Model Based Systems Engineering:

Professional certification, simulation and analysis techniques

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Agenda

- A smarter planet and smarter products
- The need for improved systems and software engineering
- Standards and Professional Certifications
- The Rational Workbench for Systems and Software Engineering
- In summary
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The planet is getting smarter

**Our world is becoming**

**INSTRUMENTED**

**Our world is becoming**

**INTERCONNECTED**

**All things are becoming**

**INTELLIGENT**
Complexity Increases The Difficulty and Value of Innovation*

From sophisticated in-device software, to complex “system of systems” ecosystems, products will continue to get smarter.

*Dr. Donna Rhodes, MIT
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Product and service innovation requires a new level of collaboration across multiple borders

**Overcoming boundaries between:**

- Engineering disciplines
- Development teams
- Geographies
- Languages
- Companies, partners and suppliers
- Multi-vendor tools

“Communication and collaboration between hardware, mechanical and software engineering teams can present a significant hurdle - hampering the overall product delivery process and resulting in too much redundant communication and rework between teams.”

“Smarter Product Enablement”, MWD Advisors, Bola Rotibi, November 2009
Delivery of smarter products will require alignment across software, product and service lifecycles.

Connect multiple products and services into a "system of systems" to deliver unique value.

Leverage systems engineering to accelerate time to market, improve quality and reduce costs.

Develop a core competency in software delivery to produce products that are differentiated.
Agenda

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System Engineering

- **Systems engineering** is an interdisciplinary field of engineering that focuses on how complex engineering projects should be designed and managed.

- SysML is the standard language for the design of systems (of systems)
- V-Model, Harmony SE, RUP MDSD are some of the most common System Engineering Processes
- DoDAF, MODAF, AUTOSAR are emerging architectural frameworks
SysML

- General purpose systems modeling language based on UML 2

- Most common used SysML diagrams
  - Requirements: Requirements diagram; Use case diagram
  - Structure: Block Definition diagram; Internal Block diagram
  - Behavior: Statechart; Activity diagram; Sequence diagram
  - Constraints: Parametric diagram

- Integrated Requirements and Design modeling environment
SysML Diagrams

- Activity Diagram
- Sequence Diagram
- State Machine Diagram
- Use Case Diagram
- Requirement Diagram
- Structure Diagram
- Block Definition Diagram
- Internal Block Diagram
- Parametric Diagram
- Package Diagram

Same as UML 2
Modified from UML 2
New diagram type
Why is Certification Important?

- **For the team**
  - Allows the team to leverage Systems Engineering concepts and activities
  - Can help establish a common Systems Engineering language for your team
  - This can help break down: geographic, organizational, cultural boundaries

- **For organizations**
  - Formally recognizes the Systems Engineering capabilities of the people
  - Certified systems engineers can be a selling point and a discriminator for the technical proposals
  - Can be used as part of the hiring and promotion process
  - It encourages employee participation in continuing education
  - Provides an independent internal and external assessment
  - It is a tool for promoting professional competence
INCOSE Certification path

- Certified against experience, education, and knowledge requirements

**ASEP Associate Systems Engineering Professional**
Targeted towards junior/emerging Systems Engineers and recent college graduates with limited Systems Engineers work experience

**CSEP Certified Systems Engineering Professional**
Targeted towards people with five or more years of Systems Engineers work experience

**ESEP Expert System Engineering Professional**
Systems Engineering leaders with significant work experience (>25 years) and demonstrated systems accomplishments
OMG Certification path

The program will award the OMG Certified Systems Modeling Professional certification at four levels.

- The first level, OCSMP Model User, covers a wide range of essential MBSE and SysML knowledge and skills.
- The levels, termed OCSMP Model Builder - Fundamental, Intermediate, and Advanced, cover advanced topics with an emphasis on the interconnectedness among the different model viewpoints that gives MBSE its advantage over conventional engineering methods.
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Model Based Systems Engineering

Rational Workbench for Systems and Software Engineering

Rational Rhapsody
- Use modeling to validate requirements, architecture and design throughout the development process

Rational DOORS
- Manage all system requirements with full traceability across the lifecycle

Rational Team Concert

Rational Quality Manager
- Achieve “quality by design” with an integrated, automated quality process

Collaborate across diverse engineering disciplines and development teams

Best-of-breed capabilities, integrated on a common platform
Rational Team Concert

- Collaborate in-context
  - Integrated work items, process guidance, reporting, chat
  - Search, query and link to resources to improve productivity with project transparency
- Streamline change
  - Out-of-the-box, Customizable Workflows
- Quickly view project health
  - Real-time access to project status and trends
  - Web-based dashboards, metrics and reporting
- Unify diverse teams
  - Collaborate across teams and geographies
  - Integrate a broad array of tools and clients
- Automate governance & visibility
- Scale to the enterprise
  - Small teams to 1000’s of contributors and stakeholders
Rational DOORS

- Comprehensive requirements management
  - Records, structures, manages, and analyzes requirements and their traceability
- Multi-disciplinary capabilities
  - Manages requirements across multiple engineering disciplines - software, electronic, electrical and mechanical
- Compliance and auditability
  - Addresses compliance to regulations and standards using audit trail, electronic signature and traceability
- Desktop and Web clients
  - Provides a rich desktop client for ‘power’ users, and a Web client for additional stakeholders
- Integrates with many Rational and 3rd party tools
Rational Quality Manager

- Collaborative test planning
  - Real-time access to the right information and tools to keep all stakeholders on the same page
- Requirements-driven testing
  - Link testing to requirements to ensure the right capabilities are developed to the right quality
- Risk-based testing
  - Reduce project risk effectively and efficiently by prioritizing high-risk functionality
- Model-driven testing
  - Keep testing up to speed with model-driven development by integrating model-based testing capabilities to the quality management workflow
- Open integrations to the testing eco-system
  - Integrate the full range of systems testing tools and technologies into the quality management workflow
Rational Rhapsody

- Model-driven systems development
  - Cross-discipline solution for the development of complex products and systems
- Standards-based development
  - Domain focused modeling in support of industry standards (UML, SysML, Multicore, DoDAF/MODAF/UPDM, AUTOSAR)
- Requirements visualization and validation
  - Demonstrate compliance to requirements information with links to system and software design and development
- Model-driven testing
  - Simulate, create and manage system and software testing from modeled scenarios
- Open integrations to lifecycle tools
  - Integrated with requirements, configuration and change, and quality management tools
Model Based Systems Engineering

Rational Rhapsody – Requirements Capture, Modeling, Trace and Analysis

- Requirements Capture and Modeling
- Requirements Traceability
- Requirements Analysis
  - Requirement Coverage Analysis
  - Change Impact analysis
  - Automatic report generation
Rational Rhapsody - Executable Models on Host & Target
Rational Rhapsody - Model Based Testing

- UML 2 Testing Profile
- Create a Test Architecture
  - Manually
  - Automatic
- Create Test Cases
  - Test Cases can be written:
    - Via Sequence Diagrams
    - Manually via code
    - Automatically via the (ATG)
- Execute Test Cases
  - The Test Cases can be executed automatically
Rational Rhapsody – The Road Ahead

- Manage architecture collaboratively
  - Jazz-based and enabled to simplify cross-discipline stakeholder engagement
  - Simplified review and mark-up
  - Web-based modeling of product and system architectures
- Jazz-based model management
  - Models stored, accessed and managed on the Jazz platform
- Adoption of common reporting technology
  - Shared reporting capabilities across the Rational Workbench for Systems and Software
- Advanced visualization and generation support for new platforms
  - Android, AUTOSAR 4.0, Java/C#
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Summary: The delivery of smart products requires significant expertise in systems and software engineering.

- Products and services of all types are becoming increasingly *instrumented, interconnected and intelligent*.

- The interconnection of multiple products and services into a “*system of systems*” delivers unique value and benefits.

- The Rational Jazz platform can help companies *design, deliver and manage smarter products*.
Questions
Learn more at:
- IBM Rational software
- Rational launch announcements
- Rational Software Delivery Platform
- Accelerate change & delivery
- Deliver enduring quality
- Enable enterprise modernization
- Ensure Web security & compliance
- Improve project success
- Manage architecture
- Manage evolving requirements
- Small & midsized business
- Targeted solutions
- Rational trial downloads
- developerWorks Rational
- Leading Innovation
- IBM Rational TV
- IBM Business Partners
- IBM Rational Case Studies

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