Lecture Notes in Computer Science 1951
Edited by G. Goos, J. Hartmanis and J. van Leeuwen

Springer
Berlin
Heidelberg
New York
Barcelona
Hong Kong
London
Milan
Paris
Singapore
Tokyo

Frank van der Linden (Ed.)

Software Architectures for Product Families

International Workshop IW-SAPF-3
Las Palmas de Gran Canaria, Spain, March 15-17, 2000
Proceedings

Springer

Series Editors

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

Volume Editor

Frank van der Linden
Philips Medical Systems
Veenpluis 4-6, 5684 PC Best, The Netherlands
E-mail: Frank.van.der.Linden@philips.com

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Software architectures for product families : international workshop IW SAPF 3, Las Palmas de Gran Canaria, Spain, March 15 - 17, 2000 ; proceedings / Frank van der Linden (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer, 2000
(Lecture notes in computer science ; Vol. 1951)
ISBN 3-540-41480-0

CR Subject Classification (1998): D.2.11, D.2, K.6

ISSN 0302-9743
ISBN 3-540-41480-0 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 Berlin Heidelberg New York
a member of BertelsmannSpringer Science+Business Media GmbH
© Springer-Verlag Berlin Heidelberg 2000
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Stefan Sossna
Printed on acid-free paper SPIN: 10780953 06/3142 5 4 3 2 1 0

Preface

This book contains the proceedings of a third workshop on the theme of Software Architecture for Product Families. The first two workshops were organised by the ESPRIT project ARES, and were called "Development and Evolution of Software Architectures for Product Families". Proceedings of the first workshop, held in November 1996, were only published electronically at: "http://www.dit.upm.es/~ares/". Proceedings of the second workshop, held in February 1998, were published as Springer LNCS 1429.

The ARES project was finished in February 1999. Several partners continued cooperation in a larger consortium, ITEA project 99005, ESAPS. As such it is part of the European Eureka Σ! 2023 programme. The third workshop was organised as part of the ESAPS project. In order to make the theme of the workshop more generic we decided to rename it "International Workshop on Software Architectures for Product Families". As with the earlier two workshops we managed to bring together people working in the software architecture of product families and in software product-line engineering.

Submitted papers were grouped in five sessions. Moreover, we introduced two sessions, one on configuration management and one on evolution, because we felt that discussion was needed on these topics, but there were no submitted papers for these subjects. Finally, we introduced a surveys session, giving an overview of the present situation in Europe, focussed on ESAPS, and in the USA, focussed on the SEI Product Line Systems Program.

The workshop was chaired by Henk Obbink from Philips Research and by Paul Clements of the SEI.

The Programme Committee was recruited from the participants of the earlier two workshops and from partners within ARES and ESAPS:

Felix Bachmann	Philippe Kruchten
Bob Balzer	Jeff Maggee
Len Bass	Nenad Medvidovic
Jan Bosch	Robert Nord
T.W. Cook	Dewayne Perry
Juan Carlos Dueñas	Juan Antonio de la Puente
Wolfgang Emmerich	Alexander Ran
Loe Feijs	Clemens Szyperski
Martin Griss	Bernhard Thomé
Mehdi Jazayeri	Will Tracz
Jean Jourdan	David Weiss

Because of our good experiences with the second workshop, this workshop was held at the same place as the previous one: Las Palmas de Gran Canaria. The local organisation was again very well done, and in the hands of the same people as the last time: Juan Carlos Dueñas from the Universidad Polytécnica de Madrid and Javier Miranda from the Universidad de Las Palmas de Gran Canaria. Again it was a great place to have a workshop and the local organisation was done very well. The workshop itself was very satisfactory and addressed very well the needs of the participants to have a forum to discuss their experiences in software family development.

It is felt that the series of IW-SAPF workshops have to be continued. A next workshop is planned in the fall of 2001, at a different place, as most participants prefer to meet in different scenery.

October 2000 Frank van der Linden

Table of Contents

Introduction 1
Frank van der Linden

Product Family Practice

Component Frameworks for a Medical Imaging Product Family 4
Jan Gerben Wijnstra

Meeting the Product Line Goals for an Embedded Real-Time System 19
Robert L. Nord

A Two-Part Architectural Model as Basis for Frequency Converter Product Families 30
Hans Peter Jepsen, Flemming Nielsen

A Product Line Architecture for a Network Product 39
Dewayne E. Perry

Railway-Control Product Families: The Alcatel TAS Platform Experience 53
Julio Mellado, Manuel Sierra, Ana Romera, Juan C. Dueñas

Business

Discussion Report "Business" Session 63
Günter Böckle

PuLSE-BEAT - A Decission Support Tool for Scoping Product Lines 65
Klaus Schmid, Michael Schank

Domain Potential Analysis: Calling the Attention of Business Issues of Produkt-Lines 76
Sergio Bandinelli, Goiuria Sagardui Mendieta

Dependency Navigation in Product Lines Using XML 82
Douglas Stuart, Wonhee Sull, T. W. Cook

Product Family Concepts

Summary of Product Family Concepts Session 94
Juha Kuusela, Jan Bosch

Software Connectors and Refinement in Family Architectures 96
Alexander Egyed, Nikunj Mehta, Nenad Medvidovíc

System Family Architectures: Current Challenges at Nokia 107
Alessandro Maccari, Antti-Pekka Tuovinen

Product Family Methods

Product Family Methods 116
Paul Clements

Organizing for Software Product Lines 117
Jan Bosch

A Comparison of Software Product Family Process Frameworks 135
Tuomo Vehkomäki, Kari Känsälä

Issues Concerning Variability in Software Product Lines 146
Mikael Svahnberg, Jan Bosch

A First Assessment of Development Processes with Respect to Product Lines and Component Based Development 158
Rodrigo Cerón, Juan C. Dueñas, Juan A. de la Puente

Evolution

Evolution of Software Product Families 168
Jan Bosch, Alexander Ran

Product Family Techniques

Product Family Techniques Session 184
David M. Weiss

Beyond Product Families: Building a Product Population? 187
Rob van Ommering

Requirement Modeling for Families of Complex Systems 199
Pierre America, Jan van Wijgerden

Creating Product Line Architectures 210
Joachim Bayer, Oliver Flege, Cristina Gacek

Extending Commonality Analysis for Embedded Control System Families 217
Alan Stephenson, Darren Buttle, John McDermid

Stakeholder-Centric Assessment of Product Family Architecture 225
Tom Dolan, Ruud Weterings, J.C. Wortmann

Surveys

ESAPS – Engineering Software Architectures, Processes, and Platforms for System Families 244
Frank van der Linden, Henk Obbink

Product-Line Engineering 253
Paul Clements

Author Index **255**