

# MBSE Workshop

Mentor Graphics use of OSLC

IW2015 – Torrance, CA

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Mentor Graphics

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# The Background

• • •

Why did Mentor Graphics use OSLC?

# System Design Challenges

## ***Dealing with Complexity and Change***

- Design requirements are ever increasing and ever evolving
- Convergence of multiple disciplines in a single system from requirements through implementation
- Complicated communication due to domain-specific tools, file formats, databases, and protocols
- Inter-divisional or even multi-company supply (i.e., development) chain
- Literally millions of design artifacts for even a moderately sized project



# Addressing Product, Project, Process & People

- Product
  - Focus on the product / system / device / ... under development
  - Associate all related artifacts with the right part of the product
- Project
  - Work towards a set of goals, milestones and validations
  - Manage the time line and deliverables to the project plan
- Process
  - Apply the relevant process[es], procedures and standards
  - Track and trace all process steps and ensure consistent execution
- People
  - Enable the team to be, and work as, a team
  - Provide all the participants with relevant information



TIME

TASK 1  
TASK 2  
TASK 3  
TASK 4



# Getting there from here – with legacy



- And the biggest legacy is the people!
- Incremental additions to existing environment
- Augment current tools to enable communication
- Automate current processes to track activities
- Use standards to maximize consistent scalability



# A Use Case

...

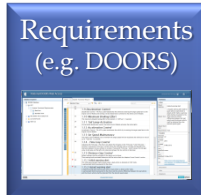
Information flow between typical stages in a design

# A flow-based Use Case Example

- Requirements
  - Typically in “Systems Engineering”
- System Architecture
  - Often not the same person[s] in “Systems”
- Structural Implementation
  - Logical Architecture[s]
- Physical Implementation
  - Many physical domains
- Change permeates throughout
  - Demands comprehension of variants across domains

# Logical and Physical Architectures

Captures system requirements



Requirements Engineer



Product Manager



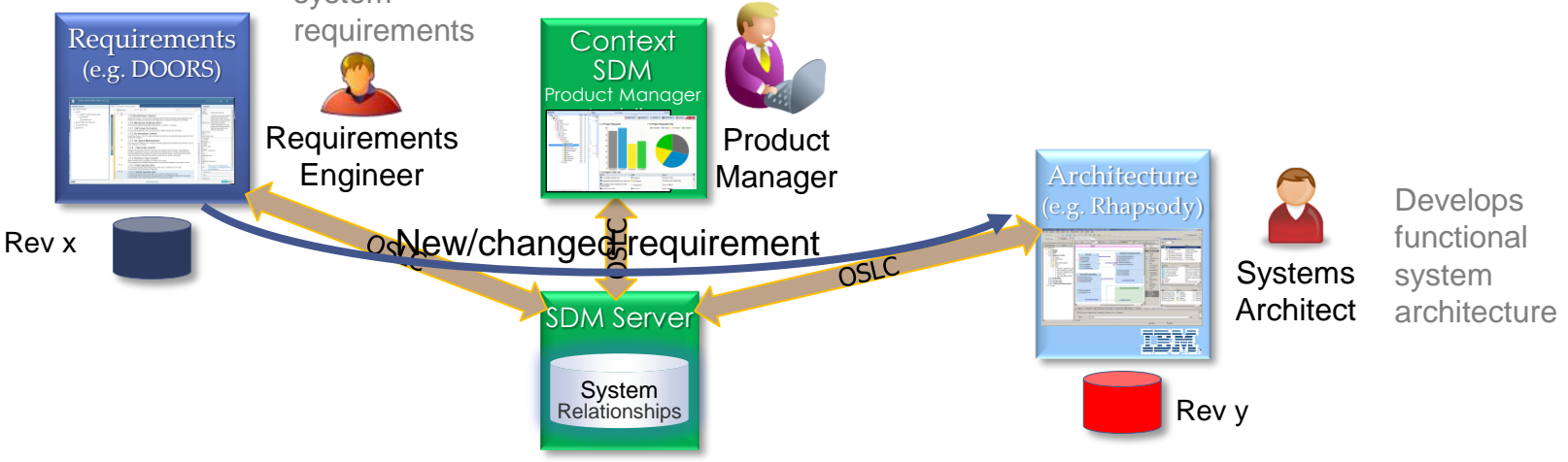
Systems Architect

Develops functional system architecture



Rev x

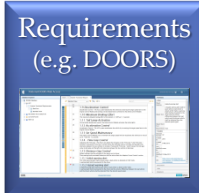
Rev y





# Logical and Physical Architectures

Captures system requirements



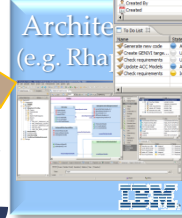
**Requirements Engineer**



**Product Manager**

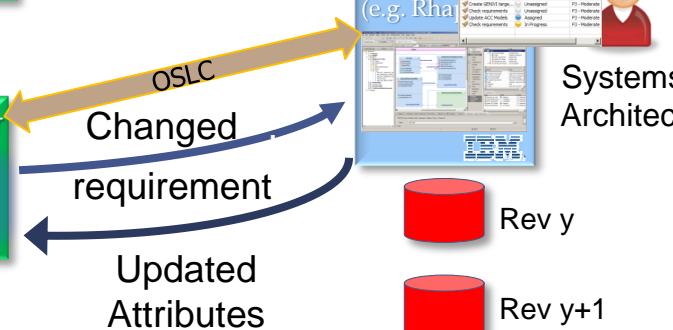
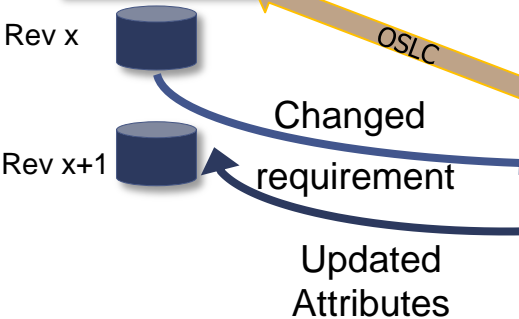


Details shown in the Architecture tool



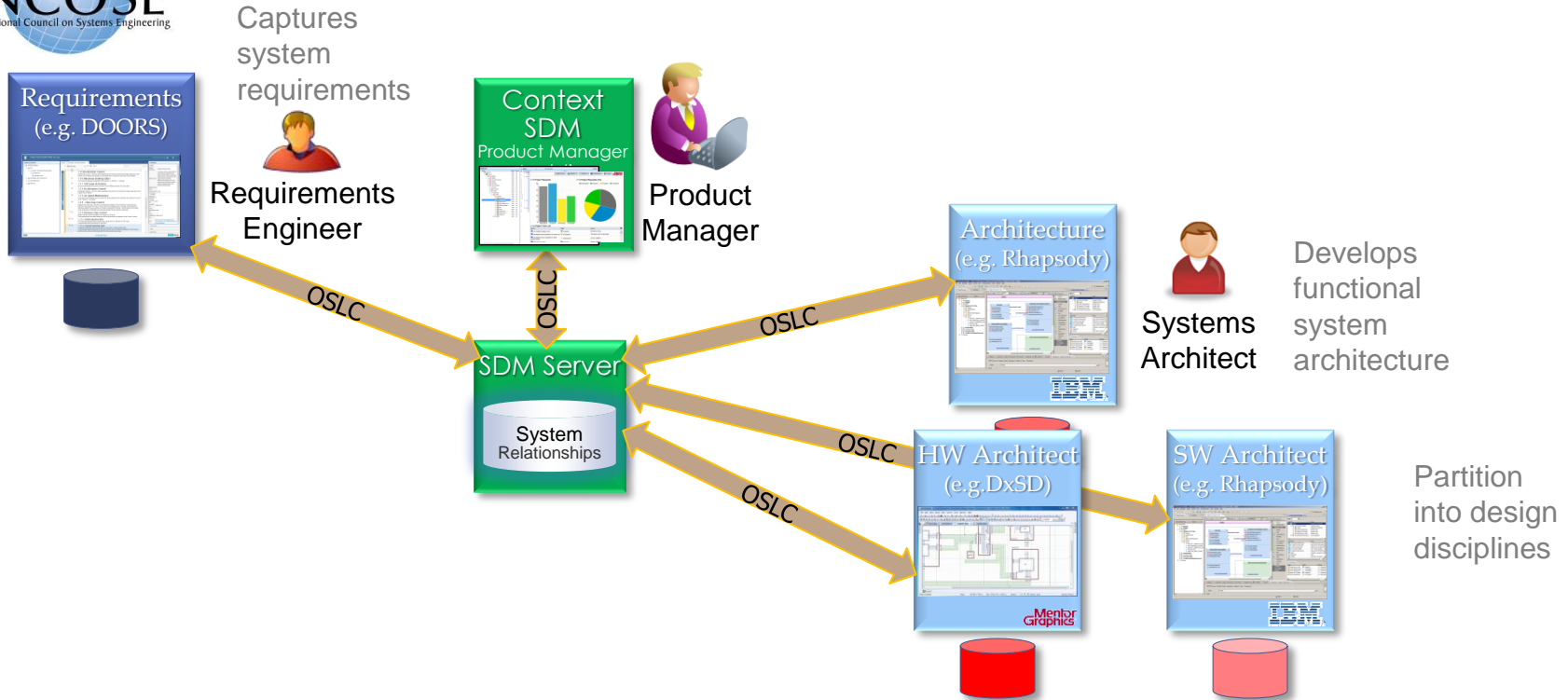
**Systems Architect**

Develops functional system architecture



Incorporates change into architecture

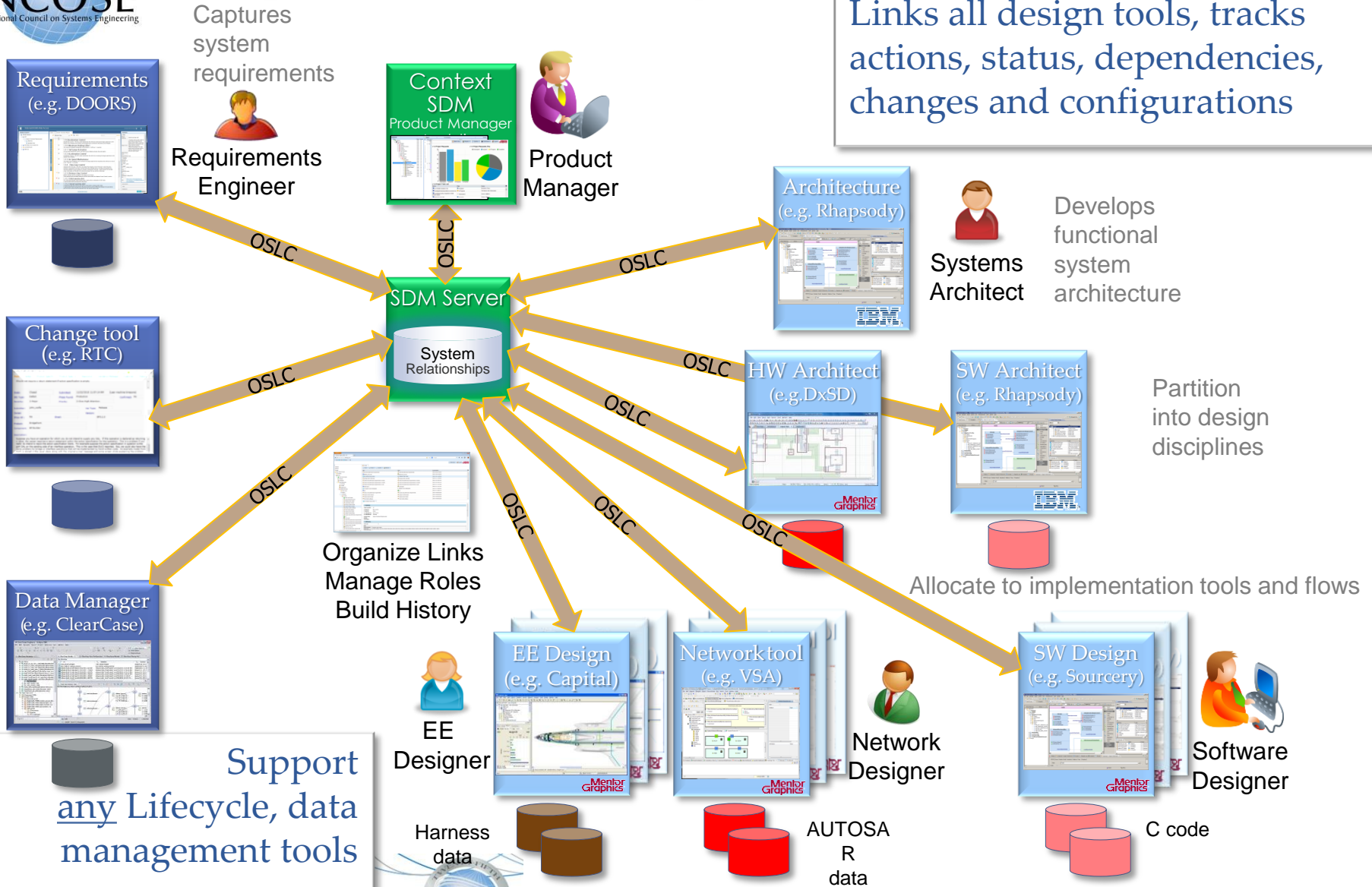
# Logical and Physical Architectures



■ Links data, tracks dependencies, changes and configurations

# Logical and Physical Architectures

Links all design tools, tracks actions, status, dependencies, changes and configurations



Support any Lifecycle, data management tools

# Lifecycle Management for 'Work in Progress'

- **Managing Change**
  - Changing Requirements, dependencies, configurations
- **Coordinating disciplines**
  - Differing schedules, steps, terminology, progress
- **Finding information**
  - Standards, processes, requirements, dependencies
- **Meeting Standards**
  - Regulatory, process and corporate needs
- **Proving process and traceability**
  - Required by most standards and regulatory bodies
- **Reporting status, standards, results, ...**
  - Extracting, abstracting and organizing information
- **Handoff to Production**
  - Version & Configuration management and tracking

# Put this into Context



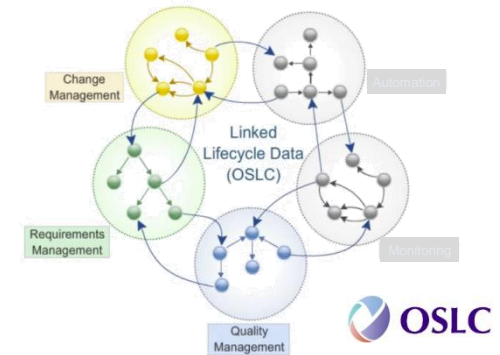
How OSLC enables our Solution

# What is Context?

- The context in which the work is being done
  - It's place in the overall system being built
  - The other related parts of the design
  - Relevant dependencies and constraints
- The team working on the system
  - The immediate work group
  - System engineering
  - Project management
  - Test and production
- The technical infrastructure
  - The tools in use today
  - The roadmap for new additions
  - Data, databases, reports, analysis
  - Communication

# What Context™ is

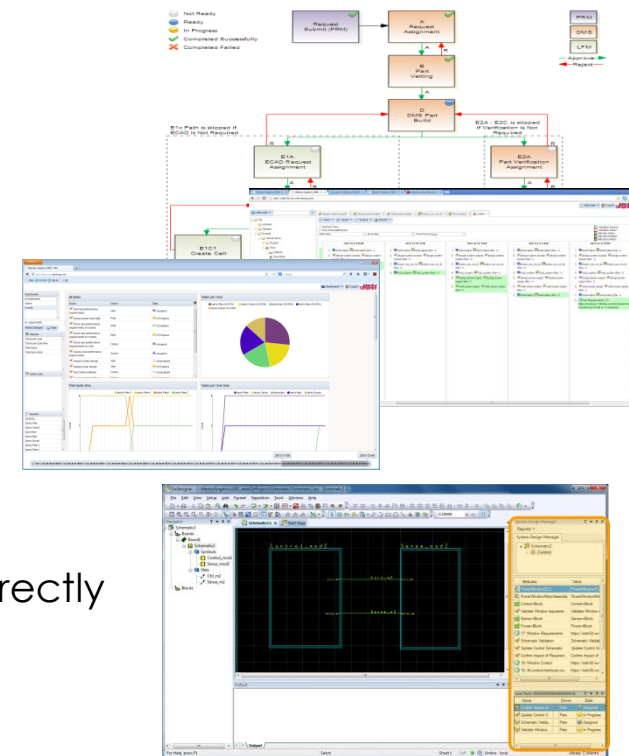
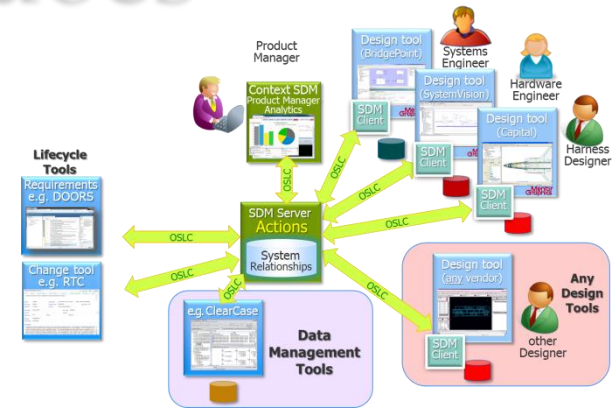
- **Management** of linked data
- Tool to tool **integration**
- Standards-based **communication**
  
- **Context™ Server** *stores* and *manages* the links
  - Builds history, enables traceability and reporting
  - Original data remains with original tools and repositories
- **Context™ SDM plugins** augment design tools
  - Integration can be available for *any Mentor tool*
  - Can also support other vendors' or internal design tools
- Web-based Product Manager accesses data and analytics
- **OSLC standard** connects to other tools
- Supports any “Lifecycle” tools (native or with plugin)





# What Context™ does

- Associates information across disciplines
  - Links original data and track relationships
  - Augments current design tools
- Tracks and manages dependencies
  - Impacts of changes, tools and history
  - Direct interactivity in real time
- Supports workflows, task management
  - Sorts and presents information concisely with built-in displays and analytics
  - Report and export in industry-standard styles
- Brings relevant data directly to users where it can be used
  - Users interact with dependencies, tasks and product directly
  - Information is seamlessly sourced from any original repositories



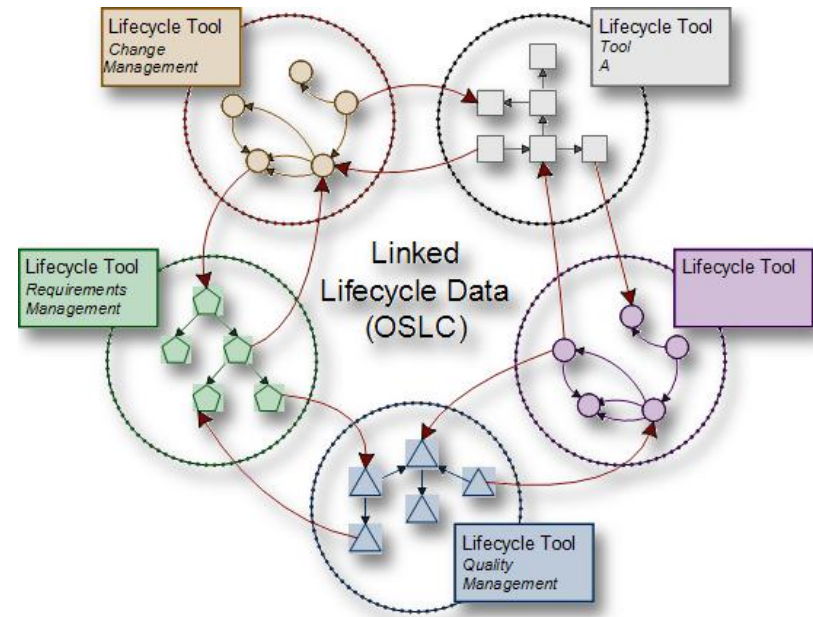


# Application Federation & OSLC



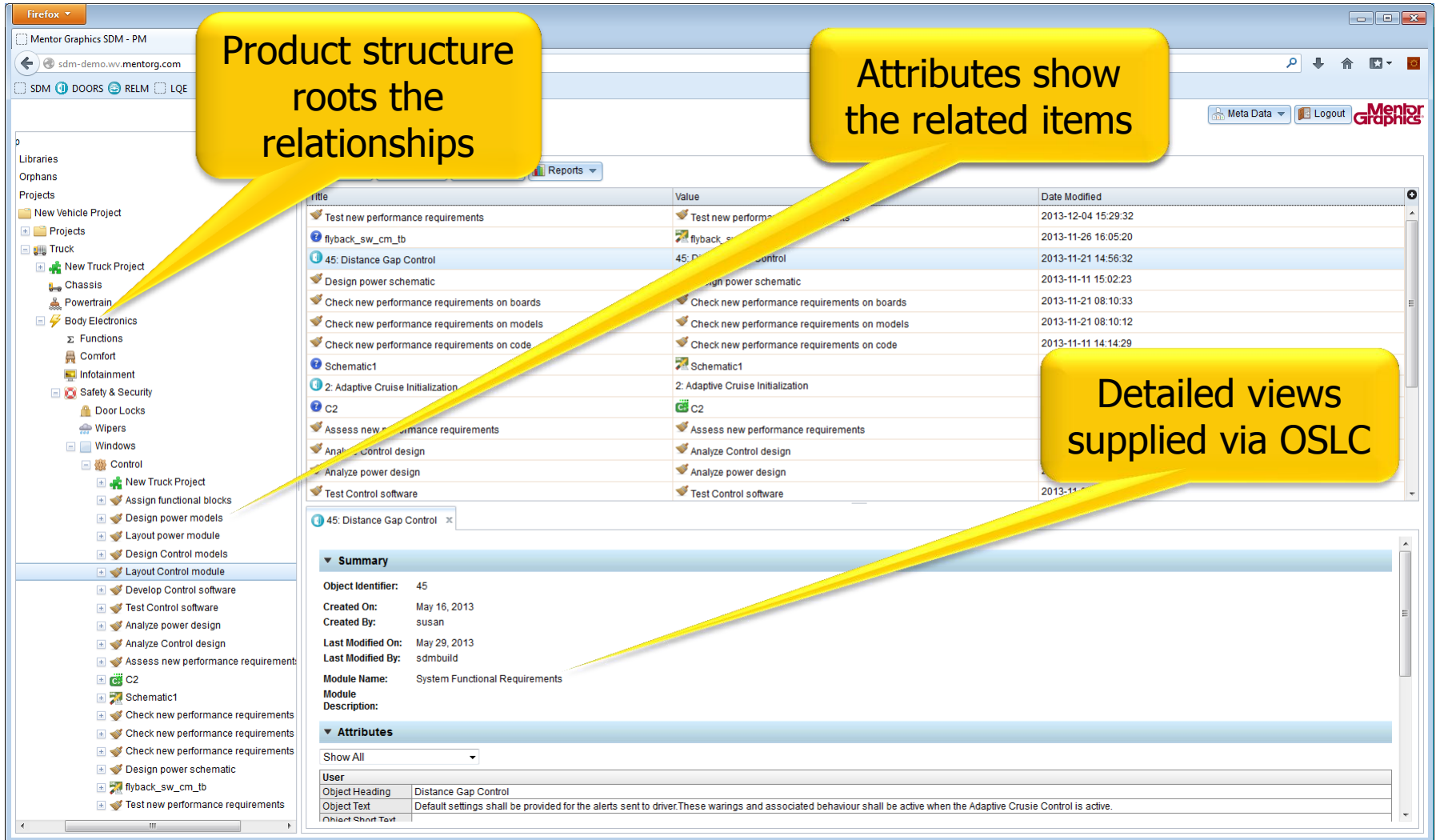
## Solves Integration, Allows Best In Class

- No single tool vendor has expertise or product capabilities in all domains
  - Data modeling
  - Software functionality
  - Deployment expertise
- **Open Services For Lifecycle Collaboration (OSLC\*)** solves traditional tool integration challenges
  - Resilient, standards based approach minimizes IT maintenance
  - Seamless experience maximizes user productivity
  - Tool vendor IP protection maximizes commercial appeal
- Mentor Graphics is a founder member of OASIS OSLC section



\* See <http://open-services.net>

# Building Relationships around the Product



The screenshot shows the Mentor Graphics SDM web application interface. On the left is a navigation tree with categories like Libraries, Orphans, Projects, and various vehicle components. The main area displays a table of items with columns for Title, Value, and Date Modified. A detailed view for '45: Distance Gap Control' is shown at the bottom, including a Summary section with metadata and an Attributes section with a table of object details.

**Product structure roots the relationships**

**Attributes show the related items**

**Detailed views supplied via OSLC**

Title	Value	Date Modified
Test new performance requirements	Test new performance requirements	2013-12-04 15:29:32
flyback_sw_cm_tb	flyback_sw_cm_tb	2013-11-26 16:05:20
45: Distance Gap Control	45: Distance Gap Control	2013-11-21 14:56:32
Design power schematic	Design power schematic	2013-11-11 15:02:23
Check new performance requirements on boards	Check new performance requirements on boards	2013-11-21 08:10:33
Check new performance requirements on models	Check new performance requirements on models	2013-11-21 08:10:12
Check new performance requirements on code	Check new performance requirements on code	2013-11-11 14:14:29
Schematic1	Schematic1	
2: Adaptive Cruise Initialization	2: Adaptive Cruise Initialization	
C2	C2	
Assess new performance requirements	Assess new performance requirements	
Analyze Control design	Analyze Control design	
Analyze power design	Analyze power design	
Test Control software	Test Control software	2013-11-21 14:56:32

**Summary**

Object Identifier: 45  
 Created On: May 16, 2013  
 Created By: susan  
 Last Modified On: May 29, 2013  
 Last Modified By: sdmbuild  
 Module Name: System Functional Requirements  
 Module Description:

**Attributes**

Show All

User	Object Heading	Object Text	Object Short Text
	Distance Gap Control	Default settings shall be provided for the alerts sent to driver. These warnings and associated behaviour shall be active when the Adaptive Cruise Control is active.	

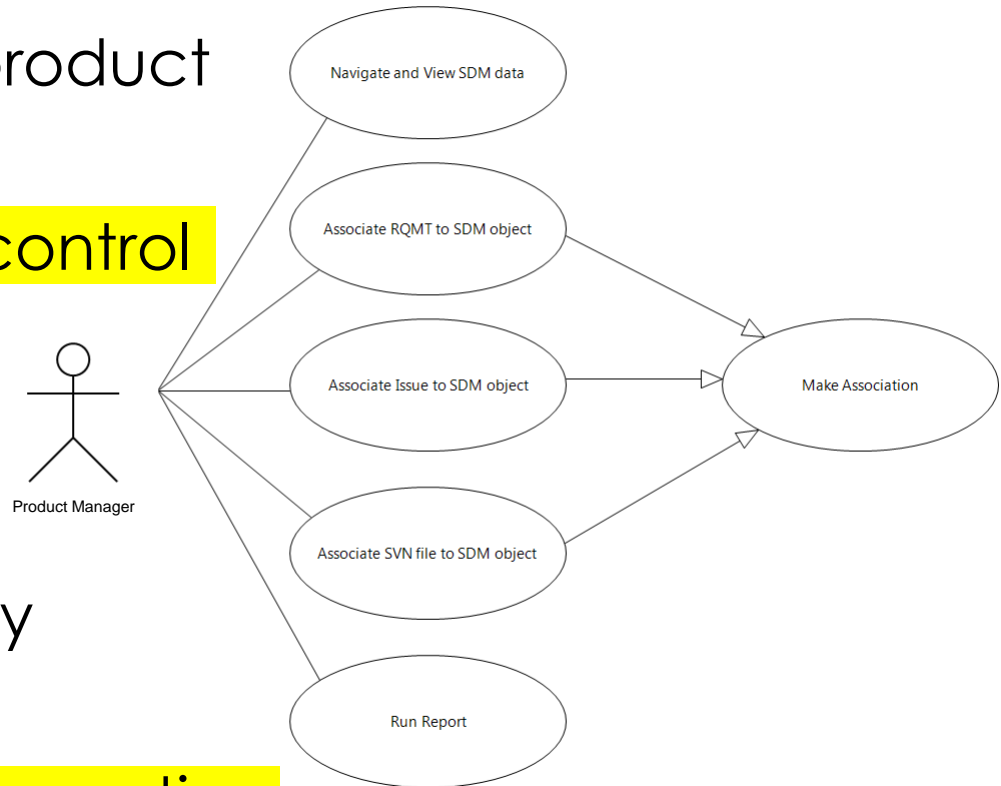
# Scenarios and Use Cases

- The Project Manager needs ...
  - **Visibility** and status
- Each Designer needs ...
  - Access to **relevant** information
- The Safety Analyst needs ...
  - **Traceability** and audit
- The Requirements Engineer needs ...
  - Complete and **current** data
- The System Designer needs ...
  - The **right product,** at the right time



# Product Manager Use Cases

- **Visibility** of the entire product
- Product and Process **control**
- Project **Management**
- **Immediate** Interactivity
- Extraction of data for **reporting**



# Product Manager Access

Firefox | Mentor Graphics SDM - PM | sdm-demo.wv.mentorg.com | Google | Dashboards | Logout | Mentor Graphics

SDM | DOORS | RELM | LQE

**Dashboards**

Dashboard

tasks

past month

Reset Changes | Save

**Reports**

Tasks per User

Tasks per User time

Pete tasks

Pete tasks time

Watch Lists

**Queries**

all tasks

tasks Pete

tasks Carlos

tasks Alan

tasks Mary

tasks Susan

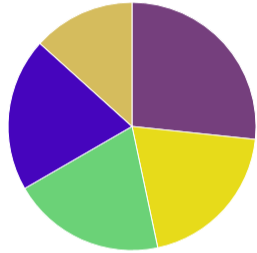
tasks Pete U

tasks Pete A

**all tasks**

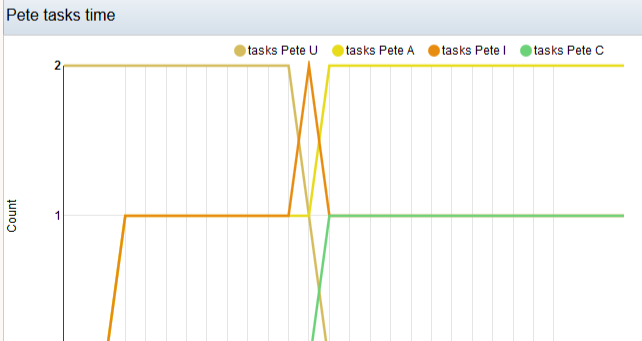
Name	Owner	State
Test new performance requirements	Alan	Assigned
Design power schematic	Pete	In Progress
Check new performance requirements on boards	Pete	Completed
Check new performance requirements on models	Mary	In Progress
Check new performance requirements on code	Carlos	Assigned
Assess new performance requirements	Susan	Assigned
Analyze Control design	Alan	Unassigned
Analyze power design	Alan	In Progress
Test Control software	Carlos	Unassigned

**Tasks per User**



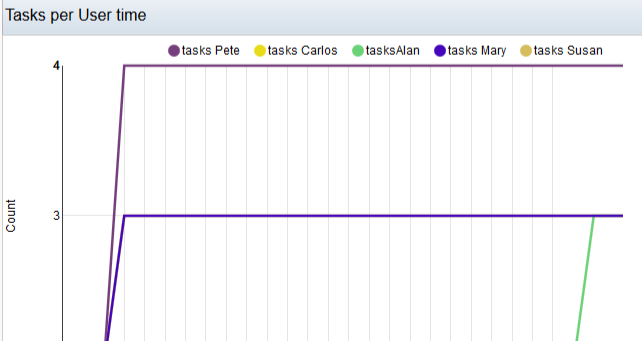
tasks Pete (26.67%) | tasks Carlos (20.00%) | tasks Alan (20.00%) | tasks Mary (20.00%) | tasks Susan (13.33%)

**Pete tasks time**



tasks Pete U | tasks Pete A | tasks Pete I | tasks Pete C

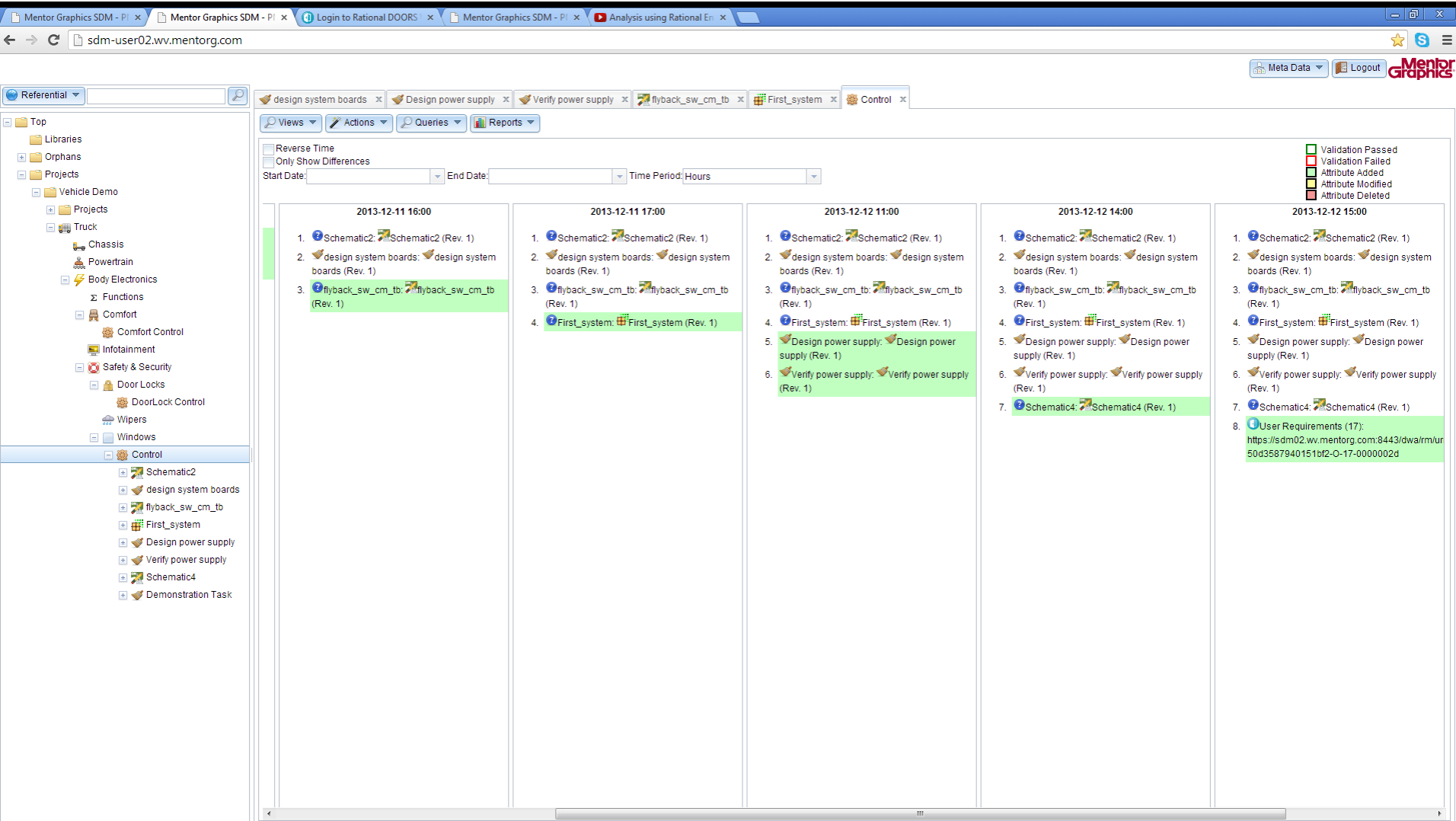
**Tasks per User time**



tasks Pete | tasks Carlos | tasks Alan | tasks Mary | tasks Susan

2013-11-09 | 2013-12-06

# History Tracks all Changes

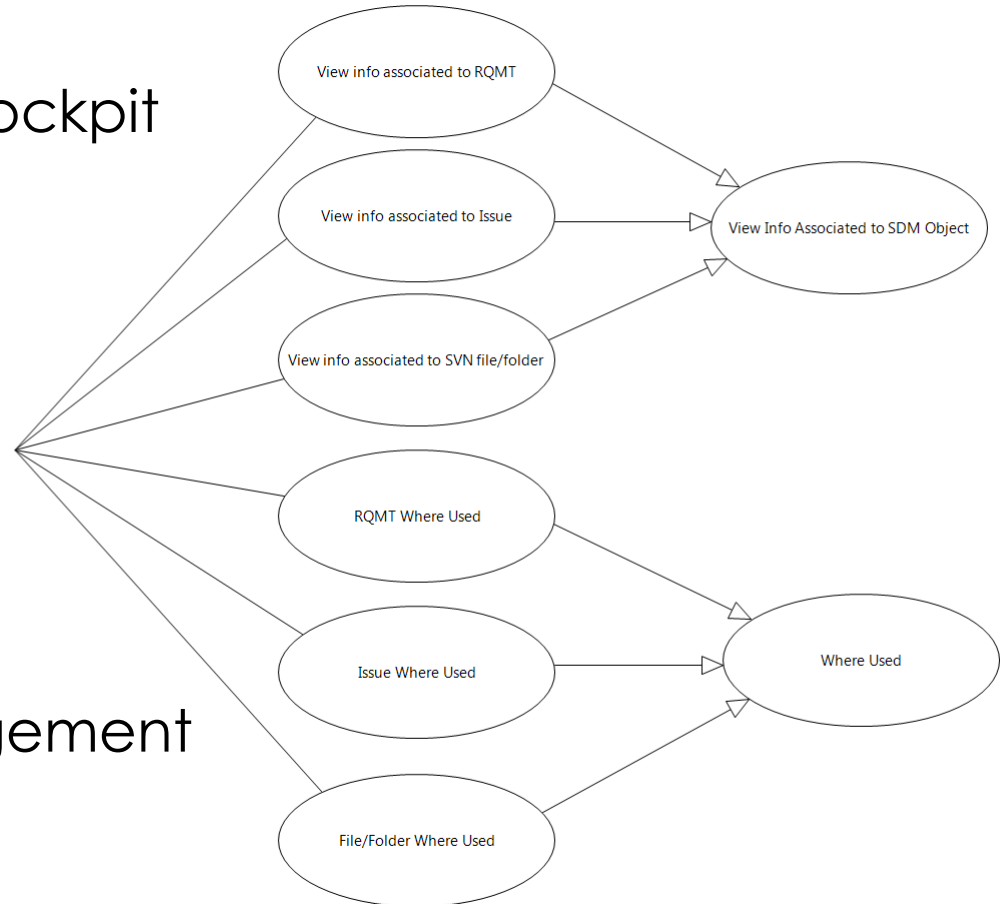
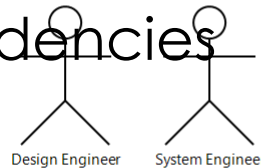


The screenshot displays the Mentor Graphics SDM web interface. The browser address bar shows 'sdm-user02.wv.mentorg.com'. The application has several tabs open: 'design system boards', 'Design power supply', 'Verify power supply', 'flyback\_sw\_cm\_tb', 'First\_system', and 'Control'. A left-hand navigation tree shows a hierarchy of components, with 'Control' selected. The main area shows a history view for the 'Control' component, with filters for 'Reverse Time' and 'Only Show Differences'. The history is presented in a grid of five columns, each representing a different time point: 2013-12-11 16:00, 2013-12-11 17:00, 2013-12-12 11:00, 2013-12-12 14:00, and 2013-12-12 15:00. Each column contains a list of system components and their revision numbers. A legend on the right indicates the status of each component: Validation Passed (green), Validation Failed (red), Attribute Added (green), Attribute Modified (yellow), and Attribute Deleted (red).

Time	Component	Revision	Status
2013-12-11 16:00	Schematic2	Schematic2 (Rev. 1)	Validation Passed
	design system boards	design system boards (Rev. 1)	Validation Passed
	flyback_sw_cm_tb	flyback_sw_cm_tb (Rev. 1)	Attribute Added
	First_system	First_system (Rev. 1)	Attribute Modified
2013-12-11 17:00	Schematic2	Schematic2 (Rev. 1)	Validation Passed
	design system boards	design system boards (Rev. 1)	Validation Passed
	flyback_sw_cm_tb	flyback_sw_cm_tb (Rev. 1)	Attribute Added
	First_system	First_system (Rev. 1)	Attribute Modified
2013-12-12 11:00	Schematic2	Schematic2 (Rev. 1)	Validation Passed
	design system boards	design system boards (Rev. 1)	Validation Passed
	flyback_sw_cm_tb	flyback_sw_cm_tb (Rev. 1)	Attribute Added
	First_system	First_system (Rev. 1)	Attribute Modified
	Design power supply	Design power supply (Rev. 1)	Attribute Deleted
	Verify power supply	Verify power supply (Rev. 1)	Attribute Deleted
2013-12-12 14:00	Schematic2	Schematic2 (Rev. 1)	Validation Passed
	design system boards	design system boards (Rev. 1)	Validation Passed
	flyback_sw_cm_tb	flyback_sw_cm_tb (Rev. 1)	Attribute Added
	First_system	First_system (Rev. 1)	Attribute Modified
	Design power supply	Design power supply (Rev. 1)	Attribute Deleted
	Verify power supply	Verify power supply (Rev. 1)	Attribute Deleted
	Schematic4	Schematic4 (Rev. 1)	Attribute Deleted
2013-12-12 15:00	Schematic2	Schematic2 (Rev. 1)	Validation Passed
	User Requirements (17)	https://sdm02.wv.mentorg.com:8443/dwalm/ur50d3587940151bf2-0-17-0000002d	Attribute Deleted

# Design Tool Use Cases

- Remain in the familiar cockpit
  - Perform usual activities
  - “Link as you think”
- Access to all design dependencies
- Interactivity with System Lifecycle Management
- Immediate status and issue visibility





# Operation inside the Design Tools

The screenshot displays the DxDesigner interface. The main workspace shows a schematic diagram with two rectangular blocks, 'Control\_mod2' and 'Sense\_mod2', connected by two green lines. The top menu bar includes File, Edit, View, Setup, Add, Format, Simulation, Tools, Window, and Help. The left Navigator pane shows a project tree with 'Schematic2' selected, containing sub-items like 'Control\_mod2' and 'Sense\_mod2'. The bottom Output pane is currently empty.

Overlaid on the right is the 'System Design Manager' panel, which is highlighted with an orange border. It contains two tables:

**Attributes**

Attributes	Value
PowerWindowECU	PowerWindowECU
PowerWindowMotorAssembly	PowerWindowMotorAssembly
Control+Block	Control+Block
Validate Window requireme...	Validate Window requireme...
Sensor+Block	Sensor+Block
Power+Block	Power+Block
17: Window Requirements	https://sdm02.wv
Schematic Validation	Schematic Validation
Update Control Schematic	Update Control Schematic
Confirm Impact of Requirem...	Confirm Impact of Requirem...
18: Window Control	https://sdm02.wv
19: All control interfaces mu...	https://sdm02.wv

**user tasks (00000000000000000019)**

Name	Owner	State
Confirm Impact of ...	Pete	Assigned
Update Control S...	Pete	In Progress
Schematic Valida...	Pete	Assigned
Validate Window ...	Pete	In Progress

- Bring information where it can be used directly



# DOORS Access (illustrated in Simulink)

**Large Preview - User Requirements (16)**

**Summary**

Object Identifier: 16  
Created On: May 21, 2013  
Created By: sdbuild  
Last Modified On: February 24, 2014  
Last Modified By: sdbuild  
Module Name: User Requirements &nbsp;nbsp;nbsp;  
Module: User Requirements  
Description:

**Attributes**

Show All

User	
Object Heading	Constraint Requirements
Object Text	
Object Short Text	

System	
Absolute Number	16
Created By	sdbuild
Created On	May 21, 2013
Last Modified By	sdbuild
Last Modified On	February 24, 2014

**Links**

- There are 0 DOORS In-links
- There are 0 DOORS Out-links

**External Links**

**References (6)**

- [Control](#)
- [Matt](#)
- [Power+Windows+System](#)
- <http://sdm-user01.vw.mentor.com/Report/vwhere-Used-Instantiated-Attribute-With-Gui?url=https%3A%2F%2Fsdm02.vw.mentor.com%3A8443%2Fdwa%2Fm%2Furn%3Arational%3A%3A1-50d3587940151bf2-O-16-0000002d>
- <http://sdm-user02.vw.mentor.com/Report/vwhere-Used-Instantiated-Attribute-With-Gui?url=https%3A%2F%2Fsdm02.vw.mentor.com%3A8443%2Fdwa%2Fm%2Furn%3Arational%3A%3A1-50d3587940151bf2-O-16-0000002d>
- [testModel](#)

**System Design Manager**

Reports

System Design Manager

- testModel
  - Out1

Attributes	Value
User Requirements (16)	https://sdm02.vw.mentor.com/Report/vwhere-Used-Instantiated-Attribute-With-Gui?url=https%3A%2F%2Fsdm02.vw.mentor.com%3A8443%2Fdwa%2Fm%2Furn%3Arational%3A%3A1-50d3587940151bf2-O-16-0000002d
Simulink Block	simulink_block://mathworks.com/Products/2013/Toolbox/Simulink/Blocksets/Physical/Physical/Out1
Last Edited By	Groves, Matthew
Last Edited	2014-02-26T15:09:04+0000
Created By	Groves, Matthew
Created	2014-02-26T14:58:10+0000
Name	Out1

# Design Tool OSLC Integration

- Context makes that tool "OSLC-enabled"
- Specifically it talks OSLC to the Context SDM server
  - Single point of contact for all System Lifecycle Management
- A Context tool integration presents the relevant information directly to the user of the recipient tool
  - Focus the right information where it can be useful, and acted upon
  - The place in the target Product that this piece of the design belongs
  - Useful related attributes of that part of the design
  - Other items, such as pending tasks, dependencies, status, etc.
- The Context integration enables interactivity
  - Providing the user with all the capabilities needed to respond to a new request, act upon it, derive new relationships or dependencies, and report status. All point-and-click. Right there in the original design tool.
- All of that was tracked in the Context SDM server, lives in the history, and thus helps to document the actual process followed and create an effective audit trail to aid in meeting compliance needs

# Integration of a Design Tool

- **Base Communication**
  - OSLC (core), registering the tool, catalog of functional capabilities, underlying standard communication
  - Context augments the OSLC capabilities in some aspects, and does not implement them in other aspects to provide the communication needed for the features of the integration
- **User Interface**
  - Tool-specific GUI extension to offer standard UI features
    - Connection to Product hierarchy
    - Associated Attributes
    - Selected Report (e.g. To Do task list)
- **Data Association**
  - Every tool has its own domain-specific data
  - Context integration allows point-and-click association between appropriate data objects and the Product environment
- To create this integration involves applying our library of functionality in the implementation of the target tool, e.g. Eclipse, Java Swing, TCL, C#/.Net, etc.
- The integration is essentially the same for any tool

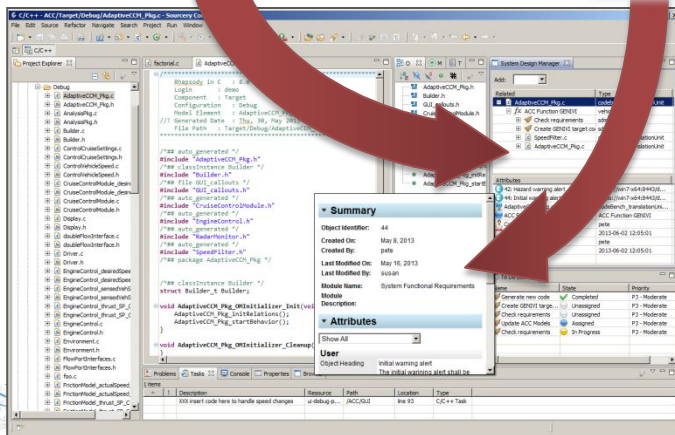
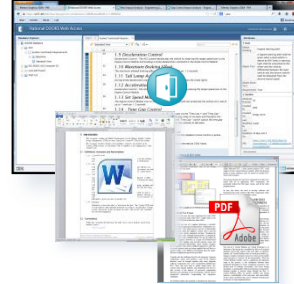
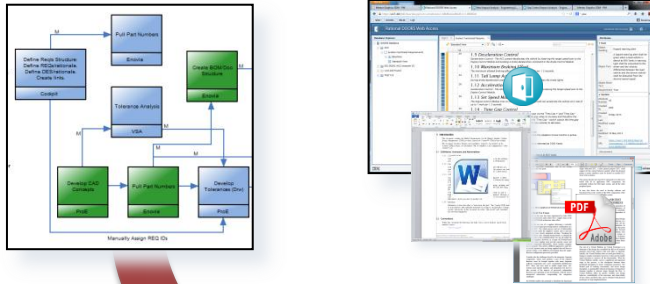
# Summarizing the Value



How this helps today's design process

# Context Supports the Users' Daily Tasks

No walking to the bookshelf  
(or heaven forbid - the library) to find the  
spec,  
going to the next status meeting to raise the  
red flag,  
and then coming back to the design to try to  
remember where she was



- This really works to make the designer's daily tasks easier, and supports better product management
- It plugs in to what they do today, into the tools they use today, without requiring methodology change



# Process Definition, Tracking and Control

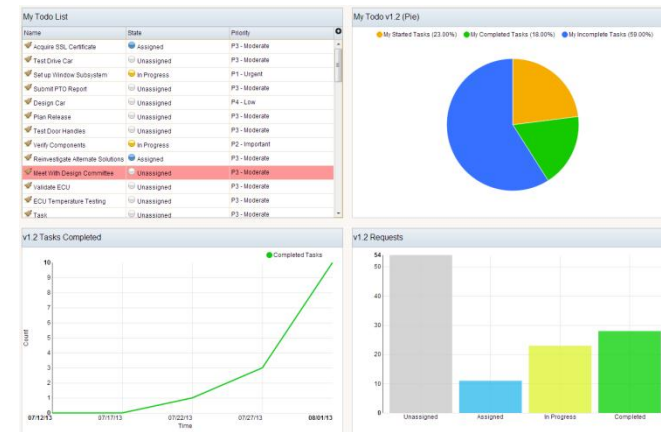
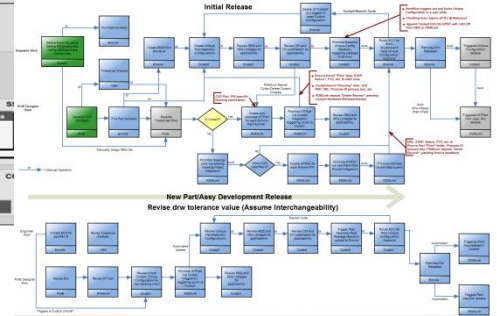
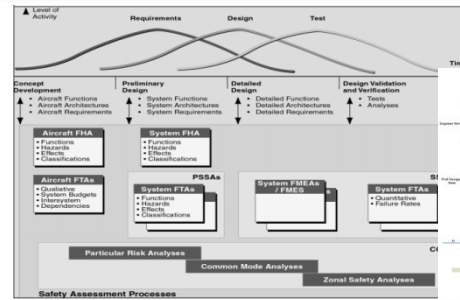


- Establish the level of process rigor
  - Specification and enforcement of development process (Integrated, Unified, Agile)
  - Objective-based activities for both independent and dependent functions
- Auditability of what was done, by whom, when, and how validated
- Full history to interrogate faults

## Compliance

— ARP4754A

Use of an Integrated Development Process with proper assignment of Development Assurance Level and Design Assurance Level



# Summarizing the Impact of an OSLC-enabled Infrastructure

- Linked Data keeps current tools and repositories
- Interoperability of disparate tools and flows enabled
- Track changes and dependencies in real time
- Traceability supports review, audit and reporting
- Incremental inclusion gets there from here!

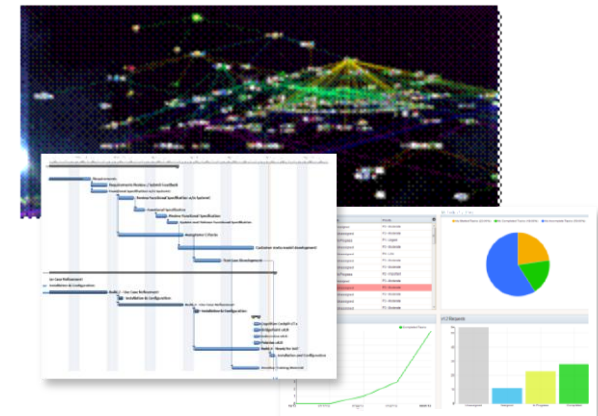
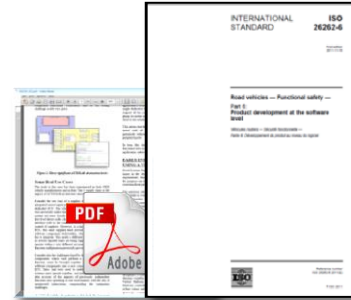
# Starting from “Last Time”

- Legacy data
  - There is always something left from an earlier project
- Previous version
  - This new product is often a derivative from the last model
- Legacy process – or not
  - A formal process may not have been in use, or a change is needed
- New requirements
  - This product will have its own unique requirements
- New standards
  - Safety-critical products are increasingly standards-driven
- New tools
  - Or continuing with the existing toolset
- New timetable
  - Of course!



# Key Benefits to the Enterprise

- **Help Support Standards** (DO-178B/C, ISO26262, ARP4754A)
  - Managed process helps drive compliance goals
  - Trace of all dependencies, requirements, throughout
  - Integrated generation of required reports
  - Especially relevant in safety critical systems
- **Reduce development costs** – increase productivity
  - Incremental introduction into existing flows
  - “We have to move from ‘who do I ask?’ to ‘I know where to find’”
  - Bring information to the right user, where and when they can use it
- **Immediate visual Analytics**
  - Create, visualize and export summary and detailed project views
  - Enable estimation of future cost/duration based on tracked history





Thank you



# Mentor Graphics use of OSLC

## Lifecycle Management for 'Work in Progress'

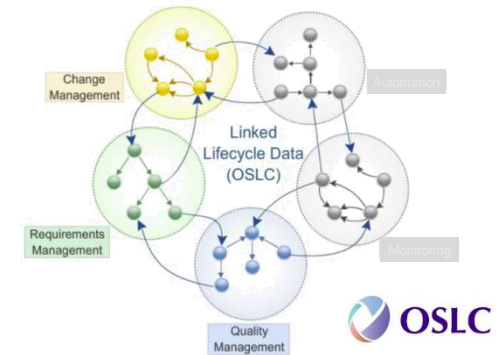
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MBSE Workshop – IW 2015

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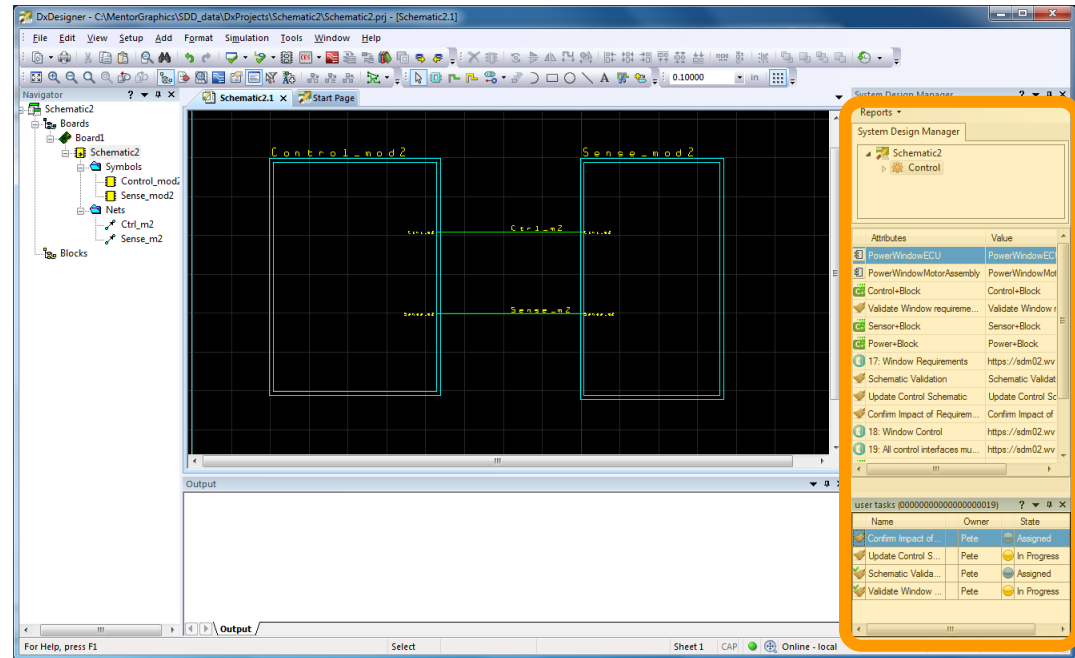
# What Context™ is

- **Management** of linked data
- Tool to tool **integration**
- Standards-based **communication**
  
- **Context™ Server** stores and manages the links
  - Builds history, enables traceability and reporting
  - Original data remains with original tools and repositories
- **Context™ SDM plugins** augment design tools
  - Integration can be available for any **Mentor tool**
  - Can also support other vendors' or internal design tools
- Web-based Product Manager accesses data and analytics
- **OSLC standard** connects to other tools
- Supports any “Lifecycle” tools (native or with plugin)



# Operation inside the Design Tools

- OSLC base communication
- Tool-specific GUI extension
- Data Association
- Point and Click linking



- Plugins for many tools from various vendors
- Bring information where it can be used directly
- Maximize users' time in the primary task

# Mentor Graphics Context™ SDM

- Manage relationships between tools across design disciplines
  - Coordinate changes, dependencies and impacts
  - Integrate with **current** tools and flows

- Bring information and interaction to the users where it can be applied directly
  - Sourced from any original repositories
  - Interactive in appropriate design tools
  - Maximize usability and efficiency

- Enable product management, tracing, analytics and reporting
  - Dynamic data views, & export capability
  - Support standards compliance needs

