Product Line Engineering for Systems and Software

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BigLever at a Glance

- **Industry leader** in Systems and Software Product Line Engineering (PLE) tools and services
  - 12 years of commercial practice with Gears™ technology and methods
  - Strategic partner of IBM Rational

- **Industry standard** PLE framework, tools and methodology
  - BigLever Gears PLE Tool and Lifecycle Framework™ and industry-wide integrations
  - BigLever 3-Tiered PLE Methodology™

- **Proven success** in large-scale PLE deployments
Proven Industry-leading Success in PLE

- World’s #1 auto-maker*
- World’s #1 defense contractor
- World’s #1 product engineering company
- World’s #1 online vacation home rental* company
- World’s #1 military training system family*
- World’s #2 data storage company*

*Software Product Line Hall of Fame

Integrated weapons system for 100 ships

With Gears...
Entire family managed with a single set of requirements and a single set of source code.

Coast Guard produced new cutter spec in 2 weeks compared to 3-4 months
Engenio Storage Division:
High-end server storage OEM for IBM, Teradata, Oracle, SGI, and more

- Software Product Line Hall of Fame
- 300 product line engineers
- Over 250K installed systems, worth over $12B

With Gears...

2x-5x improvements in scalability, productivity, time-to-market, and product quality

Wind turbine control systems customized to optimize performance based on wind speed, temperature and other environmental factors

With Gears...

90% reduction in development time
25% reduction in development costs
Live Training Transformation (LT2) training systems for US Army

General Dynamics teamed with BigLever to create the winning proposal for the US Army Live Training Transformation “Consolidated Product-line Management”.

With Gears...

US Army projects $580 million cost avoidance over 12 years and 150 deployments.

Worldwide leader for online vacation home rentals

- Software Product Line Hall of Fame
- 50 million users
- 130,000 properties in 100 countries
- $20B in travel bookings

200 different product instances engineered and hosted using BigLever’s Gears and PLE methods.

Product line was up and running **60 days** after they started using Gears.
General Motors
Mega-scale Product Line Engineering

- Largest product line and one of the most complex systems and software product line engineering challenges in the world.
  - 3000 product line engineers
  - 300 hierarchical subsystems
  - Thousands of variant features
  - Millions of product instances
  - Tens of thousands of unique product variants
  - Product line and feature set evolves annually
  - 15 concurrent temporal development streams
  - Dramatic increase in product line variation and subsystem interactions due to new propulsion systems, active safety, infotainment, and more

An Efficient Means of Production for Systems and Software Product Lines
Shared assets are like the factory’s supply chain.

Features describe capabilities that vary among products.

- Feature Catalog
  - Driven by Marketing, modeled by Feature Engineering

- Bill-of-Features
  - Driven by Portfolio, modeled by Product Engineering
**Assets** are configured according to the **feature profiles** of the products you want to build.

Features come in.

A **product** comes out.

Assets are configured.

Just like a factory.
This is a move away from the traditional product-centric development silos.

With traditional approaches there maybe some reuse among products, but it’s usually not systematic.

Can I copy your requirements document? Sure.
With traditional approaches there maybe some reuse among products, but it’s usually not systematic.

Can I borrow your source code?

OK.

This doesn’t scale very well.

Can I borrow your source code?

May I copy your project budget?

I want to borrow your project's object framework.

I'd like to look at your test cases.

May I copy your users manual?

Did you put that new feature in yet?

May I copy your security layer?

Can I use the build script you wrote?

I want to use your sequence diagrams.

Do these test cases include the new feature?

Can I use your concepts overview?

May I copy your requirements document?
Suppose Product B has a defect. Suppose it came from Product B’s requirements.

Team B can fix product B.
However...

Huh? What is?

We originally copied ours from Product A. It’s A’s fault.

Wait! Didn’t I copy my requirements from you?

I copied my source code from them!

The communication and coordination that has to occur for a portfolio of N products is proportional to $N^2$.
The Challenge of Product Line Engineering: Harnessing Complexity

Processes, tools and techniques cannot overcome the exponential complexity.

A new approach is required...

Gears PLE Lifecycle Framework and Rational SSE
Synchronous concerns in a PLE Solution

- **Multi-product.** Feature-based variation management and automated production line
- **Multi-phase.** Product line lifecycle assets, architecture and traceability
- **Multi-baseline.** Product line change management and baseline management
PLE Multi-product Solution

Example Gears Product Family Tree with Feature Models and Feature Profiles

Feature Downselection, Selection, and Inheritance
Temporal CM Management

The BigLever 3-Tiered PLE Methodology

Feature-based Portfolio Management

Feature-based Asset Engineering

Feature-based Variation Management and Automated Production
Benefits of PLE

- **Economy of Scale from Automated Production**
  - Increase in the scope of product diversity
  - Increase in the scale of different products delivered and maintained

- **Cost Savings from Efficiency and Productivity**
  - Increase in productivity and efficiency
  - Reduction in per-product development cost and overhead
  - Higher profit margins

- **Faster Profits from Faster Time to Market**
  - Reduction in time-to-market for new and updated products
  - Increased agility to react to new opportunities and changing markets

- **Better Products from Better Quality**
  - Increase in customer-perceived product quality
  - Reduction in defect density
  - Improved risk management
IBM Rational Solutions in BigLever's PLE Ecosystem

Example Integrations and Bridges

- DOORS
- Rhapsody
- Quality Manager
- Team Concert
- ClearCase
- Synergy
- Visual Studio
- Enterprise Architect
- Word
- Excel
- Perforce
- Dimensions CM
- Eclipse
- CVS
- Subversion
- Windows file system
- Linux file system
- Solaris file system
- Mac OS X file system
Services for Success

*Industry Leading Experience and Expertise*

- **Getting Started** Package (recommended first step)
  - Intense, accelerated, hands-on pilot project
  - 3-days onsite, half-day prep, half-day post
  - $5,000 (a $10,000 value). Refundable if not 100% satisfied.

- **PLE Deployment Mentoring**
  - Adoption Strategy Workshop
  - Production Line Architecture Workshop
  - PLE Feature Modeling Workshops
  - PLE Asset Engineering Workshops
  - Training Courses

The New Frontier for

*Systems and Software Product Line Engineering*
Learn More

- Gain hands-on experience
  - www.biglever.com/learn/evaluations.html
  - Customer-recommended favorite: Getting Started Package

- Sign up for BigLever Software technical newsletter
  - www.biglever.com/learn/newsletters.html

- Read our white papers, case studies and articles
  - www.biglever.com/learn/resources.html

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