Boeing Defense, Space & Security (BDS)

Integrated Engineering Data

An Industrial Perspective

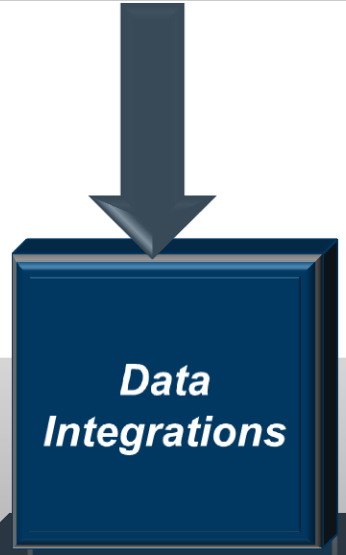
Agenda

- Engineering Challenges
- Open Services for Lifecycle Collaboration (OSLC) and the Jazz Platform
- A Systems and Software Engineering Development Environment
- Boeing CPAST (Common Process And Standard Tools) and Related Activities
- Summary

Traditional Boeing Challenges with Systems/Software Development

Boeing Defense, Space & Security (BDS)

The lack of a unified systems/software development platform leads to significant challenges …



Challenges

- Boeing program lifecycle data exists in different standard tools (in house, commercial, open source) with disparate repositories which can make accessing the data difficult for all project team members
- Software Integrations require unique, sometimes internally developed software, which is costly to maintain and can be brittle (sensitive to version compatibilities)

Need

- Better methods to link tool data that is standards-based and not dependent on periodically changing tool-unique APIs
- Remove the need to synchronize or duplicate data across databases

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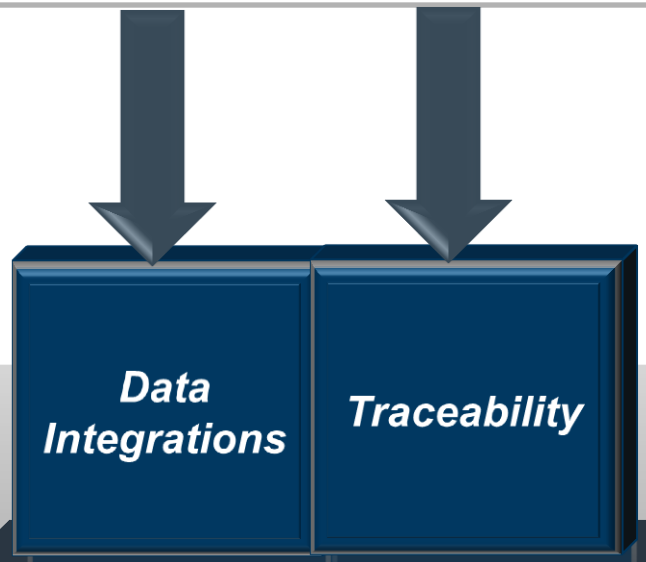

Challenges

- All of this project data needs to be linked together and understood in a comprehensive way (e.g. via analysis, reports, etc.).
- Manage product versions/configurations across all lifecycle assets

Need

- Ability to easily view all linked lifecycle assets within the scope of the entire project
- Ability to get coverage/impact analysis across lifecycle data

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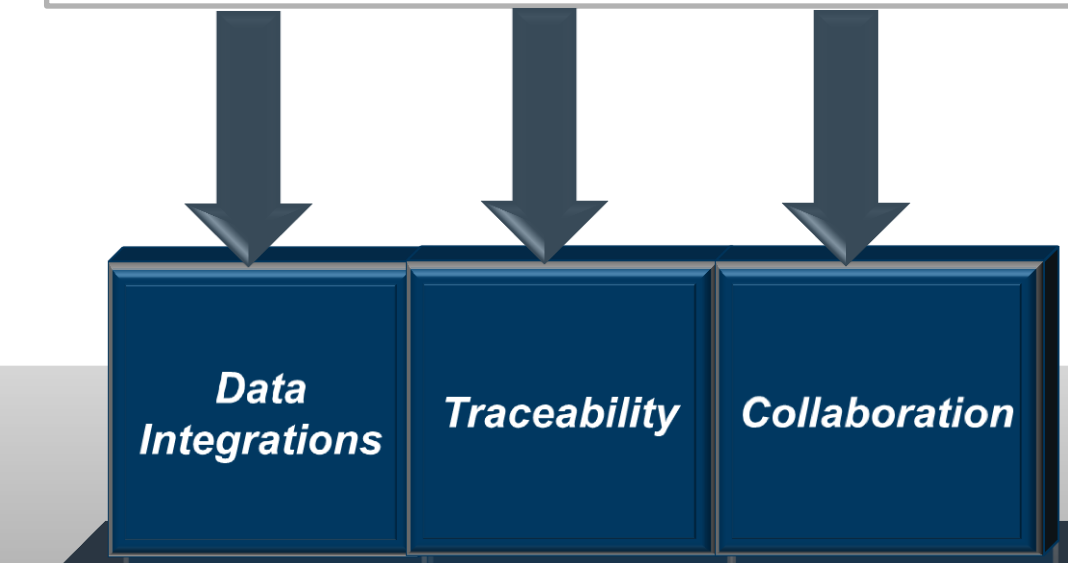

Challenges

- Distributed teams (across the country and/or beyond and across time zones)
- Frequent Meetings to coordinate work

Need

- seamless exchange of data (between teammates, across disciplines)
- integrated mechanism to communicate, share and track work (e.g. sending notifications, handling approvals, conducting reviews, viewing progress).

Traditional Boeing Challenges with Systems/Software Development

Boeing Defense, Space & Security (BDS)

The lack of a unified systems/software development platform leads to significant challenges …

…..

Challenges

- Engineering data is highly fragmented across the tools/repositories
- Pulling together versions of data across all lifecycle products for a particular release
- No single source of version/variant control for all product data

Need

- Unified interface for tracking all engineering lifecycle data
- Version/variant control that encompasses all product data
- Better Product Line Engineering (PLE) support tools

Traditional Boeing Challenges with Systems/Software Development

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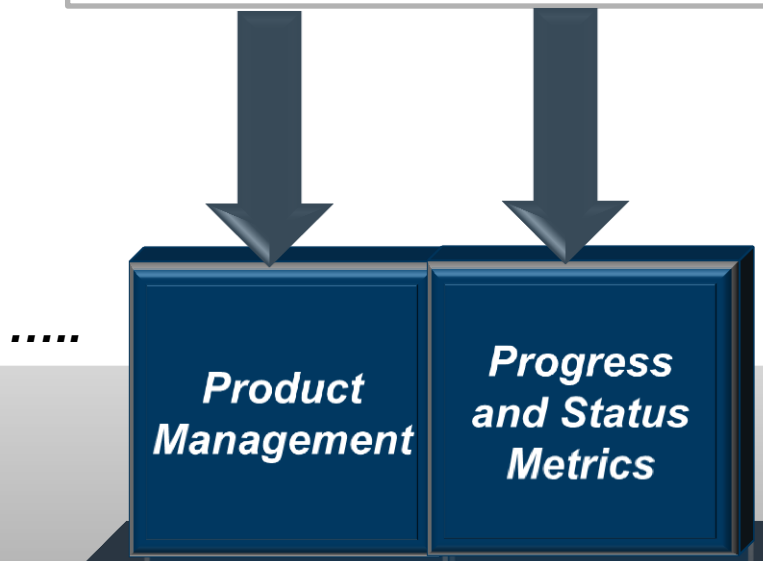

Challenges

- Visibility into where the project work stands with respect to builds, work assignments, plans, status, code reviews, approvals, effort expanded, etc. at a glance
- No end to end lifecycle visibility often exists without time consuming efforts to gather all of the project status information into required reports (*)

(*) SEE NEXT SLIDE

Need

- Easy way to configure automated, live metrics and reports
- Dashboards that are configurable for various stakeholders (e.g. developer/team/project)

Industry Issues – a lot of time is spent (not) finding information

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- Knowledge Workers spend **15% to 35% of their time searching** for information
- 40% of corporate users report that they **cannot find the information** they need to do their jobs
- 50% of most **intranet searches are abandoned**
- 90% of the time that knowledge workers spend in creating new reports is recreating information that **already exists**

Source :

http://www.kmworld.com/Articles/Editorial/Features/The-high-cost-of-not-finding-information-9534.aspx

- This same dynamic exists for engineers and engineering data. The result is that engineering teams are spending a lot of time on unproductive tasks – and a growing amount of their time.

Model Based Integration of Embedded Software (MoBIES)

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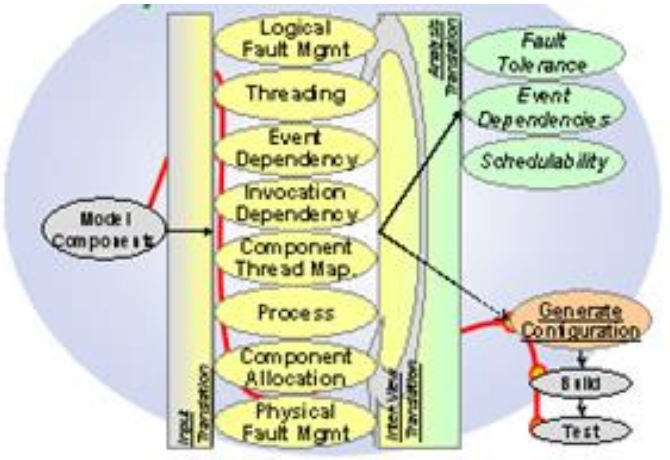
- DARPA (Defense Research Projects Agency) program 2001-05 timeframe whose objective was
  - ***to develop model-based integration technology for composing large-scale embedded software applications subject to cross cutting concerns of temporal correctness, noise, synchronization and dependability.***
- As part of an open experimental platform developed under MoBIES, tool interface standards were developed to support a semi-automated workflow of *embedded software component development*
  - Interfaces between tools were defined in XML
  - Difficult, manual translation between tools
  - OMG Model Integrated Computing Group
    - Application Component Library (ACL)
    - Analysis Interchange Format (AIF)
    - Model Editor Interface
    - Instrumentation Interface (IF)



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Jazz Overview

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- **Jazz** is not a specific product but rather is
  - An open collaboration **platform** designed to support systems and software tool integrations
    - An integration architecture that allows various tool components (both IBM and 3rd party products) to be configured together to support management, monitoring and deployment of applications.
      - Leverages the Open Services for Lifecycle Collaboration (OSLC) standard to simplify integration of tools across the ALM phases.
  - A set of **products** that support this platform.
  - Online **community** at Jazz.net where the products are being built, and developers and users interact.

- ***Introduction to IBM Jazz (5 minute video)***
- ***IBM Solution for Systems and Software Engineering (4 minute video)***

Why Jazz?

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- Boeing Software Engineering Management has viewed Jazz as a likely future strategic direction for the last 4-6 years based on our current use of IBM tool offerings and has been assessing the progress and maturity of the platform during this time
  - It utilizes or incorporates and integrates many of the IBM tools that are current sw engineering standards (e.g. DOORS, Rhapsody, CC, CQ, etc) and is the future direction for IBM in terms of tool and tool integrations

- Non IBM-Vendors are starting to look into this technology, are participating in the OSLC community, and are creating Jazz-based integrations (e.g. Big Lever, Siemens, MentorGraphics, Koneksys, Tasktop)
  - We've had discussions with these companies on Jazz integration reqmnts

Providing Needed Capability to the Business

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- Jazz improves our options for providing traceability between requirements, design data, & development data , supporting our tool interoperability and data exchange focus
- Jazz/OSLC is being leveraged as part of the Mentor Graphics capability underpinning the development environment solution for a MBSA (Model Based Safety Analysis) effort
- Rhapsody and Rhapsody Design Manager support the Object-Oriented part of our MBSE (Model Based Systems Engineering) approach being requested by programs
  - Jazz supports the ability to link between various modeling data and views (e.g. UPDM, SysML, UML, Simulink models) and to other lifecycle artifacts
- Jazz and the tools that use JAZZ/OSLC technology may facilitate a path for reuse of all of the artifacts from one program to another in the same product line
- Early pilots focused on Design Manager are starting to yield benefits

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Tool Environment Leveraging the Jazz Framework

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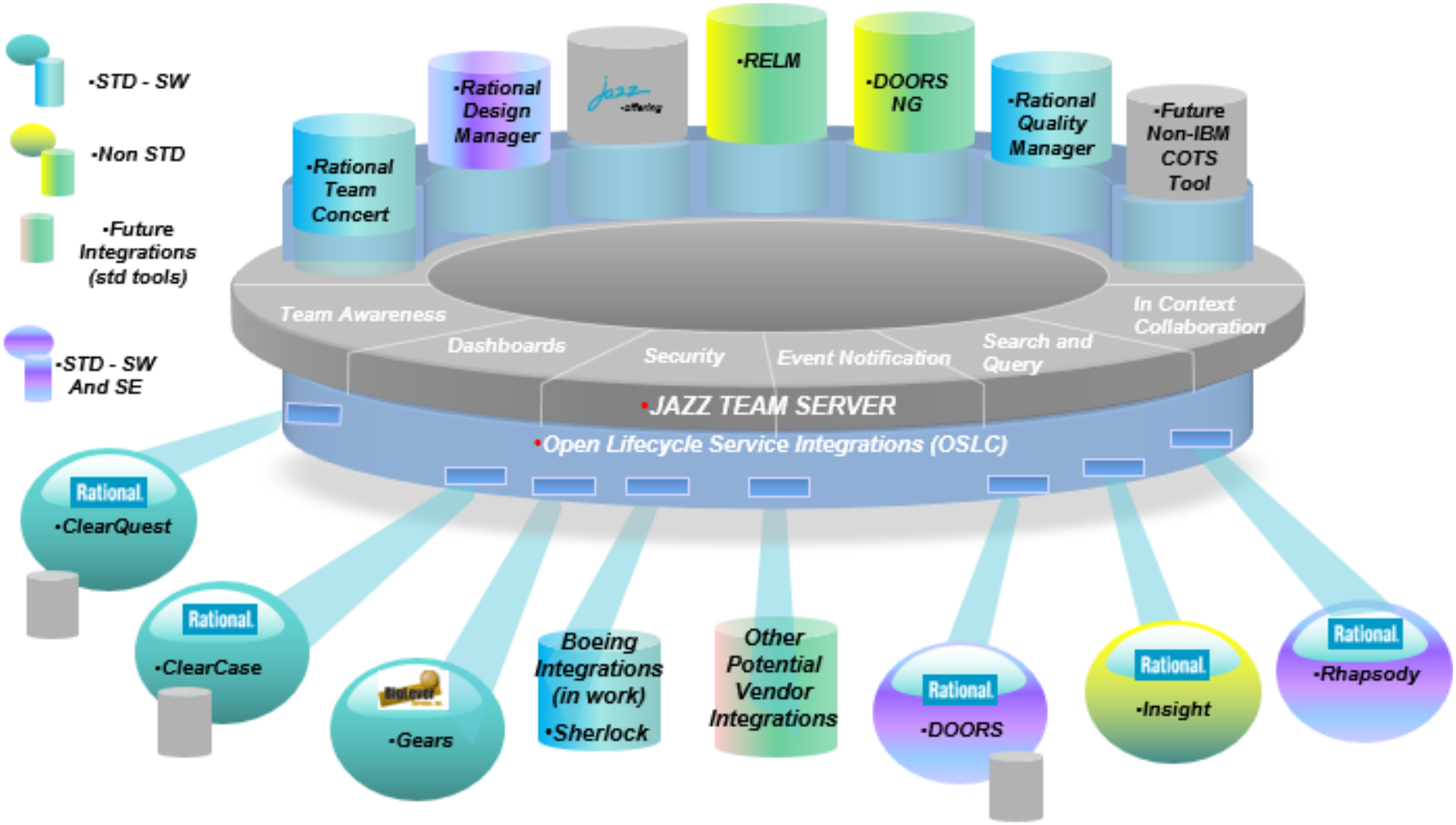
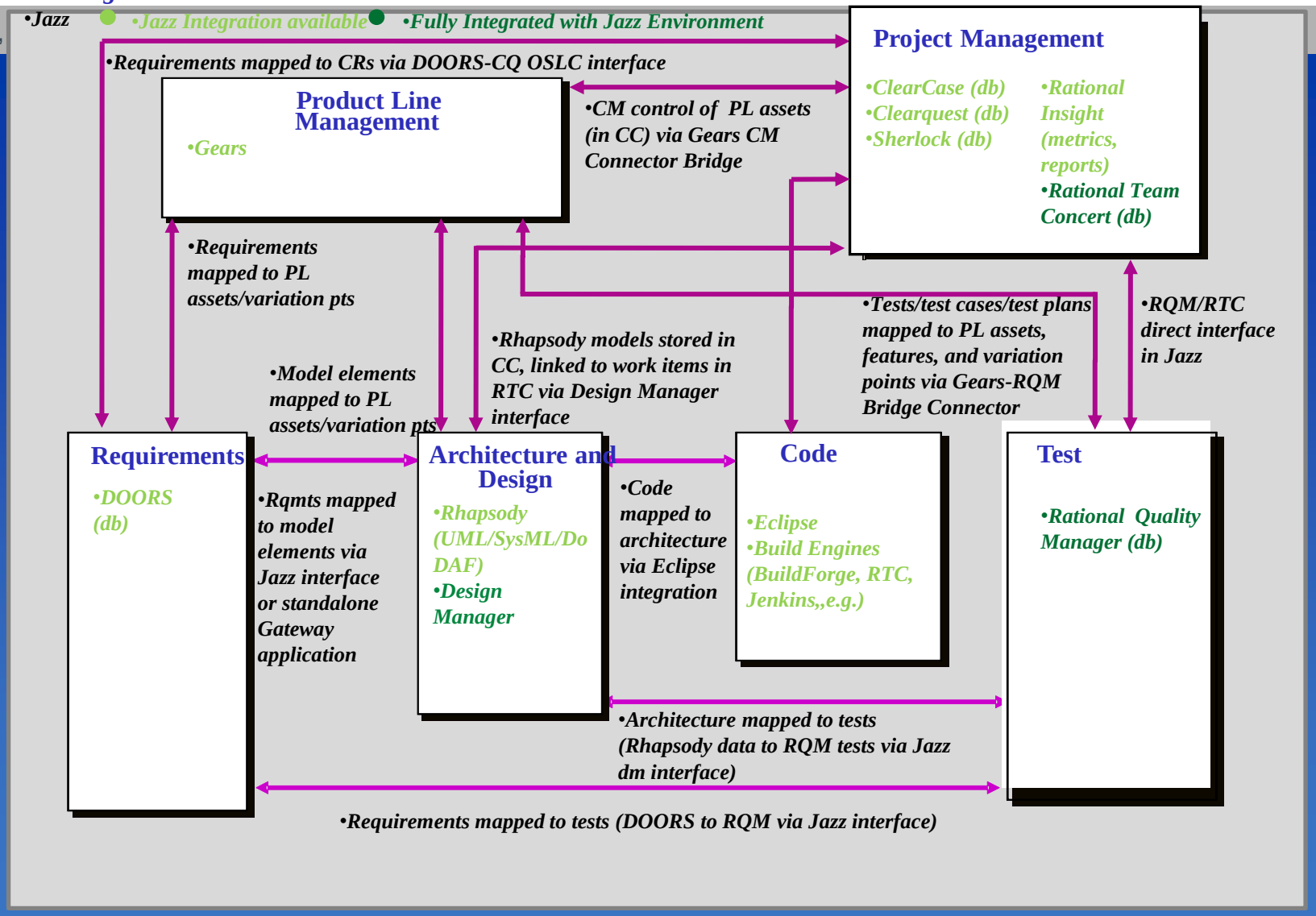


SW Integrated Collaboration Environment



Rhapsody Design Manager

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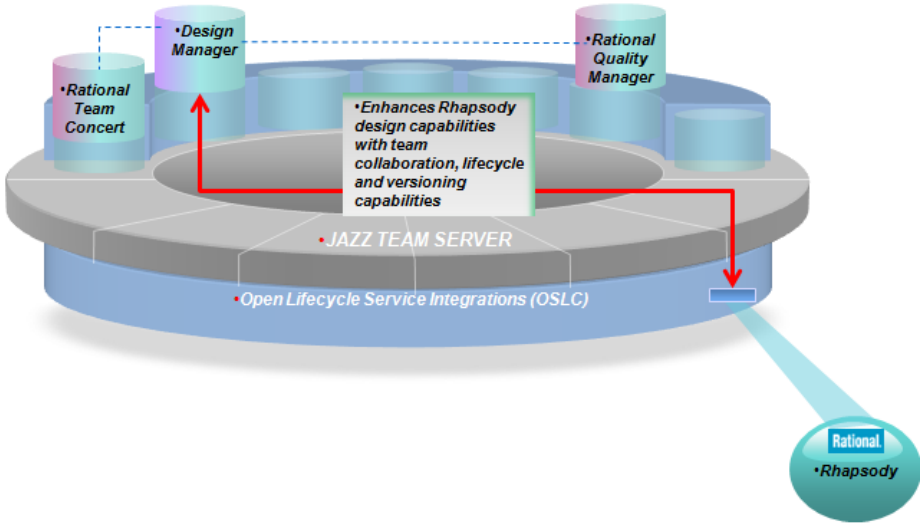
- *Projects are looking towards Model Based System Engineering (MBSE) as a robust approach to help develop affordable, operational, effective system solutions. Given the state of practice, they believe through strategic and tactical application of MBSE tools, processes, and standards they can achieve their goals partially through leverage of DM and the Jazz platform.*
- Design Manager Value Statement
  - **DM is a key focus of our current strategy as the first and most intriguing component of the Jazz platform that projects are starting to investigate**



Meeting the Challenges

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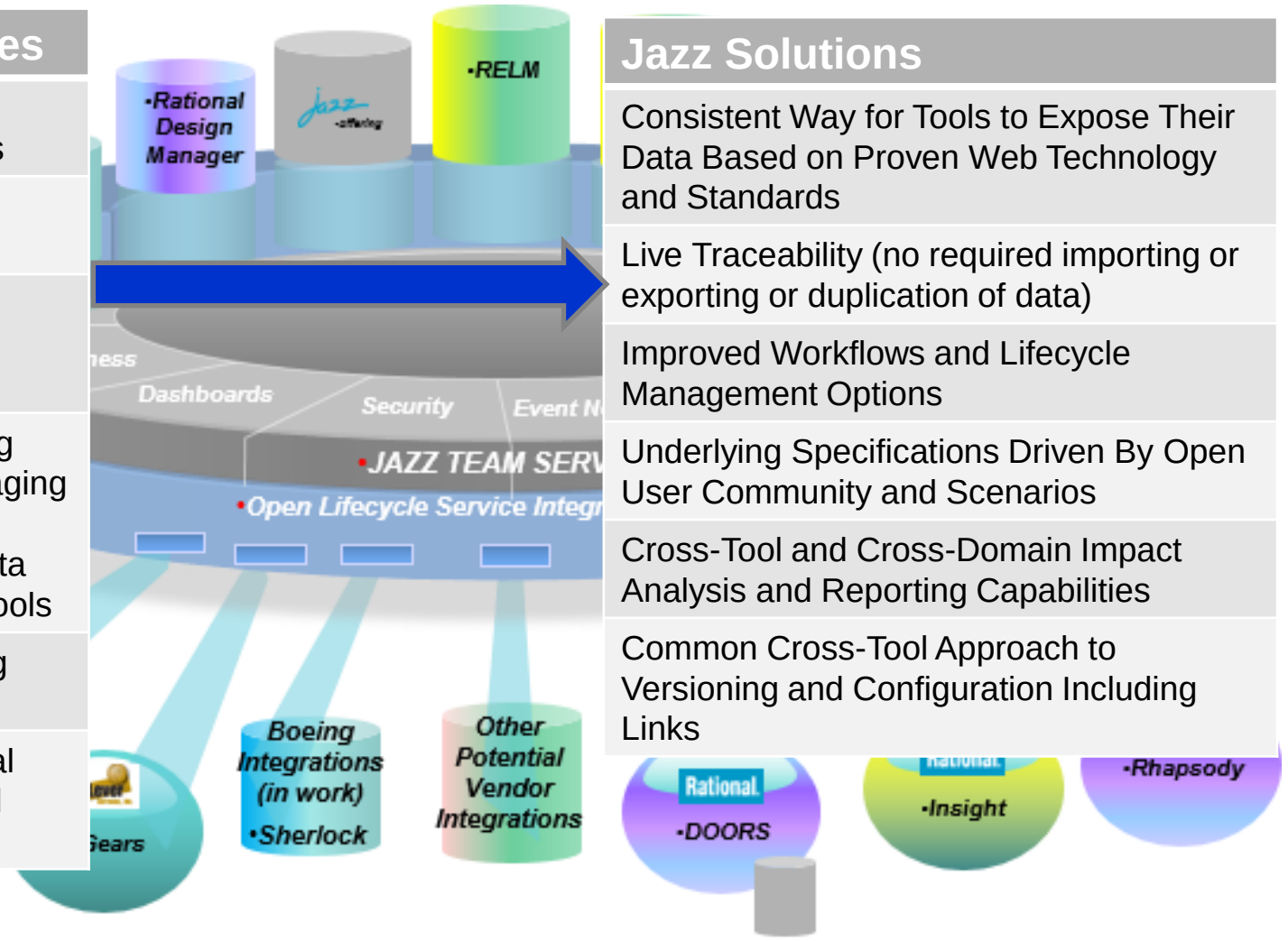
Current Challenges

- Difficulty in Locating All Related Project Artifacts
- Costly PointToPoint Integrations
- Complexity in Understanding all Data Relationships
- Complexity in Versioning and Configuration Managing Lifecycle Products or Product Lines where data stored across multiple tools
- Difficulty in Coordinating Distributed Teams
- Visibility Issues into Real Time Project Status and Metrics



Jazz Solutions

- Consistent Way for Tools to Expose Their Data Based on Proven Web Technology and Standards
- Live Traceability (no required importing or exporting or duplication of data)
- Improved Workflows and Lifecycle Management Options
- Underlying Specifications Driven By Open User Community and Scenarios
- Cross-Tool and Cross-Domain Impact Analysis and Reporting Capabilities
- Common Cross-Tool Approach to Versioning and Configuration Including Links

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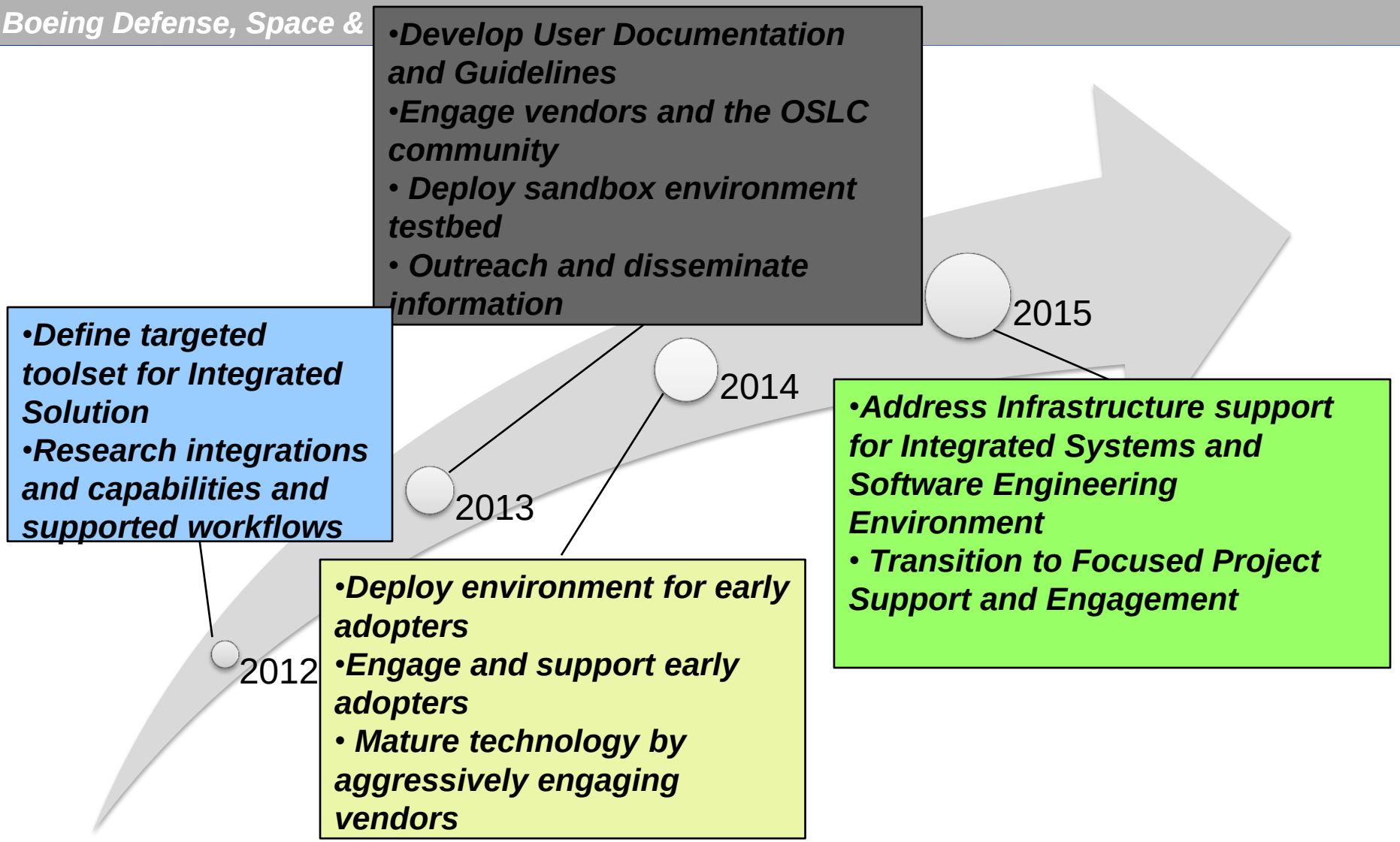
The Objective of the CPAST Team …

- CPAST – Common Process and Standard Tools
- Lead : Mark Schulte (St. Louis)
- Members: Boeing Engineers and IT from St. Louis, Seattle, S. Carolina
- Objective: Define and setup a baseline Jazz Architecture around the Boeing standard system and software engineering toolset and then use that toolset to demonstrate support for typical engineering workflows leveraging the integrations provided by the Jazz Architecture.

The Objective of the CPAST Team …

- Benefits to Realize
  - Reduce Boeing dependence on non-standard vendor-specific APIs to a standard-based model for integrating and accessing data
  - Demonstrate a tool architecture that can expand as new Jazz-enabled integrations become available
  - Increase engineering productivity due to the integration capabilities and automated workflows

Jazz Investigation and Deployment Roadmap…



OSLC Strategy

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- Engage vendors whose tools we use in Systems and Software Engineering to encourage them to develop OSLC integrations
  - Discuss workflows/scenarios we want to support
  - Work on prototype projects
- Support the OSLC standards development at OASIS
  - Beginning to engage with the technical committees developing specifications
  - Encourage people to engage with the Integration Patterns working group and help drive integration scenarios
- Develop our own integrations to get experience developing OSLC integrations for our existing in-house tools

- ***OSLC Primer located at →*** ***http://open-services.net/resources/tutorials/oslc-primer/***
- ***OSLC Introductory Video (5 minutes) →*** ***http://www.youtube.com/watch?v=B2vqL8fujgE&feature=player_embedded#t=0s***

OSLC Integrations

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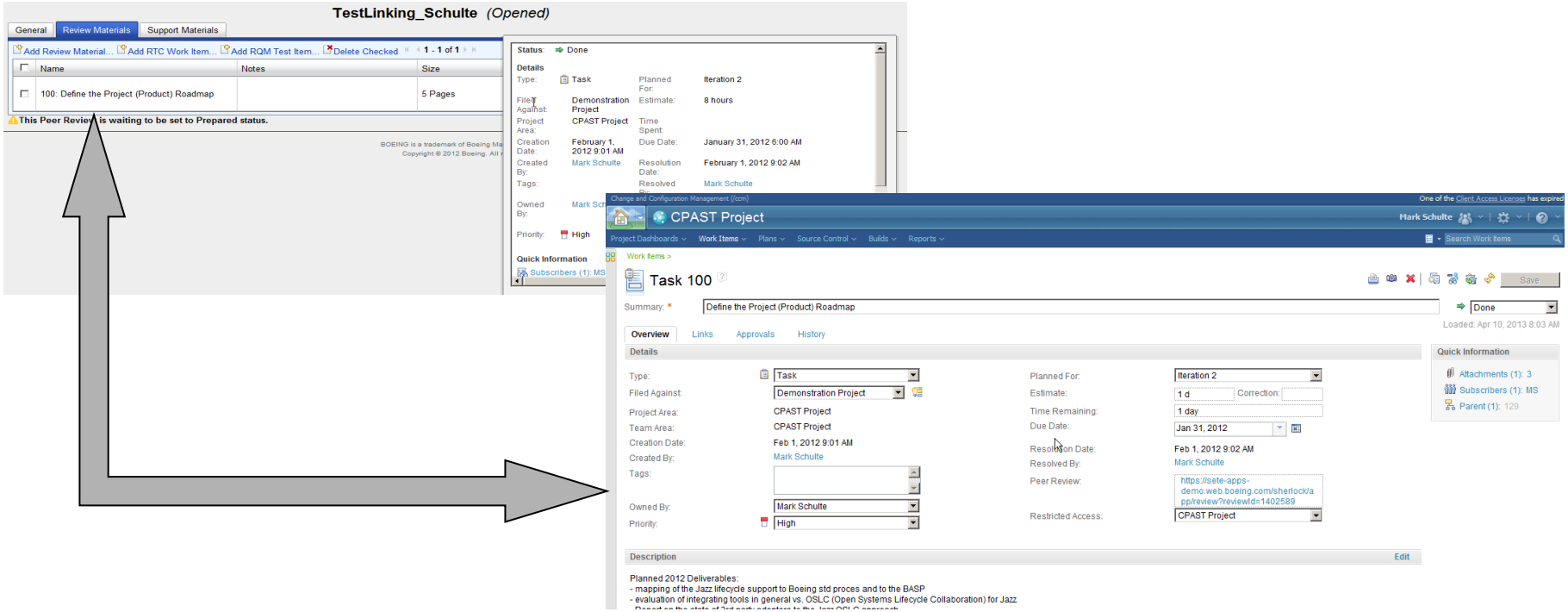
Implemented integration between in house peer review tool and RQM/RTC/DM in support of Peer Reviews



Early Adopter Support

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- CLM installation to support production programs
- Three projects and IADs focused on the value added by using Rhapsody Design Manager in conjunction with Rhapsody
  - Load systems model and customer provided models onto same server for traceability, viewing and navigating links over the web interface, and collaborating with stakeholders who do not have Rhapsody installed
  - Traceability and linking design to requirements (DOORS) and change requests (CQ)
- In general, Jazz in its entirety is a better fit for new programs, where an important emphasis is on improved sys/software integrated engineering environment
  - But there is also potential for existing programs who perhaps are already using some set of the std tools which have Jazz integrations and are looking for improvements in targeted ALM areas.

Engagement with OSLC Standards

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- ***Product Line Engineering is a key strategy for Boeing to manage the many product "variants" that typically accompany most, if not all, major Programs. In aerospace, particularly on the Defense side, almost every customer requires a specific variant.***

- The challenge is to make sure that you can work with, and identify artifacts within the context of the product variant that they pertain to. This is facilitated when tools enable you to link and navigate across domain product and team deliverables (e.g. requirements, design, test, plans, builds, etc.) but within the proper variant or baseline context.

OSLC Committees	Role
Steering	Member
Core TC	Observer
	Observer
Change and Configuration Management TC	Member
Automation TC	
Comm WG	Member
Patterns WG	
PROMCODE TC	
Requirements, Architecture and Quality TC	agreed to participate when kicks off

open-services.net	Role
Embedded Systems Working Group (use cases)	Member
OSLC4MBSE	Member

Model-Based Safety Analysis Pilot Project

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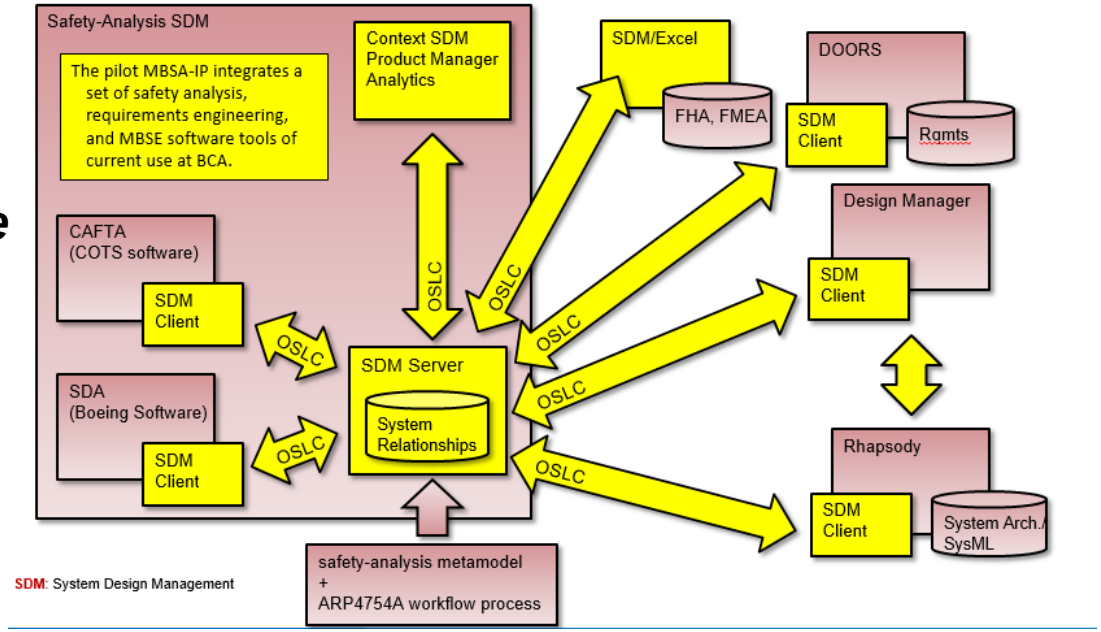
- ***The MBSA Program is working to develop an integrated framework to increase the efficiency of the safety analysis process by increasing the automation and reuse of safety-analysis artifacts, data retention and traceability to apply toward future Programs.***



- Their work revolves around leveraging OSLC adapters that work with the Mentor Graphics Context SDM solution and Boeing investigators are collaborating with them to test and understand the technical solution with the goal of eventually extending that to interface with the other Jazz-based platform tools as well, hence allowing us to integrate even more diverse engineering disciplines in the future.

Other Efforts

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- ***Another Internal R&D Project is trying to create a model-based engineering environment around linked data and engineering data shared semantics. Part of their approach is to study linked data standards to identify the best technological approach to base this framework on.***

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Conclusion

- **Continue to investigate OSLC as a useful enabling technology that can help with all of the issues described herein and how connecting data from various places within the engineering development lifecycle can enable applications to collect metrics and apply useful analytics to the resulting complete data view of the Program.**
  - Install, preview and keep apace of new IBM Jazz platform capabilities
  - Cooperate with other Boeing Programs/activities who are also working on standards-based solutions for interoperability challenges.
  - Teaming with Early Adopter Production Programs to develop and implement deployment roadmaps which leverage Jazz-based platforms and other OSLC integrations.

Conclusion (cont.)

- ***More work is required that will need continued action and collaboration between early adopters, vendors and the software and systems engineering communities.***
  - This includes end user organizations designing complex products (e.g. aerospace industry, automotive)
  - tool vendors offering software solutions for engineering and integration (e.g. IBM, Mentor Graphics as well as bridge OSLC solutions such as Gears, OSLC adapters for Simulink and MagicDraw, OSLC search and link tools) and ….
  - consultants offering data integration services (e.g. Koneksys, Tasktop).
- ***Success is being achieved but Programs will achieve more success as industry explores and defines specific interoperability usage scenarios which will drive the OSLC specification development which will ultimately result in more mature toolsets that support the standard.***

Some Key Challenges

- ***Thousands of connections which have to be made and then maintained. Are all the traceability relationships required in a typical production engineering program going to have to be created manually?***
- ***Link management (Where should those links between applications be managed? How?)***
- ***Extending the OSLC connectivity by providing understandable and usable analysis capabilities around things like coverage and impact analysis, consistency checking, other reasoning capabilities***
- ***Secure access across firewalls or requirements for encrypting the data communications when working with customers, suppliers in the face of ITAR or classified data requirements, for example.***
- ***Performance and Reliable connectivity in the context of distributed linked data repositories and web technology.***