

Managing complexity in engineering processes

Watson IoT™

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Software is everywhere

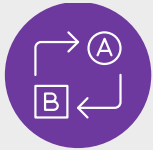
its driving transformation in
engineering



Engineers need a living, on-demand system to manage the complexity of product development

Information cannot be static. It must be ready, available, accessible and actionable both inter and intra-enterprise

Managing versions/variants



Tracking of complex configuration management and managing strategic reuse of engineering assets

Ensuring compliance



Determining compliance to functional safety, regulations and industry standards available at any time

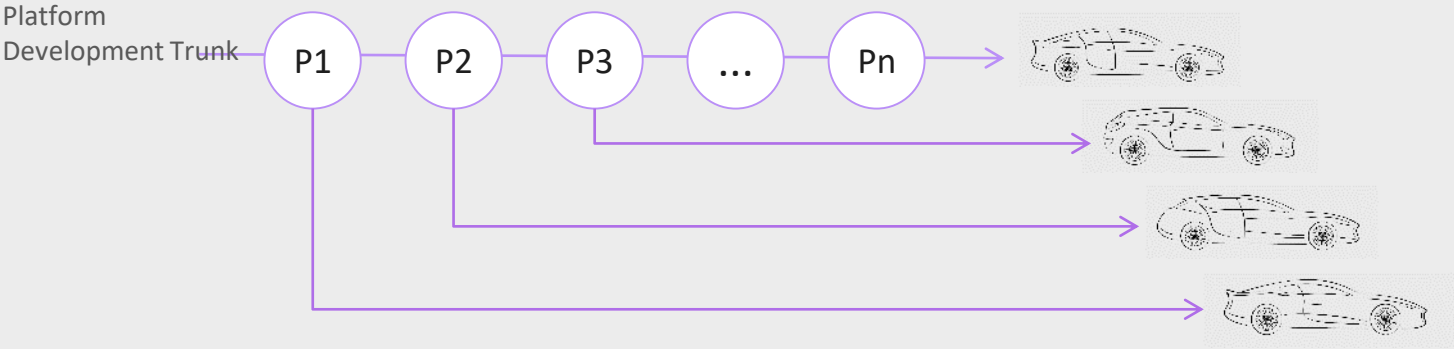
Model-based systems engineering



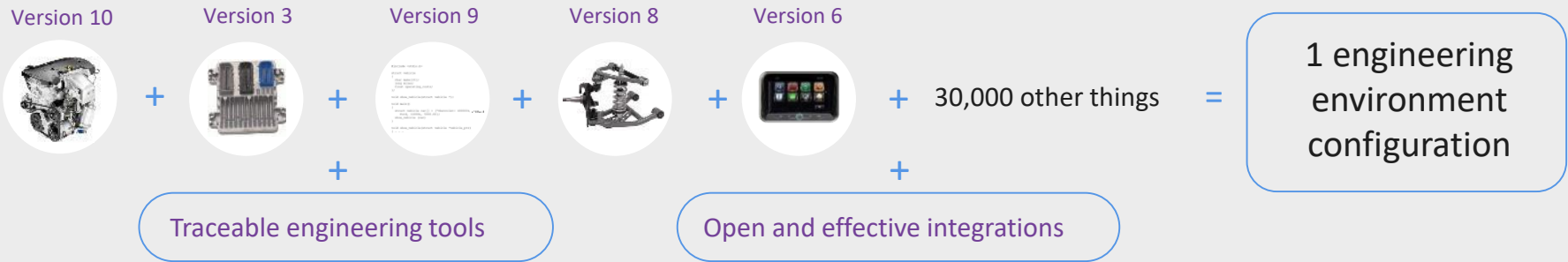
Understanding the effects of changes to requirements and the ability to model interdependencies between sub-systems

Engineers need to trace and manage strategic reuse of assets in product variants and versioning across sub-assemblies

More customization leads to variants in products and sub-assemblies

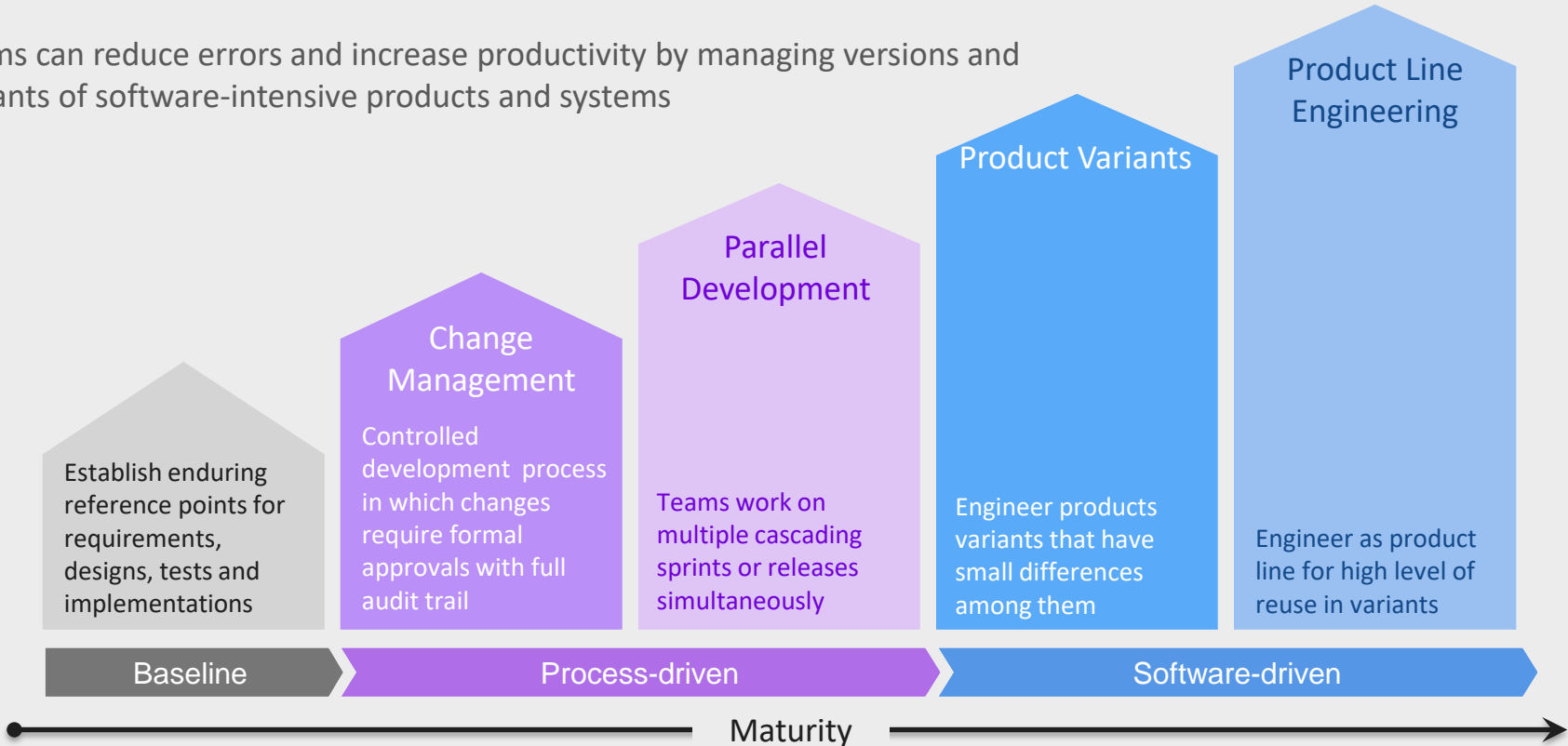


More components, interfaces and software lead to configuration complexity



Engineering teams manage complexity bases on sophistication of development processes and software

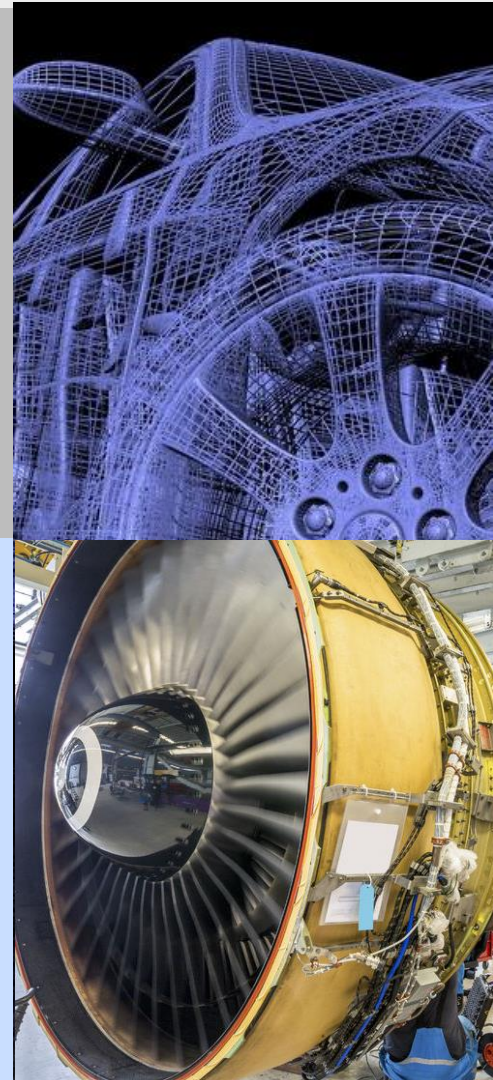
Teams can reduce errors and increase productivity by managing versions and variants of software-intensive products and systems



- As engineering complexity rises, engineering regulatory standards are demanded from manufacturers
- New engineering regulations are being introduced for SW intensive products
- Regulations relate to engineering maturity and functional safety
- With today's engineering complexity meeting compliance with ad-hoc practices is a major challenge
- Better engineering practices are needed

Our clients develop regulatory intensive products

Meeting engineering compliance demands provide an opportunity to save costs and increase efficiency



Manufacturers are struggling to manage complexity amid increasing regulation



Automotive

Lines of code in new Ford F-150 Truck 10 speed transmission = 1 million, in 2003 this was 155 K

QA and testing spend is predicted to increase to 40% of total IT budget by 2019



Aerospace and defense

5 generation F-35 functionality is 90% Software driven compared to F-16 which has 40% functionality driven by Software

F-35 testing cost overrun \$ 1 Billion caused by late identification of Software errors in prior versions of the software



Medical devices

The da Vinci S surgical robotic system:

- 1.4 million lines of code
- Computing power of 7 laptops
- 10,000 individual parts

...while the minimum viable product concept works in app development, this is a non-starter for complex safety related products

Engineering compliance requirements

- Basically demonstrating repeatable and traceable engineering process
 - Details vary across industry
- Carry out systems engineering – not only HW and SW development
- Proper management of requirements, design, and test with complete traceability across
- Carrying out safety assessments and provisions for safety related standards
- Process measurement and improvement by maturity standards

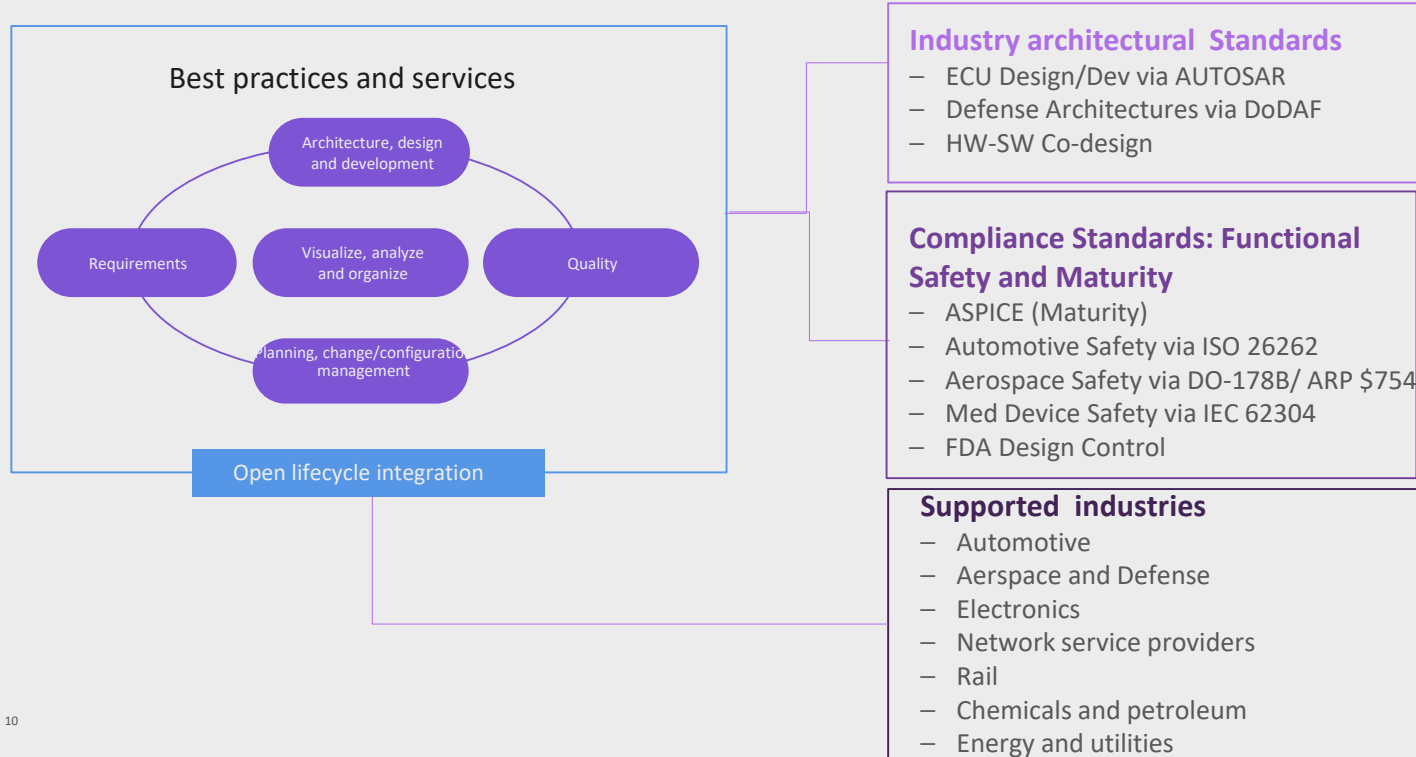


Challenges with meeting engineering compliance

- Little or no visibility into the progression of development of the various engineering artifacts
- Manage traceability across multi-disciplinary engineering artifacts
- Clear specification of the engineering process and how the process relates to the generated artifacts
- Providing evidence for required activities (e.g, verification)
- Standardizing the process across the organization
- Recording artifacts changes and configurations



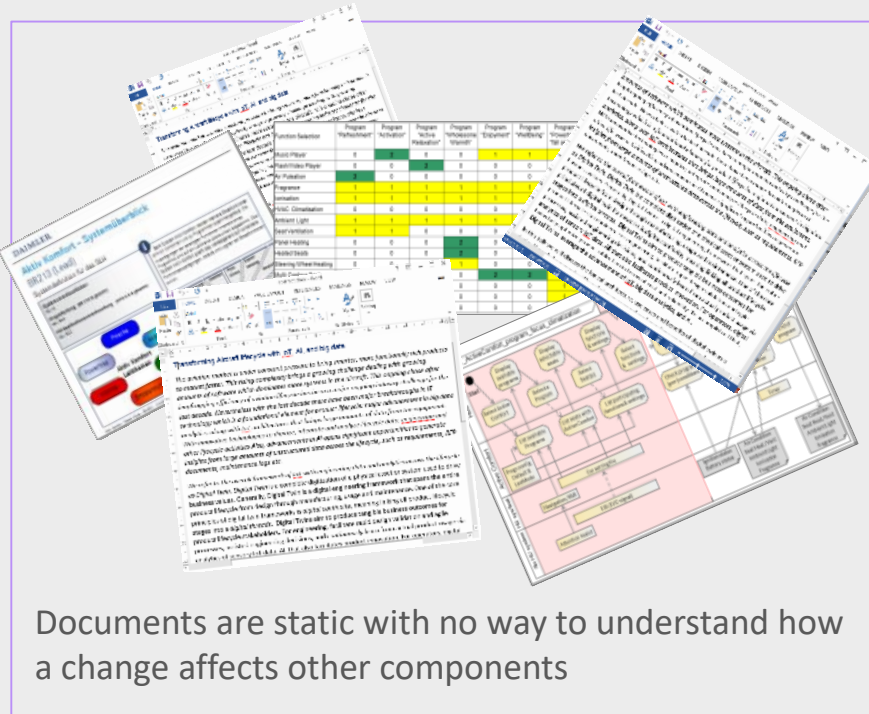
Complex products need to comply to standards to assure safety, demonstrate engineering maturity, and enable supply chains



...status of compliance to standards must be knowable at any time from any place

The migration to model-based systems engineering is an indispensable capability for delivering complex, interconnected systems

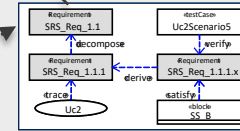
Today's system engineering is based on disparate and non verifiable documents across multiple tools...



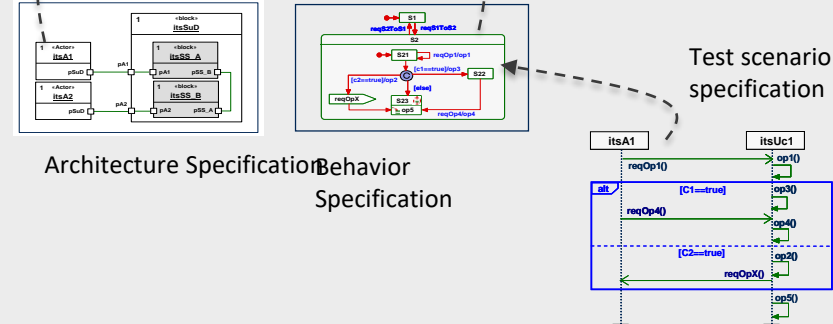
Requirements management

ID	AdaptiveCruiseControlV3.rpt	Tag ASIL
FSR4	1.1.2 FunctionalSubsystemsToSafetyReqs	
FSR5	1.1.3 FunctionalSafetyRequirements	
FSR6	1.1.4 Ensure detection of RADAR failure	A
	The RADAR shall be fitted with devices that signal back to the Adaptive Cruise Control if the RADAR is incorrectly not detecting obstructions.	
FSR7	1.1.5 ACC_CrashPreventionSafetyRequirements	

Functional Specification

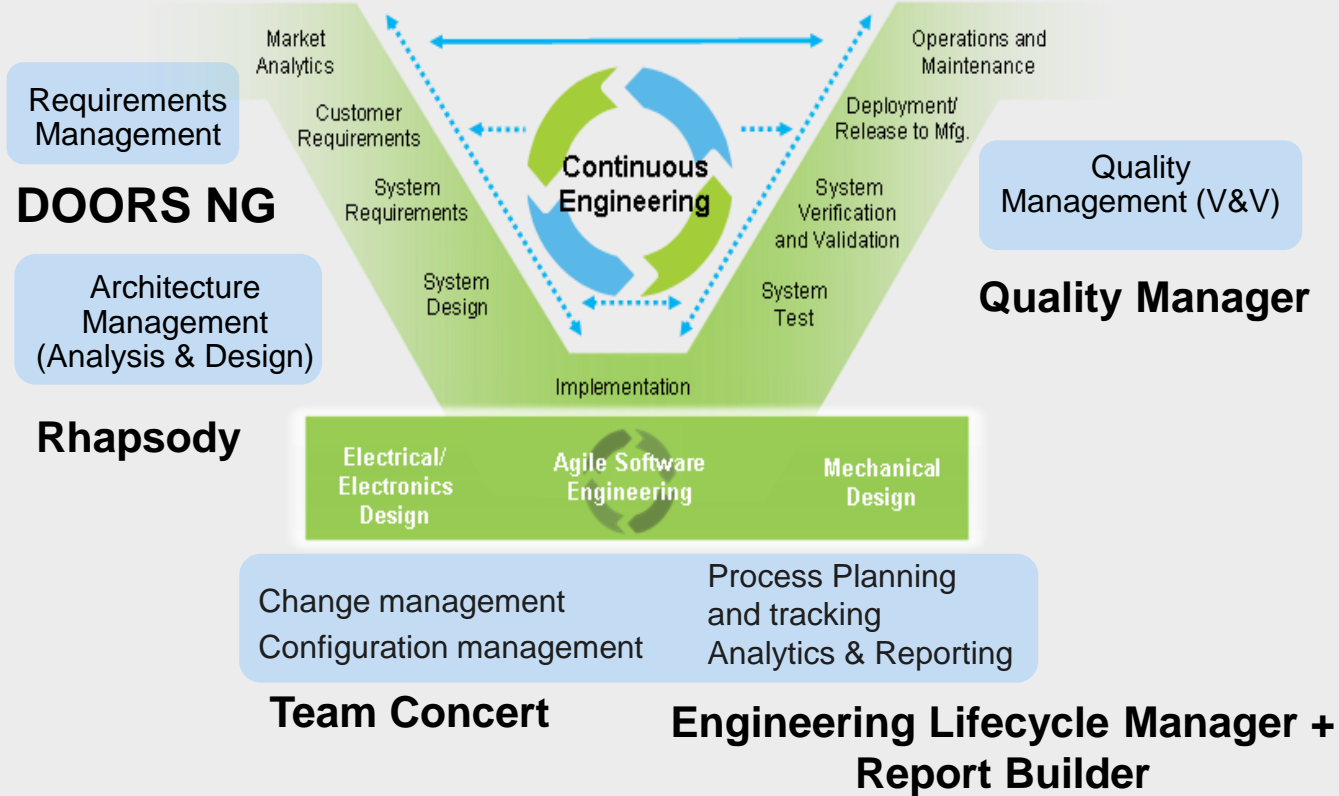


Test scenario specification



...model-based systems engineering maintains fully traceable and verified system specifications

IBM CE platform provides the necessary means to facilitate compliance with today's engineering standards

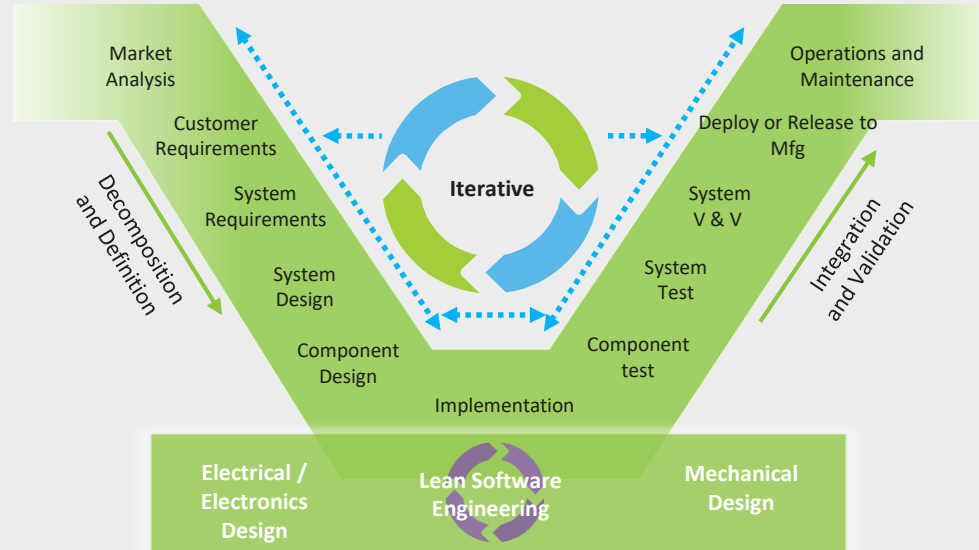


IBM CE platform provides the necessary means to facilitate compliance with today's engineering standards

Methods to **manage product complexity** can improve systems engineering processes

Agile software development can **deliver innovation faster**

Enable access to all engineering and related information through open standards



Compliance




Reuse

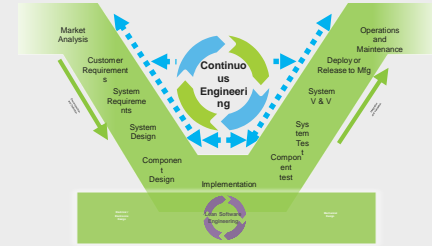


Verification
And quality



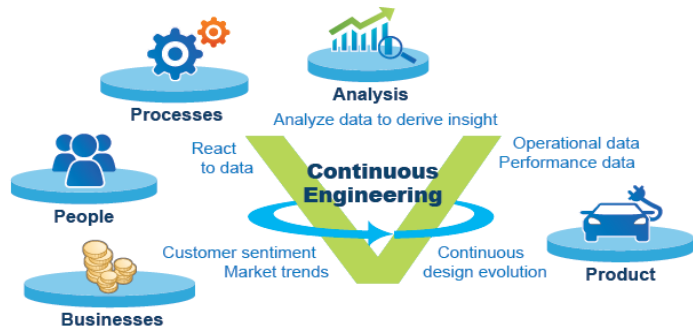
How does the CE platform help with compliance

- Properly manage requirements, design, and test
- Traceability across all engineering which is essential to support the various compliance standards based on the OSLC open standard
- Metrics and reporting – Visualization of progress as to the completion of the various engineering activities and completion of artifacts for all project stakeholders
- Configuration and Change management processes – mandated by all safety and maturity standards
- Domain specific templates
 - Aiding users to develop engineering artifacts that comply to the standard
- Process enactment through integration with 
 - Standardizing task flows that detail how to develop specific engineering artifacts in specific tools
 - Standardizing processes across the organization






Partner Integration

Bringing you a cohesive ecosystem for continuous engineering



 **stages** Define, publish, Tailor process

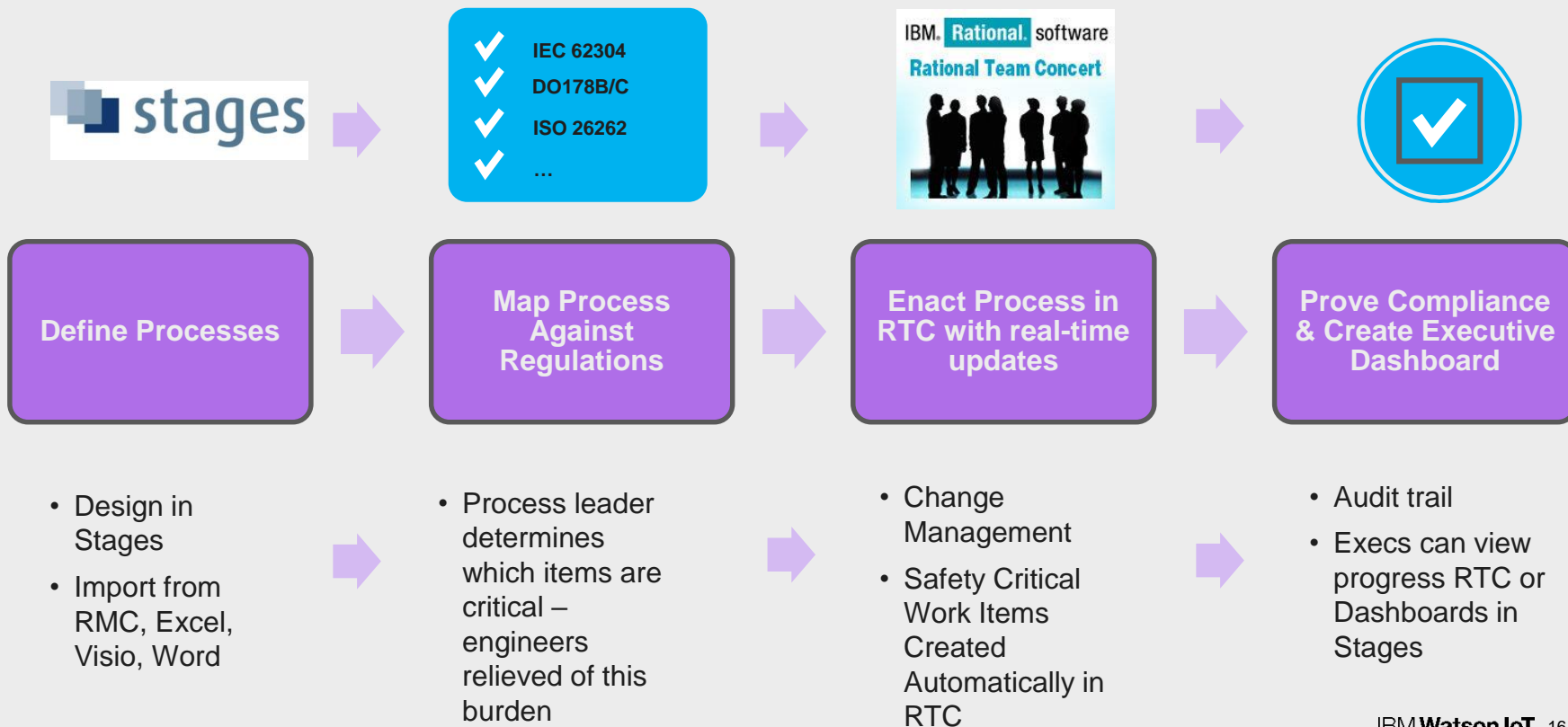
IBM.  **Rational** software
 **Rational Team Concert** Enact process workflow into task management

 **stages** Prove compliance

Tap into our other integration partners



MethodPark-IBM Workflow



Thank you

