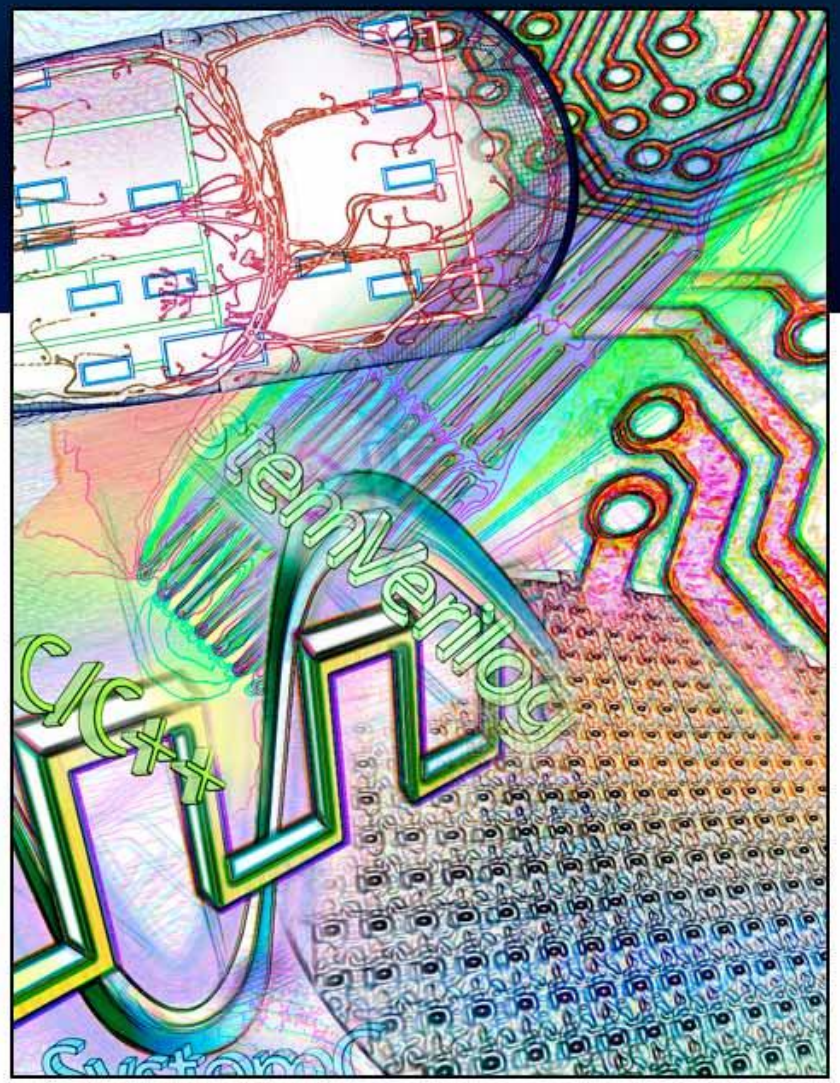
Augmenting Current Tools and Processes to increase the productivity of an engineering team



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CIO - INCOSE

OMG OSLC Summit

DECember 2015

OMG OSLC Summit - December 2015

Augmenting Current Tools and Processes to increase the productivity of an engineering team

Data integration between software tools intended to be used together in a work flow remains challenging.

While individual software providers address some of these challenges, the problem is compounded when work flows employ best in class tools contributed by different suppliers.

Increasing the productivity of an engineering team and improving first time quality of its end product requires maintaining coordination and synchronization of the information needed between software environments.

In this session, we look at an innovative solution to this problem based on OSLC, extended by the Context SDM approach to incorporate a central organizing structure for data tracking, history and analysis.

Additionally, Context augments each connected tool with communication, GUI and data access that enables direct participation in the lifecycle without discontinuities and losses associated with separate tools and flows.

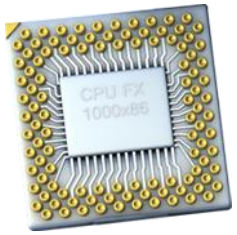
Mentor Graphics – the leader in Systems EDA

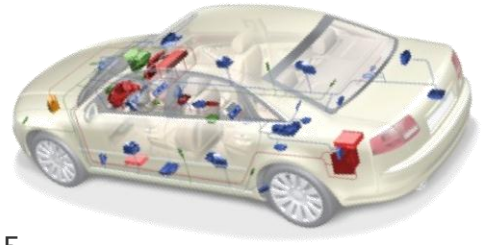
- Market Leadership in key design segments
- Enabling technology in each development flow
- Strongest Systems Engineering supplier in electronic systems design
- Consulting Services & Support that accelerate success

System Design Challenges

Dealing with **C**omplexity and **C**hange (and **C**ollaboration)

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





A Wasteful World leads to Inefficient Processes

Typical characterizations of some of the wastes in production, also found in design

- Transportation
  - Manually moving/importing/exporting data between multiple design tools
  - Manually reformatting/translating data for use in multiple tools
- Motion
  - Staff switching & multi-tasking across several unintegrated tools
  - Searching for data in multiple locations
- Waiting
  - Attempting to start tasks before inputs are ready
  - Tasks not performed according to priority (off critical path)
- Over-production
  - Creating & maintaining multiple copies of the same data
- Defects
  - Defects introduced during non-value add activities such as moving, copying, translating data

- With attention to these – and other sources of waste, a systems engineering approach can yield improvements in productivity, schedule and repeatability that yield higher quality results and enable continuing improvement of the process over iterations and time

Broader Perspective on System Design

What's Missing? A perspective of the system
that can bring forward, manage and assess ongoing implementation decisions

Systems Engineering is an interdisciplinary realization of such systems that defines and documents functional requirements … before proceeding to design synthesis & system validation while considering the complete problem

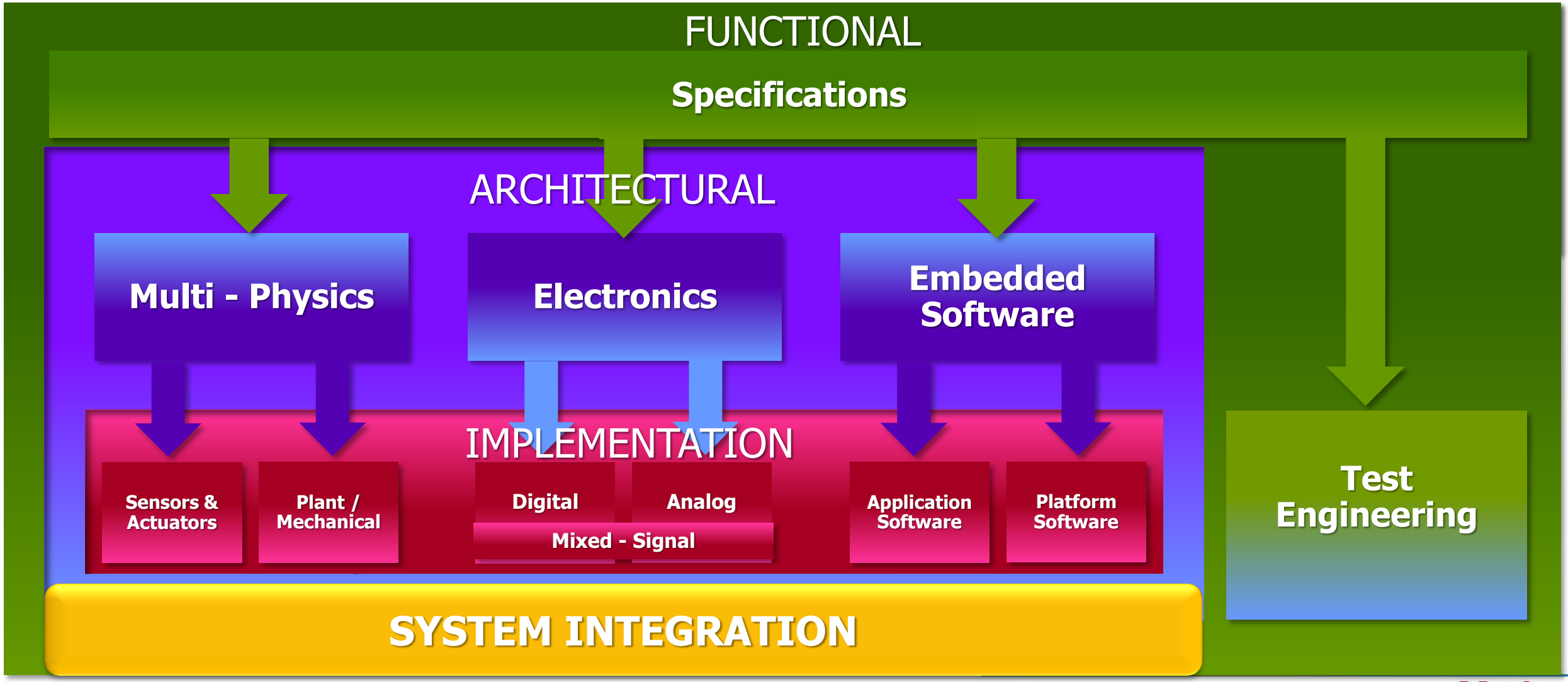
(INCOSE - International Council on Systems Engineering)

A system is a construct or collection of different elements that together produce results not obtainable by the elements alone … the value is primarily created by the relationship among them; that is, how they are interconnected

(Eberhardt Rechtin, US Dept. Defense)

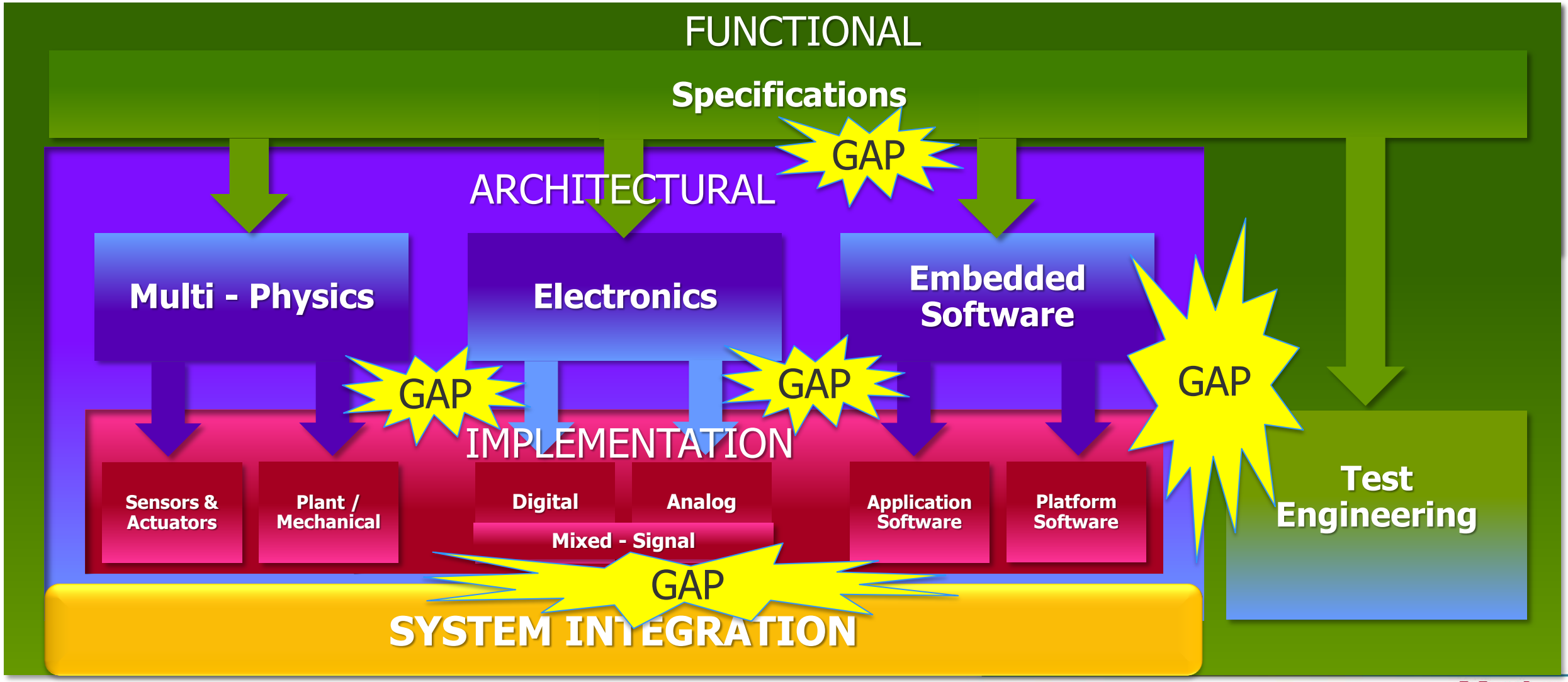
Looking at a Best Practice Flow

Concept to Implementation ….



Looking at a Best Practice Flow

Concept to Implementation – many gaps



Key Systems Engineering Goals

- Provide a structured process for integrating and linking requirements, schedule, decision milestones, and verification
- Enable the project team to work to a single, integrated set of requirements and processes
- Enable integration of the system at the requirements and design stages (before sunk costs) rather than waiting until hardware and software is available
- Reduce unplanned and costly reengineering necessary to resolve omissions and integration difficulties

Source: INCOSE Systems Engineering White Paper 1997

The Multi-Discipline Problem

- Domain Specialization
  - — Discipline-specific methods, data and technologies
- Best in Class Tools
  - — Technology-focused optimizations for each discipline
- Project and Lifecycle goals
  - — Separate flows, processes and targets in each discipline
- Manufacturing Pressures
  - — Complete product needs

- It is not solely a Data problem
- It affects Process and Project as well as the People and the Product

People spend time (not) finding information

- Engineers 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
- Up to 50% of **intranet searches are abandoned**
- 90% of the time that knowledge workers spend in creating new reports is recreating information that **already exists**

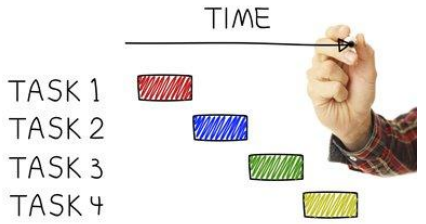
Productivity is compromised right from the start

Frustrated reliance on *people* to communicate effectively

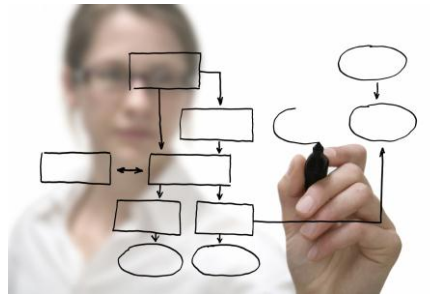
Product, Project, Process & People

- Product
  - Focus on the product / system /device / … under development
  - Associate all related artifacts with the right part of the product
  - Maintain versions and variants as development evolves

- Project
  - Work towards a set of goals, milestones and validations
  - Allocate resources according to these targets
  - Manage the time line and deliverables to the project plan



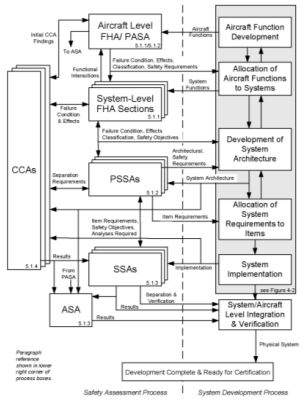
- Process
  - Apply the relevant process[es], procedures and standards
  - Track and trace all process steps and ensure consistent execution
  - Generate documentary evidence of compliance

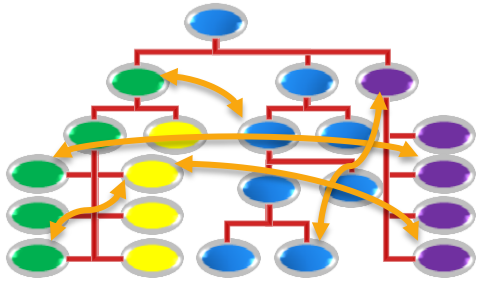


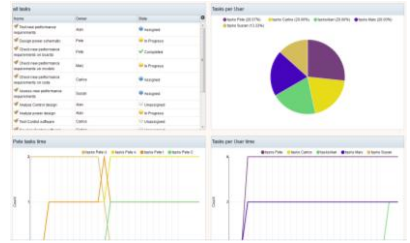
- People
  - Enable the team to be and work as a team
  - Provide all the participants with relevant information
  - Support each team member to best meet their specific objectives

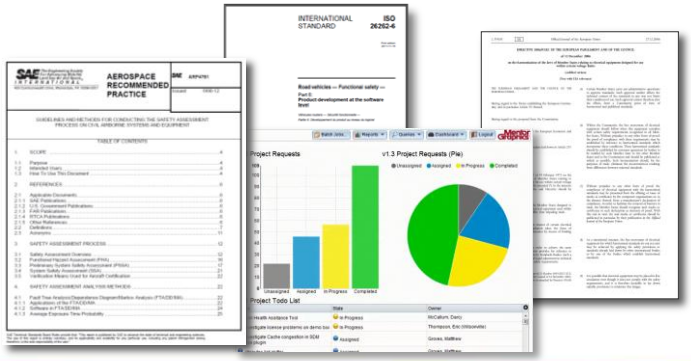
"Joined Up" Engineering Goals

- Manage the design process
  - The product, + future revisions and derivatives
  - Product development activities, workflow
- Track and control interdependencies
  - Between functions and disciplines
  - Through time, & across the supply chain
- Analyze & Document
  - Status & Dependencies
  - Change Impact
  - Compliance to standards
- Meet Product Objectives
  - More efficient and productive design processes
  - Satisfy regulatory requirements
  - Successful product delivery



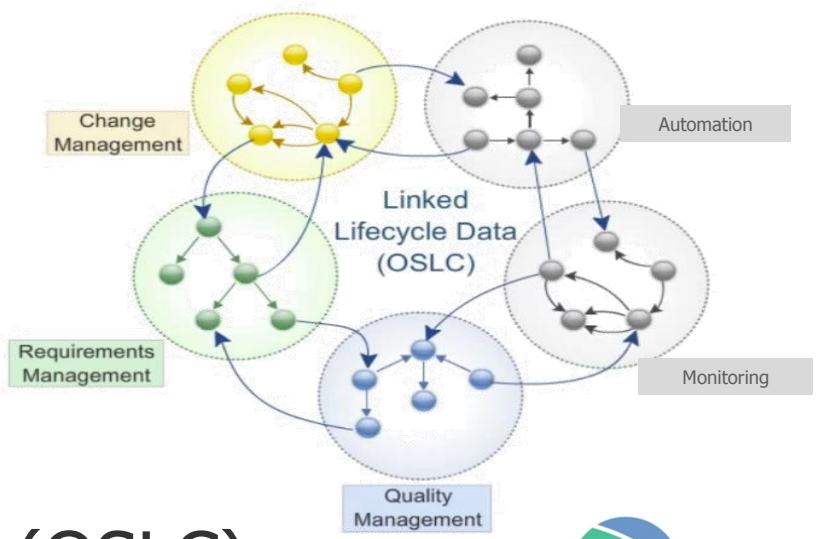






New Standard: Open Services for Lifecycle Collaboration

- **Management** of linked data
- Tool to tool **integration**
- Standards-based **communication**



- 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 flexibility

OSLC
Inspired by the web

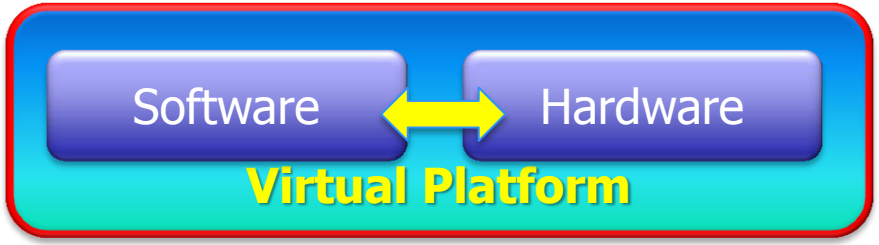
Key Interactions in the Flow

- Data
  - E.g. netlist, schematic to cabling, etc. Bulk data transfer

Not the focus of Context or OSLC today

Netlist or Transform

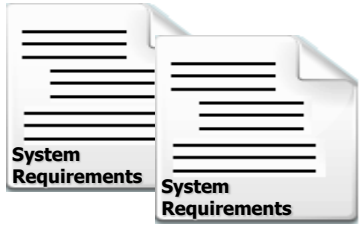
- Behavior
  - Executable models, run time code, functional co-simulation

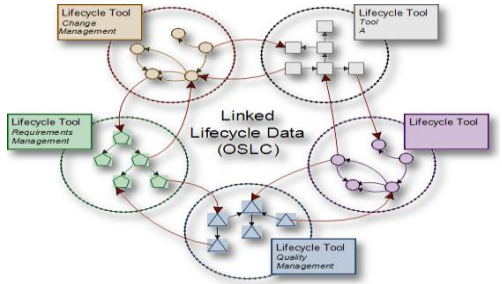


Not the focus of Context or OSLC at all

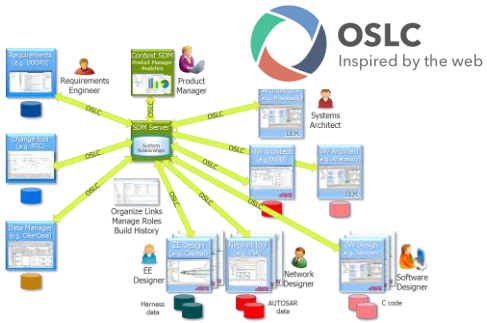
FMI, SVX, Codelink

- Intent
  - Requirements, work items, dependencies, meaning





Linked Data, Shared Information



Introduction of Context® SDM

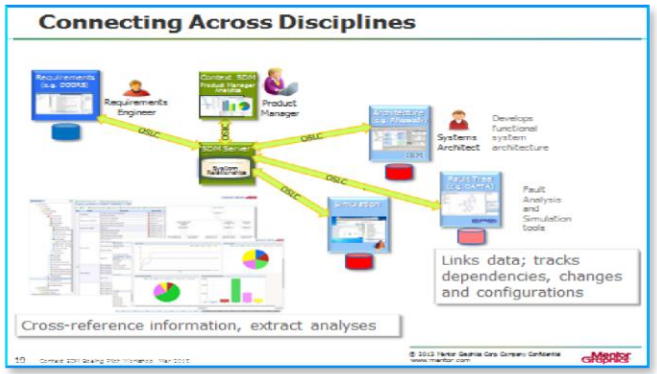
Lifecycle Management for “Work in Progress”

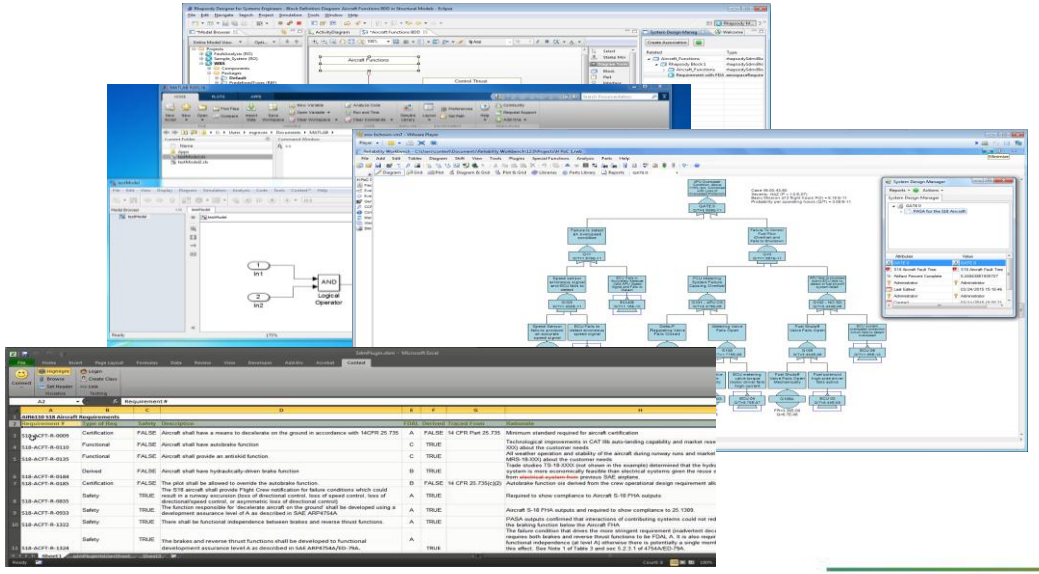
Context SDM provides a focal point

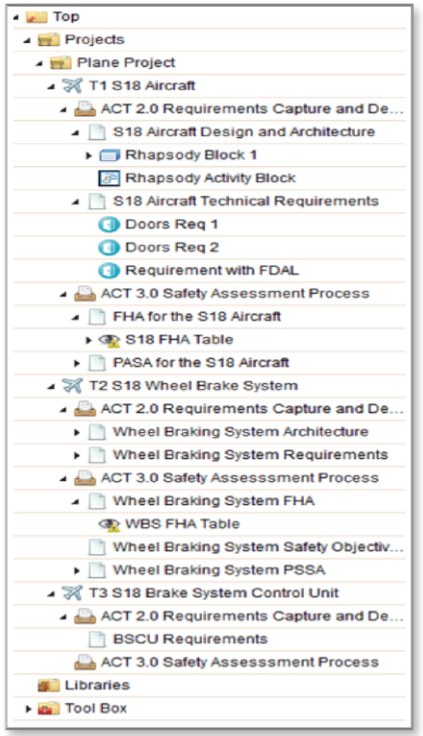
Building on the OSLC standard

Data Organization

Tools and Plugins







So What?

- The Project manager gets…
  - Visibility, control and status
- Each designer gets…
  - Access to relevant information
- The safety analyst gets…
  - Traceability and audit
- The requirements engineer gets…
  - Complete and current data
- The system designer gets…
  - The right product, at the right time



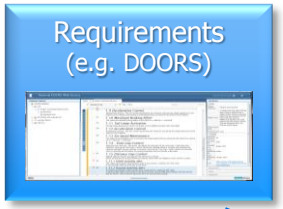


Lifecycle Management for 'Work in Progress'

- 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

Connecting Across Disciplines

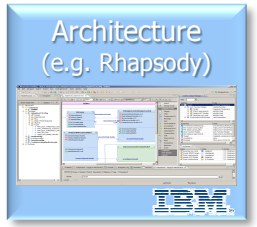
Captures system requirements

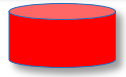


Requirements Engineer

Rev x

New/changed requirement





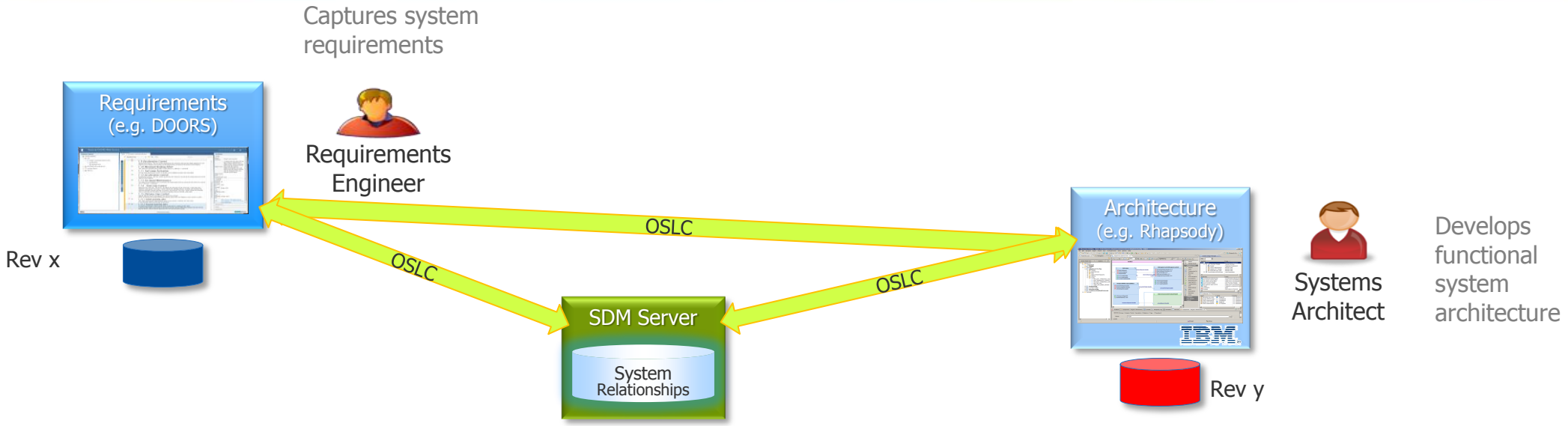
Rev y

Systems Architect

Develops functional system architecture

Traditional approaches use walking down the hall, email, or staff meetings to communicate change

Connecting Across Disciplines

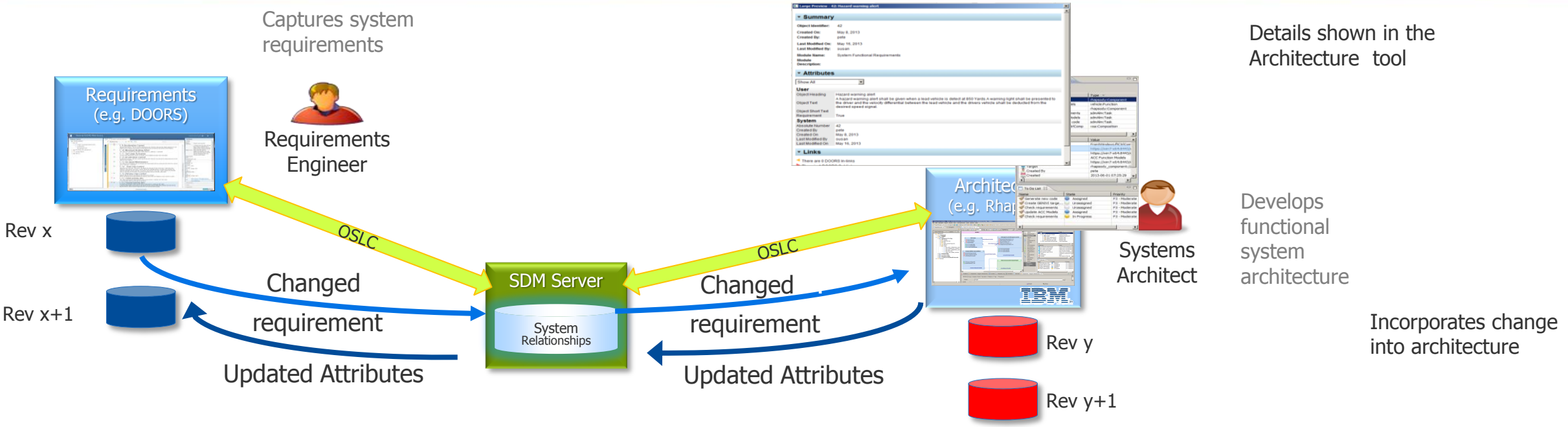


OSLC
Inspired by the web

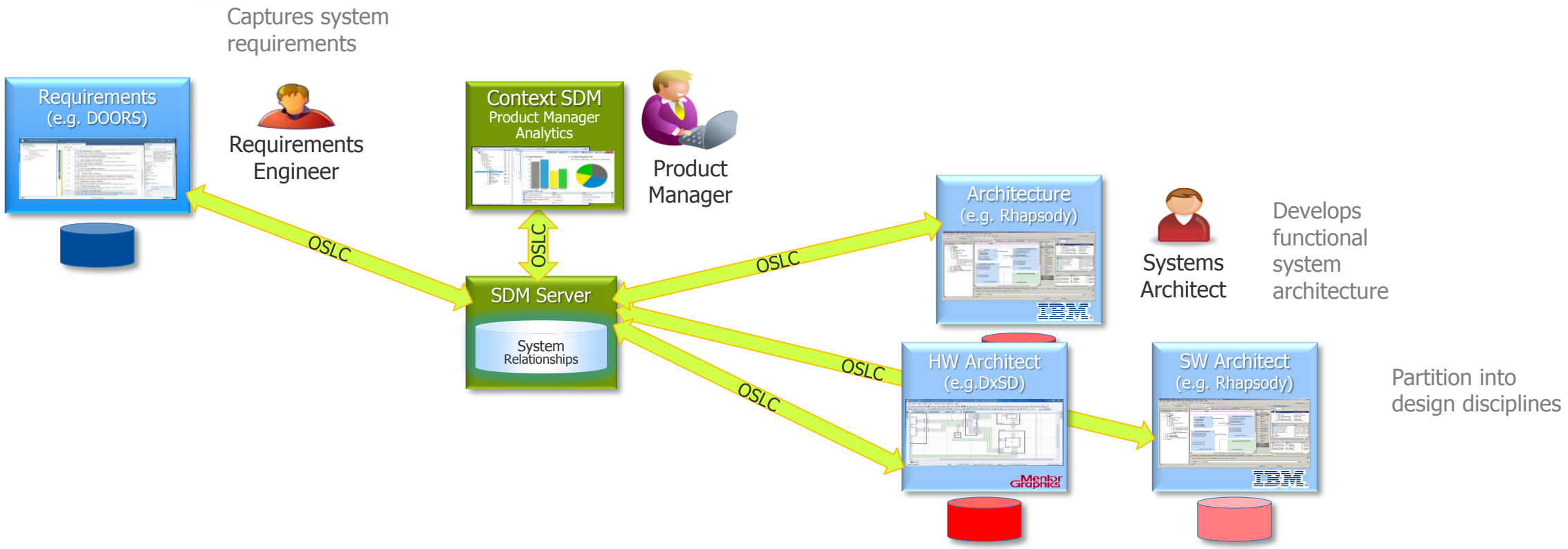
Tool to tool communication can automate and integrate

The Context SDM Server acts as a focal point, shares relevant changes, and builds history

Connecting Across Disciplines

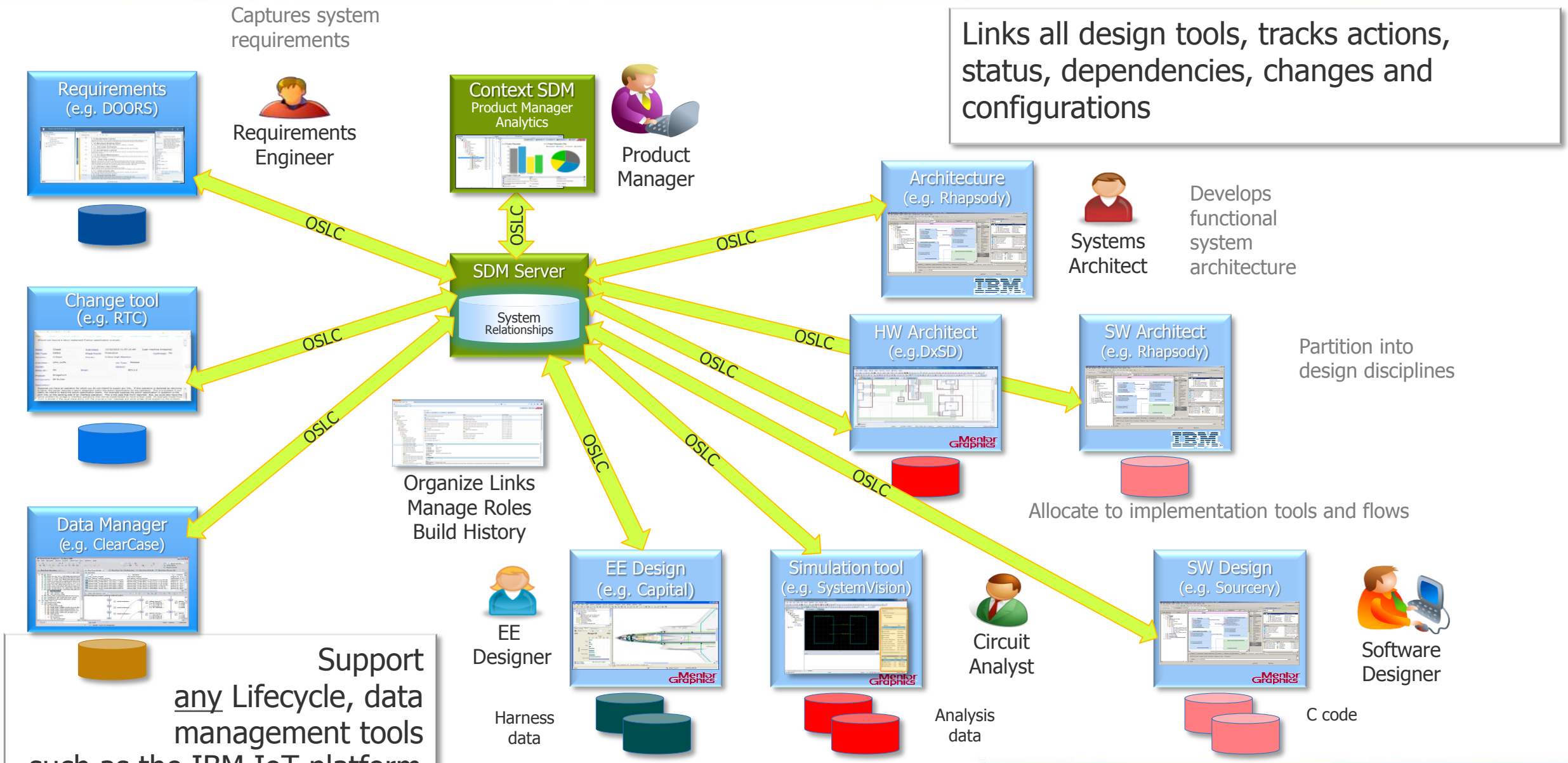


Connecting Across Disciplines



- Links data, tracks dependencies, changes and configurations

Connecting Across Disciplines



Companies are designing COMPLEX systems

- MANY software, hardware, mechanical, hydraulics, motors, combustion, etc.
  - Multiple sources of documents; Many reused legacy designs
- Huge, multi-function teams must work in a highly coordinated fashion
- Schedule & budget goals are essential to product success
- Quality and reliability are hard requirements
- Yet the process is unpredictable, painful, exceedingly manual and reliant on meetings & documents
- Alternatives are not easily applied and managed
  - PLM proves to be cumbersome, inflexible and expensive
  - Niche vendors offer point-tool partial solutions
  - Traditional "people and paper" flows

Context® SDM integrates with current tools and flows, imposes no additional constraints over data management, and delivers incremental value rapidly

The challenge: "lean" the safety analysis process

- Industry specific standards share common goals and strategies

Aerospace

ARP4754A/ARP4761
DO-178b/c
DO-254

Automotive

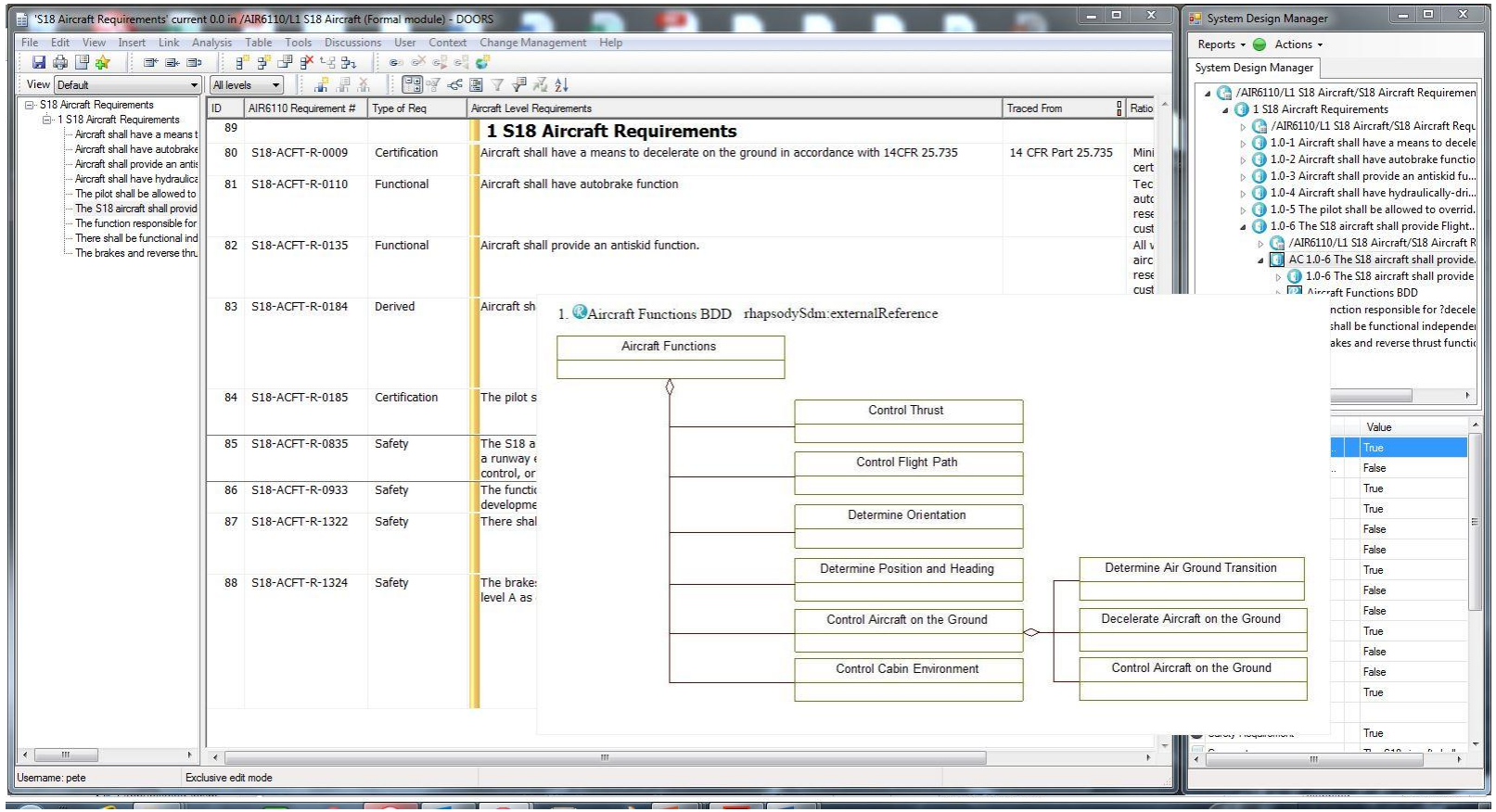
ISO26262

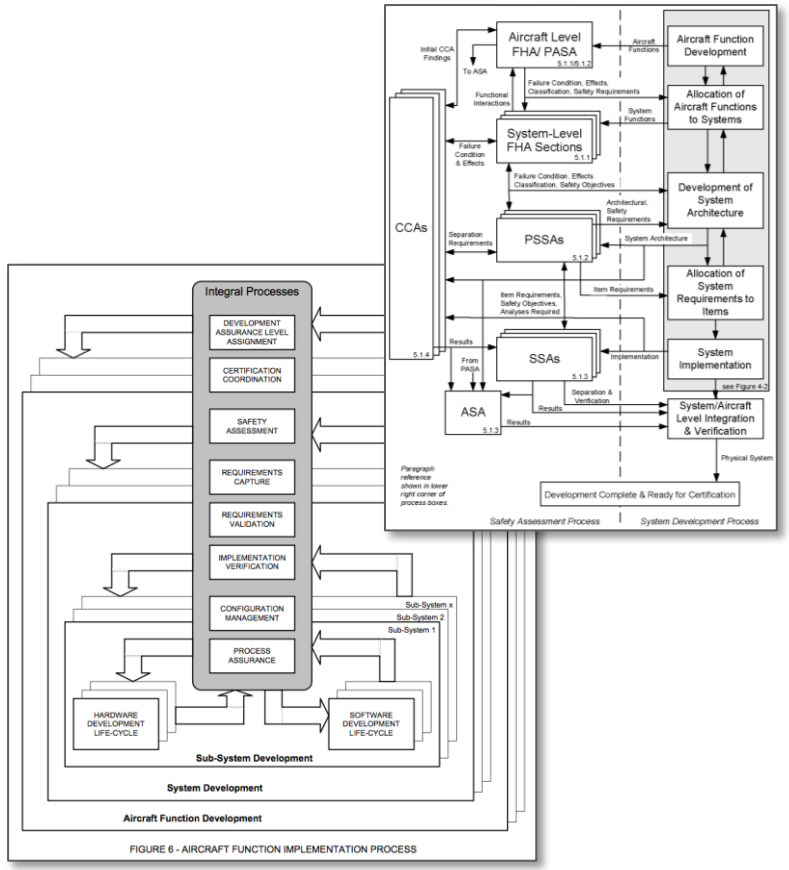
Medical

IEC 60601

Example – Model Based Safety Analysis

- Support the flows and actions mandated in ARP4754A/4761 for aircraft safety
- Link numerous tools, data sources and flows

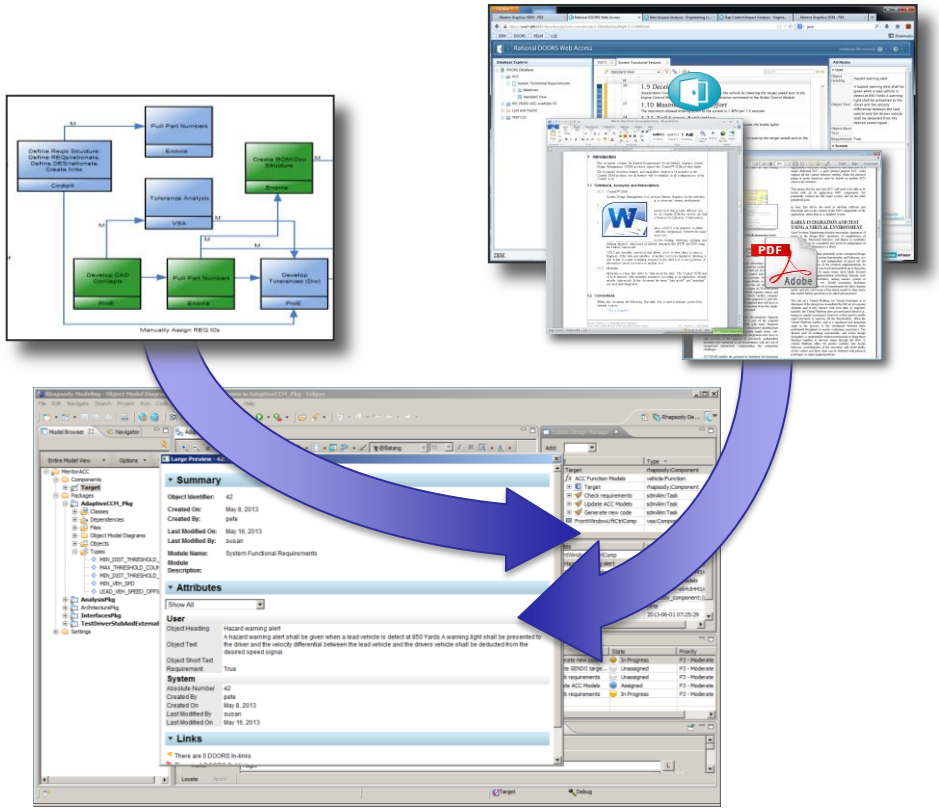




Context Supports the Users' Daily Tasks

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



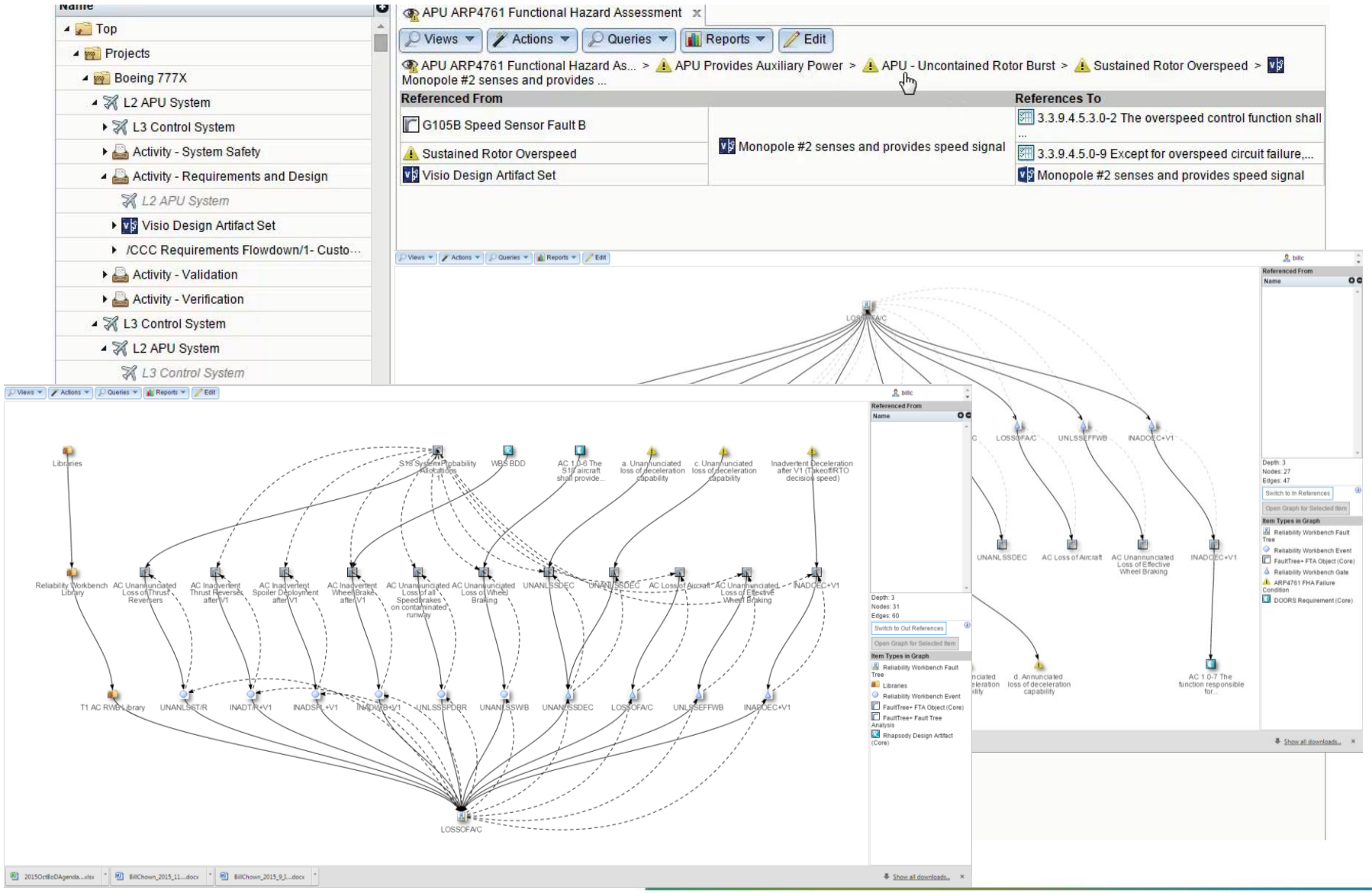
Interactive information for the user, where they can use it now

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

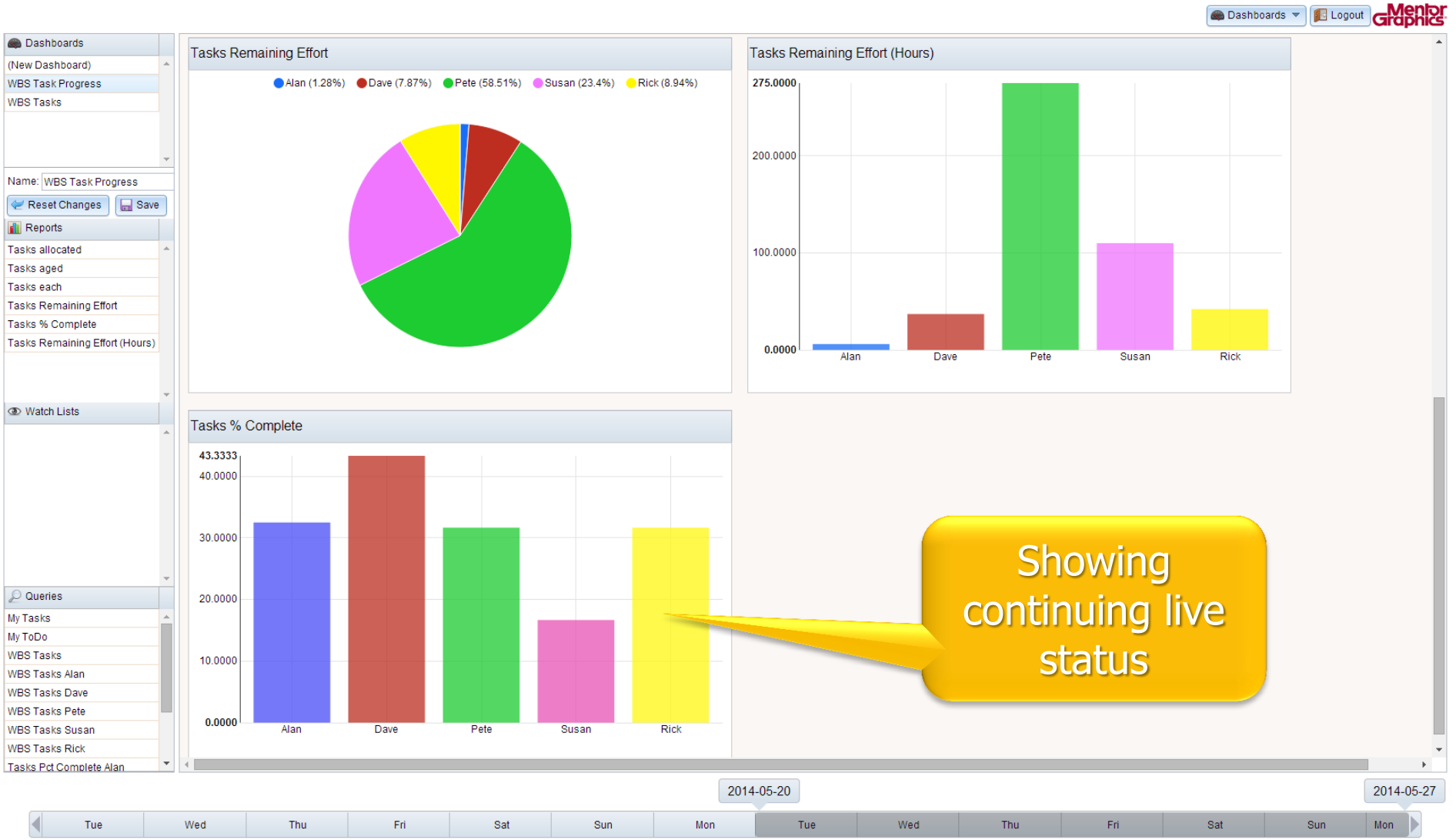
Traceability

- Each item in Context SDM is traceable to and from all related items
- For interactive traceability a trail shows items visited, in tables or graphically



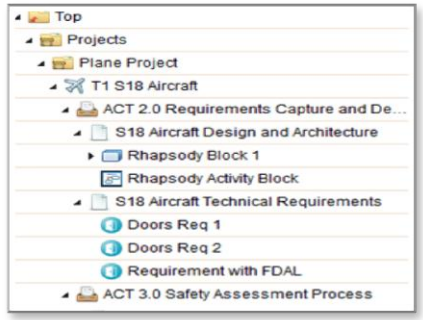
Product Manager – Tracking Resources

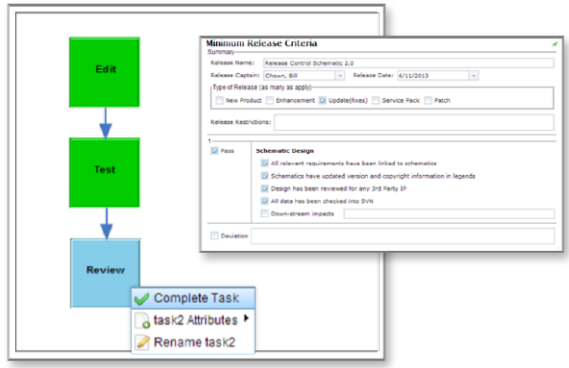
- Queries extract relevant information
- Views present effectively
- Assemble into key summaries

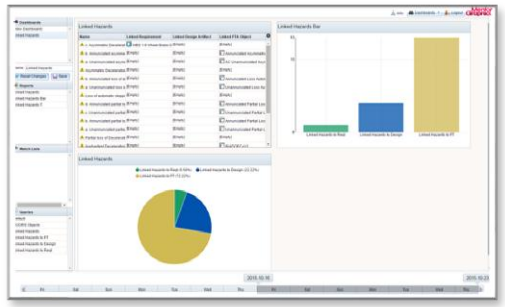


Project Management

- Product or Project Structure
  - Import from diagrams, tables
  - Instantiate template-based standard flows
- Roles, Responsibilities and Rights
  - Build on login authority
  - Assign project-specific roles
- Tasks and Actions
  - Task model supports pre- and post- actions, dependencies
  - Extensible to build custom controls
- Workflow
  - Connect Tasks into structured controlled flows
- Queries and Dashboards
  - Access any data with conditional selection
  - Assemble views to suit each need
- Reports
  - Generate report output from queries

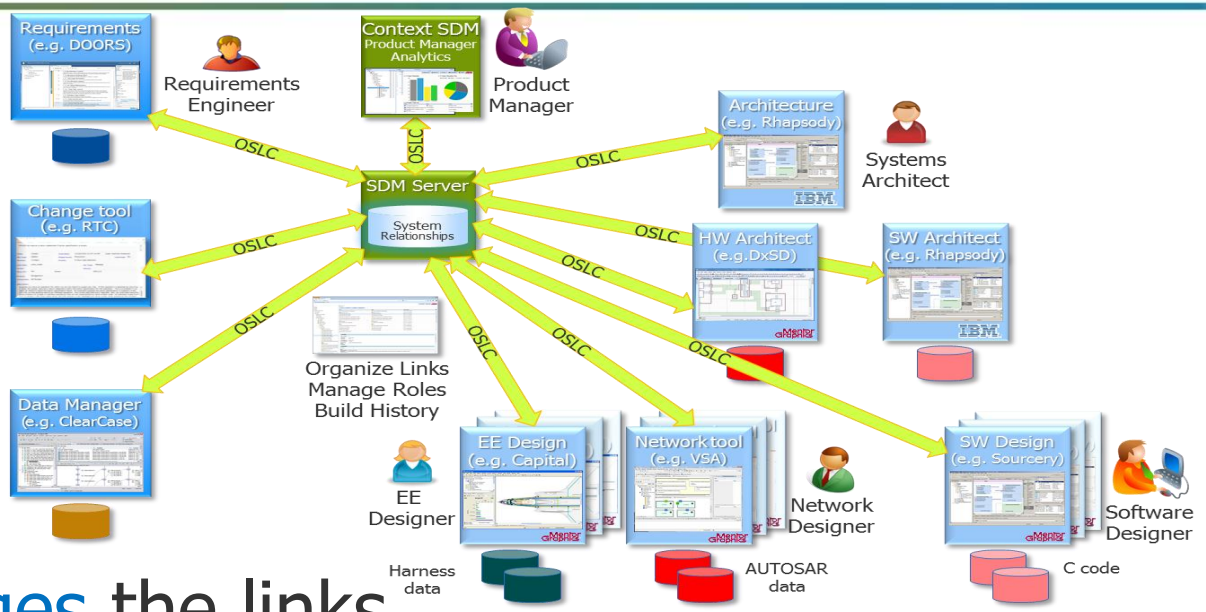






Context™ SDM

- **Management** of linked data
- Tool to tool **integration**
- Standards-based lifecycle & process **communication**



- **Context Server** stores and manages the links
  - Builds history, enables traceability and reporting
- **Context SDM** plugins augment design & lifecycle tools
  - Integration can be available for Mentor or other tools

- Web-based Product Manager accesses data and analytics
- OSLC standard connects all the tools

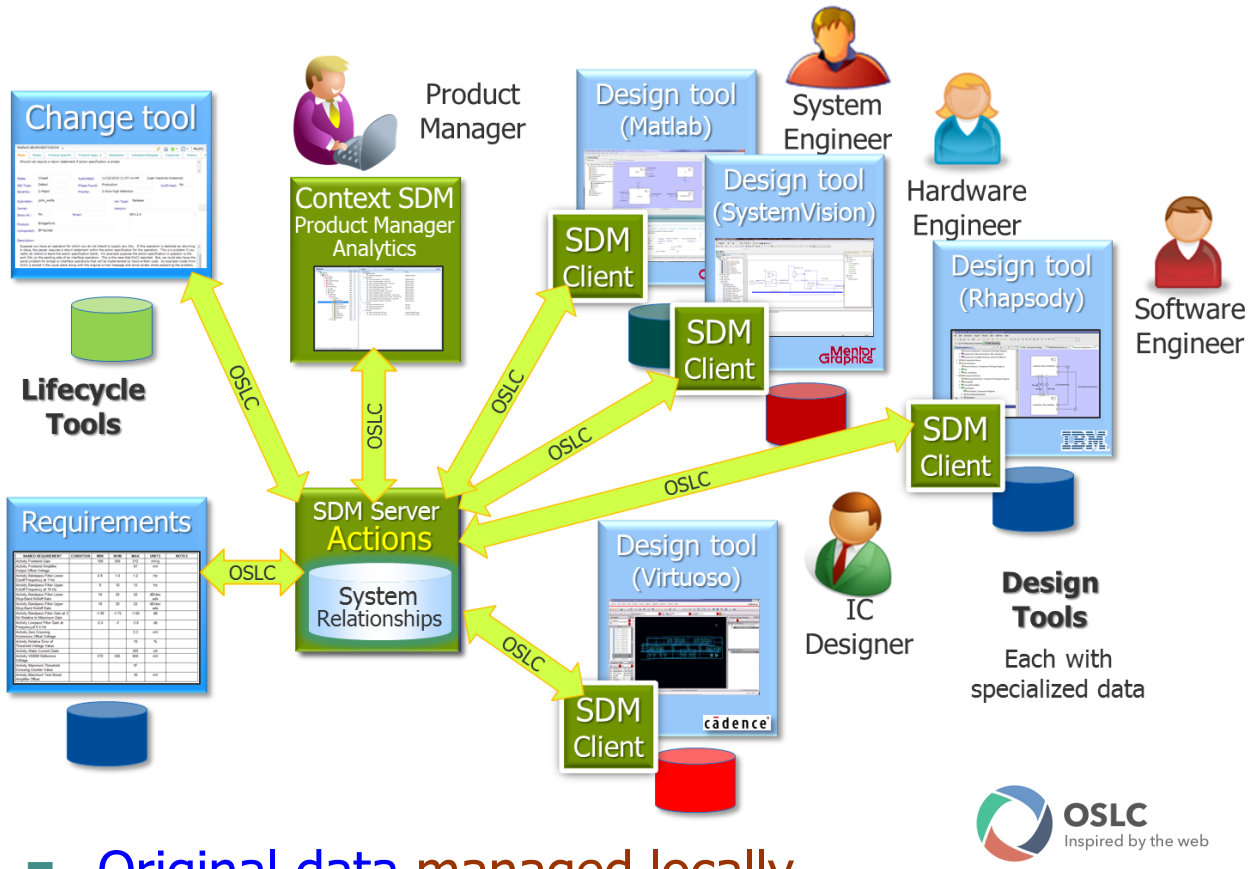
Building on OSLC

- OSLC provides the definition for a good base
  - Provides communication
  - Defines some types of data
  - … but more is needed

- An organizational analogy:
  - My iPhone is like an OSLC-enabled tool
  - It cannot talk to another phone directly, only to AT&T
  - The service provider knows where messages need to go, how to route them, tracks history and enables report generation

- An OSLC-enabled tool needs sources and destinations for information, an interface to interact with those messages, and some form of comprehension of the semantics – *content management, in Context*

Summarizing – Context® SDM Architecture



- Original data managed locally
- Context manages associations and links
- Extends beyond EDA across disciplines
- Data model extensible and customizable

Team Benefits

- Brings data to users where it can be applied
  - Saves time finding information
  - Tracks changes – reduces errors, time and costs
  - Eases reuse – saves rework, duplication

  Example Use Case: Designer and Requirements

- Links existing tools across disciplines
  - Installs and works with minimal disruption
  - enables impact analysis, reduces risks
  - Encourages teamwork, improves efficiency

  Example Use Case: MBSA methodology

- Tracks activities and project progress
  - Improves project management oversight
  - Builds a record of all actions
  - History enables reuse, satisfies audit trail needs

  Example Use Case: Systems Engineering

www.mentor.com

go.mentor.com/context