

Smart, Connected Product
Connected through a wire or wireless

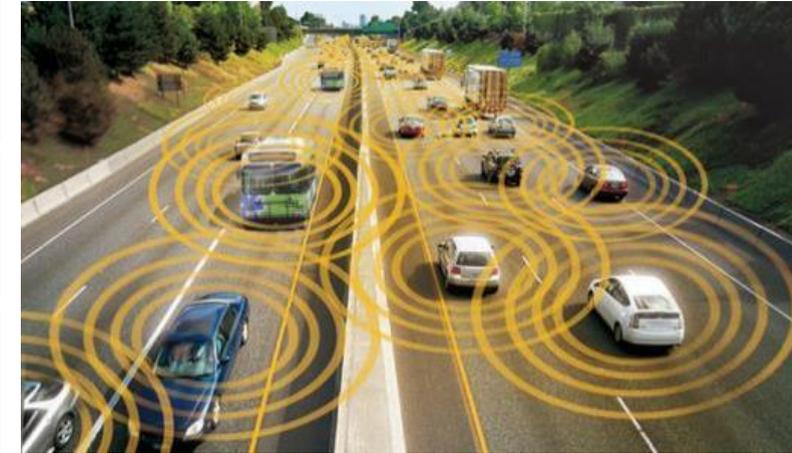
Smart Product

Mesh Connectivity

Many to Many

Hub and Spoke Connectivity

Point-to-Point Connectivity



Enhanced UI

Ability to Interact

Software

Ability to Think

Sensors

Ability to Sense

Electronics and Controls

Ability to Process

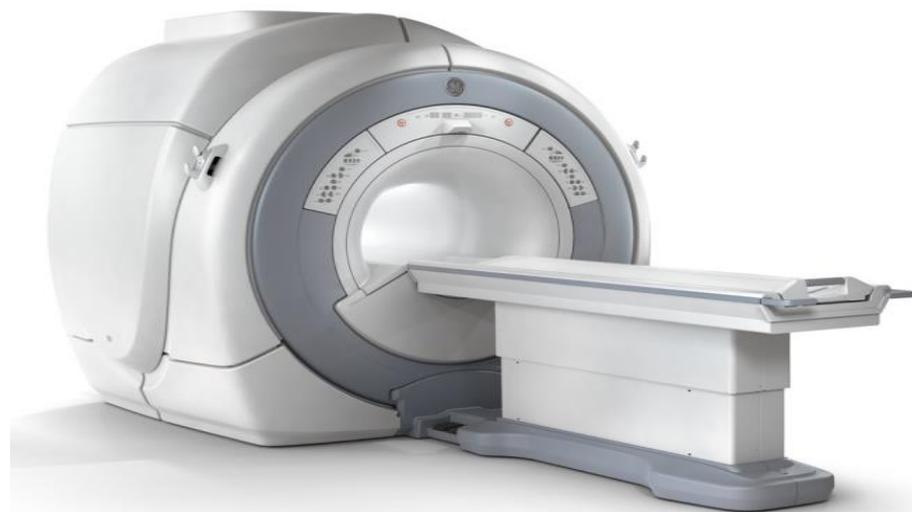


Physical Product

Electrical

Mechanical







ALM for Smart, Connected Products

A holistic software and systems engineering approach that enables successful collaboration, automation and reuse across teams and disciplines.



Unprecedented product complexity

- Product line complexity exploding
- Teams are overwhelmed by volume and velocity of change
- Exponential growth in artifacts to manage

Disconnected teams

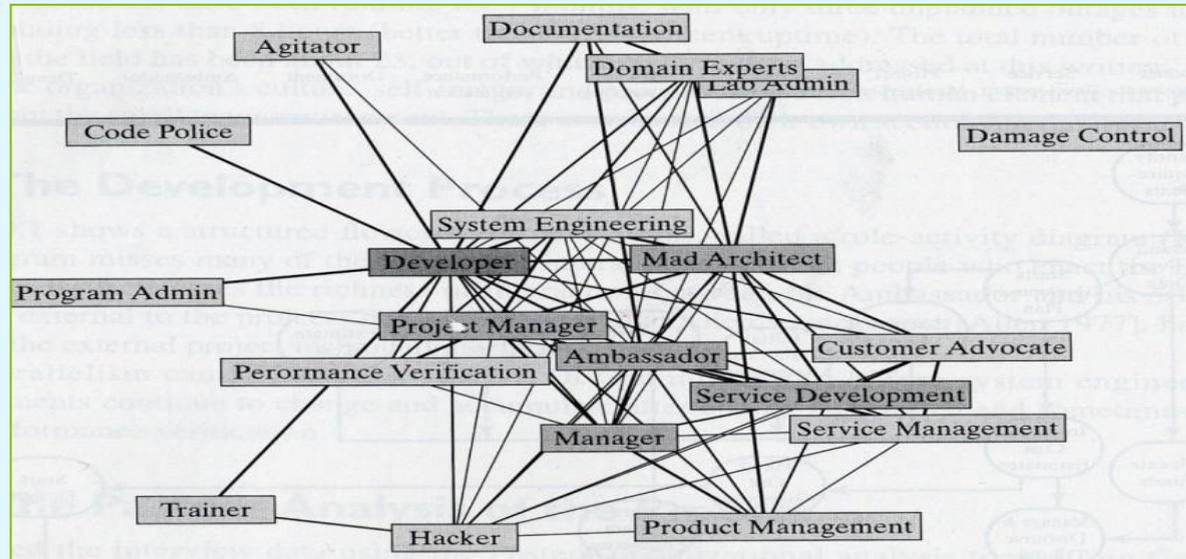
- Global teams struggle to collaborate across disciplines
- Still perform in isolated silos
- Software still seen as a “black box” disconnected from product delivery cycle

Lack of visibility

- Disjointed tools and repositories prevent integral reporting
- Errors found late – when most costly to repair
- Leaves everyone guessing at product readiness

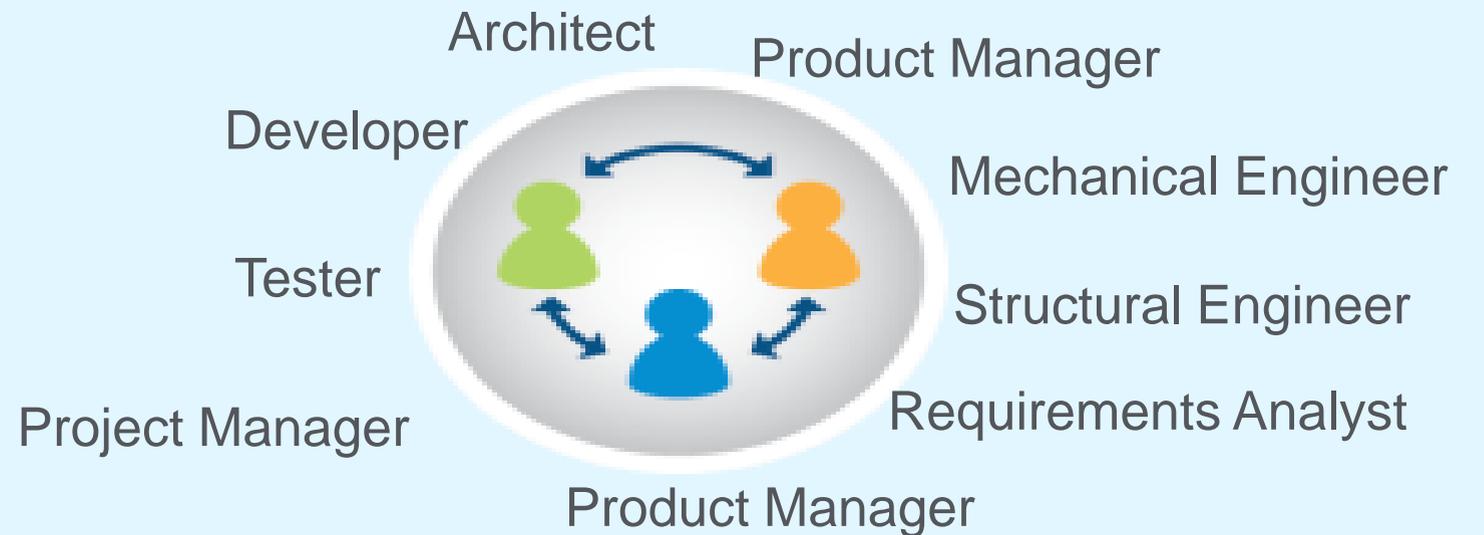
High cost of compliance

- Lack of process enforcement
- Software and systems artifacts at risk of tampering
- Skyrocketing costs of compliance



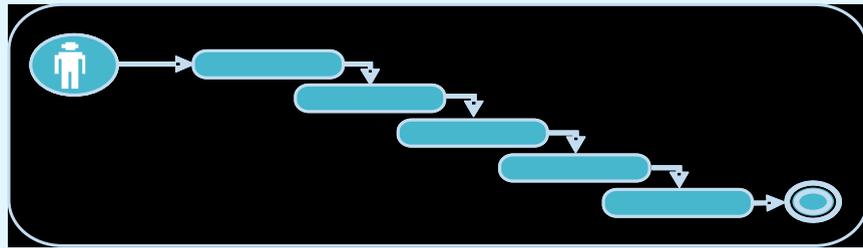
From this...

- Silos of people, process and information
- Renegade changes
- Insecure code base
- “Code from scratch”



To this...

- Transparent, global access to software artifacts
- Single source of truth
- Secure IP
- Foundation for re-use

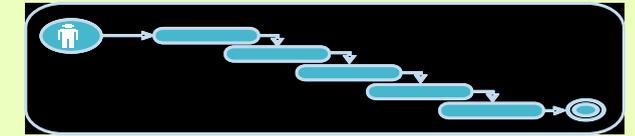


From this...

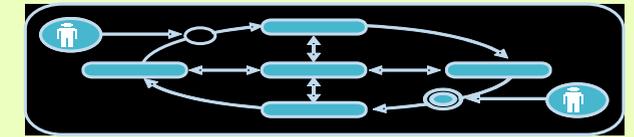
- Rigid, “one size fits all” process
- Uncontrolled hand-offs across individuals and teams
- No easy way to document process enforcement



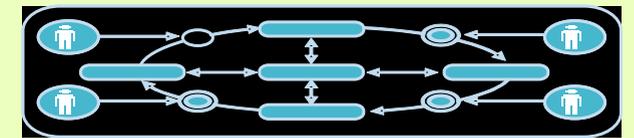
WATERFALL



ITERATIVE

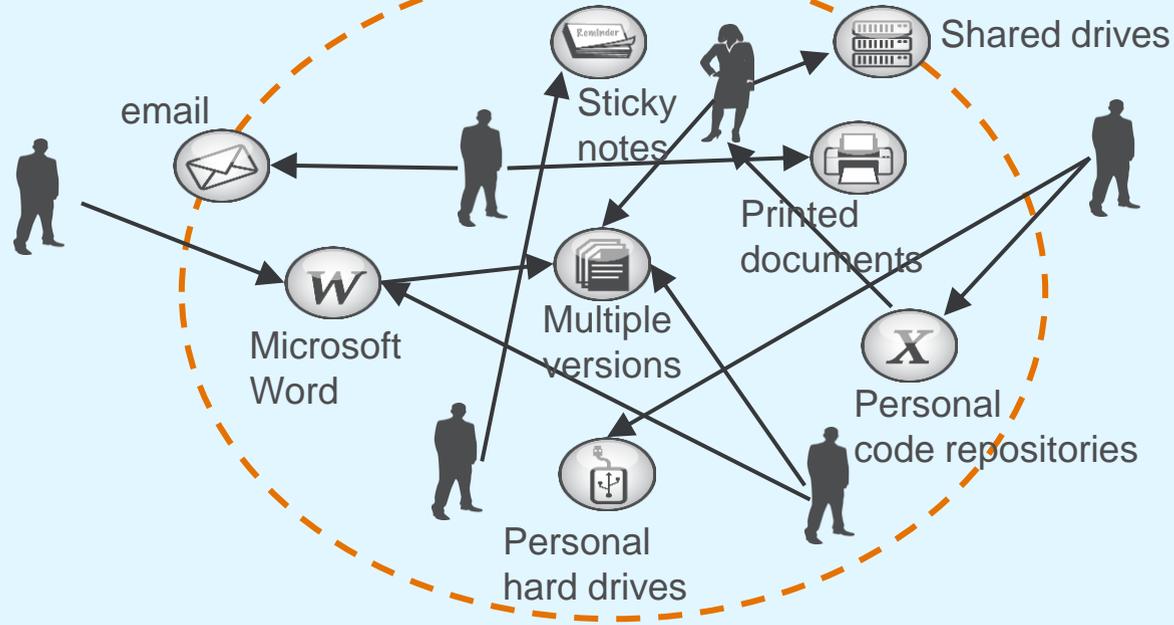


AGILE



To this...

- Tailored process to fit team needs
- Enforcement built-in
- Comprehensive reporting documents compliance with any process



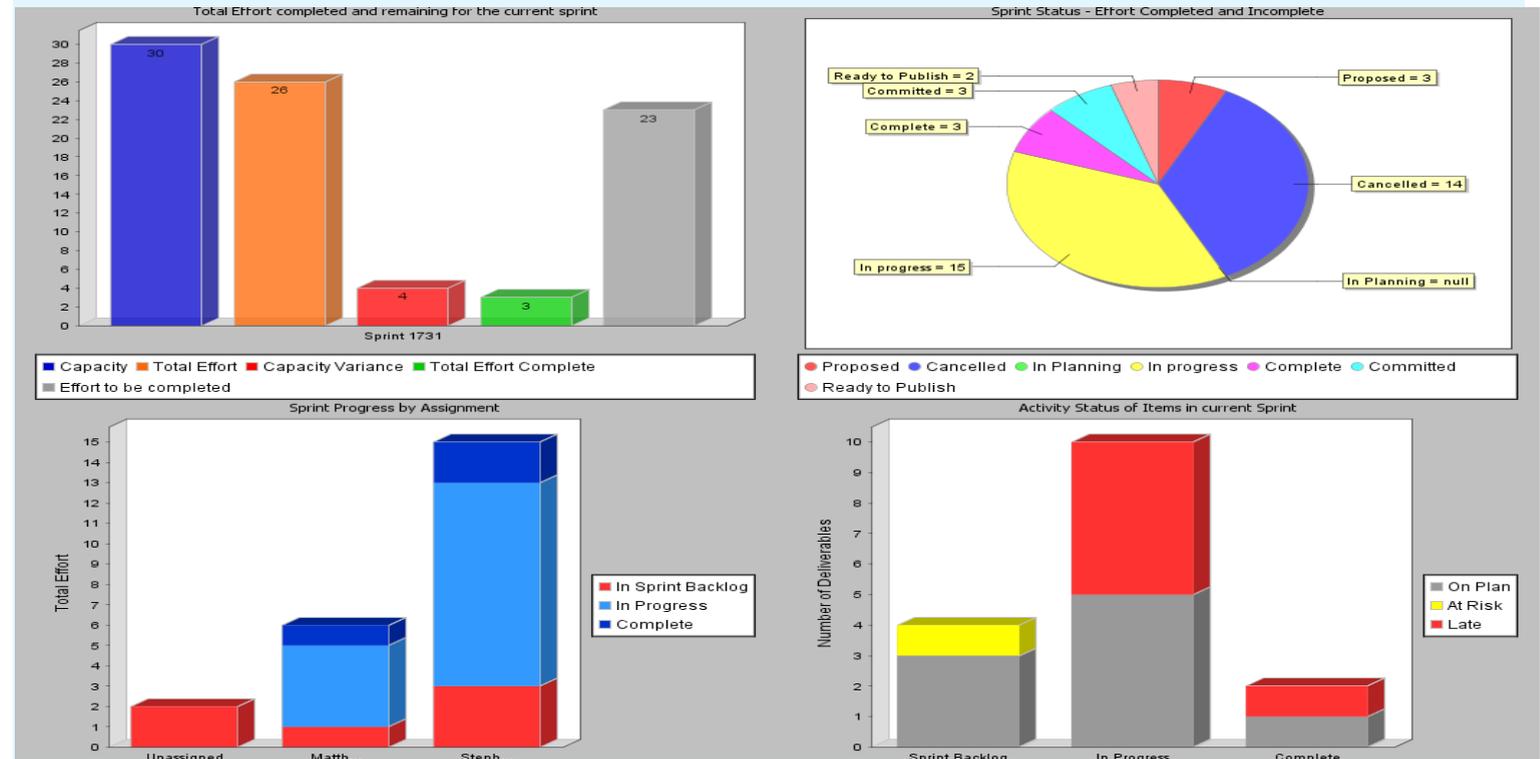
From this...

- Disjointed meta-data captured in multiple, unstructured documents
- Unreliable metrics
- Missed delivery dates
- Chaotic teams



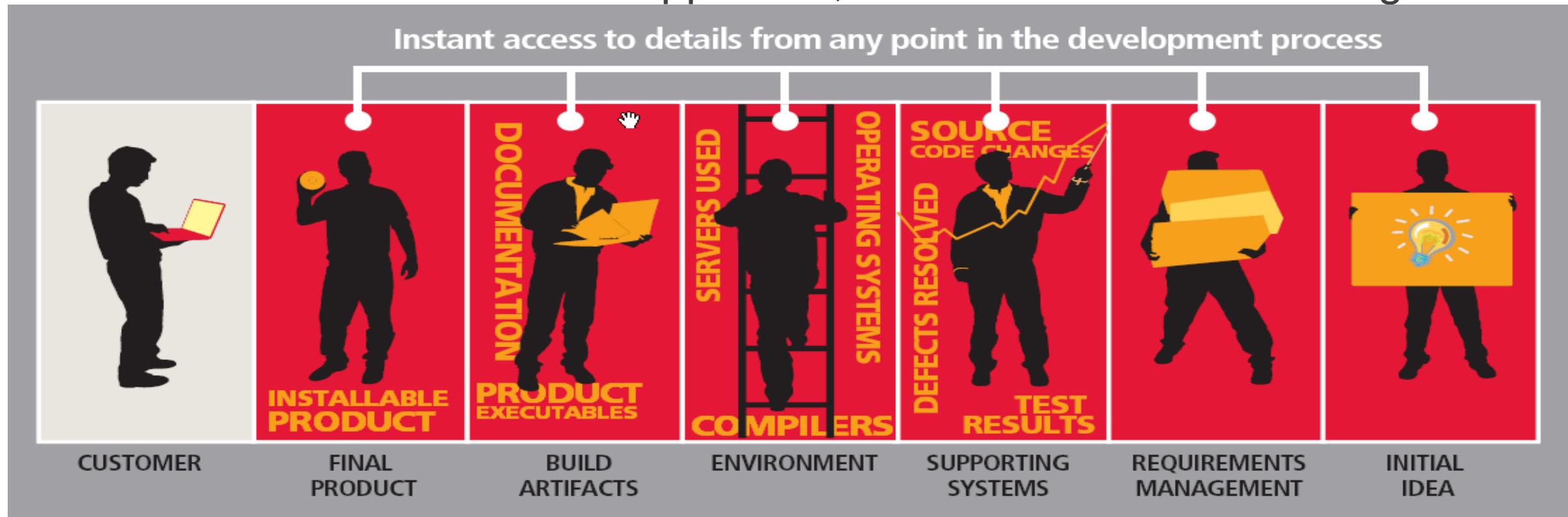
To this...

- A single source of the truth on project progress
- Fact-based metrics generated from actual work activities, not estimates
- Well organized, managed teams



What did you deliver to your customer? With PTC ALM solutions...

1. The executable is a reliable record of what was delivered to your customer
2. You can access details and intermediate work products at any step along the software engineering lifecycle
3. You can identify the “who what where when why” of any change
4. You can document all associated approvals, validation and verification gates



CAPABILITIES

- Process Inventory in the Box
 - Full Lifecycle; Systems, Software
 - PTC Process Perspective + Others
- Rich Process Content Authoring
- Project Initiation Wizard
- Project Plan Generation
- Process Deployment

Establish, measure and improve your organization's operational, engineering and development processes.



PTC Integrity™ Process Director™

BENEFITS

Merge industry best practices and your experience to improve quality

Achieve the promised productivity improvements from your processes

Reduce costs of process definition and rollout

CAPABILITIES

- Collaboratively capture and manage systems and software requirements
- Easily determine impact of proposed changes
- Identify orphaned and untraced requirements

Capture and manage the voice of the customer over the life of your product and product lines.

The screenshot displays the PTC Integrity Lifecycle Manager interface. On the left, a tree view shows a document structure for a 'Front Load Washer MHW6000XR'. The main area shows a 'Content' menu with options like 'Insert Content', 'Delete', 'Copy', and 'Paste'. A 'Requirement: 1934' is highlighted, with details including creation and modification dates. Below this, a 'Verified By' table lists various IDs and document IDs. On the right, an 'Upstream Traceability' window shows a table of requirements and their relationships, with a description for one requirement: 'The car should **optionally** support comfort functional **within cold environments**. The level of functionality should be oriented on offeri...'. A digital display showing '40' is also visible in the background.

Author and manage requirements

Report on changes across disciplines

Trace requirements to physical product information

PTC Integrity™ Lifecycle Manager

BENEFITS

Reduce time to define and document requirements

Streamline collaboration

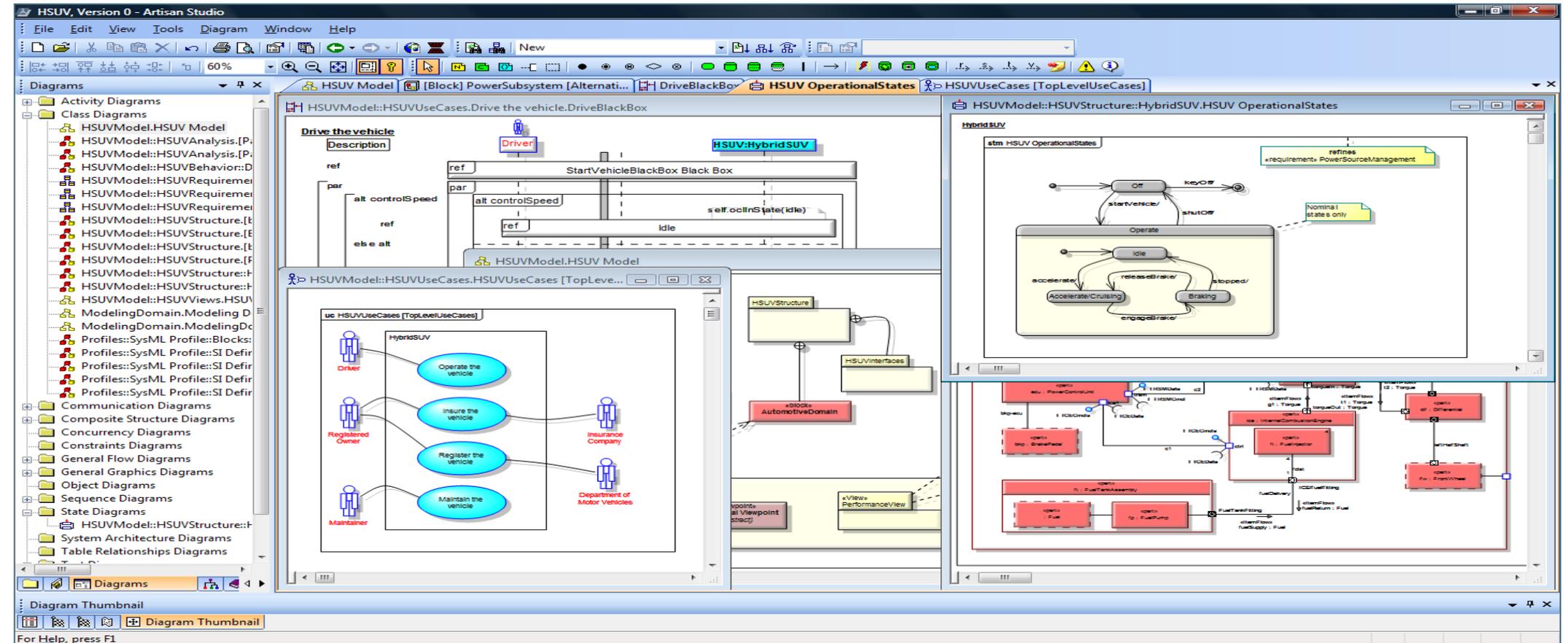
Improve First Pass Yield

Minimize release delays and missed requirements

CAPABILITIES

- Model-based systems engineering (MBSE) with SysML and UML
- Integrated product line variation modeling
- Fully associative modeling between all system elements
- Traceable model element database

Design before you build with a visual, MBSE approach.



PTC Integrity™ Modeler™

BENEFITS

Increase efficiency of detailed development

Maximize commonality

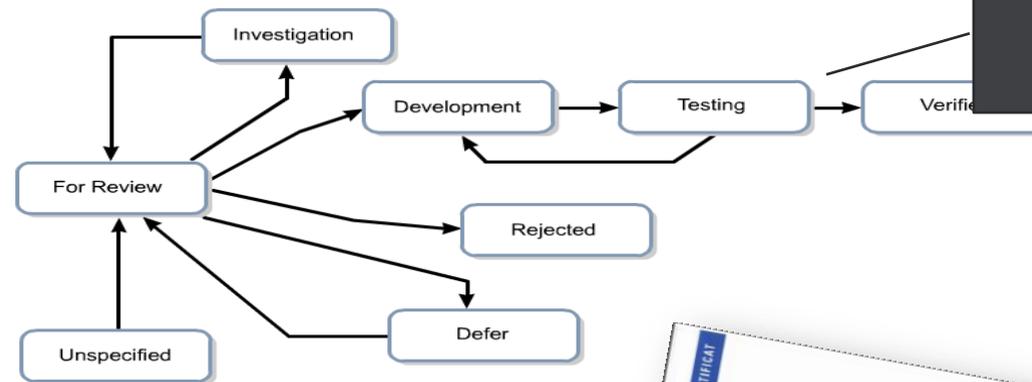
Elevate reuse

Design for product line complexity

CAPABILITIES

- Configure and automate any development process / methodology
- Govern process compliance to meet safety-critical reporting
- Access a central view of critical ALM metrics
- Correlate metrics from requirements, test, models, and source code

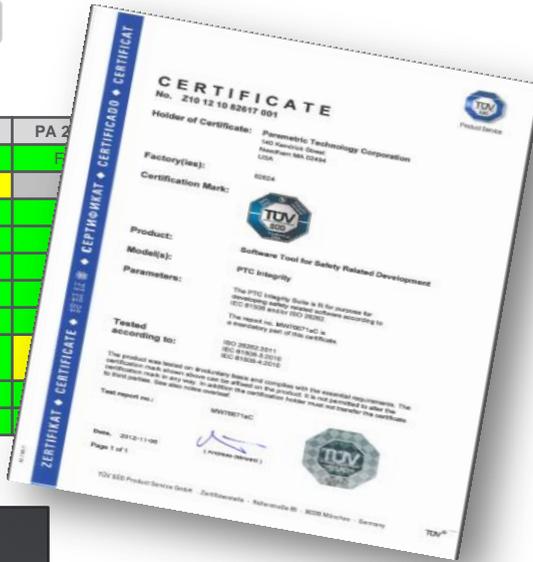
Provide an early warning system based on schedule, quality, completeness, and compliance indicators.



Configure and tailor your development process

Get real-time insight on release readiness

Process	CL	PA 1.1	PA 2
ENG.4 Software requirements analysis	2	F	F
ENG.5 Software design	1	L	F
ENG.6 Software construction	2	F	F
ENG.7 Software integration test	2	F	F
ENG.8 Software testing	2	F	F
SUP.1 Quality assurance	2	F	F
SUP.8 Configuration management	2	F	F
SUP.9 Problem resolution management	2	F	F
SUP.10 Change request management	2	F	F
MAN.3 Project management	2	F	F



Automate reporting of objective evidence for compliance and quality



PTC Integrity™ Lifecycle Manager

BENEFITS

Reduce the cost of compliance reporting

Get advance warning of project risks

Improve reporting accuracy

Match the right process to any project

CAPABILITIES

- Line of code traceability to upstream design and change process
- Promote collaboration and re-use through branching and merging of lifecycle artifacts, including requirements, code, and test
- Support time-based, feature-based and continuous releases

Gain fine-grained control over the evolution and release of strategic software assets.

Revision	Author	Date	Line	Revision Contents
1.1	Administrator	Jan 10, 2011	2	package com.ptc.demo;
1.2	Administrator	Jan 10, 2013	4	import java.util.Random;
1.1	Administrator	Jan 10, 2013	5	import com.ptc.demo.InputEvent.EVENT_TYPE;

```
/**  
 * @author $Author: Administrator (administrator) $  
 * @version $Revision: 1.3 $  
 */  
public class FrontLoadingPowerFunction implements PowerFunction  
{  
    /**  
     * Initializes the default power functions when the Front Lo  
     */  
    public void handle()  
    {  
        handleSignal(EVENT_TYPE.POWER_SIGNAL_REC'D);  
    }  
    /**  
     * Handles the specific Front Loading Washing Machine power :  
     * @param signal The Input Event for the power function  
     */  
    public void handleSignal(EVENT_TYPE signal)
```

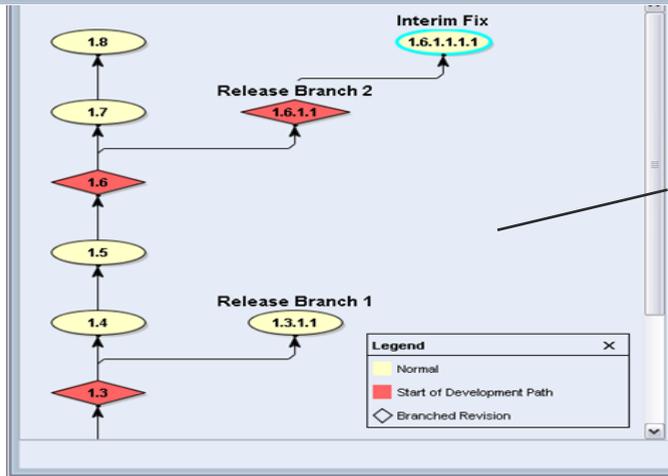
Fine-grained source code traceability

Provide visibility into builds/releases and automate handoffs

Build: 898
Created by Administrator (administrator) on Jun 29, 2013 8:28:12 AM
Modified by Administrator (administrator) on Jun 29, 2013 8:28:12 AM

Build Number	9875
Software Source Code Project	/Projects/WashingMachine/project.pl on 192.168.134.129:7001
Build Hostname	CD-I10GSD
Build Start Time	Jun 29, 2013 8:27:00 AM
Build Duration	

ID	Type	State	Summary	Assigned User	Created By	Relationships
827	Defect	In ...	Panel sends 10 hour delay when no d...	Adminis...	Adminis...	
831	Defect	In ...	Delicate Mode Defaulting to Medium 5...	Adminis...	Adminis...	



Automate and manage complex parallel development

PTC Integrity™ Lifecycle Manager

BENEFITS

Govern change across strategic software assets

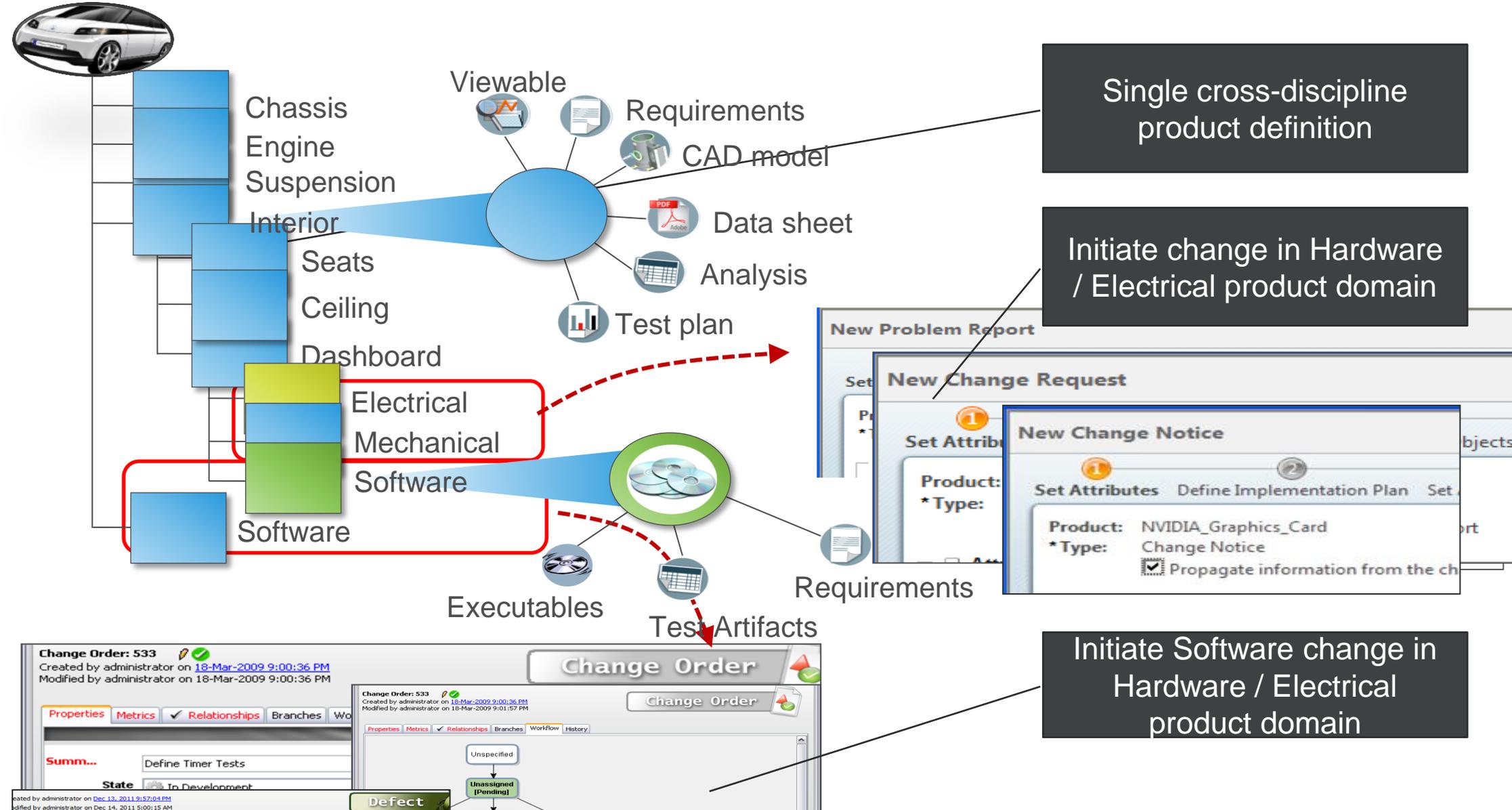
Speed software delivery and time-to-market

Identify precisely what was delivered

Reduce rework

CAPABILITIES

- Manage cross-discipline design data in a single product structure
- Associate build and executable information to structure
- Initiate tracking of software issues from Hardware / Electrical domain



BENEFITS

Improve visibility

Enable early and frequent communication

Improved release management

Reduce rework

CAPABILITIES

- Trace between requirements and test cases
- Manage test sessions and verify results against requirements
- Report metrics that measure progress against test objectives

Validate systems and software meet requirements;
verify quality management best practices were followed.

The screenshot displays the PTC Integrity Lifecycle Manager Test Management interface. At the top, there are tabs for Properties, Test Steps, Traces, Relationships, Attachments, Advanced, Test Results, Branches, Labels, and History. The main area is divided into several sections:

- Test Steps:** A table with columns for Order, Summary, and Description. It lists three steps: 1. Soft Reset (Power on the watch with a soft reset by holding down the Mode and Chronometer button simultaneously for 5 seconds.), 2. Chronometer Timing (Navigate to Chronometer mode. Ensure the Chronometer display reads 00.00.00. Press the Start button. The Chronometer should increment by .01.), and 3. (partially visible).
- Test Session:** A section for "1632 - Week 4 automated regression session" with a "Tests:" dropdown and a "State:" indicator showing "Pass 0".
- Structure:** A tree view showing a hierarchy of tests. The "544 System Test" is selected, and a context menu is open with options like "Mark as Pass", "Mark as Fail", "Mark As", "Clear Verdict", "Batch Edit", "Add Relationship", and "Create Relationship".
- Test Case: 544:** A detailed view of a test case with tabs for Test Result, Test Steps, Related Items, and Attachments. It features two pie charts showing coverage metrics:
 - Design:** Covered = 24, Not Covered = 242.
 - Requirement:** Covered = 15, Not Covered = 445.

Manage Test Cases, Test Sessions, and Test Results

Report on Testing Results and Trends

PTC Integrity™ Lifecycle Manager

BENEFITS

Reduce time / effort to evaluate product /software readiness

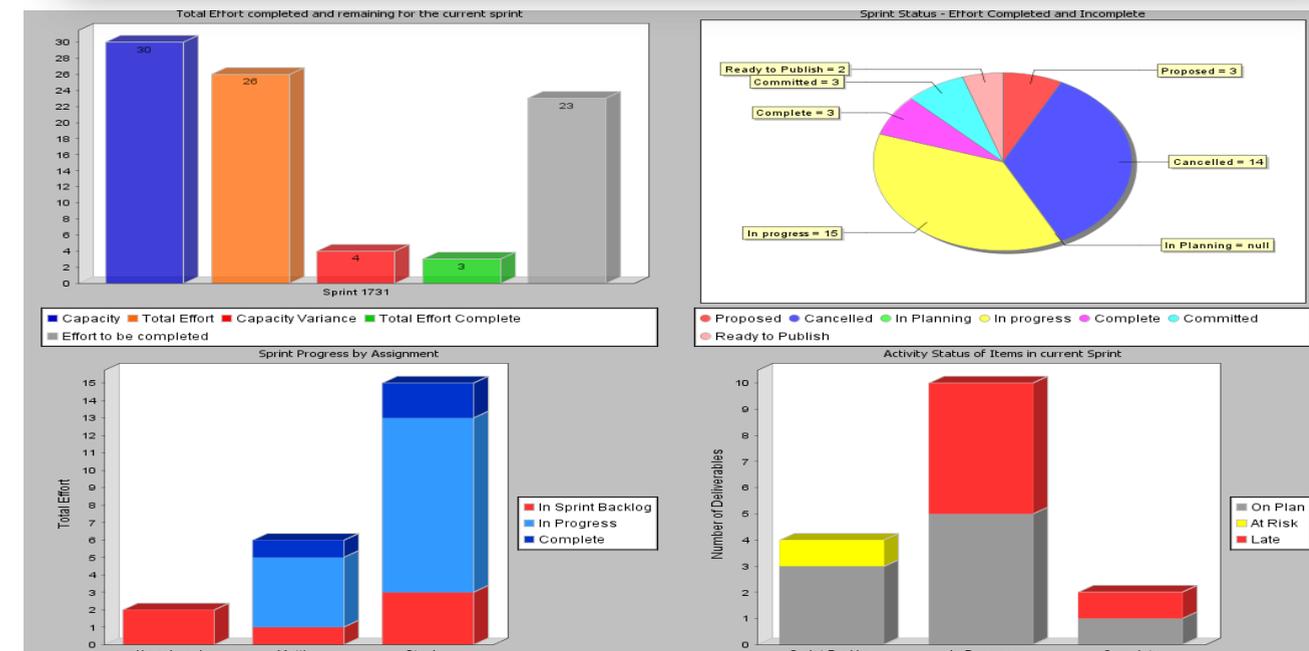
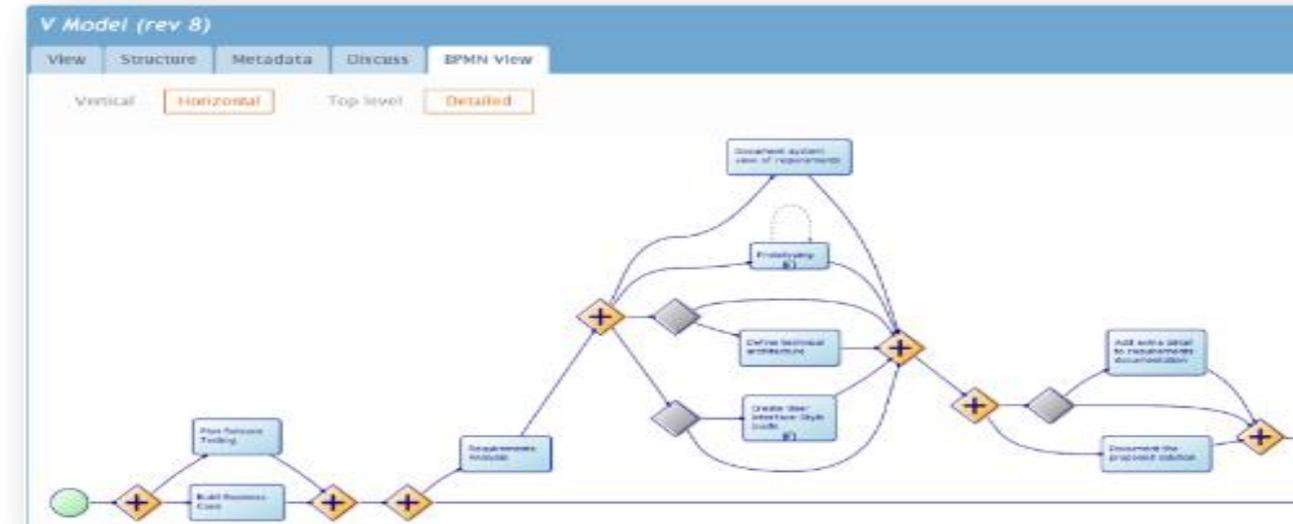
Improve effectiveness of test resources

Streamline test suites

Improve product quality

Integral solutions optimized for software intensive product engineering

- Author and communicate your **process**, then operationalize it
- **Integral** software development solution
- Supports **systematic reuse** of all development artifacts across variants and software product lines
- Automation of complex **compliance** reports showing **traceability** across all lifecycle artifacts
- Dashboards provide **real-time visibility** into quality, functionality, compliance, schedule, and budget
- Provides **ALM-PLM integration** for a complete product view



PTC ALM Delivers Value Across Industries

Aerospace & Defense



Automotive



Electronics & High Tech

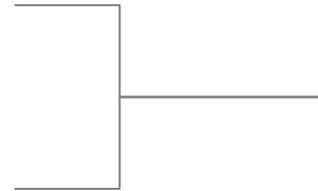


Industrial



Medical Devices





HELLA is a global, independent, family-owned company with more than 27,000 employees at 70 locations in more than 30 countries. The HELLA Group develops and manufactures lighting and electronic components and systems for the automotive industry and also has one of the largest trade organizations for automotive parts, accessories, diagnosis and services throughout Europe.

“PTC Integrity is the backbone of Hella’s development activities. It would be impossible to facilitate projects of this magnitude under such tight time constraints without this solution . It allow for better, faster and easier collaboration.”

Head of Software Automotive Standards
Hella





HELLA is a global, independent, family-owned company with more than 27,000 employees at 70 locations in more than 30 countries. The HELLA Group develops and manufactures lighting and electronic components and systems for the automotive industry and also has one of the largest trade organizations for automotive parts, accessories, diagnosis and services throughout Europe.

Initiatives

- Reduce development cycle time while improving delivery predictability of their software intensive automotive products
- Achieve SPICE Level 3 compliance while reducing development costs globally

Solution

- PTC Integrity

Source control for all global software assets

Process management providing standardized automated workflows

Compilation and visualization of key performance metrics

Results

- 33% reduction in project times while increasing scope and doubling the number of projects
- Achieved SPICE level 3 and functional safety goals based on IEC 61508 standard while lowering overall development costs

Insitu streamlined CMMI compliance and continues to deliver unprecedented development visibility to key customers



Specializing in the design, development, production, and operation of unmanned aircraft systems (UAS) for intelligence, surveillance, and reconnaissance (ISR) objectives, Insitu, Inc., has been a global leader in the UAS industry since 1994.

“PTC Integrity provides that one tool, an all-in-one solution that could link all artifacts and provide all kinds of efficiencies to our software developers. This was unique among all contenders in our evaluation process. PTC Integrity was what I imagined I would write if I had to write a tool from scratch.”

Mark Derbecker
Director of Software Engineering, Insitu



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Initiatives

- Needed to achieve CMMi Level 3 in order to win strategic government contracts
- Imperative to provide better visibility to all program stakeholders to achieve delivery predictability
- Needed to optimize software development through Agile methods while adhering to program and customer traditional check-points

Solution

- PTC Integrity
 - Global Software Development solution
 - Manage entire lifecycle set of artifacts in single solution – from requirements to design, code, test, and defects/change
 - Full traceability
 - Real-time dashboards and reports
 - DOORS integration for System Requirements

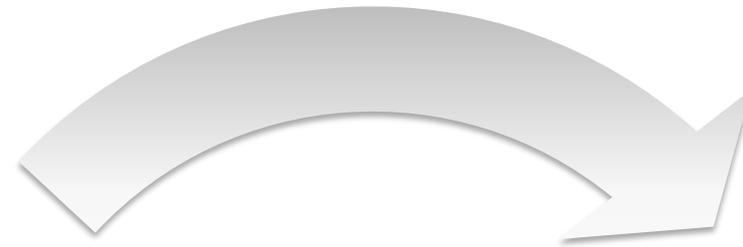
Results

- CMMi Level 3 in 9 months
- Unprecedented program visibility
- Predictable delivery
- Customer endorsement
- \$\$\$ Follow-on contracts \$\$\$
- “Our customer knows which programs use Integrity by the visibility, predictability and results delivered”

Produce and manage Smart, Connected Products



Digital Product Definition



Digital Twin



Real World Product



Leverage Smart, Connected Product data to improve products

Getting software right is only part of the challenge – you also need to get the right software!

Marwan Lahoud, Airbus' chief strategy officer, told the German newspaper that the company already believed there had been no problem with the airframe: “The black boxes attest ... that there are no structural defects, but we have a serious quality problem in the final assembly”



Tesla's Over-the-Air Fix: Best Example Yet of the Internet of Things

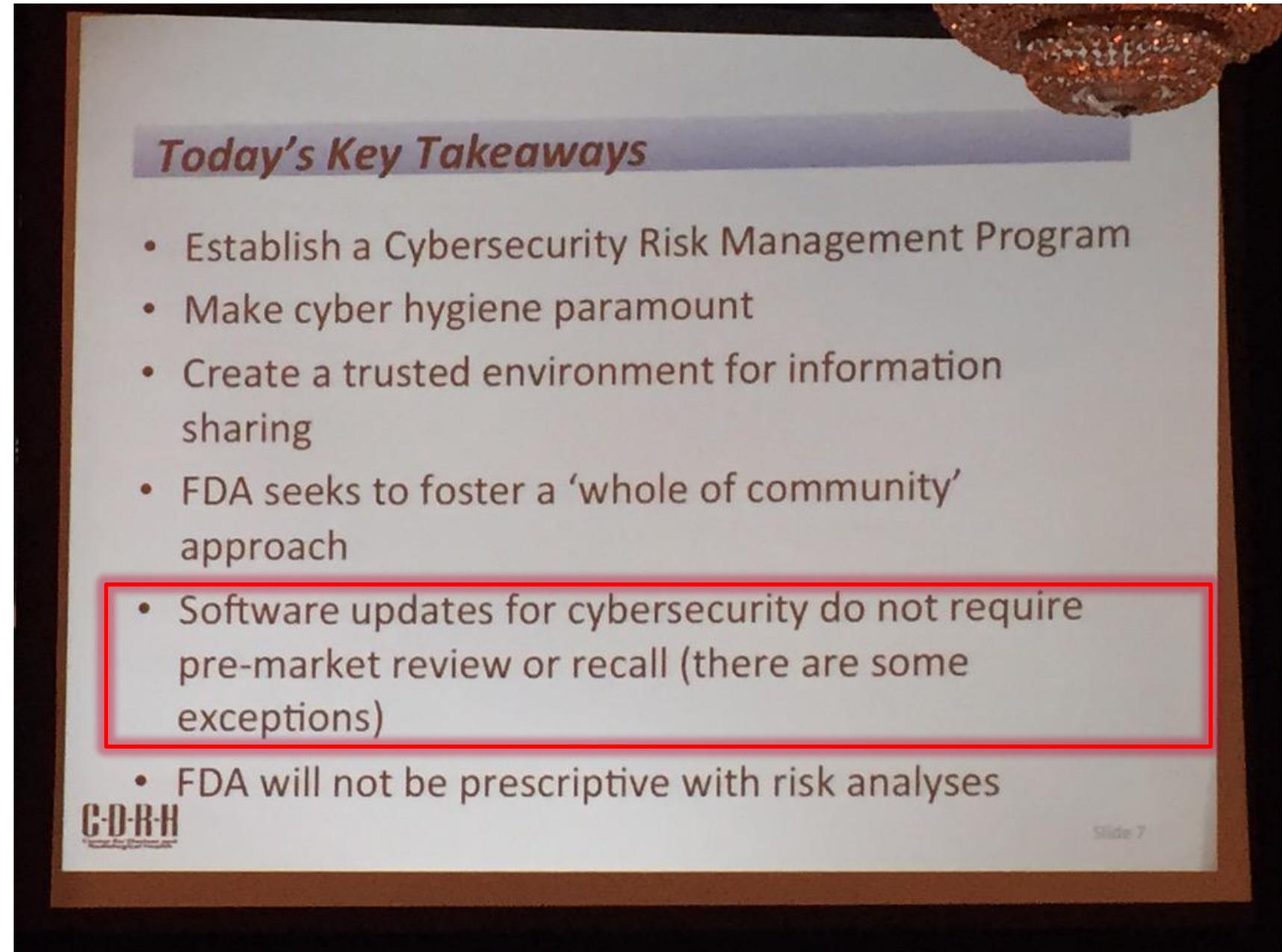
- NHSTA opens investigation into two fires caused when battery packs on the undercarriage are punctured by road debris
- Tesla addresses recall concern with OTA software update
- *“CEO Elon Musk argued that the fix should not technically be a “recall” because the necessary changes did not require customers find time to have the work performed”*



Source: wired.com - <http://www.wired.com/2014/02/teslas-air-fix-best-example-yet-internet-things/>

FDA opens the door for software updates that do not require pre-market review

- There is an increasing recognition in the industry that having agility and the ability to continuously deliver software is critical to maintaining safety and security



Today's Key Takeaways

- Establish a Cybersecurity Risk Management Program
- Make cyber hygiene paramount
- Create a trusted environment for information sharing
- FDA seeks to foster a 'whole of community' approach
- Software updates for cybersecurity do not require pre-market review or recall (there are some exceptions)
- FDA will not be prescriptive with risk analyses

C-D-R-H

Slide 7

- Your feedback is valuable
- Don't miss out on the chance to provide your feedback
- Gain a chance to win an instant prize!
- Complete your session evaluation now