



SIGPLAN NOTICES
VOLUME 25, NUMBER 10, OCTOBER 1990

OOPSLA ECOOP '90

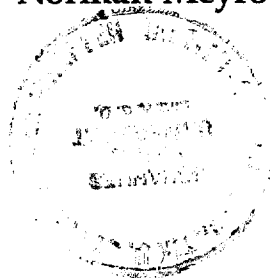
Proceedings

Conference on
Object-Oriented
Programming: Systems,
Languages, and Applications

European Conference on
Object-Oriented Programming

Ottawa, Canada
21-25 October 1990

Edited by Norman Meyrowitz



D30

12716

Sponsored by the Association for Computing Machinery's
Special Interest Group on Programming Languages
(ACM/SIGPLAN)

The Association for Computing Machinery
11 West 42nd Street
New York, New York 10036

Copyright © 1990 by the Association for Computing Machinery, Inc. Copying without fee is permitted provided that the copies are not made or distributed for direct commercial advantage, and credit to the source is given. Abstracting with credit is permitted. For other copying of articles that carry a code at the bottom of the first page, copying is permitted provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 27 Congress Street, Salem, MA 01970. For permission to republish write to: Director of Publications, Association for Computing Machinery. To copy otherwise, or republish, requires a fee and/or specific permission.

ORDERING INFORMATION

Orders from nonmembers of ACM placed within the U.S. should be directed to:

Addison-Wesley Publishing Company
Order Department
Jacob Way
Reading, MA 01867
Tel: 1-800-447-2226

Addison-Wesley will pay postage and handling on orders accompanied by check. Credit card orders may be placed by mail or by calling the Addison-Wesley Order Department at the number above. Follow-up inquiries should be directed to the Customer Service Department at the same number.

Please include the Addison-Wesley ISBN number with your order:
A-W ISBN 0-0201-52430-X.

Orders from nonmembers of ACM placed from outside the U.S. should be addressed as noted below.

Latin America and Asia:
Addison-Wesley Publishing Company, Inc.
Reading, MA 01867, U.S.A.
Tel: 617-944-3700;
Cable: ADIWES READING;
Telex: 94-9416

Canada: Addison-Wesley Publishing (Canada) Ltd.
36 Prince Andrew Place
Don Mills, Ontario M3C2T8, Canada
Tel: 416-447-5101

Australia and New Zealand:
Addison-Wesley Publishing Company
6 Byfield Street
North Ryde, N.S.W.2113
Australia
Tel: 888-2733;
Cable: ADIWES SYDNEY;
Telex: AA71919

United Kingdom, Republic of Ireland, Africa (excluding North Africa) and South Africa:
Addison-Wesley Publishers Ltd.
Finchampstead Road
Wokingham
Berkshire RG11 2NZ, England
Cable: ADIWES Wokingham;
Telex: 846136

Continental Europe, the Near East, Middle East, and North Africa:
Addison-Wesley Publishing Company
De Laresstraat, 90
1071 PJ Amsterdam
The Netherlands
Tel: 020 76 40-44
Cable: ADIWES AMSTERDAM
Telex: 844-14046

ACM Members: A limited number of copies are available at the ACM member discount. Send order with payment to:

ACM Order Department
P.O. Box 64145
Baltimore, MD 21264

ACM will pay postage and handling on orders accompanied by check.

Credit card orders only:
1-800-342-6626

Customer service, or credit card orders from Alaska, Maryland, and outside the U.S.: 301-528-4261

Credit card orders may also be placed by mail.

Please include your ACM member number and the ACM Order number with your order.

ACM Order Number: 548901
ACM ISBN 0-89791-411-2

ACM SIGPLAN NOTICES (ISSN 0362-1340) is published monthly by the Association of Computing Machinery, Inc. 11 West 42nd Street, New York, NY 10036. The basic annual subscription is \$20.00 for ACM Members. Second class postage is paid at New York, NY 10001 and at additional mailing offices. Postmaster: Send change of address to SIGPLAN NOTICES, ACM, 11 West 42nd Street, New York, NY 10036.

WELCOME TO OOPSLA/ECOOP '90

On behalf of the OOPSLA-ECOOP '90 conference committee, we would like to welcome you to the first joint conference between OOPSLA and ECOOP.

Five years ago, OOPSLA was organized to create an annual North American forum for researchers and practitioners interested in the object-oriented paradigm. The conference continues to be a unique meeting place for those interested in both research and experience.

Four years ago ECOOP was organized to structure object-oriented activities taking place in European countries by providing a European forum for theorists and practitioners interested in the object-oriented paradigm. The ECOOP tradition is to move the conference location each year from one country to another:

ECOOP '87 was held in Paris organized by AFCET,
ECOOP '88 in Oslo organized by DND,
ECOOP '89 in Nottingham organized on behalf of the BCS, and
ECOOP '91 is scheduled in Geneva.

The aims of this year's conference are two-fold: first, to join and share the American and European experiences in the development of object-oriented technology, and secondly, to increase the quality of the technical program. The former is realized by the tutorials, workshops, panels, and exhibits, while the latter was obtained by selecting only 29 papers of the nearly 200 submitted.

The success of such an international conference is due to the dedication of the members of various committees. We thank the reviewers and program committee members for reviewing and selecting the papers contained herein. Despite the size and popularity of the conference, both ECOOP and OOPSLA have been assembled year after year by a small group of volunteers. We extend our thanks to the members of the conference committee, who gave up their personal time to carry out their responsibilities.

ACM and SIGPLAN have continued to provide support to the conference. We greatly appreciate the operations and support provided by the ACM conference staff, and continued sponsorship and distribution of the proceedings by SIGPLAN.

The committee members also wish to thank their employers and sponsors for support of these conference activities. We want to express our special appreciation to Norm Meyrowitz, who has served for five years as OOPSLA proceedings editor.

Finally, we thank the attendees and hope that you enjoy the conference and proceedings.

David Thomas and Pierre Cointe, Conference Co-Chairs, OOPSLA/ECOOP '90

CONFERENCE COMMITTEE

Conference Co-Chairs

Dave Thomas (Object Technology Intl, Inc.)
Pierre Cointe (Rank Xerox)

Program Chair

Akinori Yonezawa (University of Tokyo)

Operations

Jeff McKenna (The McKenna Consulting Group)

Treasurer

Bill Bourne (Kylain Technologies Inc.)

Communications

John Pugh (Carleton University)

Tutorials

Jean Bezin (Universite de Nantes)
Philippe Gautron (Rank Xerox)

Publications

Angela Coppola (Central Intelligence Agency)
William Ruh (MITRE Corporation)

Proceedings

Norman Meyrowitz (IRIS/Brown University)

Exhibits

Steve Levine (ParcPlace Systems)
Melissa McCutchin (ParcPlace Systems)

Publicity

Karen Offerman (Datapro)

Panels

Rich Demers (IBM Corporation)

Local Arrangements

Fiona Gilfillan (Object Technology Intl, Inc.)

Workshops

Jean-Francois Perrot (Universite de Paris VI)
Ralph Johnson (University of Illinois)

Demonstrations

Pat O'Brien (Digital Equipment Corporation)

Registration

Ross MacLeod (Bell Northern Research)

Audo-Visual

Dan Steinbach (Steinbach and Co.)

Student Volunteers

Suzanne Skublics (Carleton University)

Companions Program

Liz Drake, June Burgett

THE OOPSLA/ECOOP '90 PROGRAM

Object-orientation has reached maturity. Virtually all areas of software science and technology have now recognized its significance and effectiveness. Even the Cobol community, one of the most conservative software communities, is now engaged in designing object-oriented Cobol languages.

The maturity made it possible to hold this first joint conference. We had 194 submissions and only 29 papers were selected, making it the largest and most competitive conference in the histories of ECOOP and OOPSLA. This does not imply that the quality of submissions declined. To the contrary, the program committee undertook the most difficult and unpleasant task to find the demarcation line between inclusion and exclusion. A very large group of high-quality papers, which are mutually indistinguishable in originality and significance, had to be collectively turned down due to the space and time limitation of the conference program.

Nevertheless, the program committee believes that the technical program faithfully reflects the current state-of-the art in object-oriented programming, systems, languages and applications. And we also hope that the papers included in this proceedings will suggest the future direction of research and practice.

I would like to thank the Program Committee members and all the other referees. Without their volunteered efforts, this successful program would have never been created.

Akinori Yonezawa

OOPSLA/ECOOP '90 Program Chair

1990 PROGRAM COMMITTEE

Chair: Akinori Yonezawa, University of Tokyo

Francois Bancilhon, GIP ALTAIR
Brian M. Barry, Defence Research Establishment Ottawa
Kent Beck , MasPar Computer Corporation
Alan Borning, University of Washington
Roy H. Campbell, University of Illinois
Luca Cardelli, DEC SRC
Steve Cook, Object Designers Ltd.
Jean-Marie Hullot, NeXT, Inc.
Kenneth Kahn, Xerox PARC
Wilf R. LaLonde, Carleton University
Henry Lieberman, MIT Media Lab. & University of Paris VI
Ole Lehmann Madsen, Aarhus University
James E. Rumbaugh, GE Corporate Research and Development
Alan Snyder, HP Laboratories
Luc Steels, Brussels Free University
Bjarne Stroustrup, AT&T Bell Laboratories
Dionysios C. Tschritzis, University of Geneva
Mario Tokoro, Keio University
Jon L. White, Lucid, Inc.

1990 REVIEWERS

Excluding Program Committee

Agha G.	Ishikawa Y.	Thomson D.
America P.	Johnson K.	Tanaka K.
Anderson D.	Johnson R.	Ueda K.
Arapis C.	Jones K.	Vitek J.
Barbedette G.	Kamimrua T.	Werner C.
Berild S.	Kato K.	Wilson M.
Bezivin J.	Konstantas D.	Wolczko M.
Bjornerstedt A.	Kuse K.	Yokote Y.
Briot J.-P.	Larcheque J.	Yokoyama T.
Brown M.	Lecluse C.	Yoshida K.
Casais E.	Lindstrom F.	
de Champeaux D.	Mackay S.	
Cook W.	Malhotra A.	
Coplien J.	van Marcke K.	
Cox B.	Marlowe T.	
Dami L.	Matsuoka S.	
Deknock L.	McAffer J.	
Doi N.	Medeiros C.	
Dony C.	de Mey V.	
Duimovich J.	Moss E.	
Ferber J.	Nelson G.	
Freeman-Benson B.	Nerson J.	
Gautron P.	Nieratrasz O.	
Gerhardt M.	Oelmann A.	
Hack M.	Onodera T.	
Hailpern B.	Papathomas M.	
Helm R.	Pedregal C.	
Heung A.	Perrot J.-F.	
Hewitt C.	Pintado X.	
Hopspool R.	Queinnec C.	
Hosking T.	Rademakers P.	
	Renfer S.	
	Shibayama E.	
	Shapiro J.	
	Sobalvarro P.	
	Stadelmann M.	