Lean Architecting, the Way of the Future?

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Abstract

There are different schools in Systems Engineering (SE), such as the conventional SE in the military and Aerospace domain, agile SE, and Lean Product Development. These different schools have very different approaches towards architecting. In this paper we try to combine the best of these different schools: Lean Architecting. The core idea is to document architecture knowledge in digestable chunks, where several views are visualized at once in a coherent way.

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status: preliminary draft
version: 0

logo TBD

Figure Of Contents™

3 (of many) Schools of Systems Engineering

"conventional"
Systems Engineering

control by
process and artifacts

defense and
aerospace

"agile"
Systems Engineering
EVO, XP, SCRUM, ...

early and continuous
feedback

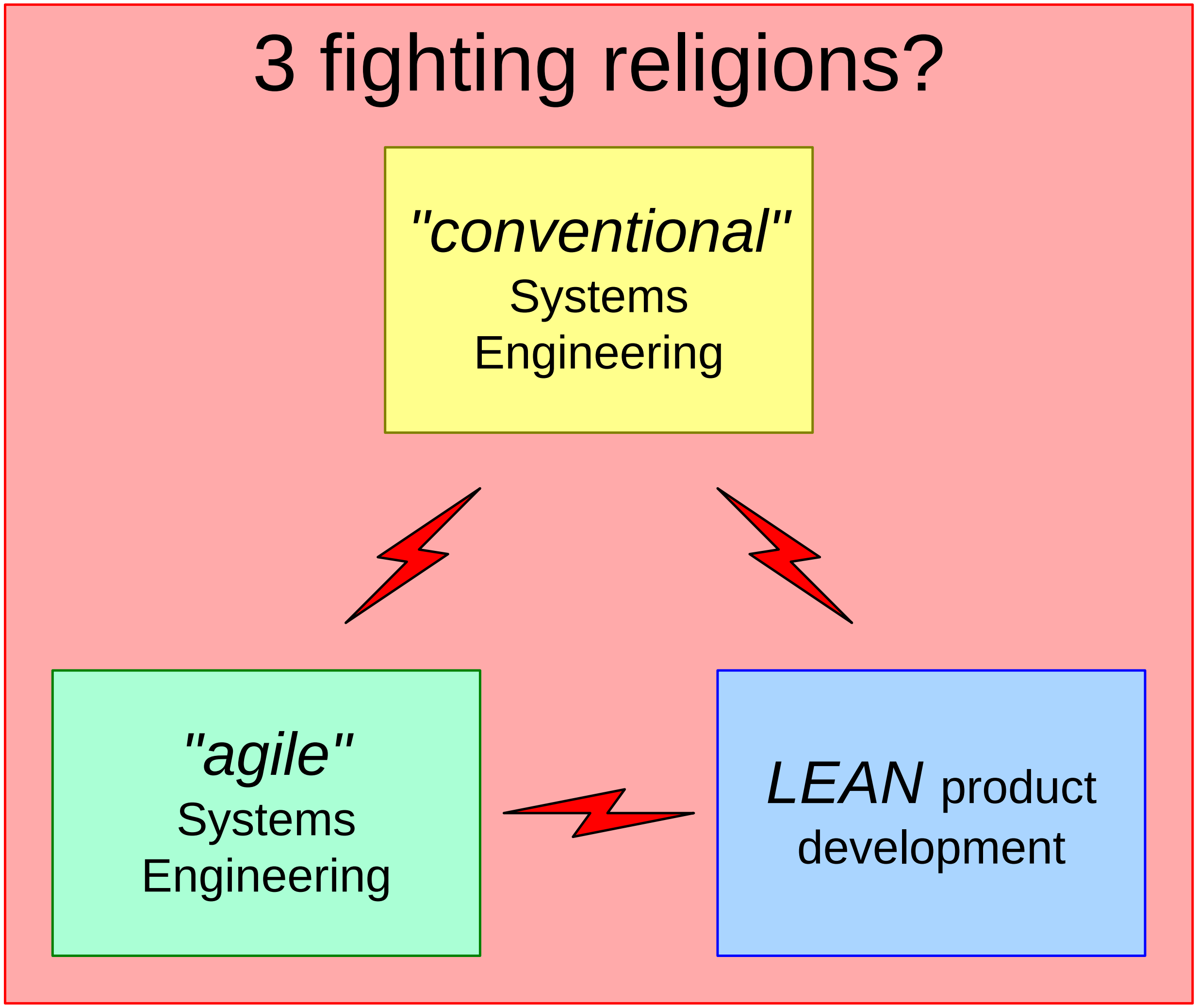
IT

LEAN product
development

avoid waste

automotive, Toyota

Differentiation or Complementing



or 3 sets of complementary principles?

+ control

+ feedback

+ avoid waste

3 schools in Systems Engineering

case: MRI scanner

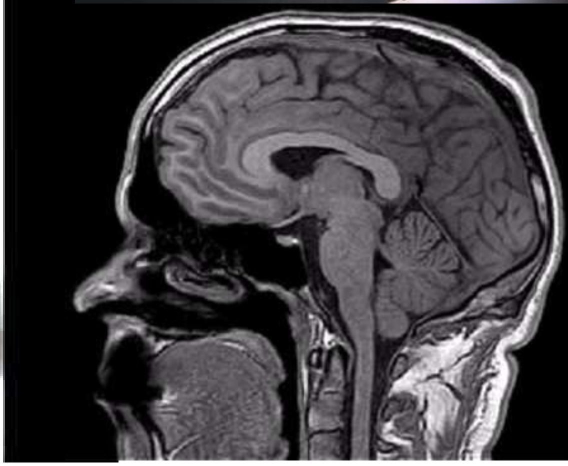
Engineering, Designing, Architecting

design handbook

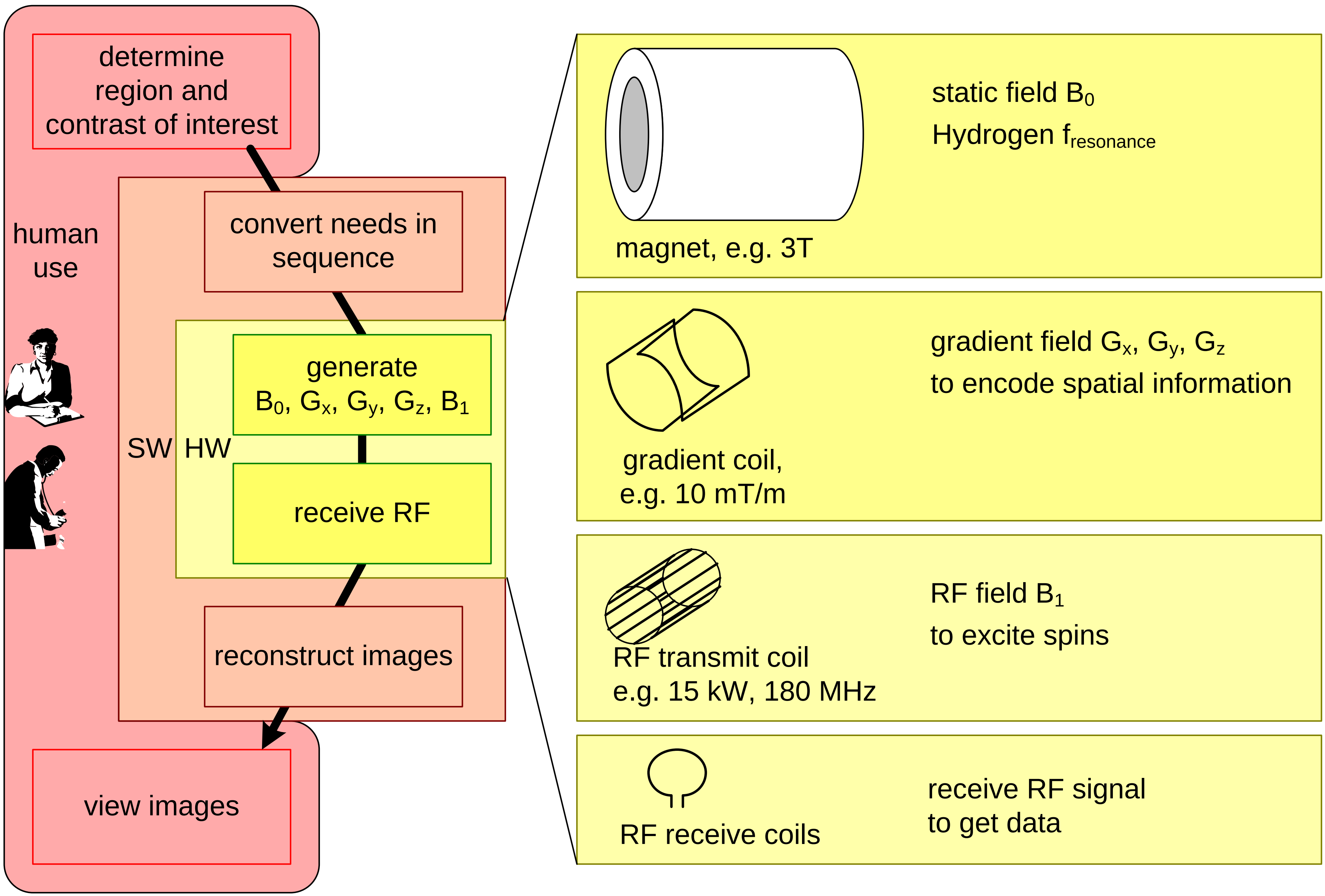
Darwin project: A3 architecting

conclusion: Lean Architecting

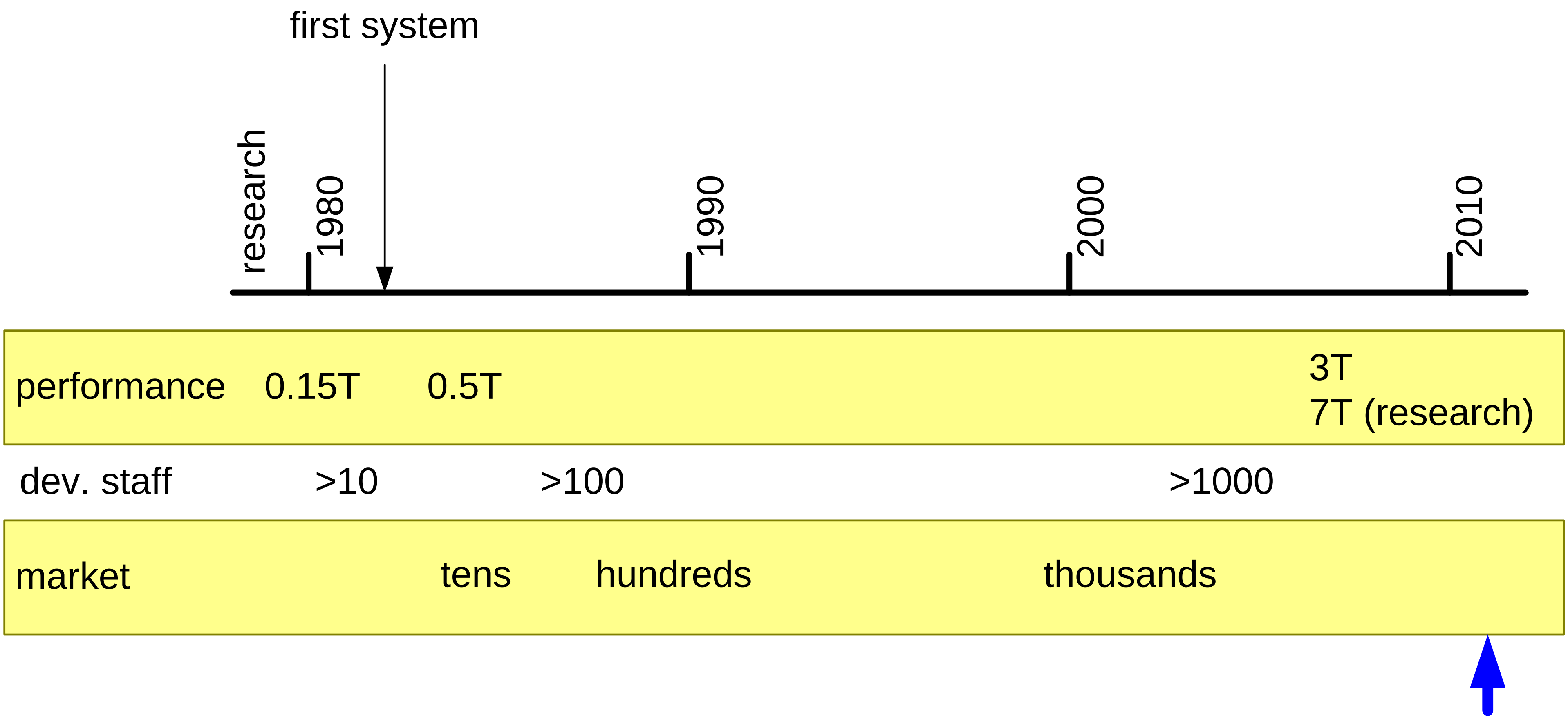
Case: Magnetic Resonance Imaging (MRI)



MRI Basic Principles



MRI History



How much knowledge has been accumulated (implicitly)?

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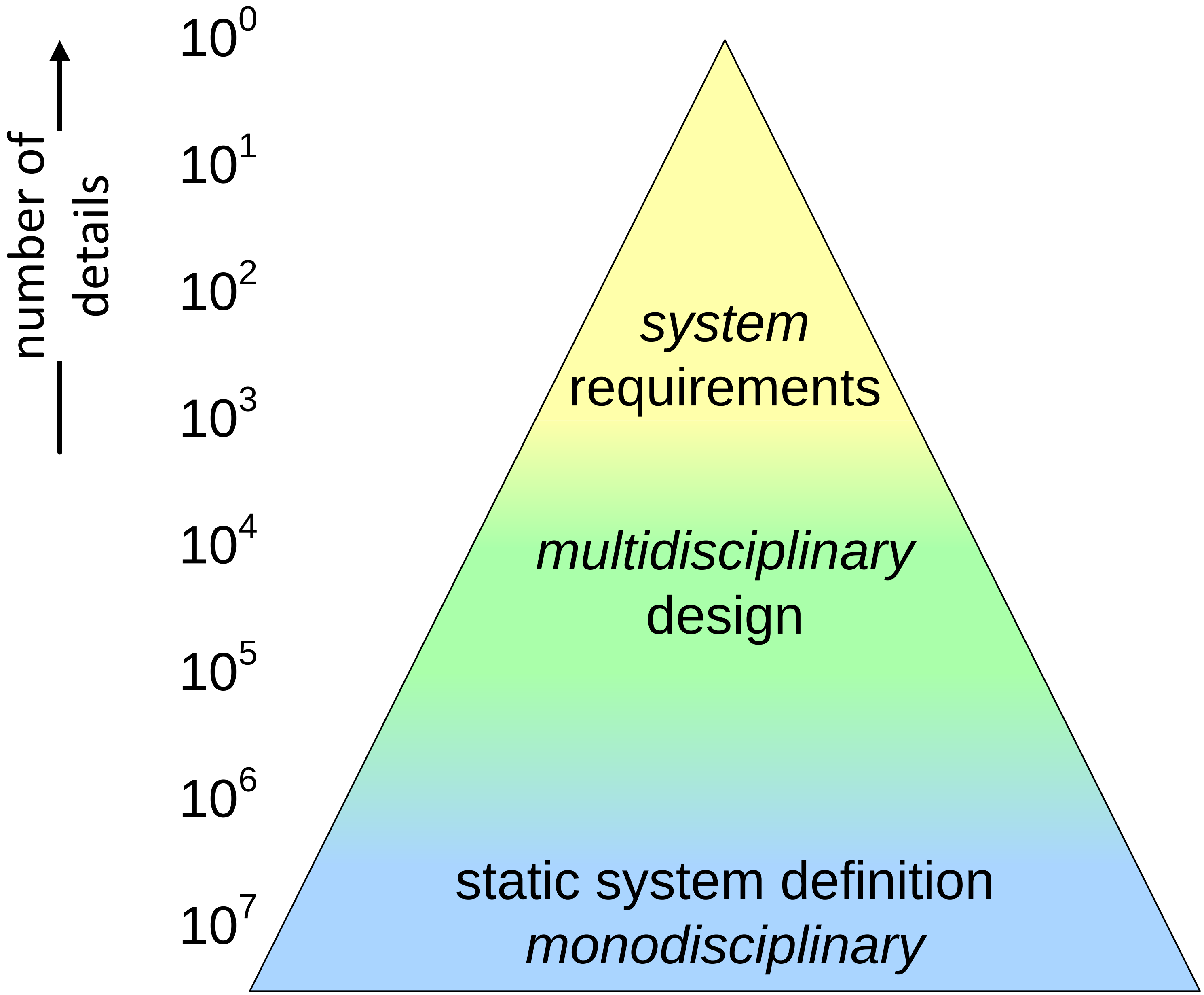
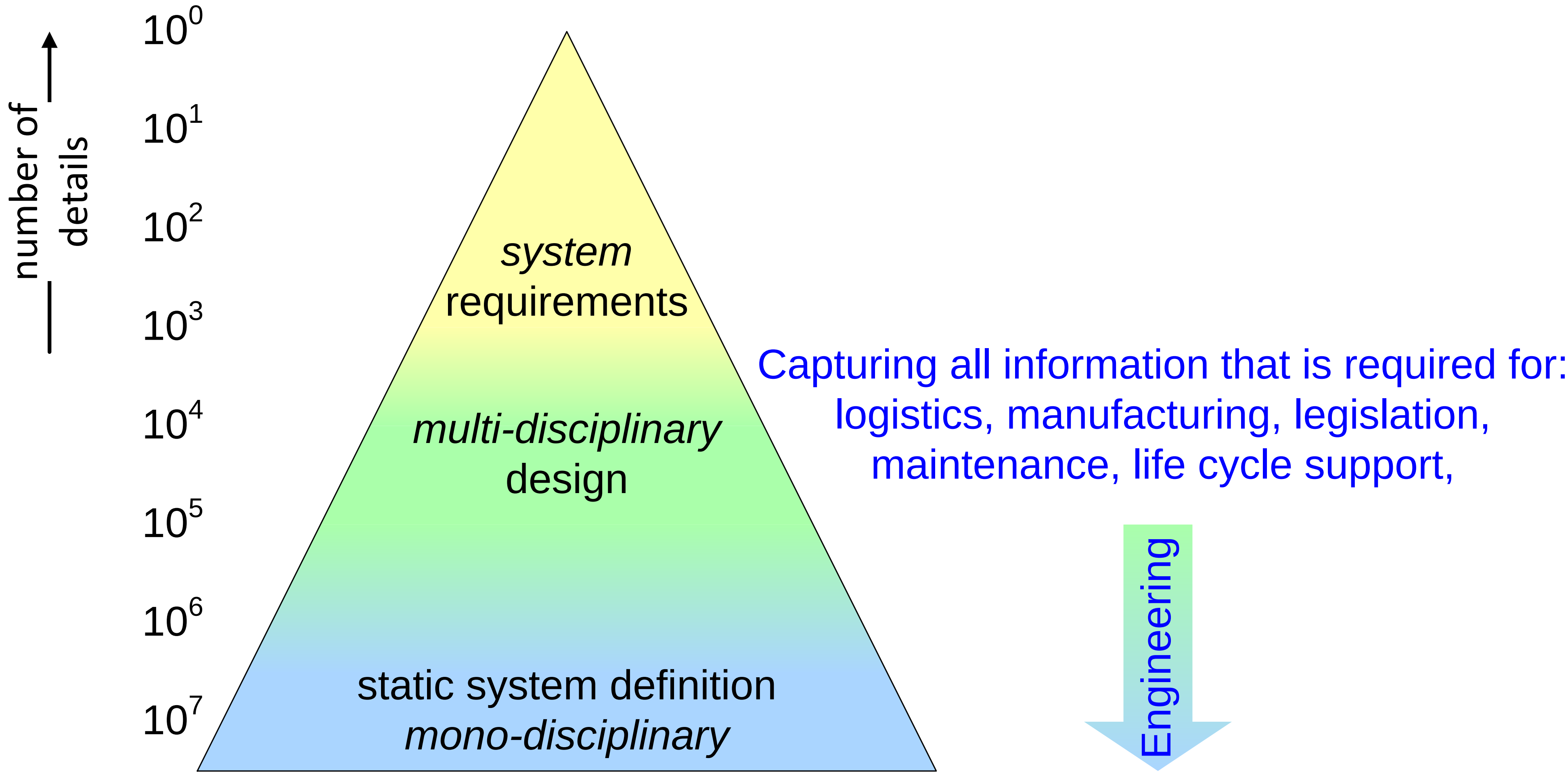
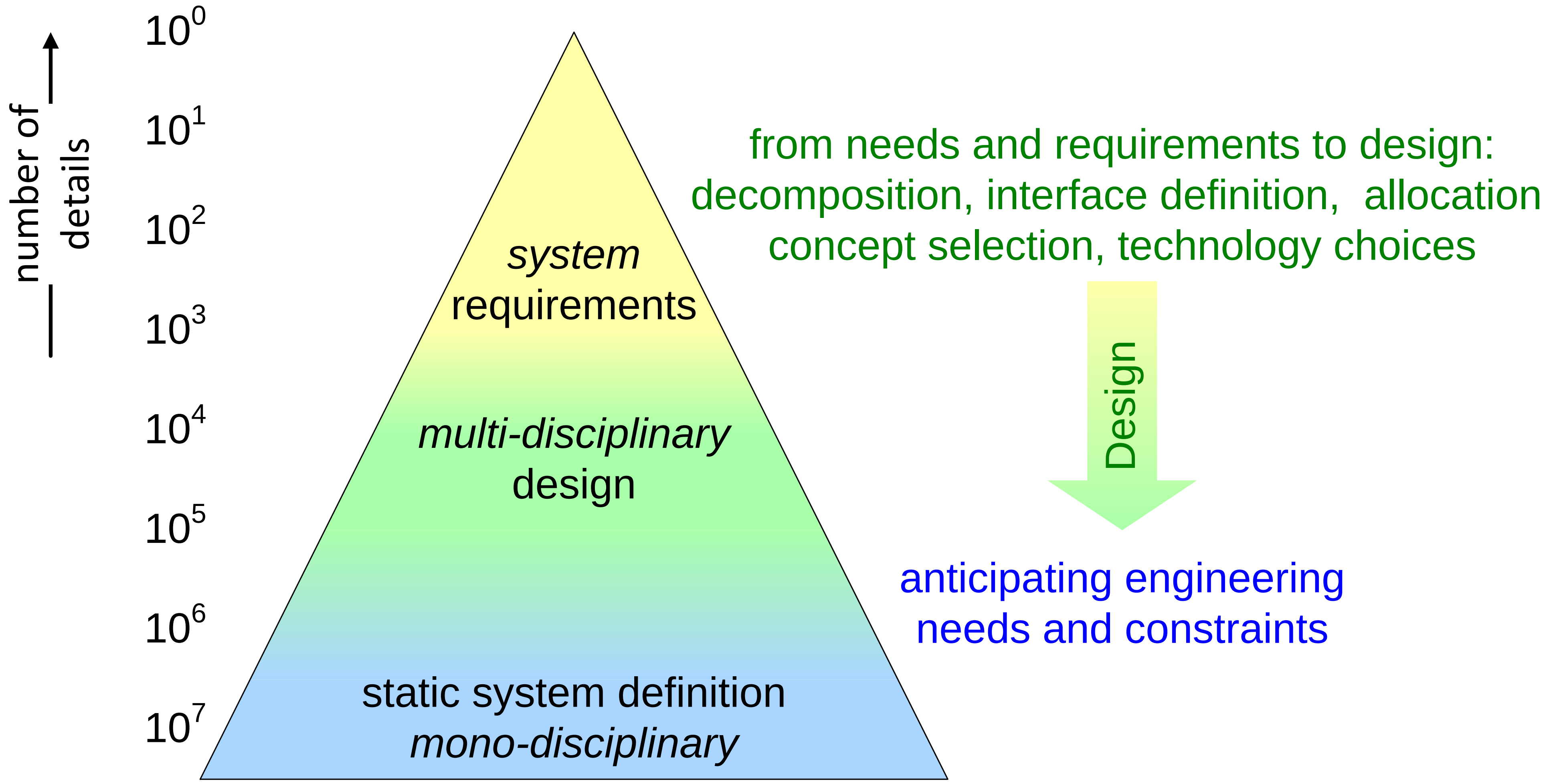
Level of Abstraction Single System



Engineering

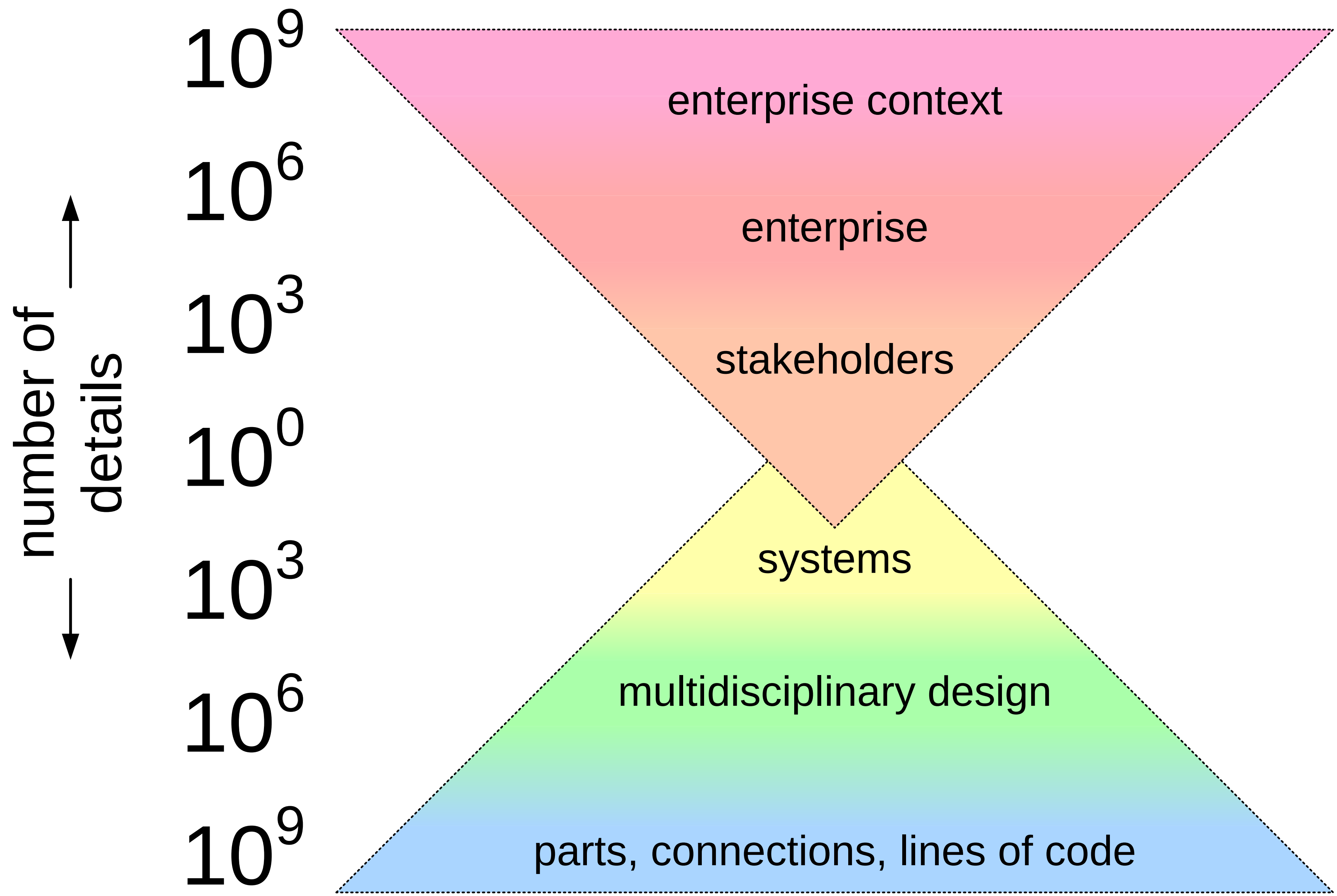


Design

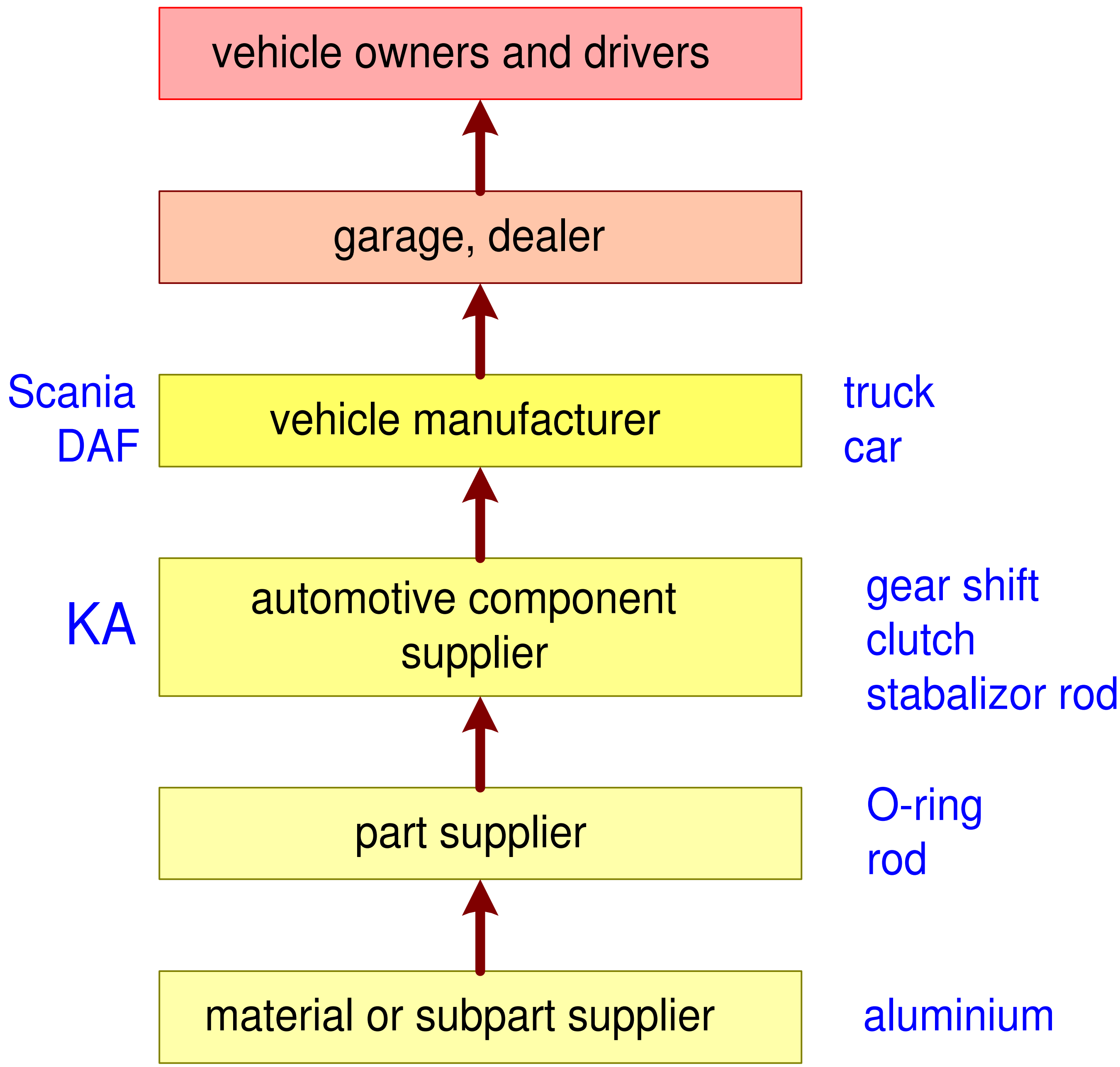


number of details
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7
system requirements
multi-disciplinary design
static system definition *mono-disciplinary*
from needs and requirements to design: decomposition, interface definition, allocation, concept selection, technology choices
Design
anticipating engineering needs and constraints

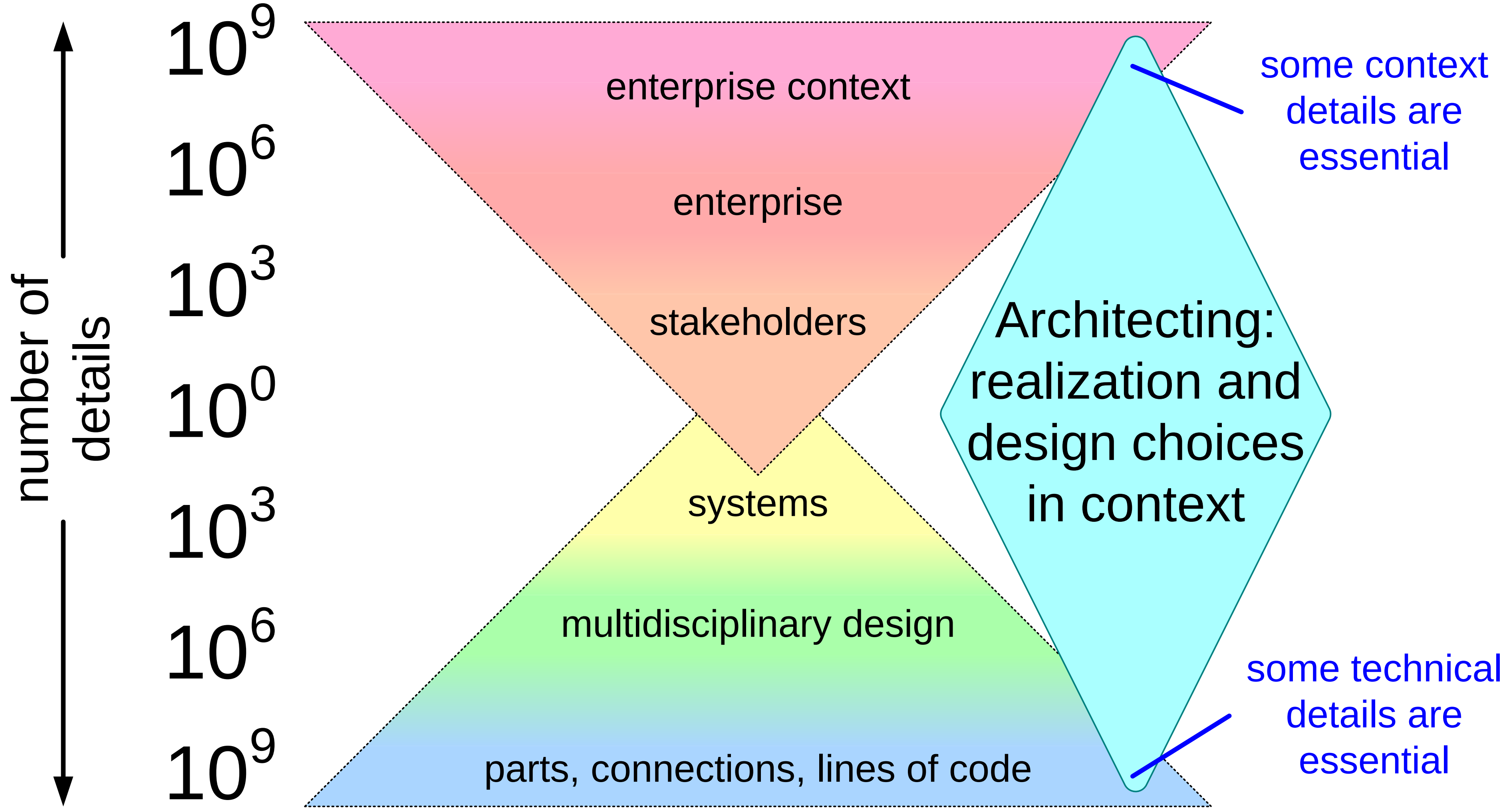
Product Family in Context



Example from Automotive



Architecting



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The Design Handbook Idea

Toyota:

+ let experts capture their expertise

+ in such way that fits their mental model

+ compact and digestable:

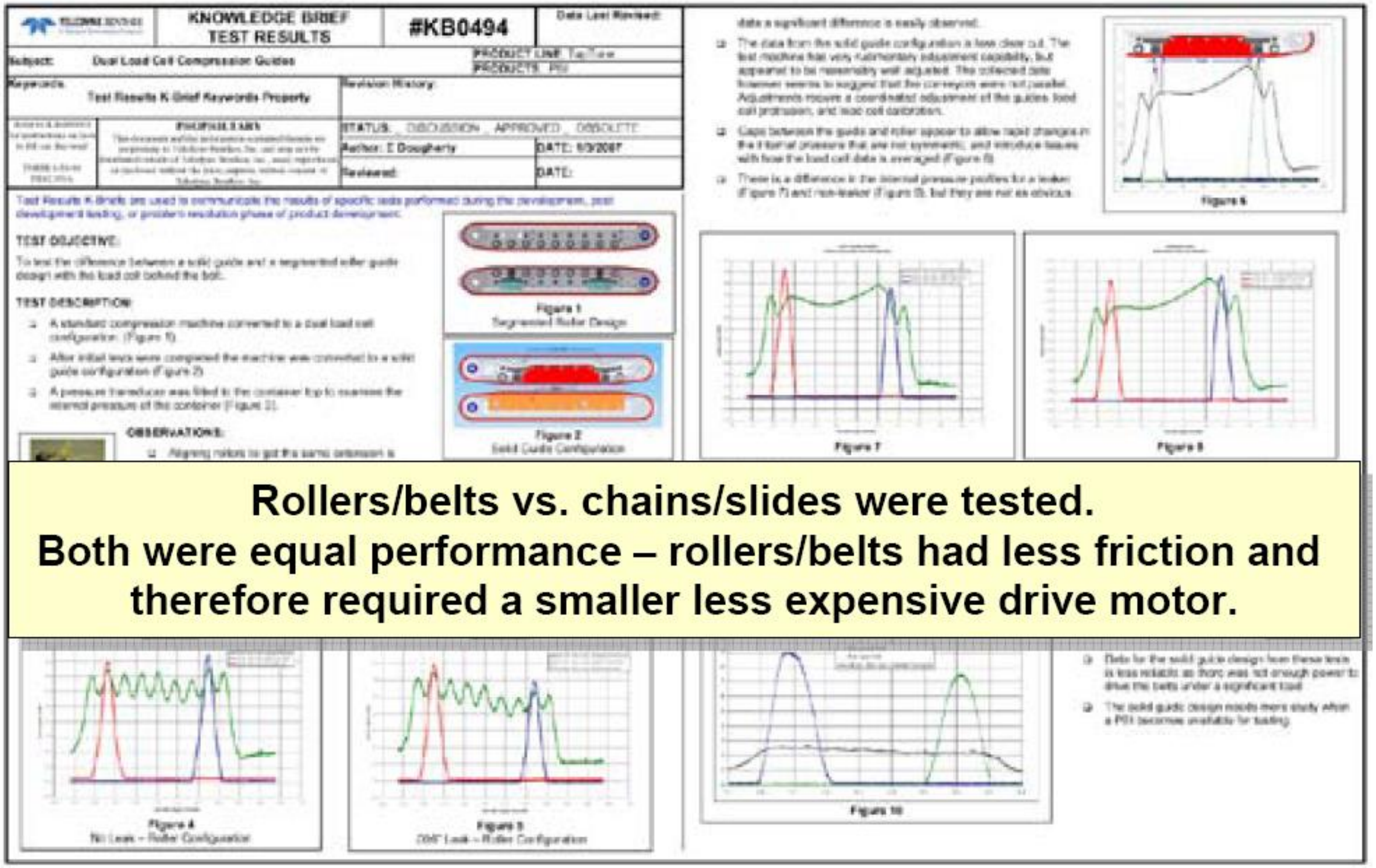
→ A3 format

+ the collection of A3's is a design handbook

+ practical, low overhead

Example of Capturing Design Knowledge

Knowledge Based Design – Case Study



source: Ron Marsiglio
www.lppde.org/conferences/2008-presentations/2008RonMarsiglio.pdf

TELEDYNE BENTHOS 25

- 3 schools in Systems Engineering
- case: MRI scanner
- Engineering, Designing, Architecting
- design handbook
- **Darwin project: A3 architecting**
- conclusion: Lean Architecting

High Level Problem Statement

Installed Base Business

Life Cycle Management

costly
high effort

diversity and # of configurations

Development efficiency

costly
high effort
too late

Innovation rate

too low
too late

see next slides

Darwin Project Goal

scientifically sound
suitable for PhD

based on modeling and
Reference Architectures

specific methods, techniques and patterns

faster to market
less effort
more predictable

to improve the evolvability

market response
to *anticipated* and
unexpected changes

very relevant for MR
also relevant for others
(partially) validated

of product families

diverse products
installed base diversity

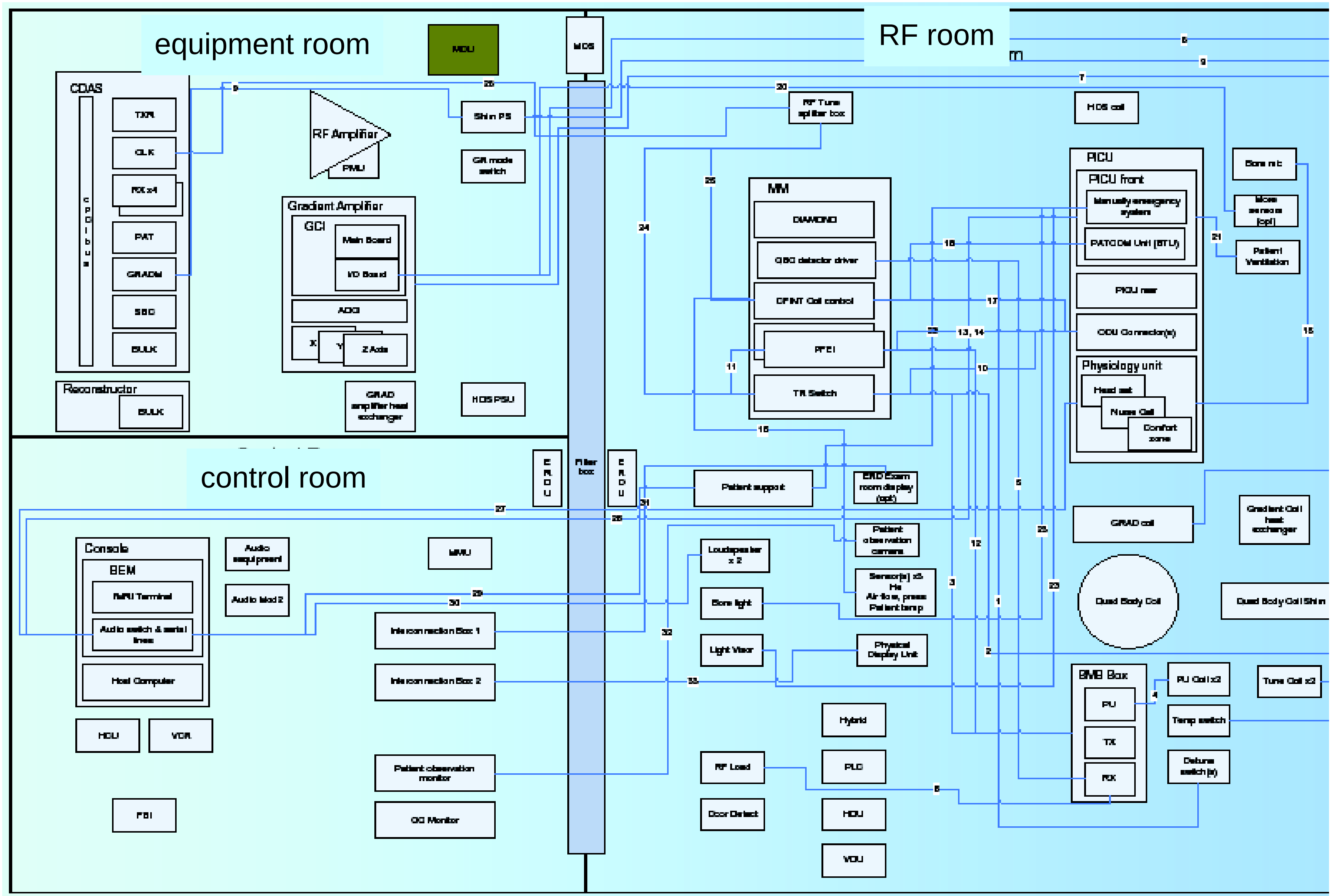
within industrial constraints

people, process,
project duration,
and cost

and while maintaining other qualities

patient throughput
system responsiveness
image quality
safety
reliability

2006: Reconstruct Physical Architecture Overview



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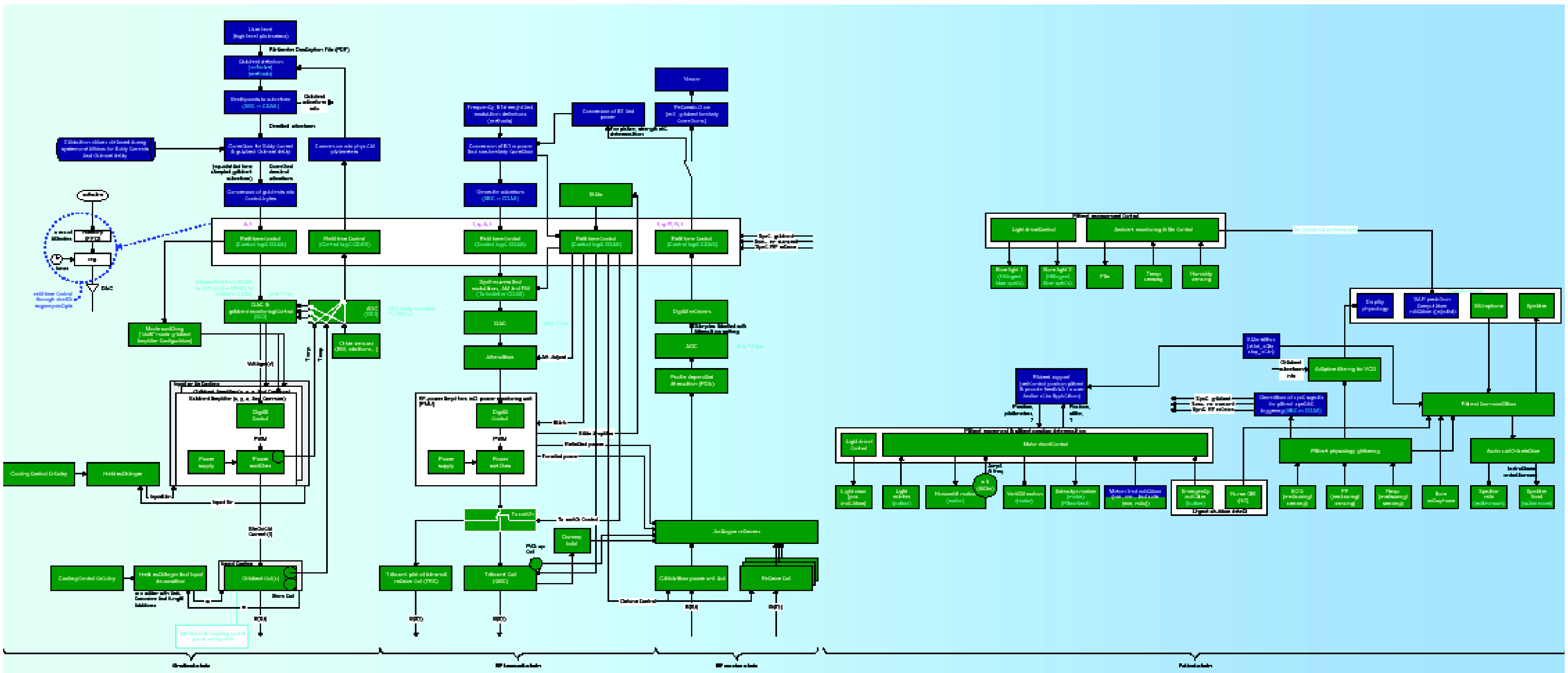


Q1 2009: Modeling Workshop

Modeling workshops:

time-boxed

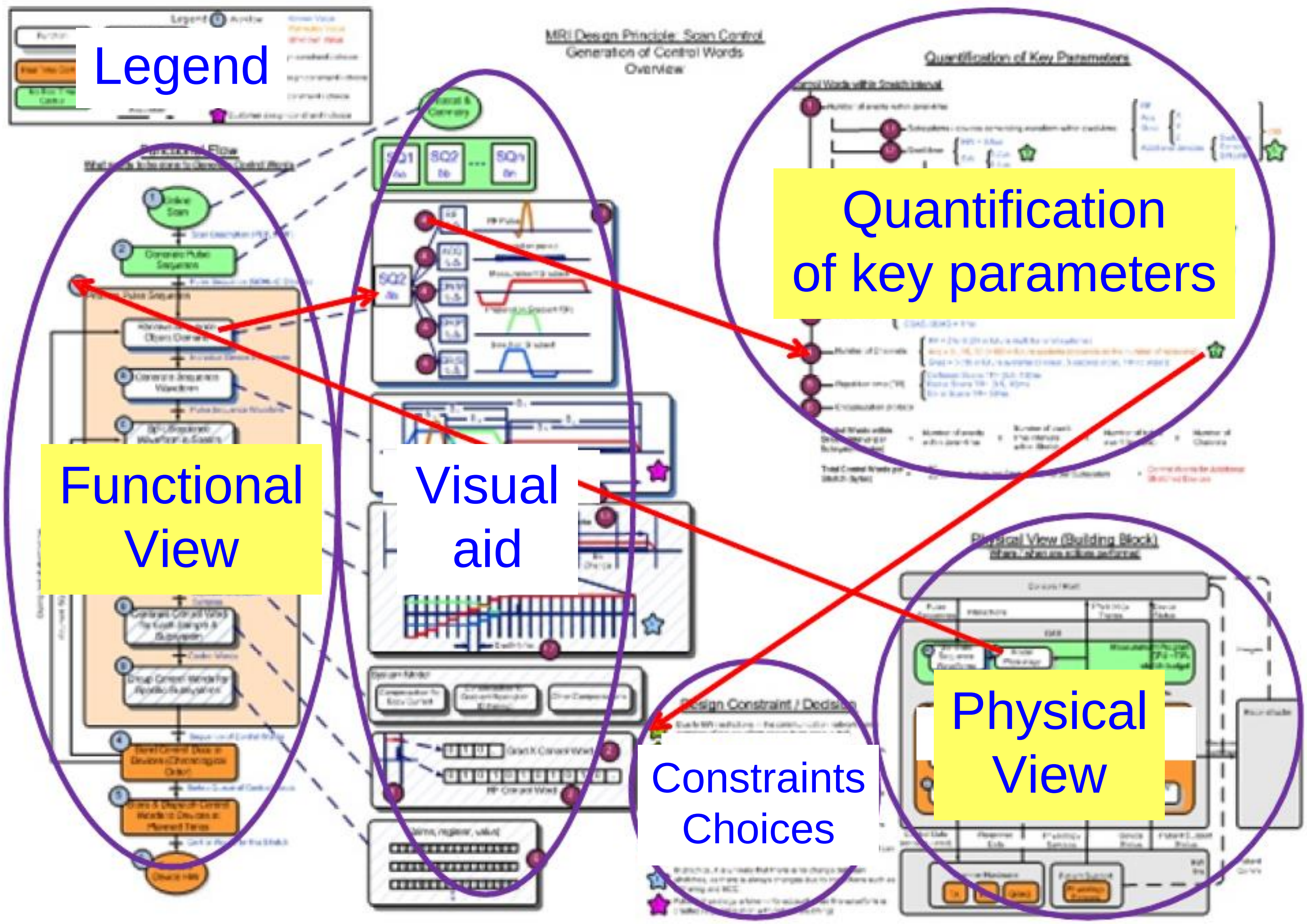
multi-view

usage and life cycle context

determine key drivers

measure and quantify

A3 Example Architecture Overview



A3 Architecture Overviews Focusing architectural knowledge to support evolution of complex systems
by: Daniel Borches and Maarten Bonnema, INCOSE 2010

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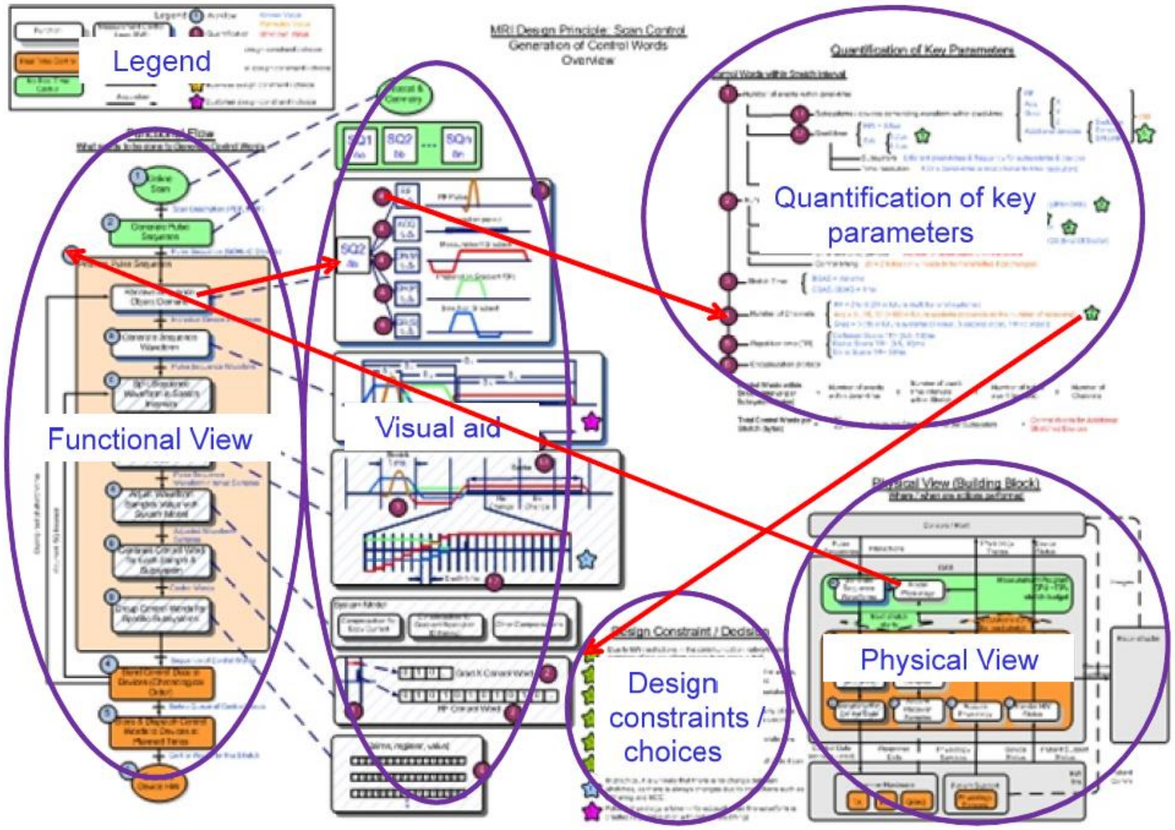
multiple related views

quantifications

one topic
per A3

capture
"hot" topics



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

digestable
(size limitation)

practical
close to stakeholder experience

Colofon

This presentation is based on:

+ the master project of *Simen Aaserud* (HiBu SE, Kongsberg Automotive)

+ Darwin research project (ESI Eindhoven, Philips Healthcare),

especially the research of *Daniel Borches* (TU Twente)