

# Architecture Overview How To

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## Abstract

An architecture overview is a compact overview capturing part of an architecture description. An architecture description should show a static view, showing parts and relations, a dynamic behavior view, and quantification. Major challenges are to reduce the amount of information to the essentials, and still to show an effective overview.

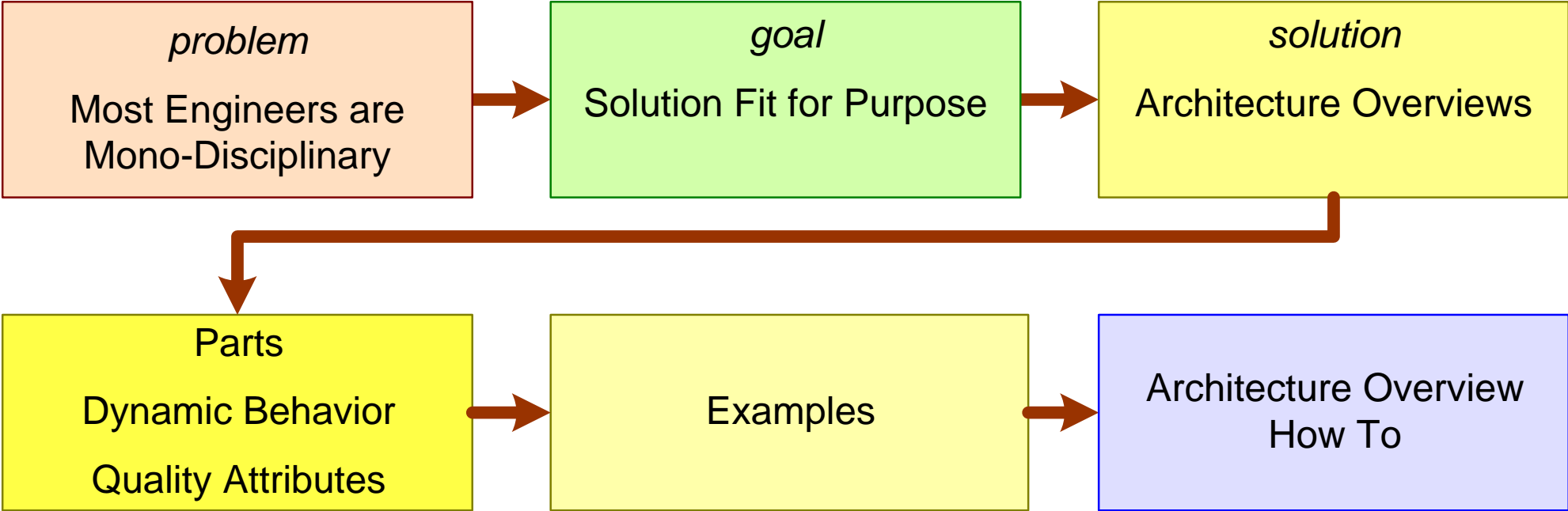
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version: 0.1



# Figure of Contents™



# Most Engineers are Mono-Disciplinary

mono-disciplinary  
engineering

*software  
engineering*

*electrical  
engineering*

*mechanical  
engineering*

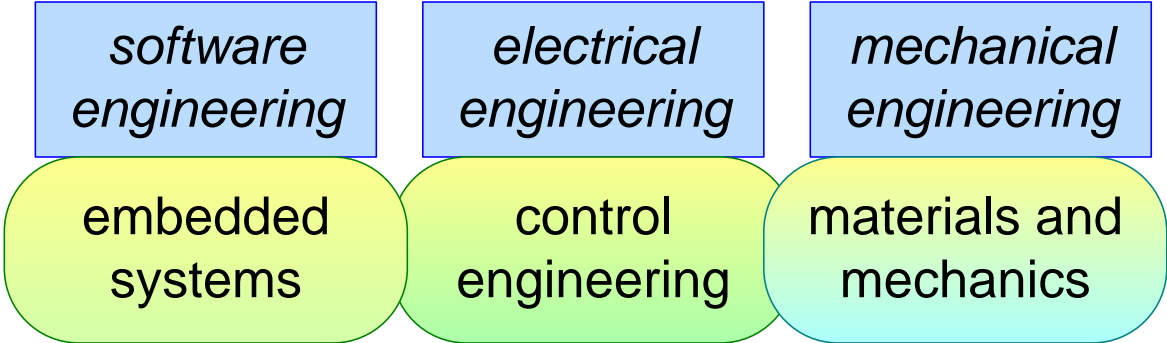
specify

design  
model, analyse,  
partition, interfaces, etc.

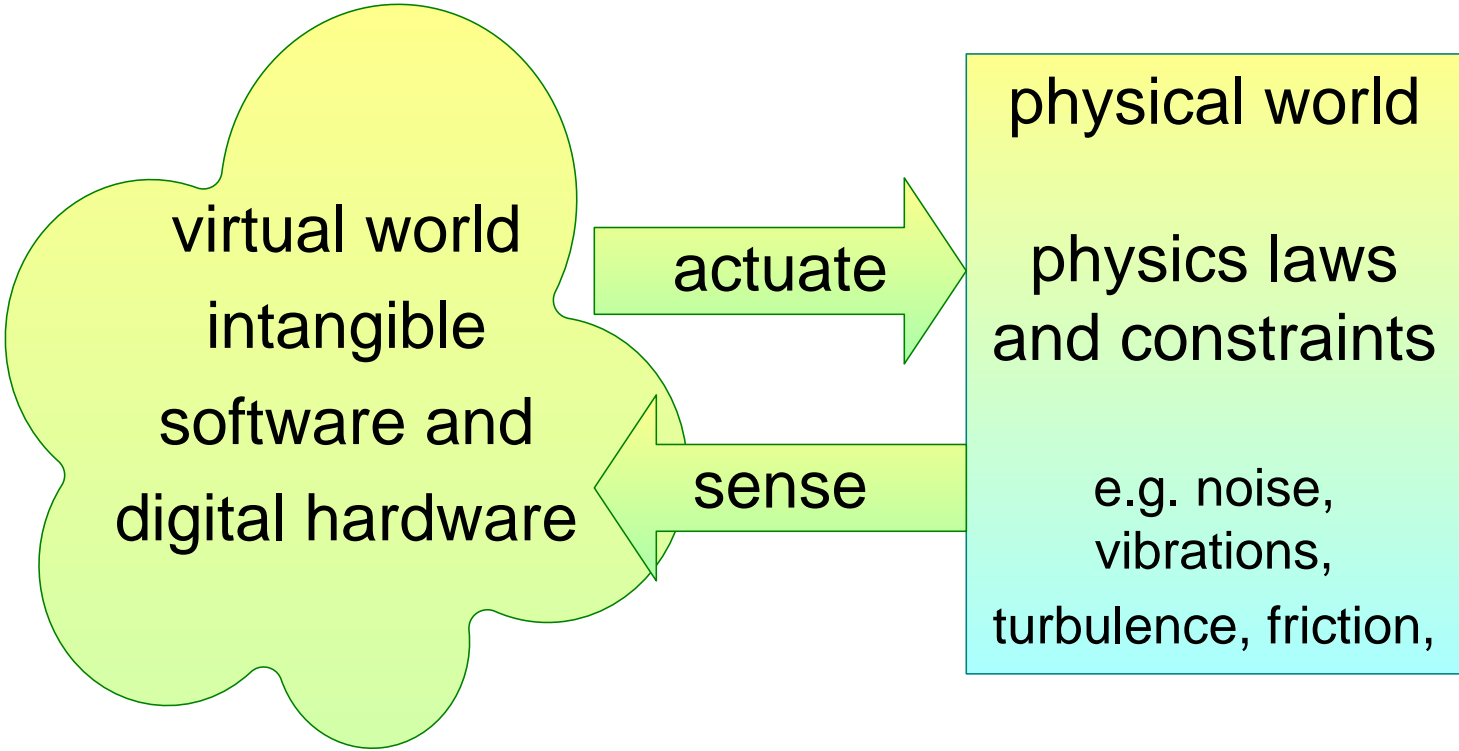
coding & CADing

testing

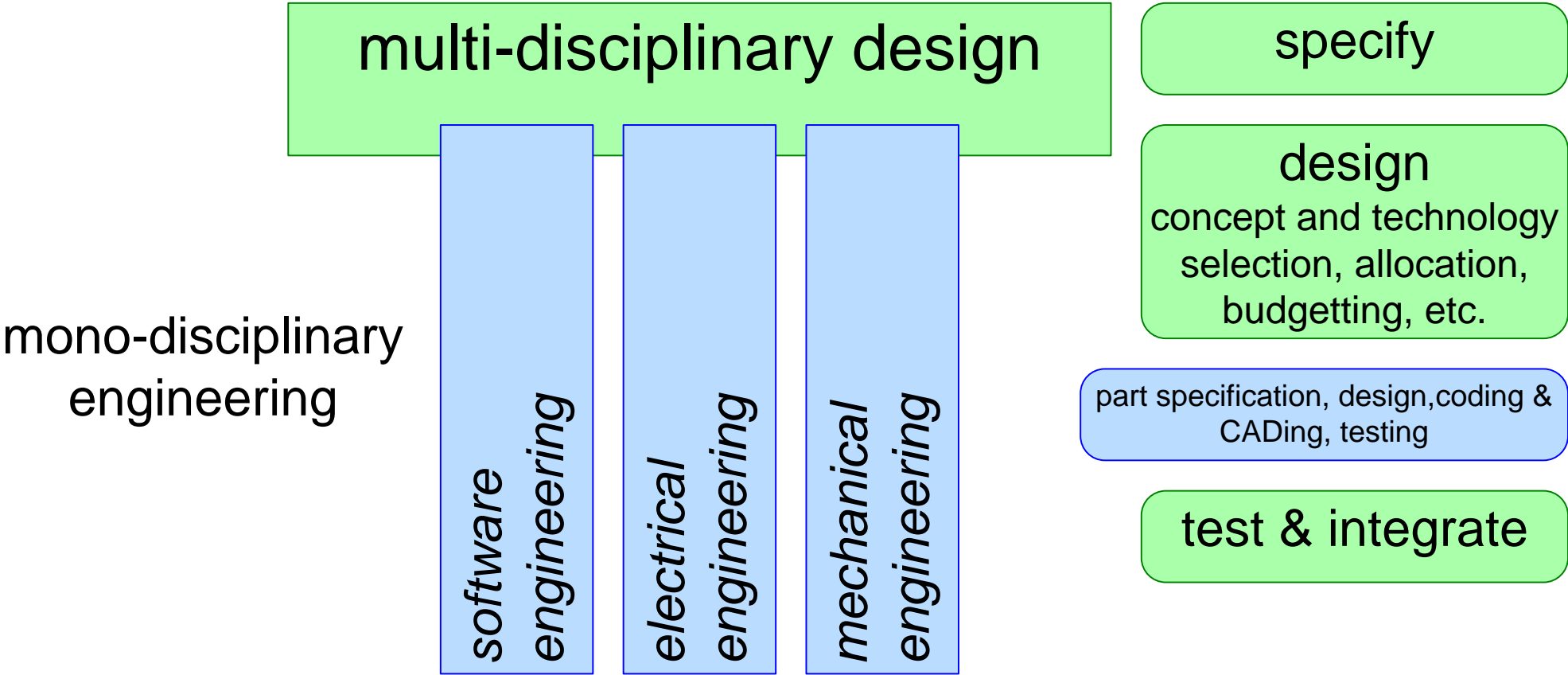
# Huge Differences in Language and Way of Thinking



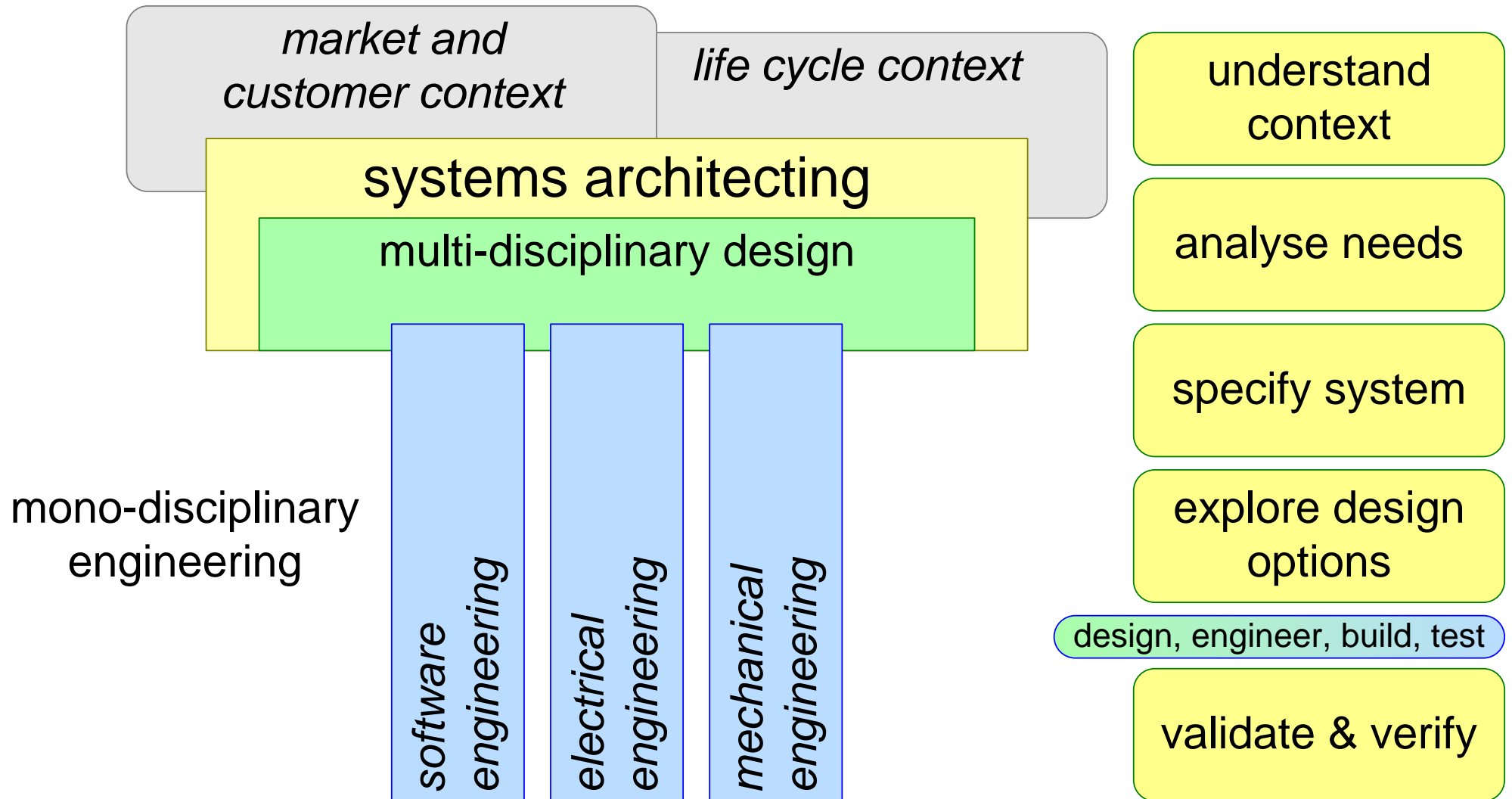
*completely different world views*



# Multi-Disciplinary Design and Engineering



# Architecting: Fit-For-Purpose



# Hierarchical Decomposition is an Ubiquitous Principle in Design

**Decomposition** is **breaking down** a **system hierarchically** to **manage**.

The decomposition provides the structure for:

- the **organization**
- the **documentation artefacts**
- the **logistics, production, and maintenance**

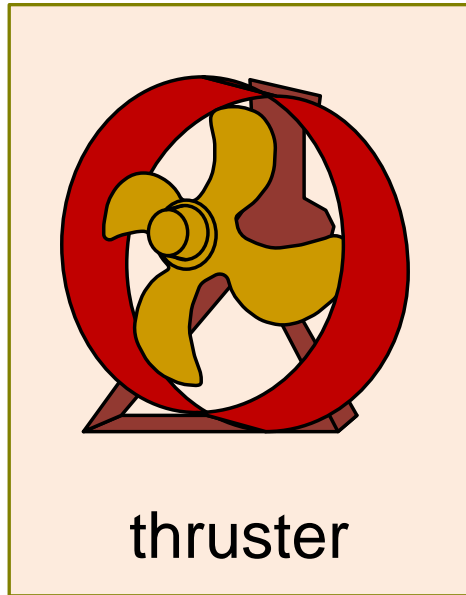
Decomposition elements are **multi-disciplinary**, until deep in the decomposition, where the decomposition elements are **mono-disciplinary**.

for later

You can decompose into **parts, functions, or quality attributes**.

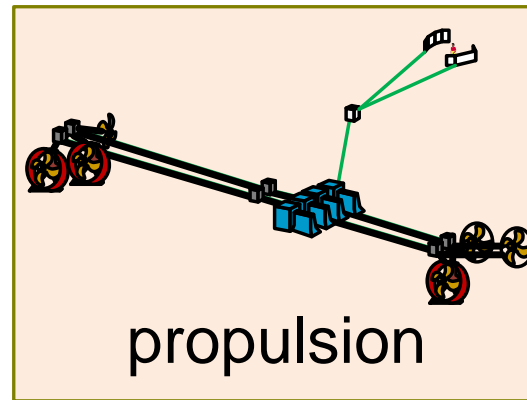
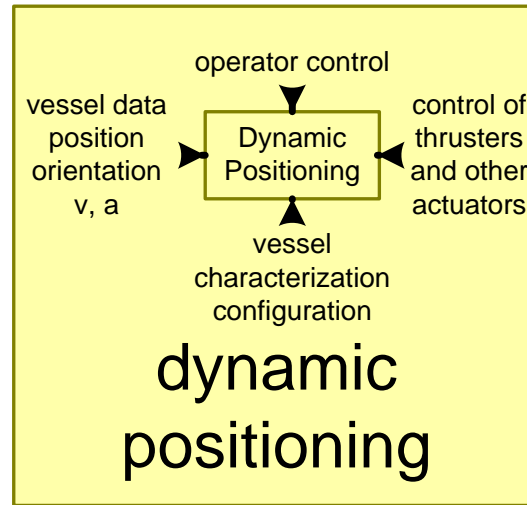
The hierarchies for **parts, functions, and quality attributes** differ.

# Example Hierarchy Offshore Support Vessel



thruster

components



propulsion

subsystems

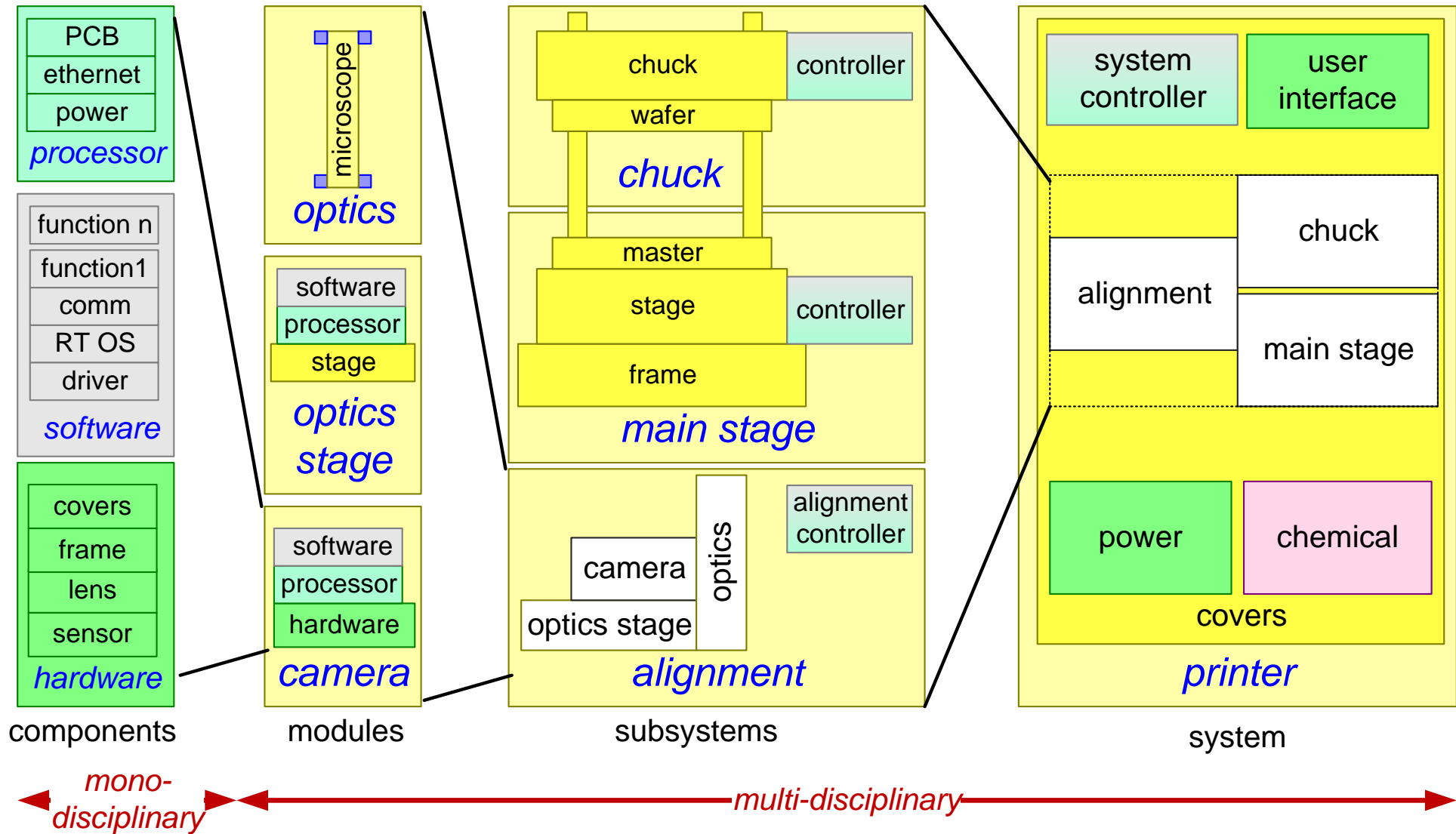


offshore support vessel

system



# Example Hierarchy Metal Printer



# The Problem Statement

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**Most stakeholders** have a **decomposition** or **parts** focus..

**Most engineers** work on a **small part** of the **system**.

They don't know the **impact** of their **design decisions** on the **system and its use**.

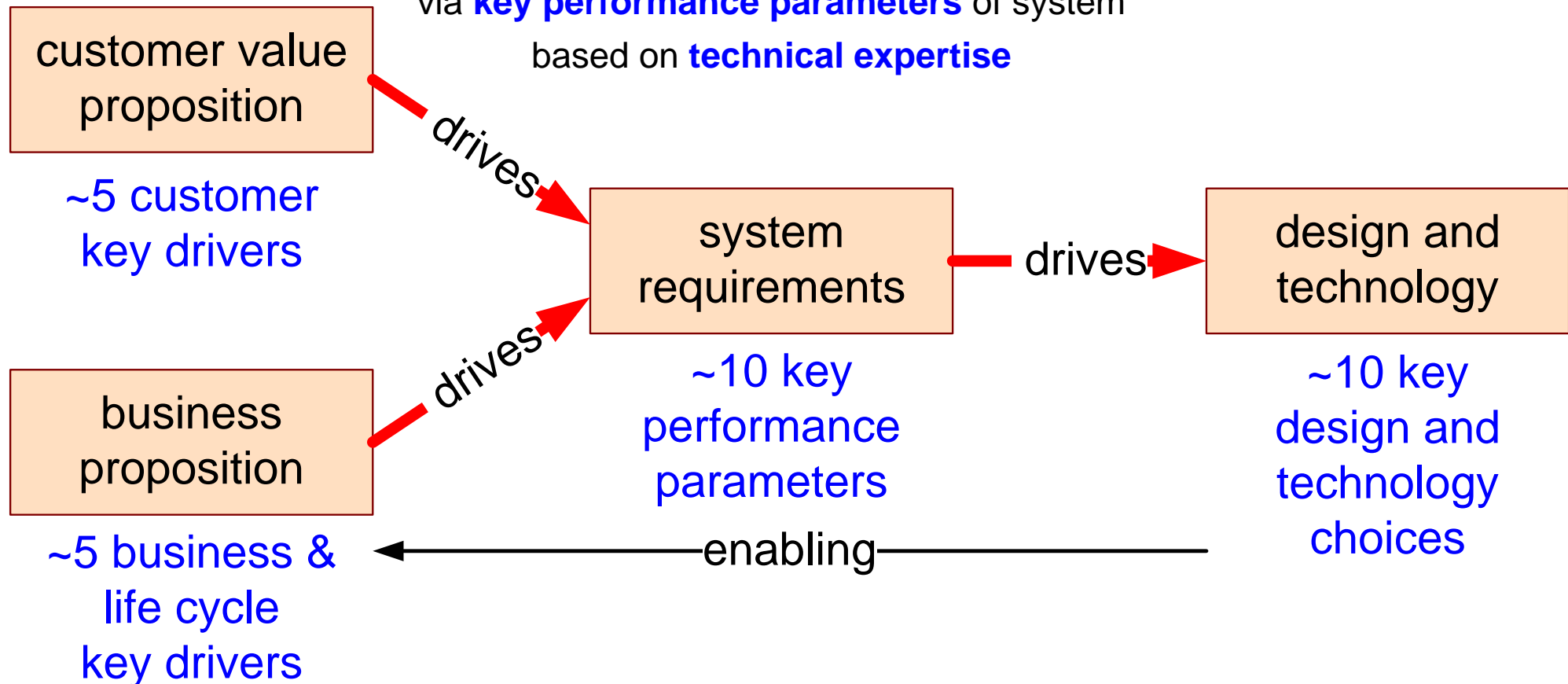
The consequence is that **system performance** may **lack** at the finish.

Missing the target causes **redesigns**, which causes **delays**, **cost overruns**, and in the end **disappointed customers**.

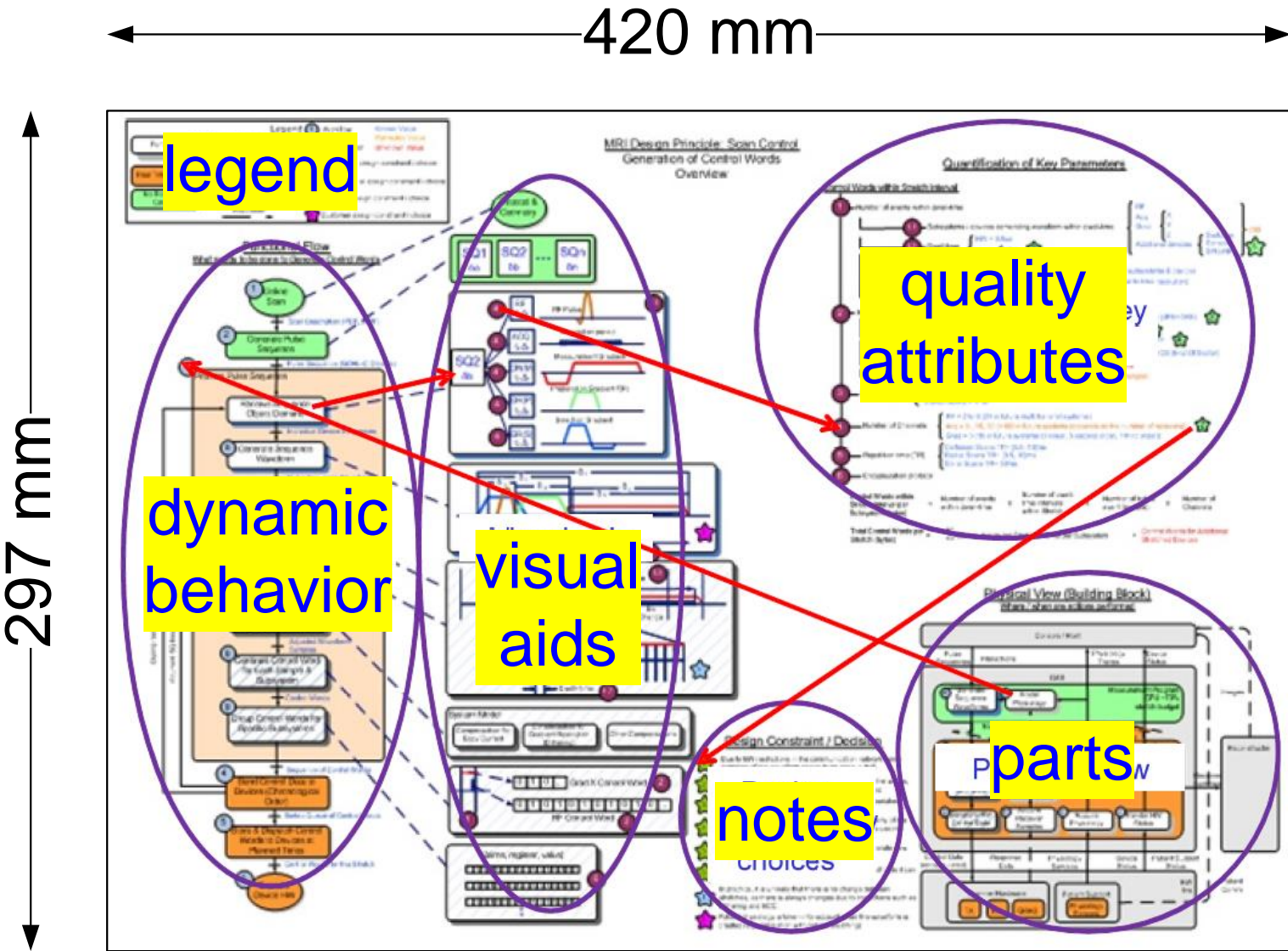
# Goal: Solutions Fit-For-Purpose

## Systems Engineering: *Fitness-For-Purpose*

Achieving **customer** and **business key drivers**  
via **key performance parameters** of system  
based on **technical expertise**



# The Solution: A3 Architecture Overviews



source: PhD thesis Daniel Borches <http://doc.utwente.nl/75284/>

A3 Space limitation → show essentials

Show multiple views:

- Parts
- Dynamic behavior
- Quality attributes (and quantify!)

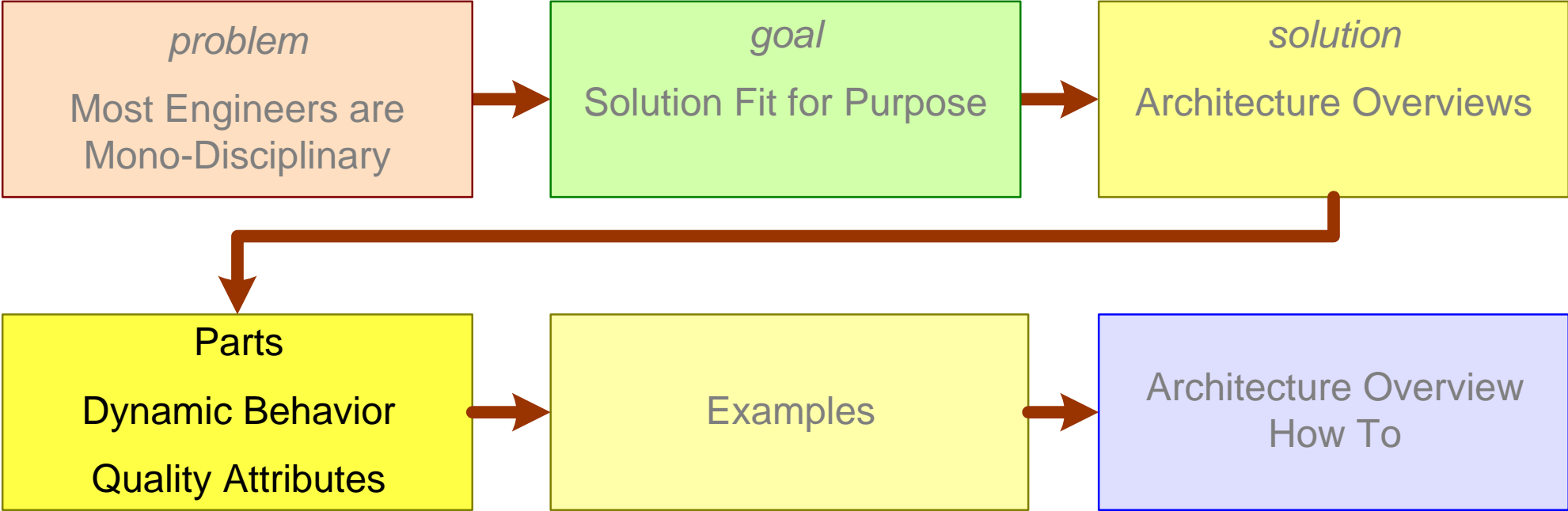
Visualize

- Use visual aids

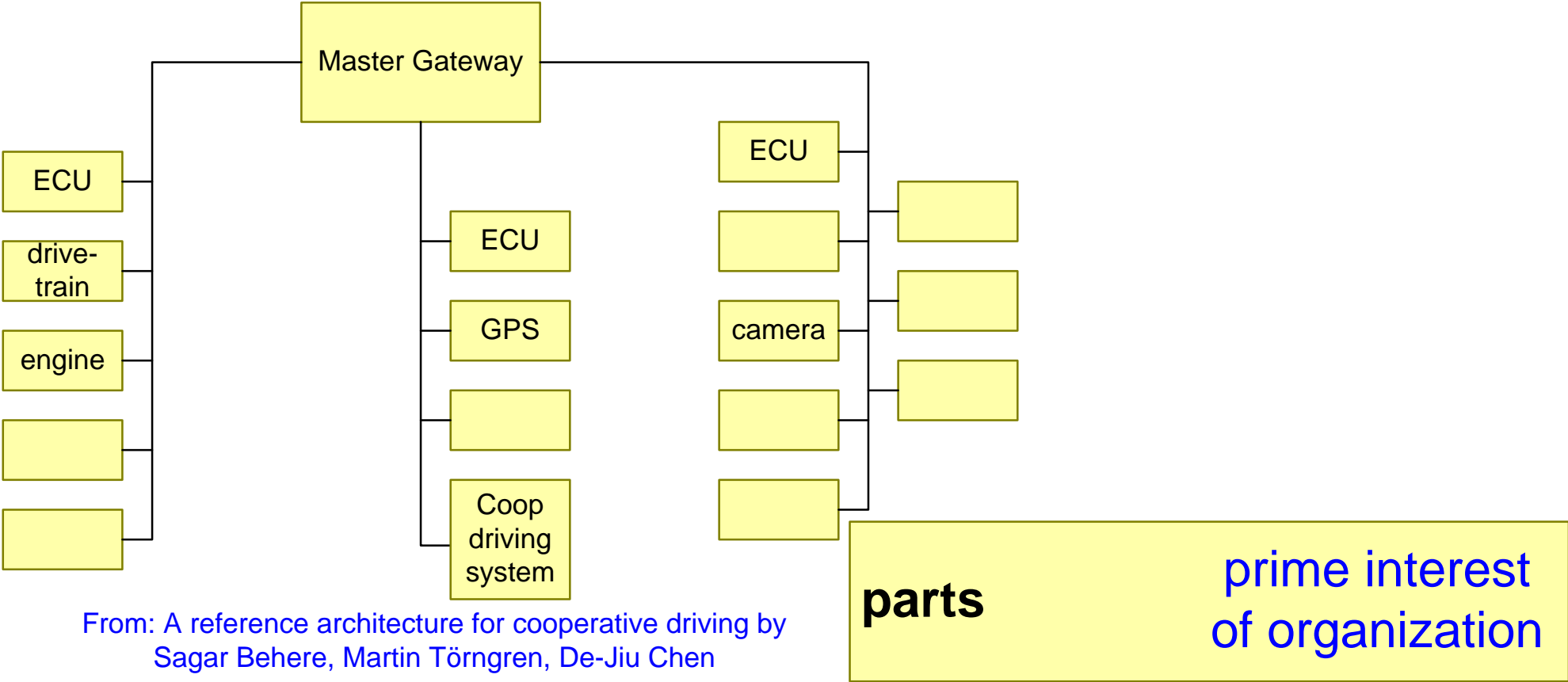
Structure of A3s:

- multiple abstraction levels

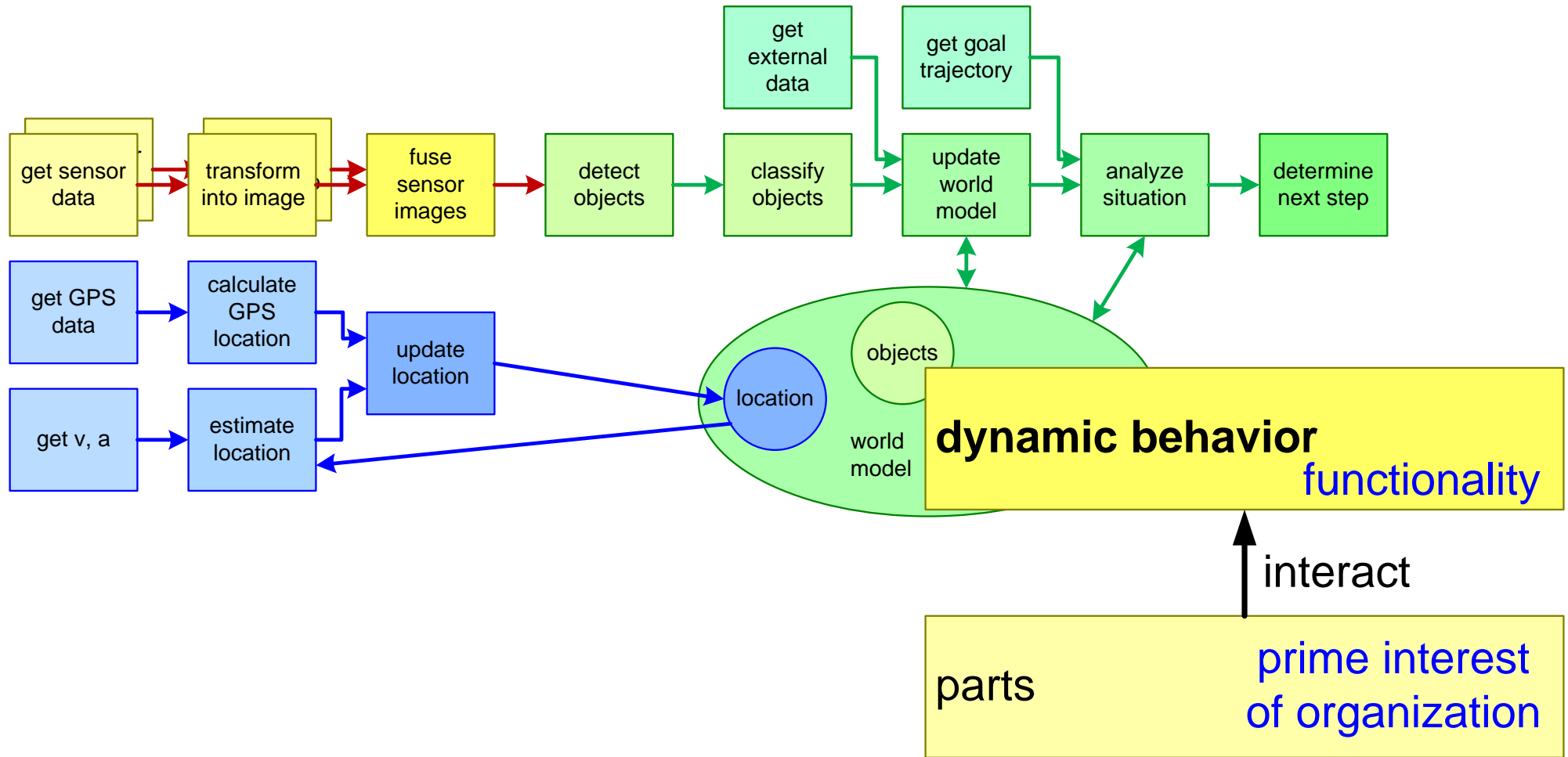
# Parts + Dynamic Behavior + Quality Attributes



# Dominating Mindset: Parts (static)



# Interaction Causing Emerging Dynamic Behavior

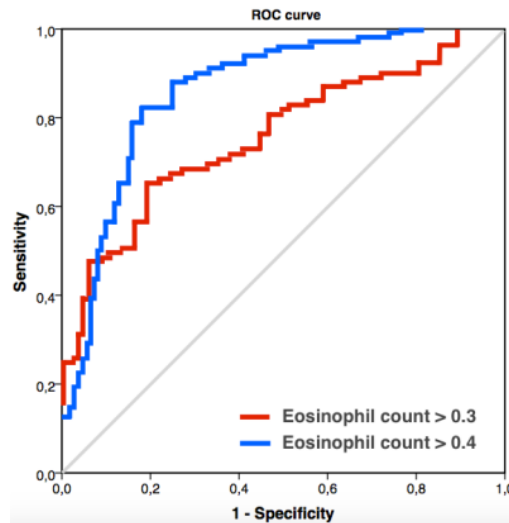




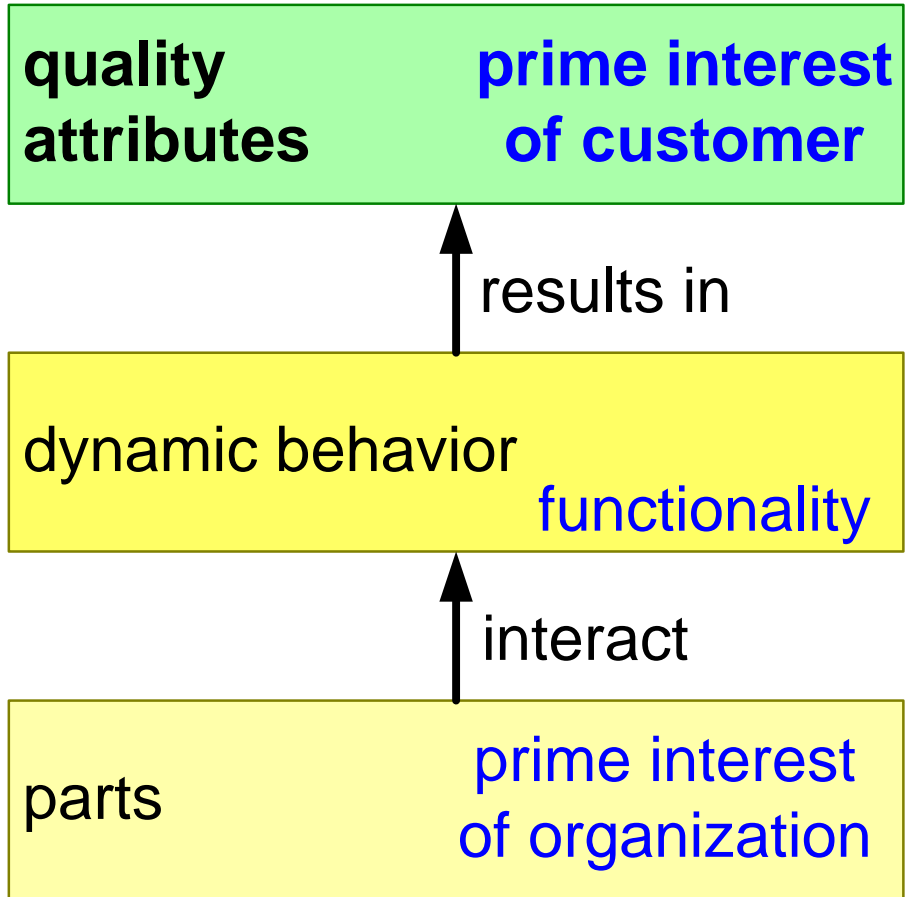
# Prime Customer Interest: Key Performance

- Throughput
- Response Time
- Accuracy
- Image Quality
- Reliability
- Safety
- Security
- Sensitivity**
- Specificity**
- ...

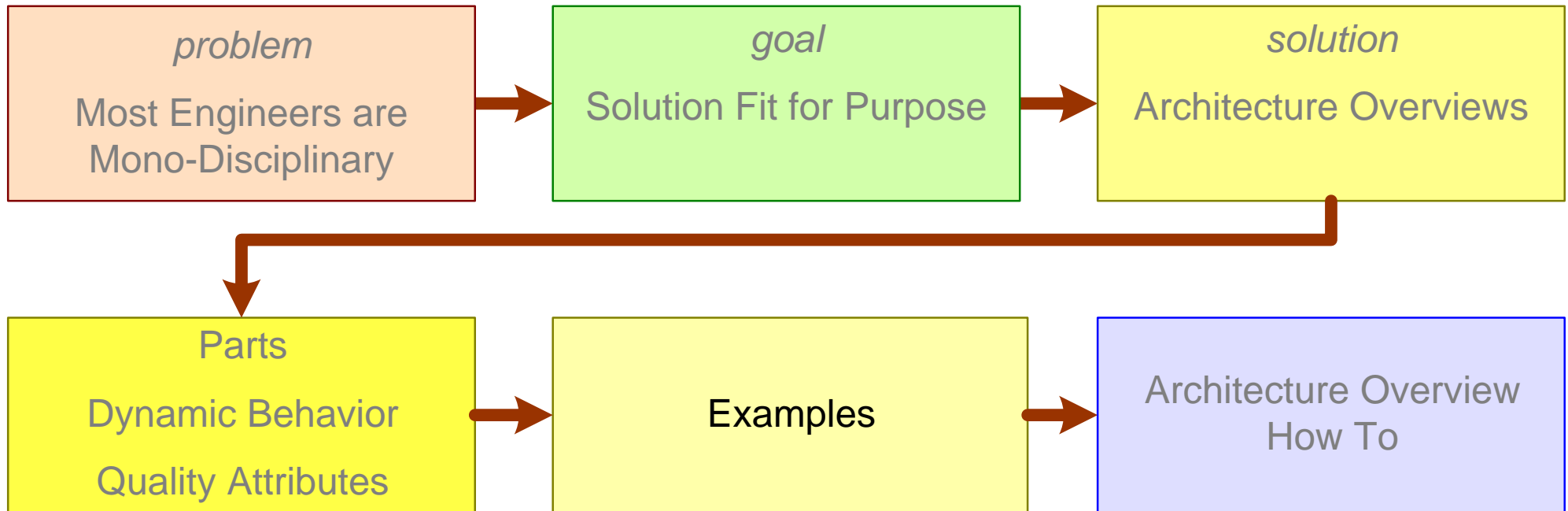
**prime system  
responsibility**



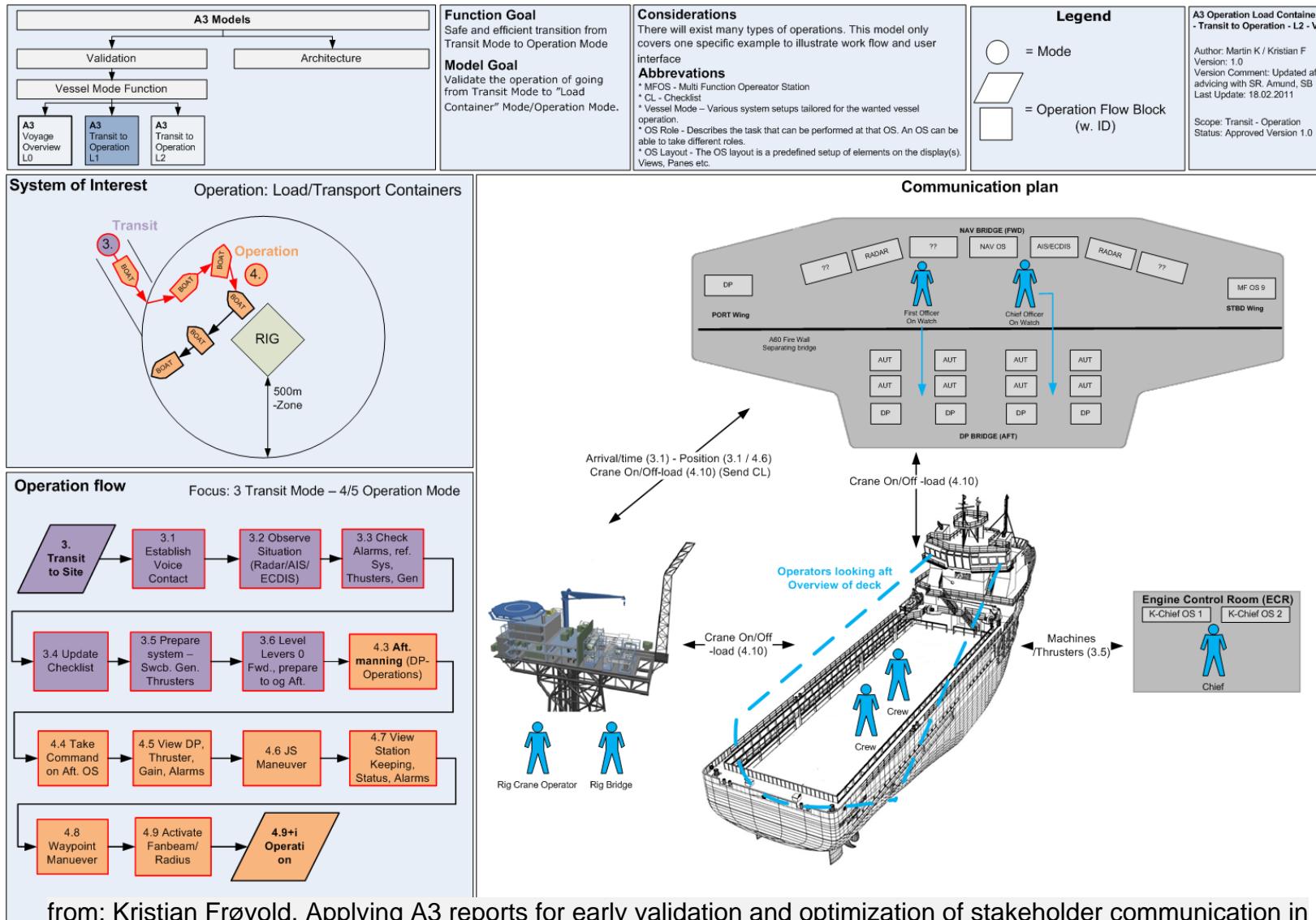
eNose Sensitivity vs Specificity from:  
<https://www.breathcloud.org/wp-content/uploads/2017/07/Poster-ERS-2016.pdf>



# Examples of Architecture Overviews



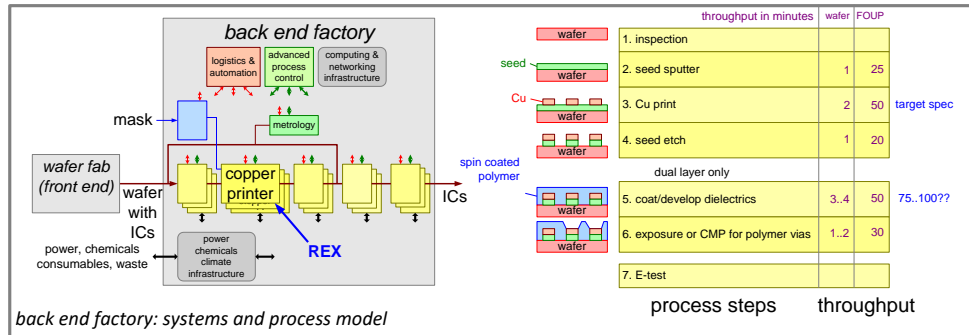
# Example A3 "Transit to Operation"



from: Kristian Frøvd, Applying A3 reports for early validation and optimization of stakeholder communication in development projects, INCOSE 2017 in Adelaide, Australia [http://gaudisite.nl/INCOSE2017\\_Frovold\\_A3.pdf](http://gaudisite.nl/INCOSE2017_Frovold_A3.pdf)

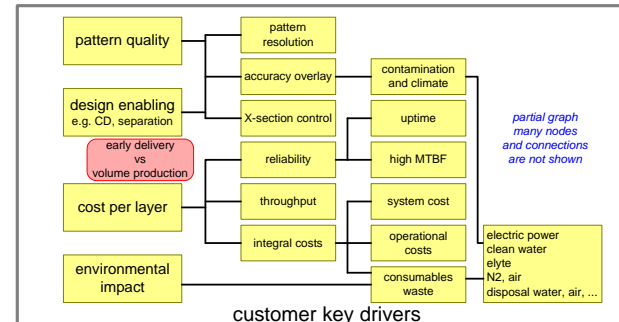
# Example Metal Printer

## Replisaurus: A3 architecture overview of the Copper Printer



back end factory: systems and process model

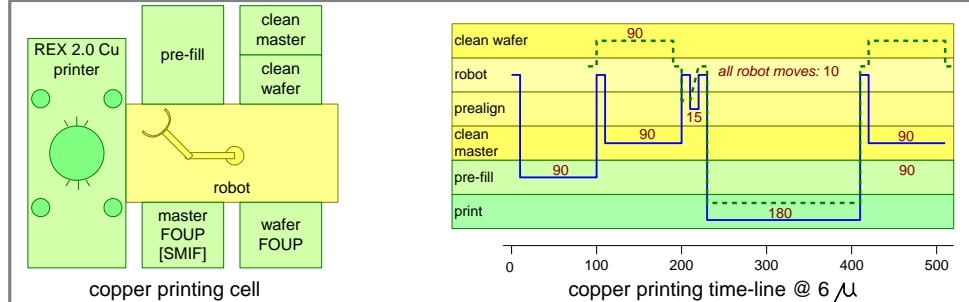
author Gerrit Muller scope system and supersystem  
 version 0.2 status preliminary draft  
 date last update September 2, 2010  
 Document meta-information



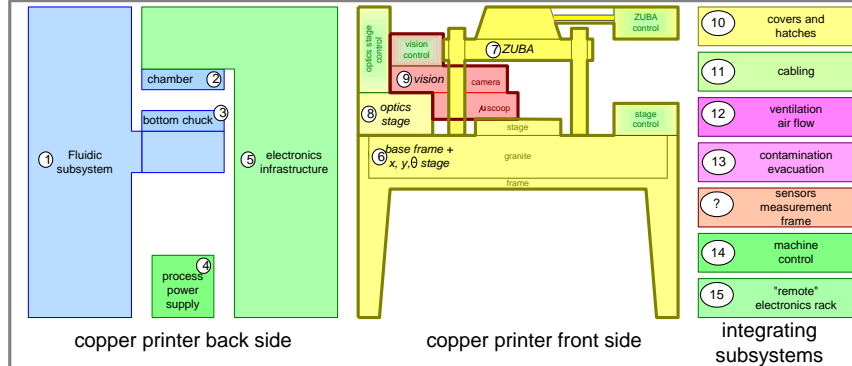
**customer key drivers**

Process Confinement Prevent electrolyte or fumes from contaminating system  
 Provide process mini-environment with clean air  
 Alignment accuracy < 250nm @ 3s, 200/300mm wafers  
 Cycle time Alignment cycle <10s, Print cycle <3min (6um thick Cu)  
 Down-force on wafer stage Up to 35,000 N print force with 300mm wafers  
 Module footprint < 1500 x 1000mm for 200/300mm modules  
 Cost Compatible with CoO levels for top IC layers

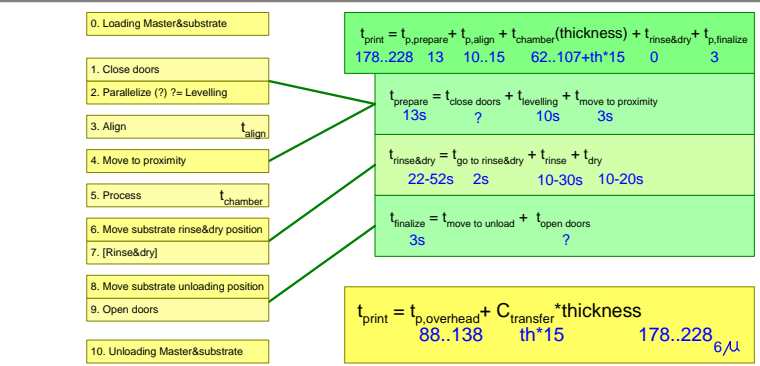
key performance parameters  
 Customer key drivers and Key Performance Parameters



copper printing cell: systems and performance model



copper printer subsystems, functions, and cycle time model



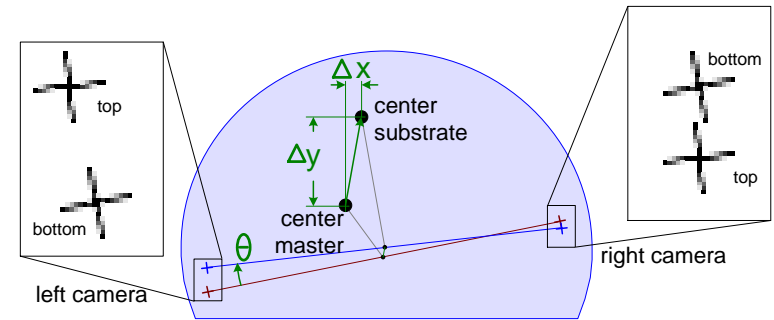
copper printer functional flow  
 formula print cycle time

# Example Metal Printer Alignment

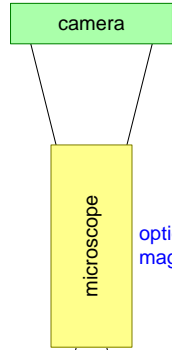
requires microscopes to be  $\varphi_x$  and  $\varphi_y$  corrected

1. move microscopes to markers
2. focus master by lens movement
3. focus substrate by lens movement
4. acquire images
5. find markers
6. compute marker centers
7. compute wafer centers and  $\theta$
8. move master  $\Delta x, \Delta y, \theta$
9. repeat 4..8 to verify alignment
10. remove microscopes

assumes marker position to be known coarsely and markers to be within microscope FOV



measurement accuracy determines required resolution

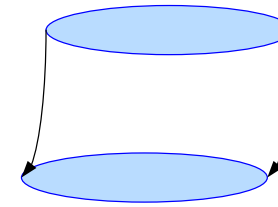


#pixels  $\approx$  5M  
pixel resolution versus maximum Field of View read-out and processing time

optical resolution magnification

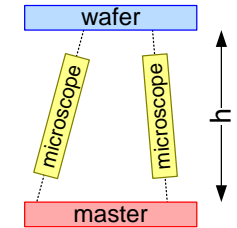
displacement determines required Field of View

1<sup>st</sup> order  
ZuBa move imperfect  
Microscope not perfectly vertical



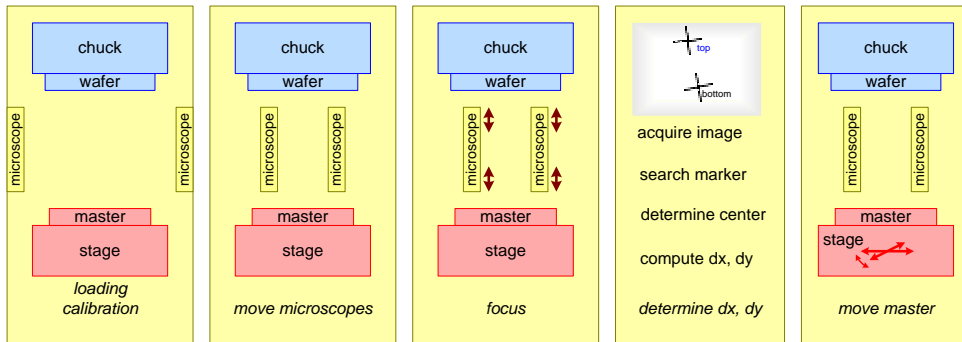
vertical move causes some translation and rotation causing

$$(dx, dy)_{left} \quad (dx, dy)_{right}$$



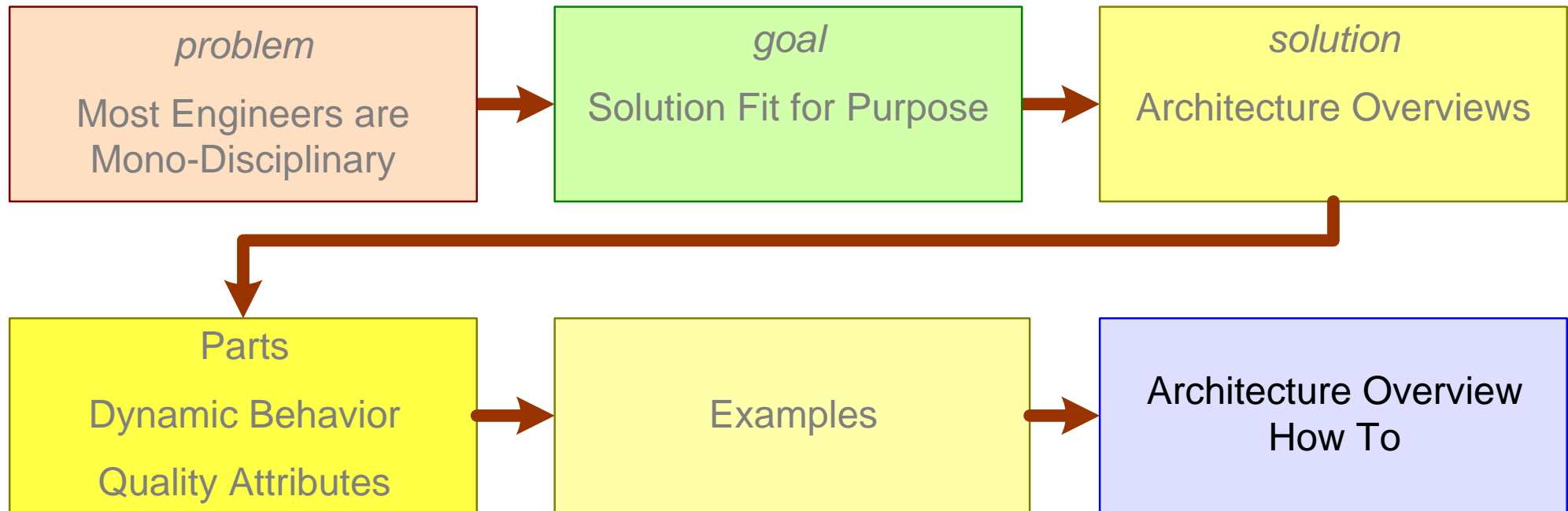
imperfect vertical axis causes dx, dy offsets

$$dx = \varphi_x * h$$



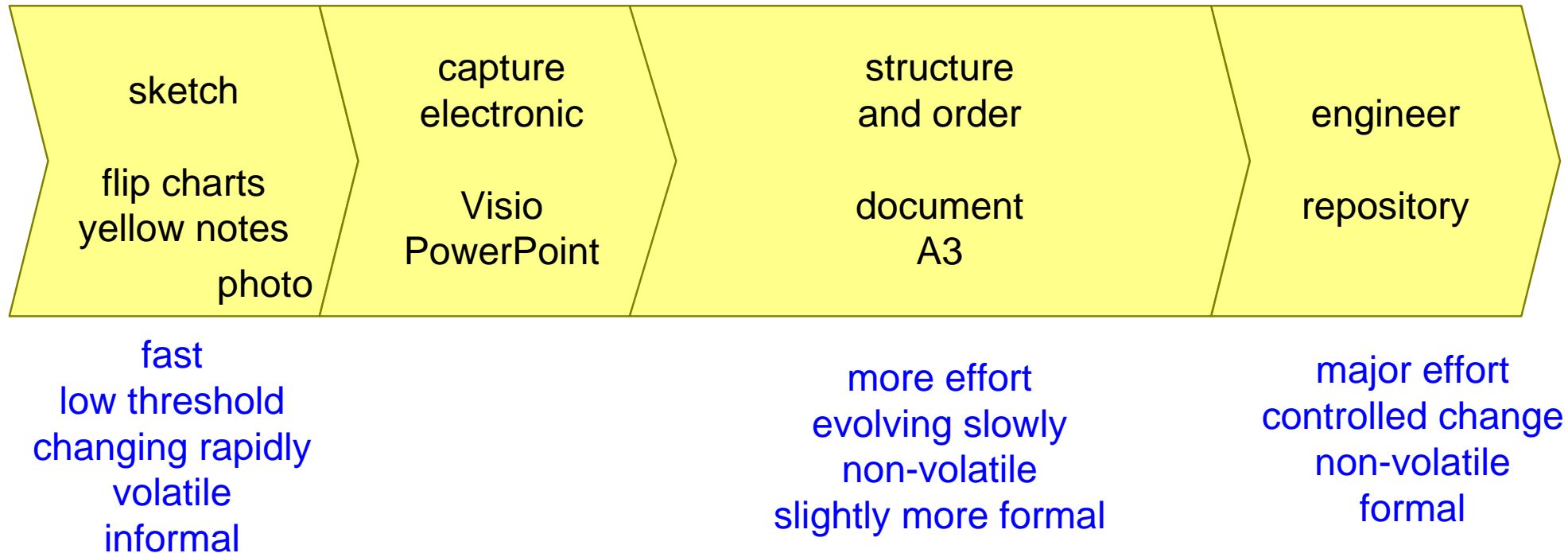
# Architecture Overview How To

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# Start Collectively on Paper

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# Keep Sketching, Use Time Boxes, and Iterate!

