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Contents

1	Institut für Informatik und angewandte Mathematik (IAM).....	1
2	Research Group on Computational Geometry and Graphics	2
3	Research Group on Computer Vision and Artificial Intelligence.....	5
4	Research Group on Computer Networks and Distributed Systems	12
5	Research Group on Theoretical Computer Science and Logic.....	23
6	Research Group on Parallel Computing	28
	Appendix A Teaching Activities	32
	Appendix B Students' Projects	34
	Appendix C Computing Facilities.....	35

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* with financial support from a third party

Guest: Dr. P.-M. Schmidt (September 1993)

2.1 Research Projects

- **d-dimensional general polyhedra**

Object-oriented implementation of the kernel of a solid modeler to perform set operations on d-dimensional general polyhedra. The polyhedra are defined as finite Boolean expressions in open halfspaces. The main emphasis is laid on an efficient intersection algorithm based on the idea of the plane-sweep algorithm of Bentley-Ottmann. Pyramids are used as intermediate data structures. The implementation is in C++.

Research staff: Prof. W. Nef, Th. Mäder

- **QUICKART**

QUICKART will be an extendable system for the quick generation of many kinds of simple computer art. But primarily it shall be a system to try out new techniques in image synthesis. One field of interest is the combination of various illumination models, another is the trade-off between photorealism and efficiency.

Research staff: E. Dubuis, S. Amann, Th. Bebie, A. Collison, A. Hofer, Ch. Streit

- **Hyperimages**

Hyperimages or generalized digital images are based on a new kind of pixel. The conventional pixel, i.e. a closed unit square, is the disjoint union of 9 new pixels of dimensions 0, 1 and 2, namely its vertices, sides and interior.

Hyper-images allow the application of euclidean topology and herewith a natural notion of boundary. In this project various tree representations of hyperimages are studied as well as applications to computer graphics and image processing.

Research staff: I. Metz

- **CIMMEDIA**

The goal of this project is to create a multimedia teaching tool which can introduce the basic notions of CIM. The underlying medium will be a CD-I. Experts in CIM, graphics design, music, psychology, and system programming are working together to examine the possibilities of this new technology, and to apply it to a practical and well suited subject.

Research staff: B. Grossniklaus

Chief project manager: M.M. Schaub, CIM-Zentrum Muttentz der Ingenieurschulen beider Basel

Financial support: various Swiss industrial firms

2.3 Masters' Theses

- Maeder, Th.: PYRAMIDS - Ein System zum Arbeiten mit Pyramiden. (PYRAMIDS - A System for Working with Pyramids)
- Studer, B.: Das Bestimmen der konvexen Hülle von n Punkten in der Ebene mit viel Sweep und wenig Backtracking. (Finding the Convex Hull of n Points in the Plane with Much Sweep and Little Backtracking)
- Streit, Ch.: Modellieren mit Lindenmayer-Systemen in der Computergrafik. (Modelling with Lindenmayer-Systems in Computer Graphics)

2.5 Further Activities

Program Committees

- member of the Program Committee of COMPUGRAPHICS '93 (H. Bieri)
- member of the Program Committee of APL 94 (H. Bieri)

Reviewing Activities (extract)

- Jahresbericht der Deutschen Mathematiker-Vereinigung
- Solid Modeling '93 (H. Bieri)
- Computer-Aided Design (H. Bieri)

2.6 Publications

- Bieri, H., Mayor, D. A ternary tree representation of generalized digital images. In Magnenat Thalmann, N., Thalmann, D. (eds.): Virtual Worlds and Multimedia, John Wiley, 1993, 23 - 35.
- Bieri, H., Grimm, F.: Approaching classical algorithms in APL2. ACM APL Quote Quad 24, 1993, 33 - 40.
- Bieri, H.: Nef polyhedra: a brief introduction. Submitted.
- Bieri, H.: Boolean and topological operations for Nef polyhedra. Submitted to CSG 94, Winchester.
- Bieri, H., Schmidt, P.-M.: On the permutations generated by rotational sweeps of planar point sets. Manuscript.
- Hüni, H., Metz, I.: Teaching object-oriented software engineering by example: the games factory. Computer Science Education, Vol. 4, No. 1, 1993, 111 - 222.
- Hüni, H., Metz, I.: Teaching object-oriented architecture by example: the games factory. OOPS Messenger, Vol. 4, No. 2, 1993, 261 - 268.
- Metz, I., Hüni, H., Bischof, R.: Umstellung auf objektorientierte Technologie: Die erste Klippe Schulung. OUTPUT Sonderausgabe, 1993, 36 - 40.

3 Research Group on Computer Vision and Artificial Intelligence

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* with financial support from a third party

Guests:	Prof. Dr. I. Bruha	(February 1993)
	Dr. S. Kockova	(February 1993)
	Prof. Dr. T. Yamasaki	(March to December 1993)

3.2 Research Projects

- **3-D Object Recognition Using Greylevel and Range Images**

In this project we are developing robust methods for the recognition of three-dimensional objects in scenes. We assume that CAD-models of the objects are given. The input data consists of both greylevel and range images of a scene. The recognition methods that are under development are using either only greylevel or range images, or a combination of both. For a given recognition task, an optimal sequence of processing steps is determined by means of a vision planner.

Research staff: X.-Y. Jiang, U. Meier, R. Robmann, A. Ueltschi
Financial support: Swiss National Science Foundation (NFP-23: Artificial Intelligence and Robotics); Landis & Gyr AG, Zug; Migros Foundation

- **Image Analysis of Printed Documents**

A variety of problems occurring in the context of image analysis of printed documents are being investigated. These include recognition and understanding of GIRO check forms, recognition and execution of manual correction instructions on printed documents, recognition of handwriting (isolated characters and cursive script), and contextual postprocessing.

Research staff: D. Möri, T. Ha Minh
Financial support: UBILAB, Union Bank of Switzerland, Zürich

- **Expert System for Diagnosis of Thyroid Gland Disease**

This project is an activity within the European COST research program. It is conducted in cooperation with the Institute of Nuclear Medicine of the Inselspital, Berne. We are developing an expert system for the diagnosis of thyroid gland disease. The system is based on various knowledge representation and reasoning methods, and uses, besides "conventional" textual input, scintigraphic images for making diagnostic inferences.

Research staff: X. Fábregas, F. Grimm
Financial support: COST Research Program, Bundesamt für Bildung und Wissenschaft; Siemens Albis

- **Approximate Graph Matching Algorithms for Case-based Reasoning and Machine Learning**

The main idea in case-based reasoning is to use the solution of a problem that has been solved earlier in order to solve a new problem. If cases are represented by graph structures, then procedures for determining the similarity of graphs are an essential component of any case-based reasoning system. Determining the similarity of two graphs is also important in the context of machine learning. In this project, we are developing measures of similarity for graphs and efficient procedures for their computation.

Research staff: B. Messmer
Financial support: Swiss National Science Foundation (Schwerpunktprogramm Informatikforschung)

- **Structural and Syntactic Pattern Recognition**

The key idea in structural and syntactic pattern recognition is the representation of patterns by means of symbolic data structures such as strings, trees, and graphs. In order to recognize an unknown pattern, its symbolic representation is compared with a number of stored prototypes. In this project, we

aim at developing new symbolic matching and parsing algorithms for a variety of applications.

Research staff: H. Bunke

3.3 Masters' Theses

- Klopstein, J.: Stereovision - eine experimentelle Studie. (Stereovision - an experimental study)
- Hänni, T.: Fuzzy Logik und Erklärungskomponente in einem medizinischen Expertensystem. (Fuzzy logic and explanation component in a medical expert system)
- Wittwer, R.: Merkmalsextraktion aus szintigrafischen Bildern der Schilddrüse. (Feature extraction from scintigraphic images of thyroid gland)

3.4 Further Activities

Awards

- B. Messmer received one of the three IBM Artificial Intelligence Prizes 1993 for his MS thesis "Fehlertolerantes Graphenmatching mit dem RETE-Algorithmus" (Error Tolerant Graph Matching Using the RETE Algorithm).
- D. Möri received a prize from the German Pattern Recognition Association DAGM for his paper "Automatic Recognition and Execution of Correction Instructions in Text Documents" presented at the 1993 annual DAGM meeting.

Editorial Boards and Technical Committees

- editor-in-charge of the *International Journal of Pattern Recognition and Artificial Intelligence* (H. Bunke)
- member of the editorial board of *Acta Cybernetica* (H. Bunke)
- member of the editorial board of *Pattern Recognition and Image Analysis* (H. Bunke)
- member of the Technical Committee on Structural and Syntactic Pattern Recognition of the International Association for Pattern Recognition (IAPR) (H. Bunke)

Program Committees

- 11th SPIE Conference on Application of Artificial Intelligence, Orlando, FL, April 12 - 16, 1993 (H. Bunke)

- Conference on "Image Processing: Theory and Applications", San Remo, June 14 - 16, 1993 (H. Bunke)
- 15. DAGM-Symposium Mustererkennung, Lübeck, September 27 - 29, 1993 (H. Bunke)

3.5 Publications

Books

- Bunke, H. (ed.): *Advances in Structural and Syntactic Pattern Recognition*. World Scientific Publ. Co., Singapore, 1993.
- Christensen, H., Bowyer, K., Bunke, H. (eds.): *Active Robot Vision*. World Scientific Publ. Co., Singapore. (Also available as *International Journal of Pattern Recognition and Artificial Intelligence*, Special Issue 7 (1), 1993).

Book Chapters

- Christensen, H., Bowyer, K., Bunke, H.: Editorial. In Christensen, H., Bowyer, K., Bunke, H. (eds.): *Active Robot Vision*. World Scientific Publ. Co., Singapore, 1993, 1 - 8.
- Dvorak, J., Bunke, H.: Using CLOS to implement a hybrid knowledge representation tool. In Paepcke, A. (ed.): *Object Oriented Programming - The CLOS Perspective*. MIT Press, 1993, 295 - 320.
- Bunke, H.: *Structural and Syntactic Pattern Recognition*. In Chen, C.-H., Pau, L.F., Wang, P. (eds.): *Handbook of Pattern Recognition and Computer Vision*. World Scientific Publ. Co., Singapore, 1993, 163 - 209.

Journal Papers

- Jiang, X.-Y., Bunke, H.: An optimal algorithm for extracting the regions of a plane graph. *Pattern Recognition Letters* Vol. 14, No. 7, 1993, 553 - 558.
- Grimm, F., Bunke, H.: An expert system for the selection and application of image processing subroutines. *Expert Systems* Vol. 10, No. 2, 1993, 61 - 74.
- Bunke, H., Csirik, J.: An algorithm for matching run-length coded strings. *Computing* 50 (4), 1993, 297 - 314.
- Bunke, H., Glauser, T.: Viewpoint independent representation and recognition of polygonal faces in 3-D. *IEEE Transactions on Robotics and Automation*, Vol. 9, No. 4, 1993, 457 - 463.
- Bunke, H., Bühler, U.: Applications of approximate string matching to 2D shape recognition. *Pattern Recognition*, Vol. 26, No. 12, 1993, 1797 - 1812.

Conference Papers

- Bunke, H.: Recent advances in string matching. In Bunke, H. (ed.): *Advances in Structural and Syntactic Pattern Recognition*. World Scientific Publ. Co., Singapore, 1993, 3 - 21.
- Sastry, R., Ranganathan, N., Bunke, H.: Systolic architectures for partial polygon recognition. In Bunke, H. (ed.): *Advances in Structural and Syntactic Pattern Recognition*, World Scientific Publ. Co., Singapore, 1993, 542 - 551.
- Sastry, R., Ranganathan, N., Bunke, H.: Hardware algorithms for polygon matching. *Proceedings 6th International Conference on VLSI Design*, Bombay, India, 1993, 41 - 44.
- Jiang, X.-Y., Bunke, H.: Fast extraction of planar surfaces from range images. *Proceedings SPIE Conference on Applications of Artificial Intelligence: Machine Vision and Robotics*, 1993, 211 - 221.
- Ha Minh, T., Bunke, H.: Very fast recognition of Giro check forms. In D'Amato, D.P. (ed.): *Character Recognition Technologies*. SPIE Proceedings, Vol 1906, 1993, 100 - 111.
- Grimm, F., Bunke, H., Hählen, J.: An approach to expert systems for image processing libraries. In Houstis, E.N., Rice, J.R., Vichnevetsky, R. (eds.): *The Third International Conference on Expert Systems for Numerical Computing*. Technical Report CSD-TR-93-028, Purdue University, West Lafayette, IN, 1993, 34 - 36 (extended abstract).
- Jiang, X.-Y., Bunke, H.: Detection and application of polyhedral symmetry: A Review. *Proceedings of the 8th Scandinavian Conference on Image Analysis*, 1993, 345 - 352.
- Jiang, X.-Y., Bunke, H.: Quantization errors in active range sensing. *Proceedings of the 8th Scandinavian Conference on Image Analysis*, 1993, 913 - 920.
- Bunke, H., Messmer, B.: A new algorithm for efficient subgraph matching. In Vernazza, G., Venetsanopoulos, A.N., Braccini, C. (eds.): *Image Processing: Theory and Applications*. Elsevier Science Publ., 1993, 303 - 307.
- Jiang, X.-Y., Bunke, H.: Polyhedral symmetry: detection algorithms and application to 3D object recognition. In Ade, F, Rutishauser, M, Trobina, M. (eds.): *Proceedings of the Conference Swiss Vision '93*, 1993, 169 - 177.
- Möri, D., Bunke, H.: Automatische Erkennung und Ausführung von Korrekturanweisungen in Textdokumenten. In Poepl, S., Handels, H. (Hrsg.): *Mustererkennung 1993*, Springer Verlag, Informatik aktuell, 1993, 678 - 685.

- Jiang, X.-Y., Bunke, H.: Range data acquisition by coded structured light: error characteristic of binary and Gray projection code. In Grün, A., Kahmen, H. (eds.): Optical 3-D Measurement Techniques II. Wichmann Verlag, 1993, 386 - 393.
- Bunke, H.: A fast algorithm for finding the nearest neighbor of a word in a dictionary. In Proceedings of the 2nd International Conference on Document Analysis and Recognition, Tsukuba City, 1993, 632 - 637.
- Bunke, H., Kaufmann, G.: Jigsaw puzzle solving using approximate string matching and best-first search. In Chetverikov, D., Kropatsch, W.G. (eds.): Computer Analysis of Images and Patterns. Lecture Notes in Computer Science, Springer Verlag, 1993, 299 - 308.
- Bunke, H., Messmer, B.: Similarity measures for structured representations. In Richter, M.M., Wess, S., Althoff, K.-D., Maurer, F. (eds.): Preproceedings EWCBR-93, First European Workshop on Case-based Reasoning. University of Kaiserslautern, 1-5 November, 1993, 26 - 31.
- Jiang, X.-Y., Robmann, R., Ueltschi, A., Bunke, H.: An intelligent multisensory vision system. In Bless, R. (ed.): NRP 23-Symposium on Artificial Intelligence and Robotics, Zürich, 1993, 79 - 84.
- Grimm, F., Fábregas, X.: An expert system for the diagnosis of thyroid gland disease. Proceedings of the SHARE Europe Spring Meeting, Hamburg, April 19 -22, 275 - 292.

Technical Reports

- Jiang, X.-Y., Bunke, H.: Quantization error analysis in range sensing by active triangulation. Technical Report IAM-93-002, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.
- Fábregas, X., Grimm, F.: Prototyp für das Schilddrüsen-Diagnosesystem SDDS. Technical Report IAM-93-007, Institut für Informatik und angewandte Mathematik, Universität Bern, March 1993.
- Robmann, R.: Ein kantenorientierter Ansatz zur Integration von Grauwert- und Tiefenbildern. Technical Report IAM-93-016, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.
- Jiang, X.-Y., Bunke, H.: Vision planner for an intelligent multisensory vision system. Technical Report IAM-93-017, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.
- Ueltschi, A.: Modellbasierte Objekterkennung in Tiefenbildern. Technical Report IAM-93-018, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.

- **Messmer, B., Bunke, H.: A network based approach to exact and inexact graph matching. Technical Report IAM-93-021, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.**

4 Research Group on Computer Networks and Distributed Systems

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4.2 Research Projects

- **Test generation based on message sequence charts**

The central aspect of this project is conformance testing for communication protocols. The evaluation of a product with respect to its specification is an important issue in system engineering, in particular if parts of the specification are defined by standards such as ISO, CCITT, ... or others.

The central question is: Given a formal specification, how can one find out whether an implementation conforms to this specification?

Automatic test case generation from formal specifications suffers from the enormous amount of resulting test cases. In this project a combination of so-called "sequence charts" and formal specifications is used for generation in order to reduce the amount of generated tests to the "interesting" ones. Based on this idea a prototype tool is being developed and implemented under the scope of this project.

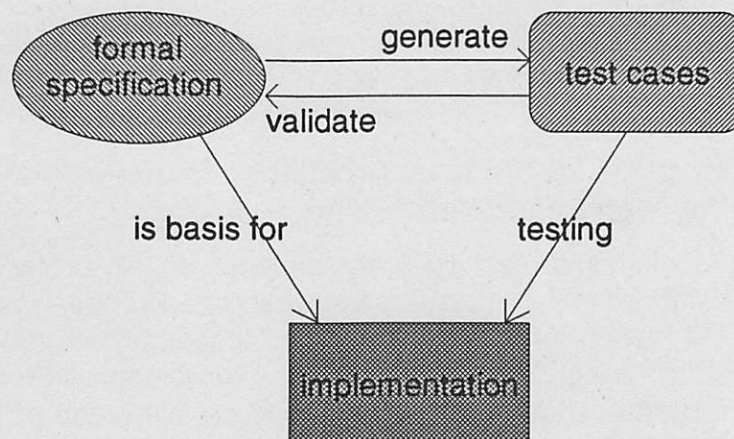


Fig. 1: Specification, Implementation and Testing

Research staff: J. Grabowski, S. Leue, R. Nahm, A. Spichiger, K. Neuenschwander, P. Gurtner, M. Günter

Financial support: Swiss PTT

Duration: 01.10.91 - 30.9.93

- **Test case specification with message sequence charts**

Within the Siemens-Albis AG the message flows of test cases for ISDN components are specified by message sequence charts (MSCs). To describe complete test cases MSCs are currently not sufficient. Therefore the goal of this project is the enrichment of MSCs with additional information which is necessary in order to define complete test cases. The additional information concerns values of transported data, test verdict assignment, and the expression of special actions, such as default and optional behaviour. Our intention is to translate MSC test cases in TTCN and SDL descriptions. The

scope of the project includes investigations on the relations between MSCs, TTCN and SDL.

Research staff: J. Grabowski, A. Spichiger, C. Rufenacht, S. Suter
Financial support: Siemens-Albis 1.10.91 - 30.09.93
Duration: 01.10.91 - 30.09.94

- **The role of time in formal specifications**

Real-time aspects are usually not considered in specifications based on formal methods like SDL, ESTELLE, LOTOS or Temporal Logic. Most applications of these well established methods focus on functional requirements of systems and unfortunately abstract from real-time. Our aim in this project is to extend the expressiveness of existing techniques to real-time behaviour, such that performance requirements can be specified consistent with functional requirements.

Research staff: D. Hogrefe, S. Leue
Financial support: Hasler Stiftung
Duration: 01.01.93 - 31.12.93

- **Formal Description Techniques, Architecture and Performance Evaluation for High Speed Networking**

In the course of this project different aspects of the protocol engineering process for High Speed Protocols are investigated. These distinguish themselves from conventional communication protocols in that they have to meet particular performance requirements as for example throughput, delay or reliability guarantees. These guarantees may be either deterministic or stochastic, and the respective requirements are sometimes referred to as Quality of Service (QoS) requirements. Starting point is the consideration of formal descriptions of these protocols, based on the CCITT specification language SDL. Firstly, the expressiveness of SDL is augmented by complementary specifications using probabilistic real-time temporal logics and equivalent automata models, which allows for a later verification and testing of the QoS requirements. Secondly, the SDL description is used to derive a queueing network model in order to perform complementary performance evaluations. Thirdly, the formal description is the starting point for the derivation of efficient parallel implementations, in particular by exploiting inherent parallelism. These steps are currently investigated, future work in the project will address the implementation of these steps as an integrated tool-set and its application to study cases.

Research staff: S. Leue, D. Toggweiler, G. Caal (at EPF Lausanne), X. Garcia (at EPF Lausanne), J. Martins (at EPF Lausanne), P. Oechslin (at EPF Lausanne)
Financial support: Swiss National Fund (together with EPF Lausanne)
Duration: 01.04.92 - 31.03.94

- **Use of structural information for test case generation**

The development of conformance test suits to examine protocol implementations requires methodological assistance and efficient tools. Existing approaches aim at full automation of the test derivation process and suffer from the fact that the test purposes employed are often unrelated to the protocol functions that should be tested. In addition, the number of tests generated is often too large to be useful in practice. Rather than aiming at complete automation, test derivation methods are needed which include parameters that can be adjusted by a test designer. This project develops such a parametrized method, which is based on exploiting the structure information available in formal descriptions.

Research staff: R. Velthuys

Financial support: IBM

Duration: 01.03.92 - 28.02.93

- **Advanced Testing Methods**

This project follows the activities of the Technical Committee for Advanced Methods for Testing and Specification in the European Telecommunication Standards Institute (ETSI TC MTS). TC MTS is responsible for the promotion and application of testing and specification methods within ETSI and prepares European standards in this area. The project contributes in particular to the area of automatic test case generation.

Research staff: A. Spichiger, H.-R. Scheurer

Financial support: ASCOM

Duration: 01.04.91 - 31.03.94

- **MUTEST**

The central idea of MUTEST is to compare different FDs of a protocol by letting each one generate a test suit and running them against the test suits generated by the other FDs, as well as against standardised and other test suits.

Other approaches to validate FDs against other FDs and against test suits may be considered as well.

Research staff: D. Hogrefe, R. Nahm

in cooperation with other internationally distributed institutions, e.g. GMD Darmstadt and University of Montreal

- **Graphical methods in the testing process**

This project deals with the representation and interpretation of test results. A problem in practical testing is that there exist no standardised notation for test results. All the different manufactures of test equipment use their own notation. This has consequences for customers and test laboratories. E.g. the employees of the test laboratories have to learn a lot of different notations, for customers, it is difficult to make critical test reviews and to compare

test results which are gained with different test equipment. One main goal of this project is to develop a standardised notation for test results and to contribute it to international standardisation bodies. Furthermore, it is intended to visualise test results by means of Message Sequence Charts. The scope of the project includes investigations on the relations between MSC and the test case description language TTCN.

Research staff: Jens Grabowski

Financial support: KWF (Commission for the promotion of scientific research), Siemens-Albis, Alcatel STR

Duration: 01.07.93 - 30.06.95

- **Testability criteria for protocol specifications**

The European Telecommunication Standards Institute (ETSI) has decided to use the ITU standard specification language SDL. It is believed that the use of SDL, and tools that support SDL will contribute to the quality of ETSI standards. Furthermore, a project is initiated to draft a European Telecommunication Standard with rules and guidelines for the use of SDL. The main objectives of this work are to improve the testability and possibilities for early validation of standards. Testability is understood as the suitability of a standard to serve as a basis for testing telecom products.

In this project testability and validation of standards are studied. Based on this, consultation of experienced SDL users, and case studies in cooperation with other ETSI project teams a subset of SDL concepts is selected. Furthermore guidelines are given how to use this subset of SDL in combination with message sequence charts, ASN.1 and normal text, tables and figures. The deliverable of the project is a draft standard named "Use of SDL in European Telecommunication Standards". It is expected that this standard will be approved by ETSI members in 1994.

Research staff: Jan Kroon

Financial support: European Telecommunication Standards Institute
(via Swiss PTT)

Duration: 01.01.93 - 31.12.93

- **TOPIC: Toolset for Protocol and Advanced Service Verification in IBC Environments**

The CEC RACE R2088 research project TOPIC focuses in its Work Area 1 on the specification and validation / verification of Quality of Service (QoS) requirements on High Speed Communication Protocols. As application cases the Xpress Transfer Protocol (XTP) and the Joint Viewing Tele Operation Service (JVTOS) have been chosen. The contribution of the University of Berne to the work of TOPIC addresses in particular the specification of QoS requirements in the context of existing standardised formal description techniques like LOTOS, SDL and Message Sequence Charts (MSCs).

Research staff: Stefan Leue, Daniel Toggweiler, NN

Financial support: EEC-RACE Program via BBW (University of Berne is

Associate Partner in TOPIC)

Duration: 01.07.93 - 31.12.94

- **Corporate Network Design**

The aim of this project is the development of concepts for corporate network (CN) design, and the implementation of corresponding prototypes. Figure 2 shows the CN of a hypothetical enterprise.

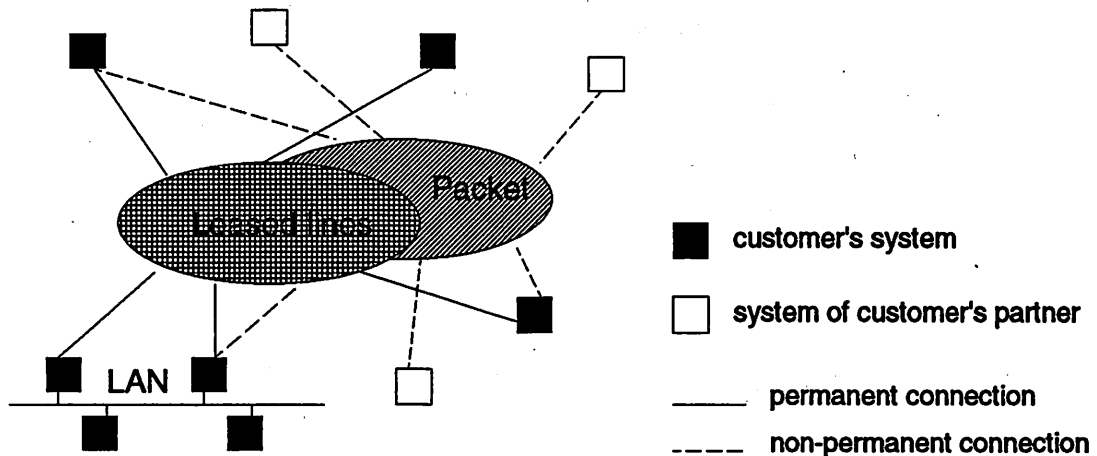


Fig. 2: A corporate network

This particular arrangement uses leased lines and packet switching services of a public service provider in order to connect the various geographically distributed sites. Of course a modern enterprise might use many very different applications: interactive sessions at terminals (ASCII, X-Windows); speech and image transmission (telephone, telefax); CAD, CAM, ...; transaction processing; database queries; file transfer; monitoring and controlling.

These practical goals translate directly into very specific requirements for the CN with respect to transmission rate, quality, security and reliability.

The services like leased line, packet switching, ISDN, MAN, X.400, have different characteristics with respect to the above mentioned requirements and tariffs.

The non-trivial problem of the optimal choice of the mix services in the CN comes up. Beyond that, the requirements for CNs and the existing services give rise to new aspects of service offers, tariffs, and capacity planning for the telecom provider.

Research staff: R. Oppliger, S. Weber, A. Greulich, J. Ernst, M. Gautschi

Financial support: Swiss PTT

Duration: 01.01.91 - 31.12.94

- **NESI - Network Security**

NESI is a cooperation project, funded by the information security section of the Swiss Federal Office of Information Technology and Systems (Bundesamt für Informatik, BFI). The aim of the project is to develop and evaluate some possible security concepts for an integrated computer and communications network for the Swiss federal administrative authorities (KOMBV).

The development and evaluation of security concepts for KOMBV is a considerable opportunity, not only because of its large size, but also because of its heterogeneity. Only few restrictions can be made with regard to system platforms, communication protocols and applications that have to be supported.

Every security concept is derived from a security policy, and consists of a set of security services and security mechanisms. Authentication services will be at the core of any security concept. Additional data confidentiality and integrity services may be offered, too. Non-repudiation services depend on the existence of a trusted third party. It is an open question, whether the authentication and key distribution systems that are available today, like Kerberos (OSF/DCE), NetSP, SPX or TESS, can be used for KOMBV.

Research staff: R. Oppliger, M. Scheuner

Financial support: Information security section of the Swiss Federal Office of Information Technology and Systems (Bundesamt für Informatik, BFI)

Duration: 01.11.93 - 30.06.94

4.3 Masters' Theses

- Greulich, A.: Einsatz eines Expertensystems für den Entwurf von Mietleistungsnetzen. (Use of an expert system for the design of leased line networks), February 1993
- Herdener, D.: Personaleinsatzplanung mit Hilfe der Informatik. (Computer Supported Staff Assignment), June 1993
- Neuenschwander, K.: Simulation von Message Sequence Charts. (Simulation of Message Sequence Charts), December 1993

4.4 Ph.D. Theses

- Blättler, D.: Networkmanagement in open systems, July 1993.
- Oppliger, R. Analysis and Design of Enterprise Networks, July 1993.
- Weber, S.: Optimization of Telecommunication Casts in Enterprise Networks, November 1993.

4.5 Further Activities

- Member of the editorial board of the "*Journal of High Speed Networks*", IOS Person
- Member of program committee of "13th International Conference on Distributed Computing Systems: ICDCS-13", Pittsburgh, USA, May 25 - 28, 1993
- Member of program committee of "IFIP workshop on Protocol Test Systems IWPTS 93", Université de Pau, September 1993
- Member of program committee of "6th SDL Forum", Darmstadt, October 11 - 15, 1993
- Member of program committee of "IFIP conference on Formal Description Techniques FORTE 93", Boston, USA, October 26 - 29, 1993
- Chairman of "IFIP conference on Formal Description Techniques FORTE 94", Bern, October 1994
- Member of program committee of "14th IFIP conference on Protocol Specification, Testing and Verification", Vancouver, Canada, June 1994
- Member of program committee of "IFIP workshop on Protocol Test Systems IWPTS 94", Kogakuin Univ., Tokyo, November 8 - 10, 1994

Standardization activities

- Chairmanship of the ISO/ITU joint project on Formal Methods in Conformance Testing
- Representation of Switzerland in ITU-T Study Group 10 "Formal Languages"
- Representation of ASCOM in the ETSI Technical Committee on Methods for Testing and Specification
- Participation in the SNV, DIN and ISO work on Open Distributed Processing

Reviewing activities (extract)

- reviewer for Eurescom projects (D. Hogrefe)
- reviewer for full professor positions in Europe and North-America (D. Hogrefe)
- *IEEE Transactions on Software Engineering* (D. Hogrefe)
- *IBM Systems Journal* (D. Hogrefe)

- *Informatik Spektrum*, Springer Verlag (D. Hogrefe)
- *Computer Networks and ISDN Systems*, North-Holland (D. Hogrefe)
- *IEE Computers and Digital Techniques*, IEE (D. Hogrefe)
- *Real Time Systems Journal*

Others

- chairman of the GI/ITG working group 3.3.1: Formal specification methods for distributed systems (D. Hogrefe)

4.6 Publications

- Colas, J.D., Ellsberger, J., Kroon, J., Verhaard, L.: Introduction of SDL methodology in ETSI, invited paper at 6th SDL Forum in Darmstadt (Germany), October 1993.
- Ellsberger, J., Kroon, J., Verhaard, L. (ETSI project team 37): Use of SDL in European Telecommunication Standards (draft standard MTS 93 10), Sophia Antipolis, June 1993.
- Grabowski, J., Rudolph, E.: Message Sequence Charts (MSC) - A Survey of the new CCITT Language for the Description of Traces within Communicating Systems. In: H. König (Hrsg.), *Formale Methoden für verteilte Systeme*, K.G. Saur-Verlag, München, ISBN 3-598-22409-5, 1993.
- Grabowski, J., Graubmann, P., Rudolph, E.: The Standardization of Message Sequence Charts. In: *Proceedings of the IEEE Software Engineering Standards Symposium 1993*, September 1993.
- Grabowski, J., Scheurer, H.R., Spichiger, A., Suter, S.: Zur Anwendbarkeit von TESDL für die automatische Generierung von TTCN Testfällen aus SDL Spezifikationen. Technical Report IAM-93-009, Universität Bern, Institut für Informatik, April 1993.
- Grabowski, J., Hogrefe, D., Nahm, R.: A Method for the Generation of Test Cases Based on SDL and MSCs. Technical Report IAM-93-010, Universität Bern, Institut für Informatik, April 1993.
- Grabowski, J., Hogrefe, D., Nahm, R., Spichiger, A.: Relating Test Purposes to formal Specifications: Towards a Theoretical Foundation of Practical Testing. Technical Report IAM-93-014, Universität Bern, Institut für Informatik, June 1993.
- Grabowski, J., Hogrefe, D., Nahm, R.: Test Case Generation with Test Purpose Specification by MSCs. In: *Proceedings of the 6th SDL Forum in Darmstadt (Germany)*, October 1993.

- Grabowski, J., Nahm, R., Spichiger, A., Hogrefe, D.: Die SAMSTAG Methode und ihre Rolle beim OSI Konformitätstesten. Technical Report IAM-93-024, Universität Bern, Institut für Informatik, October 1993.
- Graubmann, P., Rudolph, E., Grabowski, J.: Towards a Petri Net Based Semantics Definition for Message Sequence Charts. In: Proceedings of the 6th SDL Forum in Darmstadt (Germany), October 1993.
- Henderson-Sellers, B., Moser, S., Seehusen, S., Weinelt, B.: A Proposed Multi-Dimensional Framework for Object-Oriented Metrics. In: Proceedings of the First Australian Software Metrics Conference (International), Sidney, November 1993.
- Hogrefe, D., Oppliger, R., Weber, S.: Entwurf von virtuell privaten Netzen. In Gerner, N.; Hegering, H.G.; Swoboda, J. (Eds.): Communication in Distributed Systems. ITG/GI-Conference Munich, March 3 - 5, 1993, Springer-Verlag, pp. 428 - 441.
- Ladkin, P.B., Leue, S.: Interpreting Message Sequence Charts (revised version), Technical Report TR 101, Dept. of Computing Science, University of Stirling, United Kingdom, March 1993.
- Ladkin, P.B., Leue, S.: What Do Message Sequence Charts Mean? In Tenney, R.L, Amer, P.D., Uyar, M.U. (eds.): Formal Description Techniques VI, IFIP Transactions C, Proceedings of the 6th International Conference on Formal Description Techniques, North-Holland, to appear in 1994.
- Ladkin, P. B., Leue, S.: On the Semantics of Message Sequence Charts. In Koenig, H. (ed.): Formale Methoden für Verteilte Systeme, K.G. Saur-Verlag, München, ISBN 3-598-22409-5, 1993.
- Leue, S., Oechslin, Ph.: Optimization Techniques for Parallel Protocol Implementation, Proceedings of the Fourth Workshop on Future Trends of Distributed Computing Systems, IEEE Computer Society Press, September 1993.
- Nahm, R., Grabowski, J., Hogrefe, D.: Test Case Generation for Temporal Properties. Technical Report IAM-93-013, Universität Bern, Institut für Informatik, June 1993.
- Nahm, R.: Semantics of simple SDL. GI/ITG Fachgespräch 1993. In König, H. (ed.): Formale Methoden für Verteilte Systeme, K.G. Saur-Verlag, München, ISBN 3-598-22409-5, 1993.
- Oppliger, R.; Hogrefe, D.: Corporate Network Security. Proceedings of the IEEE Singapore International Conference on Networks and International Conference on Information Engineering (SICON/ICIE '93), September 6 - 11, 1993, pp 426 - 430.
- Scheurer, H.R., Spichiger, A., Grabowski, J.: ETSI TC MTS - Eine Zusammenfassung der aktuellen Aktivitäten. Technical Report IAM-93-019, Universität Bern, Instiut für Informatik, September 1993.

- **Spichiger, A.: Testspezifikationen des ETSI, Technical Report IAM-93-012, Universität Bern, Institut für Informatik, Juni 1993.**
- **Weber S., Greulich A., Hogrefe D.: Knowledge-based Design of Leased-Line Networks. Technical Report IAM-93-005, Universität Bern, 1993.**

5 Research Group on Theoretical Computer Science and Logic

5.1 Personnel

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	W. Wolff*	Tel.: +41 631 49 89 e-mail: wolff@iam.unibe.ch

* with financial support from a third party

Guests:	Prof. Dr. S. Artemov	(January, 1993) e-mail: art@log.mian.su
	M. Bianchi	(September to December 1993) e-mail: mbianchi@watcgl.uwaterloo.ca
	C. Jonker	(October to December, 1993) e-mail: Catholjin.Jonker@phil.ruu.nl
	Prof. Dr. J. Makowsky	(October to December, 1993) e-mail: janos@cs.technion.ac.il

5.2 Research Projects

- **Logic and computation**

This 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 termination and correctness of functional programs. We

study theories which permit self-application, as well as strongly typed formalisms, and are interested in the connections to constructive and explicit mathematics. Some of the relevant catch words are: Proofs as computations, formulas as types, polymorphism, flexible typing, explicit and constructive mathematics, universes of types, theories of types and names, functional programming.

Research staff: G. Jäger, M. Marzetta, Th. Strahm

- **Logic programming and deductive systems**

Logic programming is understood in our research group in a very broad sense, and we are interested in the mathematical and logical structure of its central concepts. Proof-theoretic concepts and methods are more important to us than model-theoretic approaches. Our main emphasis is put on the treatment of negative information, forms of resource bounded reasoning, and the use of modern deductive systems in computer science.

Research staff: G. Jäger, C. Jonker

- **Algebraic and logical aspects of knowledge processing**

In collaboration with Prof. Dr. E. Engeler, ETH Zürich

Several research problems from the general area of knowledge representation are being investigated. They are directed toward the mathematical foundation of this area, and refer to algebraic and logical questions. The work of the group in Berne emphasizes the logical basis of knowledge representation. One of the first and most important steps in a logical approach to knowledge representation is the development and analysis of adequate formal frameworks, both from a declarative and procedural point of view. Depending on the context, various logical formalisms (e.g. Horn logic, modal logics, type theories, etc.) have turned out to be extremely useful. We focus on questions involving structural properties of suitable logical formalisms, and the interplay between logic and computation.

Research staff: S. Artemov, G. Jäger, M. Marzetta, Th. Strahm,
T. Strassen

Financial support: Swiss National Science Foundation

- **Executable models for analysis and implementation of complex systems**

In collaboration with Dr. H. Lienhard, Landis & Gyr

The goal of this project is to develop a tool for the modeling, simulation and verification of complex distributed systems. Our approach is based on SPECS Petri nets, a system of higher order Petri nets that was implemented by Landis & Gyr. This system should be improved in the following directions:

1. Inclusion of time in the model.
2. The SPECS system should be extended to include tools for the formal analysis and verification of nets.

3. New concepts and tools that support efficient modeling of complex systems.

In Berne the theoretical background of SPECS Petri nets is investigated. There is a well-known connection between place-transition Petri nets, linear logic and category-theory. In a first step, an analogous connection between SPECS Petri nets and adequate systems of linear logic as well as category-theoretic semantics is established and applied to the analysis and verification of nets (e.g. reachability and liveness questions). Other points of interest are complexity questions and the behaviour of subnets.

Research staff: G. Jäger, U.-M. Künzi

Financial support: Schwerpunktprogramm Informatik

- **Representation and automatic evaluation of empirical especially quantitative knowledge**

In collaboration with Prof. Dr. B. Schmid, Hochschule St. Gallen

This project is directed toward the investigation of methods for the representation, organization, and evaluation of quantitative information (such as deductive databases), and utilizes a practical application orientation as well as a theoretical perspective. This undertaking is of considerable economic and scientific relevance with respect to the automatic acquisition and evaluation of quantitative information from heterogenous databases. The relevant theoretical problems shall be investigated in our group at the University of Berne, the application oriented problems by Professor Schmid and his group at the Hochschule St. Gallen.

Research staff: G. Jäger, W. Wolff

Financial support: Schwerpunktprogramm Informatik

- **A logics workbench**

In collaboration with Prof. Dr. P. Läuchli, ETH Zürich

The goal of this project is to implement a program for the treatment of different propositional logics, including e.g. classical, intuitionistic, modal, temporal logic and non-monotonic approaches.

It is planned to build in the most important propositional logics. However, there should also be facilities allowing the definition of new logics by the user. The algorithms are not restricted to theorem proving procedures, but also concern computation of normal forms, simplification of formulas, formulas-as-types interpretation and so on.

In order to make the logics workbench accessible to non-experts and available for educational purposes, it is very important to choose a user-friendly design.

Research staff: G. Jäger, M. Bianchi, A. Heuerding, S. Schwendimann

Financial support: Schwerpunktprogramm Informatik

5.3 Ph.D. Thesis

- Marzetta, M.: Predicative theories of types and names.

5.4 Further Activities

Editorial Board and Technical Committees

- member of the editorial board of *Theoretical Computer Science* (G. Jäger)
- Reviews Editor of *Journal of Symbolic Logic* (G. Jäger)
- member of interimistic board of the Swiss Center for Supercomputing (interimistischer CSCS-Ausschuss) (G. Jäger)

Program Committees

- member of the Program Committee of Computer Science Logic CSL '93, Swansea (G. Jäger)
- members of the Program Committee of the Swiss Computer Science Society (G. Jäger, Th. Strahm)

Courses given at summer schools, etc.

- Logic programming and inductive definitions, Workshop on *Constructivity and Computation* (G. Jäger)
- A deductive approach to logic programming, Summer school *Proof and Computation*, Marktoberdorf (G. Jäger)
- Logics for AI and programming, Pisa (G. Jäger)

5.5 Publications

- Artemov, S., Strassen, T.: The basic logic of proofs. In: Börger, E., Jäger, G., Kleine Büning, H., Martini, S., Richter, M.M (Eds.): *Computer Science Logic, Lecture Notes in Computer Science 702*, Springer, Berlin, 1993.
- Artemov, S., Strassen, T.: Functionality in the basic logic of proofs. Technical Report IAM-93-004, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.
- Artemov, S., Strassen, T.: The logic of Gödel proof predicate. In: Gottlob, G., Leitsch, A., Mundici, D. (Eds.): *Computational Logic and Proof Theory, Lecture Notes in Computer Science 713*, Springer, Berlin, 1993.

- Börger, E., Jäger, G., Kleine Büning, H., Martini, S., Richter, M.M. (Eds.): *Computer Science Logic, Lecture Notes in Computer Science 702*, Springer, Berlin, 1992.
- Feferman, S., Jäger, G.: Systems of explicit mathematics with non-constructive μ -operator. Part I. To appear in *Annals of Pure and Applied Logic*.
- Hösli, B., Jäger, G.: About some symmetries of negation. To appear in *Journal of Symbolic Logic*.
- Jäger, G.: Some proof-theoretic aspects of logic programming. In: Bauer, F.L., Brauer, W., Schwichtenberg, H. (Eds.): *Logic and Algebra of Specification*. Springer, Berlin, 1993.
- Jäger, G.: Fixed points in Peano arithmetic with ordinals. *Annals of Pure and Applied Logic* 60, 1993.
- Jäger, G.: A deductive approach to logic programming. Technical Report, 1993.
- Jäger, G., Stärk, R.F.: The defining power of stratified and hierarchical logic programs. *Journal of Logic Programming*, 15, 1993.
- Jäger, G., Strahm, T.: Totality in applicative theories. Technical Report, 1993.
- Jäger, G., Wolff, W. Th.: Types and Questionnaires. Bericht für den Workshop 21 des Schwerpunktprogrammes Informatik am 7-VI-93.
- Künzi, U.-M.: Logic programs for primitive recursive predicates. *Journal of Logic and Computation* 3 (4), 1993.
- Künzi, U.-M.: Categorical aspects and invariant analysis of condition/event-petrinets and specs-nets. Technical Report, 1993.
- Marzetta, M.: Universes in the theory of types and names. In: Börger, E., Jäger, G., Kleine Büning, H., Martini, S., Richter, M.M (Eds.): *Computer Science Logic, Lecture Notes in Computer Science 702*, Springer Berlin, 1993.
- Strahm, T.: Partial applicative theories and explicit substitutions. Technical Report IAM-93-008, Institut für Informatik und angewandte Mathematik, Universität Bern, 1993.
- Wolff, W.Th.: Von Skalen induzierte Prädikate. Interner Bericht IAM 18-III-93.
- Wolff, W.Th.: Welt und Skalen: Ein formales System zur Repräsentation von Messoperationen. Bericht für das SNF-Projekt "Repräsentation und automatische Auswertung von empirischem, speziell quantitativem Wissen", 29-IX-93.

6 Research Group on Parallel Computing

6.1 Personnel

Head:	Prof. Dr. H. Mey	Tel: +41 31 631 86 46 e-mail: mey@iam.unibe.ch
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	Dr. P. Kropf *	Tel: +41 31 631 86 68 e-mail: kropf@iam.unibe.ch
	Dr. E. Lederer *	Tel: +41 31 631 e-mail: lederer@iam.unibe.ch
	Dr. L. Müller *	Tel: +41 31 631 38 37 muller@iam.unibe.ch
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	K. Wyler	Tel: +41 31 631 86 48 e-mail: wyler@iam.unibe.ch
Guests:	Dr. T. Steffen	(February and July 1993) e-mail: mdts@musica.mcgill.ca
	M. Matyjewski	(1 month between June and December 1993) e-mail: mmatyjew@grape.meil.pw.edu.pl

6.2 Research Projects

- **SPINET**

The interdisciplinary SPINET project applies the current possibilities of parallel computing to the generation of biochemical simulations needed to reveal the mechanics of back injury, while evaluating and enhancing parallel processing. A finite element model is used to investigate the (static) mechanical properties of the spine system, whereas the Petri net based parallel processing tool SystemSpecs is used for the (dynamic) simulation of the neural control mechanism of the muscles involved. The two approaches will be integrated to form a dynamic simulation tool of the spine system. The scientific questions addressed include the evaluation of parallel computers, specifically the SPMD (Single Program, Multiple Data) architecture (MUSIC

system) and programming tools when porting and enhancing a large application (the finite element simulation) as well as the presently unknown procedures of how to simulate and investigate the naturally parallel neuromuscular control of the spine using an advanced parallel processing tool such as the SystemSpecs environment.

Collaborations:

- Finite element modelling fo the spine: Warsaw University of Technology, Poland (Prof. K. Kedzior, PD Dr. T. Zagrajek, M. Matyjewski)
- Mathematical modelling and Numerics: TnTech Parallel Computing Support AG, Bern (Dr. P. Schwab)
- SystemSpecs tool enhancements: Ivy Team AG, Zug
- EMG measurements: ESSM Magglingen (Prof. H. Hoppeler, Dr. D. Jucker) and Institute of Kinesiology, University of Waterloo, Canada (Prof. S. McGill)
- Biomechanical Testing and validation: McGill University, Montreal, Canada (Prof. M. Aebi and Dr. T. Steffen)

Research staff: Dr. P. Kropf, Dr. E. Lederer, J. Schneider, Dr. J. Boillat

Financial support: Schwerpunktprogramm Informatik, Swiss National Science Foundation and ESSM

- **Analysis of raw data from a sample inquiry with Kohonen like algorithms**

Within the framework of a study of the Psychologisches Institut der Universität Bern (Wohnqualität und Mobilität) a set of raw data from a related inquiry has been analysed with different topological mapping algorithms. The results will be published.

Research staff: L. Müller, K. Wyler (IAM); F. Kaiser, M. Marxer (Psychologisches Institut)

- **Neural Networks for Automatic Object-Recognition**

Different "classical" object recognition approaches are compared to neural network methods. The following subjects are currently under research:

- object-ground separation in natural, noisy environments
- object classification using Boundary-Contour Methods
- transformations: Invariant Filters, Gabor Transforms, Wavelet Theory, FFT, using Cellular Neural Networks

Research staff: L. Müller, J. Stiefenhofer, K. Wyler; H. Heuer (GRD)

Financial support: GRD

- **Self-organizing process mapping in a multiprocessor system**

In this project the applicability of neural networks to the mapping problem in a multiprocessor system is investigated. In this context, our work is presently focused on three specific areas:

- application of neural networks to graph morphism problems
- embedding of graphs into higher dimensional spaces
- quantification of topological preservation produced by a mapping

Research staff: L. Müller, K. Wyler

6.3 Masters' Theses

- Messerli, S.: Verteilter Mapping Algorithmus in Parix-CDL. (A Distributed Mapping Algorithm for Parix-CDL)
- Roth, M.: Schablonen Spezifikationsprache zur Generierung von Kommunikationsgerüsten. (A specification language for the stencil generation of communication skeletons)
- Langen, M.: Graphische Benutzeroberfläche für parallele Programmiersprachen: (A graphical Programming Tool for Parallel Programming Languages)

6.4 Further Activities

Seminar on Distributed Systems

This seminar took place on June 4th, 1993 in Berne with about 60 participants. The specific content of this seminar consisted in 6 invited presentations representing the state of the art topic in Switzerland. Additionally, the main talk (Prof. Cap) was transmitted simultaneously via ISDN to the Engineering school in Fribourg where another 100 people attended the lecture during the annual NDIT/FPIT students meeting. The workshop was jointly organized by the Parallel Computing Group at the IAM, the Special Interest Group on Parallel Systems of the Schweizer Informatikergesellschaft (SIPAR) and NDIT/FPIT.

Committees

- president of the Special Interest Group on Parallel Systems SIPAR (P. Kropf)
- Activities in NDIT/FPIT, an interregional society for postgraduate courses in Telecommunications and Informatics: Prof. H. Mey is president, Dr. L. Müller director (on behalf of Ascom) and Dr. P. Kropf a committee member
- Activities in FORMITT, a COMETT project on education in Telecommunications and Informatics (on a European level)
- technical expert at the Informatics Dept. at Ingenieurschule Bern (P. Kropf)

Courses presented at other institutes

- course on Parallel Systems , FORMITT, Palermo, Italy (P. Kropf)
- postgraduate teaching activities (NDIT/FPIT courses): Neural Networks and Genetic Algorithms (L. Müller, K. Wyler), Parallel and Distributed Systems (P. Kropf), Operating-Systems Tools (J. Stiefenhofer), Mathematics in computer science (E. Badertscher (MAI), L. Müller (IAM), P. Schwab (TNTECH))
- postgraduate course "Image Segmentation using Gabor-filters and SOFM's. (Cours Postgrade en Informatique: Réseaux de Neurones Biologiques et Artificiels, Ecole Polytechnique Fédéral de Lausanne) (J. Stiefenhofer)
- course on Neural Networks, Ingenieurschule Bern (L. Müller)

6.5 Publications

- Boillat, J.E.: Fast Load Diffusion in Cayley Graphs and in Circuits. In Proceedings of the WG93 Workshop on Graph-Theoretic Concepts in Computer Science, 1993.
- Kropf, P.G., Guggisberg, K.: Verkehrssimulation mit SystemSpecs. In Judmann, H. (ed.) EPP'93, Wien, 1993. Österreichische Computergesellschaft.
- Kropf, P.G., Steffen, T.: SPINET: Spine simulation - finite element method based simulation on a parallel computer. In Robinson, J. (ed.): Proceedings of 7th FEM World Congress, Monaco, 1993.
- Kropf, P.G., Guggisberg, K., Ziegler, U.: SystemSpecs and the Parallel Petri Net Simulator: Speedup Journal, 7 (2), 1993.
- Wyler, K.: Self-Organizing Process Mapping in a Multiprocessor System. In Proceedings of the World Congress on Neural Networks, Portland, July 11 - 15, 1993. Vol. II, Lawrence Erlbaum Associates Publ. & INNS Press, Hillsdale, 1993, 562-566.

Appendix A: Teaching Activities

Winter semester 1992/93:

- D. Benninger:** • Datenbanken
- H. Bieri:** • Datenstrukturen und Algorithmen.
• Geometrisches Modellieren
• Seminar in Computergeometrie
- H.P. Blau:** • Numerik 1
- J. Boillat:** • Einführung in die Programmierung 1
• Paralleles Rechnen 1
- H. Bunke:** • Theoretische Informatik 1
• Künstliche Intelligenz
• Seminar für Lizentianden und Doktoranden
- K. Decker:** • Parallele Algorithmen der Numerik
- D. Hogrefe:** • Computersysteme
• Software Engineering
• Computernetze
- G. Jäger:** • Proseminar: Symbolisches Rechnen
• Informatikprojekte
• Rekursionstheorie
• Deduktionssysteme
• Seminar für Lizentianden und Doktoranden
• Blockseminar Bern und Zürich
- P. Kropf:** • Petri Netze
- H. Mey:** • Grundlagen der Informatik 1
• Seminar: Parallelität
- L. Müller:** • Einführung in die Programmierung 1

Summer semester 1993:

- H. Bieri:** • Computergrafik
• Modellierung und Simulation
• 3D-Grafik
• Seminar für Lizentianden und Doktoranden
• Seminar: Mathematik und Informatik
- H.P. Blau:** • Numerik 2
- J. Boillat:** • Einführung in die Programmierung 2
• Paralleles Rechnen 2
- H. Bunke:** • Compiler
• Seminar für Lizentianden und Doktoranden
• Strukturelle Methoden der Mustererkennung
- A.-C. Godet:** • Mikrocomputer
• Informatik-Workshop

- D. Hogrefe:**
 - Betriebssysteme
 - Computersicherheit
 - Seminar: Hochgeschwindigkeitscomputernetze
 - Seminar für Lizentianden und Doktoranden
- B. Housley:**
 - Vektoriellles Rechnen auf Supercomputern
- G. Jäger:**
 - Einführung in die theoretische Informatik
 - Theoretische Informatik 2
 - Informatikprojekte
 - Seminar für Lizentianden und Doktoranden
 - Blockseminar Bern und Zürich
 - Seminar: Mathematik und Informatik
- P. Kropf:**
 - Parallele und verteilte Algorithmen
- L. Müller:**
 - Einführung in die Programmierung 2
- H. Mey:**
 - Grundlagen der Informatik 2
- A. Scheuing:**
 - Bewertung von Softwarequalität
- K. Wyler:**
 - Einführung in die Theorie und Praxis der Neuronalen Netze

Winter semester 1993/94:

- H. Bierl:**
 - Datenstrukturen und Algorithmen
 - Algorithmische Geometrie
 - Praktikum in Computergrafik
 - Seminar für Lizentianden und Doktoranden
- H.P. Blau:**
 - Einführung in die Programmierung
 - Numerik 1
- H. Bunke:**
 - Theoretische Informatik 1
 - Künstliche Intelligenz
 - Seminar für Lizentianden und Doktoranden
- D. Hogrefe:**
 - Computersysteme
 - Software Engineering
 - Computernetze
- G. Jäger:**
 - Proseminar: Symbolisches Rechnen
 - Informatikprojekte
 - Grundlagen der Logik-Programmierung
 - Seminar für Lizentianden und Doktoranden
 - Blockseminar Bern und Zürich
 - Formale Methoden des Reasoning
- G. Karjoth:**
 - Verifikation verteilter Systeme: Methoden und Werkzeuge
- P. Kropf:**
 - Petri Netze
- J.A. Makowsky:**
 - Datenbanken
- M. Marzetta:**
 - Typentheorien
- H. Mey:**
 - Grundlagen der Informatik 1
- K. Wyler:**
 - Neuronale Netze 2

Appendix B: Students' Projects

Stainhauser, D. A.: Previewer für den Raytracer Rayshade. IAM-PR-436, Betreuer: Stephan Amann, Eric Dubuis.

Spiess, L.: Implementation eines z-Buffer-Algorithmus für CSG. IAM-PR-437, Betreuer: Stephan Amann.

Zumbühl, M.: Anwendungsgebiete für L-Systeme. IAM-PR-438, Betreuer: Eric Dubuis, Christoph Streit.

Bürge, A.: Formgebung von fraktalen Gebirgen. IAM-PR-439, Betreuer: Eric Dubuis.

Hegi, R.A.: Grafikprogrammierung in Turbo-Pascal. IAM-PR-449, Betreuer: Michael F. Baumgartner.

Balsiger, P., Brambilla, P.: Funktionsrekonstruktion mit Hilfe von "neural network kernels". IAM-PR-453, Betreuer: Lorenz Müller, Kuno Wyler.

Koch, B., Padel, Th.: Implementation eines FE Algorithmus auf einem parallelen DSP System (MUSIC). IAM-PR-461, Betreuer: Peter Kropf.

Kientsch, M.: Regelstrecke Simulation mit SPECS. IAM-PR-464, Betreuer: Jacques Boillat.

Zimmermann, M.: Hand-written Character Recognition. IAM-PR-476, Betreuer: Thien Ha Minh.

Steiner, P.: Echolot-Koordinatentransformationen. IAM-PR-480, Betreuer: Klaus Budmiger.

Liechti, G.: Erweiterung von GENESIS. IAM-PR-484, Betreuer: Kuno Wyler.

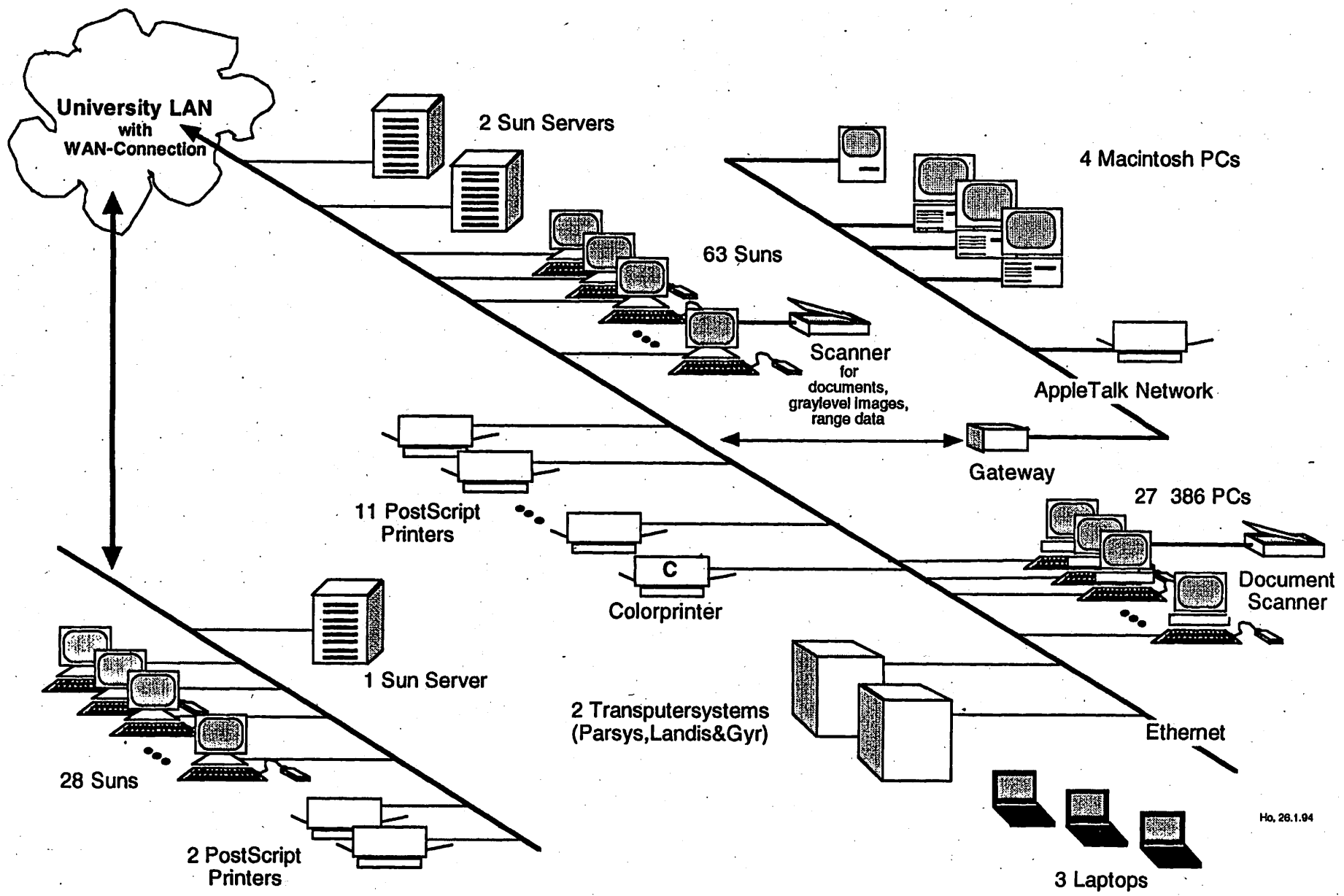
Haas, B.: Wetterkarten und Satellitenbilddaten aufzeichnen und decodieren. IAM-PR-490, Betreuer: Werner Eugster.

Brügger, L., Hanhart, D.: Topologiebilder. IAM-PR-494, Betreuer: Klaus Budmiger.

Bächler, R.: Optimale Patchform für Radiosity-Beleuchtungsmodelle. IAM-PR-497, Betreuer: Eric Dubuis.

Gonin, R.: Programm zur Analyse von Biomechanik-Daten in einem Messruderboot. IAM-PR-529, Betreuer: Igor Metz.

Appendix C: Computing Facilities



35