The South African Institute of Computer Science and Information Technology

The 1997 National Research and Development Conference

Riverside Sun
Vanderbijlpark
13 & 14 November

Hosted by

Potchefstroomse Universiteit
vir Christelike Hoër Onderwys

The Department of Computer Science and Information Systems
Potchefstroom University for Christian Higher Education
Vaal Triangle Campus

PROCEEDINGS

Edited by L.M. Venter & R.R. Lombard
The South African Institute of Computer Science
and
Information Technology

Proceedings

of the

The 1997 National Research and Development Conference
Towards 2000

Riverside Sun
Vanderbijlpark
13 & 14 November

Edited by
L.M. Venter
R.R. Lombard
©1997 Copyrights reside with the original authors who may be contacted directly

**ISBN 1-86822-300-0**

Printed and Binded by Xerox Printers, Potchefstroom

The views expressed in this book are those of the individual authors
Foreword

This book contains a collection of papers presented at a Research and Development conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT). The conference was held on 13 & 14 November 1997 at the Riverside Sun, Vanderbijlpark. Most of the organization for the conference was done by the Department of Computer Science and Information Technology of the Vaal Triangle Campus, Potchefstroom University for Christian Higher Education.

The programming committee accepted a wide selection of papers for the conference. The papers range from detailed technical research work to reports of work in progress. The papers originate mainly from Academia, but also describe work done in and for Industry. It is hoped that the papers give a true reflection of the current research scene in Computer Science and Information Technology in South Africa. Since one of the aims of the conference is Research development, the papers were not subjected to a refereeing process.

A number of people spent numerous hours helping with the organization of this conference. In this regard, we wish to thank the members of the Organizing committee, and the Programming committee who had very little time to screen the abstracts and compile the program. A special thanks goes to the secretary of the department, Mrs Helei Jooste, whose very able work was interrupted by the birth of her first child.
Organizing Committee

Conference General Chairs
Prof. J.M. Hattingh (PU for CHE)

Organizing Chair
Prof. Lucas Venter (PU for CHE)

Organizing Committee
Mrs. S. Gilliland
Mr. J.P. Jooste
Mr. R.R. Lombard
Mrs. M. Huisman

Secretariat
Mrs. H. Jooste

Program Chair
Prof A de Waal (PU for CHE)

Program Committee
Prof. D. Kourie (UP)
Prof. C. Bornman (UNISA)
Prof. L.M. Venter (PU for CHE)
# Table of Contents

Foreword ........................................... i
Organizing Committee ........................... ii
List of Contributors ............................... vii

*Software Objects Change: Problems and Solution*
S.A. Ajila ........................................... 1

*Liming-like Curve Constructions*
M.L. Baart and R. McLeod .................... 26

*A Model for Evaluating Information Security*
L. Barnard and R. von Solms ............... 27

*Integrating Spatial Data Management and Object Store Technology*
S. Berman, S. Buffler and E. Voges .......... 31

*Metamodelling in Automated Software Engineering*
S. Berman and R. Figueira .................... 32

*Using Multimedia Technology for Social Upliftment in Deprived Communities of Southern Africa*
L. Bester and E. de Preez ..................... 33

*Extending the Client-Server Model for Web-based Execution of Applications*
L. Botha, J.M. Bishop and N.B. Serbedzija .... 36

*Access Control Needs in an Electronic Workflow Environment*
R.A. Botha ........................................... 45

*The Use of the Internet in an Academic Environment to Commercially Supply and Support Software Products*
B. Braude and A.J. Walker .................... 51

*Explanation Facilities in Expert Systems Using Hypertext Technology*
T. Breetzke and T. Thomas ................. 63

*Theoretical Computer Science: What is it all about, and is it of any relevance to us?*
C. Brink ............................................ 75

*Representing Quadrics on a Computer*
M.A. Coetzee and M.L. Baart ............... 76
The Generation of Pre-Interpretations for Detecting Unsolvable Planning Problems
D.A. de Waal, M. Denecker, M. Bruynooghe and M. Thielscher 77

The Emerging Role of the Chief Information Officer in South Africa
B. Dekenah 87

A Java-Implemented Remote Respiratory Disease Diagnosis System on a High Bandwidth Network
A. Foster 88

Early Results of a Comparative Evaluation of ISO 9001 and ISO/IEC 15504 Assessment Methods Applied to a Software Project
C. Gee and A.J. Walker 89

A Neural Network Model of a Fluidised Bed
M. Hajek 99

The Effects of Virtual Banking on the South African Banking Industry
M.L. Hart and M. Dunley-Owen 100

Linear Response Surface Analysis and Some Applications
J.M. Hattingh 118

Model Checking Software with Symbolic Trajectory Evaluation
A. Hazelhurst 120

A Risk Model to Allocate Resources to Different Computerized Systems
H.A. Kruger and J.M. Hattingh 137

Returns on the Stock Exchange
J.W. Kruger 144

Cardinality Constrained 0-1 Knapsack Problems
M.F. Kruger, J.M. Hattingh and T. Steyn 150

An Investigation in Software Process Improvement in the Software Development of a large Electricity Utility
M. Lang and A.J. Walker 151

Design and Implementation of a C++ Package for Two-Dimensional Numerical Integration
D.P. Laurie, L. Pluym and Ronald Cools 162

Algebraic Factorization of Integers Using BDE’s
H. Messerschmidt and J. Robertson 169

iv
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Optimization of Routes after the Process of Recovery</td>
<td>176</td>
</tr>
<tr>
<td>M. Mphahlele and J. Roos</td>
<td></td>
</tr>
<tr>
<td>Using a Lattice to Enhance Adaptation Guided Retrieval in Example</td>
<td>177</td>
</tr>
<tr>
<td>Based Machine Translation</td>
<td></td>
</tr>
<tr>
<td>G.D. Oosthuizen and S.L. Serutla</td>
<td></td>
</tr>
<tr>
<td>Information Systems Development and Multi Criteria Decision</td>
<td>192</td>
</tr>
<tr>
<td>Making / Systems Thinking</td>
<td></td>
</tr>
<tr>
<td>D. Petkov, O. Petkova</td>
<td></td>
</tr>
<tr>
<td>The Development of a Tutoring System to Assist Students to Develop</td>
<td>193</td>
</tr>
<tr>
<td>Answering Techniques</td>
<td></td>
</tr>
<tr>
<td>N Pillay</td>
<td></td>
</tr>
<tr>
<td>Combining Rule-Based Artificial Intelligence with Geographic</td>
<td>194</td>
</tr>
<tr>
<td>Information Systems to Plan the Physical Layer of Wireless Networks</td>
<td></td>
</tr>
<tr>
<td>in Greenfield Areas</td>
<td></td>
</tr>
<tr>
<td>K. Prag, P. Premjeeth and K. Sandrasegaran</td>
<td></td>
</tr>
<tr>
<td>A Distributed Approach to the Scheduling Problem</td>
<td>202</td>
</tr>
<tr>
<td>V. Ram and P. Warren</td>
<td></td>
</tr>
<tr>
<td>More readings than I thought : Quantifier Interaction in Analysing</td>
<td>203</td>
</tr>
<tr>
<td>the Temporal Structure of Repeated Eventualities</td>
<td></td>
</tr>
<tr>
<td>S. Rock</td>
<td></td>
</tr>
<tr>
<td>Ray Guarding Configuration of Adjacent Rectangles</td>
<td>221</td>
</tr>
<tr>
<td>I. Sanders, D. Lubinsky and M. Sears</td>
<td></td>
</tr>
<tr>
<td>Developing Soft Skills in Computer Students</td>
<td>239</td>
</tr>
<tr>
<td>C Schröder, T. Thomas</td>
<td></td>
</tr>
<tr>
<td>Information Security Awareness, a Must for Every Organization</td>
<td>250</td>
</tr>
<tr>
<td>M. Thomson and R. von Solms</td>
<td></td>
</tr>
<tr>
<td>Pla Va: A Lightweight Persistent Java Virtual Machine</td>
<td>253</td>
</tr>
<tr>
<td>S Tjasink and S. Berman</td>
<td></td>
</tr>
<tr>
<td>Beliefs on Resource-Bounded Agent</td>
<td>267</td>
</tr>
<tr>
<td>E. Viljoen</td>
<td></td>
</tr>
<tr>
<td>Object-Orientated Business Modelling and Re-engineering</td>
<td>268</td>
</tr>
<tr>
<td>M. Watzenboeck</td>
<td></td>
</tr>
</tbody>
</table>
On Indexing in Case Based Reasoning Applied to Pre-Transportation Decision Making for Hazardous Waste Handling
K.L. Wortmann, D. Petkov and E Senior

Author Index
List of Contributors

S.A. Ajila
Department of Mathematics and Computer Science
National University of Lesotho
Roma, 180
Lesotho

L. Baart
Department of Mathematics
Vaal Triangle Campus of the PU for CHE
PO Box 1174
Vanderbijlpark, 1900

L. Barnard
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

S. Berman
University of Cape Town
Rondebosch, 7701

L. Bester
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

J.M. Bishop
Computer Science Department
University of Pretoria
Pretoria, 0002

L. Botha
Computer Science Department
University of Pretoria
Pretoria, 0002

R.A. Botha
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

M. Bruynooghe
Departement Computerwetenschappen
Katholieke Universiteit Leuven
Celestijnenlaan 200A
B-3001 Heverlee
Belgium

S. Buffler
University of Capetown
Rondebosch, 7701

M.A. Coetzee
Department of Mathematics
PU for CHE
Private Bag X6001
Potchefstroom, 2520

R. Cools
Katholieke Universiteit Leuven
Celestijnenlaan 200A
B-3001 Heverlee
Belgium

E. de Preez
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

D.A. De Waal
Department of Computer Science and Information Systems
PU for CHE
Private Bag X6001
Potchefstroom, 2531

B. Dekkenah
The Board of Executors

M. Denecker
Departement Computerwetenschappen
Katholieke Universiteit Leuven
Celestijnenlaan 200A
B-3001 Heverlee
Belgium

M. Dunley-Owen
Department of Information Systems
University of Cape Town
Rondebosch, 7700

R. Fiqueira
University of Capetown
Rondebosch, 7701

A. Foster
Department of Computer Science
University of Cape Town
Rondebosch, 7701

C. Gee
Software Engineering Applications Laboratory,
Electrical Engineering
University of the Witwatersrand
Private Bag 3
Wits, 2050

T. Bretzke
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

C. Brink
University of Cape Town
Rondebosch, 7700

M. Bruynooghe
Departement Computerwetenschappen
Katholieke Universiteit Leuven
Celestijnenlaan 200A
B-3001 Heverlee
Belgium

vii
K. Sandrasegaran
Department of electrical Engineering
University of Durban-Westville
Private Bag X54001
Durban, 4000

C. Schoder
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

M. Sears
Department of Mathematics
University of the Witwatersrand
Private Bag 3
Wits, 2050

E. Senior
International Center for Waste Technology
University of Natal, Pietermaritzburg
Private Bag X01
Scotsville, 3209

N.B. Serbedzija
GMD FIRST
Rudower Chaussee 5
D-12489 Berlin
Germany

S.L. Serutla
Department of Computer Science
The University of Pretoria
Pretoria, 0002

T. Steyn
PU for CHE
Private Bag X6001
Potchefstroom, 2520

M. Thielscher
Fachgebiet Informatik, Fachgebiet Informatik
Technische Hochschule Darmstadt
Alexanderstrasse 10
D-64283 Darmstadt
Germany

T. Thomas
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

M. Thomo
Faculty of Computer Studies
Port Elizabeth Technikon
Private Bag X6011
Port Elizabeth, 6000

S. Tjasink
University of Cape Town
Rondebosch, 7700

E. Viljoen
Department of Computer Science and
Information Systems
University of South Africa
PO Box 392
Pretoria, 0001

E. Voges
University of Cape Town
Rondebosch, 7701
Multicriteria Decision Making and Systems Thinking both claim to be useful when dealing with complex, messy managerial problems. They have evolved in a different way in the past 20 years and only recently there have been some attempts to explore what one of those fields can contribute to the other.

Information Systems development has been traditionally linked to "hard" systems thinking though in the past 10 years there have been considerable research attempts to apply softer approaches like Soft Systems Methodology, Strategica Assumptions Surfacing and Testing and Critical Systems Thinking to IS development. The latter is based on the principles of Critical Social Theory and the emancipatory ideas of Habermas.

The paper presents an overview of the similarities and differences between MCDM and Systems Thinking and their relevance to Information Systems development. It provides also an overview of current research in the area, including the authors' own results. The conclusion emphasises on the need for complementarist approaches combining the positive features of MCDM and Systems Thinking applied to IS development.