Lecture Notes in Computer Science2635Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

Springer Berlin

Berlin Heidelberg New York Hong Kong London Milan Paris Tokyo Olaf Owe Stein Krogdahl Tom Lyche (Eds.)

From Object-Orientation to Formal Methods

Essays in Memory of Ole-Johan Dahl



Series Editors

Gerhard Goos, Karlsruhe University, Germany Juris Hartmanis, Cornell University, NY, USA Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Olaf Owe Stein Krogdahl University of Oslo Department of Informatics P.O. Box 1080, 0316 Oslo, Norway E-mail: {olaf,stein.krogdahl}@ifi.uio.no

Tom Lyche University of Oslo Institute of Informatics and CMA P.O. Box 1053, Blindern, 0316 Oslo, Norway E-mail: tom@ifi.uio.no

The illustration appearing on the cover of this book is the work of Daniel Rozenberg (DADARA).

Library of Congress Control Number: 2004103001

CR Subject Classification (1998): D.2, D.3, D.1, F.3, F.4

ISSN 0302-9743 ISBN 3-540-21366-X Springer-Verlag Berlin Heidelberg New York

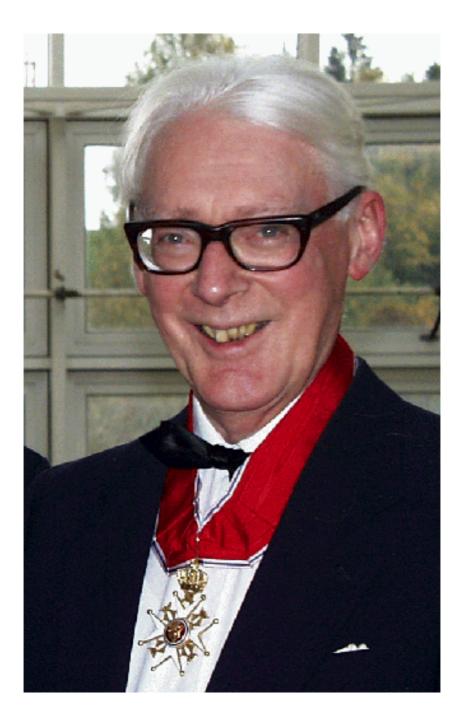
This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag is a part of Springer Science+Business Media

springeronline.com

© Springer-Verlag Berlin Heidelberg 2004 Printed in Germany

Typesetting: Camera-ready by author, data conversion by Boller Mediendesign Printed on acid-free paper SPIN: 10992401 06/3142 5 4 3 2 1 0



Ole-Johan Dahl

Preface

After Ole-Johan's retirement at the beginning of the new millennium, some of us had thought and talked about making a "Festschrift" in his honor. When Donald Knuth took the initiative by sending us the first contribution, the process began to roll! In early 2002 an editing group was formed, including Kristen Nygaard, who had known Ole-Johan since their student days, and with whom he had developed the Simula language. Then we invited a number of prominent researchers familiar with Ole-Johan to submit contributions for a book honoring Ole-Johan on the occasion of his 70th birthday. Invitees included several members of the IFIP 2.3 working group, a forum that Ole-Johan treasured and enjoyed participating in throughout his career. In spite of the short deadline, the response to the invitations was overwhelmingly positive.

The original idea was to complete the book rather quickly to make it a gift he could read and enjoy, because by then he had had cancer for three years, and his health was gradually deteriorating. Kristen had been regularly visiting Ole-Johan, who was in the hospital at that time, and they were working on their Turing award speech. Ole-Johan was gratified to hear about the contributions to this book, but modestly expressed the feeling that there was no special need to undertake a book project on his behalf. Peacefully accepting his destiny, Ole-Johan died on June 29, 2002. Kristen, who was 5 years older than Ole-Johan, was still very active. Quite surprisingly, he died 6 weeks later of a sudden heart attack. During this short period, Norway lost its two greatest computer scientists.

We are grateful to all who helped with the book, especially all the contributors and the anonymous referees. Credit is due to Ellef Gjelstad, who helped with the preparation of the manuscript.

University of Oslo December 2003 Olaf Owe, Stein Krogdahl, Tom Lyche

Table of Contents

A Biography of Ole-Johan Dahl Olaf Owe, Stein Krogdahl, and Tom Lyche	1
A Bibliography of Ole-Johan Dahl Olaf Owe, Stein Krogdahl, and Tom Lyche	8
The Birth of Object Orientation: the Simula Languages Ole-Johan Dahl	15
An Algebraic Theory of Actors and Its Application to a Simple Object-Based Language Gul Agha and Prasanna Thati	26
Towards Posit & Prove Calculi for Requirements Engineering and Software Design Dines Bjørner	58
Distributed Concurrent Object-Oriented Software Manfred Broy	83
Composing Hidden Information Modules over Inclusive Institutions Joseph Goguen and Grigore Roşu	96
Towards the Verifying Compiler <i>Tony Hoare</i>	124
Object-Oriented Specification and Open Distributed Systems Einar Broch Johnsen and Olaf Owe	137
SIMULA and Super-Object-Oriented Programming Eugene Kindler	165
Efficient Coroutine Generation of Constrained Gray Sequences Donald E. Knuth and Frank Ruskey	183
Consistency of Inheritance in Object-Oriented Languages and of Static, ALGOL-like Binding	209
The Power of Abstraction, Reuse, and Simplicity: An Object-Oriented Library for Event-Driven Design Bertrand Meyer	236

Iterative Synthesis of Control Guards Ensuring Invariance and	
Inevitability in Discrete-Decision Games	272
Michel Sintzoff	
Incremental Reasoning for Object Oriented Systems	302
Neelam Soundarajan and Stephen Fridella	002
Pure Type Systems in Rewriting Logic: Specifying Typed Higher-Order	
Languages in a First-Order Logical Framework	334
Mark-Oliver Stehr and José Meseguer	
Building Optimal Binary Search Trees from Sorted Values in	
O(N) Time	376
Jean G. Vaucher	
Author Index	389