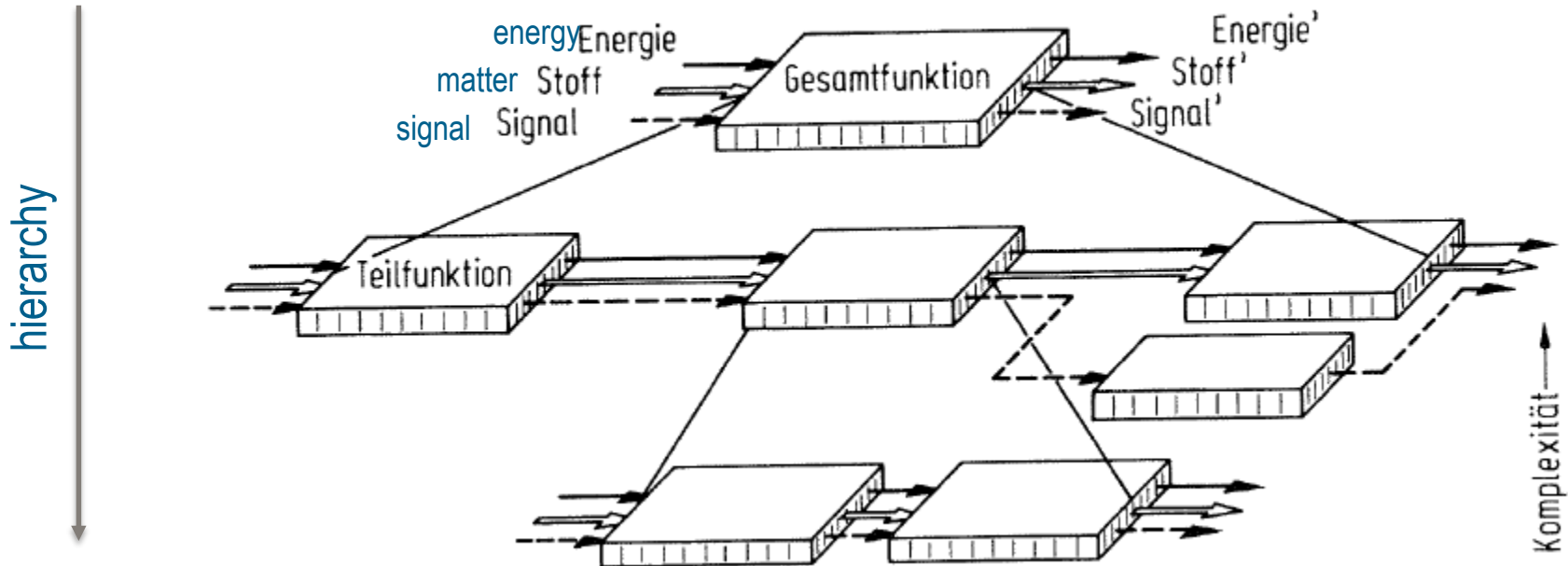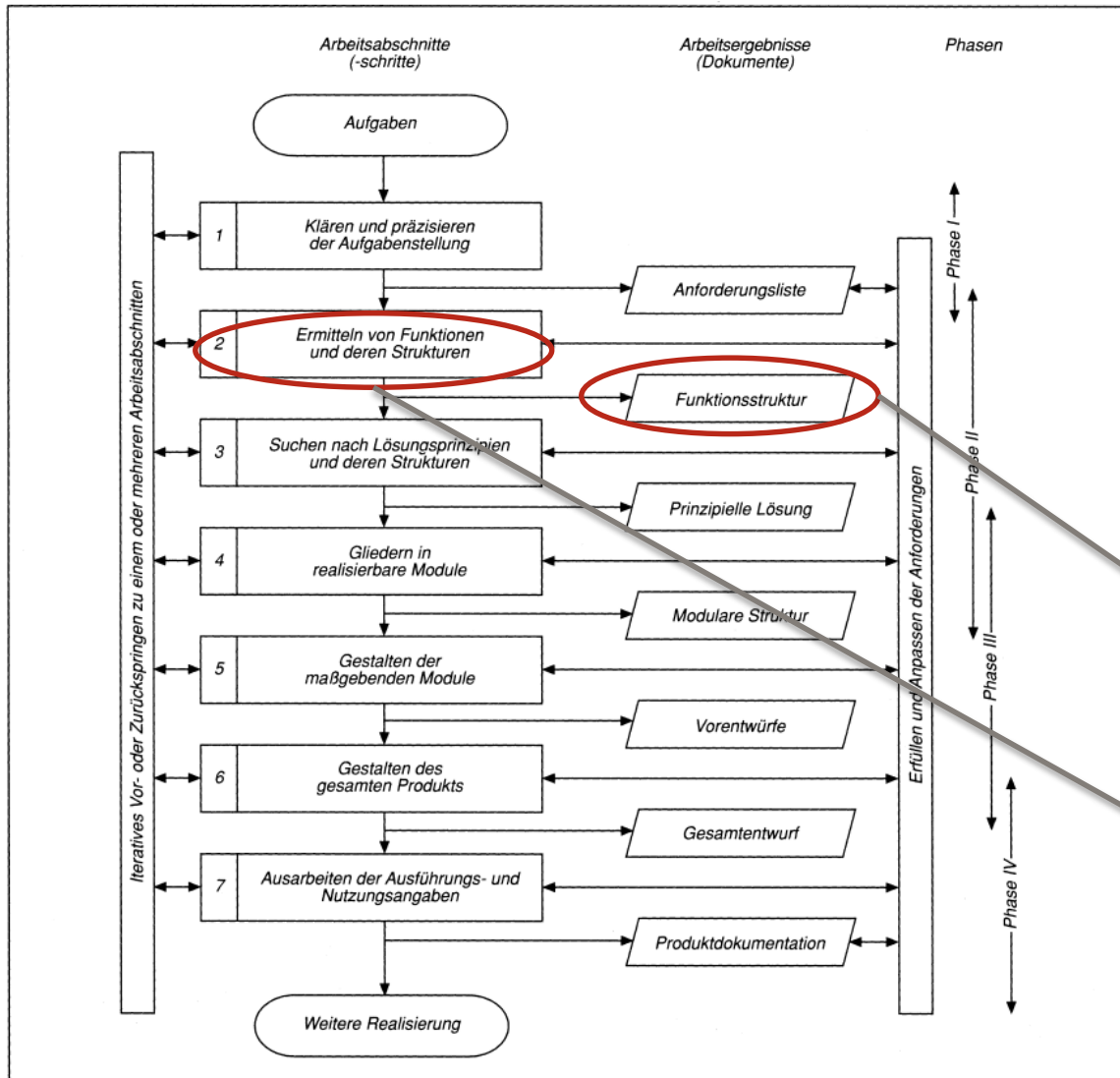# „*functions*" in SysML 2.0

La Jolla,   12/10/2015

**Technische Universität Kaiserslautern
Lehrstuhl für Virtuelle Produktentwicklung**

**Dipl. Wirtsch.-Ing. Christian Muggeo
Dipl. Wirtsch.-Ing. Michael Pfenning
Prof. Dr.-Ing. Martin Eigner**

MASCHINENBAU UND
VERFAHRENSTECHNIK
TU KAISERSLAUTERN

- Gerhard Pahl / Wolfgang Beitz
  – First published in 1976

hierarchy

energy Energie
matter Stoff
signal Signal

Gesamtfunktion

Energie'
Stoff'
Signal'

Teilfunktion

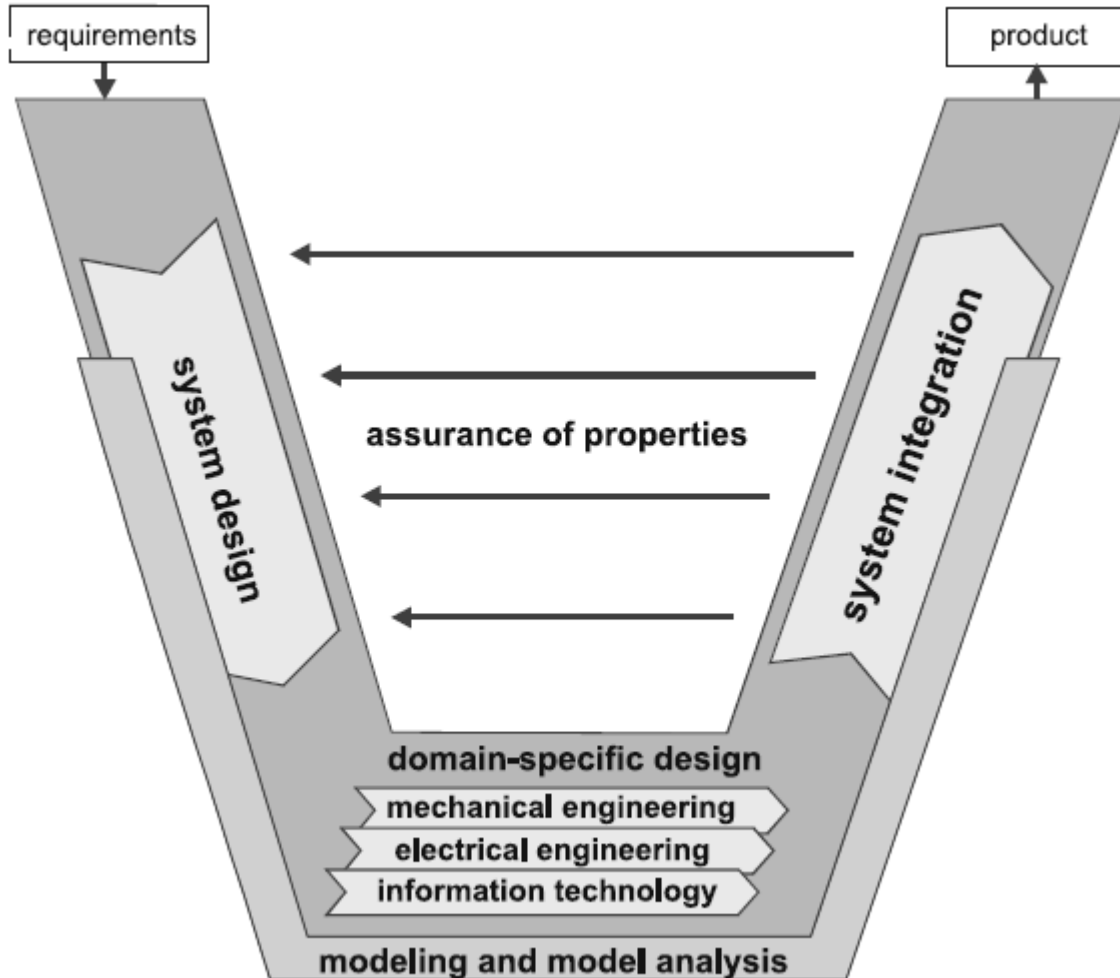Komplexität

TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

VDI 2221:
„Methodology for developing and constructing technical systems and products"
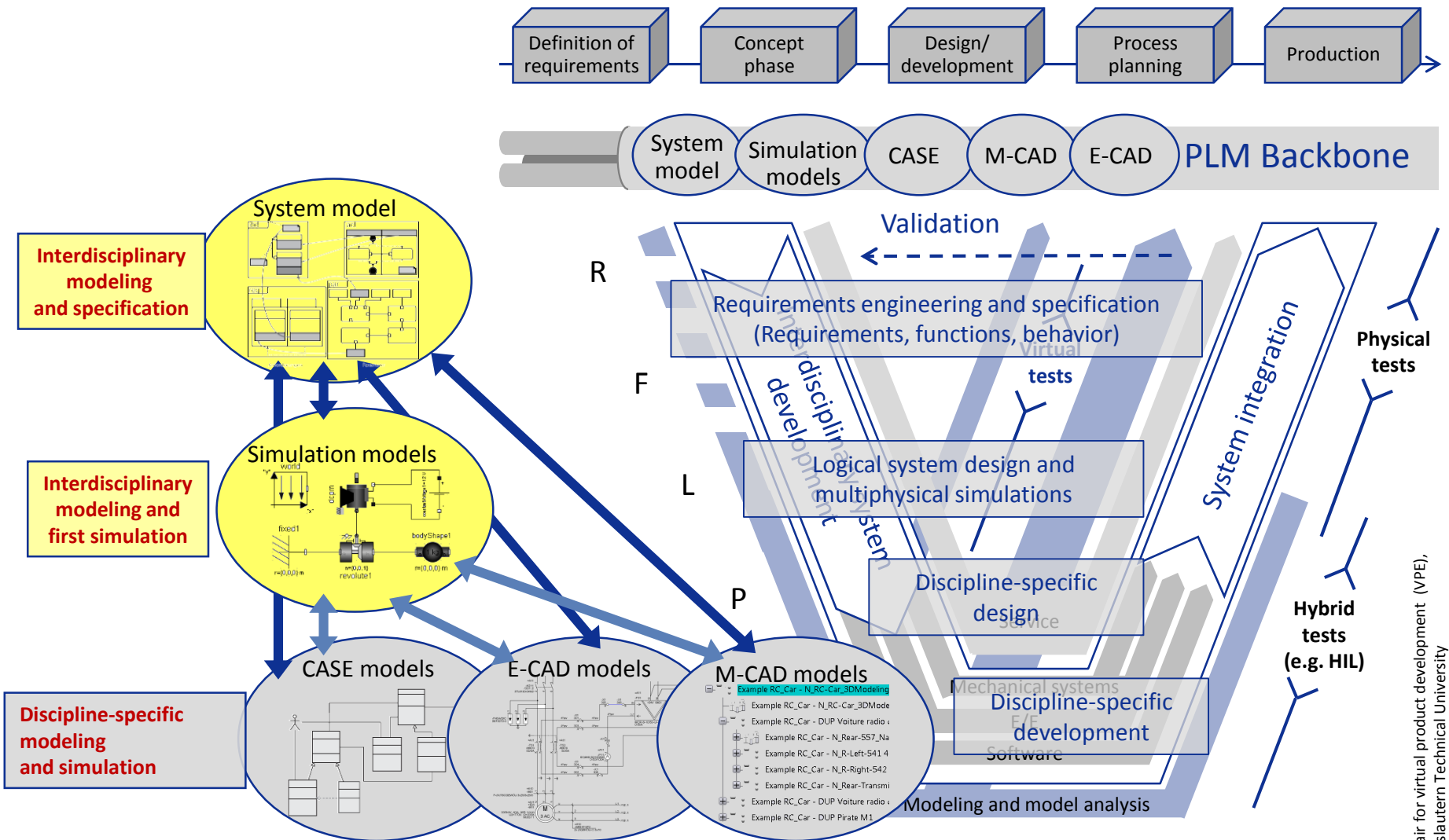(1st edition: 1993)

„functional structure"

„determination of functions and their structures"

VDI 2206:
„Development-methodology for mechatronic systems"
(1st edition: 2004)

"… . The functional integration of mechanical and electrical/electronic components takes place by connecting them by means of material, energy and information flows. The components may in this case be spatially separate from one another. ..:"

Legend: R, F, L, P: Requirements, functions, logical and physical system elements

Cf. Chair for virtual product development (VPE), Kaiserslautern Technical University

- Mathematical function

$$f(x) = \frac{a+b}{3}$$

- Software function

```c
/*Program to demonstrate the working of user defined function*/
#include <stdio.h>
int add(int a, int b);              //function prototype(declaration)
int main(){
    int num1,num2,sum;
    printf("Enters two number to add\n");
    scanf("%d %d",&num1,&num2);
    sum=add(num1,num2);             //function call
    printf("sum=%d",sum);
    return 0;
}
int add(int a,int b)                //function declarator
{
/* Start of function definition. */
    int add;
    add=a+b;
    return add;                             //return statement of function
```
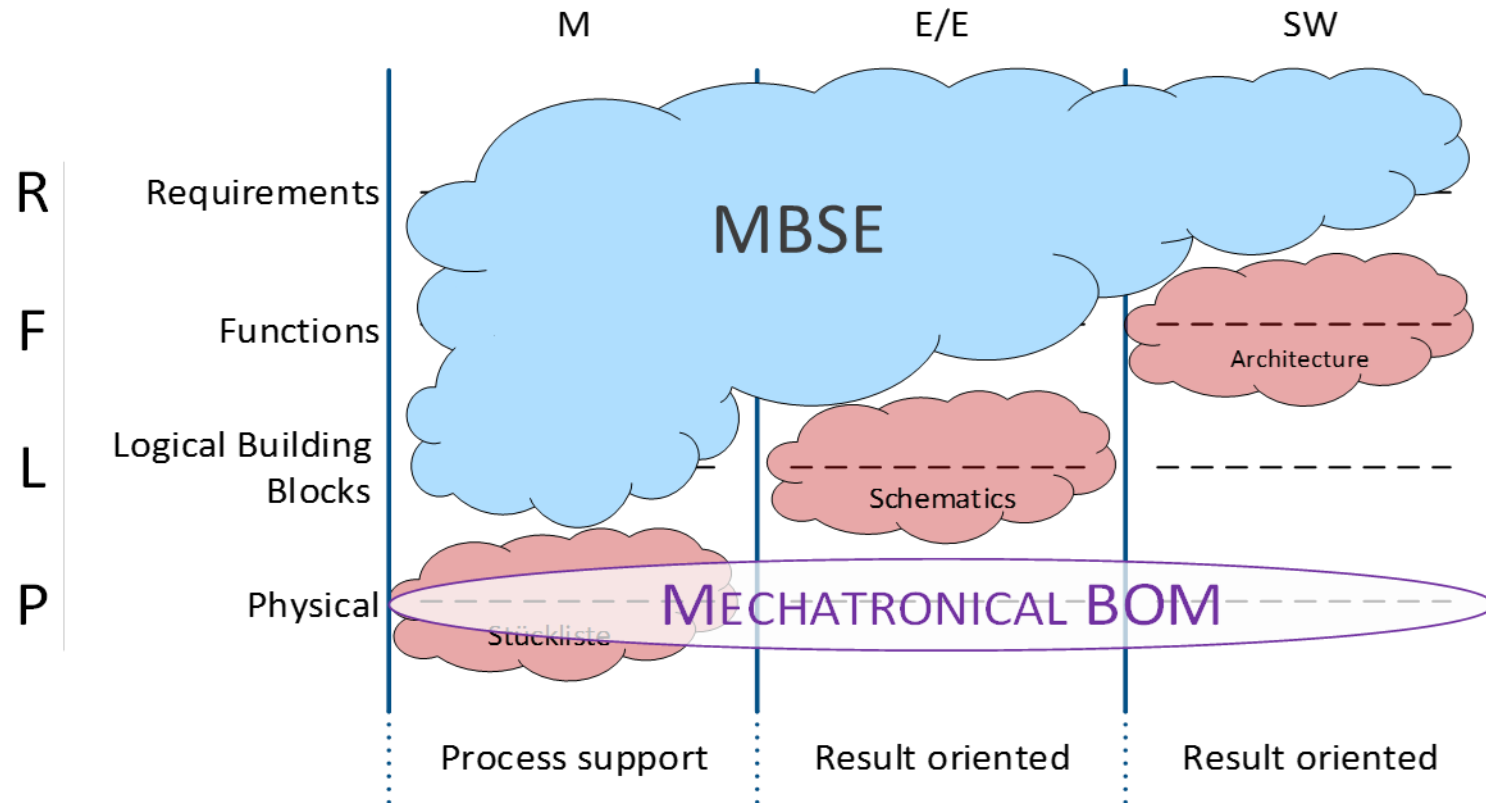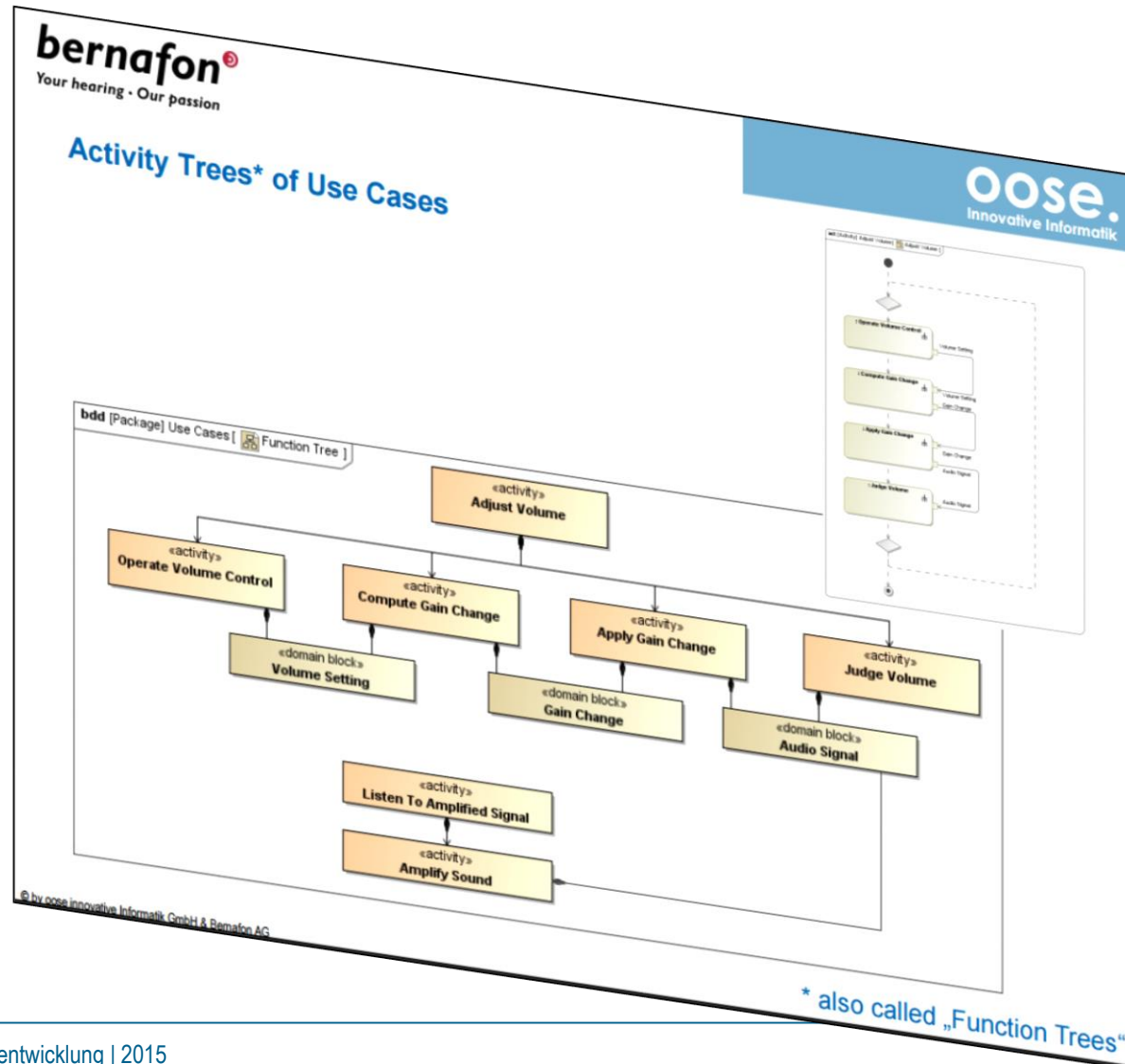
- System function

- A system function in the Sense of hardware development ...

    - ... has inputs and outputs

    - ... can be named by a noun-verb combination
      e.g. *transfer power*, *calculate delay*

    - ... is a technology independent description of a system

    - ... can be part of a hierarchy and a net

    - ... can describes expected behavior

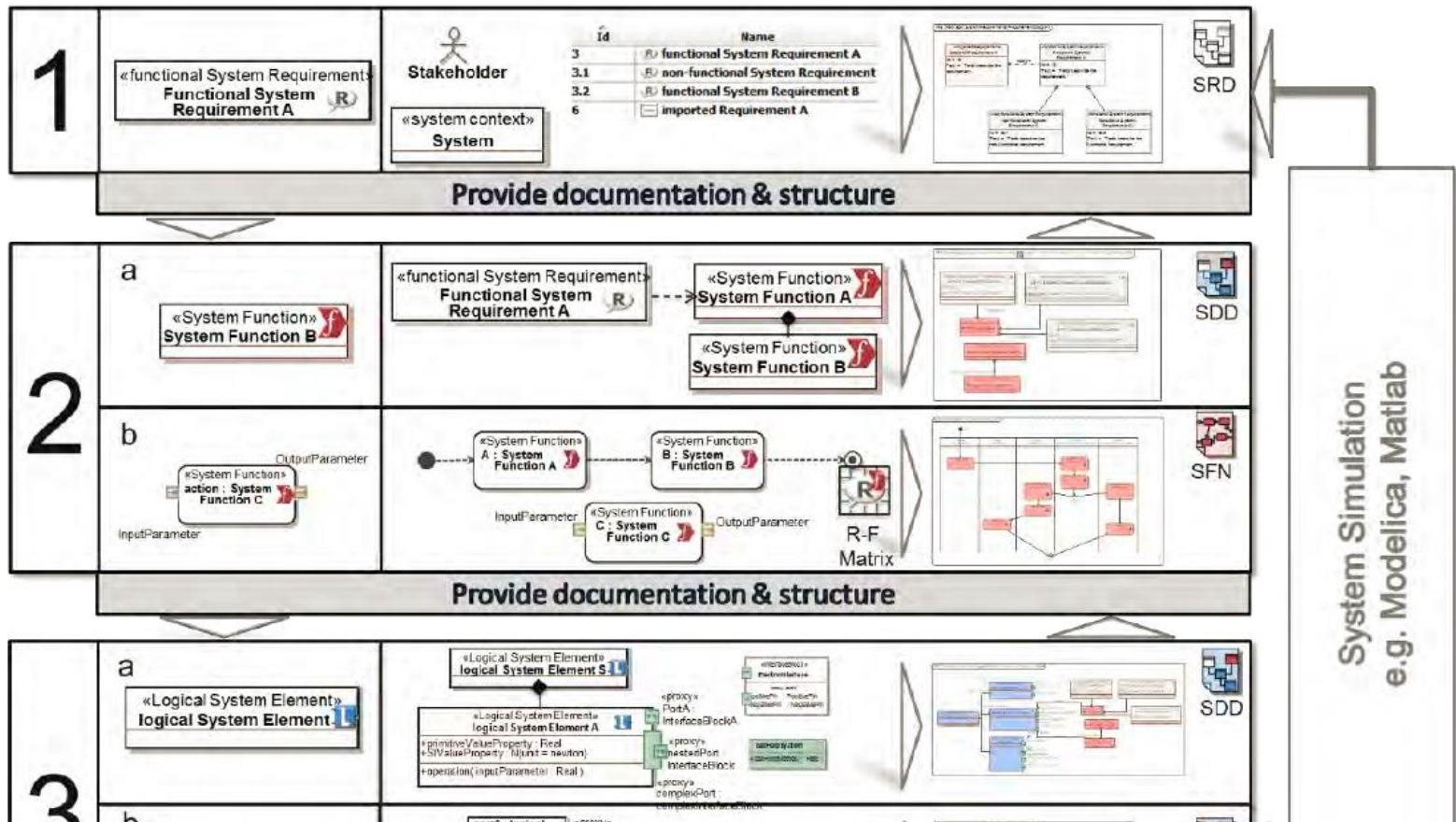- The functional abstraction layer combines the three main engineering disciplines.
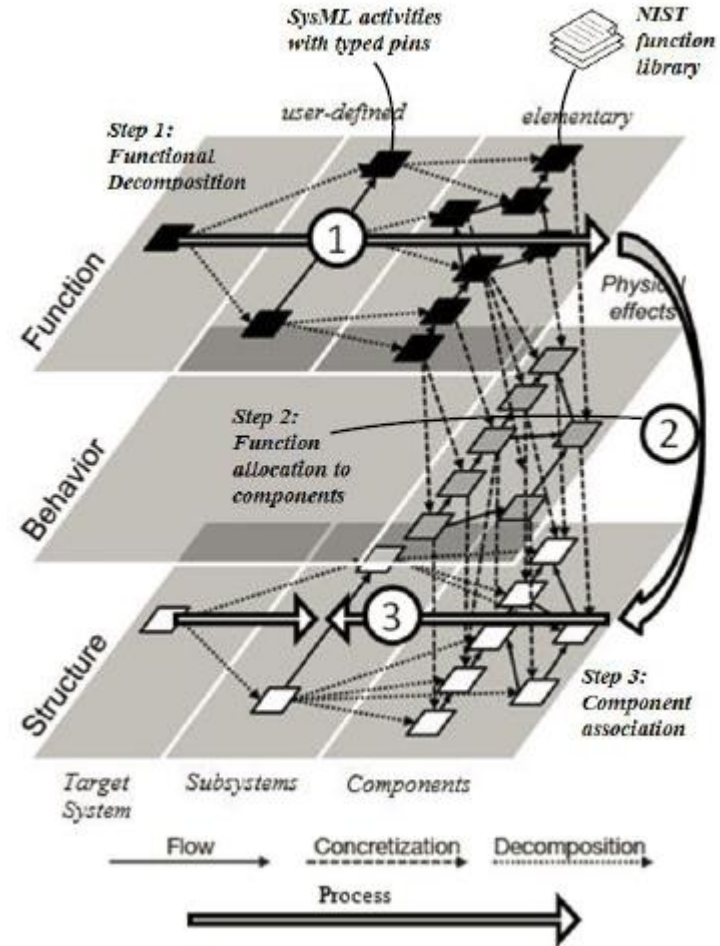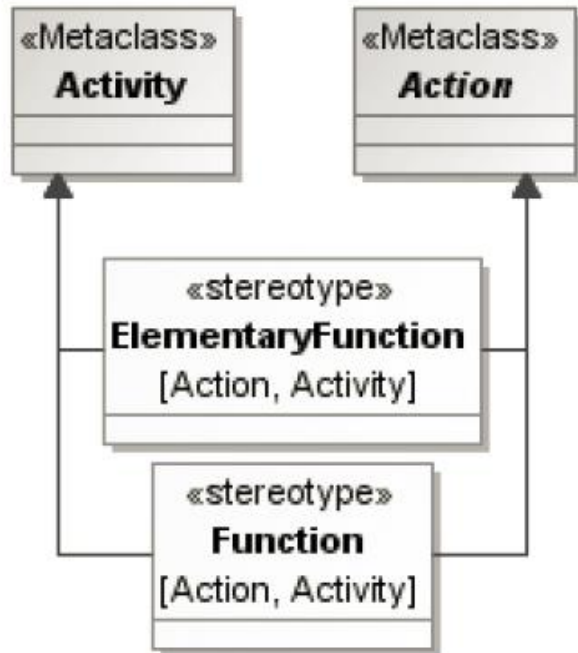

Source: Michael Pfenning, XPLM

- Tim Weilkiens and Jesko Lamm: Functional architecture for systems

- # PhD-Thesis of Dr.-Ing. Torsten Gilz:
  - PLM-Integrated Interdisciplinary System Models in the Conceptual Design Phase Based on Model-Based Systems Engineering
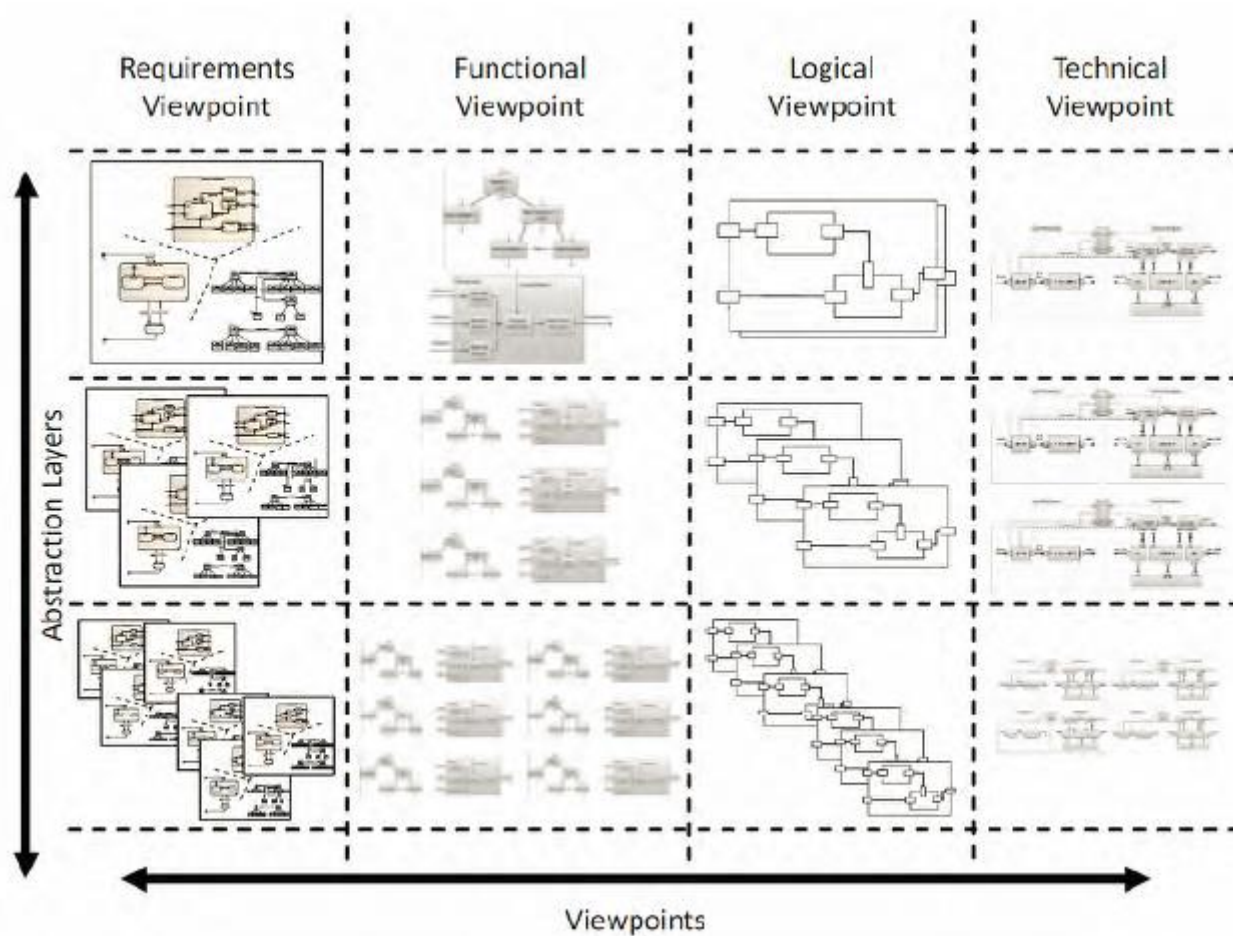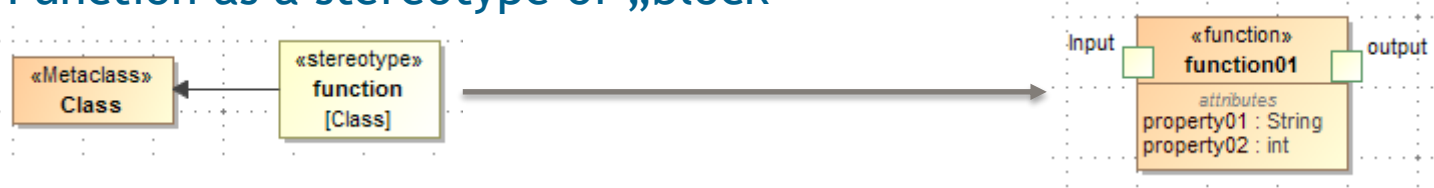
- Kruse, Shea et al.

A MODEL-BASED FUNCTIONAL MODELING AND LIBRARY APPROACH FOR MECHATRONIC SYSTEMS IN SYSML
Proceedings of the ASME 2012 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference
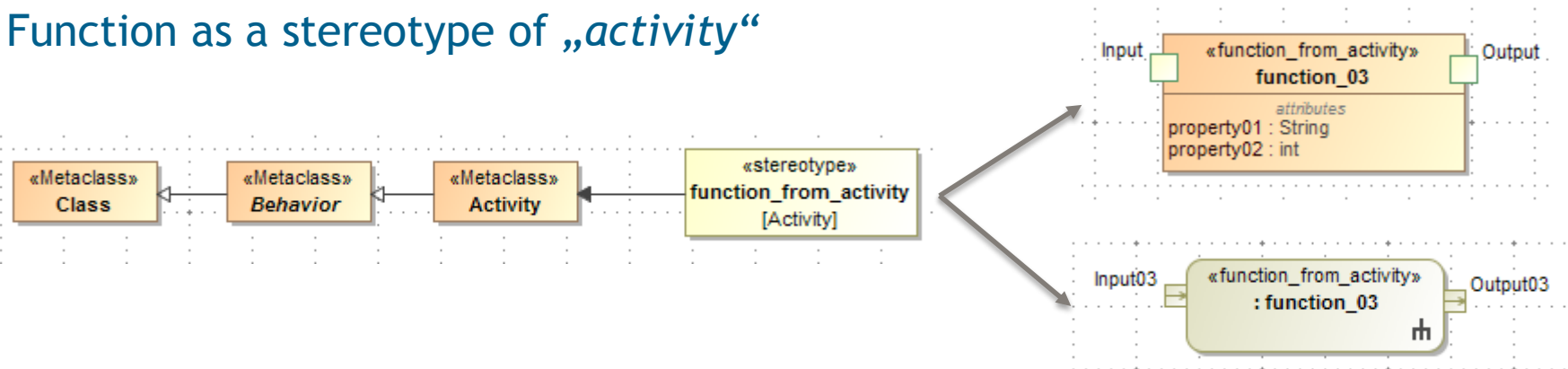**IDETC/CIE 2012, August 12-15, 2012, Chicago, IL, USA**

- SPES / SPES XT / SPES 2020

- Function as a stereotype of „block"

- Function as a stereotype of „*action*"

- Function as a stereotype of „*activity*"

- We would like to have the function in the <u>language</u> to …

  - … get more acceptance in engineering domains far from software engineering

  - … support different domains to collaborate with a SysML-based MBSE system model

- We don´t want …
  - … the integration of elements of a <u>methodology</u>, like R-F-L-P

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Thank you

https://www.facebook.com/LehrstuhlVPE