in the real world. In particular, the human hand, which is our most versatile tool, is still only very crudely represented in the virtual world. Natural manual operations, such as grasping, pinching, pushing, etc., cannot be performed with the virtual hand in a plausible and efficient way in real-time.

Therefore, the goal of this project is to model and simulate the real human hand by a virtual hand. Such a virtual hand is controlled by the user of a virtual environment via hand tracking technologies, such as a CyberGlove or camera-based hand tracking (see our companion project). Then, the interaction between such a human hand model and the graphical objects in the virtual environment is to be modelled and simulated, such that the aforementioned natural hand operations can be performed efficiently. Note that our approach is not to try to achieve physical correctness of the interactions but to achieve real-time under all circumstances while maintaining physical plausibility.

In order to achieve our goal, we focus our research on deformable collision detection, physically-based simulation, and realistic animation of the virtual hand.

This technology will have a number of very useful applications, which can, until now, not be performed effectively and satisfactorily. Some of them are virtual assembly simulation, 3D sketching, medical surgery training, or simulation games.
**Project 33: Kinetic Data Structures for Collision Detection**

**Project Members**

- Prof. Dr. Gabriel Zachmann (Leader)
- Dipl.-Inf. Rene Weller (Project Staff)

**Funding**

- DFG grant ZA292/1-1
- 60,000€ (of 300,000€ total)

**Duration**


**Project Description**

Bounding volume hierarchies for geometric objects are widely employed in many areas of computer science to accelerate geometric queries, e.g., in computer graphics for ray-tracing, occlusion culling and collision detection. Usually, a bounding volume hierarchy is constructed in a preprocessing step which is suitable as long as the objects are rigid. However, deformable objects play an important role, e.g., for creating virtual environments in medical applications or cloth simulation. If such an object deforms, the pre-processed hierarchy becomes invalid.

In order to use this method for deforming objects as well, it is necessary to update the hierarchies after the deformation.

In this project, we utilize the framework of event-based kinetic data structures for designing and analyzing new algorithms for updating bounding volume hierarchies undergoing arbitrary deformations. In addition, we apply our new algorithms and data structures to the problem of collision detection.
3.3 Computer Graphics

References
[Zachmann and Weller, 2006] (Page 163),
[Weller and Zachmann, 2006] (Page 163)

Contact E-Mail
zach@tu-clausthal.de

Project 34: Real-time camera-based 3D hand tracking

Project Members
Prof. Dr. Gabriel Zachmann (Leader)
Dipl.-Inf. Daniel Mohr (Project Staff)

Funding
DFG grant ZA292/1-1
30.000€ (of 300.000€ total)

Duration
07/2003 – 07/2009

Project Description
Tracking a user’s hand can be a great alternative to common interfaces for human-computer interaction. The goal of this project is to achieve marker-less tracking of a user’s hand. The camera’s images contain the information needed to determine the hand position and state, i.e., 27 degrees of freedom. Because of measurement noise, occlusion in the captured images, and real-time constraints, hand-tracking is a scientific challenge.

Our approach is model-based, utilizing multiple cameras to reduce uncertainty. In order to achieve real-time hand-tracking, we will try to reduce the dimensionality of the state space.
Project 35: Dedicated Hardware for Collision Detection

Project Member
Prof. Dr. Gabriel Zachmann (Leader)

Partners
Prof. Dr. Joachim Anlauf, Bonn University
Dipl.-Inform. Andreas Raabe, Bonn University

Funding
DFG grant ZA292/2-2
60.000€ (of 120.000€ total)

Duration
01/2005 – 02/2007

Project Description
Many applications, such as virtual prototyping, haptic rendering, and games, pose high demands on collision detection: it should be real-time under all circumstances, and it must be able to handle large numbers of objects and large numbers of polygons.

Currently, the computational power of graphics hardware increases faster than Moore’s Law, while the computing power of the general purpose CPU increases “only” by Moore’s Law.

Motivated by these findings, the overall objective of this project is the development of specialized hardware architectures to deliver real-time collision detection for large-scale and complex virtual environments. These are implemented on FPGA boards and will be demonstrated by representative sample applications.
References

[Weller et al., 2006] (Page 163),
[Raabe et al., 2006a] (Page 158)

Contact E-Mail

zach@tu-clausthal.de

Project 36: Open-Source Collision Detection Library

Project Members

Prof. Dr. Gabriel Zachmann (Leader)
Dipl.-Inf. Rene Weller (Project Staff)

Project Description

Fast and exact collision detection between a pair of graphical objects undergoing rigid motions is at the core of many simulation and planning algorithms in computer graphics and related areas (for instance, automatic path finding, or tolerance checking). In particular, virtual reality applications such as virtual prototyping or haptic rendering need exact collision detection at interactive speed for very complex, arbitrary “polygon soups”. It is also a fundamental problem of dynamic simulation of rigid bodies, simulation of natural interaction with objects, haptic rendering, path planning, and CAD/CAM.

In order to provide an easy-to-use library for other researchers and open-source projects, we have implemented our algorithms in an object-oriented library, which is based on OpenSG (www.opensg.org). It is structured as a pipeline and contains algorithms for the broad phase (grid, convex hull test, separating planes) and the narrow phase (Dop-Tree, BoxTree, etc.).
References
[Trenkel et al., 2007] (Page 162),
[Raabe et al., 2006b] (Page 158)

Contact E-Mail
zach@tu-clausthal.de

3.3.5 Scientific Activities

Person Prof. Dr. Kai Hormann

Organization of Conferences and Workshops
• Co-Organizer (with Alla Sheffer and Bruno Lévy)
  SIGGRAPH course “Mesh Parameterization: Theory and Practice”, San
  Diego, CA, USA, August 2007.
• Co-Organizer (with Michael S. Floater)
  Mini-symposium “Barycentric Coordinates and Transfinite Interpolation”,
  San Antonio, TX, USA, November 2007.
  See http://www.in.tu-clausthal.de/~hormann/barycentric/index.html

PC-member of Conferences and Workshops
• SGP 2006: 4th Eurographics Symposium on Geometry Processing, Cagliari,
  Italy, June 2006.
  See http://sgp2006.sc.unica.it/
• SMI '06: IEEE International Conference on Shape Modeling and Applications,
  Matsushima, Japan, June 2006.
  See http://www.ifs.tohoku.ac.jp/SMI06/
• VMV 2006: 11th International Fall Workshop Vision, Modeling, and Visualization, Aachen, Germany, November 2006. See http://www.vmv2006.rwth-aachen.de/


• Twelfth IMA Conference on the Mathematics of Surfaces, Sheffield, United Kingdom, September 2007. See http://ralph.cs.cf.ac.uk/MOSXIIcall.html


• VMV 2007: 12th International Fall Workshop Vision, Modeling, and Visualization, Saarbrücken, Germany, November 2007. See http://www.mpi-inf.mpg.de/conferences/vmv07/

Evaluator


• Expert Evaluator for Engineering and Physical Sciences Research Council (EPSRC), United Kingdom, January 2007. See http://www.epsrc.ac.uk.


Invitations/Visiting Professorships


**Person**  Prof. Dr. Gabriel Zachmann

**Editorial Board Memberships**


**Organization of Conferences and Workshops**

• Organizer (together with Stefan Müller)

• Organizer
PC-member of Conferences and Workshops

- Eurographics, Vienna, Austria, September 2006. See http://www.cg.tuwien.ac.at/events/EG06/index.php
- CAD/Graphics, Jinan, China, October 2006. See http://
- Cyberworlds, Hannover, Germany, October 2007. See http://www.gdv.uni-hannover.de/events/hcw07/
Evaluator

- Expert Reviewer for an EU FP-6 project (STREP), December 2007.

Invitations

- Invited talk at the 2nd Advanced Study Institute “Product Engineering: Tools and Methods Based on Virtual Reality”, Chania, Crete, June 2007, sponsored by the INTUITION Network of Excellence.
- Invited Talk at the 8th Corporate Workshop “Virtual and Augmented Reality” at Volkswagen, September 2006.

3.3.6 Highlights

In 2007

- January 2007:
  Kai Hormann was shortlisted (3rd) in the election of the W2 professorship “Computer Graphics” at Bielefeld University.
- September 2007:
  Kai Hormann successfully passes the mid-term evaluation of his Junior-Professorship.

Visitors

- 28 July 2006 – 5 August 2006:
  Prof. Dr. Nira Dyn from Tel Aviv and Prof. Dr. Michael S. Floater from Oslo visited us for two weeks to perform some joint research on subdivision schemes.
- 17 November 2006 – 1 December 2006:
  Andreas Raabe from Bonn University (collaboration on hardware-accelerated collision detection).
- 15 October 2007 – 19 October 2007:
  Laurent Saboret from INRIA Sophia-Antipolis visited us to scan several objects with our 3D scanner for the EU Excellence project AIM@SHAPE.
3.4 Computer Systems

3.4.1 Overview

Leader Prof. Dr.-Ing. Dr. rer. nat. habil. Harald Richter

Secretary Stefanie Cronjäger

Scientific Employees

Dipl.-Inf. Christian Asam (0,5 BAT IIa)
Dr.-Ing. Abdelaziz Guerrouat (until 09/2006)
B.Sc./B.Eng. Garry Rank (since 11/2007)
Dipl.-Inf. Dietmar Sommerfeld (0,5 BAT IIa, until 03/2007)
Dipl.-Inf. Marcel Wille

Scholars

Dr. Sergej Alexejew (since 10/2007)
B.Sc./M.Sc. Ghulam Mustafa Junejo Khan (since 09/2007)
Dipl.-Ing. Hossam A. Ramadan (until 04/2007)

External Ph.D. Students

Dipl.-Inf. Dietmar Sommerfeld, GWDG, Göttingen (since 04/2007)
Dipl.-Inf. Janko Heilgeist, Max-Planck-Computing Center, Garching

3.4.2 Research Agenda

Our group has its focus on following research areas: Computer networks (Real-time LANs for cars, process control and automation), Automobile mechatronics (X-by-wire, Cockpit-by-wire, driving simulator, remotely controlled rover), Computer architectures (Real-time parallel computers for measurement-data acquisition and -processing, feed forward and feed back control), Grid computing (Job scheduling in compute grids, job allocation in data grids),

See the group’s homepage at:
http://www.in.tu-clausthal.de/abteilungen/rechnersysteme/personen/

3.4.3 Supervised Theses


3.4.4 Projects

Project 37: Steer-by-Wire and CarRing II

Project Members
Prof. Dr. Harald Richter (Leader)
Dipl.-Inf. Marcel Wille
Dipl.-Inf. Christian Asam

Partner
Dr. Sergej Alexejew, Tambow University of Technology, Russia

Funding
German Science Foundation (DFG), TU Clausthal, German Academic Exchange Service (DAAD), Ministry for Science and Culture (MWK), Bund der Freunde der TUC, Faculty, Companies
260,000€ (of 260,000€ total)

Duration
since 2005

Project Description
In future steer-by-wire systems for cars, the front wheels are steered in real-time by means of two electric motors according to the rotation angle and torque of the steering wheel. There is no mechanical connection between steering wheel and front wheels. This is accomplished by a distributed mechatronic system with a field bus as communication means. However, field busses only have layer 1 and 2 in the ISO 7-layer model.

We propose instead a dedicated, fully-fledged, real-time computer network called CarRing II. CarRing II exhibits functions from all 7 ISO layers and aims at general intra-car-communications by means of a system’s perspective. It optimally supports future x-by-wire driver-assistance systems with steer-by-wire as a special case. Its 4 main goals in comparison to field busses are better reliability and real-time capability as well as better usability and effectiveness.
The innovations are in the chosen application itself and in the way we want to achieve the 4 goals for CarRing II. CarRing II is based on optical plastic fibers arranged in rings that transmit data with 1 Gbits/s. It has a new medium access with fairness, livelock- and deadlock-avoidance, guaranteed packet latency and high-bandwidth efficiency. It allows for automatic car-wide routing, authentication, authorization, common data-exchange format and a new programming model with distributed registers and remote interrupts. By these features, and its quality of service for data transfers, it is unique in intra-car-communication even compared to its closest competitor the AUTOSAR (AUTomotive Open System ARchitecture) middleware for interoperable communication between automotive electronics.

References
[Wille et al., 2007] (Page 163),
[Wille and Richter, 2006a] (Page 163)

Contact E-Mail
hri@tu-clausthal.de

Project Homepage
http://www.in.tu-clausthal.de/de/abteilungen/rechnersysteme/forschung/
abteilung-rechnernetze/projekt-carring-ii/

Project 38: E-Learning Academic Network Niedersachsen (ELAN)

Project Members
Prof. Dr. Harald Richter
Dipl.-Inf. Dietmar Sommerfeld (Project Staff)

Partners
Prof. Dr. Dieter Hogrefe, Universität Göttingen, Germany
Prof. Dr. Matthias Schumann, Universität Göttingen, Germany

Funding
MWK Niedersachsen
126.000€ (of 20.000.000€ total)

Duration

Project Description
The goal of ELAN in Clausthal was the creation and consolidation of a teaching network in Informatics between TUC and the University of Göttingen. In this project, vacancies in the syllabus could be filled and the personnel resources in teaching could be engaged in an optimal way on both sides. As an example, the following lectures were transmitted via MPEG II over the Internet to the University of Göttingen on a regular basis: Computer Networks I,II, Computer Architecture I and Informatics IV. Mobile Communication I,II, e.g., was imported from Göttingen among others.
The teaching network enhanced and complemented the number of lectures offered to the students as well as their quality. Thus, the lecturers were able to focus on their respective core competences and to make a larger group of people to share their knowledge.

Contact E-Mail
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Project Homepage
http://www.elan-niedersachsen.de

Project 39: Formal Methods

Project Members
Prof. Dr. Harald Richter (Leader)
Dr. Abdelaziz Guerrouat

Duration
03/2002 – 09/2006

Project Description
In the project "Formal Methods" we deal with specification and verification under real-time requirements using attributed finite state machines. When developing software for embedded systems that work in real-time, non-formal or semi-formal software and hardware design procedures reach rapidly their limits. These can be bypassed in part by formal methods. In addition to specification and verification of functions, real-time capabilities, pre- and post conditions, formal methods do also support checking of properties such as availability, system integrity, safety, robustness and maintainability. Last but not least, abstraction, independency of implementation platforms, scalability and unambiguity are improved by designing and testing with formal methods.

References
[Guerrouat and Richter, 2006d] (Page 145),
[Guerrouat and Richter, 2006a] (Page 145),
[Guerrouat and Richter, 2006f] (Page 152),
[Guerrouat and Richter, 2006c] (Page 152)

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Project 40: DEISA Subproject Metascheduler

Project Members

Prof. Dr. Harald Richter (Leader)
Dipl.-Inf. Janko Heilgeist (Project Staff)

Partner

Dr. Thomas Soddemann, Max-Planck Computing Center Garching (RZG), Germany

Duration

2006 – 2008

Project Description

With the advent of grid computing, a special form of distributed computing, computing resources of many distributed centers are available to their customers which are themselves in some projects distributed all over the world. In order to be able to efficiently offer resources to customers, the necessity grows to balance resource requests across grid infrastructures automatically. Currently, with a few exceptions grid infrastructures only offer limited support for brokering resources. Grid middlewares like UNICORE and the Globus Tool Kit require the user to make the decision on specifying the site which may be offering resources.

DEISA is the Distributed European Infrastructure for Supercomputing Applications we are participating with as subcontractor of the Max-Planck Computing Center Garching. DEISA is a research project of the European community (FP6) and formed by eleven of the top European computing centers. Hence, it is much more than just another Grid project. DEISA offers its customers the unique opportunity to access supercomputing resources hardly available elsewhere.

While most of the computing resources are used at single sites, there are projects which can make use of resources allocated at multiple sites. Due to nonexisting middleware, currently the resource allocation for such requests is performed manually. Those deficiencies in automated cross-site resource allocation lead to a few attempts of improving the situation. E.g., the Gridway project tries to address the problem especially in a Globus Tool Kit context. The Platform project offers a proprietary solution with LSF Multicluster.

All these attempts have some disadvantages our approach will try to circumvent. The core of our approach is a distributed meta-scheduling architecture which allows the migration of jobs between the participating resource providers of a grid-like infrastructure with the aim of improved resource utilization, load balancing, and turn over times. The approach makes use of Peer-2-Peer-based algorithms and multicriteria decision algorithms.
References

[Heilgeist et al., 2007] (Page 154), and


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Project Homepage

http://www.in.tu-clausthal.de/de/abteilungen/rechnersysteme/forschung/abteilung-rechnernetze/compute-grid/

3.4.5 Scientific Activities

Person Prof. Dr. Harald Richter

- PC-member of Conferences and Workshops

- Visits, Awards, Invited Talks
  - Visits to other research groups. Thanks to our external Ph.D. students, numerous visits took place to Prof. Haan at GWDG and Dr. Soddemann at Max-Planck-Computing Center, Garching and Göttingen, Germany, since 2006.
• Best Paper Award.  

• Top 20 Innovations Award.  

### 3.4.6 Highlights

- **Exhibitor.**  
  Hannover Fair, Hannover, Germany, April 2007.  

- **Exhibitor.**  
  International Automobile Exhibition IAA, Frankfurt, Germany, September 2007.  

- **Exhibitor.**  
  Ideenexpo, Hannover, Germany, October 2007.  

- **Exhibitor.**  
Professional Movie (16 minutes).
_**Caring II - Ein zuverlässiges Echtzeit-Rechnernetz für Steer-By-Wire**_ (March 2006).

Professional Movie (32 minutes).

Professional Movie (35 minutes).
See [http://video.tu-clausthal.de/kurzfilme_forschung/ifi/carRingII_eng/](http://video.tu-clausthal.de/kurzfilme_forschung/ifi/carRingII_eng/).

Donations received.
Approximately 24,000 EUR was received for _**CarRing II**_ and _**TUCar V0**_ projects in 2007.

Interviews with newspapers, radio stations and TV.
Interviews were given to _**Frankfurter Rundschau**, **Goslarscher Zeitung**, **Deutschlandfunk**, **RAI**, and others.

E-Learning.
Lectures _**Informatik IV, Rechnernetze I, Rechnernetze II, and Rechnerarchitektur**_ were transmitted on a regular basis to Clausthal and Göttingen Universities in the frame of _eLearning Academic Network Niedersachsens (ELAN)_ . Göttingen and Clausthal, Germany (since 2004).
See [http://www.in.tu-clausthal.de/abteilungen/rechnersysteme/lehre/](http://www.in.tu-clausthal.de/abteilungen/rechnersysteme/lehre/).

Host for **DAAD** scholarship holders and **IAESTE** student apprentices.
The group regularly hosts students and scientists from abroad sent by **DAAD** and **IAESTE**.
Person  Dipl.-Inf. Marcel Wille

- Invited talks
  - *Beyond FlexRay - A Survey of CarRing II*
    ATAC Design Forum on Automotive Bus Systems at IEEE International Solid-State Circuits Conference (ISSCC), San Francisco (USA), Febr. 2007

- Other functions
  - Booth Organizer and manager
  - Organizer of the annual “Student Information Days” at IfI
  - Main organizer of the “Nacht der Informatik”, 2006
3.5 Databases and Information Systems

3.5.1 Overview

Leader Prof. Dr. Sven Hartmann (since 01/2008)

Secretary Andrea Behfeld (since 06/2007)

Scientific NN (position to be filled in near future)

Employees NN (position to be filled in near future)

3.5.2 Research Agenda

Our research focusses mainly on XML data processing (keys, dependencies, query optimisation, transformation, distribution, algorithms), conceptual modelling (schema evolution and decomposition, cardinality constraints, ontologies, rich data models), business intelligence and optimisation (automated reasoning, dependency mining, vulnerability assessment, analytical lab automation, combinatorial designs), and data-intensive applications (in life sciences, engineering, OCR, and finance).

For more information, please see the group’s homepage at http://dbis.in.tu-clausthal.de.
3.6  Hardware and Robotics

3.6.1  Overview

**Leaders**  
apl. Prof. Dr. Günter Kemnitz  
Prof. Dr. Christian Siemers (FH Nordhausen)

**Secretary**  
Christine Kammann

**Scientific Employees**  
Dipl.-Inf. Carsten Giesemann  
Dipl.-Inf. Detlef Jantz (until 06/2007)

3.6.2  Research Agenda

The research group deals with various types of technical systems and applications: computer hardware, control systems, mechatronical systems and robots. The main focus is on reliability. The PERM project e.g. embeds security management features in the hardware of a RISC processor, the TEC Project (Time-Enhanced C) deals with design support (both hard- and software for small embedded systems to avoid malfunctions in real time applications. In the more application oriented projects systems to work under rough conditions has been developed.

See the group’s homepage at: [http://techwww.in.tu-clausthal.de/](http://techwww.in.tu-clausthal.de/)

3.6.3  Supervised Theses


3.6 Hardware and Robotics


3.6.4 Projects

Project 41: Fast+Safe+SPS - Hardware and Compiler Development

**Project Members**

Prof. Dr. Christian Siemers (Leader)
Dipl.-Inf. Sascha Lützel (Project Staff, Nordhausen)

**Partners**

Dipl.-Ing. Walter Zander, Zander GmbH&Co KG, Aachen, Germany (Leader)
Dipl.-Ing. Alfons Austerhoff, Zander GmbH&Co KG, Aachen, Germany

**Funding**

BMWi
61,500€ (of 87,000€ total)

**Duration**

01/2007 – 12/2008
**Project Description**

Automation technology for controlling machines and safety technology to prevent persons and machines from accidents are completely separated from each other, concerning actual products on the market. But the market itself requires combined products, and this project refers to this requirement. The programmable logic control (PLC) devices of the future will integrate the control part as well as the safety part, and this must be based on diverse redundant hardware. The project consists of developing this hardware architecture and developing the corresponding software compiler for partitioning the application and mapping it on the hardware parts.

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### 3.6.5 Scientific Activities

**Person** Prof. Dr. Christian Siemers

- **Editorial Board Memberships**
  - Advisory Board of *Mechatronik F&M*, Hanser (since 2005).
    See [http://www.elektronikpraxis.vogel.de/index.cfm?pid=2052](http://www.elektronikpraxis.vogel.de/index.cfm?pid=2052)

- **Other Functions**
  - Christian Siemers is an Expert Evaluator in the INNOWATT funding program of the BMWi since 2007.

### 3.6.6 Highlights

- In 2007
  - In spring 2007 Springer-Verlag has published the textbook “Test and Dependability of Computers” by Günter Kemnitz.
  - Writing a textbook on electronics by Günter Kemnitz (still not published) and redesigning the laboratory exercises for the electronic course.
  - Christian Siemers is involved in the “Exzellenz-Initiative Profil und Kooperation” for small and medium-sized universities (following a call for proposals by the Stifterverband für die Deutsche Wissenschaft and the Heinz-Nixdorf Stiftung), to be funded in 2008/09.
3.7 Software Systems Engineering

3.7.1 Overview

Leaders
Dr. Frank Padberg (until 09/2006)
Prof. Dr. Andreas Rausch (since 02/2007)

Secretary
Annett Panterodt (since 03/2006)

Scientific Employees
Dipl.-Inf. André Appel (since 01/2007)
Dipl.-Inf. Christian Bartelt (since 04/2007)
Dipl.-Inf. Constanze Deiters (since 05/2007)
Dipl.-Inf. Michael Deynet (since 01/2007)
Dipl.-Inf. Edward Fischer (since 01/2007)
Dipl.-Inform. Sebastian Herold (since 01/2007)
Dipl.-Inf. Holger Klus (since 01/2007)
Dipl.-Inf. Dirk Niebuhr (since 01/2007)
Dipl.-Wirtsch.-Ing. Thomas Ternité (since 01/2007)

Associated Members
Dipl.-Inf. Harald Klein (Siemens AG)

3.7.2 Research Agenda

The research goal of the group of Prof. Dr. Rausch is to improve the dependability of software systems and their development, operation, maintenance, support and evolution. Therefore we provide a kit containing methods, techniques and tools for successful engineering of software systems. Our task is to improve this kit with valid and consolidated findings from research, and to transfer it to practice.

The research of the group of Prof. Dr. Rausch focuses on the following areas: practicable and applicable process models, model based software development, and sustainable software architectures. The basis of these research areas is formed by fundamental programming techniques, technologies, and methods of software system engineering. All research results are demonstrated in seamless tool support realized within demonstrating scenarios. The results are validated together with industrial partners, and in their environment.

See Prof. Dr. Rausch’s homepage at: http://www.in.tu-clausthal.de/abteilungen/software-systems-engineering/
3.7.3 Supervised Theses


3.7.4 Projects

**Project 42: Weiterentwicklung des Entwicklungsstandards für IT-Systeme des Bundes auf Basis des V-Modell-97 (WEIT)**

*Project Members*

- Prof. Dr. Andreas Rausch (Leader)
- Dipl.-Inf. Christian Bartelt (Project Staff)
- Dipl.-Inf. Michael Deynet (Project Staff)
- Dipl.-Inf. Edward Fischer (Project Staff)
- Dipl.-Inf. Dirk Niebuhr (Project Staff)

*Partners*

- IT-AmtBw, Koblenz, Germany
- BMI/KBSt, Berlin, Germany
- Siemens AG, Munich, Germany
- EADS, Ottobrunn, Germany
- IABG, Ottobrunn, Germany
- 4Soft, München, Germany
- Prof. Dr. Dr. h.c. Manfred Broy, University of München, Germany

*Funding*

IT-AmtBw and BMI/KBSt

1.260.000€ (of 4.311.000€ total)

*Duration*

3.7 Software Systems Engineering

**Project Description**
Focus of the project is the further development of the Development Standard for IT Systems of the Federal Republic of Germany, the V-Modell XT. The V-Modell XT as it is a successor of the V-Modell 97, is a process model for planning and realizing development projects. It is designed as guidance for planning and executing development projects, considering the entire system life cycle. It defines the results to be achieved in a project and describes the actual approaches for developing these results. Moreover process management tools as well as process execution tools are developed and provided within the project.

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**Project Homepage**
http://www.v-modell-xt.de

**Project 43: Evaluation and Implementation of the V-Modell XT within the Bundeswehr (EvaXT)**

**Project Members**
- Prof. Dr. Andreas Rausch (Leader)
- Dipl.-Inf. Christian Bartelt (Project Staff)
- Dipl.-Wirtsch.-Ing. Thomas Ternité (Project Staff)

**Partners**
- IT-AmtBw, Koblenz, Germany
- Prof. Dr. Dr. h.c. Manfred Broy, University of München, Germany
- 4Soft, München, Germany

**Funding**
- IT-AmtBw and BMI/KBSt
  192,000€ (of 192,000€ total)

**Duration**

**Project Description**
Focus of the project is the evaluation of the applicability of the V-Modell XT in the context of the Bundeswehr IT projects. Based on this experience the V-Modell XT will be customized to the specific needs of the Bundeswehr and finally implemented within the Bundeswehr

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Project 44: AladinBP: A V-Modell XT Pilot Application Project (AladinBP)

Project Members

Prof. Dr. Andreas Rausch (Leader)
Dipl.-Wirtsch.-Ing. Thomas Ternité (Project Staff)

Partner

ZIVIT, Hamburg, Germany

Funding

ZIVIT
18.000€ (of 18.000€ total)

Duration


Project Description

The main goal of the project is to introduce the V-Modell XT into the AladinBP project of ZIVIT. Thereby the project management approaches should be further improved and proper tool support will be established.

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Project 45: KAPCompact: A V-Modell XT Pilot Application Project (KAPCompact)

Project Members

Prof. Dr. Andreas Rausch (Leader)
Dipl.-Inf. Edward Fischer (Project Staff)
Dipl.-Inf. Björn Schindler (Project Staff)

Partners

Funkwerk Kölleda, Kölleda, Germany
MID, Nürnberg, Germany
4Soft, München, Germany
Fraunhofer Gesellschaft, Fraunhofer IESE, Kaiserslautern, Germany

Funding

Funkwerk Kölleda HFWK
31.000€ (of 86.000€ total)

Duration

19.01.2007 – 31.05.2008

Project Description

The Funkwerk Kölleda (HFWK) is a system provider for communications technology. As safety is a vital issue in this sector, numerous engineering standards exists, constraining products and their development processes. This has regularly implied a significant resource consumption for HFWK.
To improve this situation, the process model V-Modell XT should be adopted and evaluated in this pilot project. In particular, following goals are covered: First, finding out at which degree the V-Modell XT is usefull to pursue different Safety Integrity Levels (SIL). Second, developing an integrated method for analysing, designing, implementing and testing Reactive Systems in conjunction with the V-Modell XT. Third, figuring out proper tool support, and finally fifth, operationalizing the adoption of the V-Modell XT to illustrate its impact.

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Project 46: Improvement and Maintenance of the V-Modell Bayern (WarWeiVMBay)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Wirtsch.-Ing. Thomas Ternité (Project Staff)
Dipl.-Inf. Edward Fischer (Project Staff)

Partner
Bavarian Department of the Interior, München, Germany

Funding
StMI Bayern
24.000€ (of 24.000€ total)

Duration

Project Description
The Bavarian Department of the Interior uses an organization-specific adaptation of the V-Modell XT as process model standard when developing software systems. This Process Model Bavaria was initially derived from version 1.0 of the V-Modell XT. Focus of the project WarWeiVMBay is the migration of the process model to the actual version of the V-Modell XT and to make available a development environment for further development and an easier adjustment of the process model to the developing standard.

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Project 47: Evaluation and Application of the V-Modell XT at the Federal Network Agency (BNetzA)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Wirtsch.-Ing. Thomas Ternité (Project Staff)
**Partners**  
MID, Nürnberg, Germany  
4Soft, München, Germany  
Bundesnetzagentur, Bonn, Germany

**Funding**  
BNA und BMI/KBSt  
60,000€ (of 60,000€ total)

**Duration**  
1.5.2007 – 30.6.2008

**Project Description**  
The Federal Network Agency (Bundesnachrichtenagentur) has developed an organisation specific V-Modell 97 for its software development processes. In 2005, the V-Modell XT came apparent and it was decided to migrate the defines process to the V-Modell XT metamodel. The project goals include performing this migration. In addition to that, the requirements management process is to be revised and enriched with modern requirements engineering concepts.

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**Project 48: Process Implementation and Improvement in Industrial Practice (V-Bench)**

**Project Members**  
Prof. Dr. Andreas Rausch (Leader)  
Dipl.-Inf. Christian Bartelt (Project Staff)  
Dipl.-Inform. Sebastian Herold (Project Staff)

**Partners**  
Fraunhofer Gesellschaft, Fraunhofer ISE, Kaiserslautern, Germany  
TU München, Munich, Germany  
MID GmbH Enterprise Software Solutions, Nuremberg, Germany  
Josef Witt GmbH, Weiden/Oberpfalz, Germany  
Lufthansa Systems AS GmbH, Norderstedt, Germany  
Funkwerk Köllda, Köllda, Germany  
4Soft GmbH, Munich, Germany

**Funding**  
BMBF  
210,400€ (of 1,900,000€ total)

**Duration**  
**Project Description**

The research project "V-Bench" aims at developing cost-effective practices for introducing and maturing processes. These practices will be empirical proved in industrial pilot projects in the field of the development standard for IT systems of the Federal Republic of Germany, the V-Modell XT. Those practices are going to include approaches for the tailoring and evaluating of V-Modell variants, managing variants, and tool support for introducing and maintenance of tailored V-Modell versions by a prototypical internet-based process "work bench".

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**Project 49: Common Component Modeling Example (CoCoME)**

**Project Members**

- Prof. Dr. Andreas Rausch (Leader)
- Dipl.-Inf. André Appel (Project Staff)
- Dipl.-Inform. Sebastian Herold (Project Staff)
- Dipl.-Inf. Holger Klus (Project Staff)

**Partners**

- Prof. Dr. Ralf Reussner, Universität Karlsruhe, Germany
- Raffaela Mirandola, Politecnico di Milano, IT
- Prof. Dr. Frantisek Plasil, Charles University, Prague, CZ

**Funding**

GI Research Seminar

5,000€ (of 20,000€ total)

**Duration**

08/2006 – 06/2008

**Project Description**

Component-based software development (CBSD) has changed the current paradigm of software development. As systems become more and more complex, CBSD is to a greater extend applied in industry and plays a more and more important role in research. In order to leverage CBSD to build correct and dependable component-based systems, research has developed various formal and semi-formal component models. However, many of these component models like DisCComp, Fractal, Focus, or UML Extensions concentrate on different yet related aspects of component modelling. These are for instance communication issues or performance aspects. This hinders their validation for practical usage. Therefore, the main goal of the research seminar is to evaluate and compare the practical appliance of existing component models using a common component-based system as modelling example.
Project 50: Service-Oriented Standard Architecture and Modelling Approach (WittCS)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Inform. Sebastian Herold (Project Staff)

Partner
Josef Witt GmbH, Weiden, Germany

Funding
Josef Witt GmbH
35,000€ (of 35,000€ total)

Duration
03/2006 – 01/2007

Project Description
The project "Witt Client/Server" focuses on developing and introducing a standard software architecture solution for the client/server information systems at our industrial cooperation partner, Josef Witt GmbH, which runs medium to large scale information systems to support their mail order business. Additionally, a model-driven development approach is developed to tackle the raising complexity of their systems.

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Project 51: Venus: A V-Modell XT Pilot Application Project (Venus)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Wirtsch.-Ing. Thomas Ternité (Project Staff)

Partners
MID, Nürnberg, Germany
4Soft, München, Germany
ZIVIT, Hamburg, Germany

Funding
ZIVIT and BMI/KBSt
16,000€ (of 40,000€ total)

Duration
Project Description
ZIVIT HH is slowly introducing the V-Modell XT in its organisation. The project covers the application of a pilot project VENUS with a focus on quality assurance aspects.

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Project 52: Compliance Evaluation of the Eurofighter Development Process with the V-Modell XT (Eurofighter)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Inf. Edward Fischer (Project Staff)

Partners
IESE, Kaiserslautern, Germany
BMVg, Bonn, Germany
EADS, Ottobrunn, Germany

Funding
EADS Deutschland GmbH
14,000€ (of 33,000€ total)

Duration
1.2.2007 – 31.5.2007

Project Description
The Eurofighter System Support Center (SUZ EF) is pursuing conformity to the V-Modell XT, which is the Development Standard for IT Systems of the Federal Republic of Germany. However, methods for measuring such a conformity have not been developed yet. The goal of this project is to fill in this gap by developing a suitable conformity assessment method, and applying it on the example of SUZ EF.

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Project 53: Bafög: A V-Modell XT Pilot Application Project (Bafög)

Project Members
Prof. Dr. Andreas Rausch (Leader)
Dipl.-Inf. Michael Deynet (Project Staff)

Partners
MID, Nürnberg, Germany
4Soft, München, Germany
BVA, Köln, Germany
**Funding**

BMI/BVA

11.000€ (of 22.000€ total)

**Duration**

15.11.2006 – 30.4.2008

**Project Description**

The V-Modell XT is the obligatory prescribed process standard for all IT-projects in the field of defense and public administration of the Federal Republic of Germany. The Bafög project is a pilot project of the V-Modell XT. It is accomplished by the BVA (Bundesverwaltungsamt) and deals with the redesign of the Bafög software. The Bafög software manages the collection of education accommodation.

**Contact E-Mail**

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**Project 54: RESIST (Reliable Adaptive Pervasive IT-Systems)**

**Project Members**

Prof. Dr. Andreas Rausch (Leader)

Dipl.-Inf Holger Klus (Project Staff)

Dipl.-Inf Dirk Niebuhr (Project Staff)

Dipl.-Inf André Appel (Project Staff)

**Partner**

Siemens AG, Munich, Germany

**Funding**

Siemens AG

119.000€ (of 119.000€ total)

**Duration**

1.5.2007 – 30.9.2008

**Project Description**

IT-Systems of the future are profoundly networked, dynamic, and are able to adapt themselves to new environments and situations. In this project we aim at the conception and realization of a middleware for reliable dynamic adaptive systems. In order to show feasibility and usefulness we are going to implement an exemplary scenario based on the middleware. This middleware should enable the development of networked, dynamic adaptive systems while assuring correctness and reliability.

**Contact E-Mail**

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Project 55: Seamless Requirements Engineering Approach with Respect to the NATO Architectural Framework (NAF) and the V-Modell XT Bw (ReqBw)

Project Members
- Prof. Dr. Andreas Rausch (Leader)
- Dipl.-Inf. Michael Deynet (Project Staff)
- Dipl.-Inf. Sabine Niebuhr (Project Staff)

Partner
IT-AmtBw A5, Koblenz, Germany

Funding
IT-AmtBw
140,000€ (of 140,000€ total)

Duration

Project Description
Requirements engineering and architecture design are key factors in software development: both bear the risk of serious faults, since they include decisions with far-reaching consequences, which may appear later during project progression. Therefore the goal of the project is to develop an approach for coupling requirements and architecture at an early stage with iterative intertwining of corresponding activities. This approach needs to minimize the risks while considering existing standards and guidelines for projects of IT-AmtBw.

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Project 56: Dynamic Adaptive System Infrastructure for Nordic Walking (DAiSINW)

Project Members
- Prof. Dr. Andreas Rausch (Leader)
- Dipl.-Inf. Holger Klus (Project Staff)
- Dipl.-Inf. André Appel (Project Staff)

Partner
Sun Microsystems, Inc., Santa Clara, USA

Funding
Sun Microsystems, Inc.
15,000€ (of 15,000€ total)

Duration
1.8.2007 – 31.3.2008
**Project Description**

The goal of the project is to develop a prototype demonstrator for an assisted sport training system in the area of Nordic walking. Therefore Sun Spots are used as basic sensor and communication nodes. This demonstrator should be based on the dynamic adaptive system infrastructure (DAiSI) developed by the group of Prof. Dr. Andreas Rausch. The prototype will be shown on CeBIT 2008.

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### 3.7.5 Scientific Activities

**Person** Prof. Dr. Andreas Rausch

- **Editorial Board Memberships**
    See [http://www.ijop.org/](http://www.ijop.org/)
    See [http://www.ijsa.net/](http://www.ijsa.net/)

- **Organization of Conferences and Workshops**
  - Conference Chair
  - Conference Chair

- **PC-member of Conferences and Workshops**
    See [http://se.informatik.uni-oldenburg.de/qosa/](http://se.informatik.uni-oldenburg.de/qosa/)


• QoSA 2007: Third International Conference on the Quality of Software Architectures, Boston, MA, USA, July 2007. See http://qosa.ipd.uka.de/


☐ Other Functions

• Andreas Rausch has joined the expert group of the Federal Ministry of the Interior of the Federal Republic of Germany, which advises on the Standards and Architectures for e-Government Applications of the Federal Republic of Germany.

• Andreas Rausch is a founder member of the International Software Architecture Qualification Board (iSAQB). iSAQB is responsible for certification of software architects on an industrial level.

• Andreas Rausch is the speaker of the NTH School for IT-Ecosystems, which is the first research program in planning of the Niedersächsische Technische Universität (NTH), a cooperation of the Technische Universität Braunschweig, Technische Universität Clausthal, and Leibnitz Universität Hannover.
3.7.6 Highlights

- In 2007: Andreas Rausch has organised and chaired the largest German-spoken industrial conference on software systems development processes: SEE 2007 (Software & Systems Engineering Essentials).
4 Publications

4.1 Books and Edited Volumes (24)


4.2 Book Chapters (11)


4.2 Book Chapters (11)


### 4.3 Journal Articles (50)


### 4.4 Refereed Conference and Workshop Publications (123)


4.5 Technical Reports (30)


### 4.6 Ph.D. Theses (6)

4.7 Diploma Theses (95)


4.8 Bachelor’s Theses (1)

While we did our best to make sure that all data are sound and correct, we do not claim that this report is flawless. For more recent information we refer to our webpage http://www.in.tu-clausthal.de/ which is continually updated.

Putting together this report took much more time than anticipated and planned (as always). Although all research groups provided us with material for Chapter 3, it still was a lot of work to turn it into a coherent and homogeneous booklet.

I would like to thank my colleagues Jörg Müller and Kai Hormann for writing Chapters 1 and 2. Our secretaries (Andrea Behfeld, Stefanie Cronjäger, Christine Kammann, Sandra Karpenstein, Annett Panterodt, and Anita Seiz-Uhlig) have put together most data about students (Diploma theses) and staff.

Tristan Behrens, Kai Hormann, and, even more, Wojtek Jamroga, in endless office hours, have done a splendid job in this respect: Thank you very much indeed.