



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.

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# Integrating Spatial Data Management and Object Store Technology

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July 23, 1997

**Keywords:** persistent store, object-orientation, spatial indexing, performance measurement.

Efficient access to spatial data is essential for many engineering, town planning and mining applications. Conventional database systems are not capable of performing such searches effectively over large data sets. Relational databases typically have to be used in conjunction with separate GIS (Geographical Information System) software, which is highly unsuitable from both system performance and programmer productivity viewpoints.

There has recently been considerable research into building persistent object systems (POS) that can overcome the limitations of traditional databases. A POS allows data to be manipulated independently of its longevity; that is, program objects of any type can be made to persist on disk, and program statements have the same form whether they operate over transient or persistent data. A POS frees programmers from managing transfers between memory and disk, and from coding type conversions as data migrates between stores. It also reduces runtime costs because schema validation is not required on transaction execution due to the consistent binding between code and data.

This paper describes a selection of spatial indexing mechanisms and their adaptation to run on persistent object stores. We studied two complementary techniques implemented on the Napier88 persistent store – namely grid files and R\*-trees – and a generic spatial indexing library based on the GiST (Generalized Search Tree) system for Persistent Java.

Having measured performance over a variety of data sets and conditions, we conclude that persistent object systems are highly suited to spatial data management, and suggest guidelines for choosing a particular POS and spatial indexing method based on application-specific characteristics.