BigLever Software, Inc.

BIGLEVER NEWSLETTER: **Perspectives**

Reuse is an Event. Sharing is a Journey.

Greetings from BigLever:

Early this year I was part of a week-long workshop on *Feature-Oriented Software Development* at Schloss Dagstuhl, Germany's eclectic blend of an 18th century castle, computer science think tank, secluded research retreat and unwound meeting center. The title of the workshop might well have been *Feature-Oriented Product Line Engineering* since most of us there were from the product line community.

The topic of my position statement and research during the workshop was that *feature orientation* is an essential prerequisite for the success of systems and software product line engineering approaches. Although this trend has become clear in our experiences at BigLever, it is not yet generally recognized, nor is it obvious.

In this newsletter issue, I'll focus on how the exclusive success enabled by feature-oriented approaches is a direct result of the distinct way that reuse occurs throughout the long-term product line engineering lifecycle.

Reuse in Product Line Engineering

The idea of reusing systems and software engineering assets – such as requirements, designs, source code and test cases – has long been the leading candidate for discontinuous improvements in engineering efficiency and quality. The field of Systems and Software Product Line Engineering (PLE) has focused on lucrative opportunities for reuse within a family of similar products or systems.

Reuse in concept is simple, clear and powerful. Reuse in practice, however, has been messy, muddled and anemic. The problem is, the things about reuse that seem obvious don't work, and the things about reuse that work aren't obvious.

This has resulted in many different engineering organizations predictably taking the same ruinous path to failed reuse and PLE initiatives, while consistently overlooking the readily available path to reuse and PLE breakthroughs. Not only has this inhibited the field of systems and software PLE, but it has also unnecessarily stunted the growth and advancement of entire companies and industries.

This contrast in perspectives on reuse – the seemingly obvious things that don't work versus the things that do work that aren't so obvious – can be succinctly stated as:

■ About this Newsletter

The BigLever Newsletter is designed to help companies understand and successfully leverage the order-of-magnitude benefits provided by pragmatic new generation systems and software product line engineering (PLE) approaches. We appreciate your interest and welcome your feedback regarding your organization's PLE challenges and opportunities.

■ General Motors and BigLever Software at the Smithsonian

The Smithsonian Air & Space Museum will host the IBM Rational Systems and Software Engineering Symposium to be held on September 15, 2011. The Symposium agenda will feature a special PLE session – entitled *Feature-Based Product Line Engineering Across the Lifecycle at General Motors* – co-presented by Bill Bolander, General Motors Technical Fellow, and Dr. Charles Krueger, BigLever CEO.

This presentation will offer pragmatic insights into PLE challenges and strategic benefits, plus first-hand experiences from GM's ongoing PLE deployment. The session will explore how GM is leveraging PLE to engineer and automatically assemble systems and software assets for different vehicle configurations from a high-level bill-of-features rather than manual assembly of a low-level bill-of-materials.

>> See Symposium agenda.

Reuse is an Event. Sharing is a Journey.

Reuse is an Event

Central to the least effective forms of reuse in PLE is the idea that *reuse is an event*. Unfortunately, this is also the intuitive first impression most people have about PLE, and this misperception sticks. The classic example is when an organization creates a library of reusable *core assets* for a domain. The *reuse event* occurs during *application engineering*, when someone finds and reuses a core asset from the library for a new or enhanced product or system. High fives all around.

The *reuse event* provides 100% reuse on day one, but 0% reuse every day after that. After *N* different reuse events from a library asset, there are *N* copies of the asset, plus the one in the core asset library. Enhancements, variations or fixes on any of these *N+1* copies results in divergence rather than reuse. To reconcile and consolidate this divergence requires a level of manual effort that is proportional to N^2. That is, a change to any of the *N+1* copies must be reconciled with the other *N* copies, or *N+1* times *N*.

Now we can start to see the problem with treating reuse as an event. For *N* reuse events we get savings that are proportional to a linear *N*, but thereafter throughout evolution and maintenance of a product family we incur costs that are proportional to a polynomial N^2. Not a good balance, particularly considering that the timespan, effort and cost for the evolution and maintenance phase of a system typically dominates the upfront creation effort and cost.

Forms of reuse that fall into the anemic *reuse-is-an-event* category include *clone-and-own* (new systems built by cloning, modifying and maintaining copies of previous system assets), reusable asset libraries, the lego block software component analogy, and Software Product Line approaches based on separate *domain engineering* (building a library for a domain) and *application engineering* (copy-based reuse events from the library).

Sharing is a Journey

Key to the most effective forms of reuse in PLE is the idea that *sharing is a journey*. Reuse in this case is not an event experienced in isolation, but rather an odyssey embarked upon with others over time. Unfortunately, this is a rather non-intuitive perspective that on first impression sounds like it might be more trouble than it's worth.

The *sharing* approaches to reuse in PLE are *generative* in nature, where shared PLE assets are automatically compiled, assembled or otherwise configured into systems through some type of abstract feature-based specification. This takes us back to the original premise – that feature orientation is prerequisite to success in PLE approaches.

The classic examples in PLE are feature-based product line configurators that select and configure from a supply chain of shared product line assets – such as requirements, design models, source code, documentation and test cases for a product or system family – based on the specification of features and capabilities that are needed or not needed for any particular product or system.

■ Executive PLE Roundtable Featuring General Motors and BigLever Software

As part of the Systems and Software Engineering Symposium Series, IBM Rational will host an Executive PLE Roundtable at the University of Michigan on October 19, 2011. The roundtable session – presented by Dr. Charles Krueger, BigLever CEO, Bill Bolander, GM Technical Fellow, and Greg Gorman, IBM Rational Program Director – will provide an interactive forum for executives and engineering managers to discuss the latest PLE approaches and learn about GM's current PLE deployment.

This Executive PLE Roundtable will be held in conjuction with the main IBM Rational Systems and Software Engineering Symposim event.

>> See Symposium Agenda.

To receive more information regarding the Executive PLE Roundtable, contact Cathy Martin at cmartin@biglever.com.

■ BigLever Keynote Presentations

As an acknowledged pioneer of PLE technologies and methods, Dr. Charles Krueger will speak on the topic highlighted in this newsletter – *Reuse is an Event. Sharing is a Journey.* – in keynote addresses at two upcoming international conferences:

Brazilian Symposium on Software Engineering (CBSoft)
September 26 - 30, 2011
São Paulo, Brazil

6th International Workshop on Variability Modelling of Software-Intensive Systems
January 25 - 27, 2012
Leipzig, Germany

■ U.S. Army, General Dynamics and BigLever Software I/ITSEC

In contrast to *reuse events, sharing* is long term, and that's what enables success. Reconsider our example of maintaining *N* different systems that use the same asset, but this time through *sharing* rather than *reuse events* that create *N* different copies. Enhancements, variations and fixes are now done once in the shared, pre-generator form of the asset, so that the *N* users can all automatically regenerate the new and improved asset, using their previously created feature-based abstract specification.

Without the feature-based abstraction, automation would not be possible. Dramatically better than the N^2 cost with copy-based *reuse events*, the evolution and maintenance of the shared asset is now centrally coordinated for all *N* users, so there is a linear *N* cost for the initial use of the asset and a linear *N* cost for evolution and maintenance. This provides very efficient lifetime amortization through cost sharing across the *N* products and it allows *N* to grow very large.

An Anecdote

I recently met with a customer group who is effectively using BigLever's *sharing-is-a-journey* tools and methodology for their PLE assets and automated configuration. Their management and customers were asking them for metrics on "how much reuse" they were achieving among their products. They were struggling to find a good way to express this. Can you see what's wrong with the question? Their management was asking for metrics on *reuse events*, whereas their meaningful benefit metrics were coming from their *sharing journey*.

Answering a different question provided a better answer and allows them to be mentors to their management and customers on the difference between *reuse-is-an-event* versus *sharing-is-a-journey*. Looking across their collection of shared assets, they can create a visually intuitive bar graph to illustrate how much of this asset collection is shared among all *N* systems in their product family (i.e., truly common), how much is shared among *N-1* systems, among *N-2*, among *N-3*, and so forth, all the way down to how much of the shared asset collection is unique (today) to just *1* system in the family.

Shifting perspective from *reuse-is-an-event* on individual products to *sharing-is-a-journey* for the entire product line portfolio makes it easier to see how much of the engineering effort over time is shared, as well as how the effort is distributed and amortized across the entire product family.

What to Do?

The contrasting reuse perspectives has put the PLE industry into a bit of a quandary. Reusing systems and software engineering assets is always the best candidate for discontinuous engineering improvements that lead to discontinuous business benefits. However, the r*euse-is-an-event* approaches to PLE that seem obvious don't work, while the *sharing-is-a-journey* approaches to PLE that do work aren't obvious.

There's no simple answer to get us out of this quandary, other than to educate. We must all become mentors to promulgate these ideas within our organizations and industries, and to create new mentors who can do the same.

Presentation

The Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) promotes cooperation among the Armed Services, Industry, Academia and various Government agencies in pursuit of improved training and education programs, identification of common training issues and development of multiservice programs.

Dr. Charles Krueger, BigLever CEO, will join Dr. Jeremy Lanman & Brian Kemper, U.S. Army PEO STRI, and Jorge Rivera, General Dynamics C4 Systems, to co-present a session entitled *Employing Second Generation Software Product Line Engineering for Live Training Transformation.*

Interservice/Industry Training, Simulation and Education Conference (I/ITSEC)
November 28 - December 1, 2011
Orlando, Florida

■ BigLever Software at SPLC 2011

At this year's International Software Product Line Conference, Dr. Charles Krueger will present an in-depth half-day tutorial on August 26th spotlighting "*Industry Trends in Systems and Software Product Line Engineering."*

SPLC attendees can learn more about the BigLever Gears Systems and Software Product Line Lifecycle Framework during the demonstration sessions scheduled for August 23rd. As an SPLC 2011 Gold Sponsor, BigLever will also be providing Gears demonstrations at the BigLever booth.

15th International Software Product Line Conference (SPLC 2011)
August 22 - 26, 2011
Munich, Germany

■ About BigLever Software

Best Regards,

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Note: Dr. Krueger was recently invited to provide a Guest View article regarding this topic for *SD Times*.

>> See *SD Times* article.

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BigLever Software, Inc.^{TM} is the leading provider of systems and software product line engineering framework, tools and services. BigLever's patented Gears^{TM} solution enables organizations to reduce development costs and bring new product line features and products to market faster, enabling businesses to more reliably target and hit strategic market windows.

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