



MAJOR CHALLENGES IN THE AUTOMOTIVE INDUSTRY



Energy Efficiency

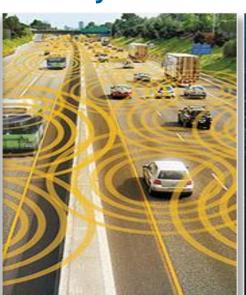
Fatality-Free Driving

Communication Everywhere

Globalization









SMART TRAFFIC













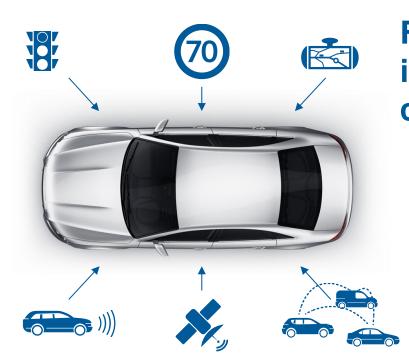


100



VEHICLE TURNING INTO A SMART PRODUCT



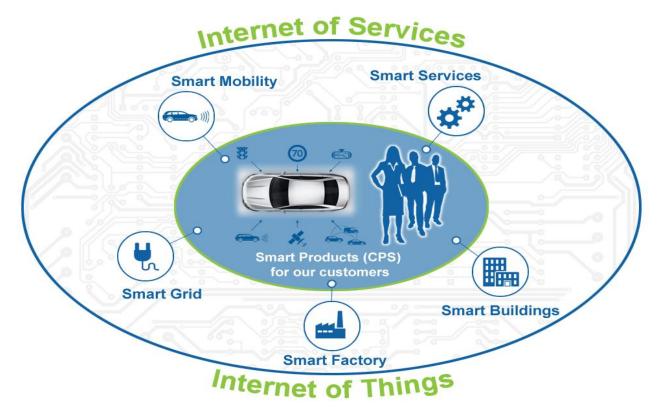


Focus is shifting from the intelligent driver...to the intelligent car (self-driving)

- Cybertronic system development
- Need for cooperation across technical and business domains
- Cross-collaboration process & organization are essential

SMART PRODUCTS ARE INTEGRATED INTO

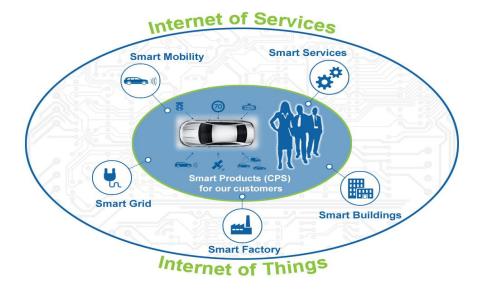




Quelle: Adaptiert nach acatech 2013

THIS NEEDS A HOLISTIC VIEW TO GENERATE THEM



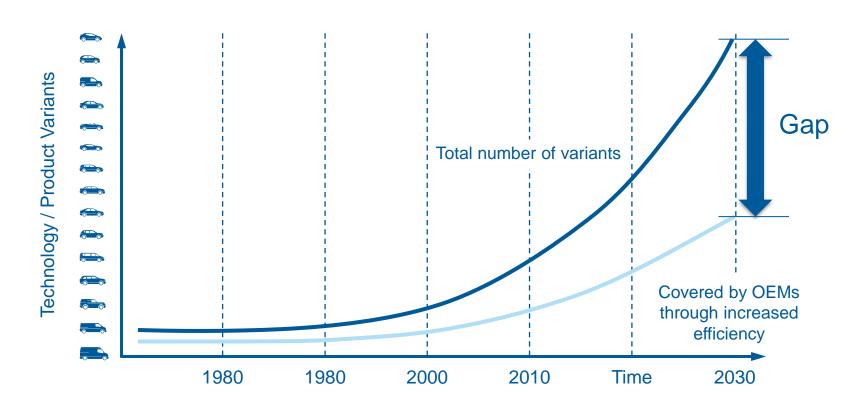


Design to Production

Design to Service

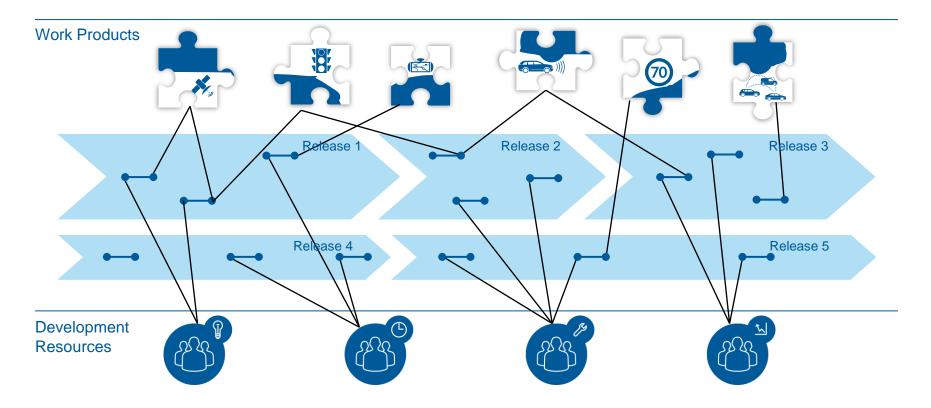
CHALLENGE PRODUCT VARIANTS EXCEED OEMs'CAPACITY





CHALLENGE ORGANISATION – PROCESS – NETWORKING

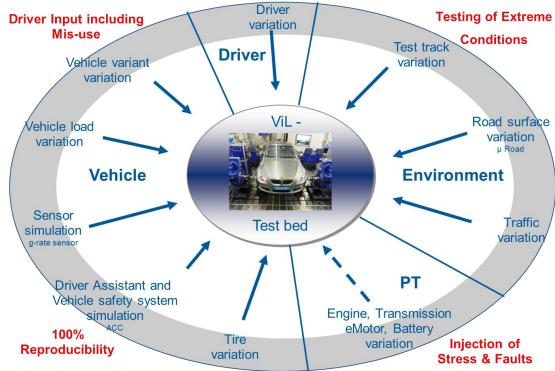






CHALLANGE REALITY BITES - BACK

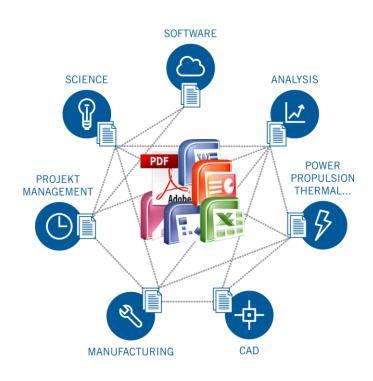




KNOWLEDGE MANAGEMENT IS ESSENTIAL

MULTIPLY THE CHALLENGE: MULTIPLE DOCUMENTS TO BUILD THE PRODUCT







THE QUESTION

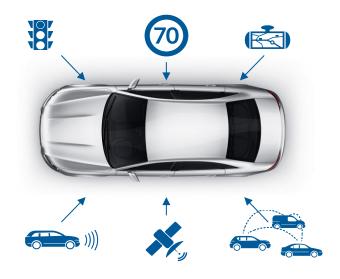




SYSTEM THINKING SUPPORT INNOVATIVE SMART PRODUCTS & SYSTEMS



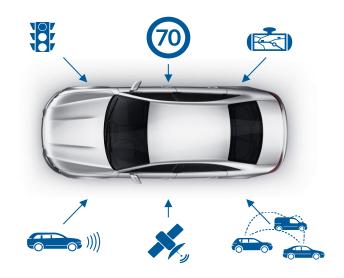




THE ANSWER: SYSTEMS ENGINEERING METHODOLOGY & TOOLS







SYSTEMS ENGINEERING REALIZE



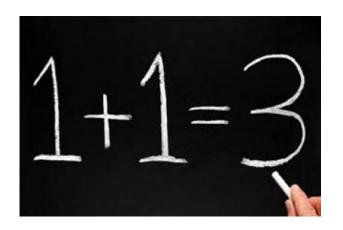




SYSTEMS ENGINEERING GENERATE







Albers, Gausemeier, Weilkiens (u.a.)

"The whole is more than the sum of its part.

The part is more than the fraction of the whole"

MEET THE CHALLENGE MODEL BASED SYSTEMS ENGINEERING





"Model-based systems engineering (MBSE) is the formalized application of modeling to support system requirements, design, analysis, verification and validation activities"--INCOSE 2007

Think in System

Manage Complexity

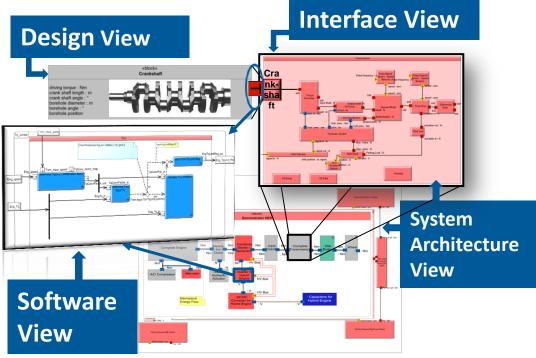
Enable Re-Use

Communication platform for multidisciplinary development teams

MEET THE CHALLENGE: "SINGLE POINT OF TRUTH" MODEL



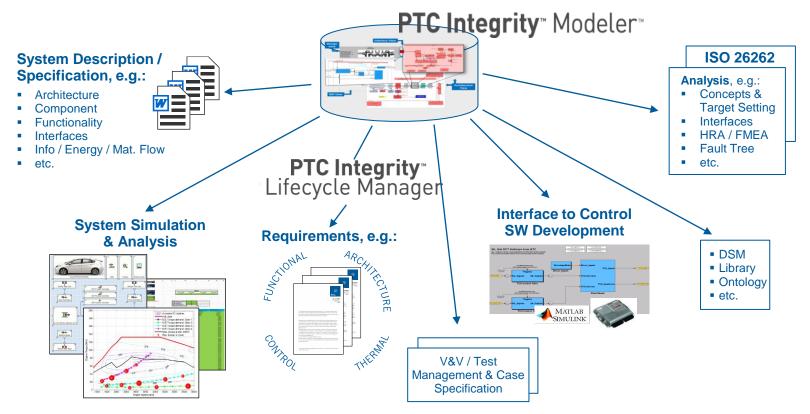




MEET THE CHALLENGE: GENERATE THE DOCUMENTS



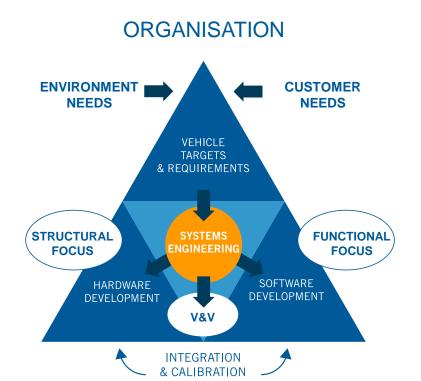


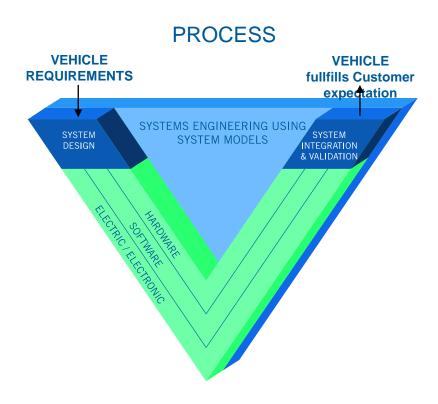


MEET THE CHALLENGE BY NEW ORGANISATION & PROCESS FORMS





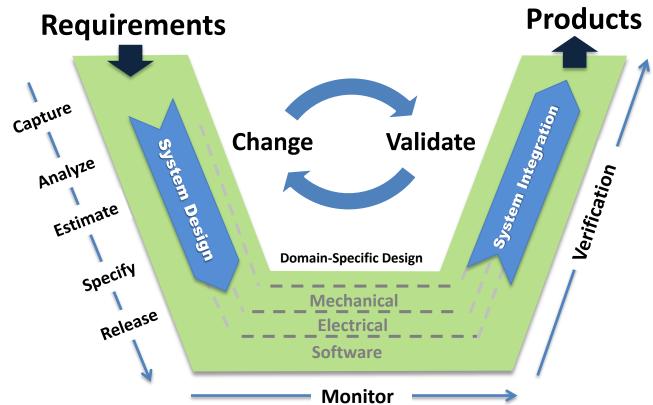




SYSTEMS ENGINEERING V-PROCESS



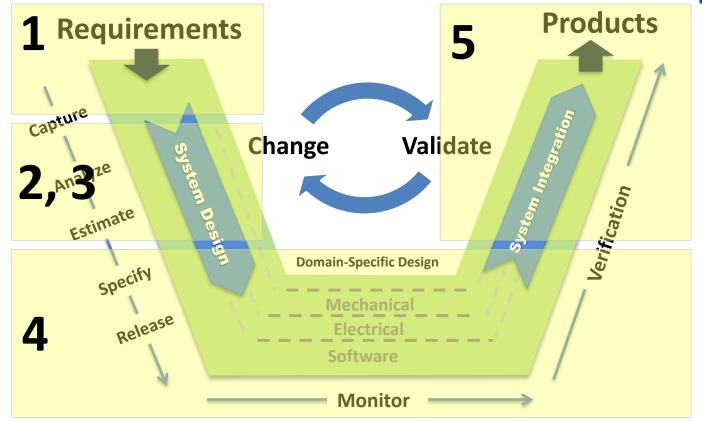




SYSTEMS ENGINEERING V-PROCESS







1. CAPTURE CUSTOMER REQUIREMENTS



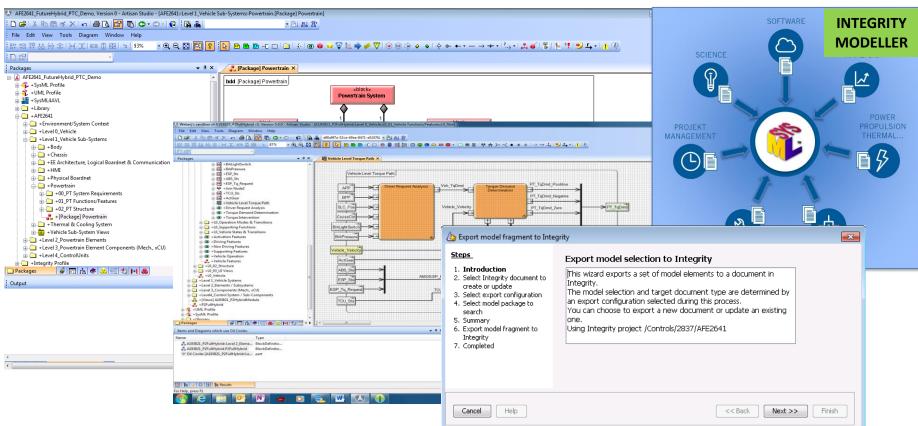




2. ANALYZE CUSTOMER REQUIREMENTS FOR SYSTEM FUNCTIONALITY



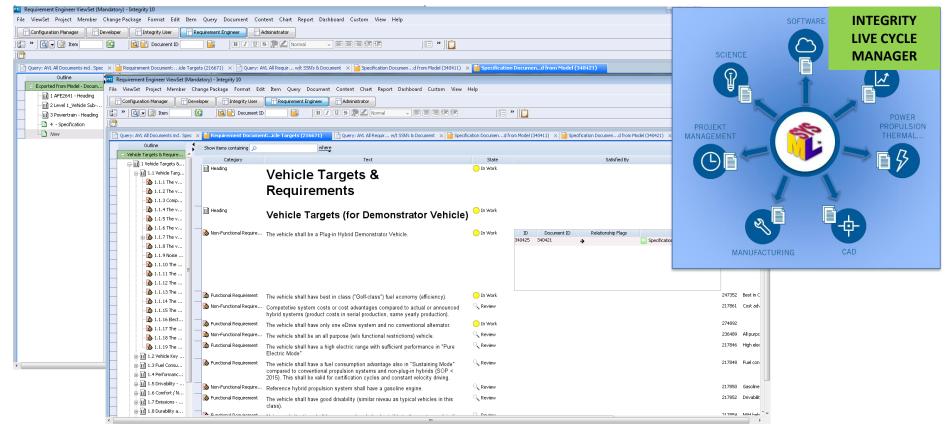




3. MANAGE REQUIREMENTS & DISTRIBUTE WORK PACKAGES







4. SIMULATE SYSTEM BEHAVIOR TO CHECK SYSTEM REQUIREMENTS







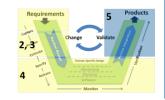




FULL VEHICLE MODEL

with environment interaction & all functionalities for intelligent car (selfdriving)

5. REAL WORLD TESTING OF FUNCTIONAL REQUIREMENTS















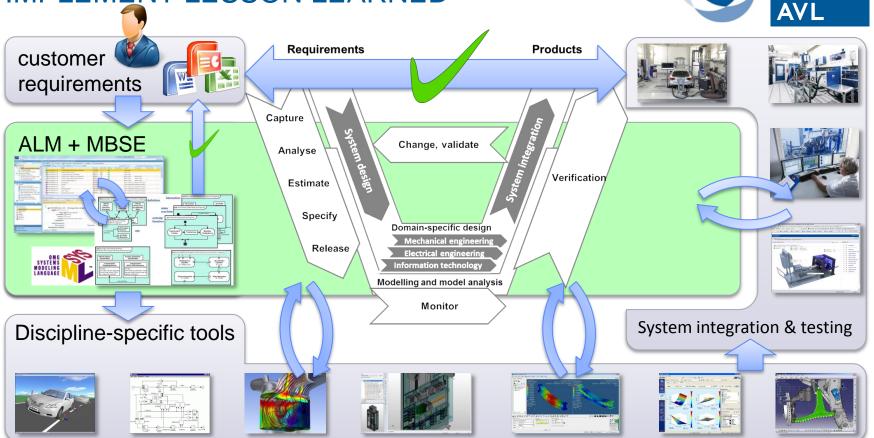




CLOSE THE V-CYCLE IMPLEMENT LESSON LEARNED



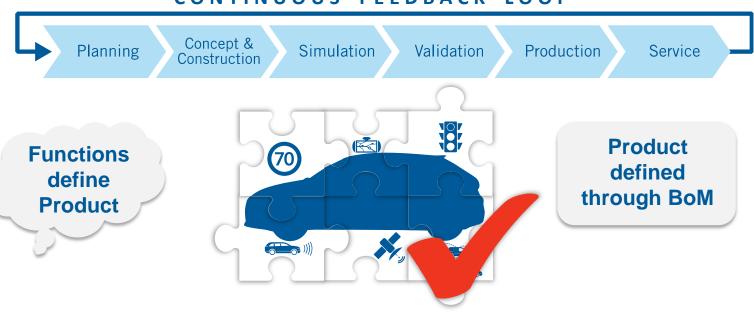




THE VIRTUOUS INNOVATION CYCLE



CONTINUOUS FEEDBACK LOOP





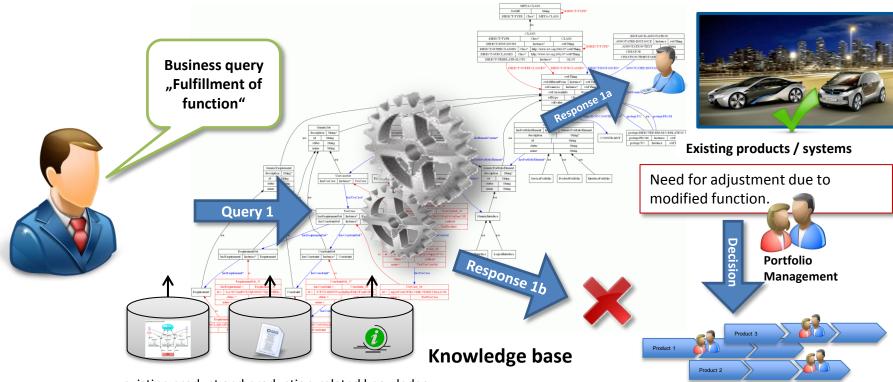


PTC Integrity[™]Lifecycle Manager PTC[®] Windchill[®]

TASK DRIVEN ANALYSIS OF SEMANTIC KNOWLEDGE MODELS







existing product and production-related knowledge in data management systems and databases

PDP for new or further development

FLmP K2 RESEARCH / AVL, BMW, VIF, IPEK, TU M

CLOSING THOUGHTS

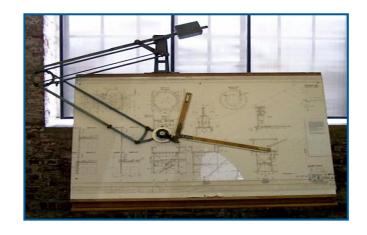




Overcoming challenges:

- Acceptance across traditional teams
- Adoption of new roles & responsibilities
- Silo'd Thinking

➤ Similar to CAD in the early 80's, MBSE will change the future of product development!







THANK YOU

