Annual Report

Academic Year 2002/2003

IAM-03-006

August, 2003

Contents

1 Institute of Computer Science and Applied Mathematics (IAM)

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1.2 Personnel

Board of directors

Prof. Dr. Hanspeter Bieri; Prof. Dr. Torsten Braun; Prof. Dr. Horst Bunke; Prof. Dr. Gerhard Jäger; Prof. Dr. Oscar Nierstrasz.

Teaching Staff

Prof. Dr. Hanspeter Bieri; Lecturer Hans Peter Blau; Prof. Dr. Torsten Braun; Prof. Dr. Horst Bunke; Prof. Dr. Stéphane Ducasse; Prof. Dr. Gerhard Jäger; Prof. Dr. Oscar Nierstrasz; Prof. Dr. K. Stoffel; PD Dr. Thomas Strahm.

Director

Prof. Dr. Gerhard Jäger.

Administration

Ruth Bestgen; Sabine Gerber; Therese Schmid; Susanne Thüler; Terri Weibel.

Library

Gudrun Heim; Katrin Wegmüller.

Technical staff

Roland Balmer; Peppo Brambilla.

Scientific staff

Dr. Joël Adler; Luca Alberucci; Lorenz Ammon; Gabriela Arévalo; Roland Balmer; Dr. Florian Baumgartner; Alexandre Bergel; Peppo Brambilla; Thomas Buchberger; Juan Carlos Cruz; Marc Danzeisen; Ruy de Oliveira; Marcus Gaelli; Tudor Girba; Karl Guggisberg; Corrado Guidobaldi; Simon Günter; Pascal Habegger; Marc Heissenbüttel; Christophe Irniger; Dr. Ibrahim Khalil; Dr. Andrei Kouznetsov; Michel Krebs; Mathis Kretz; Dr. Urs-Martin Künzi; Michele Lanza; Marcin Michalak; Michel Neuhaus; Dr. Geoffrey Ostrin; Laura Ponisio; Dieter Probst; Matthias Rieger; Philippe Robert; Vincenzo Salipante; Nathanael Schärli; Matthias Scheidegger; Andreas Schlapbach; Thomas Spreng; Dr. Günther Stattenberger; Marc-Alain Steinemann; Tamas Varga; Thomas Wenger; Attila Weyland; Marc Wirz; Dr. Roel Wuyts; Matthias Zimmermann.

2 Teaching Activities

2.1 Courses for Major and Minor in Computer Science

Winter Semester 2002/2003

- 1st Semester

  Einführung in die Informatik (H. Bieri, 3 ECTS)

  Übungen zu Einführung in die Informatik (H. Bieri, 1.5 ECTS)

  Grundlagen der technischen Informatik (T. Braun, 3 ECTS)

  Übungen zu Grundlagen der technischen Informatik (T. Braun, 1.5 ECTS)

  Programmierung 1 (H.P. Blau, 3 ECTS)

  Übungen zu Programmierung 1 (H.P. Blau, 1.5 ECTS)

- 3rd Semester

  Automaten und formale Sprachen (H. Bunke, 3 ECTS)

  Übungen zu Automaten und formale Sprachen (H. Bunke, 1.5 ECTS)

  Datenbanken (K. Stoffel, 3 ECTS)

  Übungen zu Datenbanken (K. Stoffel, 1.5 ECTS)

  Einführung in Software Engineering (O. Nierstrasz, 3 ECTS)

  Übungen zu Einführung in Software Engineering (O. Nierstrasz, 1.5 ECTS)

- 5th Semester

  Künstliche Intelligenz (H. Bunke, 3 ECTS)

  Übungen zu Künstliche Intelligenz (H. Bunke, 1.5 ECTS)

  3D-Grafik (H. Bieri, 3 ECTS)

  Übungen zu 3D-Grafik (H. Bieri, 1.5 ECTS)

Logik und Informatik (Th. Strahm, 3 ECTS)

Übungen zu Logik und Informatik (Th. Strahm, 1.5 ECTS)

Computernetze (T. Braun, 3 ECTS)

Übungen zu Computernetze (T. Braun, 1.5 ECTS)

- Special Program

  Digitale Bilder (H. Bieri, 3 ECTS)

  Multimediakommunikation (T. Braun, 3 ECTS)

  Object-Oriented Reengineering Patterns and Techniques (O. Nierstrasz, S. Ducasse, 3 ECTS)

  Parallel Algorithms and Programming (A. Cortesi, 3ECTS)

  Praktikum Computernetze (T. Braun, 3 ECTS)

  Praktikum Bildanalyse (H. Bunke, 3 ECTS)

  Seminar: Künstliche Intelligenz (H. Bunke, 3 ECTS)

  Seminar: Computergeometrie und Grafik (H. Bieri, 3 ECTS)

  Seminar: Theoretische Informatik und Logik (G. Jäger, 3 ECTS)

  Seminar: Inferenz und Deduktion (G. Jäger, 3 ECTS)

  Seminar: Software Composition (O. Nierstrasz, 3 ECTS)

  Seminar: Rechnernetze und Verteilte Systeme (T. Braun, 3 ECTS)

- Service Course

  Anwendungssoftware (H.P. Blau, 4.5 ECTS)

Summer Semester 2003

- 2nd Semester

  Datenstrukturen und Algorithmen (H. Bieri, 3 ECTS)

  Übungen zu Datenstrukturen und Algorithmen (H. Bieri, 1.5 ECTS)

  Programmierung 2 (O. Nierstrasz, 3 ECTS)

  Übungen zu Programmierung 2 (O. Nierstrasz, 1.5 ECTS)

Rechnerarchitektur (T. Braun, 3 ECTS)

Übungen zu Rechnerarchitektur (T. Braun, 1.5 ECTS)

- 4th Semester

  Computergrafik (H. Bieri, 3 ECTS)

  Übungen zu Computergrafik (H. Bieri, 1.5 ECTS)

  Einführung in die theoretische Informatik (D. Probst, 3 ECTS)

  Übungen zu Einführung in die theoretische Informatik (D. Probst, 1.5 ECTS)

  Praktikum in Software Engineering (O. Nierstrasz, 4.5 ECTS)

- 6th Semester

  Compilerbau (H. Bunke, 3 ECTS)

  Übungen zu Compilerbau (H. Bunke, 1.5 ECTS)

  Grundlagen der Mustererkennung (H. Bunke, 3 ECTS)

  Übungen zu Grundlagen der Mustererkennung (H. Bunke, 1.5 ECTS)

  Programmiersprachen (O. Nierstrasz, 3 ECTS)

  Übungen zu Programmiersprachen (O. Nierstrasz, 1.5 ECTS)

  Betriebssysteme und Verteilte Systeme (T. Braun, 3 ECTS)

  Übungen zu Betriebssysteme und Verteilte Systeme (T. Braun, 1.5 ECTS)

- Special Program

  Computergeometrie (H. Bieri, 3 ECTS)

  Mobilkommunikation (T. Braun, 3 ECTS)

  Smalltalk (S. Ducasse, 3 ECTS)

  Parallel Computer Architecture (A. Cortesi, 3ECTS)

  Praktikum Computernetze (T. Braun, 3 ECTS)

  Seminar: Künstliche Intelligenz (H. Bunke, 3 ECTS)

  Seminar: Computergeometrie und Grafik (H. Bieri, 3 ECTS)

Seminar: Theoretische Informatik und Logik (G. Jäger, 3 ECTS)

Seminar: Inferenz und Deduktion (G. Jäger, 3 ECTS)

Seminar: Software Composition (O. Nierstrasz, 3 ECTS)

Seminar: Rechnernetze und Verteilte Systeme (T. Braun, 3 ECTS)

- Service Course

  Anwendungssoftware (H.P. Blau, 4.5 ECTS)

2.2 Colloquium in Computer Science

11/12/2002	Prof. Dr. Nadia Magnenat-Thalmann MIRALab, Centre Universitaire d'Informatique (CUI), Université de Genève Research Problems in the Simulation of Virtual Humans
11/26/2002	Prof. Dr. Bertrand Meyer Departement Informatik, ETH Zürich Trusted Components: Concepts and Progress Report
12/10/2002	Prof. Dr. Stephanie Teufel iimt - international institute of management in telecommunications, University of Fribourg Information Security Culture - the Socio-Cultural Dimension in Information Security Management
01/07/2003	Dr. Ingrid Rewitzky Department of Mathematics and Applied Mathematics, University of Cape Town A Paradigm for Unifying Theories of Program/System Development
01/14/2003	Prof. Dr. Andrzej Duda LSR Laboratory, INP Grenoble Performance Anomaly of 802.11b
01/21/2003	Prof. Dr. Erik Ernst Department of Computer Science, University of Aarhus Higher-Order Hierarchies
02/04/2003	Dr. Radu Marinescu Department of Computers, Politehnica University of Timisoara Measurement and Quality in Object-Oriented Design

03/25/2003 Yann-Gaël Guéhéneuc
Faculty of Science and Technology of Information, University of Nantes
Traceability of Design Patterns for Object-Oriented Program Understanding and Quality

04/08/2003 Prof. Dr. Pascal Fua
Computer Vision Laboratory, School of Computer and Communication Science, EPFL
Recovering Human Shape and Motion from Video Sequences

06/03/2003 Prof. Dr. Thomas Kühne
Fachbereich Informatik, Technische Universität Darmstadt
Architecture Stratification

06/17/2003 Dr. Noury Bouraqadi
Computer Science Lab, Ecole des Mines of Douai
Metaclass Composition in Metaclass Talk

2.3 Students

- Major Subject Students: 223
- Minor Subject Students: 179
- PhD Candidates: 32

2.4 Degrees and Examinations

- PhD: 5
- Diploma: 17
- Major Subject Examinations: 19 (Diplom 1. Teil: 12, Propädeutische Hautpfachprüfung: 7, 810 ECTS)
- Completion of Minor Studies: 31 (60E: 5, 49E: 2, 45E: 4, 31E: 1, 30E: 8, 18E: 7, 15E: 1, 24 Stunden-Programm: 3, 1098 ECTS)
- Semester Examinations Winter Semester 2002/2003: 548 (2466 ECTS)
- Semester Examinations Summer Semester 2003: 471 (2119.5 ECTS)

3 Research Group on Computational Geometry and Graphics

3.1 Personnel

Head:	Prof. Dr. H. Bieri	Tel.: +41 31 631 8670 email: bieri@iam.unibe.ch
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	P. Habegger (until November 2002)	Tel.: +41 31 631 4679 email: habegger@iam.unibe.ch
	Ph. Robert (since July 2003)	Tel.: +41 31 631 4679 email: robert@iam.unibe.ch
	Th. Wenger	Tel.: +41 31 631 4990 email: wenger@iam.unibe.ch

3.2 Research Projects

d-dimensional General Polyhedra

These polyhedra, now called "Nef polyhedra", are those subsets of the d-dimensional Euclidean space that can be obtained by applying a finite number of Boolean set operations to a finite number of linear halfspaces. The project extends the theory of Nef polyhedra, develops and analyses convenient data structures and lays the foundation of an object-oriented implementation of the kernel of a solid modeler for working with Nef polyhedra.

Research staff: H. Bieri, W. Nef

A 3D Visualization System for Theatres and Cinemas

The goal of this diploma project is the design and development of a visualization system to be used by visitors of theatres and cinemas. The task of the system is to give theatre- and cinemagoers a vivid three dimensional impression of the location waiting for them. In this way, they should get more certainty that the booked seats will meet their expectations. The system is

designed to be used for any theatres and cinemas, but in the first place for Bern's city theatre. The project has been divided into several stages: First, the professional modeling software "3ds max 4.2" is used to obtain a three dimensional model of the theatre. After this, the resulting model will be converted to an appropriate file format. Finally, the model can be rendered and displayed in a "Theatre-Player" allowing users to have a look at their booked seats and to navigate within the virtual theatre or cinema. To make this possible, the software to be developed will use well-established technologies like XML and OpenGL. In an additional online version - to be viewed by means of a web browser - the software "Macromedia Director" will be employed.

Research staff: O. Aeberhard

Implementation of 3D Computer Games Using Subdivision Surfaces

Subdivision has proved to be a very elegant and efficient approach to generate many kinds of smooth surfaces of arbitrary topology. It seems to be especially useful for the implementation of nontrivial 3D computer games as it is able to cope naturally with continuous level-of-detail.
In this project, a framework similar to a 3D game engine is built which will allow developers to implement relevant parts of their games in an easy and efficient way, in particular surfaces generated by different kinds of subdivision techniques. Using this framework, a complete 3D game will be developed which includes a large number of subdivision surfaces. By means of this game some the most promising subdivision techniques will be tested and compared to each other.

Research staff: Ch. Ammann

Collaboration on Scene Graph Based 3D Models

Professional 3D modeling applications like Alia Maya or discreet 3ds max offer only limited support for a team of designers to work on a 3D model collaboratively. There is even less support for managing revisions and variants or different representations of designs. 3D models are often made up of thousands of objects in a scene graph (DAG) that is stored in one single file. Therefore commercial group authoring tools and revision control systems cannot provide a solution as they generally work file based and/or are specialized on text documents only and thus cannot take advantage of the DAG structure of 3D models.

This project provides support for collaboration on scene graph based 3D models by means of a specialized repository that implements extensional version control for DAG structured 3D data avoiding pitfalls like version proliferation. Collaboration is based on an optimistic locking scheme combining a check-in/-out mechanism with automatic merging of consistent changes to a 3D model. A revision history keeps track of who made when what changes to a model and also provides information about a models alternatives and different representations. A simple configuration management implements some intensional versioning aspects on top of the extensional versioning.
Support for collaboration between different 3D modeling applications is provided by heterogeneous 3D scenes that integrate the applications different representations of 3D models. When working with such a scene in an application, models stored in a representation unknown to that application are transparently replaced by proxy models in a supported representation. Those proxy models can be automatically derived by converters from the models in their original representations. For collaboration purposes, the proxy models do not need to be perfect copies but more or less accurate approximations to the original models they stand for, thus only rather simple converters have to be written or bought. The heterogeneous scene is supposed to be rendered with a common external renderer supported by all applications involved such as RenderMan or Mental Ray.

Research staff: L. Ammon

Turtle Graphics Based Predictive Site Reconstruction

This diploma project tries a possible algorithmic description and implementation of the CPSR method developed by M. Gerber at the Institute of Ancient Near Eastern Archaeology and Languages at the University of Bern. CPSR (Complexity-based Predictive Site Reconstruction) is an algorithmic approach to computer aided modeling of ancient buildings. Its main purpose is to make predictions of the architecture of ruins, especially of very large structures whose entire excavation is out of question. CPSR provides a possibility to create accurate models based on the available information. Critical parts of the model can be verified by selective excavation. The new information gained thereby, even if the assumptions made in the model are proven to be incorrect, can be used to create a more accurate new model. The results will often converge to a good reconstruction within a small number of iterations. CPSR is based on A. N. Kolmogorov's theory of complexity. The complexity of an object is measured by the minimal length of its algorithmic description. It can be proven that such a definition of complexity

is independent of the description language used. In this project, the models are restricted to ground plots of structures, thus to two dimensions. Being a simple and proven description language for linear plots, turtle graphics is a suitable modeling language. Using a graphical user interface, the known facts can be entered interactively into the modeling process. The plot is then converted to turtle graphics and, by representing the graphic primitives of turtle graphics by characters, can be reduced to character arrays. Text compression algorithms are used to find the maximum compression of these character arrays. Based on Kolmogorov complexity a rating criterion can be defined. It will be used to rate any such model, generated manually or by simulation, on the basis of the collection of graphic elements resulting from the compression process.

Research staff: R. Blattner, M. Gerber, H. Bieri

Modeling and Animation of Niklaus Manuel's Death Figure

The renaissance painter Niklaus Manuel Deutsch (approx. 1484 - 1530) created a fresco cycle "Dance of Death" which only survives through copies on canvas made by Albrecht Kauw in 1649. Most of these paintings show a characteristic death figure in different positions.
The main goal of this diploma project consists in developing a 3D model and an animation of this death figure. By considering the many existing 2D representations, a fairly "correct" 3D reconstruction is attempted. Modeling is done by making use of the professional software "3ds max".
Bern's museum of history intends to use this death figure for a number of applications, for instance as a virtual guide to lead through parts of an exhibition. Therefore, specific animations of the figure have to be developed, normally by using motion capturing in order to achieve enough "naturalness".
In a further step it is planned to model a second figure from the original cycle, namely a victim dancing with the death. This combined model representing the dancing pair shall again be animated and used in some of the museum's future applications.

Research staff: M. Bruhin

Creating Hierarchical 3D City Models

This project deals with various aspects of 3D city modelling. Its goal is the development of a generic framework supporting the creation, management,

analysis and visualization of 3D city models. A main problem is the acquisition of the underlying geometric data. Today several methods are known, but most of them are time-consuming and expensive. Thus methods that support semi-automatic generation of the model from various easy accessible data sources as e.g. city maps or cadastral data are being developed. Due to the different accuracies of the input data, a data model supporting multiple levels of detail as well as its refinement and abstraction is being worked out. Another problem is the automation of modelling geometric details of house fronts such as windows and doors. Here a rule-based approach for generating house fronts depending on various parameters is pursued. As an example application the development of the city of Bern as a function of time shall be visualized and animated.

Research staff: Th. Buchberger

Reconstruction of a Classical Animation Short

Many classical animations which were done in the past were drawn (2D) or made out of clay figures (3D). Some of them have significant lack of quality in terms of footage. Others look to be quite stiff in their motion. The main goal of this diploma project is to reconstruct an animation short with today's 3D graphics capabilities and to reduce these drawbacks. Being a typical example, the animation short "Pat & Mat: Apple" by Lubomír Beneš and Vladimir Jiránek from the year 1985 has been chosen. The reconstruction process goes through five stages:

- Modelling: Characters (Pat & Mat) are constructed using subdivision surfaces while other objects are constructed with NURBS or polygon meshes.

- Animation: Characters in the original animation short are animated by the stop motion technique. Stop motion frames translate directly into key frames in the timeline of the animation software. In-between frames will be automatically computed, which results in smoother animation of the characters.

- Texturing: Because of the original animation's poor VHS footage quality, textures have to be reproduced from other sources as they can't be extracted from the original movie material.

- Lighting: Positions and intensities of light sources will be estimated by analyzing the shadows being cast by objects in the scene.

- Rendering: For the reconstruction of the animation short, camera positions will be adopted from the original scene.

At the end, it will be possible to experiment with other camera positions to see what an effect this would have on a viewer. To fulfil all the needs of this rather complex process, the software package by Alias—Wavefront Maya is used.

Research staff: D. Bukovac

Interactive Ray Tracing of Implicit Surfaces

Implicit surfaces are especially well-suited for modeling and simulating physically based processes, but less optimal for rendering and visualisation purposes. In this project we study a variety of issues which arise when rendering implicit models at interactive frame rates using ray tracing and global illumination techniques. Part of this effort is the development of a graphics library which enables us to study various aspects of our work and compare it to other approaches which are z-buffer as well as ray tracing based.

Research staff: Philippe C.D. Robert

Financial support: Silicon Graphics, Inc.

JMesh: A Mesh Library in Java

Polygonal meshes are very popular in 3D graphics and thus the topic of many ongoing research projects all over the world. A lot of standalone tools and mesh libraries with a specialized focus are available today. But currently there doesnt exist any comprehensive software basis in Java that supports and integrates the different research approaches to meshes. This project intends to build JMesh, a uniform but flexible framework to experiment with different kinds of mesh data structures and algorithms. The most important basic algorithms for mesh generation, mesh simplification, mesh subdivision, and signal processing with meshes will be implemented. The mesh data structures and algorithms will offer extensions targeting especially at didactic use cases like e.g. visualization and documentation. Several typical JMesh-based prototype applications will investigate the extensibility, efficiency, and reliability of the framework. Although typical target application areas for JMesh come from research and didactics in computer graphics, JMesh will be useful to application developers too.

Research staff: Th. Wenger

3.3 Diploma Theses

- Denise Niedermann: Sampling und Rekonstruktion von Oberflächen - ein Tutorial

- Sani Tetik: Ein offenes Informationssystem für die Marburger Datenbank

- Patrik Schnellmann: Ein Web Service-basiertes Monitoring Tool - Client Visualisierung

- Nicolas Bonfils: Ein Web Service-basiertes Monitoring Tool - Serverseitige Überwachung

3.4 PhD Thesis

- Pascal Habegger: Evaluating Internet Topologies: An Assessment and a Framework

3.5 Further Activities

- Area editor for Geometric Modeling of the journal The Visual Computer: H. Bieri

- Project artcampus: "Art History 1200 - 2000" of Swiss Virtual Campus. Project partner: H. Bieri

- Project "Albert Einstein Exhibition" of the Historisches Museum Bern. Project Partner: H. Bieri

3.6 Publications

- H. Bieri: Teaching Algorithms and Data Structures - 10 Personal Observations. In R. Klein, H.-W. Six, L. Wegner (Eds.): Computer Science in Perspective - Essays Dedicated to Thomas Ottmann. Lecture Notes in Computer Science 2598, 39 - 48, Springer 2003

- C. Glauser, H. Bieri: From Road Maps to 3D-Scenes: A Reconstruction System. In Proceedings of the Spring Conference on Computer Graphics 2003, 288-296. April 24 - 26, 2003, Budmerice

- M. Kallmann, H. Bieri, D. Thalmann: Domain Representation Using the Dynamic Constrained Delaunay Triangulation. To appear in G. Brunnett, B. Hamann, H. Müller (Eds.): Geometric Modeling for Scientific Visualization, Springer 2003

- S. Tetik, H. Bieri, Ch. Bracht: A Local Information System Based on the Marburg Picture Index. In Proceedings of the 5th International Conference on New Educational Environment, 113-118, May 26 - 28, Lucerne

3.7 Applications

- Implementations for the project artcampus: "Art History 1200 - 2000" (Prof. O. Bätschmann, Dr. J. Nathan) of Swiss Virtual Campus: K. Rollé, J. Sommer, I. Steiner, S. Tetik, M. Wälchli

- Animations for the Historisches Museum Bern (P. Jezler, director): M. Bruhin, O. Burkert, T. Huber, D. Kilchhofer, M. Kozary, S. Schär, D. Schulte

- Development of a Web-based monitoring tool for the company AARDEX Ltd. (Advanced Analytical Research on Drug Exposure): N. Bonfils, P. Schnellmann

4 Research Group on Computer Networks and Distributed Systems

4.1 Personnel

Head:	Prof. Dr. T. Braun	Tel.: +41 31 631 4994 email: braun@iam.unibe.ch
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	Dr. F. Baumgartner* (since 1.10.03)	Tel.: +41 31 631 8646 email: baumgart@iam.unibe.ch
	M. Danzeisen*	Tel.: +41 31 631 8648 email: danzeis@iam.unibe.ch
	K. Guggisberg* (1.7.–31.8.03)	Tel.: +41 31 631 3404 email: guggis@iam.unibe.ch
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	Dr. I. Khalil (1.1.–28.2.03)	email: ibrahim@iam.unibe.ch
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	A. Weyland*	Tel.: +41 31 631 8648 email: weyland@iam.unibe.ch

* with financial support from a third party

** external Ph.D. student

4.2 Research Projects

National Competence Center in Research for Mobile Information and Communication Systems (NCCR-MICS)

The NCCR-MICS (www.mics.ch) project was launched in 2001. Its goal is to study fundamental and applied research questions raised by new generation mobile communication and information services, based on self-organization. Such systems have become very topical lately with the advent of mobile ad hoc and peer-to-peer networks on the Internet. Yet, many of the fundamental questions remain to be solved, and applications are often only emerging now. NCCR-MICS is composed of eleven research projects, and the RVS group of the University of Berne is participating in the individual project "Self-Organizing Networking Mechanisms" (IP4) which aims at investigating the main networking issues in ad-hoc networks in a broad sense. Specifically, the RVS research group is doing research on two topics: Routing and TCP in mobile ad-hoc networks.

In the area of routing the focus is on two different topics. First, a protocol architecture has been developed whose key component is inspired by the behavior of social insects like ants. Second, emphasis has been given to the aspect of power saving, which is a major concern for any mobile devices. A battery conserving and position based routing protocol has been introduced, which is able to operate without the periodical broadcast of hello messages (beacons).

In the area of TCP issues, an end-to-end approach for enhancing TCP performance in mobile ad-hoc networks has been developed. The key idea of this approach is to be independent of specific intermediate nodes' cooperation, which should not only avoid inherent security concerns posed by most existing proposals but also leverage the deployment of this approach. Specifically, this end-to-end proposal relies on round trip time measurements for inferring the internal state of the network.

Research staff: Marc Heissenbüttel, Ruy de Oliveira. Internship Students: Thomas Bernoulli, Cécile Grivaz, Till Bohbot, Markus Wälchli, Isabel Steiner

Financial support: Swiss National Science Foundation Project No. 5005-067322 and University of Bern

Virtual Internet and Telecommunications Laboratory of Switzerland (VITELS)

VITELS is part of the first series of the Swiss Virtual Campus (SVC) projects. The goal is to develop an on-line course in English language that provides theory and practical hands-on exercises in the area of telecommunications / computer networks with real network hardware for third year computer science students. Actually, VITELS consists of five modules designed and maintained by the University of Bern (4) and Fribourg (1). Four other modules might complement the course later. They are designed by the Universities of Genève and Neuchâtel as well as the Engineering School Fribourg.
Ongoing work consists in creating and implementing a course architecture that allows the participation of many institutes as course module providers and also the access to the exercise modules by many students located anywhere in the Internet. The architecture includes authentication, authorization and scheduling functions. The web-learning platform WebCT leads students through the modules offering a broad spectrum of collaboration and exercise tools with integrated assessment functions.
Further valuable experiences with similar modules stimulating the design and development of the virtual course modules have already been gained during the development and conduction of a traditional in house network laboratory course during the academic year 2002/2003.
Both modules, "IP Security" and "Simulation of IP Network Configuration" have already been used in the curriculum. "Remote Method Invocation" and "Sockets and RPC" are the two most recent modules produced by University of Bern. In addition to the course architecture and the modules, we also have developed a didactics and design guide for VITELS.

Research staff: Marc-Alain Steinemann, Attila Weyland, Stefan Zimmerli, Thomas Spreng, Christine Rosenberger, Günther Stattenberger

Financial support: Bundesamt für Bildung und Wissenschaft (BBW), Virtual Campus Switzerland Project No. 991043, and University of Bern

Student Admission Control Infrastructure for Projects of the Swiss Virtual Campus (Authentication and Authorization Infrastructure Portal)

Authentication and authorization infrastructures (AAI) simplify the mobility of network services users. In Switzerland, SWITCH started to establish

an AAI for universities and related organizations. Student data, as well as the authentication process, remain at the respective university, called home organization. Resource providers that connect to the AAI do not need to authenticate users themselves. Users are automatically authenticated by the architecture. A disadvantage of AAI is that resources must be adapted. In many cases this is not possible, for example when the resource code is not open source. In other cases it is too expensive to adapt a single resource to the AAI. The AAI portal under development is located between the core AAI and the resource provider. The AAI portal simplifies the process of connecting non-AAI-enabled resources to the AAI. The AAI portal adds interesting features for tutors. The design of the AAI portal is almost finished, the prototype is working and we started to add test resources. Currently, we are working towards an improved version and also on an interface to WebCT.

Research staff: Marc-Alain Steinemann, Thomas Spreng, Karl Guggisberg, Attila Weyland, Calogero Butera, Günther Stattenberger, Christine Rosenberger

Financial support: Schweizerische Universitätskonferenz, Mandate within the Swiss Virtual Campus Program, SWITCH Pilot 1

Advanced Architecture for Inter-Domain Quality-of-Service Monitoring, Modeling, and Visualization (InterMON)

InterMON (www.ist-intermon.org) is an EU-IST project with 12 participants from several European countries and is part of the 5th Framework Program of the EU. It aims to develop an architecture for monitoring, modeling, simulation and visualization of inter-domain quality of service. University of Bern is leading work package 5, which is concerned with developing efficient modeling and simulation techniques to support scalable simulation of large inter-networks. Two deliverables, "Specification of the Modeling and Simulation Toolkit" and "Integration of the Inter-Domain Modeling and Simulation Toolkit," have been compiled, edited and delivered to the EU successfully. Moreover, contributions to the work package 3 deliverable "Enhanced InterMON Architecture" have been provided. The "hybrid simulation" concept developed by the University of Bern achieves scalability by combining analytical models for network domain clouds (usually autonomous systems) and inter-domain links with classical packet-based simulation techniques. A mechanism to integrate these analytical models into the packet-based ns-2

simulator has been implemented. It loads models from shared object files and is even capable of loading new analytical models during a simulation run. Also, one such model, capable of simulating delay and loss behavior of multiple ISP networks at the same time, has been implemented.

Research staff: Florian Baumgartner, Matthias Scheidegger

Financial support: EU project IST-2001-34123, Bundesamt für Bildung und Wissenschaft (BBW) Nr. 01.0551

Mobile IP Telephony (MIPTel)

The MIPTel project aims to develop and support mobile telephony applications over IP networks. Currently, our research focuses on charging & accounting of QoS-enabled services in wireless networks. ISPs are in great need of scalable, extensible, flexible and transparent charging and accounting methods, which take into account the specific attributes of wireless networks and requirements of diversified services. A wide range of accounting, charging and pricing schemes have been analyzed. A promising notion is the conjunction of pricing and resource control. A preliminary accounting scheme has been defined, which uses a credit point-based accounting strategy and provides incentives for cooperation among mobile users. Ongoing work includes the investigation of new cooperation schemes, the specification of the accounting architecture and the evaluation via simulations.

Research staff: Attila Weyland

Financial support: Swiss National Foundation Project No. 2100-057077. 99/2 and 20-68086.02/1

QoS Support for the Internet based on Intelligent Network Elements (QuINE)

The QuINE project makes use of intelligent network elements providing more flexible network management mechanisms allowing the network provider to offer additional services. In particular QoS support based on Differentiated Services and various multicast mechanisms (e.g. native IP multicast and explicit multicast) should be provided.
A new concept for flexible services establishment has been developed. In this concept, most of the configuration decisions are done inside the network supported by active components. Only the decisions needing a global network

view are performed by a central entity. The concept also takes care of security issues, in particular controlling the authenticity of the information and controlling the authorization of the user. Therefore, a tool has been developed and tested allowing to check the authentication of users joining a multicast service. An outcome of the experiments showed that the reallocation of the tasks in a central task is necessary.
In another activity, the virtual router system that has been designed and implemented for the evaluation of active networking concepts has been further improved and extended. In addition to the development of a well defined application programming interface several performance evaluation experiments have been performed in order to investigate the impact of distributing virtual router topologies on multiple computers. It could be shown that the additional delay caused by distributed emulation does not limit the power of the virtual router approach. Another set of experiment compared performance evaluations of Differentiated Services mechanisms using the ns-2 network simulator and the virtual routers. The experiments showed the capability of virtual routers to emulate even complex traffic conditioning systems and yielded similar results in both cases. Therefore, the current virtual router implementation is able to provide the classical multicast services and provides a framework for more advanced multicast concepts. Finally, a new active networking system is also available for Linux systems and allows to perform experiments in heterogeneous environments consisting of Linux and virtual routers. Active network capsules have been implemented allowing the dynamic establishment and configuration of tunnels by use of mobile and native code for tunnel encryption.

Research staff: Roland Balmer, Florian Baumgartner

Financial support: Swiss National Science Fondation Project No. 2000-06624.01/1

Cellular Assisted Heterogeneous Networking (CAHN)

Existing radio technologies like wireless LAN, Bluetooth, GPRS or Ultra Wide Band (UWB) allow communication between different mobile devices like mobile phones, PDAs or Laptops. These wireless technologies require appropriate configuration to work in a desired manner. Too often, more than a basic know-how about the technology itself is required to understand the different setting needed to interconnect devices. With the CAHN approach, this configuration is performed automatically and transparently for the user. Therefore, the signaling channel is separated from the actual data channel.

The need for a reliable, secure signaling plane with a high coverage makes the cellular network a promising candidate for this purpose. The bandwidth limitation of nowadays cellular networks like GSM/GPRS is a big disadvantage in the competition against broadband wireless radio technologies such as wireless LAN, Bluetooth or UWB, which are much more appropriate for fast data transfer. But on the other hand, the cellular networks benefit from the high coverage and the "always on" characteristics. The paging of a mobile device that is cellular aware is a common functionality. Therefore, the cellular network is very well meeting the requirements of a signaling plane. Taking these facts into account, a framework for Cellular Assisted Heterogeneous Networking has been developed, where the cellular network serves as the signaling plane for wireless broadband data channels. The first implementation of the CAHN architecture will be realized in the near future.

Research staff: Marc Danzeisen, Simi Winiker, Ehsan Maghsoudi

Financial support: Swisscom Innovations AG

Multimedia Transmission in Mobile Ad-hoc Networks

Audio and video network services are getting more and more popular. Efficient transmission of real-time data is a challenging task, in particular in mobile ad-hoc networks. The initial research investigated the related work in this field, focusing especially on multi-path transmission. There are two basic issues in the multipath transmission: content division and routing. Content division decides how to divide data across different paths. Appropriate approaches are reference picture selection, multiple description, layered coding and video redundancy coding. Among routing algorithms a general principle is to use the maximally disjoint, i.e. independent, paths. Future work will include performance evaluation of existing solutions and investigation of other approaches to the topic.

Research staff: Marcin Michalak

Testbed for Mobile and Internet Communications

The RVS research group maintains its own testbed network for various purposes. One part of the testbed is used to build networks of experimental routers and end systems in order to be able to evaluate the behavior of new networking procedures and architectures in a realistic environment. Another part of the network forms a productive network of Linux PCs and provides

the storage capacity and CPU power for many of the RVS group's projects. For example, the MICS and InterMON projects use the CPU power of the machines to run specialized simulators, with focus on node mobility and large inter-domain topologies, respectively. The InterMON project further uses the testbed for its CVS, FTP and mailing list archive servers, as well as for parts of the web site. Two systems are also connected to the so called global controller of the InterMON project. An educational lab network for students' training is also connected to the testbed. The whole testbed is IPv6-enabled and is connected to the 6bone via SWITCH.

Research staff: All members of the RVS research group

4.3 Diploma Theses

- Erich Bircher: An Automated Agent-Based Marketplace for Mobile Internet Access
- Stefan Zimmerli: Internetportal für Computernetze-Praktika
- Marco Studer: Ein Simulations-Framework für Endpoint Admission Control
- Stefan Egger: Performance Simulation of Multicast for Small Conferences

4.4 PhD Theses

- Ibrahim Khalil: Dynamic Service Provisioning in IP Networks
- Günther Stattenberger: Scalable Quality of Service Support for Mobile Users

4.5 Further Activities

Memberships

- SWITCH Stiftungsrat (Torsten Braun)
- SWITCH Stiftungsratsausschuss (Torsten Braun)
- SPEEDUP Society Committee (Torsten Braun)
- Kuratorium Fritz-Kutter-Fonds (Torsten Braun)

- Swiss Representative of COST 263 Action "Quality of Future Internet Services" (Torsten Braun)
- Professor election committee at University of Zürich (Torsten Braun)
- Ph.D. Jury at University of Grenoble (Torsten Braun)
- Expert for Diploma Exams at Fachhochschule Bern (Torsten Braun)
- Steering Committee member of the Swiss IPv6 Task Force (Torsten Braun)
- Member of editorial board Informatik Spektrum / Springer-Verlag (Torsten Braun)
- Program Chair of the 3rd Workshop on Applications and Services in Wireless Networks (ASWN 2003), Bern, Switzerland, July 2–4, 2003 (Torsten Braun)
- Local Arrangements Chair of the 3rd Workshop on Applications and Services in Wireless Networks (ASWN 2003), Bern, Switzerland, July 2–4, 2003 (Ruy de Oliveira)
- Local Arrangements Committee Members of the 3rd Workshop on Applications and Services in Wireless Networks (ASWN 2003), Bern, Switzerland, July 2–4, 2003 (Ruth Bestgen, Attila Weyland)
- Chair of the Swiss IPv6 Task Force's Application Working Group (Florian Baumgartner)
- Core team member of the Swiss IPv6 Task Force (Florian Baumgartner)
- SWITCH Projektausschuss (steering committee) "e-Academia / Authentifizierungs- und Autorisierungs-Infrastruktur (AAI): Pilot-Phase" (Marc-Alain Steinemann)

Conference Program Committees

- 13th IFIP/IEEE International Workshop Distributed Systems: Operations & Management (DSOM), Montreal, Canada, October 21–23, 2003 (Torsten Braun)
- 3rd Workshop on Applications and Services in Wireless Networks (ASWN 2003), Bern, Switzerland, July 2–4, 2003 (Torsten Braun)

- IEEE Workshop on High Performance Switching and Routing (HPSR 2003), Torino, Italy, June 24–27, 2003 (Torsten Braun)
- 4th International Conference on Internet Computing (IC 2003) 2003, Las Vegas, Nevada, USA, June 23–26, 2003 (Torsten Braun)
- 5th International Conference on New Educational Environments, Lucerne Switzerland, May 26–28 (Torsten Braun)
- IEEE 2003 International Conference on Communications, May 11–15, 2003, Anchorage, Alaska, USA (Torsten Braun)
- Workshop on End-to-End Service Differentiation (EESD), in conjunction with the IEEE International Performance Computing and Communications Conference (IPCCC), Phoenix, Arizona, USA, April 9–11, 2003 (Florian Baumgartner & Torsten Braun)
- High Speed Networking Workshop (HSN 2003), March 30, 2003, San Francisco, California, USA, in conjunction with INFOCOM 2003 (Torsten Braun)
- Kommunikation in Verteilten Systemen (KiVS), February 24–28, 2003, Leipzig, Germany (Torsten Braun)
- 4th International IFIP TC6 Working Conference on Active Networks (IWAN2002), Zürich, Switzerland, December 4–6, 2002 (Torsten Braun)
- 27th Annual IEEE Conference on Local Computer Networks (LCN 2002), November 6–8, 2002, Tampa, Florida, USA (Torsten Braun)
- 2nd International Workshop on Internet Charging and QoS Technology (ICQT'02), Zürich, Switzerland, October 16–18, 2002 (Torsten Braun)

Reviewing Activities

- IEEE Communication Letters (Torsten Braun)
- IEEE Communications Magazine (Torsten Braun)
- IEEE Internet Computing (Torsten Braun)
- IEEE Transactions on Multimedia (Torsten Braun)
- IEEE Transactions on Systems, Man and Cybernetics (Torsten Braun)

- IEEE/ACM Transactions on Networking (Torsten Braun)
- Computer Networks Journal, Elsevier (Torsten Braun)
- Computer Communications Journal,Elsevier (Torsten Braun)
- Journal of Systems and Software, Elsevier (Torsten Braun)
- Simulation Modelling Practice and Theory, Elsevier (Torsten Braun)
- Annales des Télécommunications, Hermes Science (Torsten Braun)
- Addison-Wesley (Torsten Braun)
- Kluwer Academic Publications (Torsten Braun)
- OR Spektrum, Springer-Verlag (Torsten Braun)
- International Conference on Mobile Systems, Applications, and Services (MobiSys), May 5–8, 2003, San Francisco, California, USA (Torsten Braun)
- 6th EU Framework Programme for Research and Technological Development (Torsten Braun)
- Schweizerischer Nationalfonds (Torsten Braun)

Invited Talks and Tutorials

- Torsten Braun, Marc Danzeisen, Beat Perny: Innovative Dienste für die mobile Kommunikation & Forschungskooperation zwischen der Universität Bern und der Swisscom, Telematik-Cluster Bern: Know-how Transfer in der Telematik, June 24, 2003, Bern
- Marc-Alain Steinemann: Technical Workshop, Presentation of AAI-Portal, SVC Days, May 26-28, 2003, Luzern, Switzerland
- Torsten Braun: A Novel Protocol Architecture for Scalable and Energy-Saving Routing in Mobile Ad-Hoc Networks, Advanced Communications and Networking Colloquium, May 23, 2003, Sabanci University, Instanbul
- Torsten Braun: Routing and Transport Protocol Issues in Large Scale Terminode Networks, MICS Annual Workshop 2003, Zürich, February 13, 2003

- Torsten Braun: Ein Labor für virtuelle und entfernte Experimente im Bereich Computernetze, Kolloquium "Informatik und Computational Sciences," University of Basel, December 11, 2002

- Torsten Braun: Studienplan in Informatik der Universität Bern, SARIT: Nationales Treffen für Bachelor und Master der Informations- und Kommunikationstechnologien, University of Applied Sciences Fribourg, November 28, 2002

- Marc-Alain Steinemann: VITELS — Internet-based Computer Networks Laboratory, 2nd Workshop on Web Enabling Technologies for Scientists, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, UNESCO, November 19, 2002

- Marc-Alain Steinemann: Technical and Didactical Aspects of an Open Course Architecture for eLearning, 2nd Workshop on Web Enabling Technologies for Scientists, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, UNESCO, November 19, 2002

- Torsten Braun: IP Telephony over Differentiated Services, Dagstuhl Seminar 02441: Quality of Service in Networks and Distributed Systems, Dagstuhl, Germany, October 30, 2002

- Torsten Braun: Next Generation Internet Protocols for Optical Networks, Tutorial at National Fiber Optic Engineers Conference, Dallas, Texas, USA, September 15, 2002

- Torsten Braun: Mobile Information and Communication Systems — A Swiss National Center of Competence in Research, Computer Science Colloquium, September 11, 2002, Purdue University, USA

Organized Events

Know-How Transfer in der Telematik The Telematik Cluster Bern (TCBE) organized an event to show the success of several collaborations between research institutes and industrial partners. The RVS group presented the successful collaboration between the University of Bern and Swisscom Innovations (R&D department of Swisscom). At the event, the complete Mobile Virtual Private Network solution was demonstrated as a result from the collaboration between the RVS and Swisscom.

3rd Workshop on Applications and Services in Wireless Networks (ASWN 2003) The University of Bern hosted the third international Workshop on Applications and Services in Wireless Networks (http://www.iam.unibe.ch/~rvs/events/ASWN_2003) which took place in Bern on July 2–4, 2003. ASWN 2003 provided a high level forum for discussions on recent and new developments in the area of applications and services over wireless networks. The event comprised three days of presentations of invited and regular papers from manufacturers, academia, and services providers. Most of the papers came from Europe but there were also papers from the Americas and Asia. In total there were 61 papers submitted from which 31 were accepted after a systematic review process with at least three reviewers per paper. In addition to the accepted papers, the workshop also included a tutorial on mobile ad hoc networking, a keynote talk on software challenges and solutions in ad hoc networks, a panel session about aspect oriented programming and a panel session about seamless integration of heterogeneous wireless network technologies and services, involving experts on the field and services, as well as an invited talk about the rollout of Swisscom's nationwide Public Wireless LAN Service.

4.6 Publications

Books and Book Chapters

- Torsten Braun, Nada Golmie and Jochen Schiller: Proceedings of the 3rd Workshop on Applications and Services in Wireless Networks, July 2003, ISBN 3-9522719-0-X
- Marc-Alain Steinemann, Torsten Braun, Marc Danzeisen and Manuel Günter: Wiley Encyclopedia of Telecommunications, Chapter "Virtual Private Networks," 2002, ISBN 0-471-36972-1

Journal and Conference Papers

- Roland Balmer and Torsten Braun: Zugangskontrolle für einen Videoverteildienst mit Multicast, 17. DFN-Arbeitstagung über Kommunikationsnetze, Düsseldorf, Germany, June 2003, to appear 2003.
- Marc Heissenbüttel and Torsten Braun: A Novel Position-based and Beacon-less Routing Algorithm for Mobile Ad-Hoc Networks, in Proceedings of the 3rd IEEE Workshop on Applications and Services in Wireless Networks (ASWN03), Bern, Switzerland, July 2003, ISBN 3-9522719-0-X, pp. 197–209

- Ruy de Oliveira, Torsten Braun and Marc Heissenbüttel: An Edge-Based Approach for Improving TCP in Wireless Mobile Ad hoc Netorks, in Peter G. Kropf (ed.): Design, Analysis, and Simulation on Distributed Systems (DASD 2003), part of ASTC 2003, Orlando, FL, USA, March 30 – April 03, 2003, ISBN 1-56555-266-0, pp. 172–177

- Florian Baumgartner, Torsten Braun, Evelin Kurt, Marc-Alain Steinemann and Attila Weyland: Implementation of a Distance Learning Module Based on Emulated Routers, in Proceedings of the 13. ITG/GI-Fachtagung Kommunikation in verteilten Systemen (KiVS 2003), Leipzig, Germany, March 25–28, 2003, ISBN 3-8007-2753-6, pp. 71–80

- Marc Heissenbüttel and Torsten Braun: Ants-Based Routing in Large Scale Mobile Ad-Hoc Networks, in Proceedings of the 13. ITG/GI-Fachtagung Kommunikation in verteilten Systemen (KiVS 2003), Leipzig, Germany, February 25-28, 2003, ISBN 3-8007-2753-6, pp. 91–99

- Florian Baumgartner, Matthias Scheidegger, Torsten Braun: Enhancing Discrete Event Network Simulators with Analytical Network Cloud Models, in Proceedings of the International Workshop on Inter-domain Performance and Simulation (IPS), Salzburg, Austria, February 20–21 2003, pp. 21–30

- Florian Baumgartner, Torsten Braun and Bharat Bhargava: Design and Implementation of a Python-Based Active Network Platform for Network Management and Control, IFIP-TC6 4th International Working Conference (IWAN2002), Zürich, December 2002, ISBN: 3-540-00223-5, pp. 171–190 .

- Florian Baumgartner, Torsten Braun and Bharat Bhargava: Virtual Routers: A Tool for Emulating IP Routers, The 27th Annual IEEE Conference on Local Computer Networks (LCN2002), Tampa, November 2002, ISBN: 0-7695-1591-6, pp. 363–371.

- Marc-Alain Steinemann and Torsten Braun: Remote versus Traditional Learning in a Computer Networks Laboratory, in Proceedings of Communications and Computer Networks (CCN 2002), Cambridge, USA, November 4–6 2002, ISBN 0-88986-329-6, pp. 503–507

- Torsten Braun and Marc-Alain Steinemann: "The Virtual Internet and Telecommunications Laboratory of Switzerland", Whitepaper, Proceedings of the SIGCOMM 2003 Workshop on Networking Education: How

to Educate the Educators ? (NetEd), pp. 2-3, Karlsruhe, August 25, 2003

Technical Reports

- Matthias Scheidegger, Florian Baumgartner et al.: Integration of the Inter-Domain Modelling and Simulation Toolkit, InterMON Deliverable 11, June 2003
- Marc-Alain Steinemann, Attila Weyland, Jacques Viens, Torsten Braun: VITELS, Didactics and Design Guide Version 1, Technical Report, IAM-03-002, April 2003
- Marc Heissenbüttel and Torsten Braun: BLR: A Beacon-Less Routing Algorithm for Mobile Ad-Hoc Networks, Technical Report IAM-03-001, University of Bern, March 2003
- David Jud: Drei Module für Angewandtes Lernen von Computernetzwerken, Computer Science Project, March 2003
- Mauro Gargiulo, Matthias Scheidegger et al.: Architecture Components and Interactions, InterMON Deliverable 4, March 2003
- Matthias Scheidegger, Florian Baumgartner et al.: Specification of the Modelling and Simulation Toolkit, InterMON Deliverable 6, December 2002
- Summer School of RVS group, Technical Report, IAM-02-004, November 2002

Patents

- Marc Danzeisen, Jan Linder, Torsten Braun: Verfahren und Vorrichtung zum Aufbauen eines virtuellen privaten Kommunikationsnetzes zwischen Kommunikationsendgeräten, patent application, November 26, 2002

5 Research Group on Computer Vision and Artificial Intelligence

5.1 Personnel

Head:	Prof. Dr. H. Bunke	Tel: +41 31 631 44 51 email: bunke@iam.unibe.ch
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	M. Zimmermann*	Tel: +41 31 631 48 65 email: zimmerma@iam.unibe.ch
Guests:	Dr. G. Sanchez	Computer Vision Center, Barcelona, Spain May 2003
	Prof. A. Kandel	University of South Florida, Tampa, USA June – July 2003
	Dr. M. Kraetzel	DSTO Edinburgh, Australia October 2002

* with financial support from a third party

5.2 Research Projects

Document Image Analysis and Understanding

A variety of problems occurring in the context of document image analysis are being investigated. These include the processing and recognition of both machine printed and handwritten documents. Current focus is on handwriting recognition, particularly on general text recognition and the use of

natural language processing techniques. Recently, also the problem of writer identification has been studied. Furthermore, multiple classifier systems and their application to handwriting recognition are under investigation.

Research staff: S. Günter, A. Schlapbach, T. Varga, M. Zimmermann

Graph Matching Algorithms and Applications

Graphs are a flexible and powerful representation mechanism that has been successfully applied in computer vision, pattern recognition and related areas. When graphs are used to represent objects of a particular domain, the recognition problem turns into the task of graph matching. In this project we study a variety of issues, including efficient algorithms for graph matching, the adaption of concepts and techniques based on vector representations to the domain of graphs, and special classes of graphs that allow matching with polynomial complexity.

Research staff: C. Guidobaldi, Ch. Irniger, M. Neuhaus

Biometric Person Authentication Using Fingerprints

Fingerprint analysis is one of the most reliable and most widely accepted biometric techniques for person identification. Most automatic fingerprint identification systems use a procedure for the extraction of characteristic features followed by a feature matching algorithm. In this project we study the application of structural pattern recognition methods, in particular attributed graph matching, to the problem of fingerprint classification and identification. Our main objective includes the development of efficient fingerprint search algorithms based on the ridge line structures occurring in fingerprints.

Research staff: M. Neuhaus

5.3 Diploma Theses

- Nicolas Wrobel: String Clustering
- Caroline Hertel: Personenidentifikation mit Schriftmerkmalen
- Michel Neuhaus.: Learning graph edit distance

5.4 PhD Thesis

- Alessandro Vinciarelli: Offline cursive handwriting: from word to text recognition

5.5 Further Activities

Editorial Boards

- Editor-in-charge of the International Journal of Pattern Recognition and Artificial Intelligence by World Scientific Publ., Singapore (H. Bunke)
- Editor-in-Chief of Electronic Letters on Computer Vision and Image Analysis (H. Bunke)
- Member of the editorial board of the International Journal on Document Analysis and Recognition (H. Bunke)
- Member of the editorial board of Pattern Analysis and Applications (H. Bunke)
- Member of the editorial board of Acta Cybernetica (H. Bunke)
- Editor-in-chief of the book series Machine Perception and Artificial Intelligence by World Scientific Publ., Singapore (H. Bunke)

Program Committees

- 1st Iberian Conference on Pattern Recognition and Image Analysis, Puerto de Andratx, Spain, June 4 - 6, 2003 (H. Bunke)
- 4th Int. Conference on Audio and Video Based Biometric Person Authentication, Guildford, England, June 9 - 11, 2003 (H. Bunke)
- 4th Int. Workshop on Multiple Classifier Systems, Guildford, England, June 11 - June 13, 2003 (H. Bunke)
- 4th IAPR-TC15 Workshop on Graph-based Representation, York, England, June 30 - July 2, 2003 (H. Bunke)
- Int. Workshop on Machine Learning and Data Mining, Leipzig, Germany, July 5 - 7, 2003 (H. Bunke)

- 2nd Int. Workshop on Web Document Analysis, Edinburgh, Scotland, August 3, 2003 (H. Bunke)

- 10th International Conference on Computer Analysis of Images and Patterns, Groningen, The Netherlands, August 25-27, 2003 (H. Bunke)

- IAPR-TC3 Workshop on Artificial Neural Networks in Pattern Recognition, Florence, Italy, September 12 - 13, 2003 (H. Bunke)

- 12th Int. Conference on Image Analysis and Processing, Mantova, Italy, September 17 - 19, 2003 (H. Bunke)

5.6 Publications

Journal Publications

- Schenker, A., Last, M., Bunke, H., Kandel, A.: Fuzzy clustering with genetically adaptive scaling, Int. Journal of Image and Graphics 2, 2002, 557 - 572

- Günter, S., Bunke, H.: Validation indices for graph clustering, Pattern Recognition Letters 24/8, 1107 - 1113, 2003

- Günter, S., Bunke, H.: Ensembles of classifiers for handwritten word recognition, Int. Journal on Document Analysis and Recognition, Vol. 5, No. 4, 2003, 224 - 232

- Bunke, H., Gori, M., Hagenbuchner, M., Irniger, Ch., Tsoi, A.: Using attributed plex grammars for the generation of image and graph databases, Pattern Recognition Letters 24/8, 1081 - 1087, 2003

Refereed Conference Proceedings and Edited Books

- X. Jiang, H. Bunke: Weighed mean and generalized median of strings; in Dechang Chen, Xiuzhen Cheng (eds.): Pattern Recognition and String Matching, Kluwer, 2002

- Günter, S., Bunke, H.: New boosting algorithms for classification problems with large number of classes applied to a handwritten word recognition task, in T. Windeatt, F. Roli (eds.): Multiple Classifier Systems, Proc. 4th Int. Workshop, Springer, LNCS 2709, 2003, 329 - 335

- Schenker, A., Last, M., Bunke, H., Kandel, A.: Graphs representations for web document clustering, in F.J. Perales et al. (eds.): Pattern Recognition and Image Analysis Proc. 1st Iberian Conference IbPRIA, Springer, LNCS 2652, 2003, 935 - 942

- Helmers, M., Bunke, H.: Generation and use of synthetic training data in cursive handwriting recognition, in F.J. Perales et al. (eds.): Pattern Recognition and Image Analysis Proc. 1st Iberian Conference IbPRIA, Springer, LNCS 2652, 2003, 336 - 345

- Hertel, C., Bunke, H.: A set of novel features for writer identification, in J. Kittler, M.S. Nixon (eds.): Audio-and Video-Based Biometric Person Authentication, Proc. 4th Int. Conference AVBPA, 2003, 679 - 687

- Schenker, A., Last, M., Bunke, H., Kandel, A.: Comparison of distance measures for graph-based clustering of documents, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 202 - 213

- Dickinson, P., Bunke, H., Dadej, A., Kretzl, M.: On Graphs with unique node labels, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 13 - 23

- Ambauen, R., Fischer, S., Bunke, H.: Graph edit distance with node splitting and merging, and its application to diatom identification, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 95 - 106

- Irniger, Ch., Bunke, H.: Theoretical analysis and experimental comparison of graph matching algorithms for database filtering, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 118 - 129

- Neuhaus, M., Bunke, H.: Self-organizing graph edit distance, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 83 - 94

- Bunke, H., Foggia, P., Guidobaldi, C., Vento, M.: Graph clustering using the weighted minimum common supergraph, in E. Hancock, M. Vento (eds.): Graph Based Representations in Pattern Recognition, Proc. 4th Int. Workshop GBR2003, Springer, LNCS 2726, 235 - 246

- Bunke, H.: Graph-based tools for data mining and machine learning, in P. Perner, A. Rosenfeld (eds.): Machine Learning and Data Mining in Pattern Recognition, Proc. 3rd Int. Conference, Springer LNAI 2734, 7 - 19, 2003

- P. Dickinson, H. Bunke, A. Dadej, M. Kraetzl: Novel graph distance measure based on intra-graph clustering and cluster distance, Proc. 7th World Multiconference on Systemics, Cybernetics and Informatics, July 27 - 30, 2003, Orlando, Florida, Vol. III, 333 - 338

- Günter, S., Bunke, H.: Optimizing the number of states, training iterations and Gaussians in an HMM-based handwritten word recognizer, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 472 - 476

- Vinciarelli, A., Bengio, S., Bunke, H.: Offline recognition of large vocabulary cursive handwritten text, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 1101 - 1105

- Schenker, A., Last, M., Bunke, H., Kandel, A.: Classification of web documents using a graph model, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 240 - 244

- Varga, T., Bunke, H.: Generation of synthetic training data for an HMM-based handwriting recognition system, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 618 - 622

- Zimmermann, M., Chappelier, J.-C., Bunke, H.: Parsing N-best lists of handwritten sentences, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 572 - 576

- Bunke, H.: Recognition of cursive Roman handwriting - past, present and future, Proc. 7th Int. Conference on Document Analysis and Recognition, Edinburgh, 2003, 448 - 459

- A. Schenker, M. Last, H. Bunke, A. Kandel: A comparison of two novel clustering algorithms for web documents, Proc. 2nd IAPR Workshop on Web Document Analysis, Edinburgh, 2003, 71 - 74

6 Research Group on Theoretical Computer Science and Logic

6.1 Personnel

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* with financial support from a third party

6.2 Research Projects

Logic and Computation

This very general project deals with the close connections between mathematical logic and certain parts of computer science, and emphasis is put on a proof-theoretic approach to some of the central questions in this area of research. These include the development of perspicuous and feasible logical frameworks for studying typical questions in computer science like termination and correctness of functional programs, properties of distributed systems and the like.
We study applicative theories as well as strongly typed formalisms and are interested in the connections to constructive and explicit mathematics. Furthermore, we are interested in analyzing the close connections between the complexities of computations and proofs in suitable formalizations, ranging from propositional calculi up to abstract frameworks for computations (in higher types).

Research staff: All members of research group

Algebraic and Logical Aspects of Knowledge Processing

In this project we try to shed new light on various formalisms (type-theoretic, set-theoretic, explicit, intensional, non-well-founded,...) for representing declarative and procedural knowledge and on new questions concerning the logical analysis of abstract computations and computable knowledge.
The formalisms that interest us range over a wide spectrum: classical and admissible higher set theory; frameworks with a constructive and computational meaning; and theories relating to feasible computations.
Our guiding tool for analyzing the constructive/computational content of various forms of mathematical reasoning is *proof theory*. The study of the relationship between proofs and computations turns out to be a highly intrinsic approach for tackling the various problems in this project. A proof-theoretic framework which seems particularly adequate for us is *Feferman's explicit mathematics* or, more generally, applicative theories with flexible typing.
In the first part of our project we will focus on:

- higher reflection and uniform fixed points in explicit mathematics,
- nonmonotone and higher order inductive definitions and functionals.

Our research activities in the second part of the project are centered around the general relation between extensionality and intensionality. In particular, we are interested in:

- bisimulation and anti-foundation in weak admissible set theories and explicit mathematics,
- the extensional kernel of explicit mathematics and uniform weak König's lemma,
- the proof theory of extensional fixed point theories.

Finally, our activities concerning feasible and (sub-)recursive proof and type systems can be structured as follows:

- the design of feasible theories of flexible types and the study of programming paradigms in such theories,
- higher type functionals in weak applicative theories,
- the systematic study of strong tiered formalisms.

Research staff: G. Jäger, G. Ostrin, D. Probst, V. Salipante, Th. Strahm, M. Wirz

Financial support: Swiss National Science Foundation

Inference and Deduction: an Approach Integrating Logic and Probability

In collaboration with:
Prof. Dr. J. Kohlas, University of Freiburg.

Inference and deduction play an important role in many formal and semi-formal approaches to information and knowledge. Information and knowledge, on the other hand, are concepts which are mostly used in computer science in an intuitive understanding, although there exist some fragments of a formal theory of information: information theory in the sense of Shannon, algorithmic information theory, logic of information or information flow, logic of knowledge. Each of these fragments addresses a particular aspect of the concept of information and knowledge. We plan to study further aspects of information and knowledge. These include:

- Algebraic aspects of information arising from the operations of aggregation (combination) and focusing of information.
- Modelling of structures of compatible questions or domains and the relation of information and its measures relative to particular questions or domains.
- Uncertain nature of information, the corresponding inference problems, with particular attention to statistical information.
- Dynamic nature of information and knowledge, including the passage from information to knowledge and reasoning about knowledge.

- Program information, logical description of object-oriented environments.

These issues will be studied in their own right, but also with the goal to establish links between the fragments and existing fragments of a theory of information. This should be a step towards an integrated theory of information In particular, Shannon's information measure based on entropy will be generalized in order to represent various forms of information such as constraints on possible choices or probability distributions on the possible choices or more generally hints. In another direction of generalization, the relative nature of information and its measure with respect to particular questions will be emphasized. The algebraic aspects of information will be studied in the perspective of important practical systems such as relational databases. Information and its algebraic structure will also be considered in relation to general abstract structures such as contexts, classifications or Chu spaces. The combinatorial nature of information arising from their algebraic structure will be carried over to uncertain information. Frameworks for knowledge representation (including common knowledge) and knowledge accumulation, updates and belief revision will be developed. The dynamical aspects of information and knowledge and and their explicit logical treatment will play an important role. This is a common project of the theoretical computer science groups of the Universities of Fribourg and Berne. Both groups have a specific background: Fribourg more in the tradition of probabilistic modelling, in particular probabilistic argumentation systems, Berne in the field of mathematical and computational logic. The alternative, but complementary backgrounds have proven fruitful in the past and will be profitable for the project proposed here.

Research staff: L. Alberucci, P. Brambilla, G. Jäger, A. Kouznetsov, M. Kretz

Financial support: Swiss National Science Foundation

ViLoLa - a Virtual Logic Laboratory

In collaboration with:
Prof. Dr. G. Grasshoff, Prof. Dr. A. Hollenstein, PD Dr. H. Linneweber-Lammerskitten and Prof. Dr. J. Schmid, University of Bern; Prof. Dr. J. Kohlas, University of Freiburg; Dr. U.-M. Künzi, Hochschule Rapperswil; Prof. Dr. J. Rolim, University of Geneva.

ViLoLa is a virtual logic laboratory centered around some basic and advanced logic-oriented modules. Starting off from the fact that logic is a crucial basis

for many scientific disciplines, it addresses students with various backgrounds (e.g. computer science, mathematics, philosophy, electrical engineering etc.). ViLoLa intends to provide theoretical knowledge as well as the ability to make use of this knowledge for the solution of practically relevant examples. Keywords: Classical propositional logic, formal languages and automata, computability and complexity theory, logics for computer science, logic and uncertainty, structures for algebraic logic, state transition systems and concurrency, logic and philosophy.

Research staff: J. Adler, G. Jäger, M. Krebs, U.-M. Künzi

Financial support: Swiss Virtual Campus

6.3 Diploma Theses

- Philipp Keller: Information Flow
- Thomas Schweizer: Two Interpretations of WKL_0 in Subsystems of PA

6.4 Further Activities

Editorials Boards

- Member of the editorial board of *Archive of Mathematical Logic* (G. Jäger)
- Member of the consulting board of *Dialectica* (Th. Strahm)

Technical Committees

- President of the *Swiss Society for Logic and Philosophy of Science* (G. Jäger)
- Member of the *Scientific Council of the European Association for Computer Science Logic* (G. Jäger)
- Swiss representative of the *COST Action 274 "Theory and Applications of Relational Structures as Knowledge Instruments"* (G. Jäger)
- Expert for "*Maturitätsprüfungen Mathematik*" (G. Jger)
- Secretary of the *Swiss Society for Logic and Philosophy of Science* (Th. Strahm)

6.5 Publications

- L. Alberucci: Strictness of the modal mu-calculus hierarchy, in E.Graedel, W.Thomas, T.Wilke (Eds.), *Proceedings of the Dagstuhl Seminar: Automata, Logics and Infinite Games*, Lecture Notes in Computer Science 2500, 2002

- L. Alberucci and G. Jäger: About cut elimination for logics of common knowledge, *Annals of Pure and Applied Logic*, to appear

- L. Alberucci and V. Salipante: On modal μ-calculus and non-well founded set theory, submitted

- G. Jäger: An intensional fixed point theory over first order arithmetic, *Annals of Pure and Applied Logics*, to appear

- G. Jäger and D. Probst: Iterating Σ-operations in admissible set theory without foundation: a further aspect of metapredicative Mahlo, to appear

- G. Jäger and D. Probst: A variation of a theme of Schütte, submitted

- G. Jäger and T. Strahm: The proof-theoretic analysis of the Suslin operator in applicative theories, in W. Sieg et al. (Eds.), *Reflections on the Foundations of Mathematics (Essays in Honor of S. Feferman)*, Lecture Notes in Logic 15, 2002

- G.E. Ostrin and S.S. Wainer: Elementary arithmetic, *Annals of Pure and Applied Logics*, to appear

- Th. Strahm: Theories with self-application and computational complexity, *Information and Computation*, to appear

- Th. Strahm: A proof-theoretic characterization of the basic feasible functionals, submitted

7 Research Group on Software Composition

7.1 Personnel

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*financial support from a third party.

7.2 Research Projects

Tools and Techniques for Decomposing and Composing Software

Despite advances in programming languages, software development environments, documentation standards, and software processes, software continues

to be hard to develop, hard to understand, and hard to maintain. In particular, no matter how much effort is put into developing clean, modern, software systems, it seems that successful software inevitably drifts towards increasingly complex and hard-to-maintain "legacy systems".
This project proposes to develop new tools and techniques for decomposing software systems, that is, for breaking down and understanding complex software, and for composing software systems, that is, structuring software so that it becomes easier to maintain, reconfigure, and extend.
The proposed work builds on our previous work on the MOOSE reverse engineering environment and the Piccola composition language.

For further details, please consult:
`http://www.iam.unibe.ch/~scg/Research/NFS02/`

Research staff: All members of the research group.

Financial support: Swiss National Science Foundation, project no. 2000-067855.02

RECAST: Evolution of Object-Oriented Applications

This research project is about reengineering object-oriented applications. Reengineering such applications inherits complex problems related to software maintenance, *i.e.,* program understanding, program analysis, and program transformation and adds to them (1) the complexity introduced by late binding, dynamic typing, and incremental definition specific to object-oriented programming, and (2) the complexity related to the new way of software development (multiple parallel versions, frameworks, and products lines). Based on our research experience, this research project is structured in three non-orthogonal directions: (a) reengineering, (b) analysis of versions, and (c) migration of object-oriented applications towards components.

For further details, please consult:
`http://www.iam.unibe.ch/~ducasse/WebPages/Recast.html`

Research staff: All members of the research group.

Financial support: Swiss National Science Foundation, project no. 620-066077

7.3 Diploma Theses

- Roland Bertuli: Compréhension de systemes orientés-objet par lutilisation dinformations dynamiques condensées

- Stefan Kneubühl: Typeful Compositional Styles

- Andreas Schlapbach: Enabling White-Box Reuse in a Pure Composition Language

- Daniele Talerico: Grouping in Object-Oriented Reverse Engineering

7.4 Ph.D. Thesis

- Michele Lanza: Object-Oriented Reverse Engineering – Coarse-grained, Fine-grained, and Evolutionary Software Visualization

7.5 Publications

Conferences

- Gabriela Arevalo: Understanding Behavioral Dependencies in Class Hierarchies Using Concept Analysis In *Proceedings of LMO 2003 (Langages et Modeles a Objets)*, pages 47 - 59, Vannes, France, January 2003

- Alexandre Bergel, Stéphane Ducasse, and Roel Wuyts: Classboxes: A Minimal Module Model Supporting Local Rebinding In *Proceedings of JMLC 2003 (Joint Modular Languages Conference)*, Klagenfurt, Austria, August 2003

- Michele Lanza: CodeCrawler – Lessons Learned in Building a Software Visualization Tool. In *Proceedings of CSMR 2003 (7th European Conference on Software Maintenance and Reengineering)*, pages 409-418, Benevento, Italy, March 2003. IEEE Press

- Nathanael Schärli, Stéphane Ducasse, Oscar Nierstrasz, and Andrew Black: Traits: Composable Units of Behavior. In *Proceedings of ECOOP 2003 (17th European Conference on Object-Oriented Programming)*, pages 248 - 274, Darmstadt, Germany. LNCS, Springer Verlag, July 2003

- Roel Wuyts and Stéphane Ducasse: Unanticipated Integration of Development Tools using the Classification Model. ESUG 2003 Academic Conference, Bled, Slovenia, 2003

Workshops

- Gabriela Arevalo, Stéphane Ducasse, and Oscar Nierstrasz: X-Ray Views on a Class Using Concept Analysis. In *Proceedings of WOOR 2003 (4th Workshop on Object-Oriented Reengineering), pp. 76-80*, Darmstadt, Germany, July 2003

- Alexandre Bergel, Stéphane Ducasse, and Roel Wuyts: The Classbox Module System. Proceedings of the ECOOP 2003 Workshop on Object-oriented Language Engineering for the Post-Java Era, Darmstadt, Germany, July 2003

- Roland Bertuli, Stéphane Ducasse, and Michele Lanza: Run-Time Information Visualization for Understanding Object-Oriented Systems. In *Proceedings of WOOR 2003 (4th Workshop on Object-Oriented Reengineering), pp. 10-19*, Darmstadt, Germany, July 2003

- Stéphane Ducasse, Nathanael Schärli, and Roel Wuyts: Controlled Right Accesses based on Uniform and Open Surfaces. Proceedings of the ECOOP 2003 Workshop on Object-oriented Language Engineering for the Post-Java Era, Darmstadt, Germany, July 2003

- Stéphane Ducasse and Philippe Mougin: Power to Collections: Generalizing Polymorphism by Unifying Array Programming and Object - Oriented Programming. Proceedings of the ECOOP 2003 Workshop on Object-oriented Language Engineering for the Post-Java Era, Darmstadt, Germany, July 2003

- Markus Gälli: Test composition with example objects and example methods. Proceedings of the ECOOP 2003 Workshop on Object-oriented Language Engineering for the Post-Java Era, Darmstadt, Germany, July 2003

- Tom Mens, Roel Wuyts, Kris De Volder, and Kim Mens: Workshop Proceedings - Declarative Meta Programming to Support Software Development. ACM SIGSOFT Software Engineering Notes, vol. 28, no. 1, January 2003

Computer Science Projects

- Frank Buchli: An explicit model for ADVance. Informatikprojekt, Institut für Informatik, University of Berne, Switzerland, December 2002

- Beat Halter, Mauricio Seeberger, Susanne Wenger, and Vivian Kilchherr: eXtreme Programming in der Praxis – das Sentinet-Projekt. Informatikprojekt, Institut für Informatik, University of Berne, Switzerland, December 2002

- Daniel Tschan: Exjdb – Experimental Java Debugger. Informatikprojekt, Institut für Informatik, University of Berne, Switzerland, December 2002

Technical Reports

- Markus Gälli: Test composition with example objects and example methods. Technical Report IAM-03-005, Institut für Informatik, University of Berne, Switzerland, June 2003

- Oscar Nierstrasz, Franz Achermann, and Stefan Kneubühl: A Guide to JPiccola. Technical Report IAM-03-003, Institut für Informatik, University of Berne, Switzerland, June 2003

- Oscar Nierstrasz: Contractual Types. Technical Report IAM-03-004, Institut fr Informatik, University of Berne, Switzerland, August 2003

- Nathanael Schärli and Andrew Black: A Browser for Incremental Programming Technical Report CSE-03-008, OGI School of Science and Engineering, Beaverton, Oregon, USA, April 2003

Miscellaneous Publications

- Stéphane Ducasse, Oscar Nierstrasz, and Roel Wuyts: Composing Embedded Real-Time Software Components: the PECOS Data-Centric Approach. ERCIM News, vol. 52, January 2003

7.6 Further Activities

Editorial Boards

- Annals of Software Engineering (Oscar Nierstrasz)

- RSTI (Revue des Sciences et Techniques de l'Information) (Stéphane Ducasse)

Associations

- CHOOSE – Swiss group for Object-Oriented Systems and Environments (Executive Board member) (Oscar Nierstrasz)
- AITO – Association Internationale pour les Technologies Objets (Board member) (Oscar Nierstrasz)
- ESEC, the European Software Engineering Conference (Member of Steering Committee) (Oscar Nierstrasz)
- CHOOSE – Swiss group for Object-Oriented Systems and Environments (Executive Board member) (Stéphane Ducasse)
- ESUG (European Smalltalk User Group, Member of Steering Committee) (Stéphane Ducasse)
- SSUG (Swiss Smalltalk User Group, Member of Steering Committee) (Stéphane Ducasse)
- ESUG (European Smalltalk User Group, Member of Steering Committee) (Roel Wuyts)
- SSUG (Swiss Smalltalk User Group, Member of Steering Committee) (Roel Wuyts)

Program Committees

- PC Member of AOSD 2003 (Aspect-Oriented Software Development – Enschede, The Netherlands, April 22-26, 2003) (Oscar Nierstrasz)
- PC member of ECOOP 2003 (European Conference on Object-Oriented Programming – Darmstadt, Germany, July 21-25, 2003) (Oscar Nierstrasz)
- PC Member of ESOP 2003 (European Symposium On Programming – Warsaw, Poland, April 7-11, 2003) (Oscar Nierstrasz)
- PC Member of FOAL 2003 (Foundations of Aspect-Oriented Languages Workshop Co-located with AOSD 2003) (Oscar Nierstrasz)

- Member of the Workshop Committee for ICSE 2003 (International Conference on Software Engineering – Portland, Oregon, May 3-10, 2003) (Oscar Nierstrasz)
- PC member of ESUG 2003 (European Smalltalk User Group Conference – Bled, Slovenia, August 25-29, 2003) (Stéphane Ducasse)
- PC member of LMO 2003 (Languages et Models a Objets – Vannes, France, February 3 - 5, 2003) (Stéphane Ducasse)
- PC member of UML 2003(6th International Conference on the Unified Modeling Language – San Francisco, California, USA, October 20 - 24, 2003)(Stéphane Ducasse)
- PC member of ESUG 2003 (European Smalltalk User Group Conference – Bled, Slovenia, August 25-29, 2003) (Roel Wuyts)

8 Administration

University:

H. Bieri:	Member of Weiterbildungskommission Member of Collegium generale
T. Braun:	Member of Kommission Informatikdienste Delegate of the University of Bern at the board of trustees of SWITCH (Vertreter der Universität Bern im Stiftungsrat SWITCH)
H. Bunke:	Member of Wahlvorbereitungsausschuss des Senats
G. Jäger:	Member of the Senat

Faculty:

T. Braun:	Member of Evaluationskommission
H. Bunke:	Member of Fakultätsvorstand
G. Jäger:	Dean of Science Faculty

Institute:

T. Braun:	Prüfungsleiter
G. Jäger:	Director of IAM
O. Nierstrasz:	Deputy Director of IAM