INCOSE
INSIGHT Practitioners Magazine

Volume 24 Issue 1

It is our pleasure to announce the April 2021 *INSIGHT* issue published cooperatively with John Wiley & Sons as the systems engineering practitioners' magazine. The *INSIGHT* mission is providing informative articles on advancing the systems engineering practice and to close the gap between practice and the state of the art as advanced by Systems Engineering, the Journal of INCOSE also published by Wiley. The issue theme is product line engineering in context. We thank theme editor Drew Stovall, the Product Line Engineering International Working Group, and the authors for their contributions.

Paul Clements begins with "Temporal Management in Feature-Based Product Line Engineering." Clements presents an approach for handling the *temporal dimension* of product line engineering (PLE)— managing artifacts as they change and evolve. The approach relies on a proven traditional change control technique foundation but shows how they apply in the feature-based product line engineering context.

John Wood and Glenn Tolentino address "Product Line Re-Engineering for Modularity in a US Department of Defense Project." Their case study details the options evaluated and the path chosen by a software development organization to re-engineer four existing products with common features into a single product-line resulting in product sponsors taking advantage of cost savings, developers shortening implementation and testing timeframes, and users obtaining product features faster while sharing a common experience across product variants. Although they originally envisioned the software-intensive products to be a product line operating from a common code repository, they diverged due to different product sponsors having differing priorities and schedule commitments. The evaluated re-engineering options included merging common code and maintaining it in a single repository, re-using software code while keeping it in separate repositories for each product variant, and pursuing a modular open systems approach (MOSA) to create common modules that could insert, update, replace, and so forth within any product variant without disrupting the remaining product.

Clements next addresses "Funding the PLE Factory in a Multi-Customer Contract-Based PLE Organization." Feature-Based product line engineering employs the *PLE factory* concept, in which all development occurs for any products in a product line. Automatically configuring shared assets based on the feature choices for a product produces individual products. A product line organization's personnel need to carry out tasks associated with creating, developing, delivering, and evolving products in its product line. Any organization employing this paradigm in a contract-based (as opposed to a mass market) context must answer the question: who pays for the work

going on inside the factory that may benefit multiple contracts? The answer can be surprisingly complex, involving security, regulatory compliance, and intellectual property protection issues of both the PLE organization and its customers. This report offers a method for answering “Who pays for the activities in the PLE Factory?” Answering this question means establishing processes culminating with creating charge numbers to which everyone working in the PLE Factory can charge their effort. These processes must connect the funding supply to the funding consumption in a fair and equitable way that complies with applicable rules and regulations.

Evan Helmeid addresses “Development of a Hybrid Product Breakdown Structure and Variability Model.” Transforming from a project-based engineering approach to a product line engineering approach requires supporting the engineering teams throughout the transition with evolving tools and methodologies. However, a traditional product breakdown structure (PBS) format provides insufficient detail and structure. The author developed a hybrid PBS-variability model (VM) using standard desktop software, combining the familiar PBS structure with variability modeling aspects based on feature modeling and decision modeling approaches, resulting in an engineering artifact recognizable as a PBS and easy to adapt to design evolution, yet sufficiently expansive to characterize initial variability.

Thomas Froment and Guillaume Angier de Loheac take on “The Convergence of Struggles! Reusability Assessment of Inner-Source Components for Product Lines.” Inner source establishes open source-like collaborations within an organization. Product line engineering is the approach for engineering a related product portfolio in an efficient manner, taking advantage of products’ similarities while managing their differences. These two approaches propose smart techniques for reuse but use different terminology to refer to equivalent concepts, which can badly affect project performance when evolving in a multi-domain context. This paper shows it is possible to build a common way to assess the components (also called building blocks) contributing to a product line, thanks to a process to determine the component maturity level using the *similarity* approach. The authors introduce the inner sourcing process maturity level (ISPML) as a simple engineering practice for multi-domain organizations to better determine whether sharing an engineering asset is favorable or not.

Guillermo Chalé Góngora, Pierre-Olivier Robic, and Danilo Beuche address the topic of “Product Line Engineering for Digital Product-Services.” Digitizing the value chain brings along new business opportunities to organizations wishing to adopt a service-oriented approach but incurring implementation challenges. The authors present a conceptual framework to define a high-level strategy to implement a product-service offer in an organization. The distinctive framework aspects include the product-service product line (PSPL) concept, that is a product line of product-services, the elements to define the PSPL business model, a product-service typology, and a product line engineering method extension for architecting the PSPL, notably, a specific service building block

type supporting a composable design approach and a feature model including service-related, socio-technical features.

The final article by William Bolander and Paul Clements, “Key Issues of Organizational Structure and Processes with Feature-Based Product Line Engineering,” describes the transformation organizations should undertake to standup feature-based PLE based on the factory concept. The authors introduce the few roles without analog in other development disciplines but that are new to feature-based PLE. They also describe how traditional systems engineering roles doing traditional systems engineering tasks but with slight PLE-inspired extensions carry out other factory roles.

The entire issue of *INSIGHT* Volume 24, No. 1 is now available for viewing in the INCOSE Connect Library INSIGHT Practitioners Magazine. (Login required)