



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

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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**

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## **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**

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## **Organizing Committee**

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# 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

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

T. Breetzke  
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

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. Dekenah  
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. Figueira  
University of Cape Town  
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

M. Hajek  
Department of Computer Science  
University of Durban Westville  
Private Bag X54001  
Durban, 4000

M.L. Hart  
Department of Information Systems  
University of Cape Town  
Rondebosch, 7700

J.M. Hattingh  
Department of Computer Science and  
Information Systems  
PU for CHE  
Private Bag X6001  
Potchefstroom, 2520

S. Hazelhurst  
Department of Computer Science  
University of the Witwatersrand  
Private Bag 3  
Wits 2050

H.A. Kruger  
Department of Computer Science and  
Information Systems  
PU for CHE  
Private Bag X6001  
Potchefstroom, 2520

J.W. Kruger  
University of the Witwatersrand  
Private Bag 3  
Wits, 2050

M.F. Kruger  
PU for CHE  
Private Bag X6001  
Potchefstroom, 2520

M.T. Lang  
Eskom Information Technology Department

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

D. Lubinsky  
Department of Computer Science  
University of the Witwatersrand  
Private Bag 3  
Wits, 2050

R. McLeod  
Saltire Software Inc.  
Tigard  
Oregon  
U.S.A

H.J. Messerschidt  
Department of Computer Science and  
Informatics  
University of the Orange Free State  
PO Box 339  
Bloemfontein, 9300

M. Mphahlele  
Department of Computer Science  
University of the North  
Private Bag X1106  
Sovenga, 0727

G.D. Oosthuizen  
Department of Computer Science  
University of Pretoria  
Pretoria, 0002

J. Owen  
University of Cape Town  
Rondebosch, 7701

D. Petkov  
Department of Computer Science  
University of Natal  
Private Bag X01  
Scotsville, 3209

O. Petkova  
Technikon Natal  
PO Box 101112  
Scotsville, 3209

N. Pillay  
Department of Financial Studies  
Technikon Natal, Pietermaritzburg  
PO Box 101112  
Scotsville, 3209

L. Pluym  
Katholieke Universiteit Leuven  
Celestijnenlaan 200A  
B-3001 Heverlee  
Belgium

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

P. Premjeeth  
Department of electrical Engineering  
University of Durban-Westville  
Private Bag X54001  
Durban, 4000

V. Ram  
Department of Computer Science  
University of Natal  
Private Bag X01  
Scotsville, 3209

J. Robertson  
Department of Computer Science and  
Informatics  
University of the Orange Free State  
PO Box 339  
Bloemfontein, 9300

S. Rock  
Department of Artificial Intelligence  
Edinburgh University  
United Kingdom

J. Roos  
Department of Computer Science  
University of Pretoria  
Pretoria, 0002

I. Sanders  
Department of Computer Science  
University of the Witwatersrand  
Private Bag 3  
Wits, 2050

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 Chausee 5  
D-12489 Berlin  
Germany

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

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

M. Thielscher  
Fachgebiet Intellektik, 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. Thomson  
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

R. Von Solms  
Faculty of Computer Studies  
Port Elizabeth Technikon  
Private Bag X6011  
Port Elizabeth, 6000

A.J. Walker  
Software Engineering Applications Laboratory,  
Electrical Engineering  
University of the Witwatersrand  
Private Bag 3  
Wits, 2050

P. Warren  
Department of Computer Science  
University of Natal  
Private Bag X01  
Scotsville, 3209

M. Watzenboeck  
University of Botswana  
Private Bag 0022  
Gaborone  
Botswana

K.L. Wortmann  
Department of Computer Science  
University of Natal, Pietermaritzburg  
Private Bag X01  
Scotsville, 3209

# Metamodelling in Automated Software Engineering

R. Figueira and S. Berman  
University of Cape Town

August 22, 1997

This paper describes a metamodelling system that has been created at the University of Cape Town as part of an integrated software engineering environment called the Persistent Programmers Workshop. The workshop architecture is analogous to that of manual production environments: it is configured as a collection of workbenches each designed for specific tasks, with tools and workitems migrating between workbenches and the workshop shelves as jobs progress. The metamodeller is part of the Design Workbench built at UCT to complement the Programming and Application Workbenches developed at the Universities of Glasgow and Oslo.

The core function of the Design Workbench is to support end-user modelling of real-world systems and to translate these models into an extensible set of procedures and data types (the target system). A problem with many automated design environments is that they offer a very limited choice of data and process models. By adding a meta-layer to our system, we enable software design teams to specify the conceptual models they prefer using when developing computer applications. These models are then fully supported by the Workbench tools: that is, the model building, model querying and code generation facilities are tailored accordingly. This does not only make the Workbench adaptable to a variety of models; it also permits different team members to work on the design of a single system using different models (according to personal preference) and allows developers to view/alter their designs from different perspectives simply by selecting another model.

This paper outlines the Persistent Programmers Workbench and shows how a variety of conceptual models can be represented in a single software engineering repository. The metasystem is illustrated with examples to show how models are defined along with their mapping to this repository. The engineering of the metamodelling system is then presented, and we demonstrate how modern programming language features such as orthogonal persistence (all data have equal rights to persistence and program code is the same for both transient and persistent items) and linguistic reflection (calling the compiler at runtime) were used to cater for any model. We conclude with some observations on the relative strengths and weaknesses of major data models (IFO, SDM, ER, OMT and DAPLEX) and examine the potential of our repository as the basis for designing a universal data modelling language.