

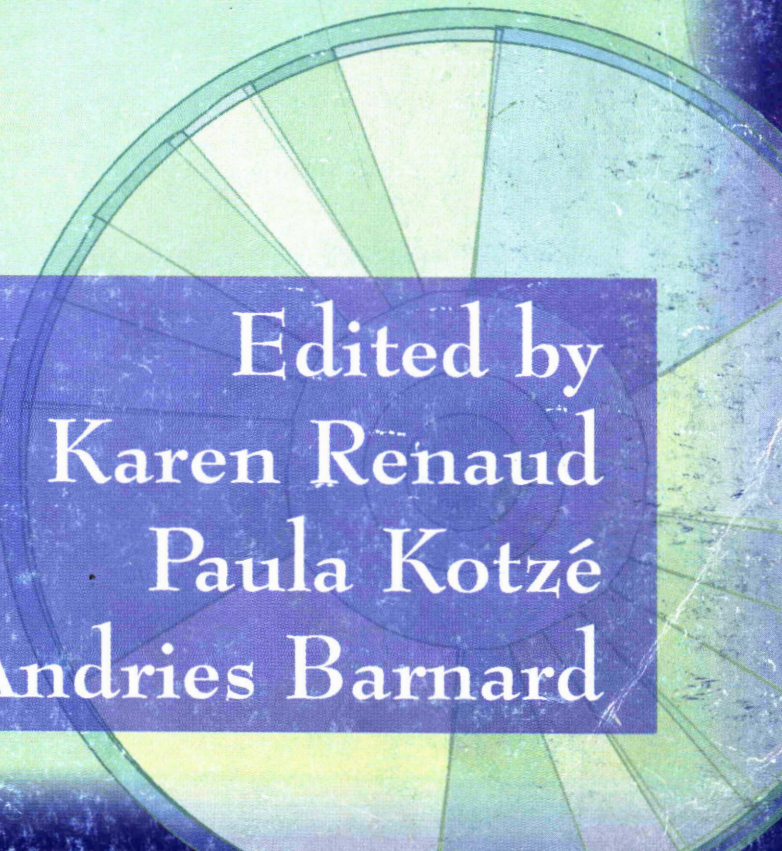
HARDWARE, SOFTWARE AND PEOPLEWARE



UNISA



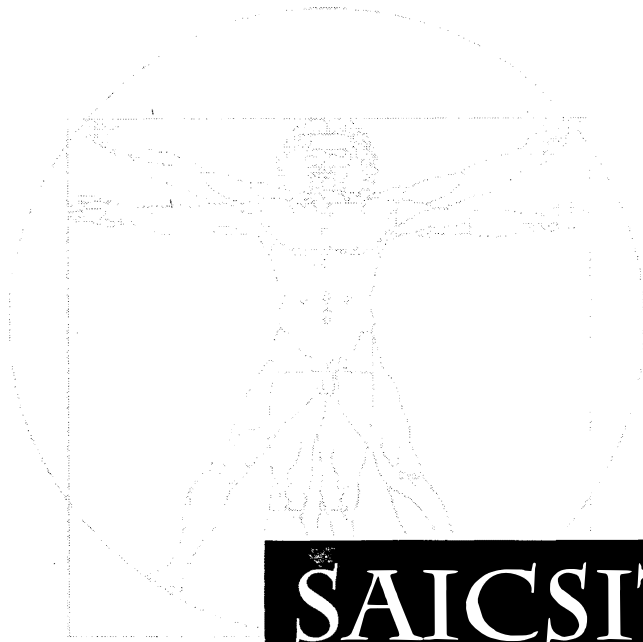
SAICSIT 2001



Edited by
Karen Renaud
Paula Kotzé
Andries Barnard

HARDWARE, SOFTWARE AND PEOPLEWARE

**South African Institute of Computer
Scientists and Information Technologists**
Annual Conference
25 – 28 September 2001
Pretoria, South Africa



SAICSIT 2001



Edited by Karen Renaud, Paula Kotzé & Andries Barnard
University of South Africa, Pretoria

Proceedings of the Annual Conference of the South African Institute of Computer Scientists and Information Technologists

First Edition, First Impression
ISBN: 1-86888-195-4

© The South African Institute of Computer Scientists and Information Technologists (SAICSIT)

Abstracting is permitted with credit to the source. Liberties are permitted to photocopying beyond the limits of South African copyright law for private use for research purposes. For other photocopying, reprint or republication permission write to the SAICSIT President, Department of Computer Science and Information Systems, UNISA, P O Box 392, Pretoria, 0003, South Africa.

The Publisher makes no representation, expressed or implied, with regard to the accuracy of the information contained in this book and cannot accept liability for any errors or omissions that may be made. The Publisher is not responsible for the use which might be made of the contents of this book.

Published by Unisa Press
University of South Africa
P O Box 392, Pretoria, 0003

Cover Design by Tersia Parsons

Editors: Karen Renaud, Paula Kotzé & Andries Barnard

Electronic Publication by the Editors

Printed by Unisa Press
2001

Table of Contents

Message from the SAICSIT President	iv
Message from the Chairs	vi
Conference Organisation	vii
Referees	viii

Keynote Speakers

<i>Cyber-economies and the Real World</i>	xi
Alan Dix	
<i>Computer-aided Instruction with Emphasis on Language Learning</i>	xiv
Lut Baten	
<i>Internet and Security Trends</i>	xv
Arthur Goldstuck	
<i>The Future of Data Compression in E-technology</i>	xvi
Nigel Horspool	
<i>Strategic Planning for E-Commerce Systems: Towards an Inspirational Focus</i>	xvii
Raymond Hackney	

Research Papers

Human-Computer Interaction / Virtual Reality

<i>The Development of a User Classification Model for a Multi-cultural Society</i>	1
M Streicher, J Wesson & A Calitz	
<i>Real-Time Facial Animation for Virtual Characters</i>	11
D Burford & E Blake	
<i>The Effects of Avatars on Co-presence in a Collaborative Virtual Environment</i>	19
J Casanueva & E Blake	

Education

<i>Structured Mapping of Digital Learning Systems</i>	29
E Cloete & L Miller	

Formal Methods

<i>The specification of a multi-level marketing business</i>	35
A van der Poll & P Kotzé	
<i>Finite state computational morphology - the case of the Zulu noun</i>	45
L Pretorius & S Bosch	
<i>Combining context provisions with graph grammar rewriting rules: the three-dimensional case</i>	54
A Barnard & E Ehlers	

Human-Computer Interaction / Web Usability

<i>Web Site Readability and Navigation Techniques: An Empirical Study</i>	64
P Licker, R Anderson, C Macintosh & A van Kets	
<i>Jiminy: Helping Users to Remember Their Passwords</i>	73
K Renaud & E Smith	

Information Security

<i>Computer Security: Hacking Tendencies, Criteria and Solutions</i>	81
M Botha & R von Solms	
<i>An access control architecture for XML documents in workflow environments</i>	88
R Botha & J Eloff	

Graphics and Ethics

<i>Model-based Segmentation of CT Images</i>	96
O Marte & P Marais	
<i>Towards Teaching Computer Ethics</i>	102
C de Ridder, L Pretorius & A Barnard	

Human-Computer Interaction / Mobile Devices

<i>Ubiquitous Computing and Cellular Handset Interfaces – are menus the best way forward?</i>	111
G Marsden & M Jones	
<i>A Comparison of the Interface Effect on the Use of Mobile Devices</i>	120
J Franken, A Stander, Z Booley, Z Isaacs & R Rose	
<i>The Effect of Colour, Luminance, Contrast, Icons, Forgiveness and Closure on ATM Interface Efficiency</i>	129
A Stander, P van der Zee, & Y Wang	

Object Orientation

<i>JavaCloak - Considering the Limitations of Proxies for Facilitating Java Runtime Specialisation</i>	139
K Renaud	

Hardware

<i>Hierarchical Level of Detail Optimization for Constant Frame Rate Rendering</i>	147
S Nirenstein, E Blake, S Windberg & A Mason	
<i>A Proposal for Dynamic Access Lists for TCP/IP Packet Filtering</i>	156
S Hazelhurst	

Information Systems

<i>The Use of Technology to Support Group Decision-Making in South Africa</i>	165
J Nash, D Gwilt, A Ludwig & K Shaw	
<i>Creating high Performance I.S. Teams</i>	172
D C Smith, M Becker, J Burns-Howell & J Kyriakides	
<i>Issues Affecting the Adoption of Data Mining in South Africa</i>	182
M Hart, E Barker-Goldie, K Davies & A Theron	

Information Systems / Management

<i>Knowledge management: do we do what we preach?</i>	191
M Handzic, C Van Toorn, & P Parkin	
<i>Information Systems Strategic Planning and IS Function Performance: An Empirical Study</i>	197
J Cohen	

Formal Methods

<i>Implication in three-valued logics of partial information</i>	207
A Britz	
<i>Optimal Multi-splitting of Numeric value ranges for Decision Tree Induction</i>	212
P Lutu	

Abstracts of Electronic Papers

<i>Lessons learnt from an action research project running groupwork activities on the Internet: Lecturers' experiences</i>	221
T Thomas & S Brown	
<i>A conceptual model for tracking a learners' progress in an outcomes-based environment</i>	221
R Harmse & T Thomas	
<i>Introductory IT at a Tertiary Level – Is ICDL the Answer?</i>	222
C Dixie & J Wesson	
<i>Formal usability testing – Informing design</i>	222
D van Greunen & J Wesson	
<i>Effectively Exploiting Server Log Information for Large Scale Web Sites</i>	223
B Wong & G Marsden	
<i>Best Practices: An Information Security Development Trend</i>	223
E von Solms & J Eloff	
<i>A Pattern Architecture, Using patterns to define an overall systems architecture</i>	224
J van Zyl & A Walker	
<i>Real-time performance of OPC</i>	224
S Kew, & B Dwolatzky	
<i>The Case for a Multiprocessor on a Die: MoaD</i>	225
P Machanick	
<i>Further Cache and TLB Investigation of the RAMpage Memory Hierarchy</i>	225
P Machanick & Z Patel	
<i>The Influence of Facilitation in a Group Decision Support Systems Environment</i>	226
T Nepal & D Petkov	
<i>Managing the operational implications of Information Systems</i>	226
B Potgieter	
<i>Finding Adjacencies in Non-Overlapping Polygons</i>	226
J Adler, GD Christelis, JA Deneys, GD Konidaris, G Lewis, AG Lipson, RL Phillips, DK Scott-Dawkins, DA Shell, BV Strydom, WM Trakman & LD Van Gool	

Message from the SAICSIT President

The South African Institute of Computer Scientists and Information Technologists (SAICSIT) was formed in 1982 and focuses on research and development in all fields of computing and information technology in South Africa. Now in the 20th year of its existence, SAICSIT has come of age, and through its flagship series of annual conferences provides a showcase of not only the best research from the Southern-African region, but also of international research, attracting contributions from far afield. SAICSIT does, however, not exist or operate in isolation.

More than 50 years have passed since the first electronic computer appeared in our society. In the intervening years technological development has been exponential. Over the last 20 years there has been a vast growth and pervasiveness of computing and information technology throughout the world. This has led into the expansion and consolidation of research into a diversity of new technologies and applications in diverse cultural environments. During this period huge strides have also been made in the development of computing devices. The processing speed of computers has increased thousand-fold and memory capacity from megabytes to gigabytes in the last decade alone. The Southern African region did not miss out on these developments.

It is hardly possible for such quantitative expansion not to bring a change in quality. Initially computers had been developed mainly for purposes such as automation for the improvement of processing, labour-reduction in production and automation control of machinery, with artificial intelligence, which made great strides in the 1980s, seen as the ultimate field to which computers could be applied. As we moved into the 1990s it was recognized that such an automation route was not the only direction in the improvement of computers. The expansion of processing power has enabled image data to be incorporated into computer systems, mainly for the purpose of improving human utilisation. For most computer technologies of the 1990s, including the Internet and virtual reality, automation was not the ultimate purpose. Humans were increasingly actively involved in the information-processing loop. This involvement has gradually increased as we move into the 21st century. Development of computer technology based not on automation, but on interaction, is now fully established.

The method of interaction has significantly changed as well. The expansion of computer ability means that the same function can be performed far more cheaply and on smaller computers than ever before. The advent of portable and mobile computers and pervasive computing devices is ample evidence of this. The need for users to be at the same location as a computer in order to reap the benefits of software installed on that computer is becoming an obsolete notion. Time and space are no longer constraints. One of the most discussed impacts of computing and information technology is *communication* and the easy accessibility of information. This changes the emphasis for research and development – issues such as cultural, political, and economic differences must, for example, be accommodated in ways that researchers have not previously considered. Our goal should be to enable users to benefit from technological advances, hence matching the skills, needs, and expectations of users of available technologies to their immense possibilities.

The conference theme for the SAICSIT 2001 Conference – *Hardware, Software and Peopleware: The Reality in the Real Millennium* – aims to reflect technological developments in all aspects related to computerised systems or computing devices, and especially reflect the fact that each influences the others.

Not only has SAICSIT come of age in the 21st century, but so has the research and development community in Southern Africa. The outstanding quality of papers submitted to SAICSIT 2001, of which only a small selection is published in this collection, illustrates both the exciting and developing nature of the field in our region. I hope that you will enjoy SAICSIT 2001 and that it will provide opportunities to cultivate and grow the seeds of discussion on innovative and new developments in computing and information technology.

Paula Kotzé
SAICSIT President

Message from the Chairs

Running this conference has been rewarding, exciting and exhausting. The response to the call for papers we sent out in March was overwhelming. We received 64 paper submissions for our main conference and twelve for the postgraduate symposium. We had a panel of internationally recognized reviewers, both local and international. The response from the reviewers was impressive – accepting a variety of papers and *mostly* returning the reviews long before the due date. We were struck, once again, by the sheer magnanimity of academia – as busy as we all are, we still manage to contribute fully to a conference such as SAICSIT.

After an exhaustive review process, where each paper was reviewed by at least three reviewers, the program committee accepted 26 full research papers and 14 electronic papers. Five papers were referred to the postgraduate symposium, since they represented work in progress – not yet ready for presentation to a full conference but which nevertheless represented sound and relevant research. The papers published in this volume therefore represent research of an internationally high standard and we are proud to publish it. Full electronic papers will be available on the conference web site (<http://www.cs.unisa.ac.za/saicsit2001/>).

Computer Science and Information Systems academics in South Africa labour under difficult circumstances. *The popularity of IT courses stems from the fact that IT qualifications are in high demand in industry, which leads in turn to a shortage of IT academic staff to teach the courses, even when posts are available. The net result is that fewer people teach more courses to more students. IT departments thus rake in ever-increasing amounts of state subsidy for their universities. These profits, euphemistically labelled “contribution to overhead costs”, are deployed in various ways: cross-subsidization of non-profitable departments; maintenance of general facilities; salaries for administrative personnel, etc. Sweeteners of generous physical resources for the IT departments may be provided. We have yet to hear of a University in South Africa where significant concessions have been made in terms of industry-related remuneration. At best, small subventions are provided. As a result, shortages of quality staff remain acute in most IT departments – especially at senior teaching levels. What is even worse is that academics in these departments have to motivate the value of their conference contributions and other IT outputs to selection committees, often dominated by sceptical academic power-brokers from the more traditional departments whose continued survival is underwritten by IT’s contribution to overhead costs.*¹

The papers published in this volume are conclusive evidence of the indefatigability and pertinacity of Computer Science and Information Systems academics and technologists in South Africa. We are proud to be part of such a prestigious and innovative group of people.

In conclusion, we would like to thank the conference chair, Prof Paula Kotzé, for her support. We also specially thank Prof Derrick Kourie for his substantial contribution. Finally, to all of you, contributors, presenters, reviewers and organisers – a big thank you – without you this conference could not be successful.

Enjoy the Conference!
Karen Renaud & Andries Barnard

¹ This taken almost verbatim from Professor Derrick Kourie’s SACLA 2001 paper titled: “*The Benefits of Bad Teaching*”.

Conference Organisation

General Chair

Paula Kotzé

Programme Chairs

Karen Renaud
Andries Barnard

Organising Committee Chairs

Lucas Venter, Alta van der Merwe

Art and Design

Tersia Parsons

Sponsor Liaison

Paula Kotzé, Chris Bornman

Secretarial & Finances

Christa Prinsloo, Elmarie Havenga

Marketing & Public Relations

Klarissa Engelbrecht, Elmarie van
Solms, Adriaan Pottas, Mac van der
Merwe

Audio Visual

Tobie van Dyk, Andre van der Poll,
Mac van der Merwe

Program Committee

Bob Baber – McMaster University, Canada
Andries Barnard – University of South Africa
Judy Bishop – University of Pretoria
Andy Bytheway – University of the Western Cape
Andre Calitz – University of Port Elizabeth
Elsabe Cloete – University of South Africa
Carina de Villiers – University of Pretoria
Alan Dix – Lancaster University, United Kingdom
Jan Eloff – Rand Afrikaans University
Andries Engelbrecht – University of Pretoria
Chris Johnson – University of Glasgow, United Kingdom
Paul Licker – University of Cape Town
Paula Kotzé – University of South Africa
Derrick Kourie – University of Pretoria
Philip Machanick – University of the Witwatersrand
Gary Marsden – University of Cape Town
Don Petkov – University of Natal in Pietermaritzburg
Karen Renaud – University of South Africa
Ian Sanders – University of the Witwatersrand
Derrick Smith – University of Cape Town
Harold Thimbleby – Middlesex University, United Kingdom
Theda Thomas – Port Elizabeth Technikon
Herna Viktor – University of Pretoria, South Africa
Bruce Watson – Universities of Pretoria and Eindhoven
Janet Wesson – University of Port Elizabeth

Referees

Molla Alemayehu	Klarissa Engelbrecht	Pekka Pihlajasaari
Trish Alexander	David Forsyth	Nelisha Pillay
Adi Attar	John Galletly	Laurette Pretorius
Bob Baber	Vashti Galpin	Karen Renaud
Andries Barnard	Wayne Goddard	Ingrid Rewitzky
John Barrow	Alexandré Hardy	Sheila Rock
Judy Bishop	Scott Hazelhurst	Markus Roggenbach
Gordon Blair	Johannes Heidema	Ian Sanders
Arina Britz	Tersia Hörne	Justin Schoeman
Andy Bytheway	Chris Johnson	Martie Schoeman
André Calitz	Bob Jolliffe	Elsje Scott
Charmain Cilliers	Paula Kotzé	Derek Smith
Elsabe Cloete	Derrick Kourie	Elmé Smith
Gordon Cooper	Les Labuschagne	Adrie Stander
Richard Cooper	Paul Licker	Harold Thimbleby
Annemieke Craig	Philip Machanick	Theda Thomas
Thad Crews	Anthony Maeder	Judy Van Biljon
Quintin Cutts	David Manlove	Alta Van der Merwe
Michael Dales	Gary Marsden	André van der Poll
Carina de Villiers	Thomas Meyer	Tobias Van Dyk
Alan Dix	Elsa Naudé	Lynette van Zijl
Dunlop Mark	Martin Olivier	Lucas Venter
Elize Ehlers	Don Petkov	Herna Viktor
Jan Eloff		Bruce Watson
Andries Engelbrecht		Janet Wesson

Conference

Sponsors



Keynote Abstracts

The Case for a Multiprocessor on a Die: Moad

Philip Machanick

School of Computer Science, University of the Witwatersrand, Private Bag 3, 2050 Wits, South Africa.
philip@cs.wits.ac.za

Abstract

Increasingly aggressive pipelining achieves diminishing returns. Simultaneous Multithreading (SMT) attempts to exploit the fact that functional units are frequently idle. This paper argues the case for keeping the processor simple, while looking for parallelism elsewhere, if it is too hard to find at the instruction level. In particular, it makes the case for a less aggressive superscalar implementation, and using the die space instead for a multiprocessor on a die (Moad), with the same theoretical peak execution rate. It is proposed that this change in design focus is more in line with characteristics of consumer applications than current design trends.