Henk Obbink
Klaus Pohl (Eds.)

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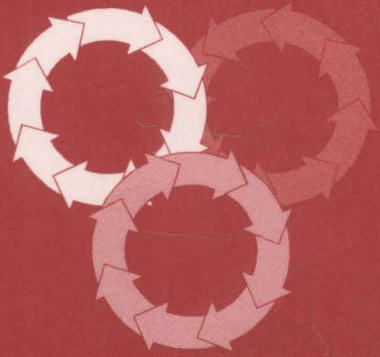
Software Product Lines

**9th International Conference, SPLC 2005
Rennes, France, September 2005
Proceedings**

SPLC 2005



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Rennes, France, September 26-29, 2005
Proceedings

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Preface

With SPLC 2005 we celebrated the formation of a new conference series, the *International* Software Product Line Conference (SPLC) which results from the "unification" of the former series of three SPLC (Software Product Line) Conferences launched in 2000 in the USA, and the former series of five PFE (Product Family Engineering) Workshops started in 1996 in Europe.

SPLC is now *the premier forum* for the growing community of software product line practitioners, researchers, and educators. SPLC offers a unique opportunity to present and discuss the most recent experiences, ideas, innovations, trends, and concerns in the area of *software product line engineering* and to build an international network of product line champions. An international SPLC Steering Committee has been established and it is the wish of this committee that from 2005 on, the SPLC conference will be held yearly in Europe, America, or Asia. The technical program of SPLC 2005 included.

- two keynotes from David Weiss (Avaya, USA) and Jan Bosch (Nokia, Finland), both leading experts with academic and industrial insights;
- 17 full and 3 short research papers organized around the following themes: feature modeling, re-engineering, strategies, validation, scoping and architecture, and product derivation;
- eight experience reports describing commercial application of product line practices;
- two panels focused on special topics in product line practice and product line research;
- tool demonstrations;
- a Hall of Fame session that continued the SPLC tradition in a slightly revised format.

In addition, the technical program was preceded by a tutorial and workshop day that included ten half-day tutorials presented by well-recognized experts and five workshops on specific areas of product line research.

The preparation of this programme would not have been possible without the help and support of many individuals. The role of the Program Committee was central in the achievement of this high-quality programme. We are indebted to each PC member for his or her commitment in reviewing the papers, participating in electronic consensus discussions and, finally, in actively taking part in the PC meeting, which was held in Essen on May 24, 2005.

Thanks also to the Organizing Committee and in particular to Jean-Marc Jézéquel for his continuous support at all stages and for making it possible to host SPLC 2005 in the beautiful city of Rennes. Most especially, we would like to thank all those who submitted their work to SPLC 2005. Without their willingness to publish and share their work SPLC 2005 would not have been possible.

June 2005 Henk Obbink and Klaus Pohl

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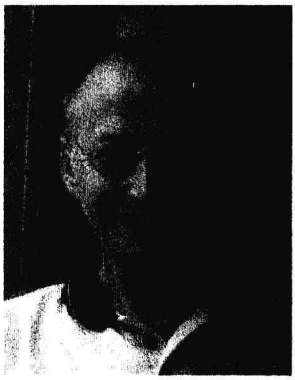

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Next Generation Software Product Line Engineering

David M. Weiss

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Software product line engineering has advanced to the point where we know how to create software product lines on small to medium scales, and some organizations are having success on a larger scale. Success has come rather slowly, however, if one considers that many of the key ideas are 25-35 years old. For example, Dijkstra discussed the idea of program families in the late 1960s, David Parnas and others clarified the idea and showed how to apply it in real-time systems in the mid 1970s, and Jim Neighbors invented domain analysis in the early 1980s. Through the 1980s and 1990s we saw the systematization of product line engineering processes and their first applications. The first Software Product Lines Conference was held in 2000. Much of the development of the field has focused on technical aspects of creating product lines and producing applications. Indeed, most of the technical problems in creating product lines now seem solvable for many product lines. The Software Product Line Hall of Fame gives us examples of successful large scale product lines.

Institutionalizing the use of product lines in industrial organizations on a large scale may now require overcoming the obstacles in creating the right organizations and in quantifying the economics. Institutionalization often founders on the question of whether to create an organizational unit dedicated to domain engineering and developing the product line engineering environment, or whether to distribute the domain engineering task among different organizational units. Are there other organizational choices that we can make that solve this problem? How do other industries, which cannot survive without creating product lines, solve this problem? The economic justifications are typically cast in terms of a simple, cost-based model. What, then, is a good model to use?

The questions for the next generation of product lines focus on the following.

1. What are reliable, repeatable techniques for creating large scale product lines and the organizations that produce them?
2. What is the right economic model for an organization to use in deciding what product lines to create?
3. What is the next step in bringing organization to the way that we think about product lines?

I will discuss some possible avenues of approach for each of these problems.

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Software Product Families in Nokia

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Abstract. The level of software development and maintenance investment in embedded products has increased considerably over the last decade. As software product families are providing a proven approach to managing the cost and quality of software artefacts, Nokia has exploited this approach to software development for many years. This paper presents some lessons learned and the key challenges for the successful use and evolution of software artefacts.

1 Introduction

Reuse of existing software artefacts can be viewed as the holy grail of software engineering. For close to four decades, we have, as a software engineering community, evolved through an extended set of techniques for achieving higher productivity, more dynamic, responsive software development and lower maintenance cost. Techniques proposed in this context include modules, components, libraries, object-orientation, frameworks, architecture and, of course, software product families.

Software product families can be viewed as addressing a specific area of software reuse as most published product families are of an embedded nature, combining mechanical, hardware and software elements and less focused on information systems style functionality. Although this division has long been an accurate one, there is a clear trend towards blurring the distinctions between these two categories of systems. Embedded systems are becoming increasingly networked, upgradeable after their initial deployment, able to dynamically embed in new contexts and record, process and store increasing amounts of data. Examples of these kinds of systems can, among others, be found in the telecom, consumer electronics and automotive industry.

The transition from traditional, closed embedded systems to a world in which embedded systems provide platforms for deploying a wide variety of distributed, possibly peer-to-peer applications has a number of implications for research in the area of software product families as well. These implications include the increasing importance of hierarchy in product families, the increased complexity of variability management, the balance domain and product engineering and the role of open-source software.

The goal and contribution of this article is an analysis of the aforementioned implications for research in software product families. This analysis is performed from the perspective of Nokia, but also includes experiences from other companies that I have

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worked with in the past and from earlier research performed at the University of Groningen. Consequently, the results should be relevant for software engineering organizations in general.

The remainder of this article is organized as follows. In the next section, an overview of the three main software product families for mobile terminals at Nokia is presented. Subsequently, in section 3, a set of challenges is presented that companies, including to various extent Nokia, are concerned with. Finally, the paper is concluded in section 5.

2 Overview of Product Families at Nokia

Nokia is a 55.000 person Fortune-500 company with revenue of around 30 billion euros. The company is organized in four business groups, i.e. Networks, primarily selling telecom infrastructure equipment and associated services, and Mobile Phones, Multimedia and Enterprise Solutions, addressing different segments of mobile devices with products and associated services.

The mobile devices business groups employ three main platforms in their products, i.e. Series 40, Series 60 and Maemo, an open-source Linux-based platform. The platforms address, with some overlap, mobile devices with different feature sets and price points. However, these platforms also share some components, so there is hierarchy in the shared artefacts.

In terms of the maturity model that I presented in [1], the platforms organizations typically employ the highest maturity model, i.e. the configurable product base approach. This means that most new features required for products under development typically are first developed as part of the platform. Once the platform is released the product configures the new platform release for use and inclusion in the product functionality.

Series 40

The Series 40 platform is a closed, proprietary platform consisting of a in-house developed operating system, a cellular subsystem managing wireless, cellular connectivity and a subsystem managing the applications and interface to the user. The Series 40 platform is primarily intended for mobile phones with restricted extended functionality, but can be extended with applications written in Java.

Series 60

The Series 60 platform is an open platform based on the Symbian operating system. The platform is explicitly intended for 3rd party application developers who can develop applications using native C/C++, Java or a scripting language such as Python or Perl. The architecture consists of an adaptation layer between the hardware and the Symbian OS, the Symbian OS, the Series 60 layer and a layer containing the core applications and extended application suite.