Product Line Engineering Takes Off in the Aerospace and Defense Sector

Greetings from Dr. Paul Clements:

The aerospace and defense (A&D) sector comprises companies and organizations that make and procure defense products, aircraft, spacecraft, and related systems. One of the most challenging application domains in all of engineering, A&D systems are often at the cutting edge of technology with stringent and challenging requirements. Many of the systems are safety-critical, with exacting certification procedures attached.

Conventional wisdom seems to be that product line engineering (PLE) is a poor fit with systems like these. For example, it is said, certification and testing constitute the bulk of development cost, and each system must be tested and certified independently. Thus, PLE cannot significantly reduce the cost of development.

Conventional wisdom seems especially harsh on PLE in the context of Department of Defense procurement programs. Detractors argue that the PLE payoff is too far in the future, outlasting the appointed tenure of any acquisition official who, to adopt PLE, must choose to absorb the up-front cost on his watch so that his successor can enjoy the benefits. Another argument holds that no Program Office will spend its acquisition dollars to build generalized shared assets that can be used in other programs.

We are now seeing case after case where conventional wisdom is shown to be out of step with reality. They give lie to the belief that there is no alternative to acquisition business as usual and show that PLE can bring, and is bringing, its proven benefits to Program Offices as well as contractors.

PLE Deployments in the A&D Sector

In one instance, the U.S. Navy's Program Executive Office for Integrated Warfare Systems (PEO IWS) has been encouraging commonality and asset sharing among the command and control systems for a number of its surface warfare combatants. This has created a mutually beneficial synergy between the DoD and its contractors. DoD's goal is to avoid vendor lock-in, which often comes about when suppliers offer proprietary one-off solutions, and to decrease cost and increase the quality of the

About this Newsletter

As BigLever Software's Vice President of Customer Success, Dr. Paul Clements helps BigLever customers understand and apply the latest product line engineering (PLE) approaches, create optimized deployment plans, and establish successful ongoing PLE practices.

In this From the PLE Frontline newsletter issue, Dr. Clements shares his unique insights, observations, and important lessons learned from interactions and collaboration with customers.

We appreciate your interest and welcome your feedback regarding your organization's PLE challenges and issues.

PLE in A&D Video

For a more in-depth look at PLE in the Aerospace & Defense sector, view BigLever's latest video: *Second Generation Product Line Engineering Takes Off in Aerospace and Defense.*

This newly released video, narrated by Dr. Clements, provides a view into the history of PLE in A&D, as well as an overview of the latest, new generation PLE methods being employed by Department of Defense contractors and Program Offices.

>> See PLE in A&D video.

CrossTalk Article

Earlier this year, BigLever Software

deliverables it acquires.

Lockheed Martin, the prime contractor for the AEGIS Weapon System, adopted PLE as the strategy to maximize their competitiveness in this new open-acquisition context. Using BigLever Software's Gears PLE solution to manage the key assets for this critically important multi-million-LOC system, Lockheed Martin has reported cost avoidance of over $139 million in the last three years, with new data trending towards a 40% to 60% reduction in test cases needed, all compared with the old clone-and-own approach. When the Coast Guard joined the AEGIS family with their National Security Cutter, they were able to produce their requirements in two weeks instead of the expected four months. And now that AEGIS has joined the navies of key US allies, Lockheed Martin uses the feature-based configuration capability of Gears to provide documented (and automated) traceability from features to delivered products, to ensure demonstrable compliance with stringent export control restrictions.

Lockheed Martin, along with the Navy, Coast Guard, and Missile Defense Agency, have developed a rich and effective governance system in which these stakeholders work together to provide a mutually beneficial evolution path for AEGIS. The governance framework for AEGIS is a showcase for product line providers working with product line customers to maximize PLE benefits for all.

In another instance, the U.S. Army's Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI) has been a long-time champion of product line approaches for its training and simulation systems. These training systems represent a $50 billion investment by the Army in state-of-the-art combat training for its warfighters and their commanders. In 2010, the PEO STRI issued the DoD's first Request for Proposals that specifically mandated a PLE solution. This contract for the family of systems known as Live Training Transformation (LT2) was won by General Dynamics, who teamed with BigLever to provide the winning solution.

Maximizing asset sharing has reduced fielding time and minimized programmatic costs, while enhancing training benefits afforded to the soldier. The LT2 product line architecture, standards, assets, and common operating environment have been used by more than 16 major live training programs with more than 200 systems fielded for the Army, Marines, and Air Force. So far, PLE is credited by the Army and General Dynamics with generating over $300M in cost avoidance – and is projected to save another $200M over the next two to five years.

Other A&D organizations are stepping up. BigLever's Gears solution is in use or is currently being evaluated by many of the top ten U.S. defense contractors. It is also the centerpiece of an enterprise-wide transformation by one of the world's leading suppliers of avionics systems as it adopts PLE to achieve marketplace competitiveness.

What's behind these success stories?

collaborated with Lockheed Martin and General Dynamics to published an article in *CrossTalk: The Journal of Defense Software Engineering* that highlights the Navy's AEGIS and Army's Live Training Transformation product lines.

>> See CrossTalk article.

■ Case Studies Spolighted at SPLC 2014

The latest PLE advances in the A&D sector were also spotlighted in two case study presentations at this year's International Software Product Line Conference (SPLC 2014):

Lessons from AEGIS: Organizational and Governance Aspects of a Major Product Line in a Multi-Program Environment

This case study tells the full story of how the AEGIS Weapon Systems product line evolved from a series of standalone software programs into a true systems and software product line – with a focus on the strong internal and external governance of the product line.

>> See AEGIS case study.

A Methodical Approach to Product Line Adoption

This case study provides insight into how General Dynamics and the U.S. Army's Live Training Transformation (LT2) product line team applied a methodical approach to product line adoption across the engineering organization and successfully employed second generation PLE processes.

PLE's maturation into a repeatable, automation-based paradigm is bringing about time, cost, and quality benefits that are too significant to ignore. Specifically:

- Features are the "lingua franca" of variation and product selection. Products are described by the features they provide, rather than the component parts they comprise. This provides a common language for managing variation across all facets of the product line.

- Artifacts across the entire lifecycle – requirements, design, implementation, test, and more – are treated consistently; variation in the artifacts (to support variation in the products they support) is expressed in the same way.

- High-quality automation – in this case, Gears – is at the center of a production line, to quickly turn a "bill of features" for a product into a set of instantiated lifecycle assets.

- Multi-organizational engineering is taken in stride, by providing feature model concepts such as imported (hierarchical) production lines, to reflect the structure of engineering activities and domain knowledge present in an ultra-large organization.

At BigLever, we see these PLE advances in A&D opening the door for PLE in other industry sectors as well. If PLE can bring about successes like the ones we've mentioned in what is arguably the most challenging application domain, it's hard to imagine an industry where it wouldn't thrive. Every organization, no matter the sector, needs the substantially increased quality, lower cost, and faster time to deployment that PLE is proven to bring.

Best Regards,

Dr. Paul Clements
BigLever Software Vice President of Customer Success
pclements@biglever.com

Don't miss your Newsletter!
Please help us make sure that you continue to receive the BigLever Newsletter by confirming your subscription with us. This ensures that future newsletters will be successfully delivered to your Inbox and not misplaced into your junk mail or spam folder. To confirm, simply click the "confirm" link in the white bar below. After confirming, you can unsubscribe from our newsletter distribution at any time.

PLE Deployments in Other Industry Sectors

In addition to A&D, PLE is experiencing significant growth in a variety of industry sectors including automotive, aviation systems, alternative energy, e-commerce, computer systems, and more.

BigLever has played an instrumental role in a spectrum of notable PLE deployments, working in collaboration with the world's largest product engineering organizations to deliver highly complex, mega-scale product lines.

BigLever's customer engagements also include medium to small enterprises that face product line engineering complexity issues.

About BigLever

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.

BigLever Software, Inc.
10500 Laurel Hill Cove
Austin, TX 78730
www.biglever.com
+1-512-777-9552
info@biglever.com