Keynote: Trends and Innovations in Complex Systems Development

Scott Darlington, Product Manager, Enterprise Architecture Management
27 Years Old and 5 Years Young

- **R1000**
  - Systems

- **Rational Software Development Platform**
  - IT
  - Systems

- **Rational software**
  - Asset Modernization
  - IT
  - Systems Take Two

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**2008**

- 28,000 Customers
- 2,000 Rational Software Developers
- 40% Growth Since 2003
Isolated systems

- Individual systems on the ship designed independently
- Threat nature changing, requires more dynamic response
- Move to ships as collection of assets and capabilities that can be rapidly assembled in support of new missions
Network Centric System – Zumwalt DDG 1000

- Total Ship Computing Environment (TSCE)
  - IBM Blade servers running RT Linux & IBM WebSphere Real-Time java
- Operates on-board functions (traditional embedded real-time such as radar, weapons control)
  - Design of systems combining IT & Embedded
- Connect to larger net-centric operations for command and control
  - Planning of missions & capabilities

System integrated with IT
What do we learn from looking at these examples?

- The **System Lifecycle governs** your priorities & investments
  - From Concept, Development, Production, Utilization, Support through Retirement
  - This may be months in fierce markets (Mobile devices)
  - Years in A&D systems (B-52 = 50+ years)

- There is a rise in the **importance of architecture**
  - Architectural standards and principles make it possible to integrate disparate systems in a logical and structured way (e.g. using SOA)
  - Architecture enables a product line approach to maximize return on R&D

- There is a **blurring of software and systems development**
  - Not so clear where one ends and the other begins
  - Best practices and frameworks being shared across domains
An Integrated and Open approach for Tools and Process Across the Lifecycle is Needed

US Department of Defense (DoD) 5000.2

Pre-systems Acquisition
Concept and Technology Development

Systems Acquisition
System Development & Demonstration

Production and Deployment

Sustainment
Operations and Support (including Disposal)

Typical High-Tech Commercial Systems Integrator

<table>
<thead>
<tr>
<th>Study Period</th>
<th>Implementation Period</th>
<th>Operations Period</th>
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<tbody>
<tr>
<td>User Requirements</td>
<td>Concept Definition Phase</td>
<td>Deployment Phase</td>
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<tr>
<td>Definition Phase</td>
<td>Concept Specification Phase</td>
<td>Operations and Maintenance Phase</td>
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<td>Acq Prep Phase</td>
<td>Source Select, Phase</td>
<td>Deactivation Phase</td>
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<tr>
<td>Development Phase</td>
<td>Verification Phase</td>
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ISO/IEC 15288

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<tr>
<th>Concept Stage</th>
<th>Development Stage</th>
<th>Production Stage</th>
<th>Utilization Stage</th>
<th>Retirement Phase</th>
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<td>Support Phase</td>
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Typical Decision Gates

- New Initiative Approval
- Concept Approval
- Development Approval
- Production Approval
- Operational Approval
- Deactivation Approval

Reference: INCOSE Systems Engineering Handbook
Our Vision for Systems and Software Delivery

**IT / back office environments**

Collaboration, governance, and SOA lifecycle management solutions to enable effective software delivery

**Systems engineering & architectural frameworks**

Enterprise & industry architectures

**Software**

Systems through Software Delivery Platform

**-DEVELOPMENT-**

Mechanical
MCAD tool vendors

Electronic
EDA tool vendors

**Product lifecycle management**

Integrating software, mechanical and electronics

Best practices
Translating Vision into Reality
Systems and Software Delivery Capabilities

Enterprise Architecture/Architectural Frameworks
Product Portfolio Management
Requirements Definition & Management
Analysis & Design
Construction
Configuration & Change Mgmt
Release Management
Quality Management
Asset Management & Reuse
Measurement & Reporting
Production

System Lifecycle Process Management
Introducing Telelogic

Mission: Help each customer succeed the first time by aligning and optimizing product, systems and software development lifecycles with business objectives and customer needs to dramatically improve quality and predictability, while significantly reducing time-to-market and overall costs.

- Founded in 1983
- More than 1,100 employees worldwide
- More than 8,000 customers worldwide
- Worldwide direct sales and partner ecosystem
- Headquartered in Malmo, Sweden with US headquarters in Irvine, CA

Focal Point (product management and product portfolio management)
DOORS (requirements lifecycle management)
System Architect (enterprise architecture)
Tau (MDD for IT/enterprise SW)
Rhapsody (MDD for embedded/real-time SW)
Statemate (systems design)
SDL (MDD for communication protocol SW)
Synergy & Change (configuration & change management)
Logiscope (quality assurance)
Combined Portfolio in Action

**Industry’s most comprehensive offering**

- **Enterprise Architecture/Architectural Frameworks**
  - Telelogic System Architect
- **Product Portfolio Management**
  - Telelogic Focal Point
- **Measurement & Reporting**
  - Rational ProjectConsole
  - Telelogic Dashboard
- **Production**
- **Requirements Specification & Management**
  - Telelogic DOORS
  - Rational RequisitePro
- **Analysis & Design**
  - Telelogic Rhapsody
  - Telelogic Tau
  - Rational Software Architect
- **Configuration & Change Management**
  - Telelogic Synergy
  - Telelogic Change Management
  - Rational ClearCase
  - Rational ClearQuest
- **Release Management**
  - Rational BuildForge
- **Quality Management**
  - Telelogic Test Conductor
  - Telelogic Tester
  - Telelogic Logiscope
  - Rational Test RealTime
  - Rational PurifyPlus
  - Watchfire AppScan
- **Construction**
  - Eclipse
  - WindRiver Workbench
  - other IDEs
- **Asset Management & Reuse**
  - Rational Asset Manager
- **System and Software Lifecycle Process Management**
  - Rational Method Composer, Harmony, RUP
The springboard for new and exciting offerings including…

► Cross-pollination of best practices
► Product line engineering
► PLM and systems governance
Expanded Customer Value from Rational and Telelogic

The Foundation of a Compelling Vision for Transforming Technical Systems Development

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  - Product line engineering
  - PLM and systems governance
Cross-pollination of best practices

Between software and systems developers

- CMMI
  - Started in A&D and Systems World
  - Now being adopted in IT domains
  - Why? A&D organizations proved value now others want to take advantage

- Agile
  - Started in IT World
  - Now being adopted in A&D and systems domains
  - Why? Driving forces behind system needs are changing more rapidly and agile development has proven to help organizations respond more quickly
    - Example: A&D - threats change more rapidly – no longer the same enemy with the same characteristics for many years
    - Example: Mobile phone devices – “Out featuring” the competition drives business – but more features means more development time
Rational Unified Process & Telelogic Harmony

Domain-specific processes for building better software and systems

Harmony

- Harmony/ESW for Embedded Software development
- Harmony/SE for Systems Engineering

Rational Unified Process

- Incl. Model-Driven Systems Development
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Product Line Engineering: Real Life Challenge

- Multiple simultaneous products
- Multiple customers
- Large commonality (85 – 90%)
Challenge: Evolving and Diversifying the Portfolio

Core Product Assets
Product \( n \)

Core Product Assets
Product \( n+1 \)

Core Product Assets
Product \( n+2 \)

Evolution

Diversity

Product Variant A

Product Variant B

Product Variant C

Inform

Instantiate
Product Lines Create an Exponentially Complex and Costly Development Problem

- Most importantly, these tactical development challenges can inhibit a company's ability to
  - Control the cost of development
  - Maximize product quality
  - Expand the scale and scope of their portfolio
  - Increase customer satisfaction
Strategy for Product Line Engineering

From delivery by construction, to delivery by configuration

- The Problem with Existing product-centric approaches
  - Product-centric approaches such as clone-and-own, branching and one-size-fits-all lead to complexity and inefficiency

- The Solution: Manage a product line portfolio as a single system rather than a multitude of products
  - Simpler approach to PLE manages complexity of a portfolio
  - Proven and practical approach which lowers risk
  - Lower adoption barrier allows companies to quickly achieve ROI
Expanding Our Product Line Engineering Capabilities

Solutions across the Development Lifecycle

- Asset Management infrastructure across Architecture, Requirements, Models, Source code, Test cases, Documentation
  - Rational Asset Manager, Rational ClearCase/Telelogic Synergy
- Common mechanism to describe and unify variation of core product assets in a product family
  - BigLever SPL Gear Framework Integration
- Common process and best practices to accelerate adoption
  - Harmony/ESW and Harmony/SE extensions to support Product Line Engineering
Expanded Customer Value from Rational and Telelogic

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Systems Engineering/PLM - The Goal

- A Systems & Software Engineering Organization that is:
  - **Predictable**
    - Perform on target and do not confront stakeholders with surprises
  - **Competitive**
    - Make the right choices for your product and deliver on time
  - **Profitable**
    - Work cost efficiently and deliver for the right price
  - **Compliant**
    - Comply with relevant industry or government regulations
The Process Challenge
The Technology Challenge
Removing Friction from Tools and Processes

Requirements management and system design across system of systems and down to the component level

Integration of requirements, configuration and change management with PLM/EDA

Integration, Collaboration & Workflow Infrastructure