PLM and ALM Getting Together
Pascal Vera – Siemens PLM
Stefano Rizzo – Polarion Software
Presenter Background

Pascal Vera – Siemens PLM Teamcenter Product Management

- Leading Systems Engineering and Mechatronics product initiatives and strategic planning at Siemens PLM
- 20+ years experience in electronics and embedded systems across different industries
- Holding a doctoral degree in industrial computer engineering

**Philosophy and Focus:**
Mastering complexity to increase innovation while decreasing risk
Presenter Background

Stefano Rizzo - SVP Strategy and Business Development

• Academic, technical and sales background. First Product Manager at Polarion Software up to 2010.
• Doctor of Computer Science, University of Genoa, Italy

Philosophy:
What’s next?
Why ALM and PLM get together
Google joins with GM, Honda, Audi for Android-powered cars
An expected auto alliance backing Google’s OS is unexpectedly broad with the arrival of the world’s largest carmaker. The first Android vehicles will arrive this year.

CES 2014: BMW shows off 'drifting' self-drive cars
BMW’s promotional video of its latest autonomous driving technology

BMW has shown off self-driving cars that can “drift” around bends and slalom between cones.
Aerospace and defense

- Rise in unmanned aircraft for both Military and Commercial activities leads to increase software and embedded systems complexity.

US Navy trials Rolls-Royce powered surveillance UAV

25 September 2014

Rolls-Royce has powered the successful cross-country flight of MQ-4C Triton, a new unmanned aircraft system built for the US Navy.

A Rolls-Royce AE 3007A turbofan engine powered the 11-hour flight from prime contractor Northrop Grumman's Palmdale facility in California to Naval Air Station Patuxent River, Maryland where the aircraft will be fitted with a sensor suite.
Heavy equipment

Self-driving Agricultural Vehicle increases farm output and efficiency.

From precision farming to autonomous farming: How commodity technologies enable revolutionary impact
by Jeremy H. Brown

The popular conception of farming as low-tech is woefully out of date. Modern farmers are high-tech operators: They use GIS software to plan their fields, GPS to guide field operations, and auto-steer systems to make tractors follow that GPS guidance without human hands. Given this technology foundation, the transition to full autonomy is already in progress, leveraging commodity parts and advanced software to get there more quickly than is possible in many other domains.

This article outlines some of the key technologies that enable autonomous farming, using the Kinze Autonomous Grain Harvesting System as a case study.
Consumer products

Smart hardware and domestic appliances all controlled by Internet connected Apps...

Device Management (M2M)

Connecting Things: Flexible Options

Machine-to-Machine Communication

A new dimension of device management!

Contact EMEA

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Electronics and software

Google – Nests:
- Internet of Things starts to become a reality…
<table>
<thead>
<tr>
<th>Internet of Things</th>
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<tr>
<td><strong>New Markets for Software</strong> (wearable, connected)</td>
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<td><strong>Product Differentiation through Intelligent Features</strong></td>
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<td><strong>Compliance with Evolving Regulations</strong></td>
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<td><strong>Mass Customization</strong></td>
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<td><strong>Continuous Innovation</strong></td>
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Wishes

- Avoid putting faulty products on the market
- Global corporations need to optimize their processes and tools
- Reduction of the cost of new product introduction
In the past ALM and PLM have been operating in isolation. This has compromised product quality and delivery.

Siemens and Polarion believe PLM and ALM must work in unison to address today’s product development demands.
Business benefits of ALM-PLM integration

• Visibility across all assets
  - Improve search and locate information
• Accurately link firmware with hardware
  - Avoid errors, avoid damage costs, avoid reputation risk
• Traceability of assets for engineers in all lifecycle phases
  - Reduce time wasted
  - Enable effective collaboration across globally distributed units
• Support maintenance, repair, & operations (MRO):
  - Quickly locate parts and manage defect fixes
  - Reduce inoperative time of broken products
Levels of integration

1. Link & Trace
   - Product
   - Software

2. Level 2
   - Act & Communicate

3. Level 3
   - Change & Propagate

4. Level 4
   - Align & Unify

5. Level 5
   - Collaborate & Report

10/16/2014
Polarion & Siemens
$10M Capital Investment

“We took our time to thoroughly investigate the ALM market; and in every analysis, Polarion showed up as the number one provider in its category. We look forward to working with Polarion Software to accelerate penetration of the company’s technology across large, distributed teams and enterprises worldwide.”

- Ralf Schnell, CEO,
  Siemens Venture Capital
Foundation Agreement

“Siemens PLM Software is committed to creating partnerships to help enhance the end-user experience of our customers. We are pleased to work with Polarion Software to provide open, integrated solutions that improve the productivity of our mutual customers. The partnership addresses the pressing need for integration across enterprises in industries including automotive, medical devices, electronic engineering, manufacturing and aerospace, and we look forward to working with Polarion Software to bring value to large, distributed teams and enterprises worldwide.”

- Eric Sterling, SVP Lifecycle Collaboration Software, Siemens PLM Software
What Market Analysts Think

“Polarion has a first-class ALM solution… In the near future we expect Siemens to be able to offer an integrated ALM–PLM solution to address the current needs of software engineers, and the choice of Polarion is a good one”

Michael Azoff, Principal Analyst, Ovum
What Customers Think

“This is great news that we’ve been hoping for ever since we started using both Teamcenter and Polarion. The integration of software and product development processes will allow us to achieve a much better use of our tools and resources and help our teams bring innovative products to market at a much faster pace.”

Edoardo Sivera, System Integration Team Leader, CNHi
Siemens PLM Software
Systems Driven Product Development
The Role of Siemens PLM Software: Delivering the Smart Innovation Platform

- **Engaged Users**
  Right information. Right time. Right context.

- **Intelligent Models**
  Representing reality. Understanding connectedness.

- **Realized Products**
  Virtual product definition. Real production environment.

- **Open System**
  Easy deployment today. Flexibility for tomorrow.
System Performance Engineering
Ex.: Balance Fuel Economy and “Brand” Performance

- Eco-Driven Powertrain Concepts
- Innovative and Lightweight Design
- Creating Brand Value via Performance
- Creating Brand Value through Systems
Embedded Systems
Control Complexity and Manage Risks

Dramatic Growth of Electronics Systems

Exploding Requirements and Test Cases

Multiple Variants and System Architectures

Multiple Sites, Multiple Participants
Every Business Is A Software Business…

“Software is eating the world”
Marc Andreessen, Aug 2011

Another manufacturer recalled 160,000 cars with hybrid engines due to a failure of its engine control software.
--McKinsey, The Detroit News

One Japanese manufacturer recalls 81,000 sedans due to a sensor failure causing the air bag system to default to the fully deployed position, regardless of seat position – CNN

Segway is recalling all of its high-tech electric scooters because a SW glitch has caused riders to fall off and break teeth and wrists. The problem is fixed by a 15 minute software upgrade...
– USA TODAY
High heterogeneity between applications
...It isn’t just about linking data

- Comprehend complete product definition
- Cross-domain artifact relationships
- Configure data and variants across areas
- Identify cross-impact of changes

- Coordinate planning
- Orchestrate processes
- Complete traceability
- Consistent versioning
ALM-PLM
Taking Care of the User Experience

- Don’t migrate, duplicate or even aggregate data from applications but maintain meaningful relationships across these data enabling configuration and viewpoints.
- Don’t force the engineers to migrate to PLM concepts that are meaningless for their domain but automatically create correspondences that are relevant for their domain.
- Don’t migrate local engineering workflows but orchestrate the workflows.
- Don’t imply switching tools but provide the required data and relationship authoring/viewing functions to the engineers from their applications.
- Don’t overwhelm engineers with data irrelevant to them but expose personalized and immediately relevant product content for their domain.
- Don’t suggest to manually create and maintain the million relationships between artifacts but capture and automatically create relationships along engineering activities.
Openness and Integration Capability
A Common Framework for Integrating Multiple Engineering Applications

- Avoid point-to-point integration
- Common messaging framework
- Common data communication and transformation capabilities
- Common orchestration and mediation platform
- Use standard frameworks such as SOA, REST, OSLC, JSON, and XML
- Reduces cost of ownership and maintenance of integrations
Systems Driven Product Development
Solution Framework

Product Line Engineering

Systems Modeling and Validation

Enterprise Model Management

Domain Authoring and Integration

Multi-Domain Traceability and Configuration

Software
- Software Modeling
- Software Development
- Build and Deploy

Control
- Control Modeling
- MiL, SiL, HiL
- Calibration

Physical
- 1D Behavior Modeling
- 3D MCAD / CAE Modeling

Continuous Integration Verification, Validation, Change

Product Line Engineering
- Product Line Variability
- Product Requirements
- Attribute Management
- Product Architecture

Requirements
- Functions
- Logical

Part Master / BOM
ALM within Systems Driven Product Development

**MULTI-DOMAIN:**
- Governance guided by valid product configurations
- Change Management
- Decision making
- Continuous integration
- Closed-loop validation
Teamcenter PLM and Polarion ALM Together

Value points and key use cases
Polarion ALM – Teamcenter Integration 1.0 GA
Integrated Requirement Management

- Ensure and track that SW requirements satisfy product requirements and vice-versa
- Enable SW Engineers to derive product requirements in SW requirements from their ALM environment
- Both PLM and ALM have access to requirements full traceability (i.e.: as needed for change impact analysis)
- Automatically create and maintain mapping
- Enable traversing traceability beyond requirements

- Bidirectional referencing of SW and product requirements
- Access to product requirements from ALM
- Access to software requirements from PLM
- Product and Software requirements automated traceability
Polarion ALM – Teamcenter Integration 1.0 GA
Integrated Software Change Management

- Ensure complete and accurate software changes
- Orchestrate Software and Product change workflows
- Expose in ALM the impact of Software changes to Product before executing changes
- Consolidate Software change analysis for accurate Product change decisions
- Integrate Software changes from ALM into Product
- Traceability of PR, CR, CN, tasks with Software and Product resulting changes
Polarion ALM – Teamcenter Integration 1.0 GA
Closed-Loop Embedded Systems and Software

- Integrating SW engineering into PLM cycles
- Complete traceability from requirements to software deliveries, going through models and test data
- ALM tight integration with MBSE process and HW
- Manage Software deliveries as BOMs for product lifetime
- Expose product level data into ALM environment and ALM data to PLM environment
- Integrate software test and quality results for accurate product target assessment
Polarion ALM – Teamcenter Integration 1.0 GA
Enabling traceability discovery to all levels

- Traceability based on Remote References - No duplication of data in either PLM or ALM
- Through RDF offer configured data traversal on either end
- Seamless user experience
- The potential of RDF triple store for semantic indexing
Key Takeaways
How is it different than what others have made before?

- The first-ever software engineering data and process integration with product lifecycle to provide consistent configuration of multi-domain data

- There are probably niche-tools somewhere that can possibly do better in some areas....BUT from any other vendors you will not find an end-to-end PLM-ALM integrated vision that also encompasses embedded software and MBSE aspects

- It comes with a large set of other capabilities and other integrations you can incrementally adopt at your speed and per your business priorities

*Take advantage of now integrated market recognized best-in-class PLM and ALM solutions*
## Benefits

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<th><strong>Productivity</strong></th>
<th>Software development closed-loop with Product Lifecycle Management from Inception to EOL</th>
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<td><strong>Quality</strong></td>
<td>Part of MBSE for continuous software validation</td>
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<td>Leverage modeling &amp; simulation capability</td>
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<td><strong>Cost</strong></td>
<td>Right first time software deliveries and reuse</td>
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<td>Optimize software design decisions in context of overall products</td>
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<td><strong>Scalability</strong></td>
<td>Proven Enterprise infrastructure</td>
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<td>Very minimal changes in your organizations</td>
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Roadmap
Roadmap
Integration based on Teamcenter 10.1.2 onward

Release 1.0 GA
Integration is delivered as a package from Polarion scheduled with next major release
1. Link & Trace (1)
2. Change & Propagate
3. Act & Communicate (1)
   - Integrated Requirement Management
   - Integrated Software Changes
   - Closed-Loop Embedded Systems and Software
   - Enabling traceability discovery to all levels

Release 2.0
1. Link & Trace (2)
   - Full traceability reports in TC
3. Act & Communicate (2)
   - Revise and release PLR and SWR
   - Support of the Integration for different platforms

Release 3.0
4. Align & Unify
   - Configuration management
5. Collaborate & Report (1)
   - User Management
   - Integrating the technologies
Questions?
Thank you.