One of the most exciting aspects about software product lines is how they put technical and enterprise issues on the same page.

Software product lines represent a paradigm on the rise in software engineering that comes with true order-of-magnitude improvements in cost, schedule, and quality. As the field grows and matures, case studies are becoming more plentiful and beneficial. Books, papers, conferences, workshops, and special issues of magazines such as this one provide ideas that can inspire us.

For me, one of the most exciting aspects about software product lines is how they put technical and enterprise issues on the same page. This is best demonstrated when a software product line capability helps a savvy organization quickly enter and thrive in a whole new market area. CelsiusTech Systems, a Swedish seller of shipboard command-and-control systems, recognized that a new market lay nearby in ground-based air defense systems—guns mounted on moving platforms. On the first day CelsiusTech decided to enter that market, 40 percent of its entry system was complete because of its roots in a ship system product line. Cummins, an American manufacturer of diesel engines, recognized that a vast untapped market in industrial diesel engines lay right next to its product line of (software-intensive) automotive and truck diesel engines. The industrial diesel domain encompasses an extraordinary range of applications, from ski lifts to rock crushers, but no single application is a high-volume proposition. Without the capability to field a product variant quickly and easily, the market is not attractive. But with that capability—that is, with a product line capability—an organization can score a coup, which is precisely what Cummins did.

The key to this enterprise-level strategic positioning is understanding the scope of the product line. A product line’s scope states what systems an organization would be willing to build as part of its product line and what systems it would not. In other words, it defines what’s in and what’s out. Defining a product line’s scope is like drawing a doughnut in the space of all possible systems. The doughnut’s center represents the set of systems that the organization

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Eliminating the Adoption Barrier

Charles Krueger

Stories of successful software product line deployments often read like epic adventures. In the end, there is triumph of inspirational proportions, but along the journey there is risk, hardship, sacrifice, heroes, antagonists, love lost, love found, and fortuitous events of both happy and tragic consequences. For example, for Cummins to achieve its impressive software product line successes, it stopped all product deployments for six months while it rearchitected its engine control software, support technology, organizational charts, and processes. Imagine the consequences if, after an extended production shutdown, unanticipated events had led to project failure.

Although these epics make for great, inspiring reading, many software organizations need to operate on a more predictable and less dramatic story line. They can’t afford to slow or stop production for six months to reinvent themselves, even if the potential payoff is huge. For most organizations, the risks, timetables, efforts, and costs experienced by the pioneers represent an adoption barrier to software product line practice.

For software product lines to become part of mainstream software engineering culture, organizations need software product line strategies with low adoption barriers. They need low-risk strategies that afford small upfront effort, incremental transition from current practices, and rapid return on investment. Several organizations have recognized this need and are successfully creating technology and techniques that lower the adoption barrier to software product lines (see www.biglever.com, www.esi.es/Projects/Reuse/projects.html, and www.iese.fhg.de/Business_Areas/Product_Line_Development).

These new approaches offer two things not found in the epic proactive software product line approaches. The first is lightweight technologies and techniques that specifically support software product line engineering. The second is using a variety of adoption models for establishing and operating a software product line practice.

Lightweight software product line technologies and techniques minimize the paradigm shift between conventional software
could build, and would be willing to build, under the auspices of its product line capability. Systems outside the doughnut represent those that are out of scope, that the product line is not equipped to handle well. Systems on the doughnut itself could be handled with some effort, but require case-by-case disposition as they arise. In a product line of office automation systems, a product with a conference room scheduler would be in, but one with a flight simulator would be out. One with a specialized intranet search engine might be in if it could be produced in a reasonable time and if there were strategic reasons for doing so (such as the likelihood that future customers would want a similar product).

Explicitly scoping the product line lets us examine regions in the neighborhood that are underrepresented by actual products in the marketplace, make small extensions to the product line, and move quickly to fill the gap. In short, a consciously preplanned, proactive product line scope helps organizations take charge of their own fate. The scope feeds other product line artifacts; the requirements, architecture, and components all take their cues for the variabilities they need to provide from the scope statement.

P utting an organization on the same strategic page requires vision, strong management, technical competence, process discipline, and no small amount of dedicated leadership. But the payoffs can be spectacular, as companies large and small in all domains are discovering. Help is available. The Software Engineering Institute’s product line practice framework (www.sei.cmu.edu/plp) describes how to extend software engineering and managerial practices from one-system-at-a-time product building to make them apply to product line engineering. The growing body of literature and case studies also provide invaluable guidance for practitioners who want to adopt the approach. Together, we are taking product lines into the realm where organizations can be proactive about the systems they are prepared to build.

References

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barrier. For example, Salion, an enterprise software producer, needed to transition from conventional one-of-a-kind software engineering to software product line engineering. Based on time and cost constraints, an epic proactive transition was out of the question. So, it adopted lightweight software product line technology from BigLever Software, an extractive approach to reuse existing conventional product as the baseline for the product line and a reactive approach to implement unanticipated requirements from new customers. While maintaining its aggressive production schedule, Salion transitioned to a live software product line in about four person-months of total effort, which was less than 5 percent of the time required to build the conventional product used as the product line’s baseline.

It has been said that “the right point of view is worth 20 points of IQ.” That is certainly the approach we need to take in moving software product line practice from the realm of epic adventures to mainstream software practice. New advances in technology and methodology show that, by taking the right viewpoint, the adoption barrier disappears.

References


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