Virtual product development – future requirements from an automotive system supplier perspective

Wolfgang Sczygiol
Brose Fahrzeugteile GmbH & Co. KG, Coburg

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Agenda

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Founding and building of a family-owned company
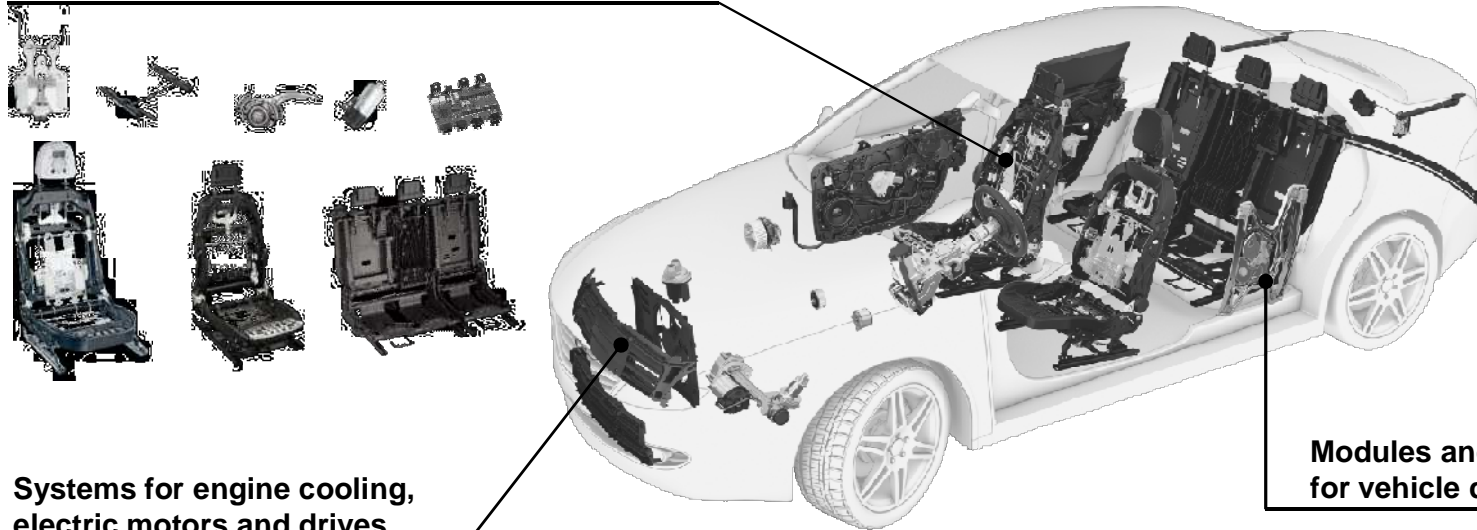## Three generations in 100 years
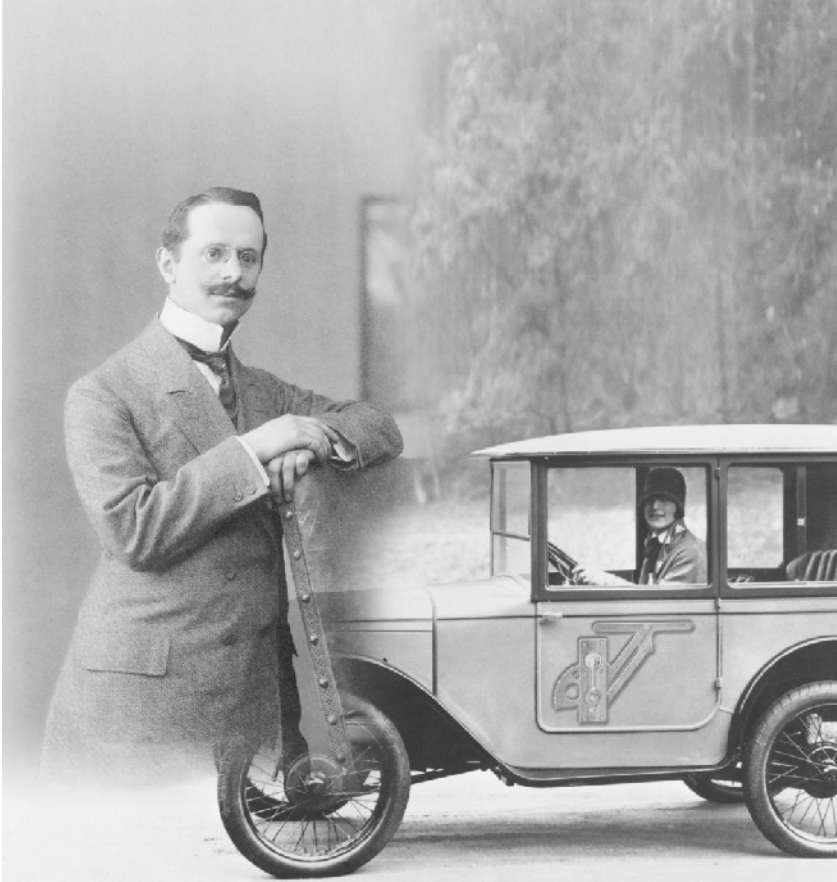
Company founder Max Brose

Product range
Mechatronic Systems and Drives for Automobiles

Structures and components for vehicle seats

Systems for engine cooling, electric motors and drives
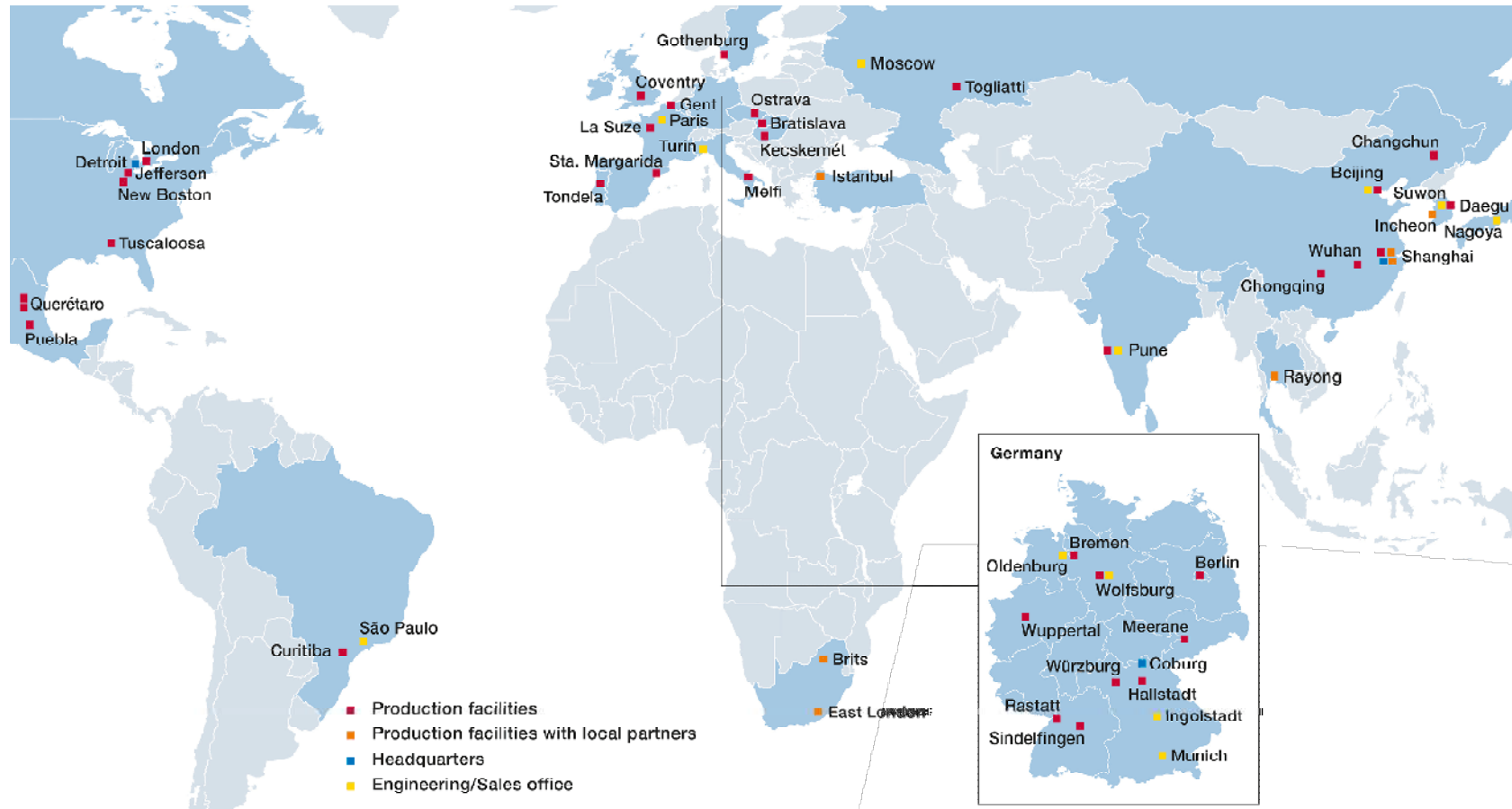
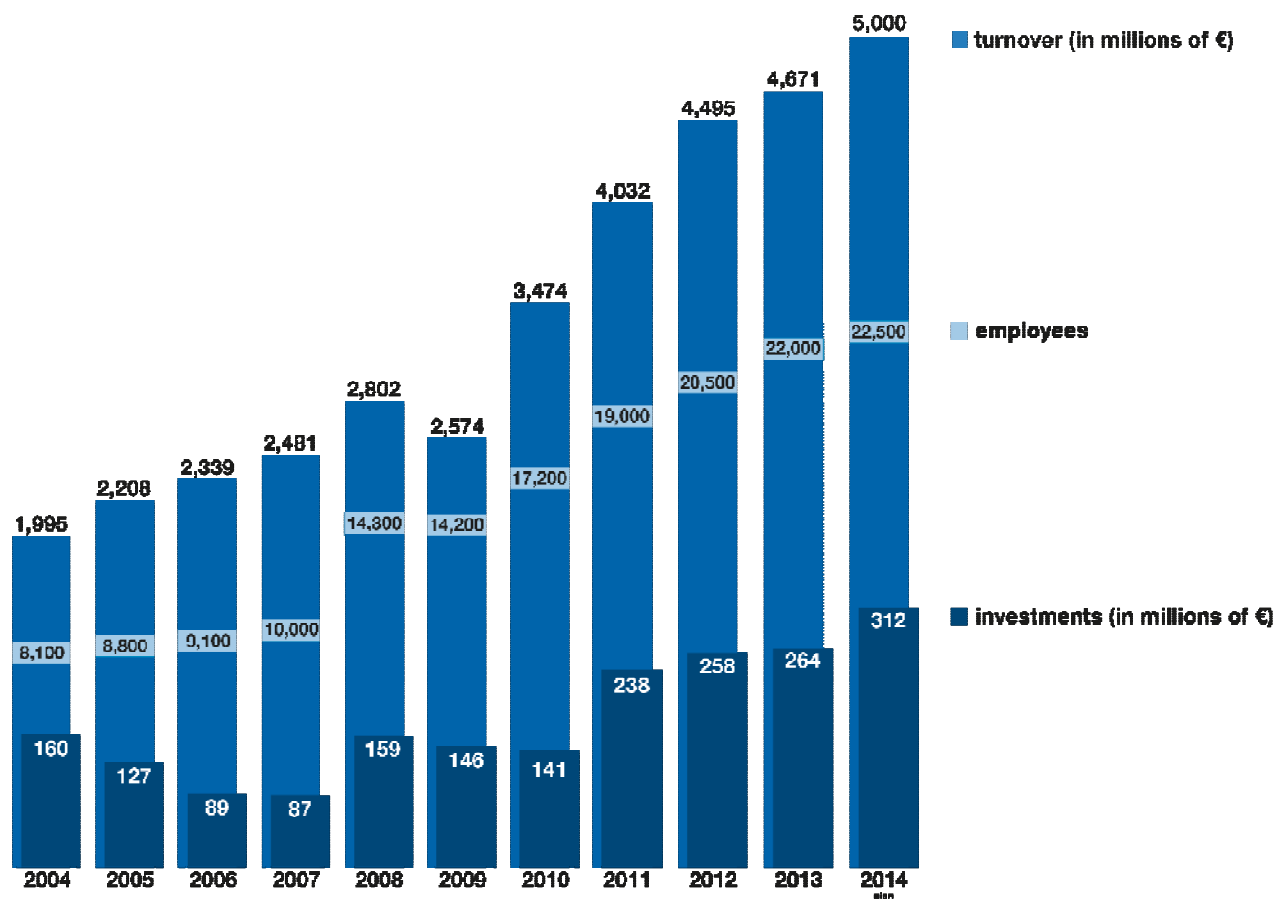**Modules and components for vehicle doors**

Customers worldwide

Global presence
57 locations, 23 countries, 4 continents, 22000 employees

Legend:
- Production facilities
- Production facilities with local partners
- Headquarters
- Engineering/Sales office

Germany (inset): Bremen, Oldenburg, Wolfsburg, Berlin, Wuppertal, Meerane, Würzburg, Coburg, Hallstadt, Rastatt, Sindelfingen, Ingolstadt, Munich

World map locations: Gothenburg, Moscow, Togliatti, Coventry, Gent, Ostrava, Bratislava, La Suze, Paris, Kecskemét, Changchun, Beijing, Suwon, Daegu, Turin, Istanbul, Incheon, Nagoya, Sta. Margarida, Melfi, Wuhan, Shanghai, Tondela, Chongqing, London, Detroit, Jefferson, New Boston, Tuscaloosa, Pune, Querétaro, Rayong, Puebla, São Paulo, Curitiba, Brits, East London

Business development
Continuous self-generated growth

Year	turnover (in millions of €)	employees	investments (in millions of €)
2004	1,995	8,100	160
2005	2,208	8,800	127
2006	2,339	9,100	89
2007	2,481	10,000	87
2008	2,802	14,300	159
2009	2,574	14,200	146
2010	3,474	17,200	141
2011	4,032	19,000	238
2012	4,495	20,500	258
2013	4,671	22,000	264
2014 plan	5,000	22,500	312

Sczygiol, Wolfgang   Development Brose Group   Date: 6/04/2014

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Virtual Product Development - Motivation

- Reduce of development time by 20%

- Manage complexity and worldwide distributed development

- Frontloading (increase of the product maturity & reduce of risk)

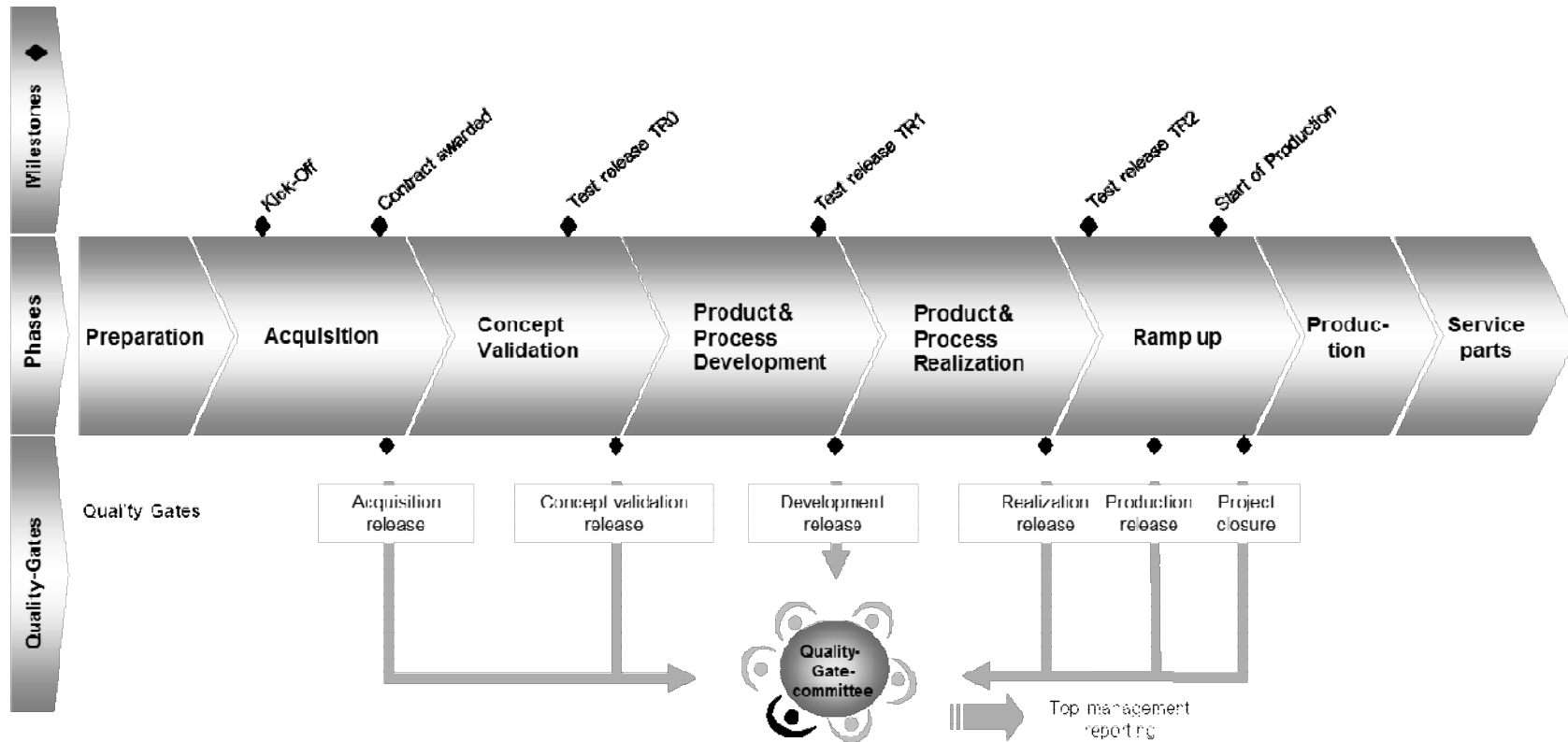- Regulations by law, standards and norms, e.g. functional safety (ISO26262)

Complexity

Thermomanagement
with grill shutter,
cooling fan module
and EC-Motor

Cooling fan modules
with EC-Motor

EC-Motor

Integration
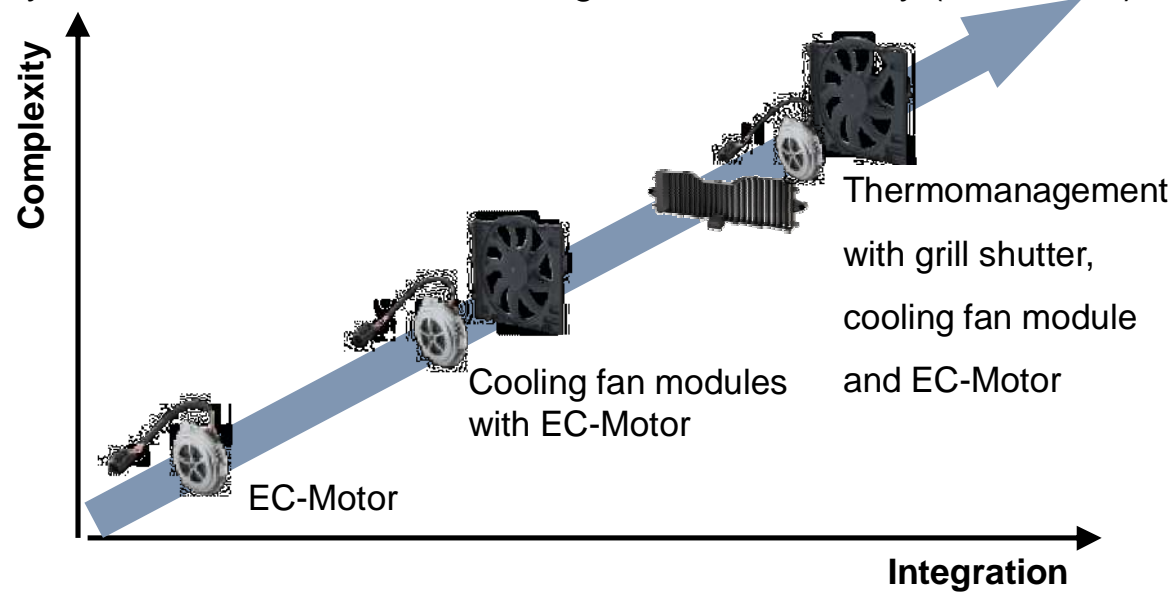
Virtual Product Development - Motivation

Reduce of product cost within reduction of technology cost

Task management 1%

Tools and methods 2%
(simulation, automatization)

Controlling 2%

First time right,
fast decisions in
early project phase 2%

Technology cost

Learning culture1%

Σ **14%**

Training and education 1%

Standardization 3%

Collaboration (off shore dev.) 2%
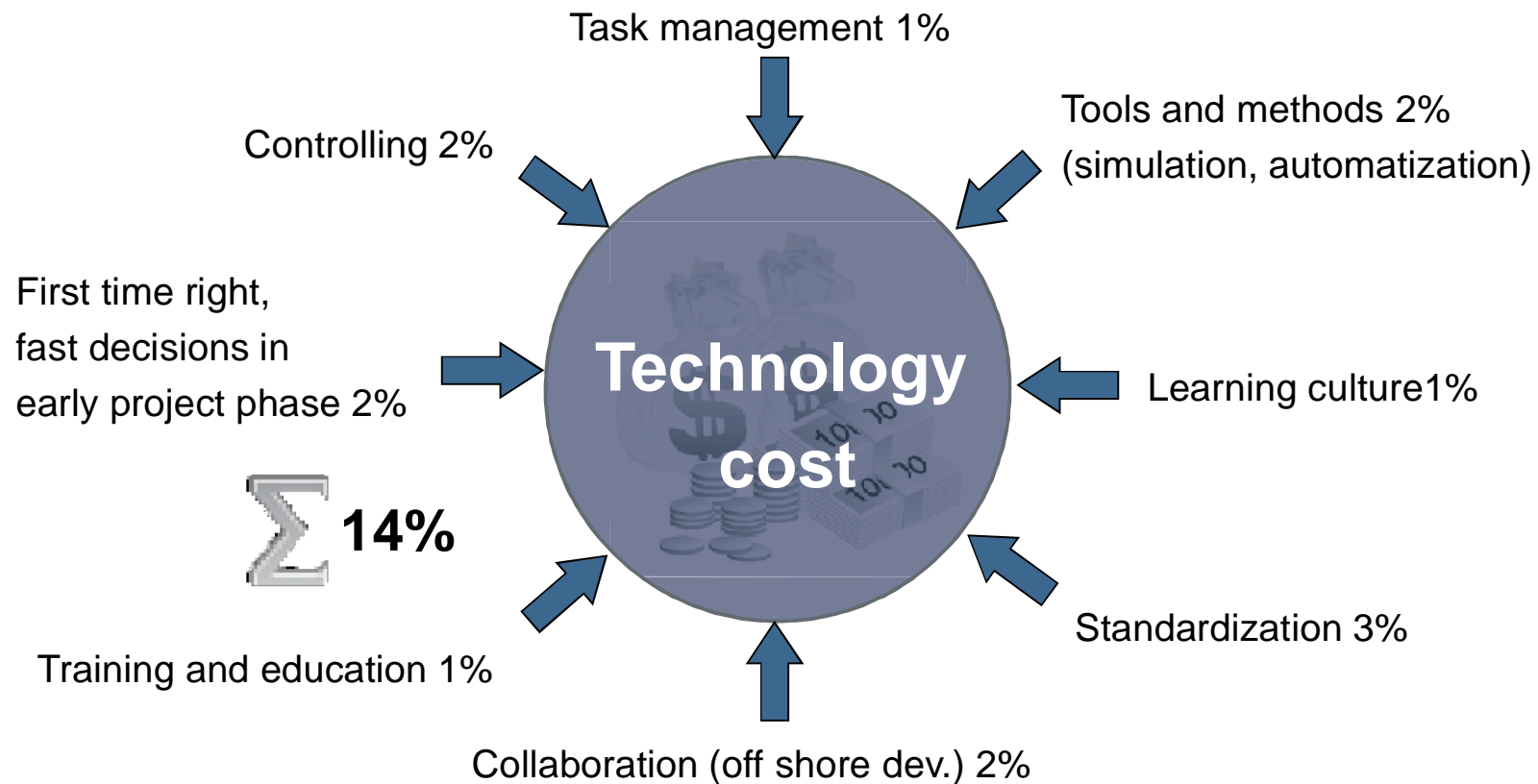
Virtual Product Development - Motivation

Brose Product Development Process - Today

Brose Product Development Process - Complexity

Requirements level

Product complexity

Customer requirement

SW + E/E + motor + mechanics
(mechatronic product)

SW + E/E + motor
(drive unit)

SW + E/E
(ECU)

SW

Customer function

Action chain

Realization of function within software

process advances (t)
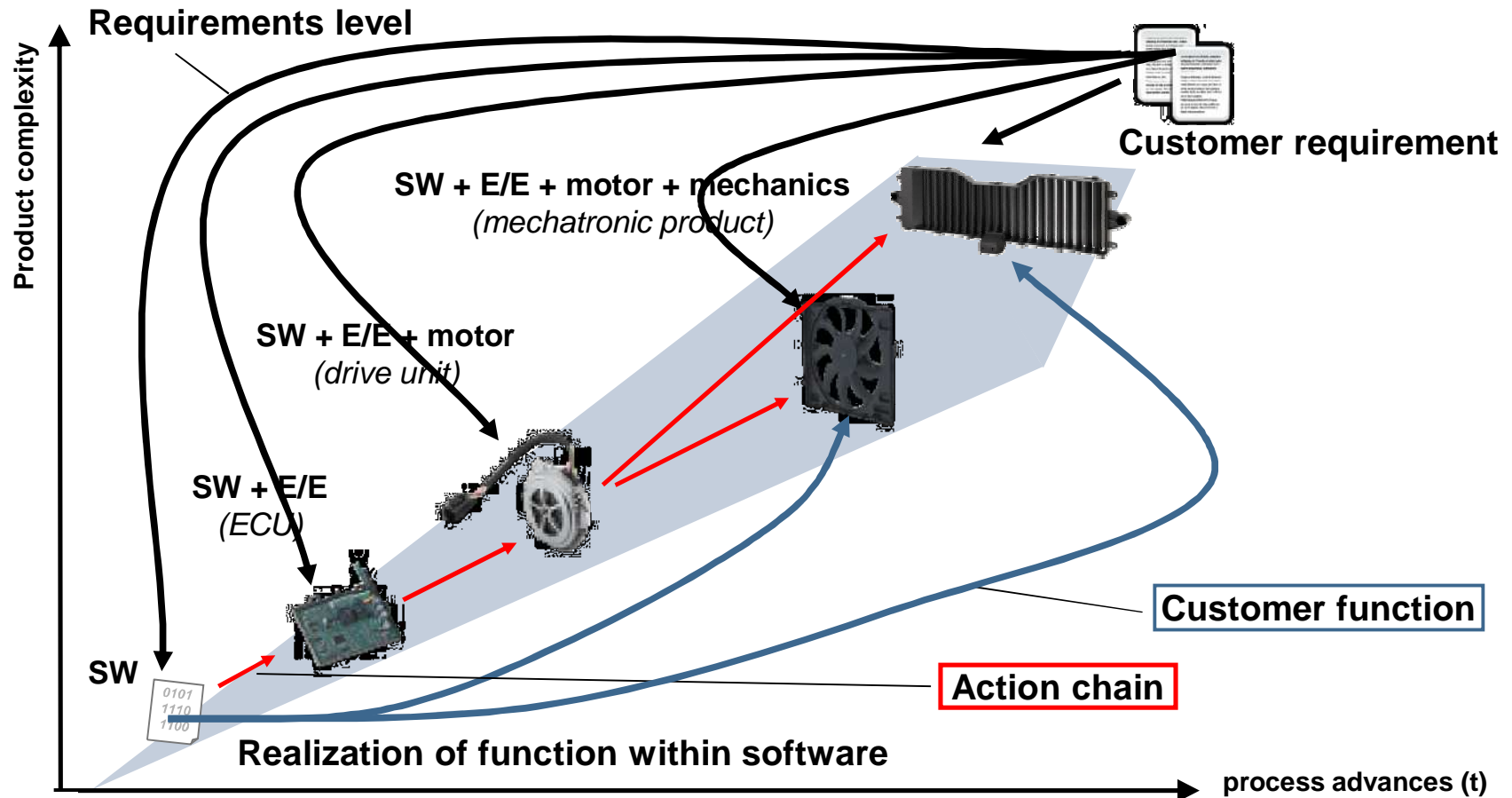
Virtual Product Development - Vision

**System engineering approach
e.g. Cooling fan module**
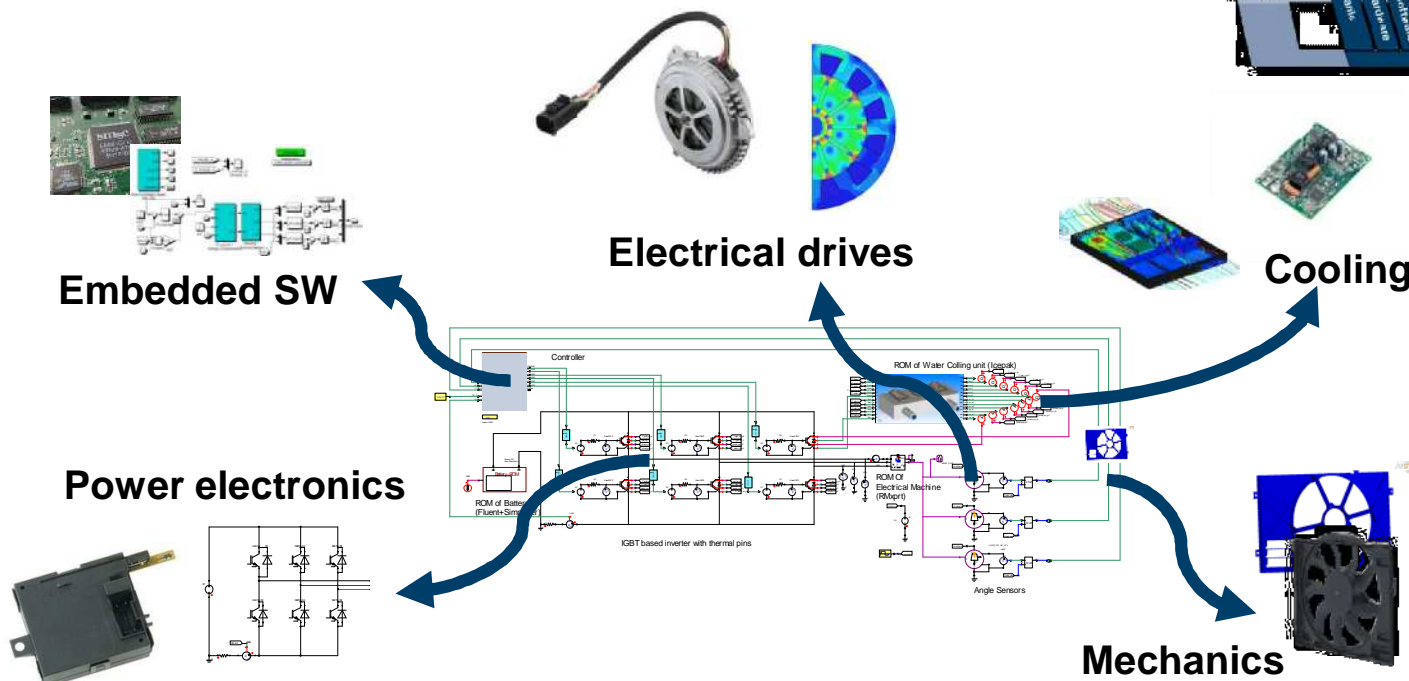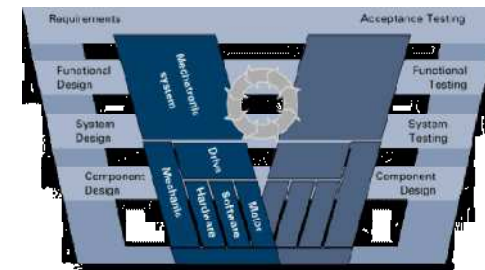
Embedded SW

Electrical drives

Cooling

Power electronics

Mechanics

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Virtual Product Development – Status Quo

Virtual system design

- Analytical and numerical methods
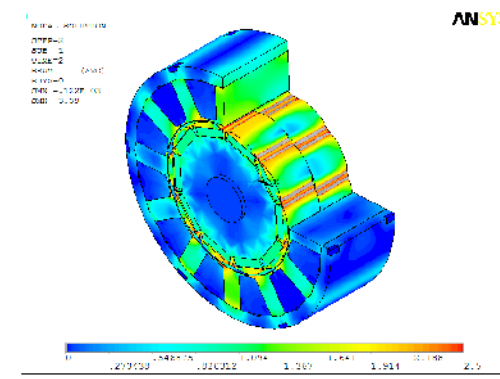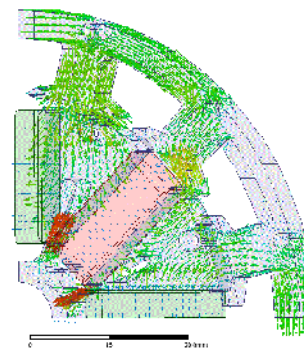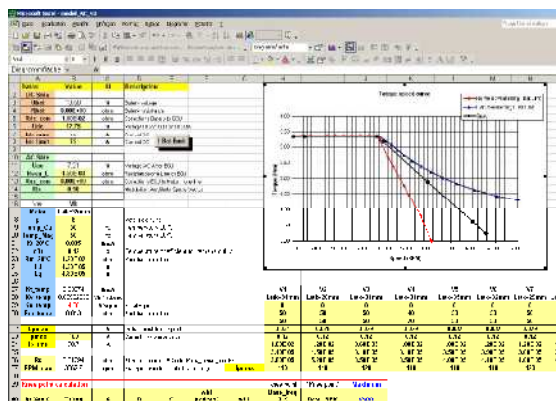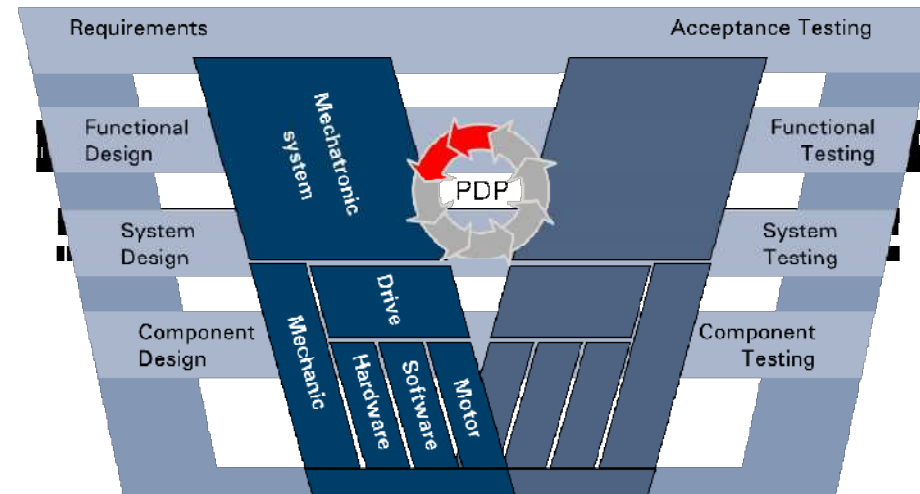
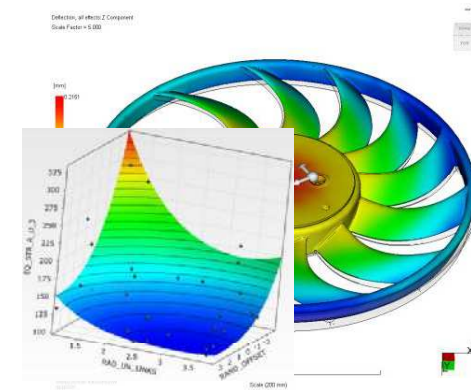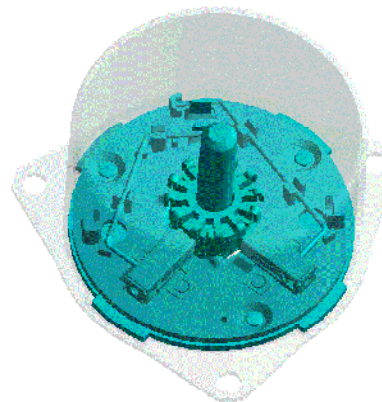# Virtual Product Development – Status Quo

Component design and testing

- Standard simulations for component design and testing
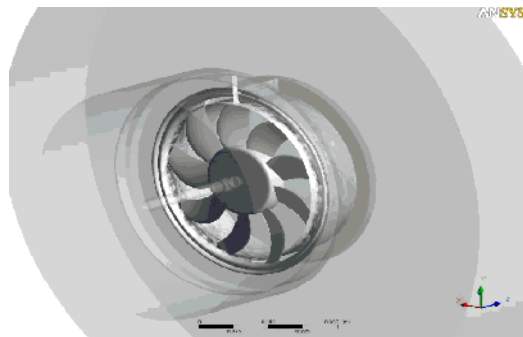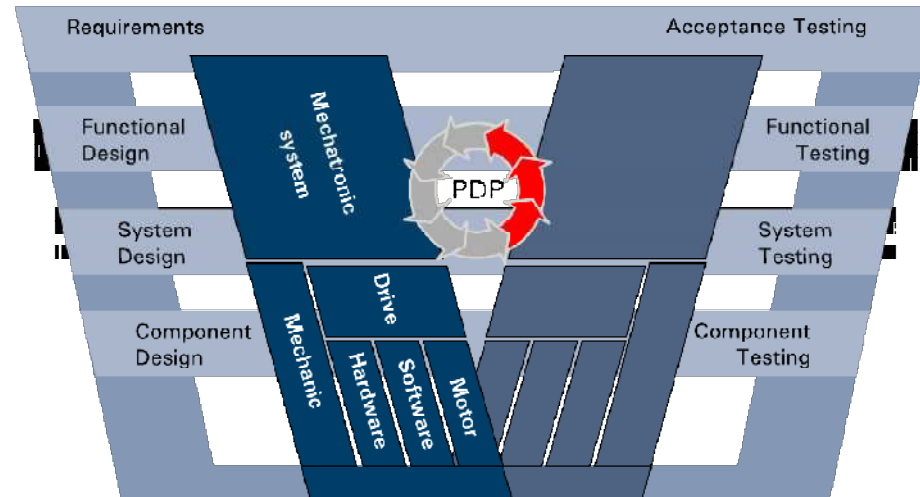- Robust design and optimization methods
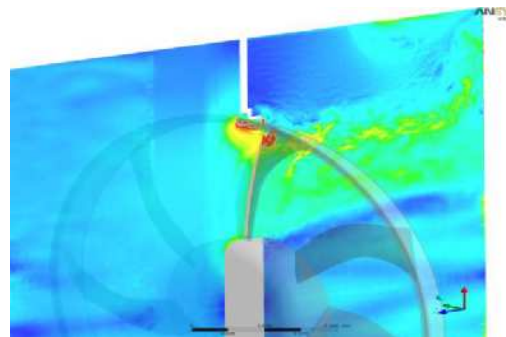
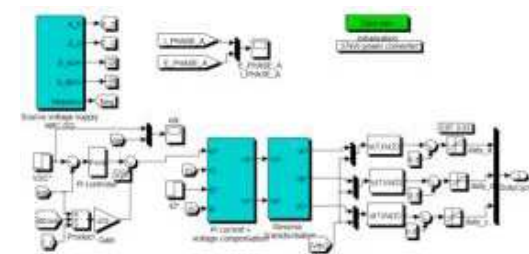# Virtual Product Development – Status Quo

System and functional testing

- System simulation approach
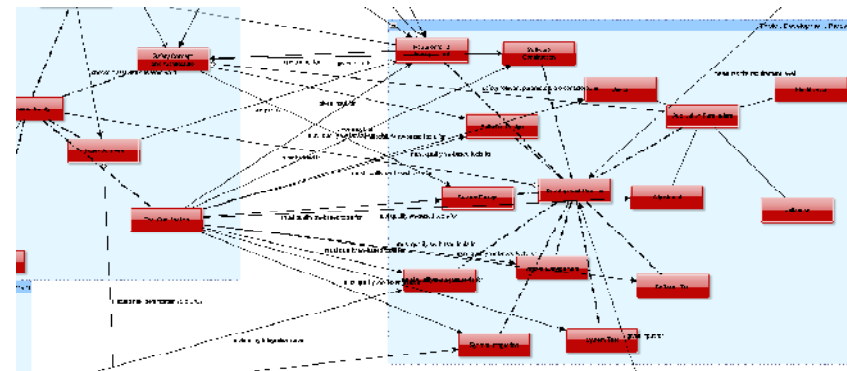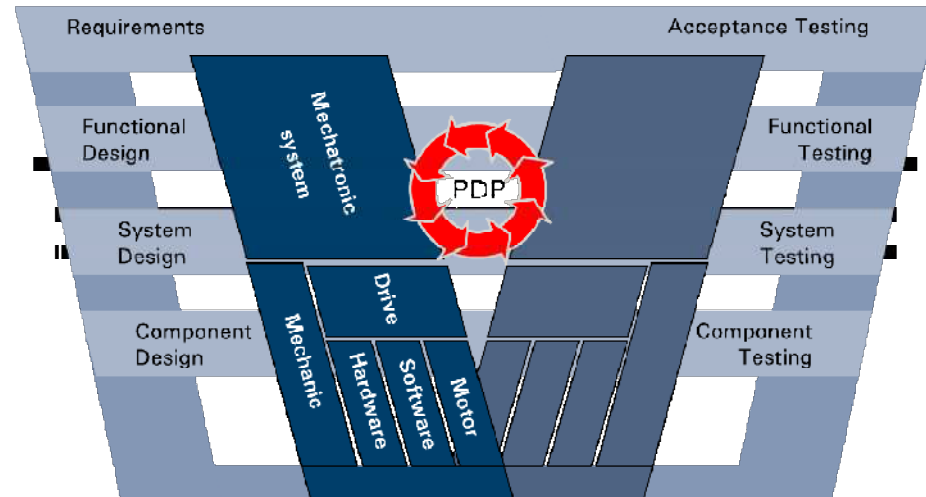 for software testing

- Evaluation of the complete system

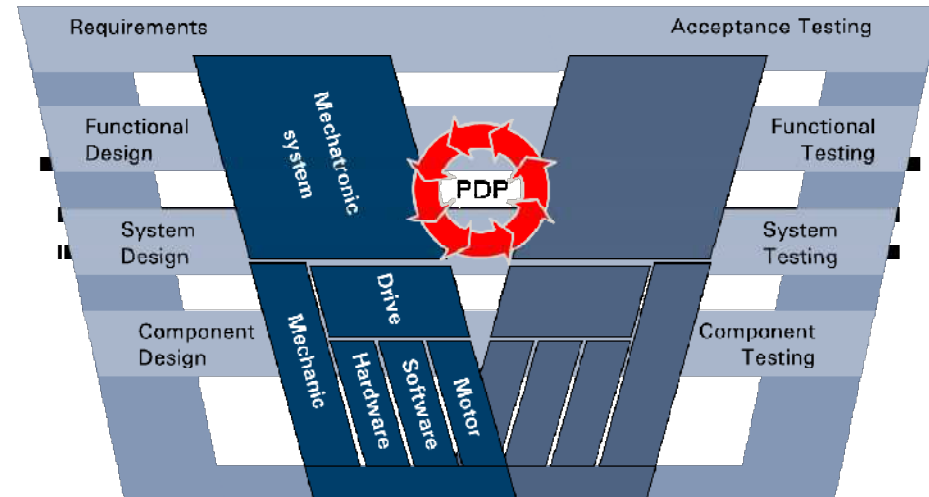# Virtual Product Development - Challenges

- Organization and company culture

- Open Mindset for

  - Systems engineering approach

  - Thinking in systems

- Prozess & Data Management

  - Requirements Management

  - Functional Management

  - Tools and Method Management

  - Consistent Data Management

Virtual Product Development - Requirements

- IT Systems & Infrastructure

    - Crosslinking of information

    - Interfaces between physical
      domains (multiphysics coupling)

    - The right data at the right place
      at the right time

    - IP protection

- Manage complexity

    - Systems of systems

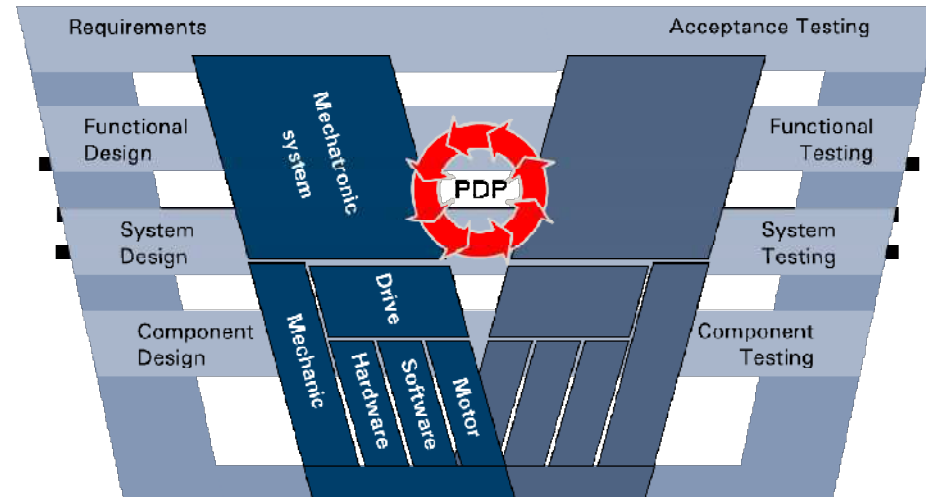- Etablish functional design techniques in product development processes

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Virtual Product Development

Key Success Factors

- Readyness of the organization

- Right balance between top down and bottom up approach

- Right IT Infrastructure

- Strategic collaboration with software and tool vendors

System supplier of the international automotive industry