Systems and Software
Product Line Engineering
with the DOORS/Gears Bridge

DOORS Day
Montreal Canada
September 9, 2010

Glenn Meter, VP of Engineering
BigLever Software
Agenda

• Systems and Software Product Lines (SPL)
• Gears SPL Framework and Methodology
• DOORS/Gears Bridge Demo
BigLever at a Glance

• Industry leader in Systems and Software Product Line engineering tools and services
  - 9 years of commercial practice with Gears™ technology and methods
  - Strategic partner of IBM Rational

• Proven success
  - BigLever customer case studies illustrate successful transitions
    • Large-scale deployments: Lockheed Martin, General Dynamics, General Motors, ...
  - Best ROI metrics in the industry
Systems and Software Product Lines

- The **key to business** success depends on the infusion of new ideas about how products and systems are brought to market.

- To achieve this goal, today's product development organizations must deliver a **product line**
  - A portfolio of similar products or systems with **variations in features and functions**
  - Not just an individual product or system
Product Lines and Profitability

• Companies need **economy of scale** in their product lines

• In manufacturing, **greater profitability** is achieved by investing in an **efficient means of production** – manufacturing infrastructure and shared product assets – that can be used to deploy different “flavors” of a product

• As product differentiation and innovation move from the physical attributes to software-based features, the need for an efficient means of production for **systems and software product lines** has become universal
An Efficient Means of Production for Systems and Software Product Lines
Overview of Systems and Software Product Line Engineering and Delivery
Systems and Software
Product Line Engineering and Delivery

• Systems and software product line (SPL) engineering and delivery has emerged as a new approach that
  - provides an **efficient means of production** for systems and software product lines
  - supports the **full** product line development and delivery **lifecycle**
Complexity of Product-centric Thinking Impedes Portfolio Production

Order $N^2$ Complexity

“Vertical” Product Perspective
The Challenge of Product Line Engineering: Harnessing Complexity

- Processes, tools and techniques cannot overcome the exponential complexity
- A new approach is required...
Shift in Perspective: Efficient Means of Production

Feature-based Abstraction

Requirements Engineers

Architects

Developers

Quality Assurance

Reusable SPL Assets

Profile A

Feature Profiles

Gears Product Configurator

Key

Variation Points

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Shift in Perspective: Efficient Means of Production

Feature-based Abstraction

Product Line Management

Profile A

Feature Profiles

Simplicity of a Single Automated Production Line

Requirements

Testing

Design Models

Source Code

Gears Product Configurator

Reusable SPL Assets

Requirements

Test Cases

Product A

Product B

Product N

“Horizontal” Core Asset Perspective

Key

Variation Points

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Benefits of a Software Production Line

• **Economy of Scale from Automated Production**
  - Increase in the scope of product diversity
  - Increase in the scale of different products effectively 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 market conditions

• **Better Products from Better Quality**
  - Increase in customer-perceived product quality
  - Reduction in defect density
  - Improved risk management
2nd Generation SPL Approach
Multiple Dimensions in a 2G SPL Solution

- Synchronous concerns: multi-product, multi-phase, multi-baseline
  - *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
The BigLever 3-Tiered SPL Methodology

**Leverage. Feature Based SPL Management**

Business-wide management of portfolio by features rather than by products leads to optimized:
- Scalability
- Time-to-Market

**Simplify. SPL Asset Focused Development**

High levels of reuse, deep asset expertise, stable organization structure leads to optimized:
- Quality

**Consolidate. Variation Management & Automated Production**

Eliminating duplication, divergence, merging, manual variation techniques, lifecycle silos, and manual production leads to optimized:
- Productivity and Cost
Minimally Invasive Transitions to SPL Practice

- Start with what you’ve got
- Use an **incremental transition** strategy
- Create a **pilot as the catalyst** for change
- Stage transition to be **non-disruptive** to production schedules
BigLever Software Tools and Services
What We Offer

• Gears™
  - Software product line engineering tool & framework
  - Powerful patented technology
  - Industry leading
  - Award winning

• Bridge integrations
  - Rhapsody/Gears Bridge
  - DOORS/Gears Bridge
  - Eclipse Plugin
  - Universal Configuration Management Bridge
  - Rational Quality Manager/Gears Bridge
  - Methodology integrations: Focal Point, Publishing Engine, Team Concert, ...

• The industry’s most innovative software product line services
SPL Requirements Engineering
with the DOORS/Gears Bridge
Early Generation SPL
Requirements Engineering for Product Lines

• Early generation product-centric approaches lead to exponential complexity
  - Clone-and-own (and requirements branching)
    • For each new product, make a copy of requirements and modify
    • Optionally add links to track commonality and variations
    • Leads to expensive duplication, divergence and merging
  - Attributes, links, scripting
    • Tag each requirement with one or more attributes about product diversity
    • Leads to high overhead
      - Major effort to define and implement attributes, dictionaries, semantics, schemas, scripts and filters
      - Labor intensive to revisit all requirements and attributes during maintenance and portfolio extension
  - One-size-fits-all
    • Write the portfolio variations and diversity directly into the requirements text
    • Leads to complexity and errors interpreting requirements for any particular product
DOORS Requirements as Gears SPL Assets

Feature-based Requirements Engineering

Feature-based Abstraction
DOORS/Gears Bridge

- Dual Plugin “Bridge” between DOORS and Gears SPL Framework
  - Gears plugin extensions
    - Automated configuration of DOORS requirements, based on Gears feature profiles
  - DOORS plugin extensions
    - Any requirement can be converted into a first-class Gears variation point
DOORS/Gears Variation Points

- DOORS extended with Feature-based SPL variation points
  - Optional requirements
  - Requirements with variants
  - Requirements with text transformations
The New Frontier for Product Line Engineering and Delivery
Industry Trend to 2G SPL – a Discontinuous Jump
Into the New SPL Frontier

• Automated Production Line – an Efficient Means of Production
  - The *scale of your product line* and the *scope of diversity* can be *based on business opportunities* and profitability rather than the complexity limitations
  - The BigLever SPL solution *opens new frontiers* in innovation, economy of scale and profitability, *impacting the fundamentals* of how you compete

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<thead>
<tr>
<th>Available Benefits</th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>Transition Time, Cost &amp; Effort</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>Return-on-Investment</td>
<td>Slow</td>
<td>Fast</td>
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<tr>
<td>Cost of Doing Nothing</td>
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Next Steps to Learn More

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