## The Second Software Product Line Conference

August 19–22, 2002 San Diego, California



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The Software Engineering Institute (SEI) held the second Software Product Line Conference in San Diego, CA, August 19-22, 2002. There were 157 attendees, roughly two thirds from the United States and the remaining third from 16 other countries spanning North America, Europe, Asia, and Africa. Most of the participants were from commercial organizations, but academia and government were well represented. There was participation from most of the software product line leaders including: Hewlett Packard, Nokia, Philips, Robert Bosch GmBh, Avaya, Motorola, Cummins Inc., Siemens, Ericsson, Thales, and General Motors.

The conference program included seven tutorials; seven workshops, including one that was focused on DoD product line practice; an inspiring keynote talk, "Global Software Product Lines and Infinite Diversity," by Anders Heie from Nokia Mobile Phones; two panels; twenty-four technical paper presentations; four technical demonstrations; several Birds-of-a-Feather Sessions; and the Second Software Product Line Hall of Fame at which attendees voted in five new members to the software product line elite.

The Third Software Product Line Conference (SPLC3) will be held in the United States in autumn 2004. The Fifth Product Family Engineering Workshop will be held in Italy in autumn 2003. A mixture of SEI and international product line leaders will organize each.

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#### Post–Conference Information

#### SPLC2 Hall of Fame Inductees

- **Slide Presentations**
- Seynote: <u>Global Software Product Lines and Infinite Diversity</u> Anders Heie
- Crossing the Chasm Panel Scott E. Preece
- Product Line Adoption and Institutionalization Günter Böckle, et. al.
- Governance Polarities of Internal Product Lines Truman M. Jolley, et. al.

The Second Software Product Line Conference (SPLC2)



### Conference Information



All conference activities were held at the Sheraton San Diego Hotel and Marina.

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The following product lines have been inducted into the Software Product Line Hall of Fame. Nominations were accepted at the SPLC2 and participants voted on the nominees based on preestablished <u>criteria for election</u>.

#### Diesel engine software product line, Cummins, Inc.

Cummins, Inc., is the world's largest manufacturer of large diesel engines. Modern engines can contain over 100KSLOC of software to micro-control ignition to produce an optimum mix of power, economy, and emissions. In 1993, faced with the need to produce almost 20 new systems but with staff and resources available only for six, Cummins changed the way they developed software and embraced the product line approach. Their product line is a story of extensive use of legacy software, strong processes, and a culture of intra-organizational cooperation.

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Today the Cummins software product line covers 9 basic engine types ranging over 4-18 cylinders and 4-164 liters of displacement, with 12 kinds of electronic control modules, 5 kinds of processors, and 10 kinds of fuel systems. To date, 20 basic software builds have been parlayed into well over 1000 separate products. Cycle time has been reduced from around 250 person months to a few person months. Quality and customer satisfaction are both up, and 15 of 15 projects are on track. Cummins estimates a productivity improvement of 3.6, and an ROI of 10:1, from the product line approach. It has also enabled them to quickly enter and become successful in a related market area -- namely, industrial diesel engines that power a variety of applications from rock crushers to ski lifts.

• P. Clements and L. Northrop, Software Product Lines: Practices and Patterns, Addison Wesley, 2001.

LEGACY Telecommunication Switching System, Philips
The PKI tss (Telecommunications Statements) The PKI tss (Telecommunications Switching System) is a product family (product line) originating from the middle of the 1980s. PKI was a small player in the telecommunications world, and had to survive by addressing a niche market. In particular, the tss family had to serve a large variety of clients and regulations. The approach emphasized a component-based architecture; components were called "Building Blocks." The architecture consisted of a component based framework where plug-ins are available to tailor the system to the actual requirements. Moreover, aspects were defined for meeting quality requirements. For many aspects automatic LEGACY code generation was available. For other aspects code guidelines were available, easing the burden of implementation.

The architecture of the system ensured that it could be built and tested incrementally. The family was very successful in having a fast time-to-market, and high reuse.

In 1994 PKI was sold to Lucent, which did not continue the tss family. The knowledge about the tss system stayed within Philips, however, and the majority of the present day product family developments within Philips are still influenced by the tss experiences.

Frank van der Linden and Jürgen K. Müller: "Creating Architectures with Building Blocks," IEEE Software, Nov. 1995.

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- Frank van der Linden, Jürgen K. Müller: Composing Product Families from Reusable Components, Bonnie Melhart, Jerzy Rozenblit (eds.), Proceedings 1995 International Symposium and Workshop on Systems Engineering of Computer Based Systems, IEEE, pp. 35 - 40 (1995).
- Jürgen K. Müller: "Integrating Architectural Design Into The Development Process," Bonnie Melhart and Jerzy Rozenblit (eds.), Proceedings 1995 International Symposium and Workshop on Systems Engineering of Computer Based Systems, IEEE, pp. 114 - 121 (1995).
- Jürgen K. Müller: "Feature-Oriented Software Structuring," Proceedings CompSAC'97, pp. 552-555, (1997).
- Jan Gerben Wijnstra: Critical Factors for a successful Platform-based Product Family Approach, Gary J. Chastek (ed.) Proceedings SPLC2, Springer LNCS

2379, (2002).

# 5ESS telecommunications switch, Bell Labs / AT&T / Lucent

The 5ESS<sup>tm</sup> product-line is a family of telephone switches that has an unparalleled reputation for reliability, quality, and performance. The switch was originally developed by AT&T Bell Labs and was first put into commercial use in 1982. It is currently made by Lucent Technologies. The majority of local telephone switches in the U.S. today are still 5ESS switches. If you live in the U.S. most likely when you pick up the handset on your telephone you are connected to a 5ESS switch.

Any particular switch in the product line is operated by approximately 10MLOC. The software architecture reflected in that code has remained relatively stable at the subsystem level over a period of 20 years, and was designed to accommodate a set of variabilities that can still be discerned by examining the architecture. In the early 1990s some of the first applications of domain engineering to a large, complex system were successfully accomplished in the 5ESS software and documented in the software engineering literature. Domains such as switch maintenance, signalling, and traffic management showed productivity improvements of factors of 3 to 5 as a result.

• W. Howard, editor, "The 5ESS Switching System," vol. 64, *AT&T Technical Journal*, July-August, 1985, Special Issue on the 5ESS Switch.

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#### Bold Stroke avionics software family, Boeing

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The Bold Stroke Software Product Line is comprised of a wide range of artifacts required to create Operational Flight Programs for a variety of Boeing military fighters, including a highly configurable architecture, application components, middleware framework, and development processes and tools. Operational Flight Programs are mission critical distributed real-time embedded applications supporting the avionics and cockpit functions for the pilot. A well-defined software architecture and carefully designed approaches to handle commonality and variability were crucial to the success of this product line. The architecture is heavily based on and expressed via object-oriented patterns. These patterns were leveraged to convey both the architecture and its rationale to a large community of software engineers previously experienced primarily with military standard assembly language systems. The product line exploits commercial standards, technologies, and products as much as possible, using an open source real-time Object Request Broker - The ACE ORB-developed in partnership with Washington University in St. Louis and a commercial real-time operating system. The Bold Stroke Software Product Line is the foundation for an



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SPLC2 - Product Line Hall of Fame
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increasing number of production and research programs including several funded by the Air Force Research Laboratory and the Defense Advanced Research Projects Agency.

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- Sharp, David C., "Reducing Avionics Software Cost Through Component Based Product Line Development", Patrick Donohoe (ed.) *Proceedings SPLC1*, Kluwer Academic Publishers, 2000.
- Doerr, Bryan S., and Sharp, David C., "Freeing Product Line Architectures from Execution Dependencies", Patrick Donohoe (ed.) *Proceedings SPLC1*, Kluwer Academic Publishers, 2000.
- Popp, Timothy J., "Software Architecture Development for Product Line Software", *AIAA/IEEE Digital Avionics Systems Conference*, October 1999.

The MERGER Software Product Line (MARKET MAKER Software AG) MARKET MAKER Software AG, Kaiserslautern, Germany, provides Europe's most popular stock market software. Since 1989, its products have allowed the stock market to be tracked and analyzed. In 1999, MARKET MAKER decided to launch an internetbased version of its product, using the functionality of their desktop products as the engine to power other companies' financial web sites. This kind of system has to integrate with the customers' databases and other content-producing software, run on who-knows-what kind of computing platforms and servers, satisfy human-user performance requirements, and be tailored to show exactly the kind of data, in exactly the kind of charts, in exactly the kind of form required by each particular customer's web site. That is, the product must be flexible, widely tailorable, deliverable in a very short amount of time, and producible by a very small development staff.

For these reasons, MARKET MAKER decided to plan the internet versions right from the beginning as a software product line, which they called MERGER. The result is a 520 KSLOC system that meets all of those requirements and more. Six people (two of whom were part-time) worked for about a year to produce the core system, from which instantiated products are turned out. Each product in the family must be built to the client's specifications and installed and tested on the client's own platform. Because of their systematic product line approach, MARKET MAKER is able to set up such systems in a few days. In the early days of the product line, this short time-tomarket was the major advantage of MARKET MAKER over its competitors. In the current bad economic times, MARKET MAKER can survive because of their small, efficient team required for maintaining the running systems.

• P. Clements and L. Northrop, *Software Product Lines: Practices and Patterns*, Addison Wesley, 2001.

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EGAY FGAY C. Gacek, P. Knauber, K. Schmid, and P. Clements. Successful Software Product Line Development in a Small Organization. A Case Study, Technical Report, Fraunhofer Institute for Experimental Software Engineering (IESE), 013.01/E, 2001.

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## SPLC1 Hall of Fame Inductees

EGACY EGACY The founding members of the SPLC Software Product Line Hall of Fame, inducted at SPLC1, are:

#### A-7E Operational Flight Program, U.S. Naval Research Laboratory

The A-7E operational flight program (OFP) is the software that assists the pilot of the Navy's A-7E aircraft to operate the airplane. The OFP was redesigned by the Software Cost Reduction project at the Naval Research Laboratory to show how to apply familybased software development principles in the development of a hard real-time system. Commonalities and variabilities were explicitly identified starting in the requirements LEGAC specification for the family, and were a strong driving factor in the modular design of the OFP. The OFP design, including a modular structure, a process structure, and a uses relation, was explicitly created and documented to be an engineering model that others could follow. It has had a strong influence on the field of both software engineering and of product line engineering.

#### ShipSystem 2000, CelsiusTech Systems AB

ShipSystem 2000 is a family of naval shipboard comment and control systems produced by CelsiusTech Systems AB of Sweden since the late 1980s. Begun in 1985 as a business and technical response to two large contracts awarded simultaneously, ShipSystem 2000 is based upon a robust architecture that was designed to handle both of those initial systems as well as the more than fifty variants that followed. Family members include systems for ships from coastal corvettes to cruisers to submarines, for navies all over the world. These systems comprise 1-1.5 million SLOC of Ada code, are hard-real-time, embedded, and safety-critical. CelsiusTech has been able to slash production time, build more systems with fewer people, and increase quality. The story of ShipSystem 2000 was one of the first and most important case studies in successful software product line engineering.

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#### Mobile phones, Nokia

Nokia Mobile Phones produces a wide range of mobile phones. Currently 32 different phones are manufactured covering six different protocol standards, a wide variety of functional features and capabilities, different user interface designs, and many platforms and environments. The initial software architecture for this product line addressed variations in hardware, communication standards, and user interfaces; the product line was selected "The Product of the Year" by *Business Week* and *Connect* magazines. The current architecture is component based in the client-server style. It allows separate service providers to be plugged in or taken out without restarting the system. This architecture supports both local and remote message passing and component management, task scheduling and event control. Nokia Mobile Phones is the world's largest mobile phone manufacturer, and they believe that software product line engineering has helped it to reach that position.

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#### Owen Firmware Cooperative, Hewlett Packard

Owen is a community of firmware development teams from HP product divisions in two states in the USA; they produce firmware for a number of printers and printer/ copier/scanner/fax devices. Participating teams contribute to the cooperative by producing assets conformant to the Owen architecture, and benefit from other teams' contributions. Owen is unique because of its strong cultural aspects. A steering team, firmware architect, firmware asset lead, and "cooperative steward" roles provide the overall direction. There are cooperative operating principles, and members (while first and foremost turning out their own products) have explicit responsibilities to the coop. Owen products have been produced using 1/4 of the staff, in 1/3 of the time, and with 1/25 the number of bugs of earlier products.

# LEGACY Criteria for Election To Software Product Line Hall of Fame

Members of the software product-line hall of fame should serve as models of what a software product-line should be, exhibiting most or all of the following characteristics.

- The family that constitutes the product line is clearly identified, i.e., there is a way to tell whether or not a software system is a member of the product line, either by applying a known rule or a known enumeration.
- The family that constitutes the product line is explicitly defined and designed as a product line, i. e., the commonalities and variabilities that characterize the members of the product-line are known and there is an underlying design for the product line that takes advantage of them.
- The product-line has had a strong influence on others who desire to build and evolve product-

lines, and has gained recognition as a model of what a product-line should be and how it should be built. Others have borrowed, copied, and stolen from it in creating their product-lines or in expounding ideas and practices for creating product-lines.

- The product-line has been commercially successful.
- There is sufficient documentation about the product line that one can understand its definition, design, and implementation without resorting solely to hearsay.

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CORPORATE TECHNOLOGY



## Product Line Adoption and Institutionalization

## Discussion Result of the Dagstuhl Workshop on Product Line Engineering, 16 - 20 April, 2001

Günter Böckle, Siemens AG Jesús Bermejo, Telvent Peter Knauber, Fraunhofer IESE (now University of Mannheim) Charles Krueger, BigLever Software, Inc. Julio Cesar Sampaio do Prado Leite, PUC-Rio de Janeiro Frank van der Linden, Philips Medical Systems Linda Northrop, SEI Michael Stark, University of Maryland David M. Weiss, Avaya

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	Representing Variability in Software Product Lines: A Case Study	Establishing a Software Product Line in an Immature Domain
. EGA	Michel Jaring, University of Groningen Jan Bosch, University of Groningen	Stefan Voget, Robert Bosch GmbH Martin Becker, University of Kaiserslautern
L	Variation Management for Software	Critical Factors for a Successful Platform-
	Production Lines	based Product Family Approach
	Charles Krueger, BigLever Software, Inc.	Jan Gerben Wijnstra, Philips Research Laboratories
12:00 noon	Lunch	
1:00 p.m.	Panel - Workshop Summaries Moderator: Sholom Cohen, Software Engine	eering Institute
2:15 p.m.	Break	
2:30 p.m.	<b>Technical Session 3 - Architecture</b>	<b>Technical Session 4 - Implementation</b>
	<b>Design</b> Moderator: Robert Nord, Siemens Research, Inc.	Moderator: Grady Campbell, Prosperity Heights Software
	Product Line Architecture and the	Adaptable Components for Software
	Separation of Concerns	Product-Line Engineering
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	Model-driven Product Line Architectures	Using First Order Logic for Product Line
	Dirk Muthig, Fraunhofer IESE	Model Validation
	Colin Atkinson, Fraunhofer IESE	Mike Mannion, Glasgow Caledonian University
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	Systematic Integration of Variability into	Product line annotations with UML-F
	Product Line Architecture Design	
	N	Wolfgang Pree, University of California,
1 EGA	Steffen Thiel, Robert Bosch GmbH	Berkeley
LL	Andreas Hein, Robert Bosch GmbH	Marcus Fontoura, IBM Almaden Research
		Bernhard Rumpe, Munich University of
		Technology
4:00 p.m.	Break	
4:30 p.m.	Panel: Tool Support for Product Lines: What We Have and What We Need	
LEGA	Moderator:	
	David Weiss, Director of Software Technology Research, Avaya Laboratories	
	Den Hater	N and
	Panensis: Charles Knuegen Diel even Software Inc.	-' IEGAU
	Charles Klueger, DigLever Software, Inc.	
	Grady Comphell Prognarity Heights Software	
	Daniel Simon, Universität Stuttgart Institut für Informatik	
	Damer Simon, Oniversität Stuttgart, Institut	
5:30 p.m.	Presentations end. Birds of a feather sessions and demonstrations begin.	

## Thursday, August 22, 2002

9:00 a.m.	<b>Technical Session 5 - Feature Modeling</b> Moderator: Frank van der Linden, Philips Medical Systems	<b>Technical Session 6 - Organization Issue</b> <b>II</b> Moderator: Günter Böckle, Siemens AG
	Feature Modeling: a Meta-Model to	Maturity and Evolution in Software
	Enhance Usability and Usefulness	Product Lines: Approaches, Artifacts and
		Organization
	Daniel Fey, Nokia Research Center Robert Fajta, Nokia Research Center Andras Boros, Nokia Research Center	Jan Bosch, University of Groningen
LEGA	Assembling Software Products from Feature Selections	Evolutionary Introduction of Software Product Lines
	Arie van Deursen, CWI	Daniel Simon, Universität Stuttgart
	Merin de Jonge, CWI	Thomas Eisenbarth, Universität Stuttgart
	Tobias Kuipers, Software Improvement Group	

	Feature Interaction and Dependencies:	Governance Polarities of Internal Product
LEGA	Modeling Features for Re-engineering a	Lines
	Legacy Product Line	LEG
		Truman Jolley, Boeing Commercial
	Stefan Ferber, Robert Bosch Research	Airplanes
	Jürgen Haag, Robert Bosch Gasoline	David Kasik, Boeing Commercial
	Systems	Airplanes
	Juha Savolainen, Nokia Research Center	Conrad Kimball, Boeing Commercial
		Airpianes
10:30 a.m.	Break	
11:00 a.m.	Panel: Software Product Lines: Crossing the	e Chasm
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has not	Moderator:	
	Stuart Faulk, Department of Computer and I	nformation Science, University of Oregon
	Panelists:	
	Dan Paulish, Siemens	
	Scott Preece, Motorola	
	Sergio Bandinelli, European Software Institu	ute
	Linda Northrop, Software Engineering Instit	tute
12:00 p.m.	Lunch	
1:00 p.m.	Technical Session 7 - Components	Technical Session 8 - Choosing the
LEG.	Moderator: Charles Krueger, BigLever	Assets
	Software, Inc.	Moderator: Steffen Thiel, Robert Bosch
		GmbH
	Performance Analysis of Component-	Method for Product-Line Scoping based
	based Applications	on Decision-Making Framework
	Sherif Yacoub, Hewlett-Packard	Tomoji Kishi, NEC Corporation
	Laboratories	Natsuko Noda, NEC Corporation
-		Takuya Katayama, Japan Advanced 💦 🦯
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#### SPLC2 - Technical Program

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LECT	Using Options Analysis for Reengineering	Using a Marketing and Product Plan as a
	(OAR) for Mining Components for a	Key Driver for Product Line Asset
	Product Line	Development
	Dennis Smith, Software Engineering	Kyo Kang, Pohang University of Science
	Institute	and Technology
	Liam O'Brien, Software Engineering	Patrick Donohoe, Software Engineering
	Institute	Institute
	John Bergey, Software Engineering	Eunman Koh, Pohang University of
ILEGA	Institute	Science and Technology
LL	LL	Kwanwoo Lee, Pohang University of
		Science and Technology
		and Technology
	Widening the Scope of Software Product	Engineering Software Architectures
	Lines From Variation to Composition	Drocossos and Distforms for System
	Emes - From Variation to Composition	Eamilies ESADS Overview
	Deb von Ommerine Dhiling Dessent	Failines - ESAFS Overview
	Kob van Ommering, Philips Research	Endels and index Division Medical
- C N	Laboratories	Frank van der Linden, Philips Medical
L CGP		systems
2:30 p.m.	Break	and the second se
<b>3:00 p.m.</b>	Panel: <u>Product Line Hall of Fame</u>	
	Moderator: Paul Clements, Software Engineering Institute	
4:00 p.m.	Conference Ends	

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#### **Tutorial 1: Software Product Lines: Practices and Patterns**

Presenters: Linda Northrop and Paul Clements, Software Engineering Institute

Monday, August 19 Time: 8:30 a.m.– 5:00 p.m. Room: Coronado A

**Abstract:** The primary aim of this tutorial is to help a decision-maker understand the basics of software product line strategies, the advantages of the approach, and what will be involved in adopting a product line approach. Additionally, the aim is to help them assess where their organization stands in relation to the capabilities needed to launch a product line and to give them the necessary tools to tailor adoption

and execution strategies to their organization.

**Intended Audience:** The tutorial is aimed at those in an organization who are in a position to make decisions affecting the decision to adopt a product line approach, and those in a position to carry out that decision. This includes technical managers at all levels, as well as those on the software development staff. Anyone who can act as a technology change agent will benefit from this tutorial.



**Tutorial 2: Experiencing Product Line Adoption Presenter:** Grady Campbell, Prosperity Heights Software

Monday, August 19 Time: 8:30 a.m.– 12:00 p.m. Room: Coronado B

**Abstract:** The goal of this tutorial is to give participants a roadmap for adopting a product line approach to software development. Guided by the reuse-driven Process Improvement  $(PI_r)^{\underline{1}}$  method, the tutorial

will step participants through the activities of a systematic adoption process. Participants will be presented guidance on identifying market-oriented business objectives and success criteria, evaluating the viability of a product line approach for meeting those needs, determining related process improvement goals, and deriving a suitable strategy and plan for instituting product line practices. **Intended Audience:** This tutorial is targeted to experienced engineers and managers whose organizations have a need to build similar products and, in doing so, want to increase their productivity and product quality. Tutorial attendees should be familiar with the principles and use of a conventional process improvement method such as the SEI Capability Maturity Model<sup>2</sup> approach.

**Tutorial 3: Building Reusable Test Assets for a Product Line Presenter:** John D. McGregor, Clemson University

Monday, August 19 Time: 1:30 p.m. – 5:00 p.m. Room: Coronado B

Abstract: The resources needed to test a software product can equal or exceed the resources required to create the product. This tutorial takes a typical comprehensive testing process that includes both "development" testing and "system" testing and identifies those aspects of software product line practice that can be applied to the development of test assets. Achieving profitable reuse requires the same disciplined, managed approach to the production of test assets as is applied to the creation of development assets. Creating a software architecture for the test software, using abstract and generic classes, and mirroring the architecture of the application in the test architecture are some of the

techniques illustrated in the tutorial.

Intended Audience: This tutorial presents a comprehensive test process that includes roles for software developers, traditional testers and managers of both. The test process is tightly integrated with the development process during the early phases of development and becomes more independent as development proceeds. The tutorial will describe techniques used by each of the roles at each of the stages of development.

**Tutorial 4: Practical Product Line Scoping and Modeling Presenter:** Isabel John, Fraunhofer IESE

**Tuesday, August 20 Time:** 8:30 a.m. – 12:00 p.m. Room: Coronado A

Abstract: While the technologies for scoping and modeling of product lines are typically treated as independent, practical experience shows that they are actually strongly interrelated. This observation is a key point for this tutorial: its focus is on an integrated presentation of product line scoping and modeling technologies. The presentation illustrates this with the PuLSE<sup>3</sup> method, which has been successfully applied in industrial practice.

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**Intended Audience:** The tutorial aims both at researchers wishing to get a fresh view of the topic of product line modeling and scoping, and at practitioners wishing to gain an understanding of how they can integrate product line scoping and modeling techniques in their existing practices. FGAC

**Tutorial 5: Component-based Product-line Engineering with the UML**<sup>4</sup> Presenter: Dirk Muthig, Fraunhofer IESE

**Tuesday, August 20 Time:** 1:30 p.m. – 5:00 p.m. Room: Coronado A

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Abstract: To date the component paradigm has only really penetrated the implementation and deployment phases of the software life cycle; it does not yet play a major role in the earlier analysis and design activities of large software projects. This tutorial will present a new method for component-based software engineering, known as KobrA, which supports a higher-level, model driven representation of components and thus enables the benefits of components to be realized throughout the software life cycle. Other distinctive features of the approach include the use of a product-line approach to develop and deploy component frameworks, a systematic, architecture-centric process that highlights the component composition hierarchy, and fully integrated quality assurance in the form of inspections and

quality modeling.

Intended Audience: The audience for this tutorial is software professionals with knowledge of the unified modeling language (UML) and basic familiarity with the concepts of component technology.

### **Tutorial 6: Global Analysis: Developing Software Architecture Design Strategies to Respond to** Variation and Anticipated Change

Presenters: Robert L. Nord and Daniel J. Paulish, Siemens

**Tuesday, August 20** Time: 8:30 a.m. – 12:00 p.m. Room: Coronado B

Abstract: The purpose of global analysis is to analyze the factors that influence the architecture and to develop strategies for accommodating these factors in the architecture design. Some of these influencing factors-which include market requirements, technologies, hardware, and business factors-affect the entire system, and some directly contradict other factors. In order to avoid major potential rework, they must be addressed from the beginning of high-level design. By applying the approach described in this tutorial, we believe that projects will have better understanding and control of the risks associated with alternative software architecture designs. Such an approach can be used to support the design of a single evolving system or variation within a product line.

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Intended Audience: This tutorial is intended for experienced software engineers, architects, and project and technical managers.

**Tutorial 7: Architecture-Centric Software Engineering** Presenter: Jan Bosch, University of Groningen

**Tuesday, August 20 Time:** 1:30 p.m. – 5:00 p.m. Room: Coronado B

EGACY EGAC Abstract: This tutorial provides both an overview and an in-depth treatment of the issues surrounding architecture-centric engineering of software. Topics include software architecture design in the presence of existing components and infrastructure (top-down versus bottom-up), architecture evaluation and assessment, software artifact variability management, software product lines, and the role of the software architect. In addition to the technical perspective, the topics are discussed from process and organizational viewpoints, and are extensively illustrated by examples and experiences from many industrial cases.

Intended Audience: The expected audience is (1) software engineers and technical managers

considering the introduction of architecture-centric software development and evolution, and (2) researchers interested in the experiences collected by the tutorial presenter and his research group and the reflections made based on the experiences. Participants are assumed to have some experience with industrial software development.

<sup>1</sup> PI<sub>r</sub> is a trademark of Prosperity Heights Software.

- <sup>2</sup> Capability Maturity Model is registered in the U.S. Patent and Trademark Office.
- <sup>3</sup> PuLSE is a registered trademark of the IESE.
- <sup>4</sup> UML is a trademark of the Object Management Group.

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## The Second Software Product Line Conference

### **Conference Workshops**

**Important: Workshop Attendance Criteria** 



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#### Monday, August 19

- Workshop 1: <u>Techniques for Exploiting Commonality Through Variability Management</u>
- Workshop 2: Model Driven Architecture and Product Line Engineering
- Workshop 3: Mining and Reengineering of Legacy Assets for use in a Product Line
- Workshop 4: <u>Future Visions of Interoperable Ground System Product Lines</u>

#### Tuesday, August 20

- Workshop 5: <u>The Fifth Department of Defense Product Line Practice Workshop</u>
- Workshop 6: Managing the Architectural Evolution of Software Product Lines
- Workshop 7: <u>Educator's Workshop</u>

Workshop 1: Techniques for Exploiting Commonality Through Variability Management

Monday, August 19 Room: La Jolla Time: 8:30 a.m. – 5:00p.m.

Variability is a quality factor expressing the ease with which existing software may be adapted and reused. This workshop will explore promising techniques for managing variability through a case study approach. The workshop will present attendees with a specific product line problem to solve. The goal of the workshop is to establish approaches for managing variability as a means of exploiting commonality across a product line. The problem statement will go out in advance of the workshop. We will take position papers in return and organize into subgroups:

- specific domains within the product line UI, data base, embedded sensors, etc.
- product line practice areas requirements management, architecture, tool support, etc.
- methods for handling variability generators, aspect-orientation, UML extensions, etc.

#### Workshop Organizers:

Sholom Cohen Software Engineering Institute Pittsburgh, PA 15217 Phone: +1 412-268-5872 FAX: +1 412-268-5758 email: sgc@sei.cmu.edu

Mehmet Aksit University of Twente The Netherlands email: aksit@cs.utwente.nl Bedir Tekinerdogan University of Twente The Netherlands email: bedir@cs.utwente.nl

Krzysztof Czarnecki DaimlerChrysler AG **Research and Technology** Software Engineering Lab Software Architecture Group (FT3/SA) Wilhelm-Runge-Str. 11 89081 Ulm, Germany email: krzysztof.czarnecki@web.de

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### Workshop 2: Model Driven Architecture and Product Line Engineering

#### Monday, August 19 Room: Carmel Time: 8:30 a.m. - 5:00p.m.

LEGACY LEGACY Model Driven Architecture (MDA)[www.omg.org/mda/presentations.htm], the new OMG initiative, defines an approach to IT system specification. The approach separates the specification of system functionality from the specification of the implementation of that functionality on a specific technology platform. MDA addresses the complete life cycle of specifying, designing, deploying, integrating and managing IT applications placing models at the center of the development. The goal of this workshop is to analyze Model Driven Architecture as a technological proposition underlying product line engineering. The analysis will bring answers to the following questions:

- Why would MDA be a good technological approach for product line engineering?
- What are the characteristics of MDA that are of interest to a product line approach?
- How does MDA address product line issues such as: variability modeling, traceability, derivation supports, platforms configurations, etc.
- What is missing in MDA in order to address all the technical issues behind product line engineering?

For details on the workshop please contact the chair at: jean.jourdan@thalesgroup.com.

#### Workshop Organizers:

Jean Jourdan (General Chair) Thales Research and Technology Domaine de Corbeville 91404 ORSAY France Phone: +33 (1) 69 33 09 18 email: jean.jourdan@thalesgroup. com

Philippe Desfray SOFTEAM 144 Avenue des Champs Elyssée 75008, Paris, France email: Philippe.desfray@softeam. com

EGAC Serge Salicki Thales Research and Technology Domaine de Corbeville 91404 ORSAY France Phone: +33 (1) 69 33 09 14 email: serge.salicki@thalesgroup. com

Desmond D'Souza Kinetium email: desmond@kinetium.com Sergio Bandinelli European Parque Tecnologico de Zamudio # 204 E-48170 Bilbao Spain Phone: +34 9 4 420 95 19 email: sergio@esi.es

Jean Bézivin Université de Nantes, email: Francejean. bezivin@sciences.univ-nantes. fr

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### Workshop 3: Mining and Reengineering of Legacy Assets for use in a Product Line

Monday, August 19 Room: Del Mar Time: 8:30 a.m. - 5:00p.m.

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Few product line efforts start from "green fields" because organizations have a substantial legacy base of existing software assets. But a lot of work must be done before an organization can reuse these legacy assets in a product line. The theme of this workshop is to examine what needs to be done.

The workshop's goal is to explore the current state of the practice in methods, tools and technology that can assist in carrying out the required work. The workshop will examine the following aspects of the problem of reusing legacy components: LEGAC

- Understanding the legacy base through architecture reconstruction
- Decision making to identify what components can be reused
- Refactoring of the legacy software to produce reusable components
- Tool support for these activities

For more information please contact the workshop organizers:

#### Workshop Organizers:

Liam O'Brien Software Engineering Institute 4500 Fifth Ave, Pittsburgh, PA, 15213 Phone: +1 412-268-7727 FAX: +1 412-268-5758 email: <u>lob@sei.cmu.edu</u> Dennis Smith Software Engineering Institute 4500 Fifth Ave, Pittsburgh, PA, 15213 Phone: +1 412-268-6850 FAX: +1 412-268-5758 email: <u>dbs@sei.cmu.edu</u> LEGAC

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## Workshop 4: Future Visions of Interoperable Ground System Product Lines Monday, August 19

Monday, August 19 Room: 7th Floor Boardroom Time: 8:30 a.m. – 5:00p.m.

Many organizations have presented success stories and lessons learned regarding their ground system product lines; however, each organization presents results with respect to its own product lines. There has been little discussion, and no conclusions, regarding the possibility of interoperable product lines or product line components. The workshop will explore the current state of ground system product lines and begin to converge on a consensus regarding a future vision for ground system product line architectures and standards. The workshop will focus on the unique challenges and potential benefits of increasing interoperability among ground system product lines.

The workshop will focus on the issues above and include discussions of

- perspectives on the current state of ground system product lines
- lessons learned
- potential for and benefits of interoperable ground system product lines
- future visions for a component industry to support ground system product lines
- areas for potential standardization to support these visions

The workshop at SPLC2 will build upon and contribute to ground system product line work at the <u>Ground System Architectures Workshops</u> (GSAW). For more information on the SPLC2 workshop, please see http://www.aero.org/conferences/splc/ or contact the organizers.

#### Workshop Organizers:

Judy Kerner The Aerospace Corporation PO Box 92957 - M1-106 Los Angeles, CA 90009-2957 Phone: +1 310-336-6555 FAX: +1 310-336-8266 email: Judy.Kerner@aero.org

a 14 M Mark Walker The Aerospace Corporation PO Box 92957 - M1-178 Los Angeles, CA 90009-2957 Phone: +1 310-336-8841 FAX: +1 310-336-8266 email: Mark.G.Walker@aero.org EGA~

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Workshop 5: The Fifth Department of Defense Product Line Practice Workshop

**Tuesday, August 20** Room: La Jolla Time: 8:30 a.m. – 5:00p.m.

This workshop will bring together participants from the DoD, other government organizations, and commercial practitioners who support these agencies. The SEI has held four previous DoD Product Line Practice workshops as separate events. This year we have decided to hold the DoD Workshop in conjunction with SPLC2 to both broaden and deepen the opportunity for software product line exposure for the DoD community. As in the past four DoD workshops, participants will share their product line development and acquisition practices in support of government product line efforts. Working groups will be established to make progress in specific areas. These focus areas will be finalized based on the participants' experiences and interests. A secondary agenda item is to obtain input as well as feedback and suggestions for the SEI's Software Product Line Acquisition - A Companion to the Framework for Software Product Line Practice.

If you have questions, please feel free to contact the workshop organizers:

#### Workshop Organizers:

Lawrence G. Jones Software Engineering Institute 1155 Kelly Johnson Blvd., Suite 111 Colorado Springs, CO 80920 Phone: +1 719-548-4744 FAX: +1 719-590-7652 email: lgj@sei.cmu.edu

Software Engineering Institute Phone: +1 215-348 0520 email: jkb@sei.cmu.edu

Workshop 6: Managing the Architectural Evolution of Software Product Lines LEGAC

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## **Tuesday, August 20**

#### **Room: Carmel** Time: 8:30 a.m. - 5:00p.m.

This workshop brings together researchers and practitioners who wish to debate and extend their ideas in the area of managing the extension and re-design of the architectures of software product families that they develop. This workshop builds on the experience of the organizers in conducting similar events in this area and on the results reached during previous events: LEGACY

ECOOP 2001 Workshop on Object-Oriented Architectural Evolution

WICSA 2001 Workshop on Architectural Viewpoints

To optimize the exposition of participants' views and to maximize interaction, the workshop adopts a question-and-answer style, whereby a number of questions concerning the architectural evolution of product families are proposed. We invite participants to submit well-reasoned answers to at least two of the questions. For details on the questions and the desired format of the answers please contact the workshop organizers.

### Workshop Organizers:

Alessandro Maccari Nokia Research Center email: alessandro.maccari@nokia.com

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Galal H. Galal University of North London email: galal@acm.org

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Sergio Bandinelli ESI email: sergio@esi.es

### Workshop 7: Educator's Workshop

**Tuesday, August 20 Room: Del Mar** Time: 8:30 a.m. - 5:00p.m.

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Research in software product line practice and the use of those ideas in industry have advanced to a point where product line topics are being introduced into a number of university curricula. The spreading use of software product line practices in industry is also resulting in an increase in industrial training courses. The purpose of this workshop is to provide a forum in which both academic and industrial educators can exchange experiences and ideas. The topics to be covered include, but are not limited to:

- The appropriate places in the graduate and undergraduate curriculum for product line topics,
- What resources, case studies, artifacts, or tools are available to support instruction,
  Instructional techniques that have succeeded and these there.

- What academic prerequisites or experience should be required,
- What the appropriate role of product-line engineering is in the teaching of software engineering as a whole.

Participants from industry are strongly encouraged to apply.

For more information, please see the workshop web site: <u>http://www.cs.clemson.edu/~johnmc/splc2.</u> <u>htm</u>.

#### Workshop Organizers:

John D. McGregor Dept of Computer Science Clemson University Clemson, SC 29634 Phone: +1 864-656-5859 Fax: +1 864-656-0145 email: johnmc@cs.clemson.edu Stuart Faulk Computer and Information Science University of Oregon Eugene, OR 97403-1202 Phone: +1 541-346-1350 Fax: +1 541-346-5373 email: faulk@cs.uoregon.edu

### Workshop Attendance

Workshops are by invitation only. Each workshop may have its own invitation criteria. The most likely criteria for attendance will be the submission and acceptance of a workshop paper. Workshop papers tend to be much less formal and comprehensive than main-conference papers.

If you are interested in attending a specific workshop, please follow the invitation criteria provided with the workshop and contact the workshop organizer(s).

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## **Tool Support for Product Lines: What We Have and What We Need**

Moderator: David Weiss, Director of Software Technology Research, Avaya Laboratories

Panelists: Charles Krueger, BigLever Software, Inc. Bedir Tekinerdogan, University of Twente Grady Campbell, Prosperity Heights Software Daniel Simon, Universität Stuttgart, Institut für Informatik

We in the product line community have long decried the lack of tool support specifically geared to help manage the multi-dimensional production capability inherent in the software product line approach. After several years, though, some tool vendors are responding to the challenge. What tools are out there, and how do they compare with the needs (real or perceived) of product line practitioners?

This panel will explore that question. Each panel member has been chosen because of his experience in

SPLC2 Panels

building product-line-related tool technology. After a short opening statement by each, the session will turn to the audience for questions and discussion about where we should go from here.

## Software Product Lines: Crossing the Chasm

EGACY Moderator: Stuart Faulk, Department of Computer and Information Science, University of Oregon

**Panelists:** Dan Paulish, Siemens Scott Preece, Motorola Sergio Bandinelli, European Software Institute Linda Northrop, Software Engineering Institute

We know that software product lines represent a way to achieve true order-of-magnitude improvements in cost, schedule, and quality, something of a holy grail of the software engineering community. Given that, why isn't everyone using the approach where it is applicable?

The theme of this panel is how we as a community can help bridge the gap between those of us who know the benefits of software product lines, and industry and practice at large where the idea is still considered risky, unproven, and avant garde—where it is even considered at all.

The panel members each bring a unique perspective to the problem of transitioning software product line practice to the community. Technology transition organizations and academic institutions will represent the "push" side of the problem, while industrial practitioners will speak to the "pull" side of the equation.

Each panel member will make a short position statement, but the bulk of the session will be turned over to audience questioning and discussion.

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#### **Title: Global Software Product Lines and Infinite Diversity**

Nokia Mobile Phones creates a wide range of products each year. Each of these has a unique combination of system software, style, and features. Not only is it an immense challenge to develop robust software to support all these products, but we also need to release them in time to market. Requirements pour in from across the world, as almost every operator is now starting to distance themselves from the mainstream. As if that wasn't enough, new features are constantly being thought up in-house as well. The capacity of our software and hardware is being constantly challenged, and it is essential to stay ahead of the game. In this talk, I will provide examples from Nokia illustrating how we handle such a variance of input and how we have attempted to create a software architecture that can support such demands. I will also touch on some of the processes that are necessary to get it all in place.

Anders Heie is a Software Specialist at Nokia Mobile Phones. He began at Nokia in 1995 working on the GSM protocol, first as a Configuration Manager and then moved on to the Software Architecture group. Here he helped develop parts of the core software that is now running throughout Nokia products. He regularly provides software training in Nokia Centers across the world.

Anders currently has 22 patents pending for Nokia in the US, three worldwide, and more in the works. He is a graduate of the Engineering Academy of Denmark



The SPLC2 will host four demonstrations. The demonstrations will be held Wednesday, August 21st, from 5:30 p.m. to 6:30 p.m. Each demonstration will be approximately 1/2 hour in length.

## Rumi: A Tool Environment for Managing Product Alternatives

Bedir Tekinerdogan, University of Twente

Time: 5:30 p.m. – 6:00 p.m. Room: Point Loma B This demonstration presents the Rumi environment, which includes a set of tools for supporting the techniques of design space models (DSMs). DSMs provide a complementary technique to existing domain engineering and product line scoping techniques, to explicitly model and reason about domain alternatives. Design space modeling consists of a design space representation and semantic information for configuring and depicting the constraints on the alternatives.







SPLC2 Demonstrations

MetaSyn (TM): A Family of Tools for Building Product Families Grady Campbell, Prosperity Heights Software Time: 5:30 p.m. – 6:00 p.m. Room: Carmel	This demonstration exhibits a progression of prototype tool parts and assemblies that support the construction and instantiation of software product families. The focus of this demonstration will be on notations and mechanisms for the direct and explicit representation of variability as an orthogonal attribute characterizing a product family. A secondary emphasis will be on the resulting ease of deriving varied instances from a properly defined family using MetaSyn <sup>TM</sup> capabilities.
GEARS (TM): Commercial Engineering Infrastructure, Development Environment, and Product Generator Enabling Rapid Adoption of Software Mass Customization Charles Krueger, BigLever Software, Inc. Time: 6:00 p.m. – 6:30 p.m. Room: Point Loma B	This demonstration illustrates the capabilities of BigLever Software GEARS <sup>TM</sup> , a commercially available technology that supports software product line engineering through "software mass customization." The demo will benefit practitioners and managers with responsibility for establishing and maintaining software product lines as well as researchers interested in learning more about the practical issues of engineering software product lines.
Feature Analysis for Evolutionary Introduction of Software Product Lines Daniel Simon and Thomas Eisenbarth, University of Stuttgart Time: 6:00 p.m. – 6:30 p.m. Room: Carmel	This demonstration shows an analysis of the graph- drawing tool, XFIG, using our feature analysis tools. Our tools analyze the monolithic legacy source code for product line initiation. The demonstration addresses mining and reengineering for product lines. Our tools guide developers through the legacy code in a feature-driven way. The results are produced by using the mathematically founded methods of "concept analysis."
Demonstration Discussions	

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Time: 5:30 p.m. – 6:30 p.m. **Room: La Jolla** E - 1 P

<sup>TM</sup>MetaSyn is a trademark of Prosperity Heights Software. TMGEARS is a trademark of BigLever Software, Inc.

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# The Second Software Product Line Conference

August 19–22, 2002 San Diego, California



# **Call for Participation**

The Software Engineering Institute is proud to sponsor the second Software Product Line Conference (SPLC2). SPLC2 is a forum for researchers and practitioners working in software product lines. Multiple successful workshops and <u>SPLC1</u> have shown that the community is growing and its focus sharpening. SPLC2 is sure to enhance this maturation. The conference will feature technical papers, topical panels, tutorials, workshops, demonstrations, and birds-of-a-feather opportunities.

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We look forward to interacting with you at SPLC2.

Linda M. Northrop Software Engineering Institute SPLC2 Conference Chair

#### Len Bass Software Engineering Institute SPLC2 Program Co-Chair

Henk Obbink **Philips** SPLC2 Program Co-Chair

# **Program Committee**

Felix Bachmann Software Engineering Institute Sergio Bandinelli European Software Institute Don Batory University of Texas at Austin Joseph H. Bauman Hewlett Packard Günter W. Böckle Siemens AG

Stuart Faulk University of Oregon Cristina Gacek University of Newcastle André van der Hoek University of California, Irvine Jean Jourdan Thales Peter Knauber Fraunhofer IESE Frank van der Linden Philips Medical Systems Nenad Medvidovic University of Southern California Michael Moore NASA/Goddard Space Flight Center Robert L. Nord Siemens Research, Inc. Scott Preece Motorola

http://www.sei.cmu.edu/SPLC2/announcement.html (1 of 6)10/17/2008 1:50:31 PM

Conference Announcement

メレ Jan Bosch University of Groningen Grady H. Campbell **Prosperity Heights Software** Paul Clements

Software Engineering Institute

Philippe Kruchten Rational Software Canada Charles W. Krueger **BigLever** Software Juha H. T. Kuusela Nokia Research Center

Alexander Ran Nokia Research Center **David Sharp** The Boeing Company Steffen Thiel Robert Bosch GmbH David M. Weiss Avaya

# **Technical Papers**

Papers on all aspects of software product lines describing research results, research in progress, case studies, and industrial experience are being solicited for the conference. In particular, submissions that cover research or experience in the development and fielding of software product lines for complex systems, and that expose problems in the design, development, or evolution of software product lines are highly encouraged. We are primarily interested in papers that emphasize those aspects of product lines that differ from single system development.

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Specific topics of interest include:

#### Understanding and managing variability in product lines

- product line scoping
- tool support
- requirements
- software architecture
- binding time
- lightweight technologies for managing multiple systems simultaneously

#### **Business issues for product lines**

- data about adoption costs, error costs, sustaining costs
- economic models
- lowering the up-front investment
- metrics

#### **Organizational issues for product lines**

- organizational structures
- personnel issues
- institutionalizing a product line approach
  risk management

## **Product line life-cycle issues**

• adoption models





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- technology refreshment and insertion
- LEGACY • recognizing degradation in product lines
- mining and reengineering

## Paper Submission Guidelines and Templates

Technical papers may be submitted as research papers (describing work in progress) or experience reports (summarizing the results of previous work). Each must describe original work that has not been published and must not exceed 7500 words.

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Selected research papers and experience reports will be published by <u>Springer-Verlag</u> in conference proceedings. Papers will be accepted in MS Word format. Submissions should be in PDF or PostScript based on the following LNCS templates: sv-lncs.dot (for use with PC systems) or sv-lncs (for use with Macintosh systems). Please read the "Instructions for Using Author Template" sv-lncs.doc carefully. Also provided is typeinst.doc, the "Authors' Instructions" as an example input. All four files can be downloaded as a ZIP archive.

Technical papers will be accepted starting November 1, 2001.

**NOTICE:** The electronic submission service may be briefly unavailable on Monday mornings (during the hours of 1:00am EST to 8:00am EST) for system maintenance.

#### LEGACY LEGACY GAC Panels

Paul Clements Software Engineering Institute Panels Chair

The program will include one or more panel sessions in which participants share their views on a specific topic or debate both sides of a stated resolution. The goal of a panel is to stimulate thought on related topics and encourage lively and engaging discussion among conference participants. Special consideration will be given to proposals that are creative or innovative in topic or presentation approach. Panel proposals must not exceed 500 words.

Each should contain

- a precise statement of the topic to be discussed or debated
- the names and affiliations of up to seven panelists (for whose participation you are willing to be responsible)

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- a short statement about each panelist's qualifications to discuss/debate the proposed topic
- the steps the panel will take to actively engage the audience

E-mail panel proposals in plain ASCII format to clements@sei.cmu.edu by December 15th 2001. EGACY

# **Tutorials**

Patrick Donohoe Software Engineering Institute Tutorials Chair

Tutorials provide a valuable opportunity for conference participants to expand their product-line knowledge and skills. Tutorials may focus on introductory product-line topics, such as how to introduce a product-line approach into an organization, or on more advanced applied topics such as industrial product-line engineering practices.

Tutorials will be held on Monday and Tuesday of the conference week, and will be presented in half-day or full-day sessions.

A tutorial proposal consists of two to three pages describing the topic, the plan for conducting the tutorial, and the presenters' backgrounds.

- The Topic section should include the title, the goals, and the intended audience for the tutorial. The topic should be described in detail, stressing its importance and timeliness.
- The Plan section should include the duration of the proposed tutorial (half or full day), a preliminary schedule of events including estimated times, a breakdown of the subtopics within the general topic (i.e., a detailed description of what the tutorial will cover), a justification of the tutorial for a product-line audience, and an explanation of how the tutorial will be conducted, including sample materials to be included in the tutorial notes.
- The Presenters' Backgrounds section should include relevant biographical information, and summaries of the presenters' technical, presentation, and tutorial experience.

E-mail tutorial proposals to pd@sei.cmu.edu by December 15th, 2001.

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## Workshops

Sholom Cohen Software Engineering Institute

Kyo C. Kang Pohang University of Science and Technology, Korea

Workshop Co-Chairs

Workshops provide a valuable opportunity for small groups of people with diverse perspectives to discuss topics of common interest. Interaction among participants is important, so participants must have informed positions based on experience.

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Workshops can focus on research or applied topics. Innovative, controversial, or highly practical topics are particularly suitable for workshops. Workshop proposals on all aspects of product lines are encouraged. Topics could range from product line development methods such as domain analysis, product line requirements analysis, product line architectures to domain specific issues in areas such as telecommunications, embedded systems, etc. Each workshop will result in an SPLC workshop report that will provide an organized way of viewing the topic and will suggest directions for promising future research.

The workshops will be held on Monday and Tuesday of the conference week and will last one day. Most workshops should have 20 or fewer participants. Each workshop organizer will summarize the workshop discussions as part of a plenary panel on Thursday, August 22nd, 2002.

Workshop proposals should be 2-3 pages and should contain

- workshop name
- organizer names and affiliations
- LEGACY LEGAC • an outline of the theme and goals of the workshop and its relevance to the conference
- a description of the desired number of participants, the participant solicitation and selection process, and any preworkshop activities
- planned workshop activities, including details such as length of time, required rooms and facilities, and expected workshop outputs

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• a brief description of each organizer's background, including relevant past experience with product lines and workshops

E-mail workshop proposals to sgc@sei.cmu.edu by December 15th, 2001.

## **Demonstrations**

Felix Bachmann Robert Bosch GmbH **Demonstrations** Chair

Demonstrations provide an opportunity to describe work-in-progress, to display the results of software product lines, and to share the unique and interesting technical aspects of product line tools or systems. The demonstrators will be technical people who will seek active participation of and interaction with the attendees. The demonstrators will supply any equipment needed for the demonstration. Each demonstration will be given in a 30-minute session.

Demonstration proposals should be 2-3 pages in length and should include

- demonstrator name and affiliation
- demonstration name and description, including the relevance to software product lines and the experience to date
- a brief description of each demonstrator's background

E-mail demonstration proposals to fb@sei.cmu.edu by December 15th, 2001.

## **Electronic Submissions**

NOTICE: The electronic submission service may be briefly unavailable on Monday mornings (during the hours of 1:00am EST to 8:00am EST) for system maintenance.

All papers must be submitted in MS Word using the Springer supplied templates. Submissions should be in PDF or . CGA

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Conference Announcement

PostScript based on the following LNCS templates: <u>sv-lncs.dot</u> (for use with PC systems) or <u>sv-lncs</u> (for use with Macintosh systems). Please read the "Instructions for Using Author Template" <u>sv-lncs.doc</u> carefully. Also provided is <u>typeinst.doc</u>, the "Authors' Instructions" as an example input. All four files can be downloaded as a <u>ZIP archive</u>. Papers will be accepted starting November 1, 2001.

#### Send

Technical paper questions: <u>ljb@sei.cmu.edu</u> Panel proposals to: <u>clements@sei.cmu.edu</u> Tutorial proposals to: <u>pd@sei.cmu.edu</u> Workshop proposals to: <u>sgc@sei.cmu.edu</u> Demonstration proposals to: <u>fb@sei.cmu.edu</u>

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For general information, contact Linda Northrop at <u>lmn@sei.cmu.edu</u> For SPLC2 Web page information, contact Bob Krut at <u>rk@sei.cmu.edu</u>

#### San Diego

San Diego has nearly perfect year-round climate and terrain, from sunny beaches and lush foliage to rugged mountains and breathtaking desert. It is both a modern metropolis, with the accompanying cultural advantages, as well as a yearround resort. Home to many world class chefs, you will enjoy San Diego's dining and nightlife, shopping and entertainment, and cultural and leisure activities such as the city's 92 golf courses!

For more information about San Diego visit http://www.sandiego.org

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#### Important Date: July 31, 2002

- Last day to register at the Early Bird Rate
- Last day to register with a Purchase Order
- Last day to cancel conference registration minus a \$50 Administrative Fee

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• Last day for accepting dietary restrictions

# Price Description

## **General Attendee**

Early Bird Price (until July 31)	Just In Time Price (after July 31)	
\$400.00 \$775.00 \$1,150.00 \$375.00 \$750.00	\$450.00 \$875.00 \$1,300.00 \$425.00 \$850.00	
Early Bird Price (until July 31)	Just In Time Price (after July 31)	
\$250.00 \$625.00 \$1,000.00 \$375.00 \$750.00	\$300.00 \$725.00 \$1,150.00 \$425.00 \$850.00	
Early Bird Price (until July 31) Just In Time Price (after July 31)		
\$925.00 \$550.00 \$700.00 \$700.00 \$525.00 \$150.00 \$300.00	\$1,075.00 \$650.00 \$850.00 \$625.00 \$200.00 \$400.00	
	Early Bird Price (until July 31) \$400.00 \$775.00 \$1,150.00 \$375.00 \$750.00 \$250.00 \$625.00 \$1,000.00 \$375.00 \$750.00 \$750.00 \$750.00 \$750.00 \$250.00 \$1,000.00 \$375.00 \$750.00 \$750.00 \$750.00 \$750.00 \$1,000.00 \$375.00 \$750.00 \$1,000.00 \$375.00 \$1,000.00 \$300.00 \$1,000.00 \$300.00 \$1,000.00 \$300.00 \$1,000.00 \$300.00 \$1,000.00 \$300.00 \$1,000.00 \$300.00	

# **Dietary Restrictions**

We will order special meals (lunches only) for attendees who indicate a dietary restriction (vegetarian, low-fat, kosher, diabetic, or shellfish allergy) on registration forms received by July 31, 2002. The event organizers must order special meals by the date, and therefore will be unable to accommodate special meal requests received after that date.

# Fees and Options

All registration fees include meals and conference materials.

# **Terms and Conditions**

#### Payment

The Early Bird rate will be honored until 12 midnight U.S. Eastern Time on July 31, 2002. Payment in full must accompany registration. Method of payment may not be changed after submission of registration. Acceptable methods of payment include the following:

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#### **Credit Cards**

- MasterCard, Visa, American Express, or Diners Club
- Credit cards are processed upon receipt

## **Company or Personal Checks**

- Made payable to SEI/CMU
- Must indicate registrant's name

## **Complete Purchase Orders**

- Accepted only until July 31, 2002
- Must indicate "Advanced Payment Required"
- Signed by the designated fiscal officer in your organization
- For government purchase orders, we recommend using DD Form 1556 as a pre-paid training form, with "Advanced Payment Required" in block #37 and fiscal officer's signature in block #29

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# **Refunds and Substitutions**

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#### Hotel

#### **Hotel Reservations**

Nestled at the water's edge on spectacular San Diego Bay, the <u>Sheraton San Diego Hotel and Marina</u> offers panoramic views of the bay and the downtown city skyline. Some of the country's most unique attractions are within a 10-minute drive of the hotel - including Sea World, the world famous San Diego Zoo, historic Old Town, Balboa Park and Seaport Village.

Sheraton San Diego Hotel and Marina 1380 Harbor Island Drive San Diego, CA 92101 Phone: 619-291-2900 Fax: 619-692-2337 **Registration Information** 

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Rates

Room	Single Rate	<b>Double Rate</b>	
Standard	\$199.00	\$209.00	
Premium	\$219.00	\$229.00	
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Room	Single Rate	<b>Double Rate</b>	LEGAL
Standard	\$99.00	\$99.00	

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The Sheraton San Diego Hotel and Marina is easily accessible from Lindbergh Field International Airport. For a map and directions, please visit the Sheraton San Diego Hotel and Marina Web site at: <a href="http://www.sheraton.com/sandiegomarina">www.sheraton.com/sandiegomarina</a> For general information, please call the San Diego Convention and Visitors Bureau at 619 / 232-3101 or see its Web site at <a href="http://www.sandiego.org">www.sheraton.com/sandiegomarina</a> For general information, please call the San Diego Convention and Visitors Bureau at 619 / 232-3101 or see its Web site at <a href="http://www.sandiego.org">www.sandiego.org</a>.

# San Diego, California

California's second largest city and the United States' seventh largest, San Diego boasts a citywide population of nearly 1.3 million residents and more than 2.8 million residents countywide. Within its borders of 4,200 sq. miles, San Diego County encompasses 18 incorporated cities and numerous other charming neighborhoods and communities, including downtown's historic Gaslamp Quarter, Little Italy, Coronado, La Jolla, Del Mar, Carlsbad, Escondido, La Mesa, Hillcrest, Barrio Logan, Chula Vista and more.

Known for it's near-idyllic climate, 70 miles of pristine beaches and dazzling array of world-class family attractions, including the World-Famous San Diego Zoo and Wild Animal Park, Sea World San Diego and LEGOLAND California, San Diego offers a wide variety of things to see and do, appealing to guests from around the world.

In San Diego's East County, the terrain varies from gentle foothills to mile-high mountains and the historic mining town, Julian, down to the 600,000-acre Anza Borrego Desert State Park, offering nature-conscious visitors endless opportunities to hike, camp, fish, observe wildlife and much more. In San Diego's North County, the land produces quantities of flowers as well as quality grapes that become

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excellent wines, which are served at some of the most elegant restaurants and resorts in the region. Along the west, 70 miles of Pacific Ocean coastline not only supports year-round outdoor recreation, such as surfing, boating, sailing and swimming, but also important scientific research at the Scripps Institution of Oceanography. To the south, it's a whole different country, Mexico, featuring its own cultural offerings in various towns along the border and coastline, including Tijuana, Rosarito and Ensenada.

San Diego's arts and culture and culinary arts are making a name for themselves, both nationally and internationally. Balboa Park, the largest urban cultural park in the U.S., features 15 museums, numerous art galleries, beautiful gardens, the Tony Award-winning The Globe Theatres and the World-Famous San Diego Zoo. The region is also a breeding ground for the hottest, new talents of culinary arts, who prepare award-winning meals in many of the region's 6,400 eating establishments.

San Diego County also features 92 golf courses and a variety of exciting participatory and spectator sports, beachfront resorts and luxury spas, gaming, a dynamic downtown district, annual special events and unique holiday offerings, multicultural festivals and celebrations, colorful neighborhoods and communities, a rich military history, accessibility for travelers with disabilities and much more.

The most difficult decision to make regarding a vacation to San Diego is determining what to do and see among the region's vast and diverse variety of offerings. San Diego County offers a vacation experience for everyone.

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For more information about things to see and do in San Diego, call the San Diego Convention and Visitors Bureau at 619-232-3101 or see its Web site at <u>www.sandiego.org</u>.

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# What chasm?

- "Every software company does product line development" (Charlie Krueger, yesterday)
- My first software gig (1967) involved cloneand-own, asset mining, and parameterized generators
- So, the rest of this is talking about formalized SPL (planning, methods, and tools)

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### If we all do it, is SPL a secret?

- Agile methods took two years to common knowledge – no special tools or training and it panders to what engineers like to do
- O-O took 20 years to catch on, despite our love for anthropomorphism
- Modeling isn't common, despite UML buzz
- Colleges don't teach version control we expect them to teach SPL?

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## Why might we cross the chasm?

- Would we be able to do something we can't do, that produces more revenue than it costs?
- Would we save more, compared to existing methods, than additional costs?
- Is the pitch so compelling that we just really want to buy a bridge?

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#### What's on the other side?

- Cross-over chart isn't very convincing if you know enough to think about SPL, you aren't building similar products from scratch
- Comparison has to be against what we actually do, not against start-from-scratch
- Tool cost is only a start all the formal SPL methods involve a lot of additional models that need to be built and maintained

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## Who needs to cross the chasm?

- Need guidelines and economic models:
  - How much planning to do?
  - How many models to do?
  - What tools do I need?
  - What can I expect to get back?



You have to care about tenths of a knot to think a \$100K sail is a necessity

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## So, how do we cross the chasm?

- · First, convince people there's a chasm
  - Measure it in widely-accepted assessments
  - Build CEO buzz
- Then convince them there's a bridge
  - More success stories using packaged methodologies
  - Include it in university programs and business schools
- · Then sell them a bridge
  - Major research funding to get to validated tools and models
  - Get Rational to sell it
- And people will cross it (or say they did)

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Polarity Examples

#### US Constitution: Elegant Polarity Management



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Customer-Focus(CF) : Product-Focus(PF) Polarity Map					
	Customer-I	Focus	Product-Focus	3	
+:	<ul> <li>listen for gen</li> <li>respond to ge</li> <li>strong produ</li> <li>product well-</li> </ul>	ns ems ct support deployed	<ul> <li>reliable</li> <li>predictable</li> <li>on-time</li> <li>on-\$\$</li> </ul>	+:	
-:	<ul> <li>product reqts change too rapidly</li> <li>standard bearer: fail to harvest benefits</li> <li>process transparent</li> <li>too few products</li> </ul>		<ul> <li>product does not match customer need</li> <li>technology push</li> <li>crusader: too much techno change</li> </ul>		
CANAR	LIES	·			
		System Mgr Process CF Mgr Product CF Mgr Program CF Mgr Product Line CF Mg	Project Mgr Process PF Mgr Product PF Mgr Program PF Mgr product Line PF Mgr	<u>Project</u> <u>Process</u> <u>Product</u> <u>Program</u> <u>Product Line</u>	
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#### Hold the CUSTOMER-FOCUS << > PRODUCT-FOCUS Polarity



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#### Shared Products

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Successful	Unsuccessful		
Repetitively assessed family     member crebitectural programs	<ul> <li>Not all products were able to identify probitopto</li> </ul>		
member a chitectural progress.	identity architects.		
<ul> <li>Mitigated risk of changes</li> </ul>	<ul> <li>Architect roles, responsibilities,</li> </ul>		
through product line architect	and reporting relationship were		
reviews.	ill-defined.		
Product line architects expended			
most energy on core			
components			
- Instituted a consistent forum for			
Instituted a consistent forum for	an King and		
architecture issues.			
Project Ngr 🔶 Architect	Project Mgr 🔶 Architect		
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#### Shared Architecture

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Successful	Unsuccessful
<ul> <li>Assessed IT processes for usage and benefits.</li> <li>All processes formally inspected and walked through.</li> <li>"at least they are talking", not armed camps</li> </ul>	<ul> <li>IT processes did not have clear stewards, making usage and benefit assessments uneven.</li> <li>Processes not as clearly appreciated as technology.</li> </ul>
Customer-Focus 🔶 Producti-Focus	CustomenFocus 🔶 Producti-Focus
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#### Shared Processes

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- points of view, starter kit of four Product Line polarities
- extends governance readily as product composition changes

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The following information provides the title, author(s), and abstract of each of the 24 technical papers accepted for The Second Software Product Line Conference. Papers are alphabetically listed based on first author.

### Adopting and Institutionalizing a Product Line Culture

Günter W. Böckle, Siemens AG Jesús Bermejo, Telvent Peter Knauber, Fraunhofer IESE Charles Krueger, BigLever Software, Inc. Julio Cesar Leite, Pontifícia Universidade Católica do Rio de Janeiro Frank van der Linden, Philips

**Abstract**: The strengths of product line engineering have been described before. But how can an organization make the move from developing one-off products to product line engineering without major interruptions in the day-to-day work? This paper describes how to perform the transition to product line engineering and lists the various strategies for such a transition. It describes how to create an adoption plan and how to institutionalize product line engineering in an organization.

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# Maturity and Evolution in Software Product Lines: Approaches, Artifacts and Organization

Jan Bosch, University of Groningen

**Abstract**: Software product lines have received considerable adoption in the software industry and prove to be a very successful approach to intra-organizational software reuse. Existing literature, however, often presents only a single approach towards adopting and evolving a software product line. In this paper, we present an overview of different approaches to architecture-centric, intra-organizational reuse of software artifacts. We relate these to maturity levels for product line artefacts and organizational models.

#### Adaptable Components for Software Product-Line Engineering

John Brown, Queen's University of Belfast Ivor Spence, Queen's University of Belfast Peter Kilpatrick, Queen's University of Belfast Danny Crookes, Queen's University of Belfast

**Abstract**: This paper explores techniques for implementing adaptable software components. Such techniques can greatly facilitate the implementation of software product lines. The techniques we present allow the construction of large, transparently adaptable components via composition and parameterisation. Functional and structural adaptation, to any level of nesting, is achieved at the point of instantiation via recursive argument lists whose structure mirrors that of the component. The techniques are currently based on the C++ language, although work is under way to extend them to other languages (particularly Java).

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## **Assembling Software Products from Feature Selections**

Arie van Deursen, CWI Merin de Jonge, CWI Tobias Kuipers, Software Improvement Group

**Abstract**: In this paper we discuss the construction of software products from customer-specific feature selections. We address variability management with the Feature Description Language (FDL) to capture variation points of product line architectures. We describe feature packaging which covers selecting and packaging implementation components according to feature selections using the autobundle tool. Finally, we discuss a generic approach, based on the abstract factory design pattern, to make instantiated (customer-specific) variability accessible in applications.

SPLC2 Papers - Authors and Abstracts

The solutions and techniques presented in this paper are based on our experience with the product line architecture of the commercial documentation generator DocGen.

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#### Feature Interaction and Dependencies: Modeling Features for Reengineering a Legacy Product Line

Stefan Ferber, Robert Bosch Research Jürgen Haag, Robert Bosch Gasoline Systems Juha Savolainen, Nokia Research Center

Abstract: Re-engineering a legacy product line has been little addressed by current product line research activities. This paper introduces a method to investigate feature dependencies and interactions, which restricts the variants that can be derived from the legacy product line assets. Reorganizing the product line assets with respect to new requirements needs more knowledge than what is easily provided by the classical feature modeling approaches. Hence, adding all the feature dependencies and interactions into the feature tree results in unreadable and unmanageable feature models, which fail to achieve their original goals.

We therefore propose two complementary views to represent the feature model. One view shows hierarchical refinement of features similar to common feature modeling approaches in a feature tree. The second view describes what kind of dependencies and interactions there are between various features.

We show two examples of feature dependencies and interactions in the context of an engine control software product line and we demonstrate how our approach helps define correct product configurations out of product line variants.

#### Feature Modeling: a Meta-Model to Enhance Usability and Usefulness

Daniel Fey, Nokia Research Center Robert Fajta, Nokia Research Center Andras Boros, Nokia Research Center

LEGACY Abstract: A feature model captures the stakeholder-visible aspects and characteristics of a product line. By revealing a product line's inherent commonalities and variabilities, it acts as a key driver in the creation of core assets. Usability and usefulness, however, are important qualities for a feature model to possess in order to fulfill its role. In our opinion, these qualities can be ensured by building upon an adequate meta-model. The purpose of this article is to describe an extended meta-model for feature

modeling. Meta-model elements, such as features and inter-feature relations, are presented in detail. We propose automated model analysis as the way of extracting information encapsulated in a feature model: algorithms are suggested for identification of the commonality and variability in the modeled product line and for automated consistency checking of products.

### On the Influence of Variabilities on the Application Engineering Process of a **Product Family**

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Lars Geyer, University of Kaiserslautern Martin Becker, University of Kaiserslautern

EGAC Abstract: Product Families typically comprise a set of software assets, which offer the possibility to configure the product family to the needs of a specific application. The configuration process is driven by the variabilities, i.e., the variable requirements that were implemented into the software assets in the form of variation points. During application engineering, a developer selects a consistent set of variabilities, this set is used in order to instantiate the family assets to the needed functionality. The paper describes the influence of this configuration step onto the application engineering process of a product family. In addition, it identifies the requirements imposed onto a configuration technique by the described product family application engineering process.

#### **Representing Variability in Software Product Lines: A Case Study**

Michel Jaring, University of Groningen Jan Bosch, University of Groningen

Abstract: This paper focuses on variability in industrial software product lines. Variability is the ability to change or customize a software system, i.e., software architects anticipate change and design architectures that support those changes. If the architecture is used for different product versions, e.g., in a software product line context, it becomes important to understand where change has to be planned and the options possible in particular situations. Three variability issues have been identified in a case study involving a Dutch software company. In our opinion, this company, Rohill Technologies BV, is representative for small and medium sized enterprises in software industry. The issues identified are discussed and analyzed and illustrate the need for handling variability in a more explicit manner. In this paper, we suggest a method to represent and normalize variability in industrial software systems. The method is exemplified by applying it to Rohill's software product line.

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## **Governance Polarities of Internal Product Lines**

Truman Jolley, Boeing Commercial Airplanes David Kasik, Boeing Commercial Airplanes Conrad Kimball, Boeing Commercial Airplanes

**Abstract**: Tension occurs when multiple organizations develop and deliver their own product lines to a single user community. We apply polarity management to governance of the shared architecture, products, and processes for delivery and management of tens of product lines containing hundreds of applications for thousands of engineering users in Boeing Commercial Airplanes. This paper focuses on the use of polarity management to construct extensible governance bodies and processes for a second phase of product line expansion. We define polarity to be two principles which are both true, but conflict. Polarities are often mistaken to be problems to be solved; however, polarities are held, not solved. Polarity management of the product line infrastructure, a complex customer-supplier network, identifies primary organizational tensions that require management; poorly held polarities cause chaos and failure.

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## Using a Marketing and Product Plan as a Key Driver for Product Line Asset Development

Kyo Kang, Pohang University of Science and Technology Patrick Donohoe, Software Engineering Institute Eunman Koh, Pohang University of Science and Technology Kwanwoo Lee, Pohang University of Science and Technology Jaejoon Lee, Pohang University of Science and Technology

**Abstract**: The product line engineering paradigm has emerged recently to address the needs to minimize the development cost and the time to market in this highly competitive global market. Product line development consists of product line asset development and product development using the assets. Product line requirements are essential inputs to product line asset development. These inputs, although critical, are not sufficient to develop product line assets. A marketing and product plan, which includes plans on what features are to be packaged in products, how these features will be delivered to customers (e.g., feature binding time), and how the products will evolve in the future, also drives product line asset development; thus this paper explores design issues from the marketing perspective and presents key design drivers that are tightly coupled with the marketing strategy. An elevator control software example is used to illustrate how the product line asset development is related with the marketing and product plan.

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### Method for Product-Line Scoping based on Decision-Making Framework

Tomoji Kishi, NEC Corporation Natsuko Noda, NEC Corporation Takuya Katayama, Japan Advanced Institute of Science and Technology

Abstract: It is indispensable for strategic product-line development, to define proper scope of the product-line. Once scope has been defined, we examine product-line architecture for it to examine systematic reuse for the product-line. Therefore, in defining scope, we have to examine whether or no it is appropriate for products in the product-line to share the same architecture. The appropriateness of sharing the same architecture among multiple products has to be examined from two points of view. One is from the point of view of individual optimal, i.e. if it is good for each product to use the shared architecture, and the other is from that of whole optimal, i.e. if it is good for product-line as a whole to share the architecture. In this paper, we propose a method for product-line scoping. We consider scoping as decision-making activities, in which we evaluate multiple candidates of scoping, and select proper one examining the appropriateness from the two points of view. In order to demonstrate the applicability of the method, we applied the method to the scoping for products examined for on-board systems in Japanese ITS (Intelligent Transport Systems) projects. EGAC

#### Engineering Software Architectures, Processes and Platforms for System Families - ESAPS Overview

Frank Van der Linden, Philips Medical Systems

Abstract: Between July 1999 and June 2001, 22 European companies and research institutes worked together in the ESAPS project to enhance their capabilities for engineering software for system families. This paper describes the main objectives of the project, and an overview of the results obtained in the project. Finally, the project is related to other projects and initiatives with similar goals.

#### Variation Management for Software Production Lines

Charles Krueger, BigLever Software, Inc.

Abstract: Variation management in a software product line is a multi-dimensional configuration management problem. In addition to the conventional configuration management problem of managing variation over time, software product lines also have the problem of managing variation among the the individual products in the domain space. In this paper, we illustrate how to divide and conquer the

variation management problem into a collection of nine smaller problems and solutions. We also show how to address the nine problems with lightweight solutions that can reduce the risks, costs, and time for establishing and maintaining a software product line.

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## Using First Order Logic for Product Line Model Validation

Mike Mannion, Glasgow Caledonian University

Abstract: Product line models are used to drive the generation of requirements for single systems in the product line. They are difficult to validate because they are large and complex. By modelling variability and dependency between requirements using propositional connectives a logical expression can be developed for the model. Validation of the selection of requirements from the model can be achieved by satisfying the logical expression. This approach can be used to validate the model as a whole. A detailed worked example is presented and the computational aspects of the approach are discussed.

#### **Model-driven Product Line Architectures**

Dirk Muthig, Fraunhofer IESE Colin Atkinson, Fraunhofer IESE

Abstract: It has long been recognized that successful product line engineering revolves around the creation of a coherent and flexible product line architecture which consolidates the common parts of a product family for reuse and captures the variant parts for simple adaptation. However, it has been less clear what form such architectures should take and how they should be represented. One promising approach is offered by the new Model Driven Architecture (MDA) paradigm of the OMG, which holds that an organization's key architectural assets should be represented in an abstract "platform independent" way, in terms of UML models, and thereby shielded from the idiosyncrasies and volatility of specific implementation technologies. In this paper we discuss the opportunities and challenges involved in using the MDA paradigm for product line engineering, and explain how model driven, product line architectures can be developed, maintained and applied. After first outlining the core concepts of product line engineering and ad hoc strategies currently used to support it, the paper provides a detailed metamodel of the information that needs to be stored within a product-line architecture. It then explains how these concepts can be added to the existing UML metamodel in a clean and coherent way, thereby extending the language to support product-line engineering.

### Widening the Scope of Software Product Lines - From Variation to

#### Composition

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**Abstract**: Architecture, components and reuse form the key elements to build a large variety of complex, high-quality products with a short lead-time. But the balance between an architecture-driven and a component-driven approach is influenced by the scope of the product line and the characteristics of the development organization. This paper discusses this balance and claims that a paradigm shift from variation to composition is necessary to cope with an increasing diversity of products created by an everlarger part of an organization. We illustrate our claim with various examples.

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## Product line annotations with UML-F

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**Abstract**: The Unified Modeling Language (UML) community has started to define so-called profiles in order to better suit the needs of specific domains or settings. Product lines represent a special breed of systems they are extensible semi-finished pieces of software. Completing the semi-finished software leads to various software pieces, typically specific applications, that share the same core. Though product lines have been developed for a wide range of domains, they apply common construction principles. The intention of the UML-F profile is the definition of a UML subset, enriched with a few UML-compliant extensions, that allows the annotation of such artefacts. The paper presents aspects of the profile with a focus on patterns and exemplifies its usage.

#### **Evolutionary Introduction of Software Product Lines**

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**Abstract**: Software product lines have proved to be a successful and efficient means for managing the development of software in industry. The significant benefits over traditional software architectures have the potential to convince software companies to adopt the product line approach for their existing products. In that case, the question arises how to best convert the existing products into a software product line. For several reasons, an evolutionary approach is desirable. But so far, there is little

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guidance on the evolutionary introduction of software product lines.

In this paper, we propose a lightweight iterative process supporting the incremental introduction of product line concepts for existing software products. Starting with the analysis of the legacy code, we assess what parts of the software can be restructured for product line needs at reasonable costs. For the analysis of the products, we use feature analysis, a reengineering technique tailored to the specific needs of the initiation of software product lines.

#### Using Options Analysis for Reengineering (OAR) for Mining Components for LEGAC LEGAC a Product Line

Dennis Smith, Software Engineering Institute Liam O'Brien, Software Engineering Institute John Bergey, Software Engineering Institute

Abstract: Options Analysis for Reengineering (OAR) is a systematic, architecture-centric means for mining existing components for a product line or new software architecture. The method incorporates a set of scalable techniques and exercises to collaboratively analyze existing components, determine viable mining options, and evaluate the most promising options. OAR has 5 activities which are followed in a systematic manner to identify components for mining and estimate the cost and risk of changes required to each legacy component to enable its reuse within a new software architecture. OAR provides visibility into this highly complex analysis activity. It also provides insights into implicit stakeholder assumptions, constraints, and other major drivers that impact the mining of components. Results from a pilot application of OAR are presented in this paper.

#### Systematic Integration of Variability into Product Line Architecture Design

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LEGAC Abstract: Product lines consider related products, their commonalities and their differences. The differences between the single products are also referred to as variability. Consequently, variability is inherent in every product line and makes the key difference compared to single systems. While on the requirements level the methods for analyzing product line variability are understood today, its transition to architecture remains vague. Bringing variability to architecture as an add-on is just a provisional solution and forebodes the risk of violating other intentions. This paper presents a systematic approach to integrating variability with product line architecture design. In particular, it promotes variability as an architectural driver, embeds variability requirements in the architecture design framework QUASAR,

and gives guidelines and examples for documenting variability in architectural views.

#### Critical Factors for a Successful Platform-based Product Family Approach

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Abstract: The idea of software product families is becoming more and more popular, both in research and in industry. When listening to the ideal story, the benefits of product families are stressed and very little attention is paid to possible problems. However, in practice, it is important to know what these problems are and how they can be dealt with. In this paper we want to identify some of the most critical issues, and how the can be handled. This will be done based on the experiences from three industrial product families for professional markets. The focus will be on product families that use platforms with reusable assets for the development of the family members.

## Establishing a Software Product Line in an Immature Domain LEGAC

Stefan Voget, Robert Bosch GmbH Martin Becker, University of Kaiserslautern

Abstract: Often product lines are applied to stable domains, i.e. a set of common features is identifiable in advance and the evolution of the domain is manageable during lifetime. These prerequisites are not always given. But there may be a market pressure which requires to develop products with systematic and preplanned reuse in a domain not properly overlookable. In such a case the product line approach also offers a set of methods which helps to overcome the risks of an immature domain. In this paper we consider such risks and present some approaches to manage them. The considerations are substantiated by experiences made in the domain of driver information systems in an automotive context. The development is deeply influenced by technological changes (e.g. Internet, MP3-player, UMTS) that challenge the successful deployment of product line technology.

#### Performance Analysis of Component-based Applications

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Abstract: Performance analysis is a software engineering activity that involves analyzing a software application with respect to performance quality attributes such as response and execution times.

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Performance analysis tools provide the necessary support for the analyst to monitor program execution, record and analyze performance data, and locate and understand areas of poor performance. Performance analysis methods and techniques are highly dependent on the properties of the software system to be analyzed. Product line engineering applications possess some special properties that impose constraints on the selection of the performance analysis techniques to be applied and the tools to be used. The development of a component-based reference architecture is crucial to the success of a true product line. The component-based nature facilitates the integration of components and the replacement of a component with another to meet the requirements of an instance application of the product line. In this paper, we discuss performance analysis of component-based software systems and its automation. We discuss how component-based system properties influence the selection of methods and tools used to obtain and analyze performance measures. We use a case study of document content re-mastering product line to illustrate the application of a performance analysis method to component-based applications.

#### Product Line Architecture and the Separation of Concerns

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LEGAC Abstract: Software product lines present many benefits over the traditional methods of building systems. With the diverse implementation of both application and technology architectures, organizations are faced with complex design constraints. Layered architectures assist with breaking down complexity through separating elements based on their use and applicability. To really achieve high levels of re-use and productivity without only focusing on one architectural style, is difficult to do. This paper discusses two primary concepts namely, product line architecture and separation continuum. It starts by presenting a product line architectural view that shows how various concepts are separated based on abstraction. In order to provide context, the Software Engineering Institute and Carnegie Mellon University's product line practices are briefly discussed. The separation continuum shows how vertical and horizontal layering can assist with separating user interface from business logic and data, also the separation of customer facing processes from infrastructure facing processes. Software product developers know that these relationships are not easily related. Customer facing business processes have different requirements to infrastructure facing processes. In order to tie all the concepts together, vertical layering is needed whereby the more abstract elements are separated from the implementation of those elements. An application assembly approach is discussed whereby the product line architecture is tied to the separation continuum showing how high levels of productivity can be achieved when realizing product lines. The approach presented in this paper is still under development with implementation on a limited number of product lines only. It is intended that the content will provoke and stimulate the thinking and experimentation needed to deal with application assembly by means of having a separation LEGAC continuum and a matching product line architecture.

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This material is being posted by Carnegie Mellon University's Software Engineering Institute (SEI) on this Web site as a community service.



SPLC2 will provide a forum for people to meet informally and discuss product-line-related issues in a relaxed setting. These birds-of-a-feather sessions will occur the evening of Wednesday, August 21. Any SPLC2 participant may create a birds-of-a-feather session. Simply post a description for the session on the conference's message board, and choose a time and place from the available meeting rooms (which will also be posted on the message board). Rooms will be allocated on a first-come-first-served basis.

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