

Springer

Berlin

Heidelberg

New York

Barcelona

Hong Kong

London

Milan

Paris

Tokyo

Gary J. Chastek (Ed.)

Software Product Lines

Second International Conference, SPLC 2
San Diego, CA, USA, August 19-22, 2002
Proceedings



Springer

Series Editors

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

Volume Editor

Gary J. Chastek
Carnegie Mellon University
Software Engineering Institute
4500 Fifth Avenue
Pittsburgh, PA 15213, USA
E-mail: gjc@sei.cmu.edu

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Software product lines : second international conference ; proceedings /
SPLC 2, San Diego, CA, USA, August 19 - 22, 2002. Gary J. Chastek (ed.). -
Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ; London ; Milan ;
Paris ; Tokyo : Springer, 2002
(Lecture notes in computer science ; Vol. 2379)
ISBN 3-540-43985-4

CR Subject Classification (1998): D.2, K.4.3, K.6

ISSN 0302-9743

ISBN 3-540-43985-4 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

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2002
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Steingraber Satztechnik GmbH, Heidelberg
Printed on acid-free paper SPIN: 10870457 06/3142 5 4 3 2 1 0

Foreword

Software product lines are emerging as an important new paradigm for software development. Product lines are enabling organizations to achieve impressive time-to-market gains and cost reductions. In 1997, we at the Software Engineering Institute (SEI) launched a Product Line Practice Initiative. Our vision was that product line development would be a low-risk, high-return proposition for the entire software engineering community. It was our hope from the beginning that there would eventually be sufficient interest to hold a conference. The First Software Product Line Conference (SPLC1) was the realization of that hope.

Since SPLC1, we have seen a growing interest in software product lines. Companies are launching their own software product line initiatives, product line technical and business practices are maturing, product line tool vendors are emerging, and books on product lines are being published. Motivated by the enthusiastic response to SPLC1 and the increasing number of software product lines and product line researchers and practitioners, the SEI is proud to sponsor this second conference dedicated to software product lines.

We were gratified by the submissions to SPLC2 from all parts of the globe, from government and commercial organizations. From these submissions we were able to assemble a rich and varied conference program with unique opportunities for software product line novices, experts, and those in between. This collection represents the papers selected from that response and includes research and experience reports.

I would like to take this opportunity to thank the authors of all submitted papers, and the members of the program committee who donated their time and energy to the review process. I offer my special appreciation to Len Bass and Henk Obbink, the program co-chairs, to Gary Chastek, the tireless editor of these proceedings, and to Pennie Walters who assisted in the editing process. We hope you will enjoy the fruits of our labor. Together we are pushing the frontier of software product lines.

August 2002

Linda M. Northrop

Preface

SPLC2 continues to demonstrate the maturation of the field of product lines of software. By their nature, product lines cut across many other areas of software engineering. What we see in the papers presented at this conference is the sharpening of the distinction between software engineering for single system development and software engineering for product lines. The distinction exists not only during the software life cycle (requirements gathering, design, development, and evolution) but also in the business considerations that enter into which systems to build and how to manage the construction of these systems.

We have papers that cover the introduction of product lines and the dynamics of organizations attempting to introduce product lines. We have papers that discuss how to choose which products to produce and how to model the features of those products. All of these topics are essential to the success or failure of a product line within an organization and contribute to the uniqueness of the discipline.

We have several sessions that deal with the discovery, management, and implementation of variability. Variability is perhaps the single most important distinguishing element of product lines as compared to single system development. Identification of variation among products is essential to discover the scope of a set of core development assets and identification of variations within a design is essential to manage the production of products from these core assets.

We also cover specialized topics within normal software engineering and their relationship to product line development. Topics such as necessary tool support, validation of aspects of a system's behavior, and the relationship between product lines and component-based software engineering are also covered within the program.

In short, we have selected a collection of papers that cover a broad spectrum of the areas within product lines of software and are excited about the continued development of the field.

August 2002

Len Bass and Henk Obbink

Organizing Committee

Conference Chair:	Linda M. Northrop (Software Engineering Institute, USA)
Program Co-chair:	Len Bass (Software Engineering Institute, USA) Henk Obbink (Philips, The Netherlands)
Tutorial Chair:	Patrick Donohoe (Software Engineering Institute, USA)
Workshop Chair:	Sholom Cohen (Software Engineering Institute, USA)
Panel Chair:	Paul Clements (Software Engineering Institute, USA)
Demonstration Chair:	Felix Bachmann (Software Engineering Institute, USA)
Proceedings Editor:	Gary Chastek (Software Engineering Institute, USA)

Program Committee

Felix Bachmann (Software Engineering Institute)
Stuart Faulk (University of Oregon)
Frank van der Linden (Philips Medical Systems)
Sergio Bandinelli (European Software Institute)
Cristina Gacek (University of Newcastle)
Nenad Medvidovic (University of Southern California)
Don Batory (University of Texas at Austin)
André van der Hoek (University of California, Irvine)
Michael Moore (NASA/Goddard Space Flight Center)
Joseph H. Bauman (Hewlett Packard)
Jean Jourdan (Thales)
Robert L. Nord (Siemens Research, Inc.)
Günter W. Böckle (Siemens AG)
Peter Knauber (Fraunhofer IESE)
Scott Preece (Motorola)
Jan Bosch (University of Groningen)
Philippe Kruchten (Rational Software, Canada)
Alexander Ran (Nokia Research Center)
Grady H. Campbell (Prosperity Heights Software)
Charles W. Krueger (BigLever Software)
David Sharp (The Boeing Company)
Paul Clements (Software Engineering Institute, USA)
Juha H. T. Kuusela (Nokia Research Center)
Steffen Thiel (Robert Bosch GmbH, Germany)
David M. Weiss (Avaya)

Table of Contents

On the Influence of Variabilities on the Application-Engineering Process of a Product Family.....	1
<i>Lars Geyer, Martin Becker</i>	
Representing Variability in Software Product Lines: A Case Study	15
<i>Michel Jaring, Jan Bosch</i>	
Variation Management for Software Production Lines.....	37
<i>Charles W. Krueger</i>	
Adopting and Institutionalizing a Product Line Culture.....	49
<i>Günter Böckle, Jesús Bermejo Muñoz, Peter Knauber, Charles W. Krueger, Julio Cesar Sampaio do Prado Leite, Frank van der Linden, Linda Northrop, Michael Stark, David M. Weiss</i>	
Establishing a Software Product Line in an Immature Domain	60
<i>Stefan Voget, Martin Becker</i>	
Critical Factors for a Successful Platform-Based Product Family Approach	68
<i>Jan Gerben Wijnstra</i>	
Product Line Architecture and the Separation of Concerns	90
<i>Jay van Zyl</i>	
Model-Driven Product Line Architectures	110
<i>Dirk Muthig, Colin Atkinson</i>	
Systematic Integration of Variability into Product Line Architecture Design	130
<i>Steffen Thiel, Andreas Hein</i>	
Adaptable Components for Software Product Line Engineering	154
<i>T. John Brown, Ivor Spence, Peter Kilpatrick, Danny Crookes</i>	
Using First-Order Logic for Product Line Model Validation	176
<i>Mike Mannion</i>	
Product Line Annotations with UML-F	188
<i>Wolfgang Pree, Marcus Fontoura, Bernhard Rumpe</i>	
Feature Modeling: A Meta-model to Enhance Usability and Usefulness....	198
<i>Dániel Fey, Róbert Fajta, András Boros</i>	

Feature-Based Product Line Instantiation Using Source-Level Packages ... 217
Arie van Deursen, Merijn de Jonge, Tobias Kuipers

Feature Interaction and Dependencies: Modeling Features
for Reengineering a Legacy Product Line..... 235
Stefan Ferber, Jürgen Haag, Juha Savolainen

Maturity and Evolution in Software Product Lines:
Approaches, Artefacts and Organization 257
Jan Bosch

Evolutionary Introduction of Software Product Lines 272
Daniel Simon, Thomas Eisenbarth

Governance Polarities of Internal Product Lines..... 284
Truman M. Jolley, David J. Kasik, Conrad E. Kimball

Performance Analysis of Component-Based Applications 299
Sherif Yacoub

Using the Options Analysis for Reengineering (OAR) Method
for Mining Components for a Product Line 316
Dennis Smith, Liam O' Brien, John Bergey

Widening the Scope of Software Product Lines –
From Variation to Composition 328
Rob van Ommering, Jan Bosch

A Method for Product Line Scoping
Based on a Decision-Making Framework 348
Tomoji Kishi, Natsuko Noda, Takuya Katayama

Using a Marketing and Product Plan
as a Key Driver for Product Line Asset Development 366
*Kyo C. Kang, Patrick Donohoe, Eunman Koh, Jaejoon Lee,
Kwanwoo Lee*

Engineering Software Architectures, Processes and Platforms
for System Families – ESAPS Overview 383
Frank van der Linden

Author Index 399