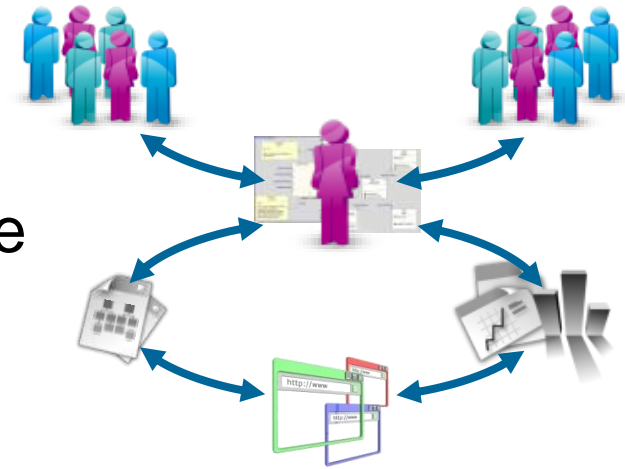


IBM Rational

IBM System and Software Solutions

Design and Model Management across the Product Development Lifecycle



Amit Fisher, IBM Rational Systems Technical Client Relationship Manager,
amfisher@us.ibm.com

Agenda

- **Integration of multiple life-cycle artifacts – why a new approach is needed?**
- The new approach ...
- IBM Rational solution offerings
- A word on versioning and configuration
- Standards, call for action!

Complexity is the biggest challenge facing organizations today!

“Today’s complexity is only expected to rise, and more than half of CEOs doubt their ability to manage it.”

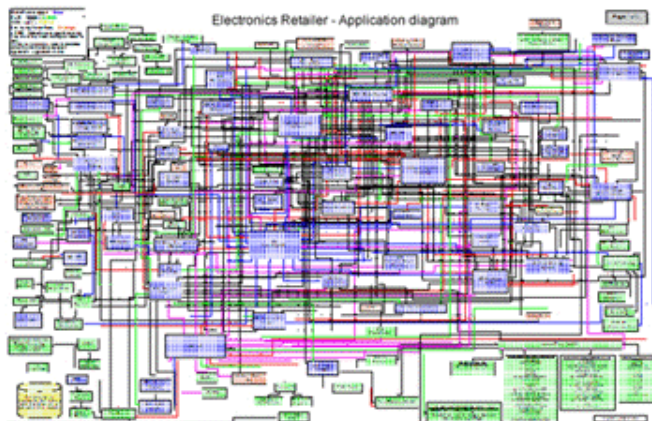
IBM 2010 Global CEO Study: 1500 face-to-face interviews, Companies of all sizes across 60 countries, representing 33 industries. ([IBM CEO study](#))

Whether IT or device-based, software-based applications continue to grow in size and complexity. Globally distributed and diverse teams, outsourcing and supply chain dependencies lead to increased challenges in the timely launch of competitive products and services.



Organizations struggle to balance agility and complexity.

It's not enough to manage development, the design process itself must become more streamlined and efficient.



Smarter products mean that complexity is rising



- Product innovation enables companies to:
 - Leapfrog their competition
 - Grow demand
 - Increase revenues
 - Raise profits

- The next generation of innovative, smarter products requires more:
 - Instrumentation
 - Intelligence
 - Interconnection

- This leads to increasing complexity

Increased complexity impacts productivity and innovative capacity

Engineers struggle to answer key questions

Are we ready to ship our new UK aircraft variant?

Which requirements, tests and model elements contain the words 'on-board radar'?

A safety standard has changed—which requirements, tests, design elements and implementation artifacts are impacted?

How many requirements for the satellite payload are related to tests that failed on their last execution run?

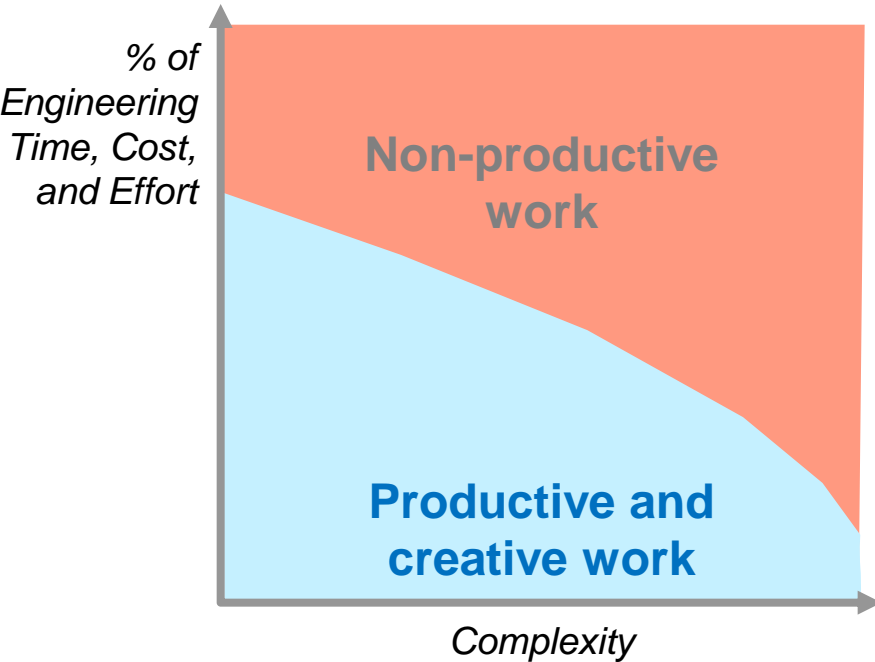


I need to define a new variant for France that reuses parts of the US model – which artifacts define the US variant?

Less Productivity = Less Innovation

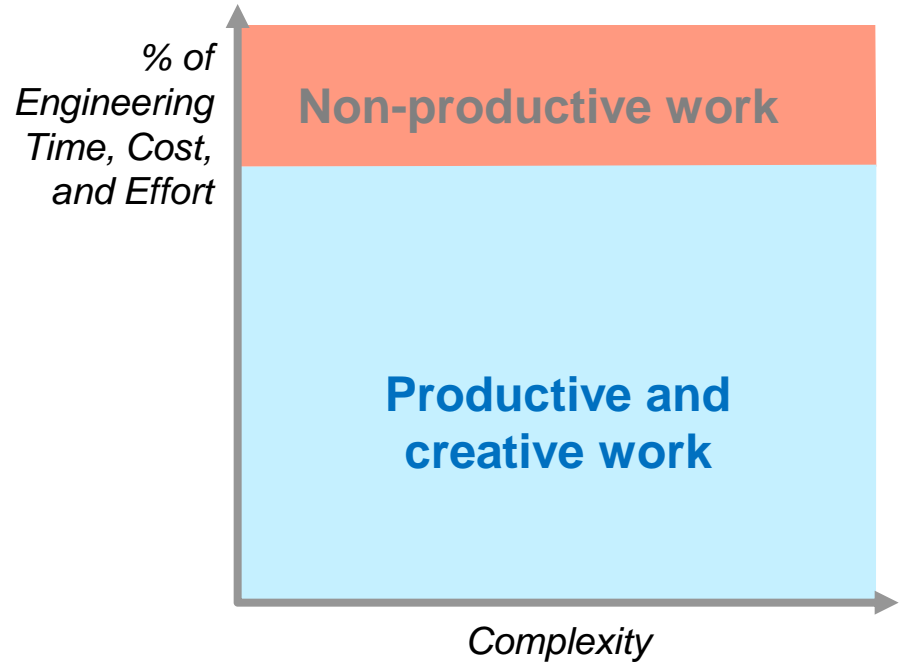
The need for smarter products means that complexity will keep rising
The time, cost, and effort needed to manage complexity increases faster than the complexity itself

Core Engineering Current Workload
(trying to manage complexity)



- Engineers spend more time trying to manage complexity and less time being productive
 - Extra manual steps are needed resulting in increased errors

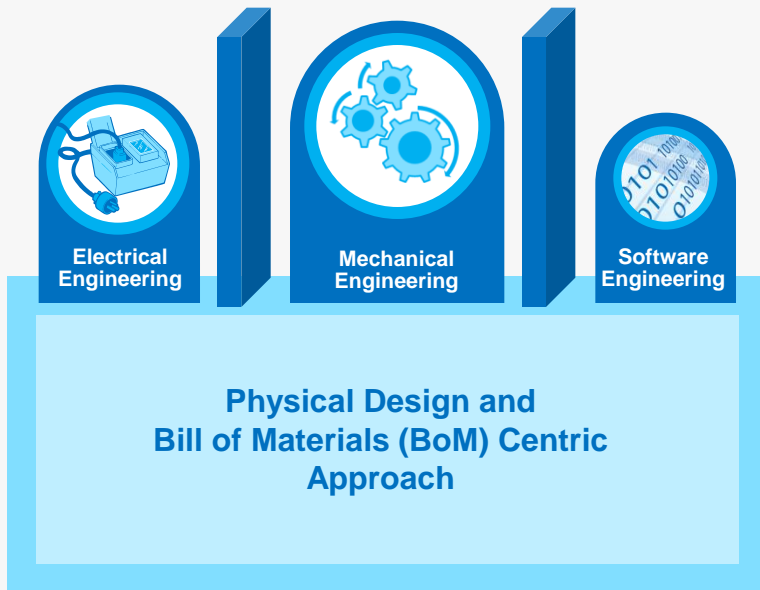
Core Engineering Desired Workload
(Successfully managing complexity)



- Engineers spend more time being productive
 - Automated steps deliver higher quality work with less errors

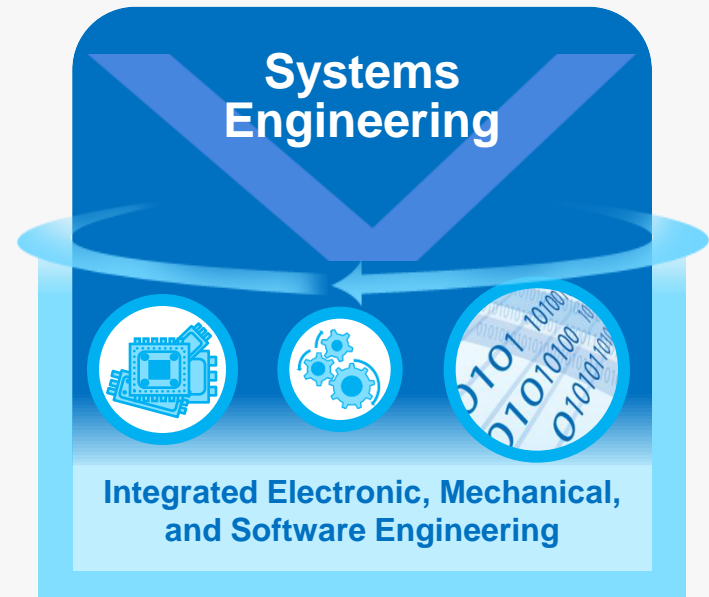
Smarter products won't be developed the same old way

Traditional Product & Systems Development



- Focused on CAD/CAM and BoM
- Slower to react to change
- Silos of engineering disciplines

Next Generation Product & Systems Development



- More focus on software and electronics
- Responsive to change
- Systems engineering methods optimize product designs and engineering collaboration

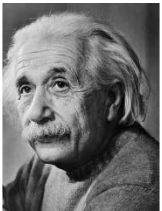
But what does it really mean?

- The challenge is multi-dimensional...
 - Model Management is part of a bigger lifecycle management challenge
- No single vendor can address the challenge alone...
 - ~~Most~~ **All** Systems companies today use large variety of best of breed tools
- No single platform can address the challenge alone...
- No Single standard can address the challenge alone...

- **Yet we need much better integration and cross-domain analysis capabilities ...**

- ***We need fresh thinking***

How can we be different this time?



“We can’t solve problems by using the same kind of thinking we used when we created them”

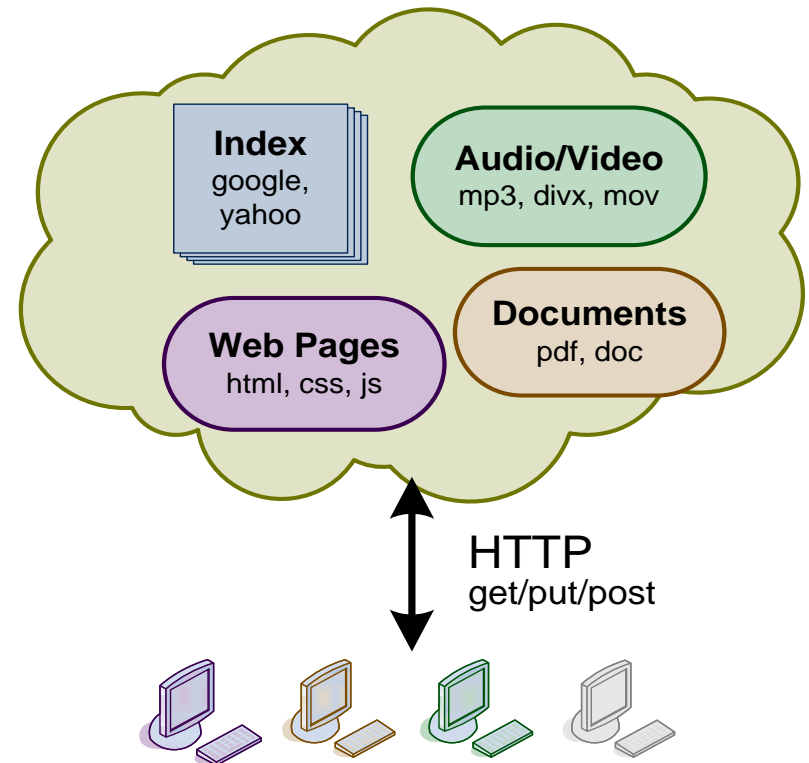


Agenda

- Integration of multiple life-cycle artifacts – why a new approach is needed?
- **The new approach ...**
- IBM Rational solution offerings
- A word on versioning and configuration
- Standards, call for action!

Let's look at something we all know very well ...

- The Internet : distributed and global “data space” of linked documents.
- Enormous content providers
- Simple – adhering to common basic protocols
- Extremely scalable
- Open, Standardized



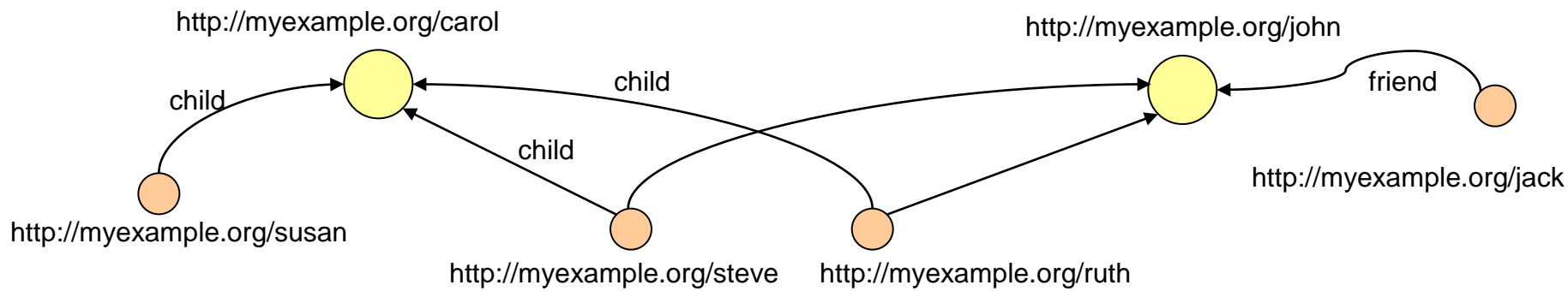
Linked Data



<http://www.w3.org/DesignIssues/LinkedData>

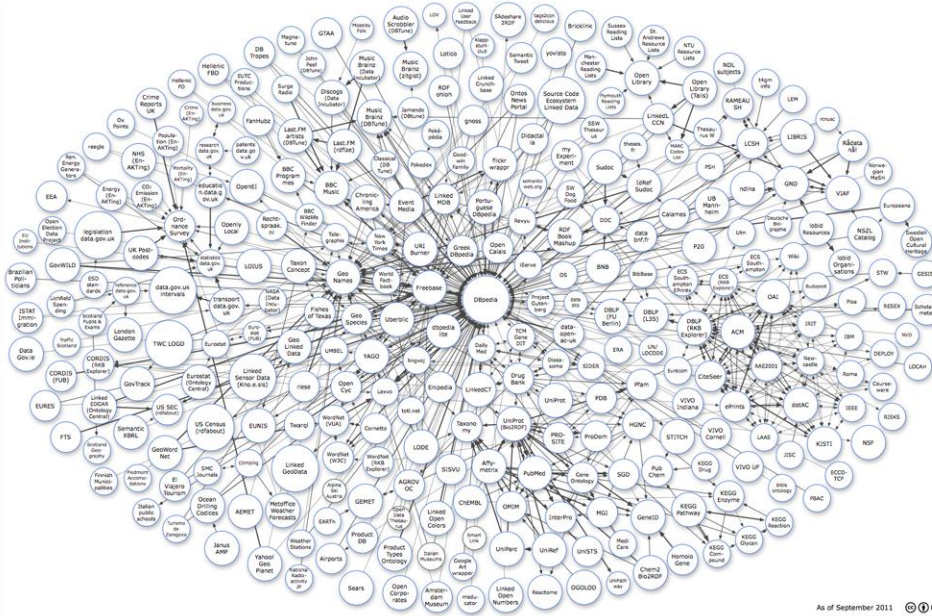
Four simple principals :

1. Use URIs as names for things
2. Use HTTP URIs so that people can look up those names
3. When someone looks up a URI, provide useful information, using standards (e.g. RDF*, SPARQL**, ***REST)
4. Include links to other URIs, so that they can discover more things



*RDF, the Resource Description Framework provides a generic graph-based data model for describing things, including their relationships with other things.
 ** SPARQL is a query language able to retrieve and manipulate data stored in RDF format
 ***REST, REpresentational State Transfer (REST) is a style of software architecture for distributed systems where requests and responses are built around the transfer of representations of addressable resources

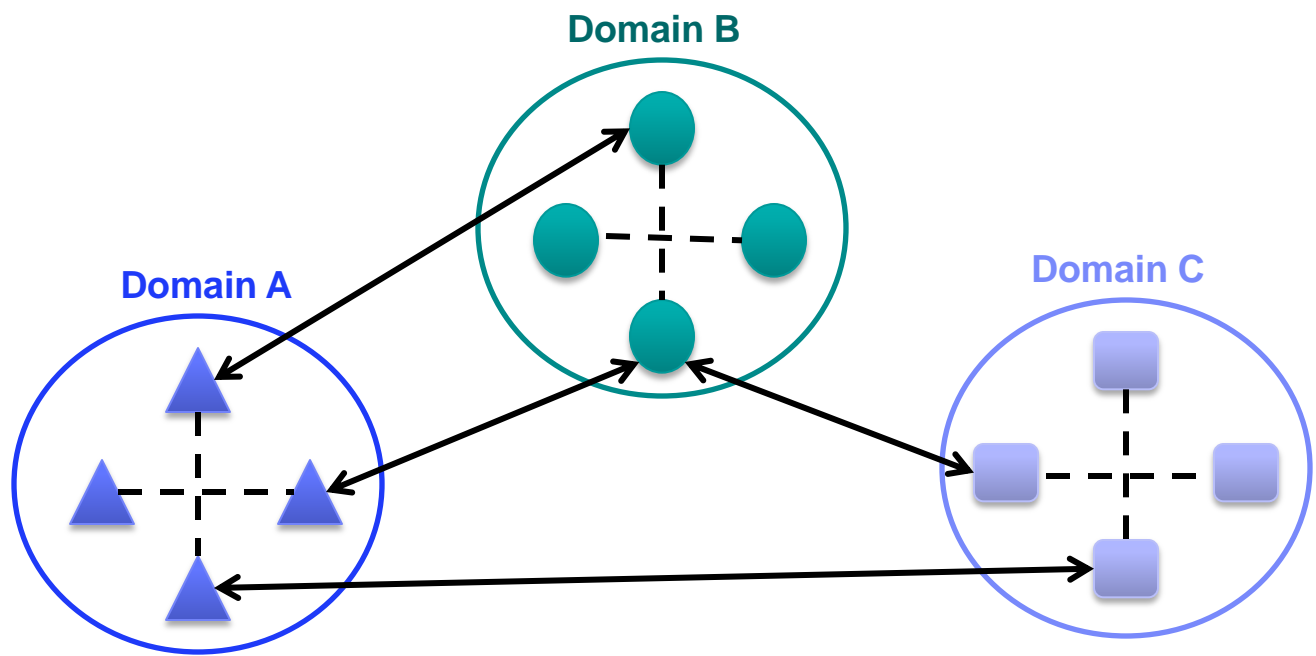
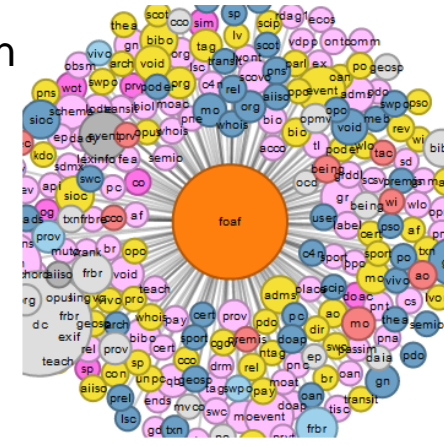
Highly scalable, but still simple



The figures above show the data sets that have been published and interlinked by the [Open Data Movement](#) so far. Collectively, the 295 data sets consist of over **31 billion RDF triples**, which are interlinked by around **504 million RDF links** (September 2011).

Domains

- Domain is a formal representation of knowledge as a set of concepts within a specific context, and the relationships among those concepts.
- Domain specifications help in unification and standardization of Linked Data sources that are “semantically close”.
 - Prevent duplications
 - Enhance understanding



Engineering and the Web?



=



?

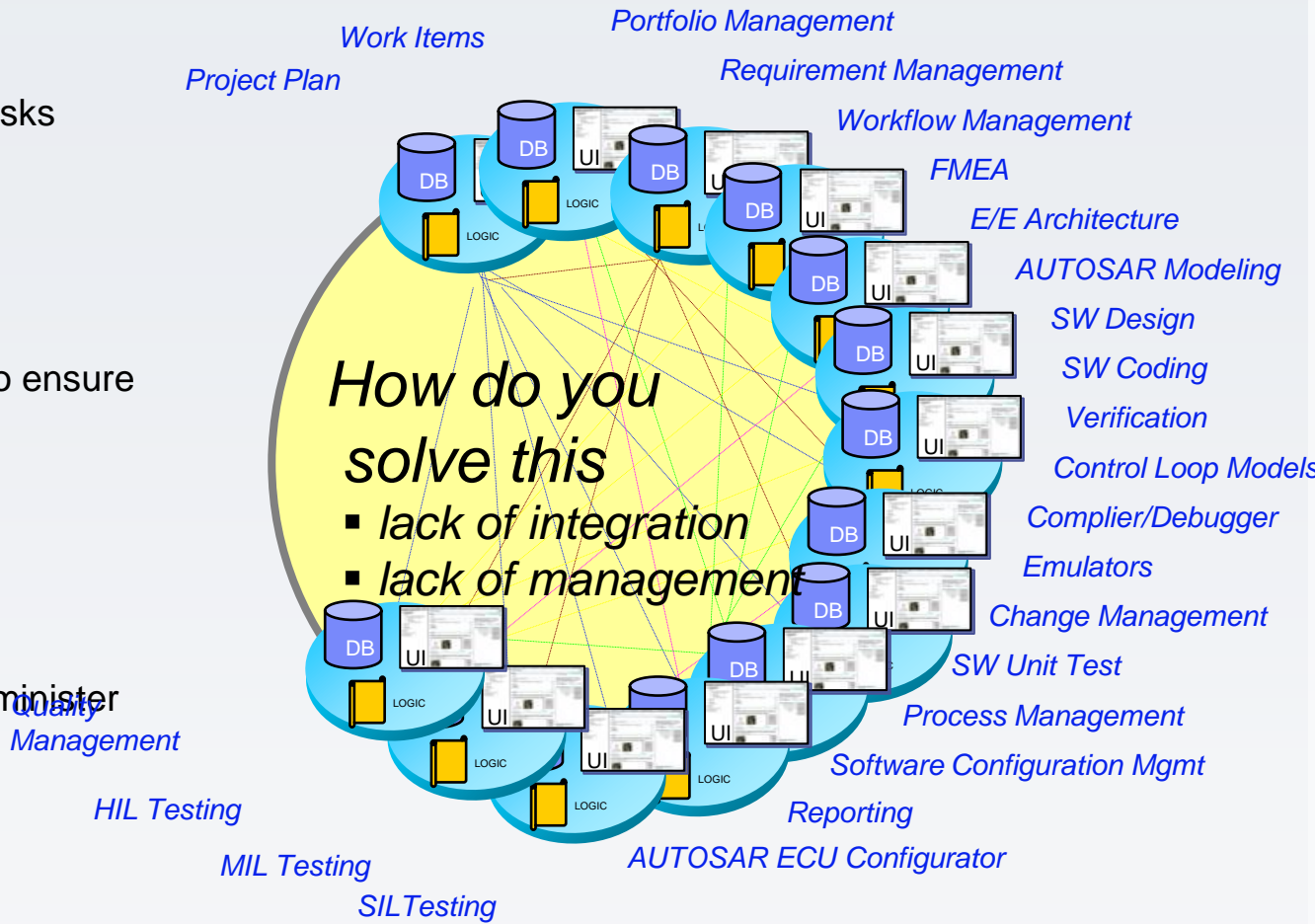
E/E engineering environments are highly fragmented - *the challenge to connect them is increasing exponentially*

Traditionally, each tool came with its own

- **UI** - Web and desktop presentations of views and tasks
- **Logic** - Workflow, process, search, query, scale, security and collaboration
- **Storage** - individual files on workstation or servers: how to ensure availability and traceability?

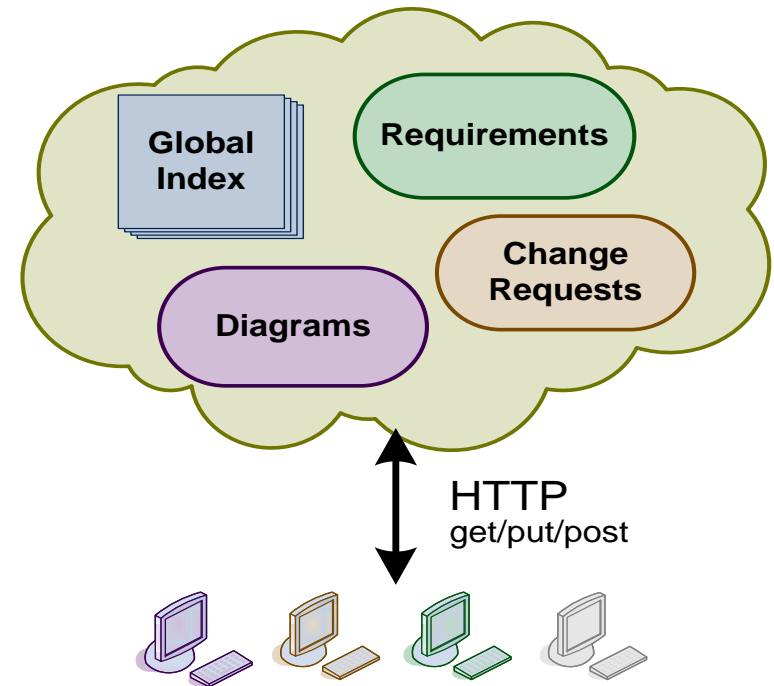
Resulting in...

- Brittle/poor integrations
- Silos everywhere
- High cost to maintain and administer
- Low re-use

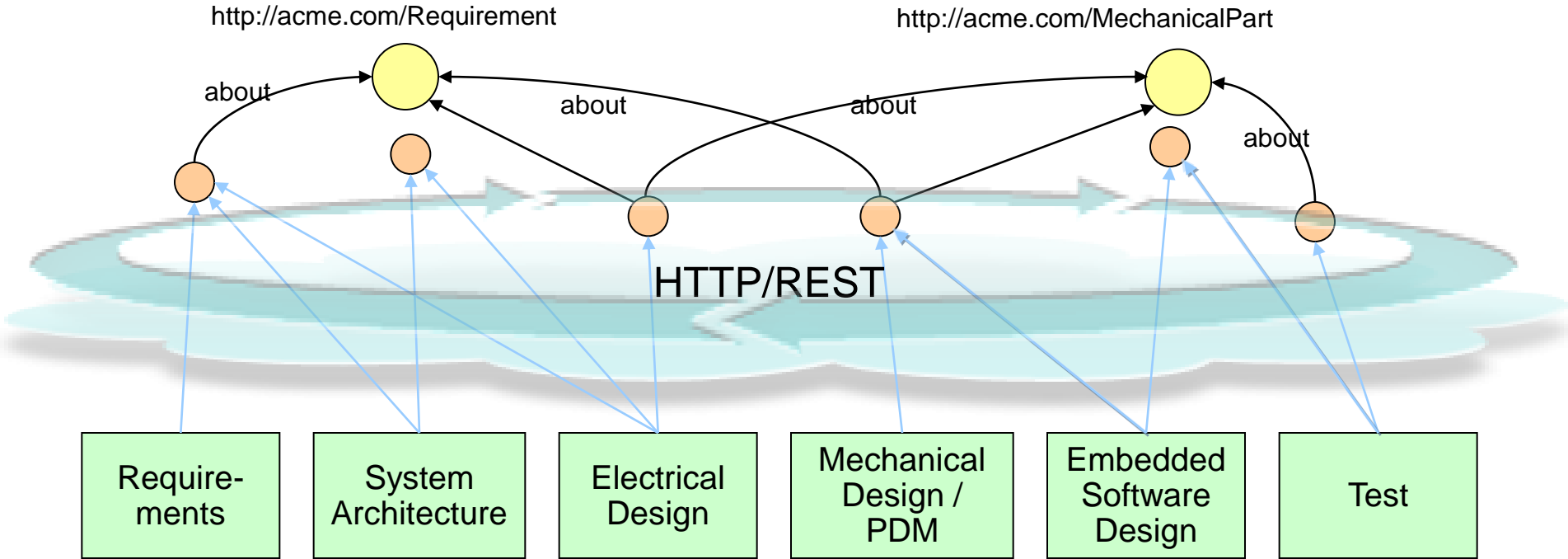


What does Internet inspiration mean?

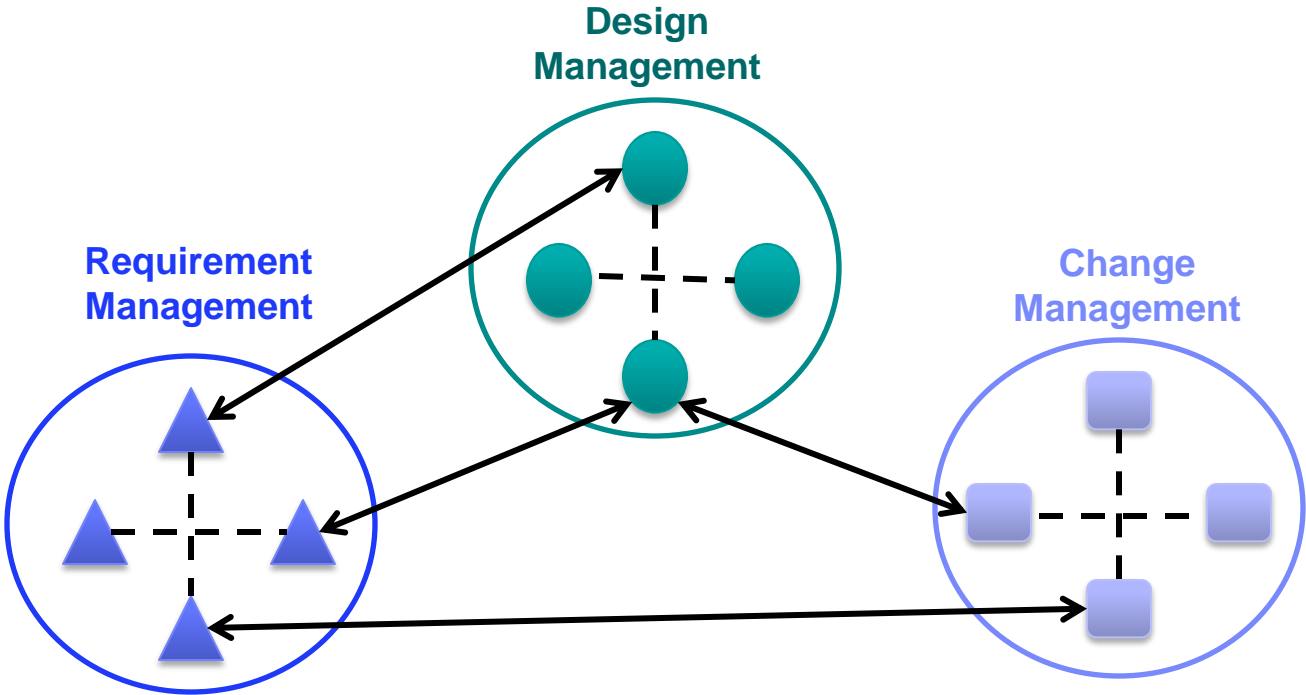
- Data specified independently of tools
- All data are resources with URLs
- Multiple tools access data
- References are embedded URLs
- Resources have representations
- Unprecedented extensibility



Leveraging the Linked Data concepts of Web Technology

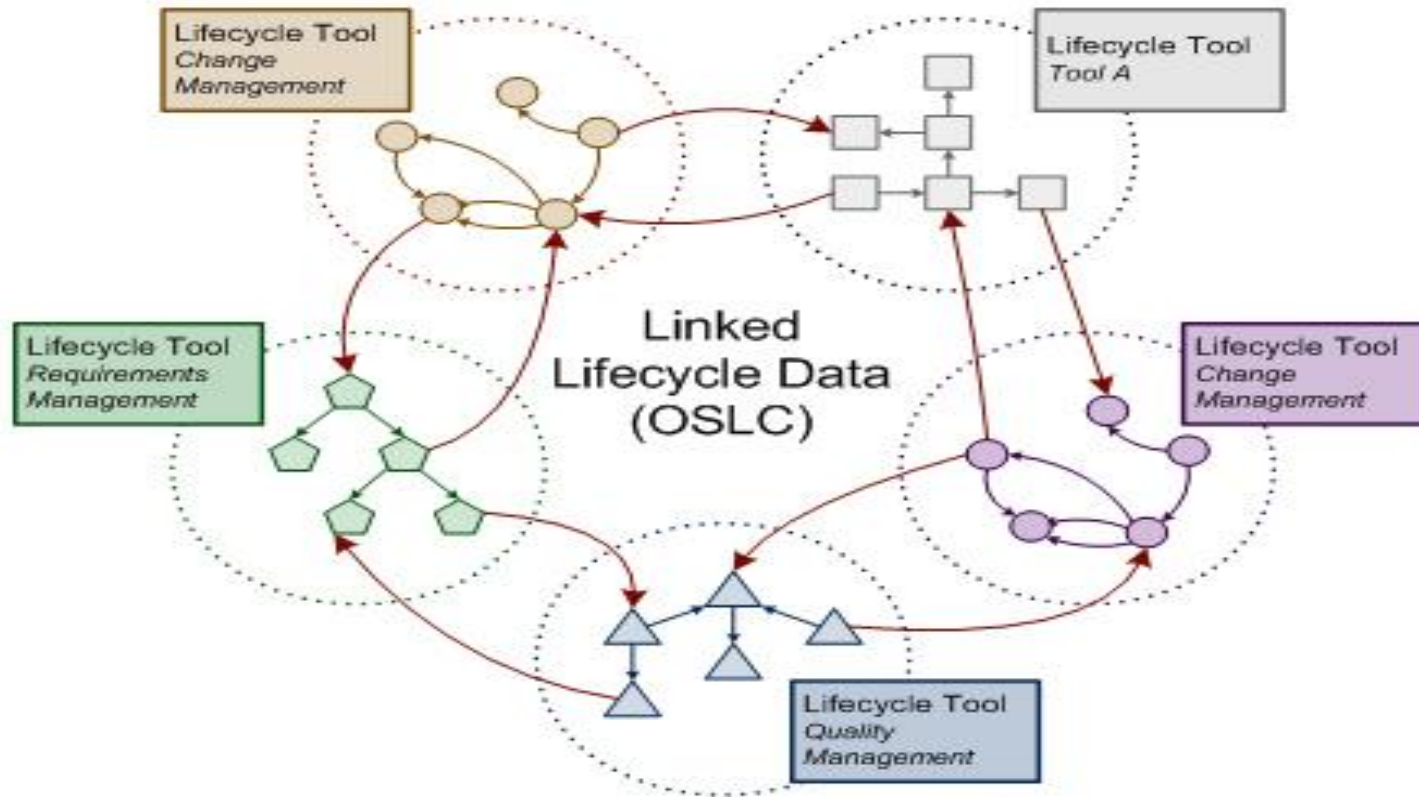


Defining engineering domains



Linking Lifecycle Data via OSLC

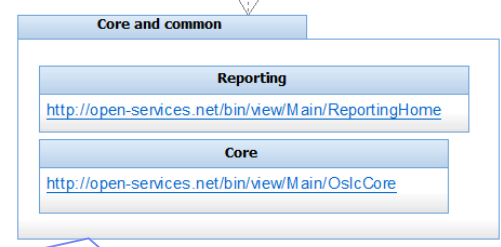
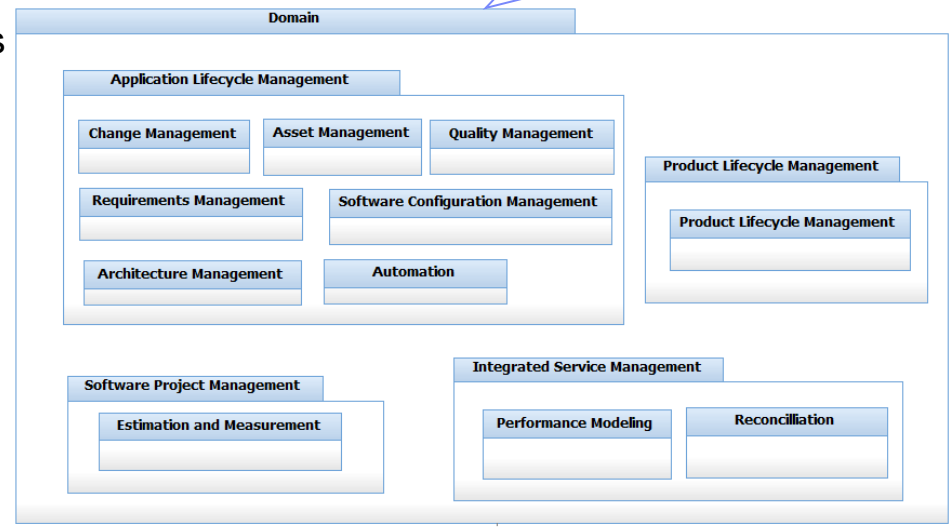
- Resources from different domain tools are linked together using OSLC



What is OSLC?

- OSLC is a set of *work groups* writing specifications for **interactions between lifecycle tools**
 - Standardizing a small number of resource types and a minimal protocol
 - It is *not* trying to standardize tools behavior, capabilities or data
- OSLC is based on Linked Data:
 - Access life cycle data created by different tools over a web of raw data
 - Every lifecycle artifact (requirement, defect, model element,...) is an HTTP resource identified uniquely by an HTTP URI
 - The resource is manipulated using standard HTTP methods (GET, PUT, POST, DELETE)
 - Every resource must have an RDF representation

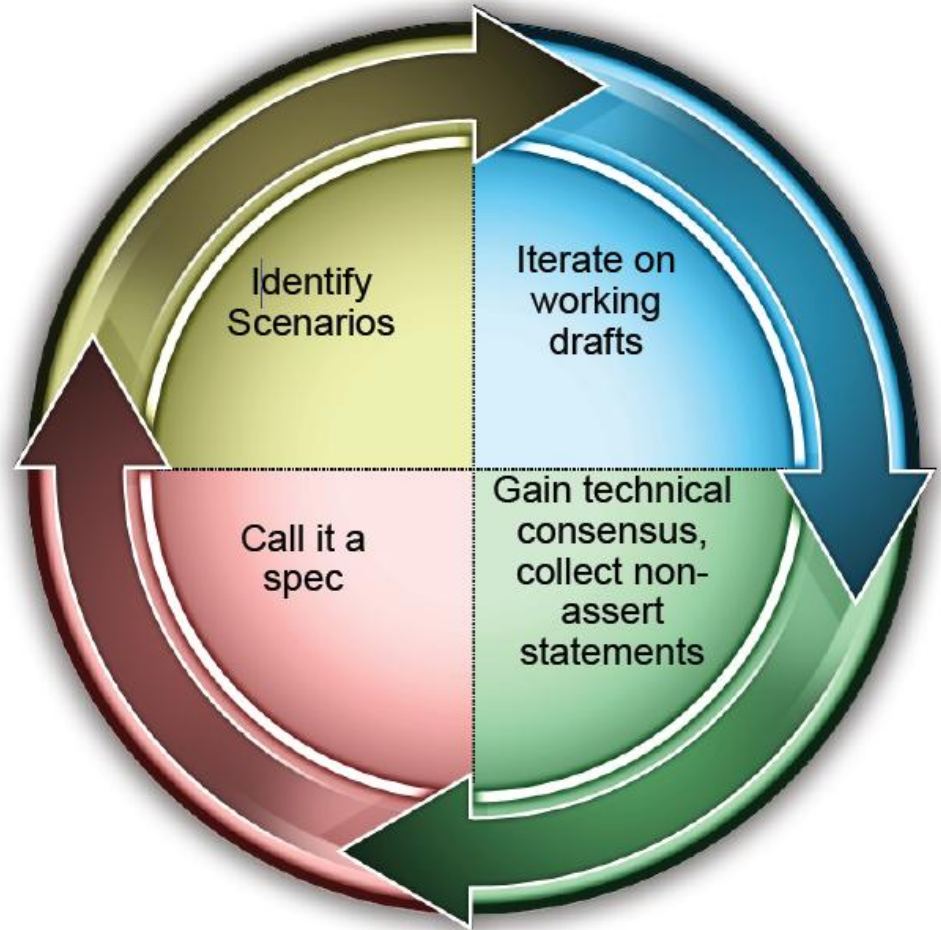
- Minimal set of resources and services required for the domain
- Resource types, properties and relationships
- Creation factories, query capabilities, operations



- How to use HTTP and RDF, how to define resources and services
- Common resource types and properties

OSLC approach to produce specifications

- Minimalist approach:
 - “Just enough” for a given domain
 - No tool’s behavior specification
 - No tool’s data specification
- Scenario driven scope
- Co-evolve spec and implementation
- Open participation in active workgroups



OSLC community

Wide range of interests, expertise, participation

- Vendors, end users, industry consortia
- 40+ organizations have had employees participate in specification development efforts
- Collaborating on solutions for ALM, DevOps, ISM, PLM

Growing list of implementations from IBM and others

- Implementations from IBM Rational, Oracle, IBM Tivoli and open source
- 3rd party adapters from IBM, Kovair, Tasktop, and open source
- Dozens of end users enabling homegrown tools

Completed and active specifications for many domains

- Change Management, Quality Management, Requirements Management, Asset Management, Architecture Management, Automation
- Product Lifecycle Management, Configuration Management
- Performance Monitoring, Reconciliation

OSLC website at <http://open-services.net>

Open Services for Lifecycle Collaboration
Lifecycle integration inspired by the web

Forum Wiki Mailing lists Log in Sign up

Blog About Resources Workgroups Specifications Software Organizations Participate

OSLC

An open community dedicated to making it easier to use lifecycle tools in combination

Learn more [about the OSLC community and linked data](#)

Get involved with our community and [see who else is involved](#)

Catch up on [what's new with the community](#)

See [tools, tutorials, and references](#) to help you adopt our specifications

Browse our [current specifications](#) and see [available software](#)

Follow +1 50 Like 126 people Sign Up your friends

Open Services for Lifecycle Collaboration
Lifecycle integration inspired by the web

Blog About Resources Workgroups Specifications Software Organizations Participate

Home /

Specifications

Core and common

Core	v2	Score
Configuration Management	v1	Score
Reporting	v1	Score

Application lifecycle management

Change Management	v2	Score
Quality Management	v2	Score
Requirements Management	v2	Score

Resources

Tools

Eclipse Lyo
The Eclipse Lyo project focuses on providing an SDK to help the Eclipse community to adopt OSLC specifications and build OSLC-compliant tools. The source code is available in a Git repository.

OSLC Tools Project on SourceForge
A project from the OSLC Community to help you learn and implement OSLC specifications. The project creates reference implementations, test suites, example code and other content that supports the OSLC community.

(These tools on SourceForge have been mostly replaced with Eclipse Lyo)

Tutorials

Integrating products with OSLC
This tutorial explains how to integrate tools with OSLC. The tutorial uses examples, starting with simple ones and building to more advanced topics such as implementing an OSLC Provider.

OSLC Primer
(Download as PDF or EPub)
A primer for technical leaders who want to understand the concepts and goals of OSLC and its relationship to other standards for evaluation, as well as potential OSLC implementers who want a general overview of the OSLC concepts and an understanding of the thinking and use-cases that led to their definition.

Videos

Getting started on implementing OSLC
Watch Steve Speicher describe the planning and tasks involved in integrating software with Open Services...

Using OSLC to integrate JIRA with the Rational solution for Collaborative Lifecycle Management
This demo shows how JIRA can seamlessly integrate with the Rational solution for Collaborative Lifecycle...

[See more Videos](#)

Articles

Aligning Software Development Teams through Collaborative Design Management
How OSLC principles help development teams share, analyze, find, and review design information while also...

Silos Changing: Ensure the product does what the customer said
This blog post explores the problems of managing and refining customer requirements using many software...

[See more Articles](#)

Presentations

Eclipse Lyo Perl Modules (Mini-cast 3-pack)
This webcast will be presented in 3 parts: Details and demo of the Lyo-OSLC module which...

OSLC ALM-PLM Interoperability
View the YouTube playlist with all five parts. View the entire single video on Vimeo.

[See more Presentations](#)

W3C Linked Data Platform Working Group website at:
<http://www.w3.org/2012/ldp>



The **mission** of the Work Group is to produce a W3C Recommendation for HTTP-based (RESTful) **application integration patterns** using read/write Linked Data. This work will benefit both small-scale in-browser applications (WebApps) and large-scale Enterprise Application Integration (EAI) efforts. It will complement SPARQL and will be compatible with standards for publishing Linked Data, bringing the data integration features of RDF to RESTful, data-oriented software development.

The logo for the World Wide Web Consortium (W3C). It features the W3C logo on the left, followed by the text "WORLD WIDE WEB" in white on a blue background, and "consortium" in white on a darker blue background below it.

LINKED DATA PLATFORM WORKING GROUP

[-Linked Data Basic Profile](#)

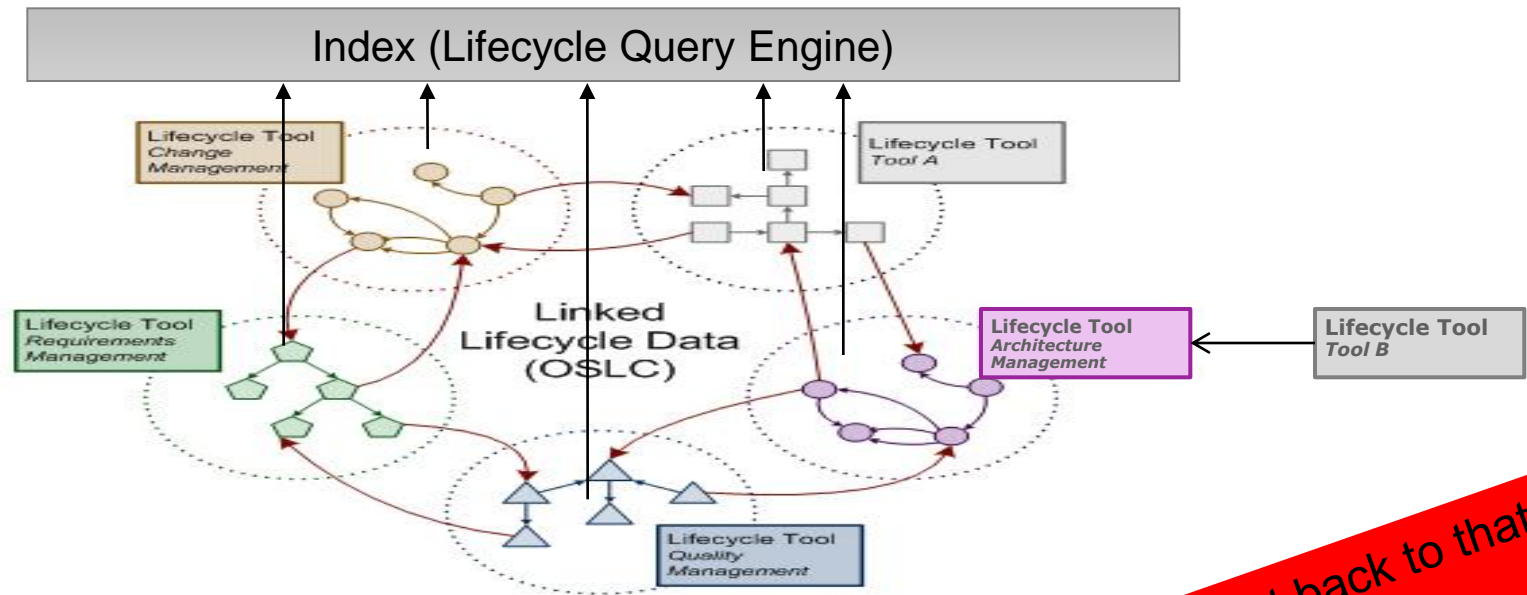
-IBM, DERI, EMC, Oracle, Red Hat, SemanticWeb.com, Tasktop

-Supporters: Siemens, Cambridge Semantics

-Over forty participants from over twenty organizations

Now it is possible! Index of Linked Lifecycle Data

- An index of Linked Data is created from domain tools that allows for cross-domain **Lifecycle Analysis**



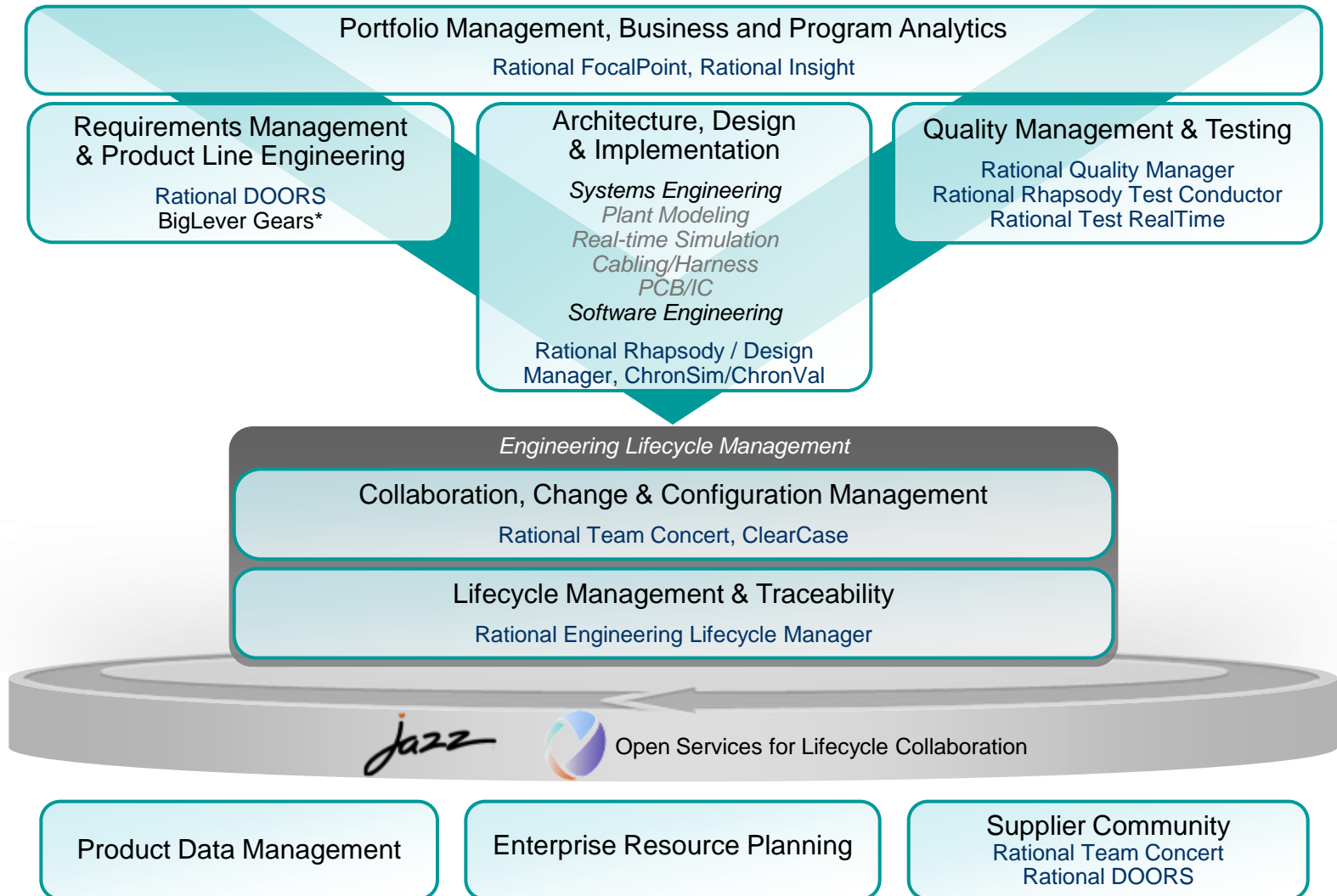
We will get back to that in few minutes ...

Agenda

- Integration of multiple life-cycle artifacts – why a new approach is needed?
- The new approach ...
- **IBM Rational Solution offerings**
- A word on versioning and configuration
- Standards, call for action!

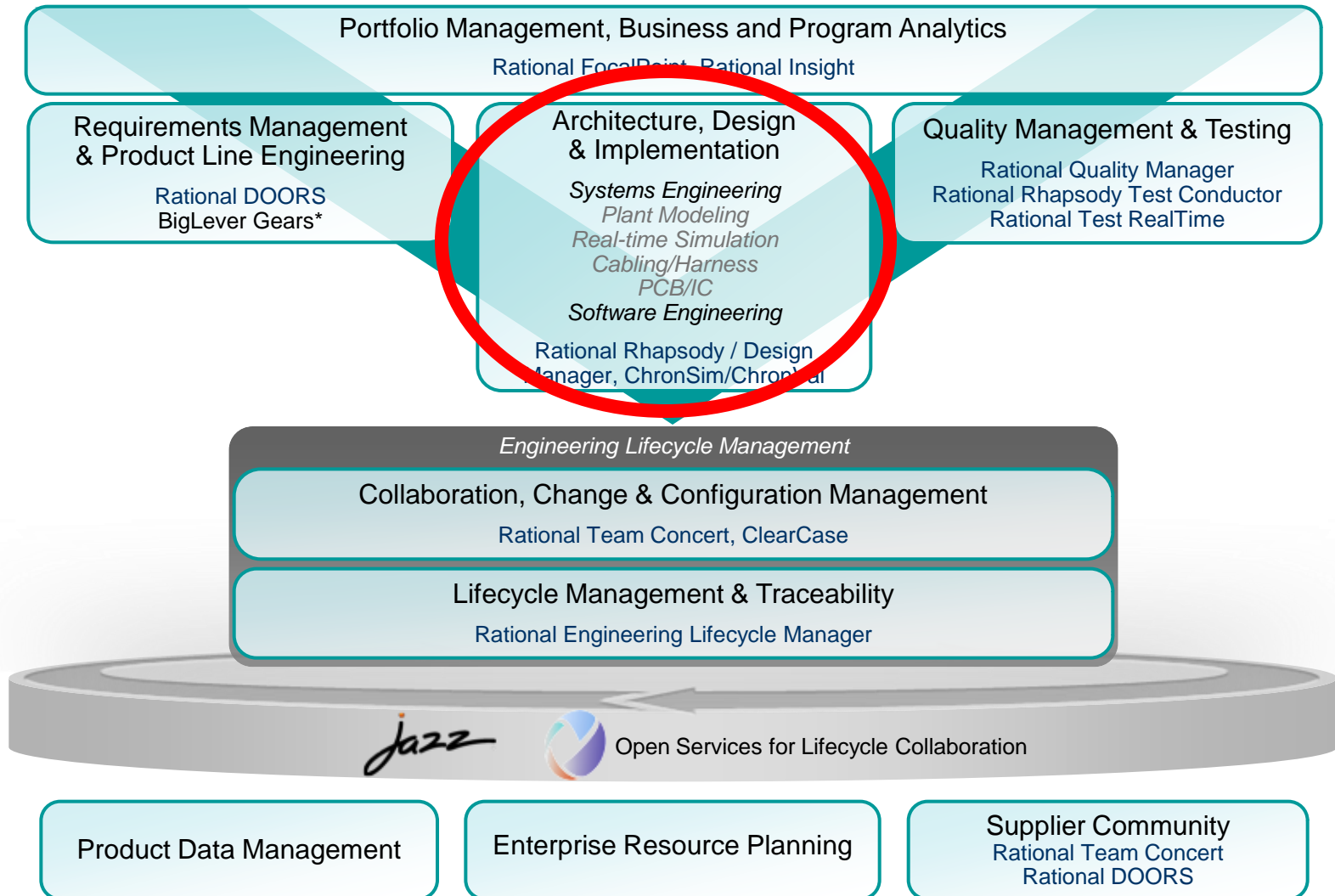
IBM Rational Software Platform for Aerospace & Defense Systems

Integrations based on standardized and open technologies



IBM Rational Software Platform for Aerospace & Defense Systems

Integrations based on standardized and open technologies



Collaborative Design Management

Enhance cross-team collaboration on software and systems design

Central Design Hub

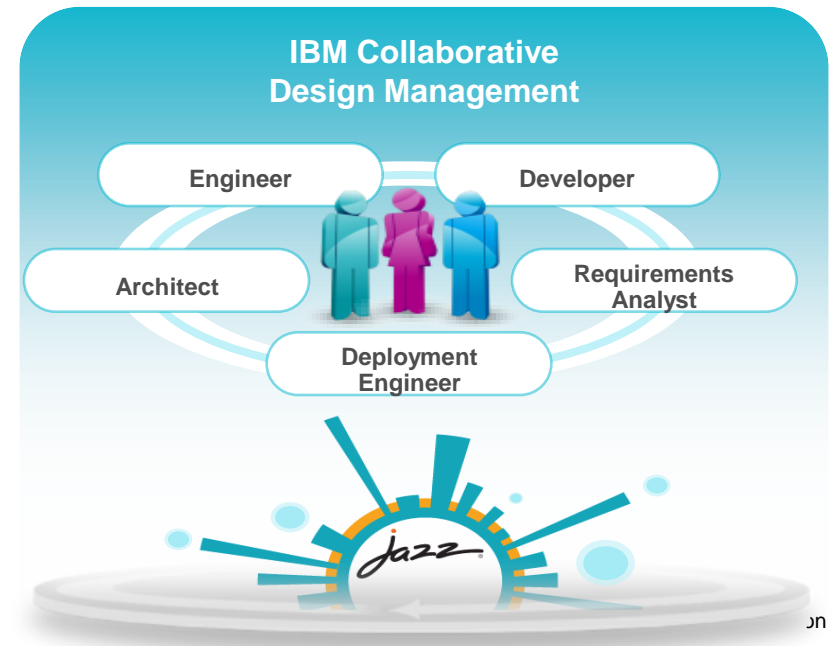
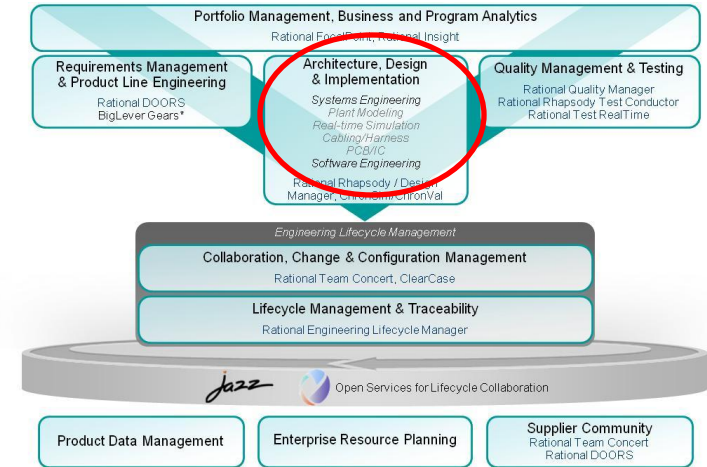
- ✓ Enterprise-wide design storage for search, review, analysis, and reuse
- ✓ Links design elements to lifecycle artifacts
- ✓ Navigate and visualize relationships
- ✓ Simplify design collaboration through Jazz-based model management

Stakeholder Collaboration

- ✓ Automated design reviews at all stages of development
- ✓ Intuitive extended team web client for broader access to designs
- ✓ Unify requirements and design with single-source of truth workflow utilizing OSLC

Document Generation and Reporting

- ✓ Create documents directly from the development lifecycle
- ✓ Draw from information and assets linked through OSLC



Design Management and Collaboration



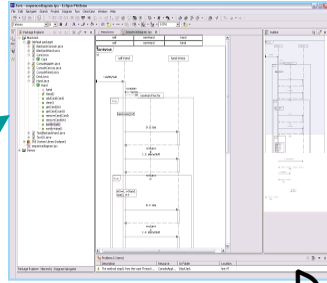
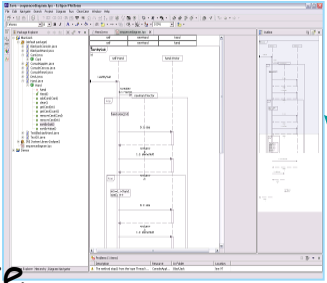
Requirements Server
DOORS / RCC

Change Management Server
RTC *Jazz*

Quality Server
RQM *Jazz*

OSLC

DM Team Server
▪ Models
▪ Cross Lifecycle links
▪ Comments & Markups
▪ Reviews
Jazz



Developer



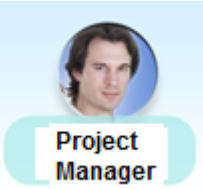
Systems Engineer/Designer

Design Collaborate
Manage Link

Design Collaborate
Manage Link

Rhapsody Client

Rhapsody Client



Project Manager



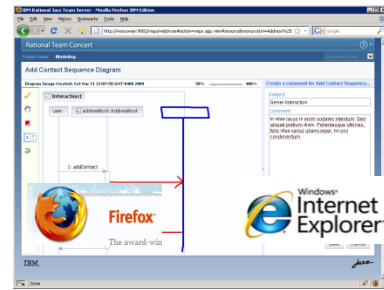
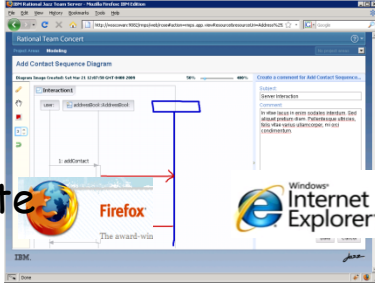
Software Architect

Review Collaborate
Link

Review Collaborate
Link

Web Client

Web Client

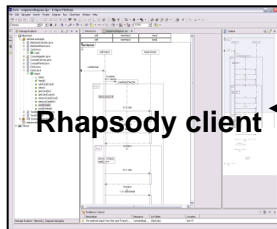


Server Based Model Management



Design change control and versioning (model-based)

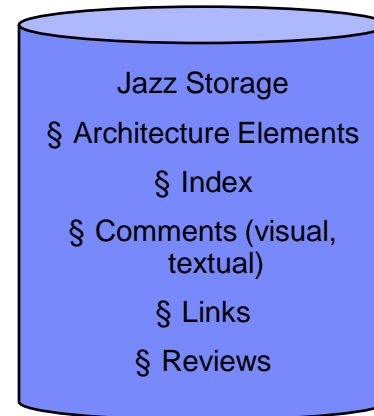
Design creation, editing, MDD/MBSE/MBT, search, query, validate, analyze, report



Rhapsody client

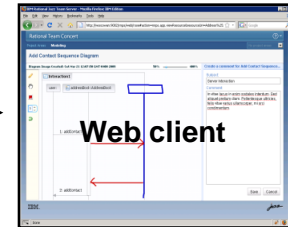
OSLC + DM REST APIs

Design Management services on Jazz Team Server (JTS)



OSLC + DM REST APIs

Design search, query, view, comment, review, link, report, validate, analyze, limited editing



Web client

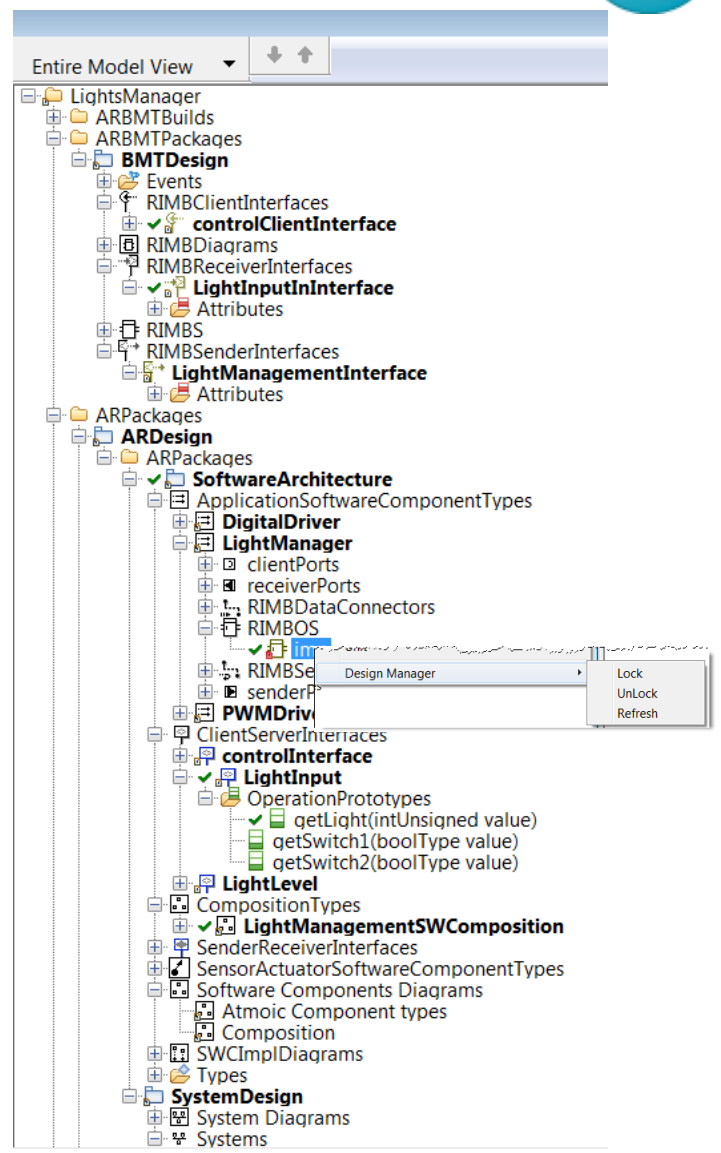
Benefits

- Direct editing of designs and change control on server providing a more simplified environment
- Change control (locking, history) at the model resource level providing more granularity
- No duplication or design synchronization issues
- Use of SCM still available for users who need more powerful change control capabilities (i.e. Software Engineers)



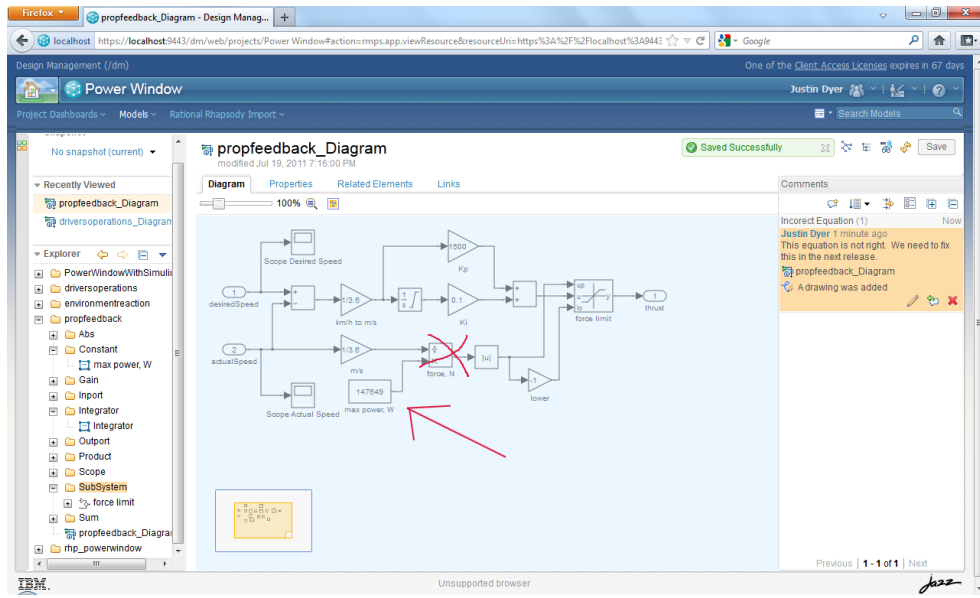
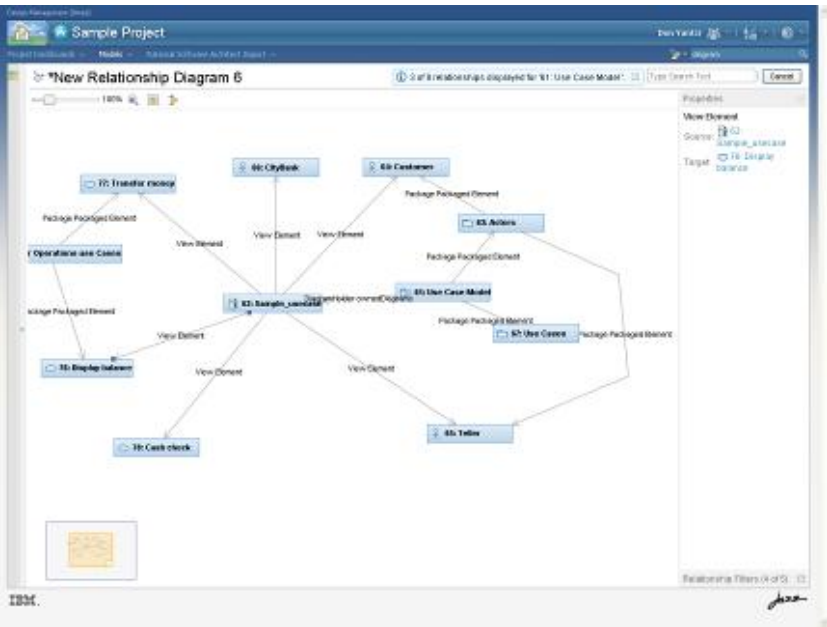
Simplified Design Collaboration

- **Server Based Model Management**
- Designs **directly editable on Jazz** from Rhapsody client
- Locking, versioning, history, and **change control** on **individual model elements**
- **Parallel workspaces** and snapshots
- Changes grouped into **change sets**
- **Design reviews** on private changes prior to sharing



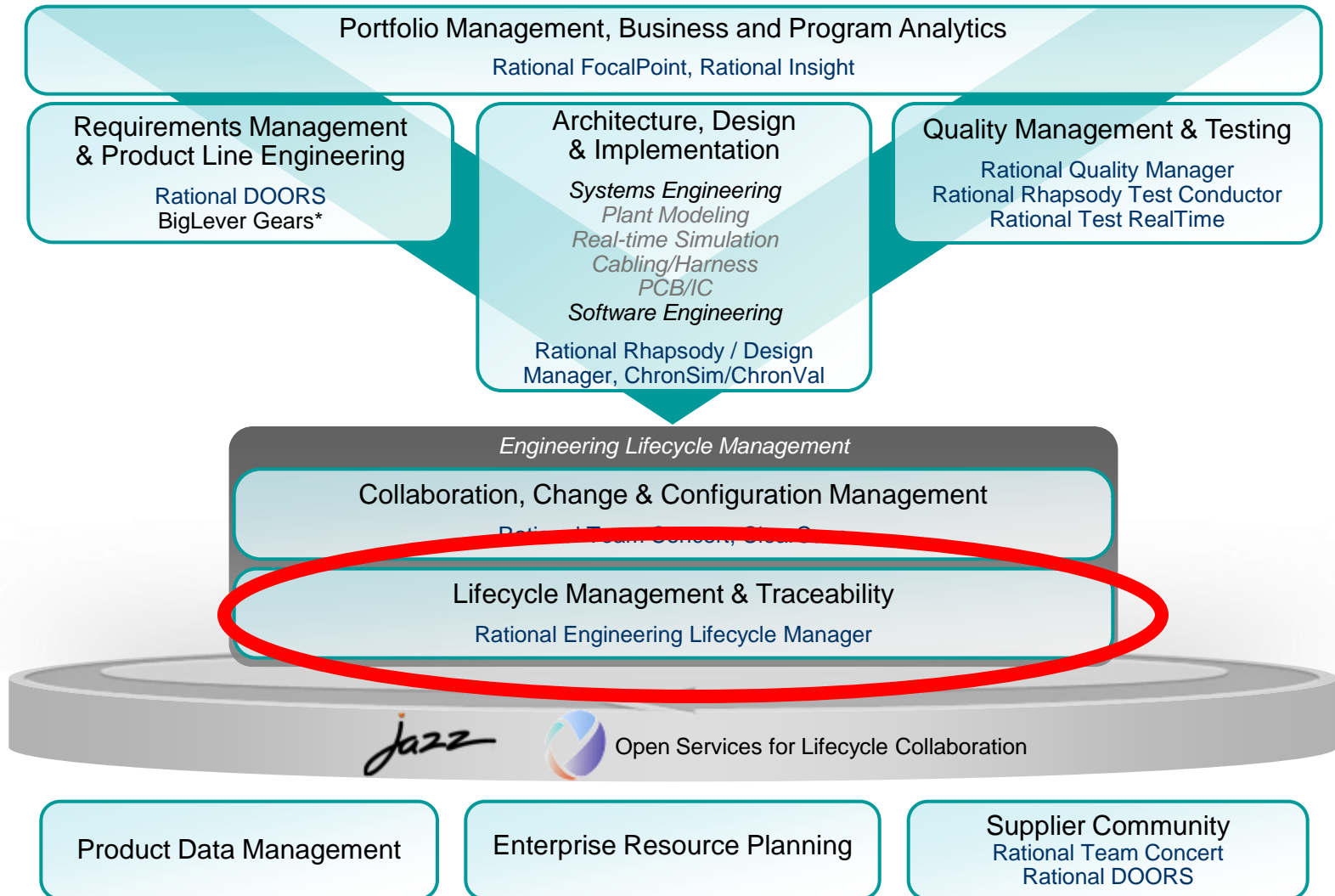
Integrating 3rd party models in Design Manager

- It is possible to publish 3rd party models into Design Manager DM and create links to the model
- Example below shows Simulink models and its associated OSLC links to external artifacts



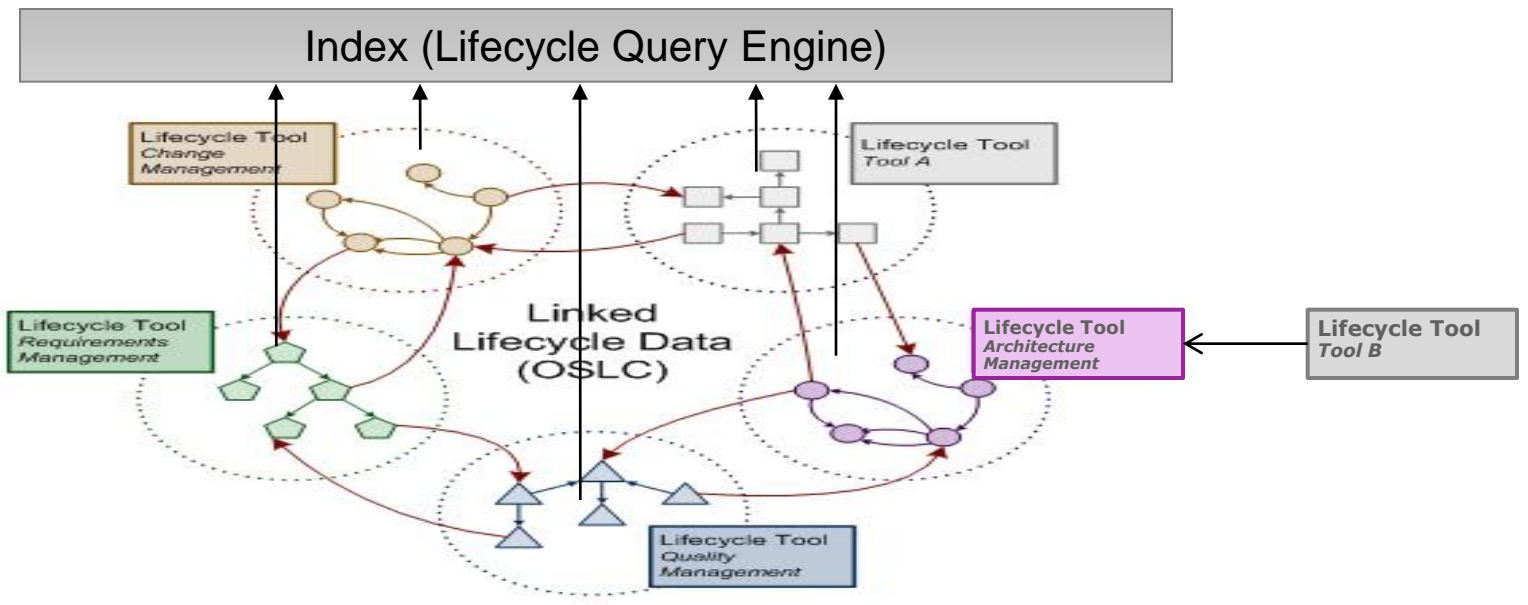
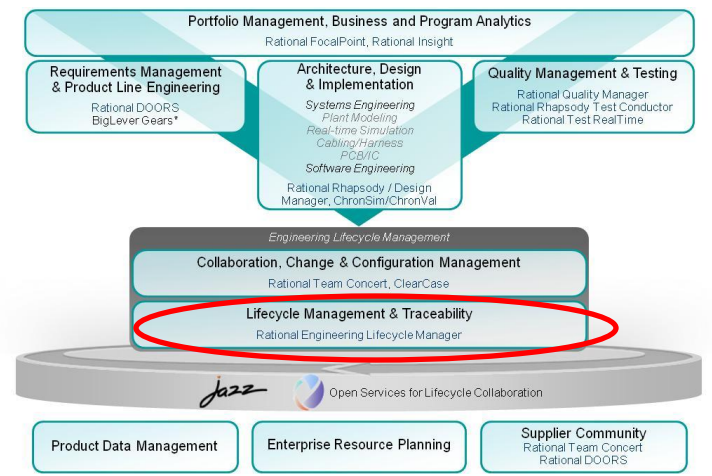
IBM Rational Software Platform for Aerospace & Defense Systems

Integrations based on standardized and open technologies



Reminder: Index of Linked Lifecycle Data

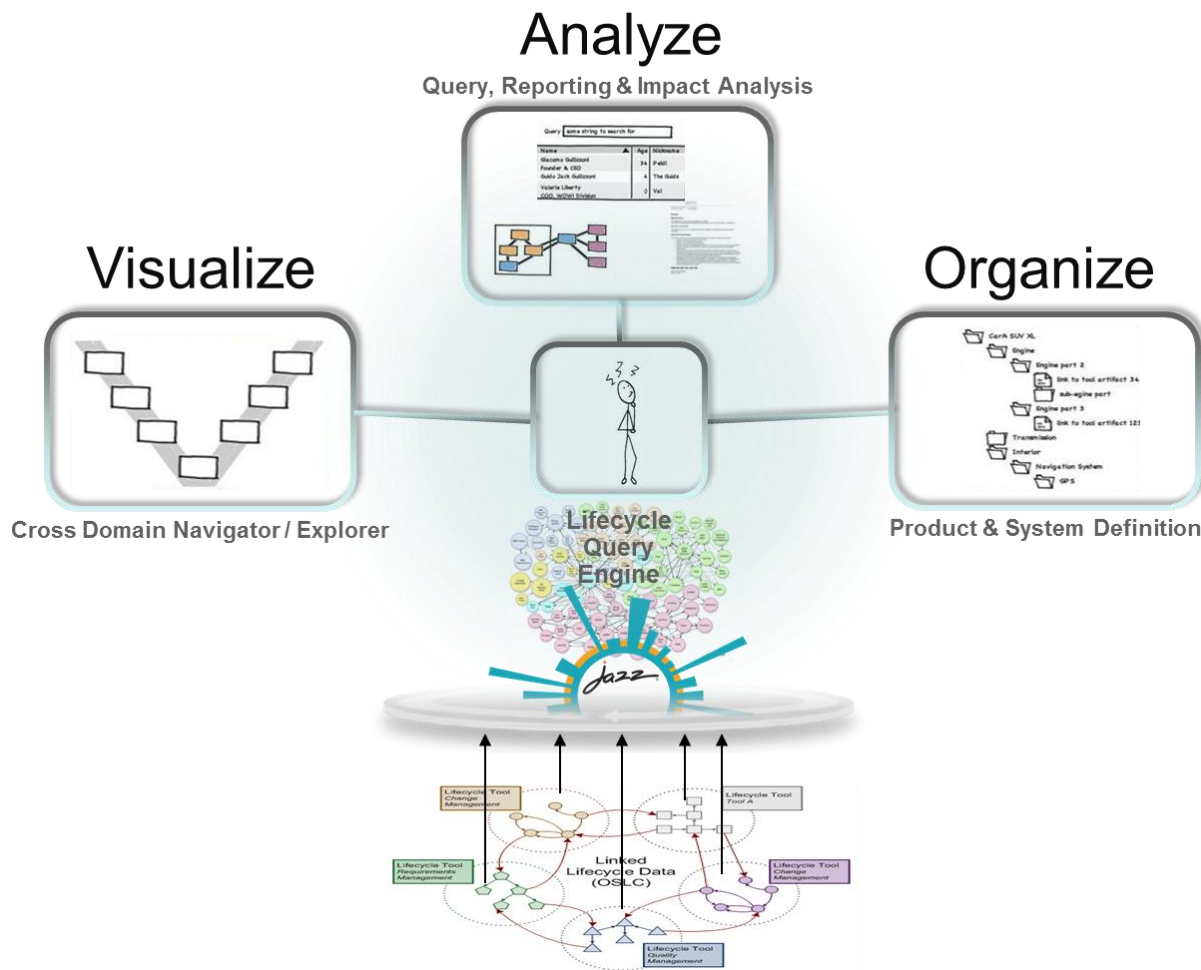
- An index of Linked Data is created from domain tools that allows for cross-domain **Lifecycle Analysis**



Rational Engineering Lifecycle Manager

Visualize, Analyze and Organize Engineering Lifecycle Data

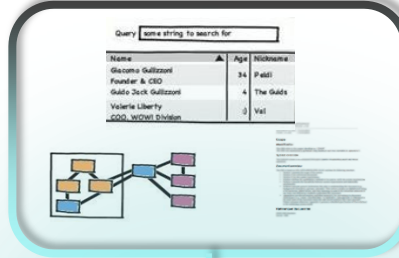
- Easy search, query and reporting across artifact types regardless of data source/location
- Understand relationships between engineering lifecycle data and analyze impact of changes
- Visualize engineering data and relationships in the context of role, process or product structure
- Get faster, more complete answers to key engineering questions across the lifecycle



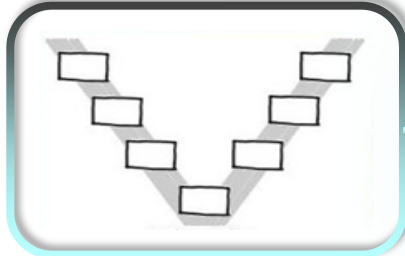
Rational Engineering Lifecycle Manager

Analyze

Query, Reporting & Impact Analysis

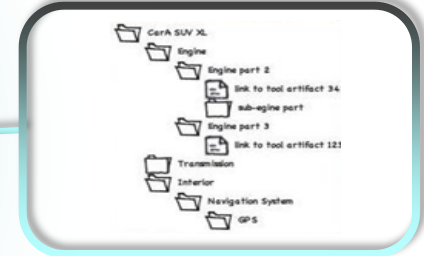


Visualize

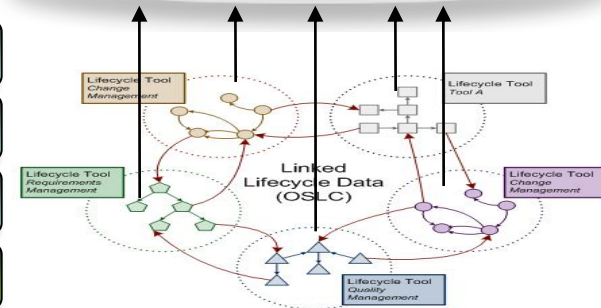
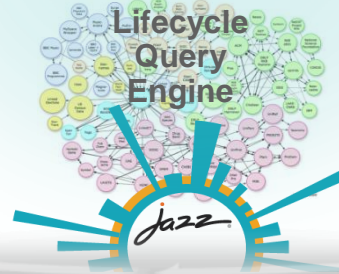


Cross Domain Navigator / Explorer

Organize



Product & System Definition

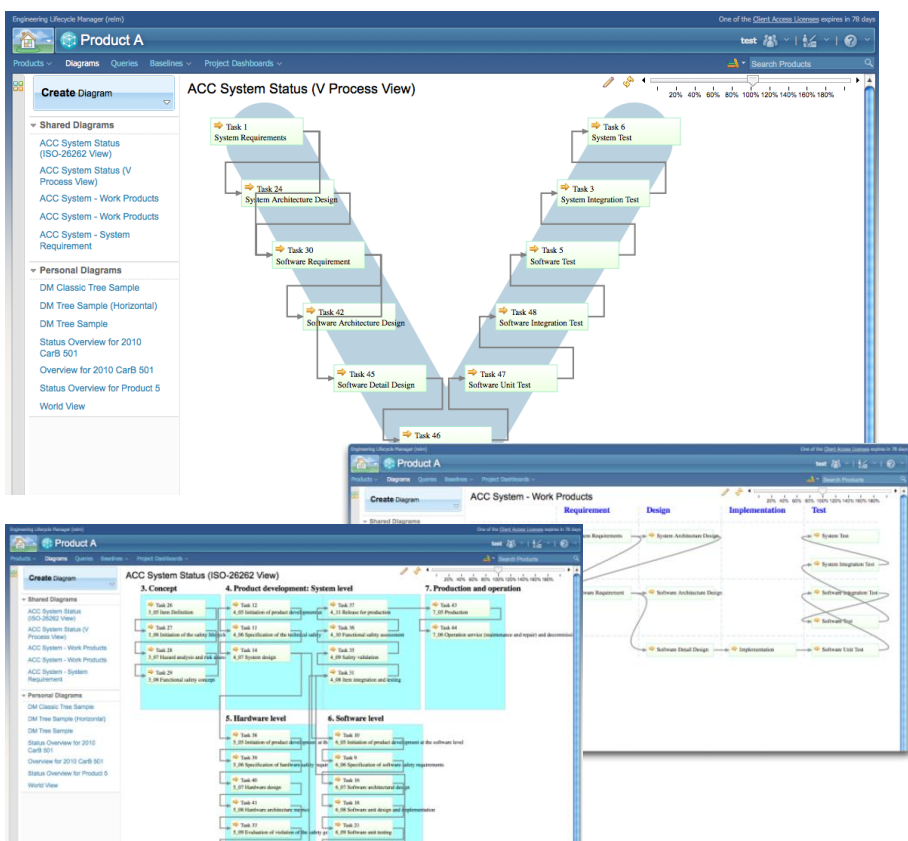


Plus data from integrating products (e.g. Simulink)

- ARCHITECTURE & DESIGN
Rational Rhapsody with DM
- CHANGE MANAGEMENT
Rational Team Concert
- ...
- ...
- HOMEGROWN
Homegrown Tool

- REQUIREMENTS MANAGEMENT
Rational DOORS
- QUALITY MANAGEMENT
Rational Quality Manager
- ...
- ...
- 3RD PARTY
3rd Party Tool

Visualize: Navigator / Explorer



- **Structured and traceable views of engineering data across the development lifecycle**
 - Role and task relevant views
 - Product, system, sub-system, capability and component centric views
 - Process, standards and framework centric views with access to supporting guidance

- **Views are 'live' and dynamic**

- **Interactively explore and interrogate development lifecycle data and relationships**

- **Predefined views to support specific industries (e.g. ISO 26262)**

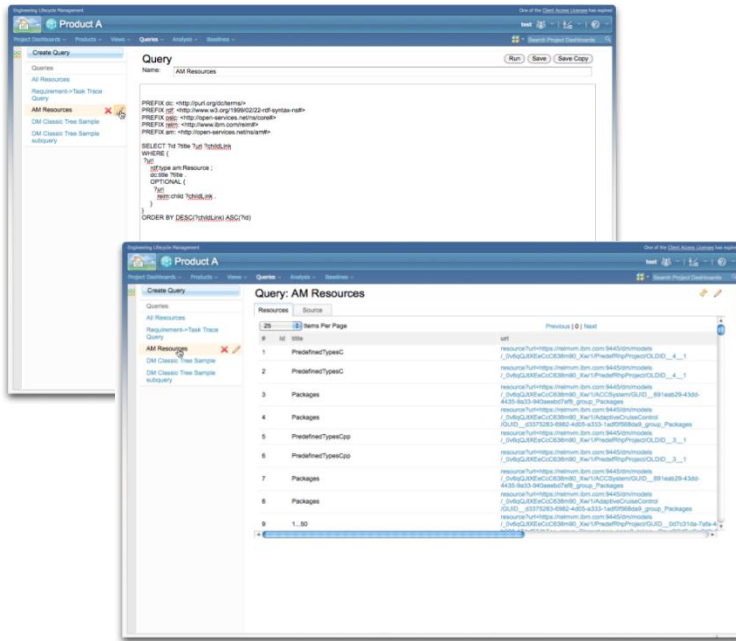
- **Ability to create new views or customize predefined views**
 - Table / Grid, Tree, Freeform

- **Save and share views**

Example User Story

“So that I can more easily achieve, maintain and monitor compliance to ISO26262, as a Safety Manager I need a view that shows me the different process tasks, their status and related tasks, and allows me to drill down to analyze linked lifecycle resources”

Analyze: Search / Query



- Perform plaintext searches across development lifecycle data
- Construct powerful queries to answer specific questions about development
- Save, share and re-use searches and queries

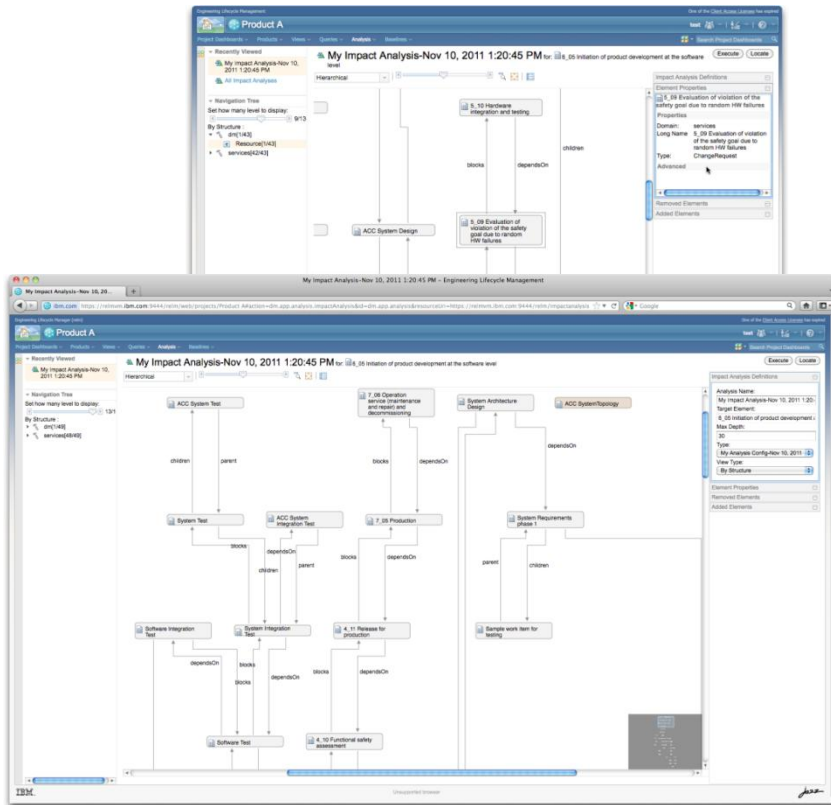
Example User Story

Example User Story

“So that I can understand overall implementation status for a specific product variant for a new market, as a Product Manager I need to be able to construct a query that shows me which requirements are associated with tests that failed on their last execution run within the context of my specific product variant.”

“So that I can perform ‘Where Used’ analysis, as a Systems Engineer I need to be able to construct a query that shows me which products, systems, subsystems, capabilities, components and their versions and variants are associated with a given requirement, logical design element, or E/E artifact.”

Analyze: Impact and Coverage Analysis Tool

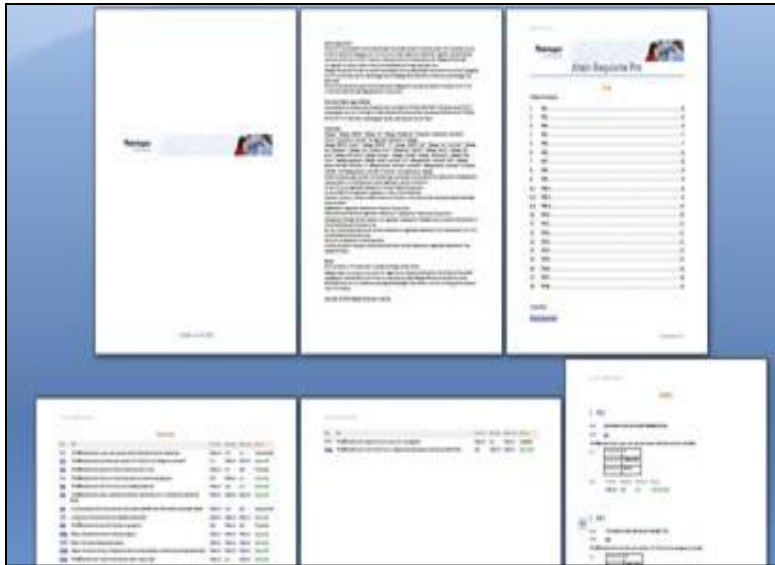


Example User Story

“So that we can understand the impact of a change to a safety requirement on product variants for different markets, as a small cross-functional team, we need to be able to visualize any development lifecycle resources related to that requirement”

- *Understand the impact of change to development lifecycle resources*
- *Validate coverage of design, test and implementation*
- *Prevent gold-plating*
- *Demonstrate compliance to requirements or standards*
- *Discover which products, systems, sub-systems, capabilities, components and their versions and variants use given development lifecycle resources*
- *Save, re-use and share analysis queries*

Analyze: Document Generation

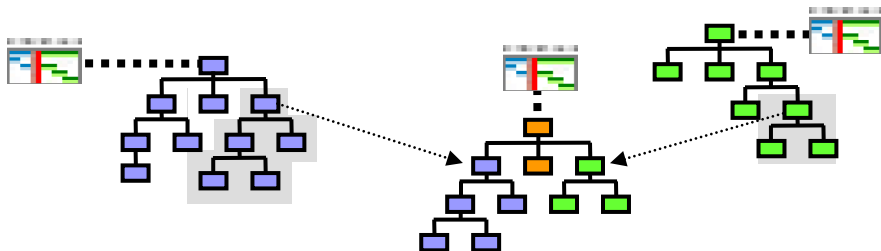
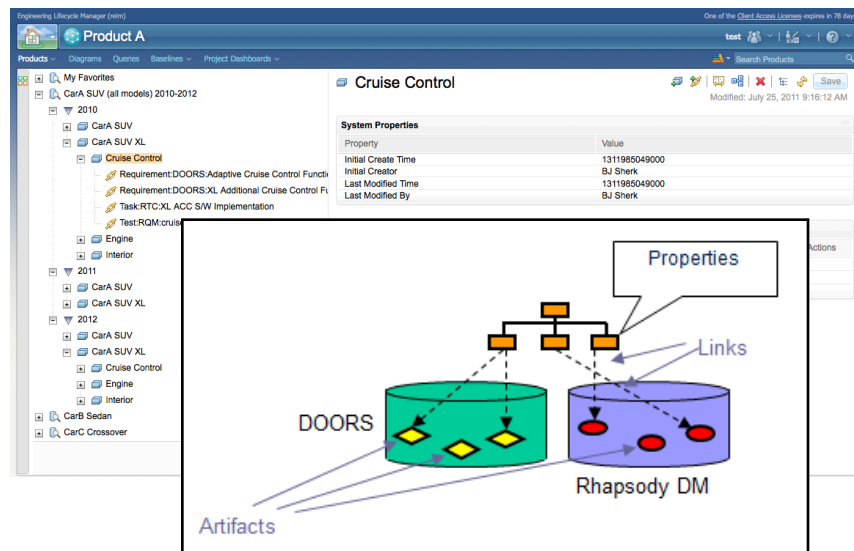


- *Ability to efficiently create important documents including data from across the entire development lifecycle*
- *Predefined documents supporting specific industries / frameworks*
- *Enables documenting proof of compliance (to requirements, to standards etc.)*
- *Enables creation of mandatory deliverables*
- *Uses standard RRDG/RPE technology*

Example User Story

"So that I can document compliance to ISO 26262, as a Safety Manager, I need to be able to create a document that demonstrates required traceability across development lifecycle resources including coverage of safety requirements"

Organize: Systems Definition Tool



Example User Story

“So that I can define product variants for specific markets, as a Product Manager, I need to be able to create a structure for my product and sets of re-usable capabilities, and allocate lifecycle development resources to that product structure”

- **Central facility to define hierarchies of products, systems, sub-systems, capabilities and components**
- **Ability to allocate development lifecycle resources to definitions of products, systems, sub-systems, capabilities and components**
- **Ability to define and compare versions and variants of products, systems, sub-systems, capabilities and components**
- **Ability to specify re-use of development lifecycle resources across products, systems, sub-systems, capabilities and components**
- **Provides a context for visualization and analysis (e.g. queries, reports, impact and coverage analysis)**

Agenda

- Integration of multiple life-cycle artifacts – why a new approach is needed?
- The new approach ...
- IBM Rational Solution offerings
- **A word on versioning and configuration**
- Standards, call for action!

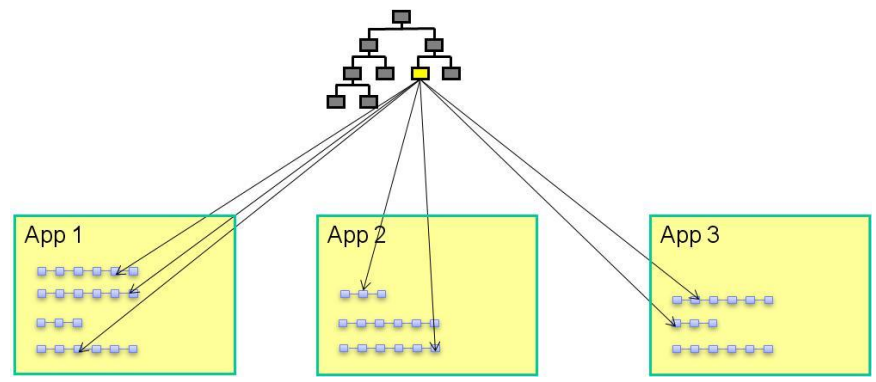
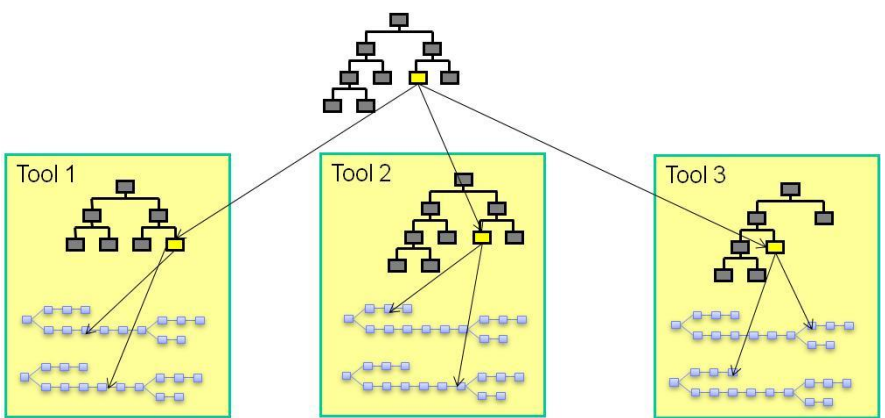
Versions, Variations and Configurations (VVC)

- VVC stand for a community effort to standardize and simplified the configurations of versions and variants of linked data resources across multiple tools

- VVC is addressing the following two goals:

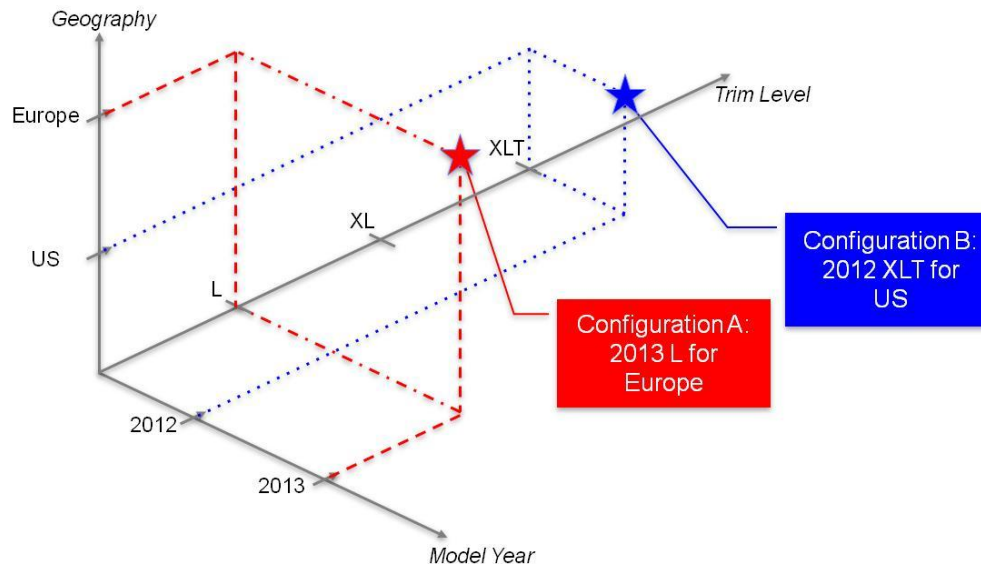
1. Support composite or global configuration management coordination scenarios, with an open API specification (OSLC)

2. For applications that do not have existing configuration management, provide a versioning system and configuration management capabilities using a linked data model



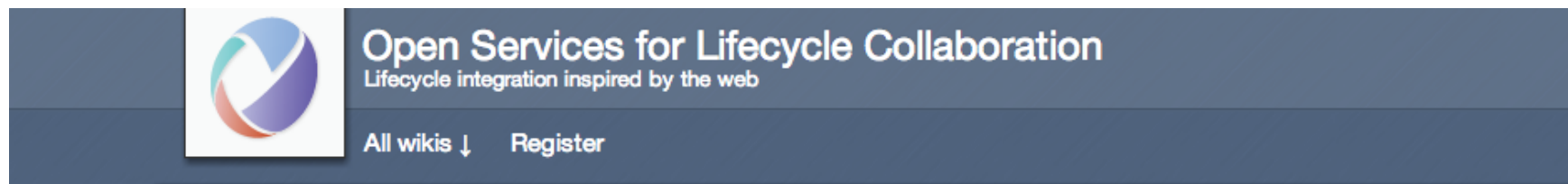
Versions, Variations and Configurations - Dimensions

- Different configurations for some set of resources vary according to different criteria, for example by **time**, by **platform**, by **geography** or **language**, and so on. These criteria that differentiate between configurations are called **variability dimensions** or **just dimensions**
- VVC provides two out-of-the-box dimension: time (used for snapshot/baseline) and purpose(used for streams or branches)
- Users can define their own dimensions, and the values for those dimensions



OSLC Configuration Management Working Group

- <http://open-services.net/wiki/configuration-management/>



Open Services for Lifecycle Collaboration
Lifecycle integration inspired by the web

All wikis ↓ Register

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Configuration Management Wiki Home

Scope

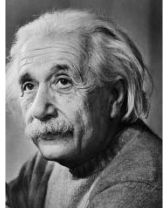
Produce an RDF vocabulary and associated semantics for configuration management of linked data, capable of addressing the scenarios described below, covering resources in multiple OSLC domains.

- Work has begun on scenarios, terminology, and resource definition

Agenda

- Integration of multiple life-cycle artifacts – why a new approach is needed?
- The new approach ...
- IBM Rational Solution offerings
- A word on versioning and configuration
- **Standards, call for action!**

Call for action !



“We can't solve problems by using the same kind of thinking we used when we created them”

•We have enough evidences that past integration approaches have limited value:

- Single repository
- Peer-to-peer import/export/transformation integration
- A single schema/metadata standard
- A single implementation platform

•We have a great example of the most successful, flexible, scalable, easy to use and well adopted system that was ever created by mankind ...



Call for action !

OSLC website at <http://open-services.net>

W3C Linked Data Platform Working Group website at: <http://www.w3.org/2012/ldp>

Open Services for Lifecycle Collaboration
Lifecycle integration inspired by the web

Forum Wiki Mailing lists Log in Sign up

Blog About Resources Workgroups Specifications Software Organizations Participate

OSLC

An open community dedicated to making it easier to use lifecycle tools in combination

Learn more about the OSLC community and linked data

Get involved with our community and see who else is involved

Catch up on what's new with the community

See tools, tutorials, and references to help you add

Browse our current specifications and see available

Home / **Specifications**

Core and common

Core	v2	Scope	Draft	Converge	Final	Wiki →
Configuration Management	v1	Scope	Draft	Converge	Final	Wiki →
Reporting	v1	Scope	Draft	Converge	Final	Wiki →

Resources

Tools

Eclipse Lyo
The Eclipse Lyo project focuses on providing an SDK to help the Eclipse community to adopt OSLC specifications and build OSLC-compliant tools. The source code is available in a Git repository.

Tutorials

Integrating products with OSLC
This tutorial explains how to integrate tools with OSLC. The tutorial uses examples, starting with simple ones and building to more advanced topics such as implementing an OSLC Provider.

OSLC Tools Project on SourceForge
A project from the OSLC Community to help you learn and implement OSLC specifications. The project creates reference implementations, test suites, example code and other content that supports the OSLC community.

OSLC Primer
(Download as PDF or ePub)
A primer for technical leaders who want to understand the concepts and goals of OSLC and its relationship to other standards for evaluation, as well as potential OSLC implementers who want a general overview of the OSLC concepts and an understanding of the thinking and use-cases that led to their definition.

Information about OSLC around the web

Videos
Getting started on implementing OSLC
Watch Steve Speicher describe the planning and tasks involved in integrating software with Open Services...

Articles
Aligning Software Development Teams through Collaborative Design Management
How OSLC principles help development teams share, analyze, find, and review design information while also...

Presentations
Eclipse Lyo Part Modules (Mini-cast 3-part)
This webcast will be presented in 3 parts. Details and demo of the Lyo-OSLC module which...

W3C WORLD WIDE WEB consortium

LINKED DATA PLATFORM WORKING GROUP

[-Linked Data Basic Profile](#)

-IBM, DERI, EMC, Oracle, Red Hat, SemanticWeb.com, Tasktop

-Supporters: Siemens, Cambridge Semantics

-Over forty part twenty organiza

W3C Member Submission

Linked Data Basic Profile 1.0
W3C Member Submission 26 March 2012

This Version:
<http://www.w3.org/Submission/2012/SUBM-ldbp-20120326/>

Latest Version:

W3C Member Submission

Linked Data Basic Profile 1.0 - Use Cases and Requirements
W3C Member Submission 26 March 2012

This Version:
<http://www.w3.org/Submission/2012/SUBM-ldbpucr-20120326/>

Latest Version:
<http://www.w3.org/Submission/ldbpucr/>



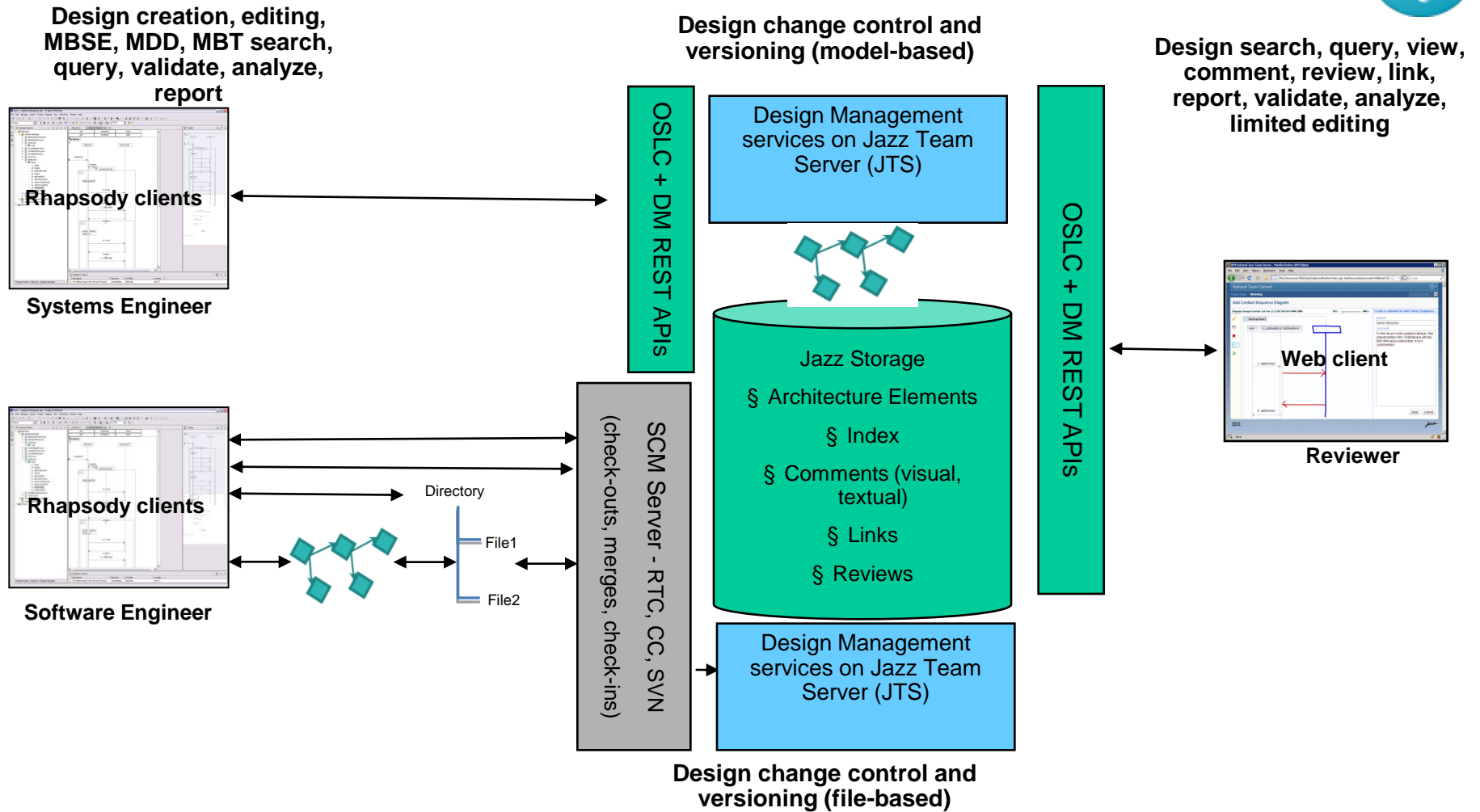
www.ibm.com/software/rational

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Additional slides



Work together with SCM and DM model management



- Systems Engineers work directly from the database for design change control and versioning
- Software Engineers work with their Software Configuration Management system for design change control and versioning