Produktentwicklung im Laufe der Zeit
Herausforderungen und Ideen für die Zukunft

Product-Development over time
Challenges and Ideas for the Future

Bosch Conversations Germany

Stuttgart Feuerbach

May 29th, 2019

Katzenbach Executive Consulting

Inhalt

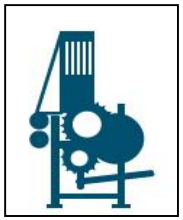
- Without History no Future
- Status of Today
- Defining the Future – some Examples
- Conclusion

Without History no Future

- The fourth industrial Revolution
- Changes in Product-Structure
- Changes in Development - Methods
- Changes in der Companies Strategy

The fourth industrial Revolution

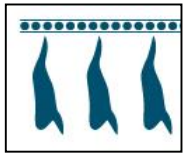
Complexity



Erster mechanischer Webstuhl
1784

Erste Industrielle Revolution

Durch Einführung mechanischer Produktionsanlagen mithilfe von Wasser- und Dampfkraft



Erstes Fließband, Schlachthöfe von Cincinnati
1870

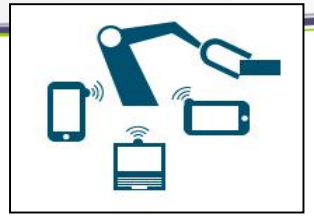
Zweite Industrielle Revolution

Durch Einführung arbeitsteiliger Massenproduktion mithilfe von elektrischer Energie

Erste Speicherprogrammierbare Steuerung (SPS), Modicon 084
1969

Dritte Industrielle Revolution

Durch Einsatz von Elektronik und IT zur weiteren Automatisierung der Produktion



Fourth industrial Revolution

Based on

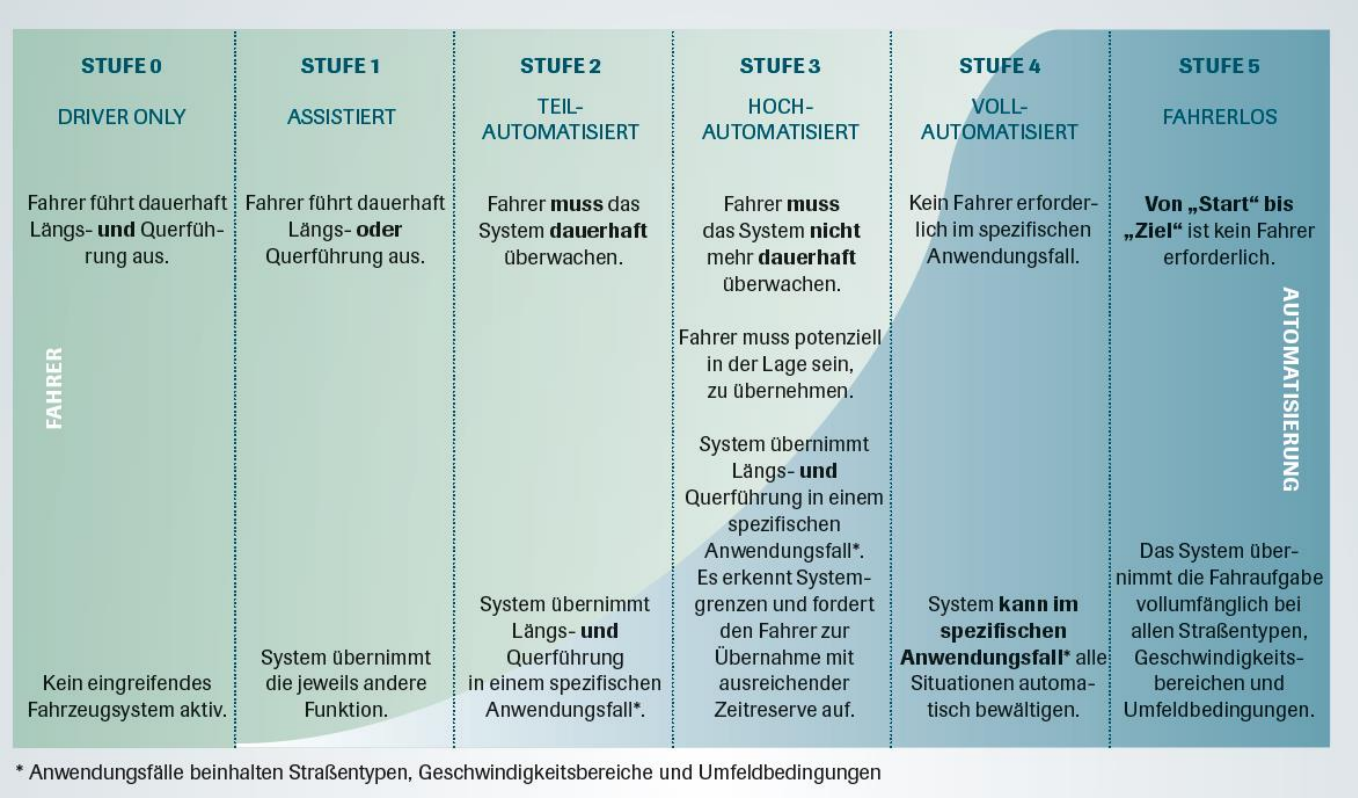
- **Cyber-Physical-Systems**
- **Internet of Things**
- **Social Media**
- **Mobile Computing**
- **Big Data Analytics & Prediction**
- **Machine Learning**

Time

Ende 18. Jhd. | Beginn 20. Jhd. | Beginn 70er Jahre 20. Jhd. | today

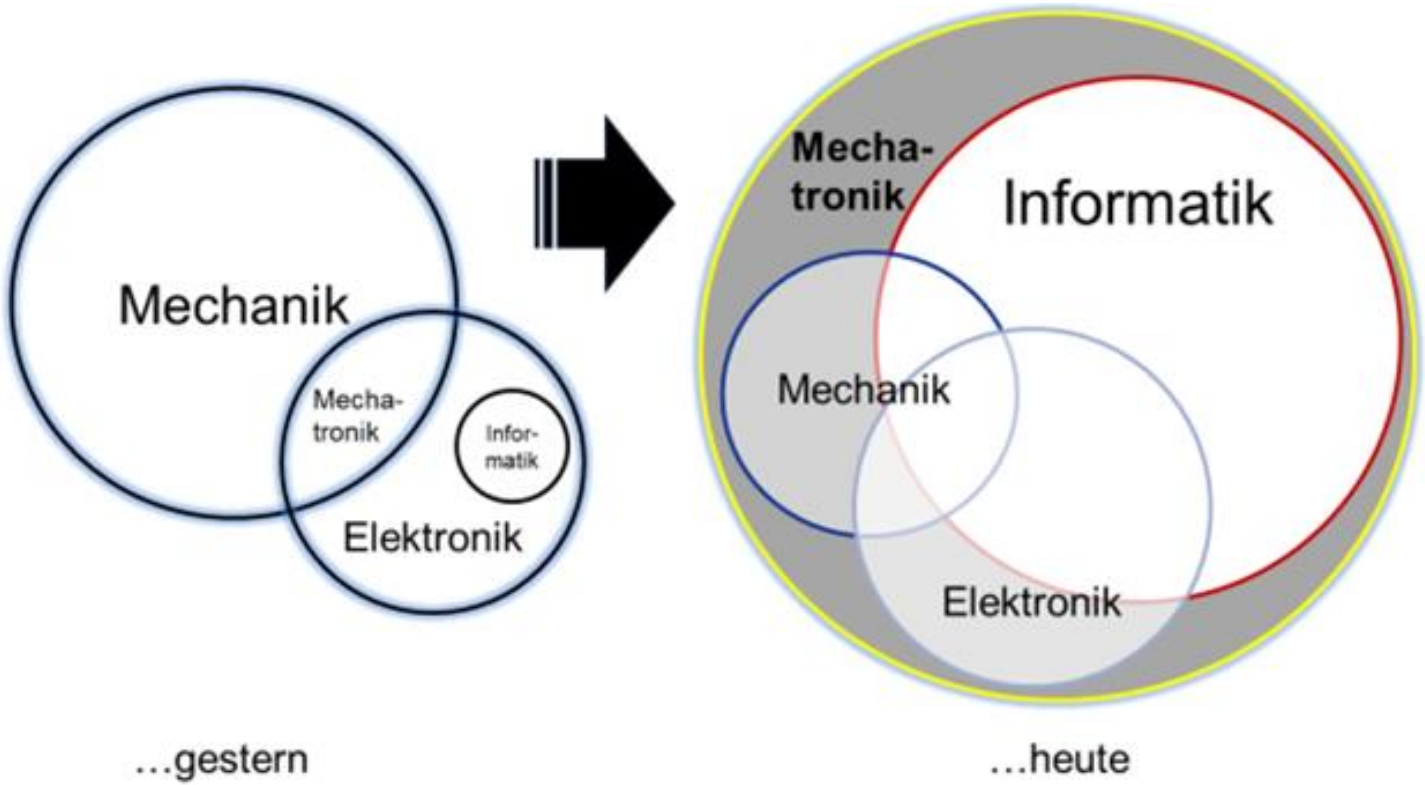
Source: nach Trumpf, IBM, Bitcom

Steps to autonomous Driving



Source: VDA, Automatisierung – von Fahrerassistenzsystemen zum automatisierten Fahren, 2015

Changes in Thinking complex Products



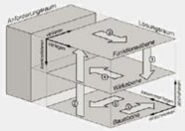
Changes in Development-Methods

Mechanik

Pahl/Beitz (1996)

VDI 2221 (1993)

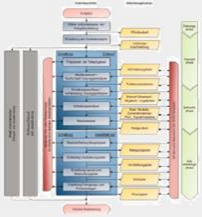
MKM Ponn & Lindemann (2011)



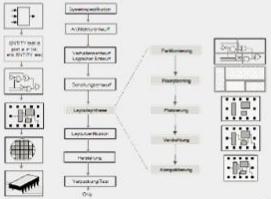
E/E

Y-Chart Gajski and Kuhn (1983)

VDI/VDE (1993)

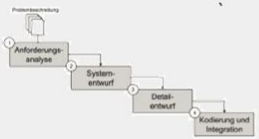


Layout Synthesys Lienig (2006)



Software

Waterfall Model Royce/Boehm (1970/1981)



V-Modell Nasa Bradley (2000)

Agile Methods f.e. Beck, Andres (2008)

Quelle: Eigner, Acatech, 2014

Magic Triangle over the last Decades

Quality was key in the 80´s

Last decade, those enterprises were successful which are able to deliver high value with low cost in short time

In 90´s time was success factor

In 70´s focus was on cost

Today

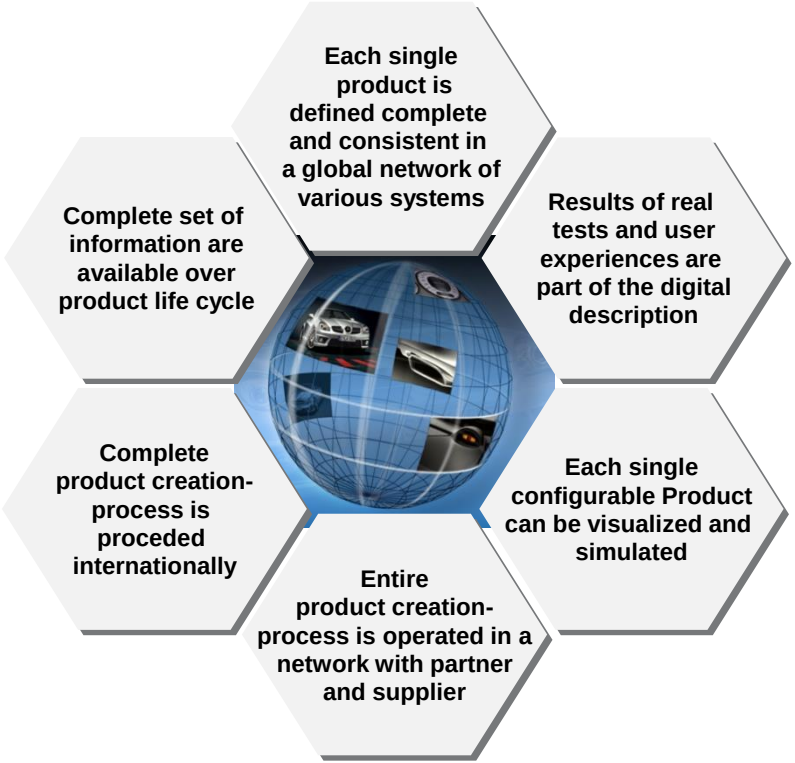
Those enterprises are successful which are able to deliver high value with low cost in short time in international collaborations.

Source: A. Katzenbach, Lecture University of Stuttgart alligned with K. Ohmae

Status of Today

- From DMU to Digital Twin
- Development Methods converges
- PLM /ALM – Integration – Mission impossible?
- Worldwide seamless Collaboration has n-dimensions

Vom DMU zum Digital Twin / Shadow / Thread/…….



Source: Alfred Katzenbach 1998

A Digital Twin

- is the digital representation of an asset
- is located in several places simultaneously
- has multiple states
- has a context specific state and a specific processing situation

The Information-Model of a digital twin

- is infinitely large (real infomation mode)
- can be approximated (the rational infomation model)

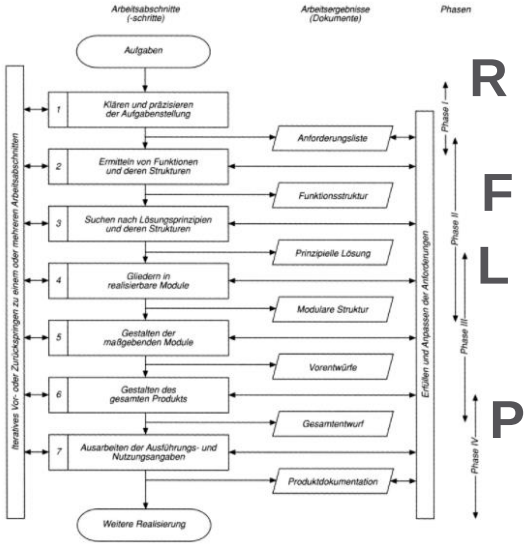
The Rational Information Model

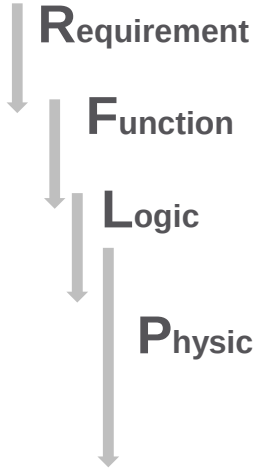
- cannot be stored in a single place
- is never complete visible

Source: Andreas Deuter, Hochschule Ostwestfalen, 2018

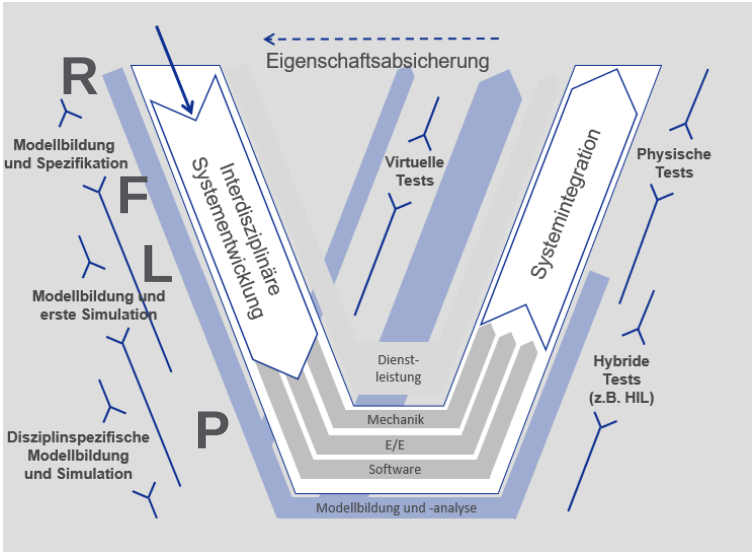
Development Methods converges

VDI 2221(Pahl/Beitz)



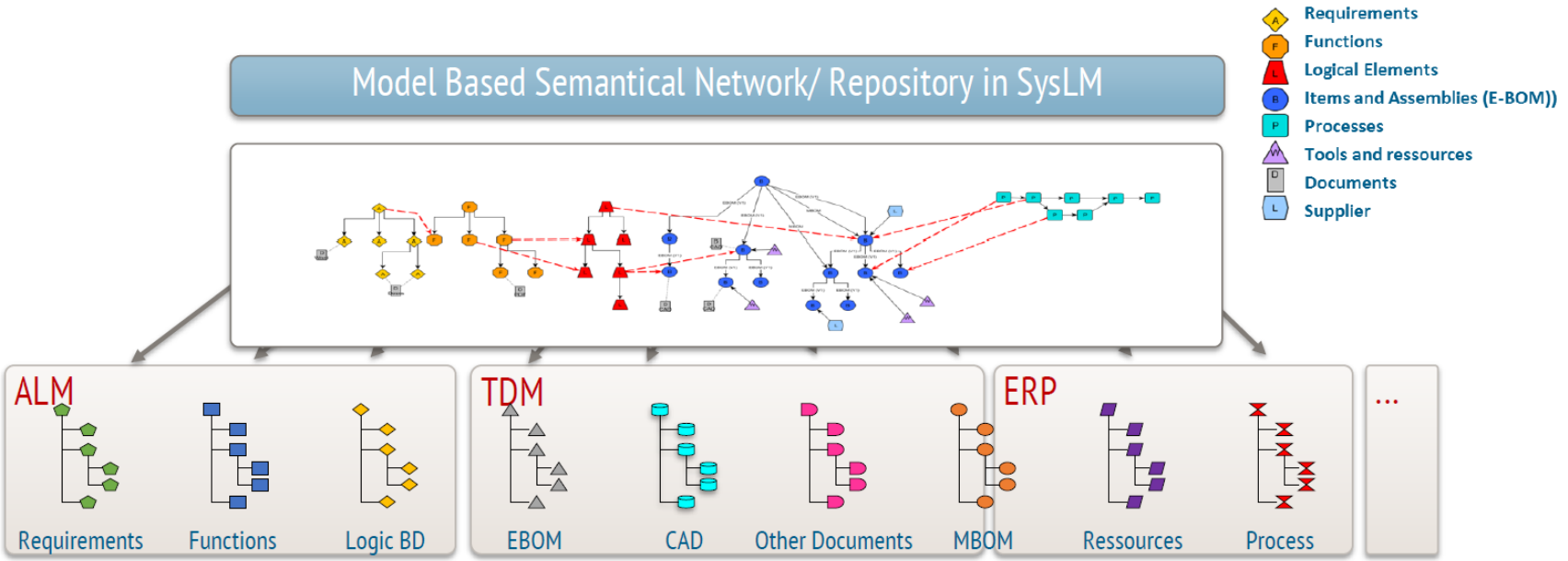


VDI 2206 (V-Modell)



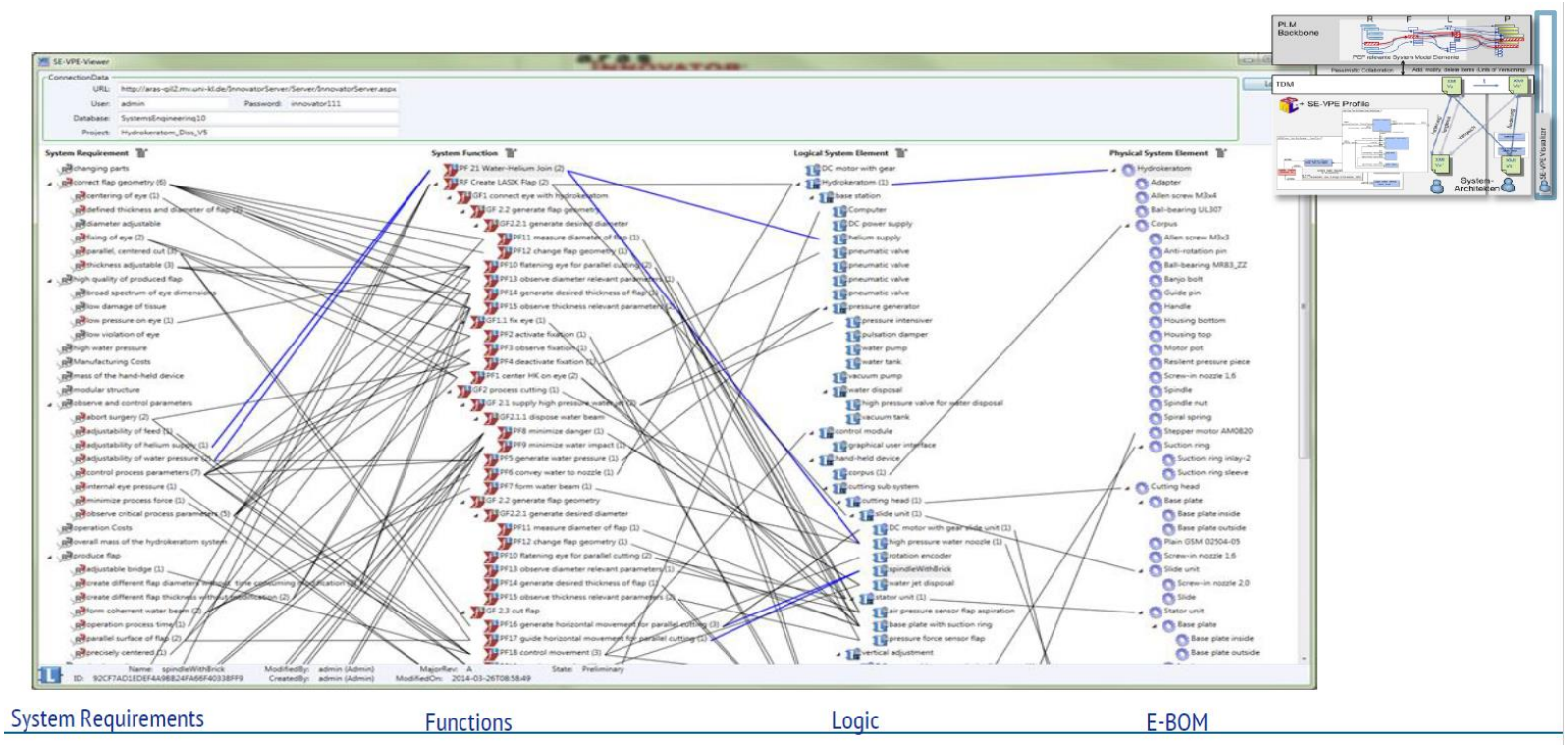
!!! The basics of thinking are similar!!!

PLM –ALM Integration - Mission impossible? (1)



Source: Eigner, Uni Kaiserslautern

PLM –ALM Integration - Mission impossible? (2)



Source: Eigner, Uni Kaiserslautern

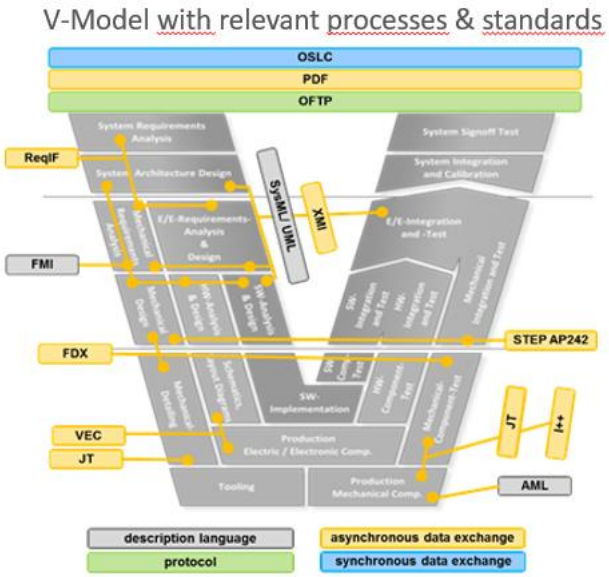
Worldwide seamless Collaboration has n-dimensions

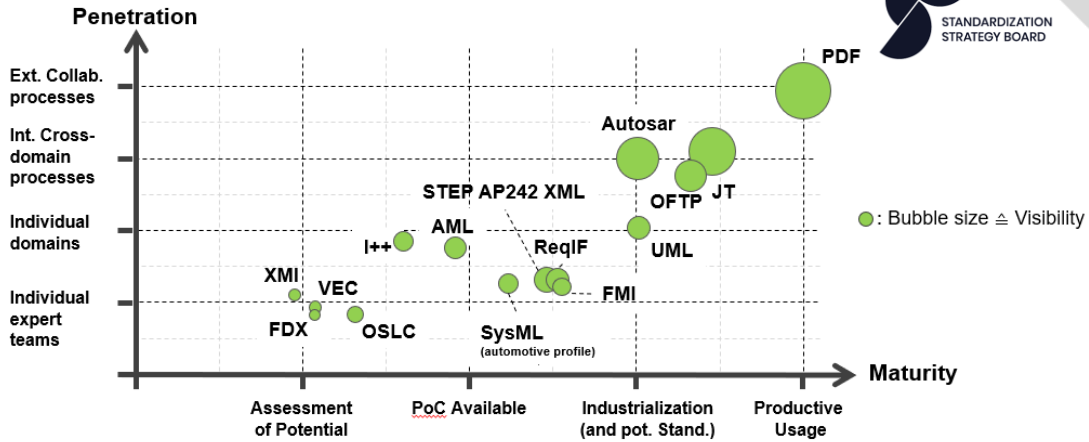
Source: Siemens PLM Community, 2018

Conclusion

Prozess- und IT - Standards are the crucial prerequisite for international collaboration

Maturity level of Standards today





Source: prostep ivip, standardization strategy board, 2017

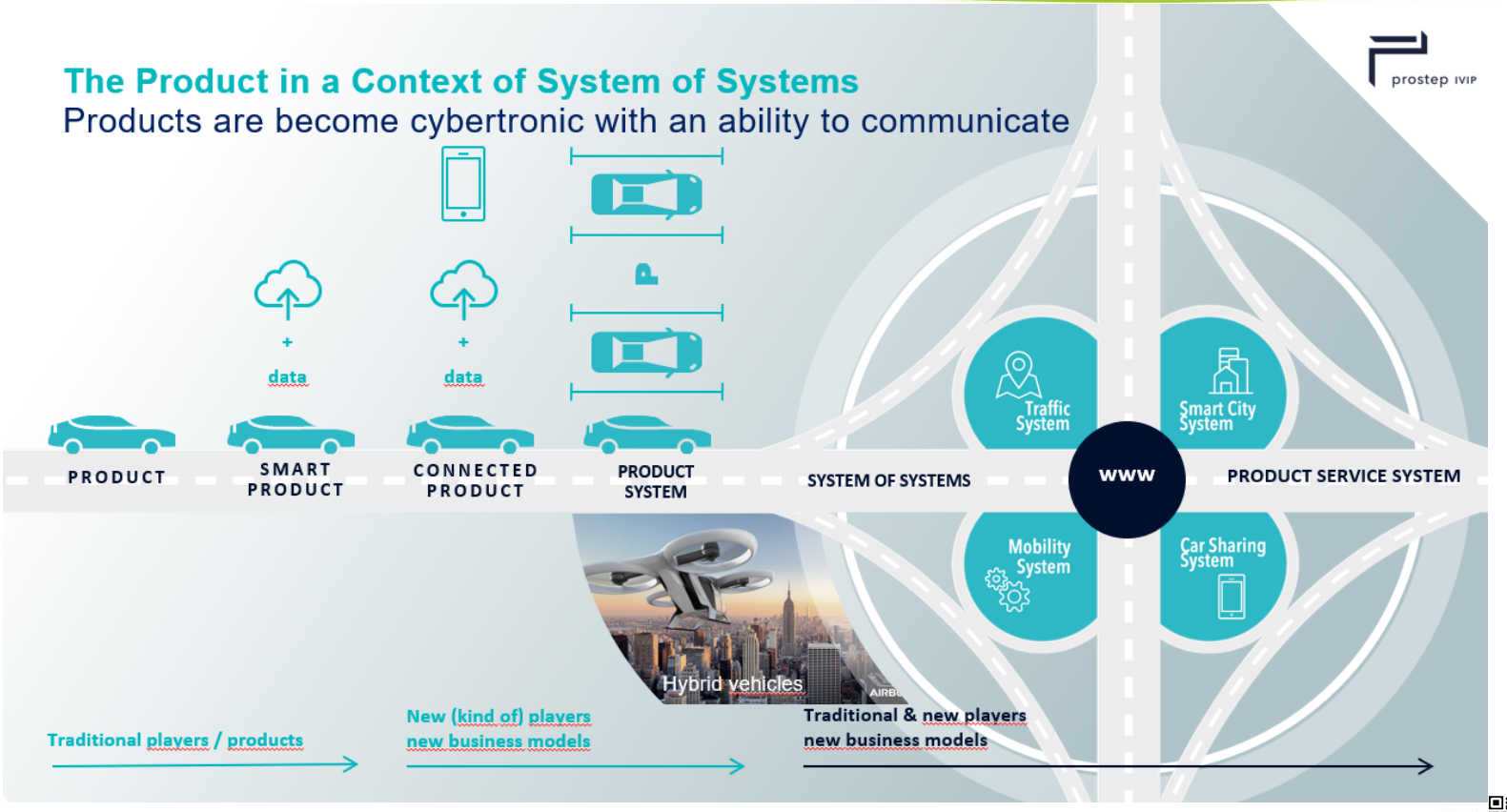
Defining the Future
- some Examples-

- A future scenario
- Integrative approach of Standardization
- Intention of a “Digital Data Package”
- Smart Systems Engineering
- SYS-ML: the common language
- Results of mecPRO²
- Product-Service-Systems – Inno Serv Pro
- Examples

A Future Scenario

The Product in a Context of System of Systems

Products are become cybertronic with an ability to communicate



Source:prostep ivip inspired by Porter/ Heppelmann

➢ Integrative Approach of Standardizierung

Code of PLM Openness (DIN Spec 91372-1) creates the framework

CODE of PLM OPENNESS

Certification defines foundation

READY FOR OPENNESS
ORGANIZATION
Code of PLM Openness certified

CONWEAVER HCL ptc SIEMENS Ingenuity for life

Source: prostep ivip 2019

Example Bosch

CPO@BOSCH

STEP BY STEP IMPLEMENTATION OF CPO@BOSCH

ProStep IVIP Symposium 2019

06/2018 : CPO Announcement / Communication

CPO continuously proposed as one of the decision making instruments for future engineering IT architecture and tool decisions

03/2019 : Preparation of HPLM Initiative.

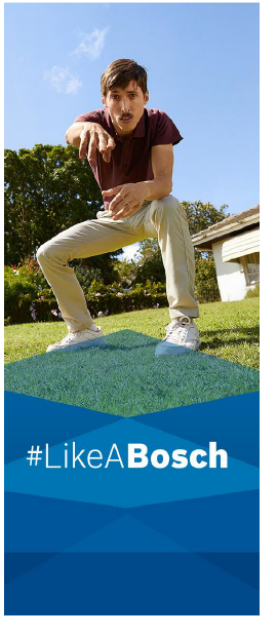
CPO defined as one of the guiding principles for the upcoming holistic PLM Architecture

07/2019 : Definition of Bosch required details, scope, setup of training material

CPO will be announced to and trained with the organisation (Architects, Purchasing etc.)

01/2020 : Start of the HPLM program

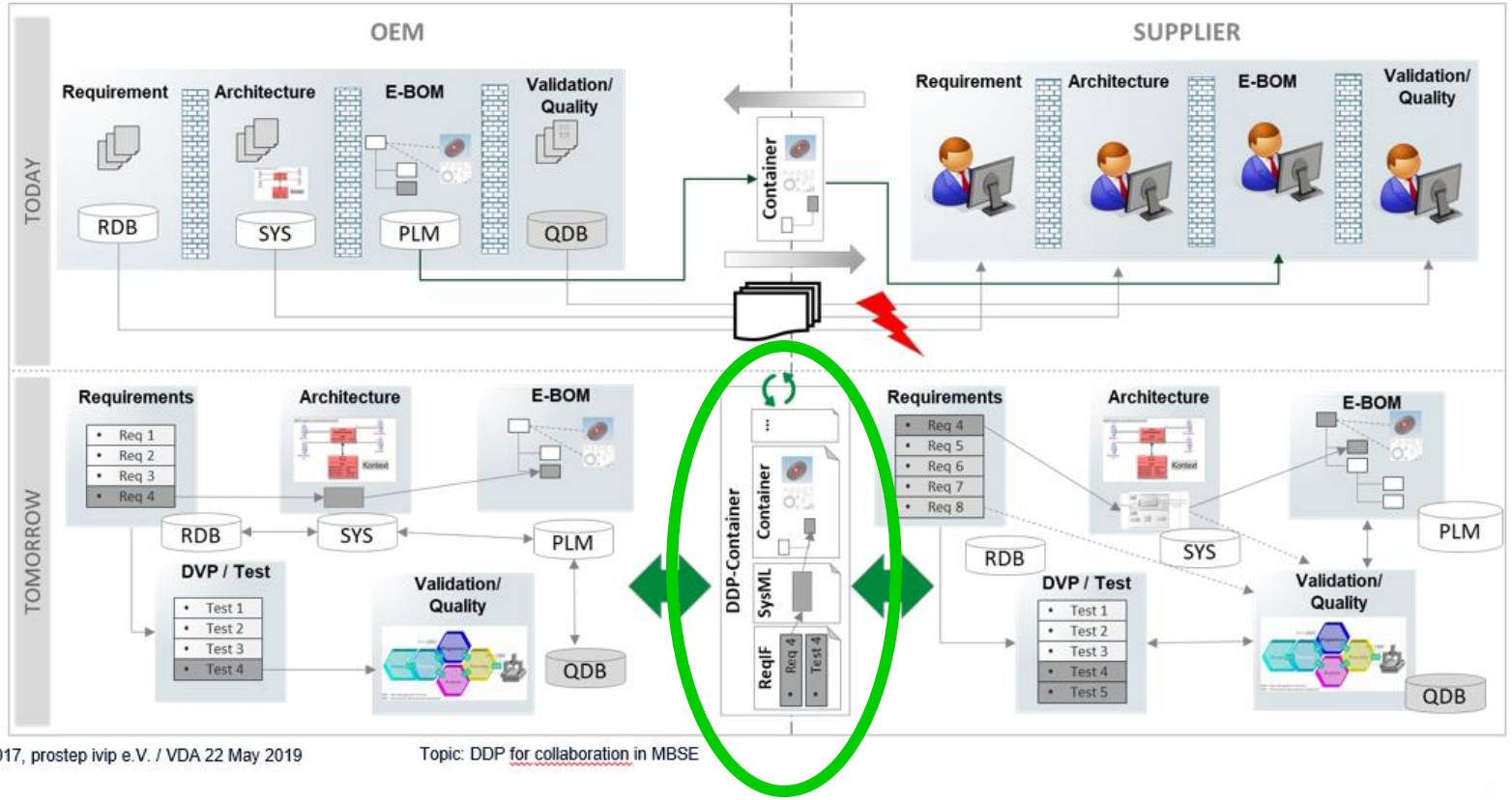
Continuous use of CPO in architecture / vendor decision of the HPLM program



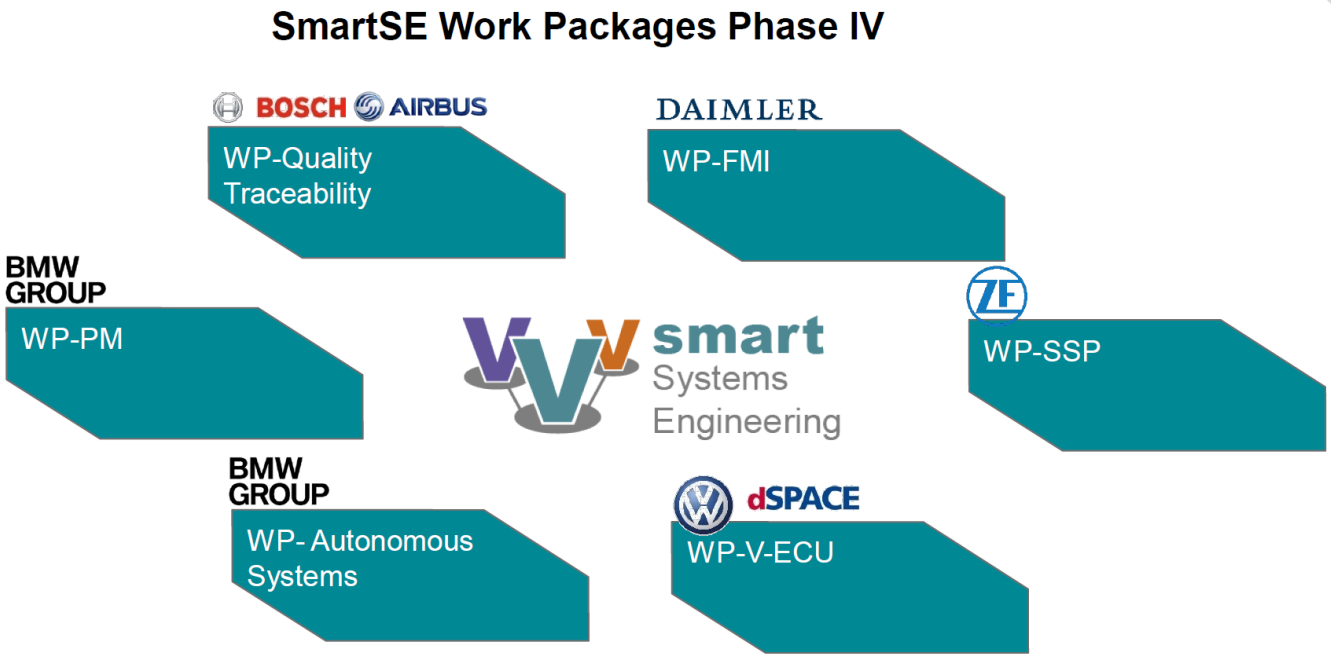
2

Source: prostep ivip 2019

The Intention of a “Digital Data Package”



SmartSE Project Work Package and Mentors

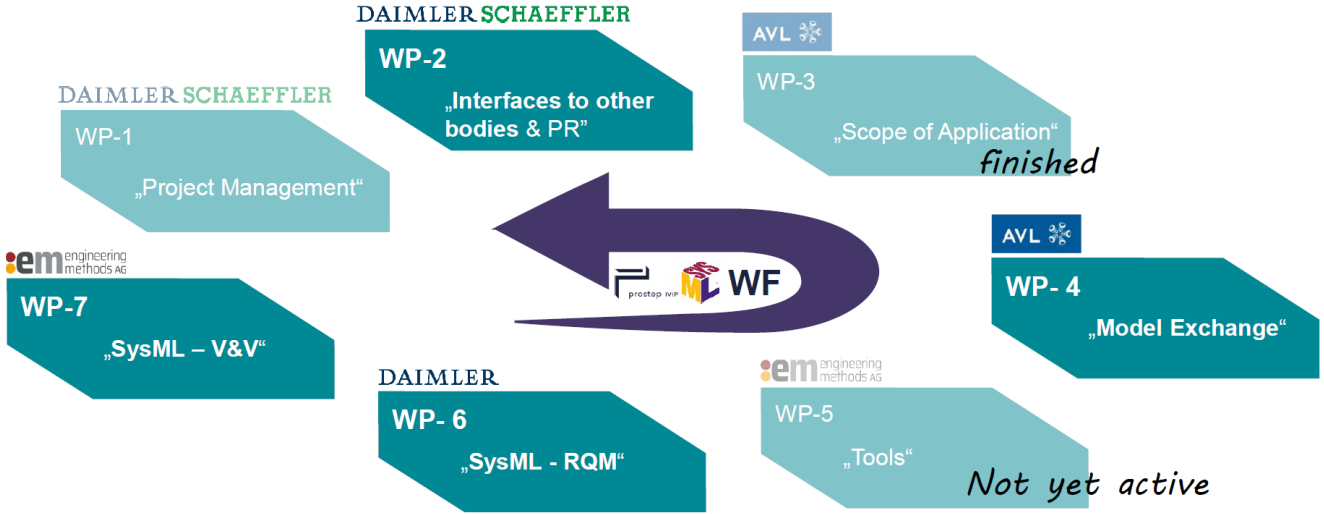


Source: Rude, Weckerle, prostep ivip Symposium 2019

SYS-ML: the common language

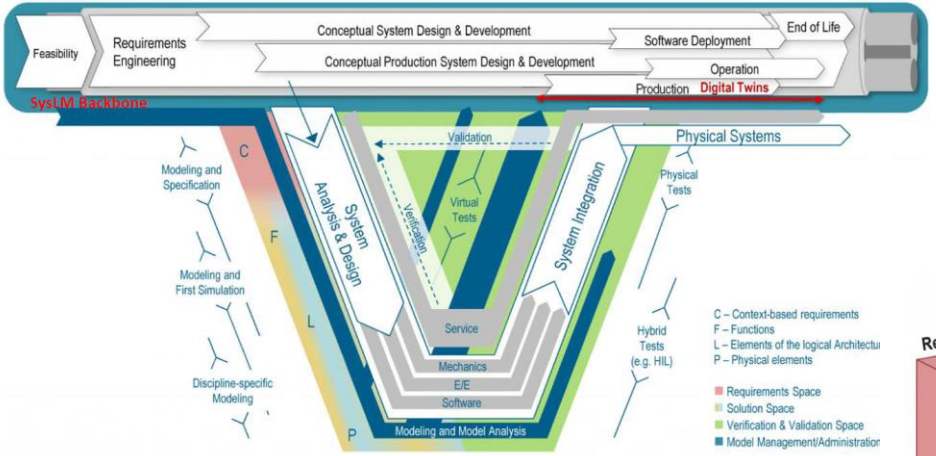
SysML-WF Organization

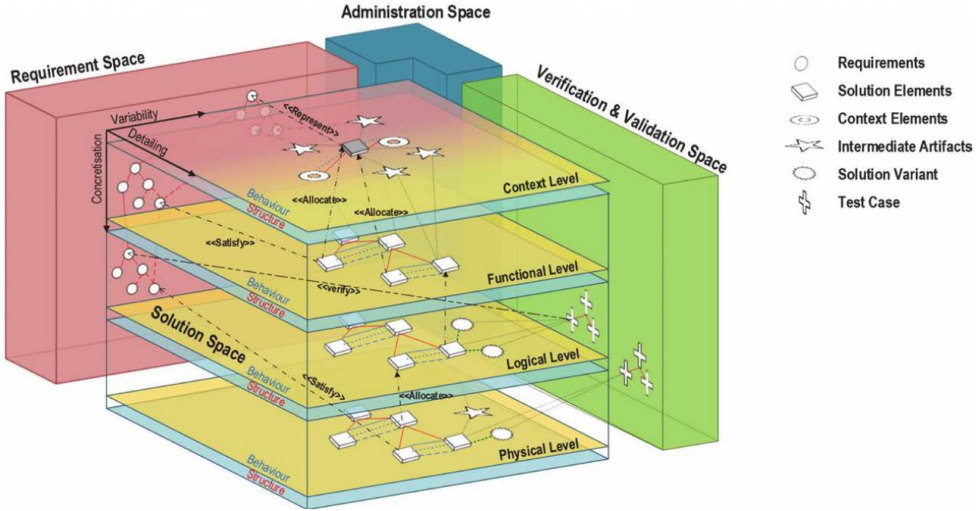
prostep ivip SysML-WF Project Consortium and Work Package Mentors



Source: prostep ivip Symposium 2019

Results of mecPRO²





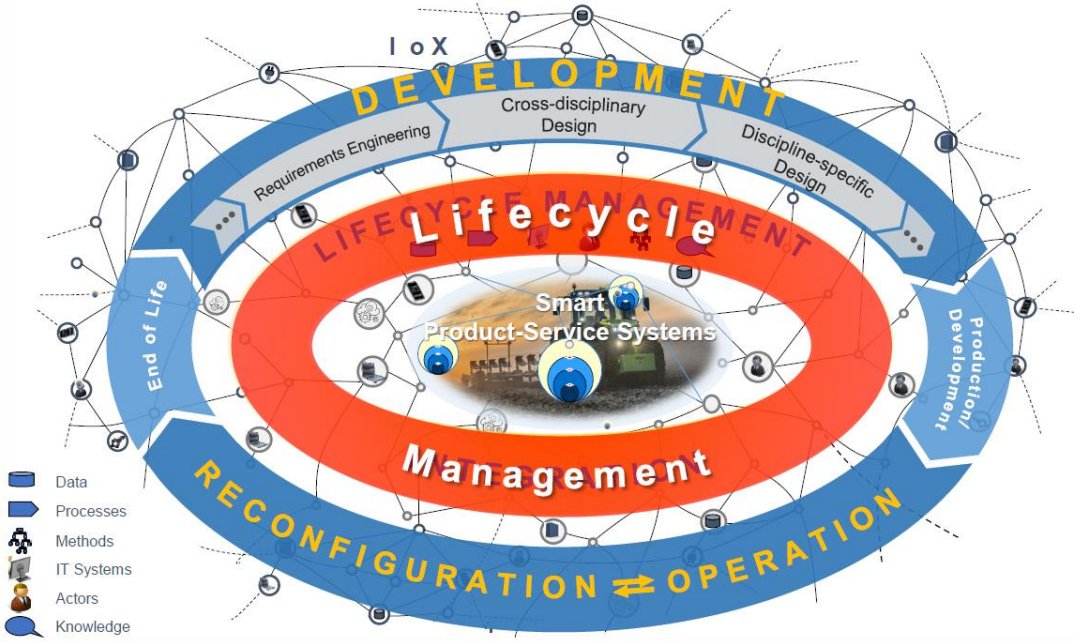
Source: Eigner 2019 aus mecPRO² Ergebnisse

Product-Service- Systems: InnoServPro

Bundesministerium für Bildung und Forschung

Lifecycle Management of Smart PSS

InnoServPro

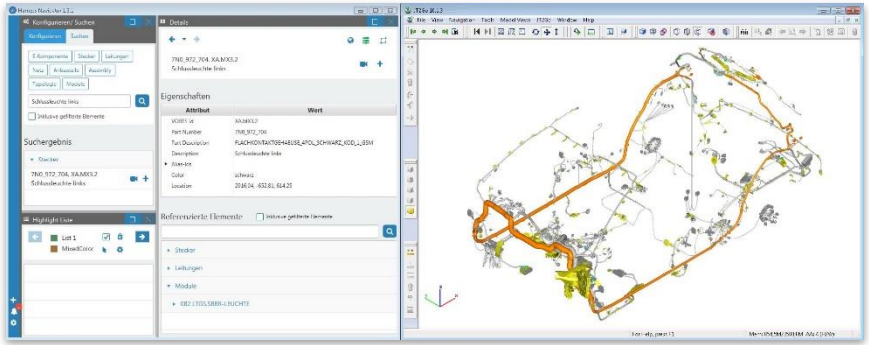


InnoServPro | prostep ivip Symposium, 10.April 2019, Stuttgart

Source: Koch, Göbel, prostep ivip Symposium 2019

Two Examples

Link between Geometry und Logic based on standards



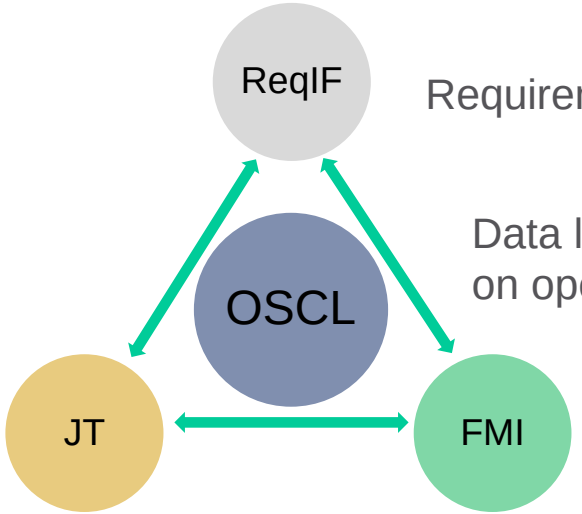
Vehicle Electrical Container (VEC)
VDA 4968 (2011)
PSI 19 (2018)

⟷

JT Industrial Application Package JTIAP V2
DIN Spec 91383 (2018)
PSI 14 (2016)

Source: Bild: Volkswagen 2018

A contribution to “Digital Data Package”



Source: Katzenbach 2019

Conclusion

Conclusion

The development of intelligent systems, product-service-systems and new business models can only be successful with

- an interdisciplinary approach
- in a tight international collaboration of OEM´s and supplier
- in cooperation von science and industry
- based on powerful process- and IT- standards

Let´s work together successfully

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May 29th, 2019

Katzenbach Executive Consulting

Prof. Alfred Katzenbach

Katzenbach Executive Consulting

Science:

Information Technology and Knowledge Based Engineering in Product Development

Universität Stuttgart

www.iktd.uni-stuttgart.de/

Consultancy:

Product Development -processes, -methods and –systems:

- *Management Consulting*
- *Strategy Consulting and -Development*
- *Organisational Changemanagement*
- *Intercultural Collaboration*
- *Project Coaching*
- *Knowledge Management*
- *Start up mentoring*

www.katzenbach-web.com

Coaching:

Senior coach focusing on organisation-development

ICO BUSINESS ACADEMY
Leadership & Change

ico-business-academy.de

CPO in a Nutshell

2.1 Interoperability

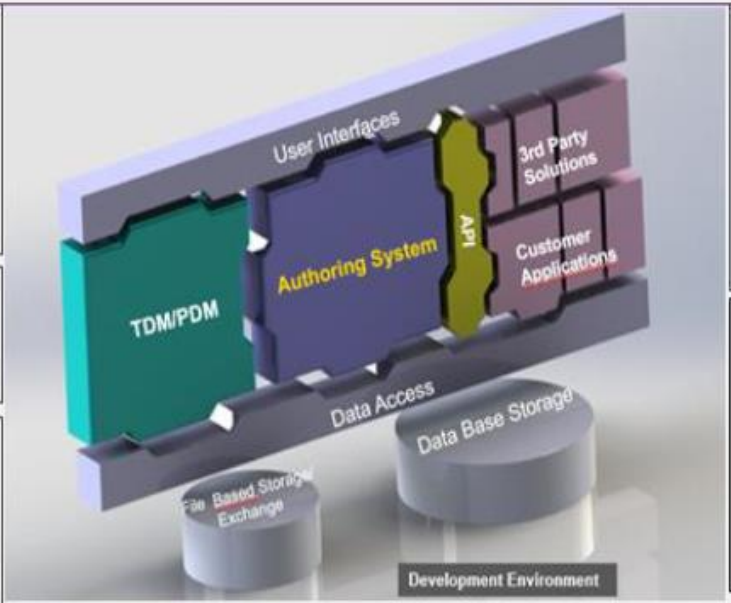
- IT customers shall be able to realize system integration, on their own or via third parties
- Customers shall have access to their data
- Therefore IT interfaces shall be provided by the IT vendors

2.2 Infrastructure

- The IT customer and the IT vendor shall share lifecycle planning

2.3 Extensibility

- IT vendors shall provide development environments
- In case of an IT system upgrade, IT vendors should endeavor that the application of extensions realized by IT customers (or by third parties commissioned by these IT customer) is unaffected



2.5 Standards

- IT vendors should support relevant standards and document their usage. IT vendors shall provide a list of the standards that support openness

2.6 Architecture

- If applicable, the IT system shall have a clear and documented separation of the individual tiers (e.g. n-tier architecture, peer-to-peer etc.)

2.4 Interfaces

- IT vendors should offer the same IT interfaces to IT customers (or third parties commissioned by these IT customers) as those used internally by the IT vendors

CPO in a Nutshell

FROM COMMITMENT TO PRACTICAL APPLICATION

An initiative of the prostep ivip association

Practical application of users presented at the prostep ivip symposium 2019

CODE of PLM OPENNESS

BMW GROUP · Rolls-Royce Motor Cars Limited

BOSCH

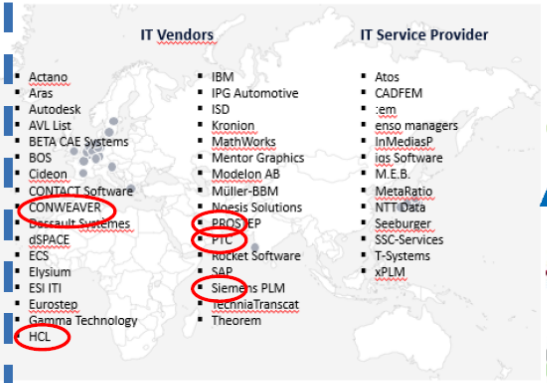
Continental

DAIMLER

Volkswagen

Certified vendors presented at the prostep ivip symposium 2018

READY FOR OPENNESS
ORGANIZATION
Code of PLM Openness certified



CONWEAVER

HCL

PROSTEP integrate the future

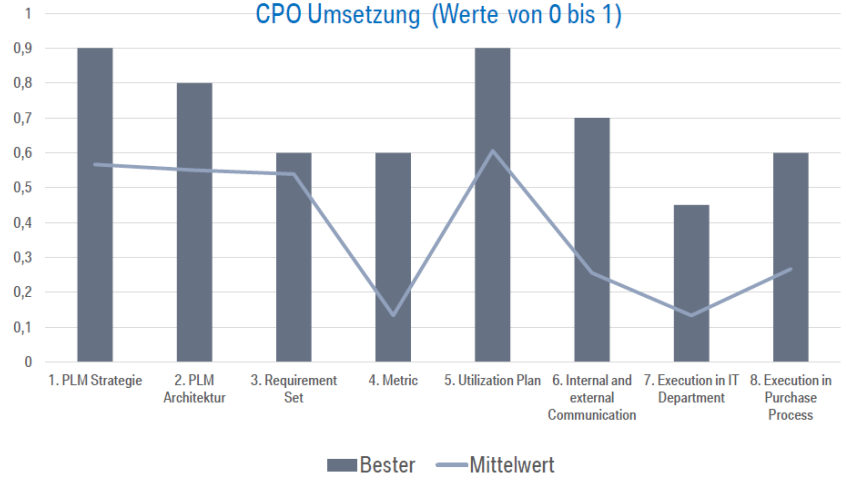
ptc

SIEMENS

CPO in a Nutshell

CPO@INDUSTRY_IN_9/2018

Evaluation of the questionnaires (10 of 11 companies)



AVL, AIRBUS, BOSCH, BMW GROUP, Rolls-Royce, DAIMLER, Continental, Ford, Volkswagen, PORSCHE, SCHAEFFLER, YAZAKI