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onePLE: Delivering Product Line Engineering Capability to Your Organization

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Product line engineering (PLE) is delivering higher return on investment than any other systems or software engineering discipline in use today. Organizations using PLE are enjoying discontinuous jumps in competitiveness, provided through whole-integer factors of improvement in product time to market, engineering staff productivity, portfolio scalability, product quality, and more. BigLever's onePLE provides you with everything your organization needs to successfully adopt and succeed with product line engineering.

The name **onePLE** comes from the idea that we provide a *single* deliverable to your organization: A *successful product line engineering capability*.

1. Introduction

BigLever's experience in bringing PLE success to product engineering organizations is unmatched in the industry. Our customers include the largest companies in automotive, aerospace, defense, aviation, e-commerce, and other industry sectors. This experience has enabled us to create a robust, repeatable path to success called **onePLE™**.

The name **onePLE** comes from the idea that we provide a *single* deliverable to your organization: *A successful product line engineering capability*. BigLever provides the organizational change expertise, services, body of knowledge, training and mentoring, and technology necessary to achieve that success — *all in a single package*.

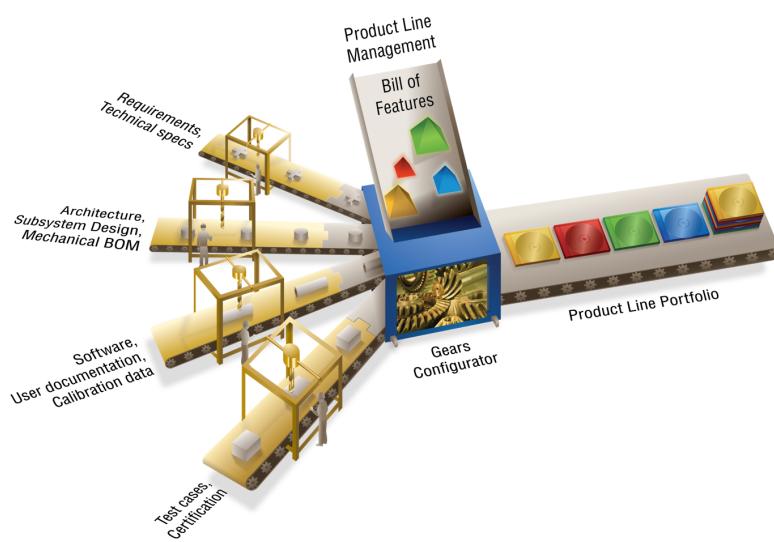


Figure 1: The product line factory

2. Feature-based PLE and the PLE Factory

Figure 1 illustrates the PLE Factory concept that underpins BigLever's industry-leading approach to successful PLE. Shared assets (the engineering artifacts used to develop, sustain, and operate your products) come in to the factory from the left.

Figure 1 shows examples, but these can be any artifacts you use to develop, deploy, maintain, and/or operate your products. A configurator (BigLever's Gears™ PLE Framework) produces product-specific instantiations of the shared assets according to a feature-based description of the product (a Bill-of-Features™) that Figure 1 shows entering the PLE factory in from the top.

Figure 1 shows the proven technical approach, known in the industry as Feature-based Systems and Software Product Line Engineering (“Feature-based PLE”) utilized by all of BigLever’s customers.

Under the Feature-based PLE approach, organizations can engineer an entire product line portfolio as a single production system rather than a multitude of products. With this innovative “single system” capability, a product line can be developed, evolved and managed, smoothly and efficiently, through each lifecycle stage – from requirements to design, implementation, testing, delivery, maintenance and evolution.

The Gears PLE Framework provides a set of industry-standard PLE concepts and constructs that augment existing tools, assets and processes across the entire lifecycle:

- A feature model used to express the feature diversity (optional and varying feature choices) among the products in your product line.
- A uniform variation point mechanism that is available directly within existing tools and their associated assets, to manage feature-based variations in all stages of the engineering lifecycle.
- A product configurator for automatically assembling and configuring assets and their variation points – based on the feature selections made in the feature model – for producing all of the assets for each product within a product line with the push of a single button.

Gears provides a unique "console" – the Gears Development Environment – for managing the portfolio-specific facets of systems and software development including a powerful collection of browsers, views, languages, constraints, editors, dashboards, wizards, and analytical tools.

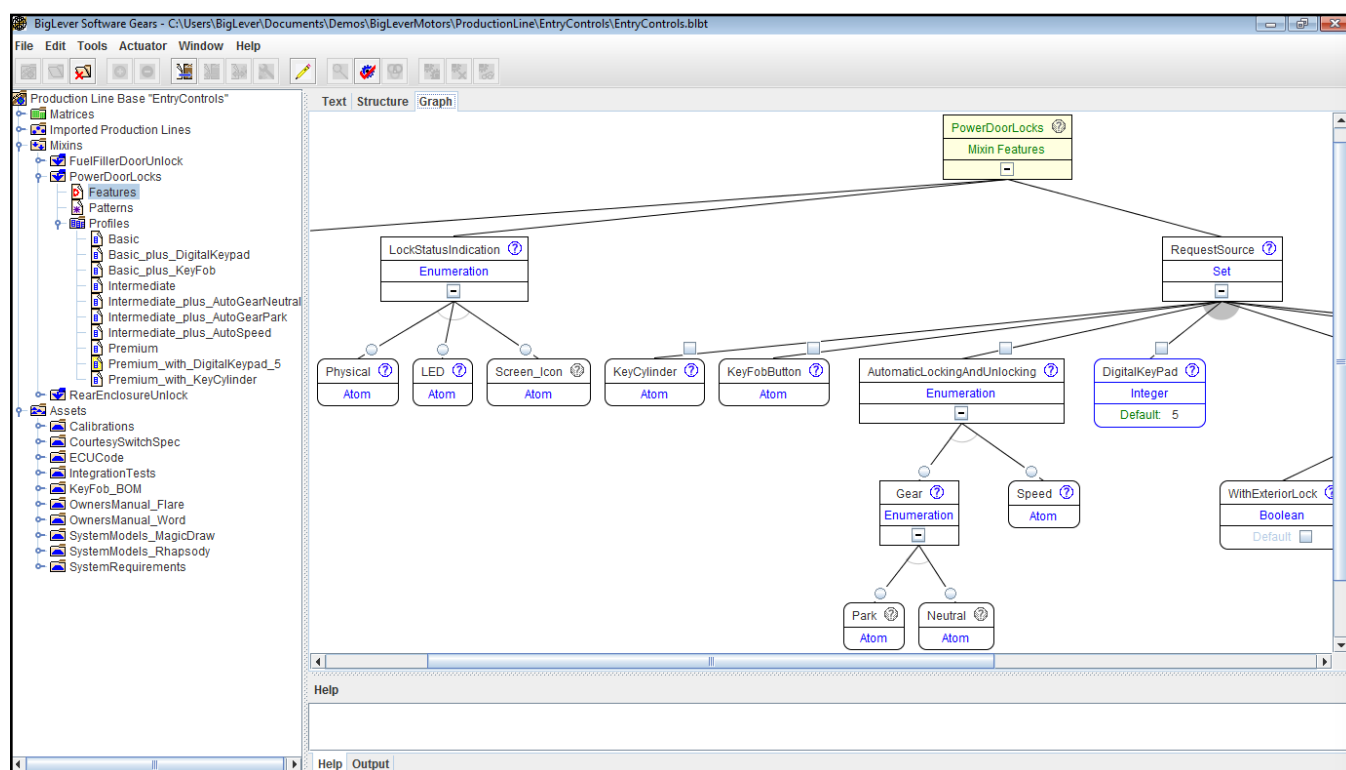


Figure 2. Gears Development Environment

3. PLE and Organizational Change

PLE cannot be applied by individuals alone, but must be embraced by whole teams, projects, and organizations.

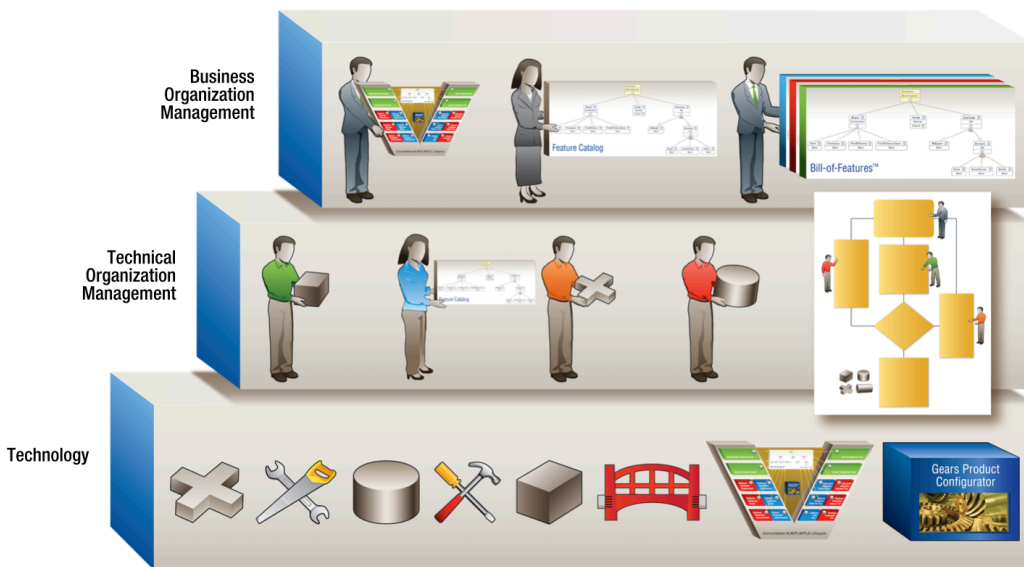
PLE cannot be achieved with tooling alone, but must be part of a business strategy sponsored by executive leadership.

While the PLE Factory plays the central role in the PLE story, it is only one part of a larger picture. Unlike other technical disciplines, PLE cannot be applied by individuals alone, but must be embraced by whole teams, projects, and organizations. PLE cannot be achieved with tooling alone, but must be part of a business strategy sponsored by executive leadership. Just as these things are true of actual manufacturing factories, they are true for PLE Factories.

Adopting PLE by your organization means moving your organization to the PLE factory paradigm for the creation, production, and evolution of the products in their portfolio. A full picture of PLE adoption includes:

- A Business Organization Management layer, driven by executive leadership, that focuses on the people, roles, and processes that utilize and leverage the PLE Factory to achieve the business objectives of the enterprise, as well as on the required processes for enterprise leadership to establish the PLE Factory, and to provide the necessary support for the PLE Factory during its operation.

Using the analogy to a conventional factory, the Business Organizations tier provides guidance and support for the executive leadership working in the office high-rise that overlooks the factory.



- Technical Organization Management, which focuses on the people, roles, and processes that operate the PLE factory. In combination with a technological infrastructure, this provides a fully operational Feature-based PLE Factory capable of producing the System Asset Instances for all of the products in a product line portfolio.
- Technology that puts in place and maintains the tool and technology environment to operate the PLE Factory. Think of this as the fully functional factory but without any of the people inside to run the factory.

Figure 3: BigLever's 3-Tiered PLE Methodology showing the three concerns that must be addressed in any PLE adoption: business, organization, and technology

These three aspects of successful PLE adoption (as well as steady state PLE factory operation) are reflected in BigLever's 3-Tiered PLE Methodology, shown in Figure 3.

4. Getting Started

The first steps of BigLever's **onePLE** are a pair of intense hands-on working events, facilitated by BigLever experts, typically two to three days in duration:

- **The Technical Getting Started Workshop** entails the interactive creation of a pilot project that illustrates product line concepts in your application domain and organizational context. This provides input to executives and organizational managers as to the feasibility of the technological approach, and enables your technical leadership to weigh in on the advantages and issues associated with the PLE factory approach in your organization's own context.

The Technical and Business Getting Started Workshops constitute your organization's first **onePLE** adoption spiral. Subsequent spirals will build on these early iterations, and continue to stand up, fund, staff, and then operate the factory to produce products.

Your organization can take the journey to PLE in small steps that you can absorb without disrupting ongoing production. Each step brings benefit and leaves you better off than before.

The primary outcome will be one or more production lines that satisfy your product line needs, with feature models that correspond to your products and shared assets configured to support them. Another important outcome is the knowledge and hands-on experience you will gain with advanced product line strategies and techniques, as well as specific knowledge applicable to your situation and context.

- **The Business Getting Started Workshop** is the business-oriented analog to the Technical Getting Started Workshop. It gathers your organization's business leaders and product and project managers to produce the first iterations of the:
 - **Living business plan.** This seven-part plan is created, owned, and carried out by executive leadership. It establishes your organization's precise need, importance, and urgency for adopting PLE. It lays out unambiguously who owns the problem that PLE is intended to solve, and the intended scope of the PLE solution.
- The business plan also makes clear what investment is needed for successful adoption, and the payoff that investment can be expected to bring. The business plan provides the ongoing means for your executive leadership to not just endorse PLE as a corporate direction, but the means to drive, fund, and own its adoption.
- **PLE Concept of Operations.** The PLE Concept of Operations is the "operating manual" for your PLE factory on a day-to-day basis. Activities include "steady state" activities for a product line that is up and running, along with definitions of the role and responsibilities for those staffing the PLE Factory as well as the leadership overseeing it.

- **Spiral adoption plan.** Your transition to PLE will not happen overnight or in one massive shift. BigLever's approach to PLE transition, provided through **onePLE**, is highly incremental. Your organization can take the journey to PLE in small steps that you can absorb without disrupting ongoing production.

Nevertheless, each step brings benefit and leaves you better off than before, and closer to the goal of full PLE capability. To facilitate incremental transition planning, we employ a spiral model of adoption, illustrated in Figure 4. Spiral models chart an incremental path through various areas of activity.

With the completion of each cycle, your organization is further along its adoption journey (as measured by the distance from the origin point at the center). Progress is steady, but no cycle overwhelms your ability to absorb new practices and processes. The quadrants capture activities corresponding to each of the layers described in Section 3, plus a quadrant devoted to spiral planning itself.

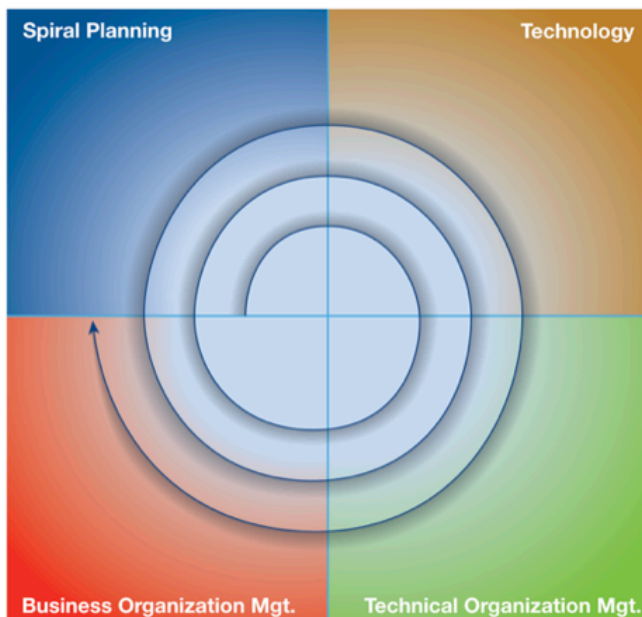


Figure 4: BigLever's spiral model for PLE adoption

5. Establishing and Operating a PLE Center of Excellence

Organizations applying PLE in multiple parts of the enterprise (for example, across business units or on multiple product lines) gain important benefits from centralizing the production and maintenance of their body of PLE material and knowledge. Applying the most fundamental of PLE's tenets, sharing these materials — and equally

importantly, the knowledge and experience they embody — is key to accelerating the PLE transition across the three tiers (as discussed in section 3).

Re-inventing these foundational elements within each part of the organization can result in the loss of vital insights and knowledge. And, it can greatly impede the organization's PLE transition momentum by creating repetitive, low-value work and duplication — the antithesis of PLE.

Serving as the focal point of this sharing is the role of a *Product Line Engineering Center of Excellence (COE)*. A PLE Center of Excellence assists the overall organization, and supports individual PLE efforts, by imparting consistent and high-quality material, assisting and helping to carry out activities with skill based on experience — while drastically reducing the amount of re-discovery, false starts, re-work, and duplication that would otherwise occur across the various PLE projects. As part of **one**-PLE, BigLever will help your organization establish and operate a PLE Center of Excellence so that you can efficiently scale your PLE journey, and accelerate your transition, across your entire organization¹.

Powering an organization's PLE Center of Excellence is BigLever's Body of Knowledge.

6. Body of Knowledge for Feature-based PLE

BigLever's unmatched experience in PLE has allowed us to create an industry first: A comprehensive body of PLE knowledge structured and available on-line for use throughout your organization under **one**PLE.

The Body of Knowledge contains detailed process descriptions for every aspect of Feature-based PLE, including all of the activities involved in establishing and operating your PLE Factory:

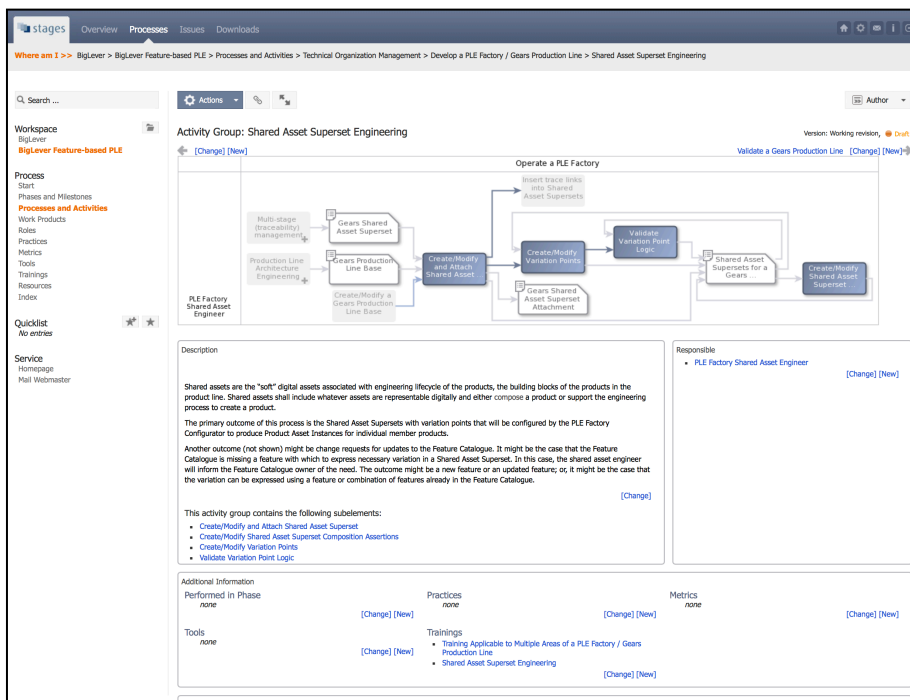


Figure 5: A Body of Knowledge page showing the process description for Shared Asset Superset Engineering.

- producing your Living Business Plan and Spiral Adoption Plan,
- establishing and managing the PLE Factory,
- establishing the right organizational structure for the PLE Factory,
- building a Feature Catalog and Bills-of-Features for your product line,
- engineering shared asset supersets with variation points and traceability,
- using the PLE Factory to build and deliver products,
- managing change and product line temporal evolution,
- ensuring IP protection and operating the PLE Factory in a classified environment,
- funding policies for the PLE Factory,
- defining PLE metrics and measures, and much more.

¹ For organizations with fewer PLE groups, or even a single one, a single individual can take the role of a Center of Excellence.

Anyone in your organization can go to the Body of Knowledge, look up their role, determine its definition and the processes and activities for which they are responsible, and then undertake associated training.

The training materials offered by the Body of Knowledge include an inventory of specialized courses, best practices compendia, Quick Reference Guides, slide presentations, detailed how-to videos, white papers, and more.

7. Conclusion

BigLever's **onePLE** is an all-inclusive packaged offering for PLE success to an organization. It is available for organizations of any scale: an entire company, a division, a business unit, or the organization responsible for the production of a single product line.

For one fixed price, **onePLE** includes:

- A license for Gears and its integration bridges for each member of the organization who needs it.
- The Getting Started Workshops described in Section 5, facilitated by BigLever experts, to establish your PLE Factory and launch your PLE journey.
- Full access to BigLever's Body of Knowledge for Feature-based Product Line Engineering.

The result is the shortest-path solution to PLE self-sufficiency and success.

For more information about **onePLE** or to get started, contact: sales@biglever.com.