

# Communicating the Essence of an Architecture Compactly

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`www.gaudisite.nl`

## Abstract

A major task of an architect is to communicate about the essence of an architecture with a wide variety of stakeholders. Effective communication facilitates shared understanding and reasoning, which in turn helps decision making and reduces noise in the organization. In this presentation, we show how to use project and architecture overviews for this purpose. These overviews contain multiple views and the essential facts.

### Distribution

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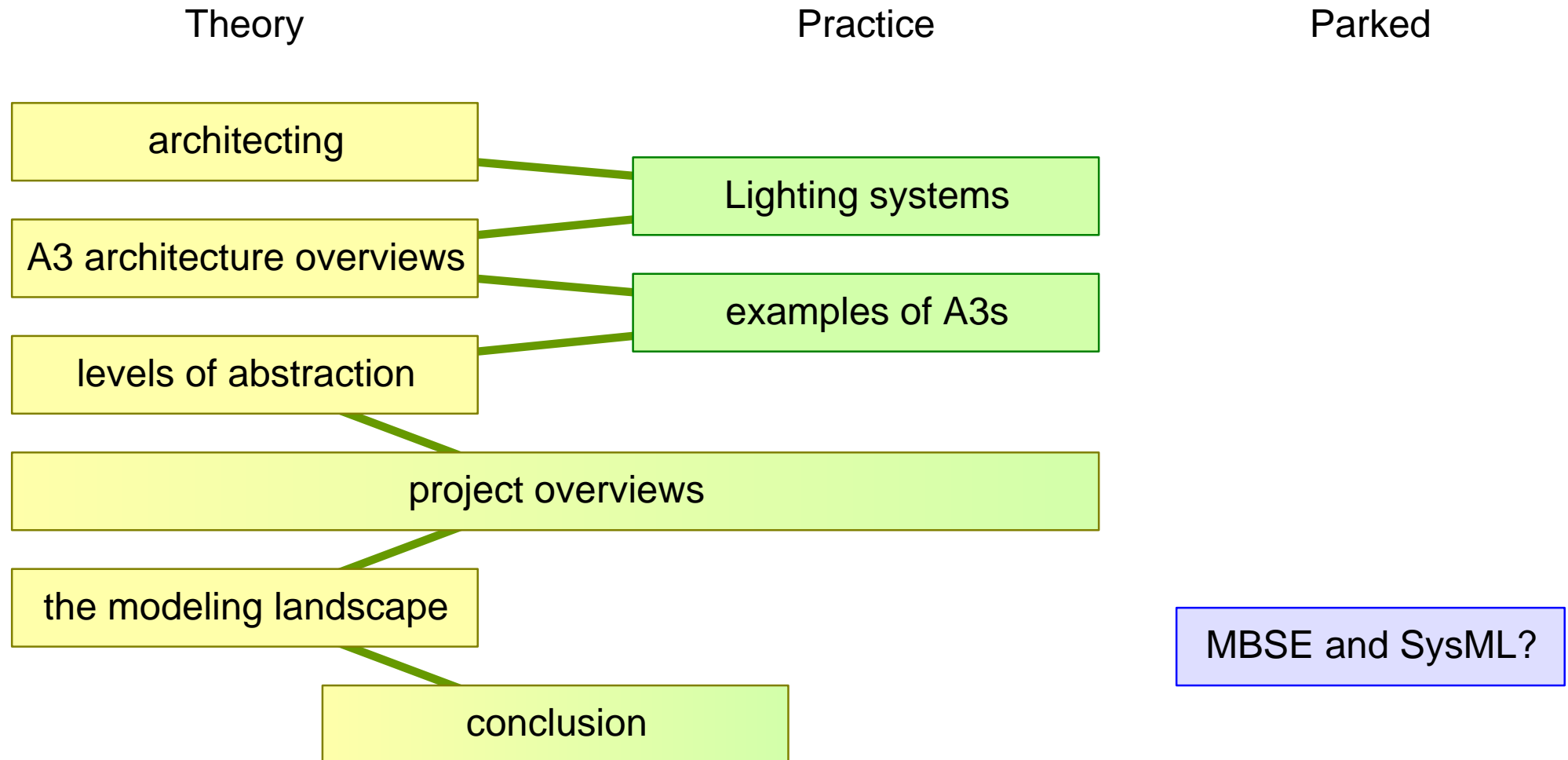
August 16, 2025  
status: draft  
version: 0

A major task of the architect is to help the development team and its stakeholders to **navigate** the **problem and solution space** to

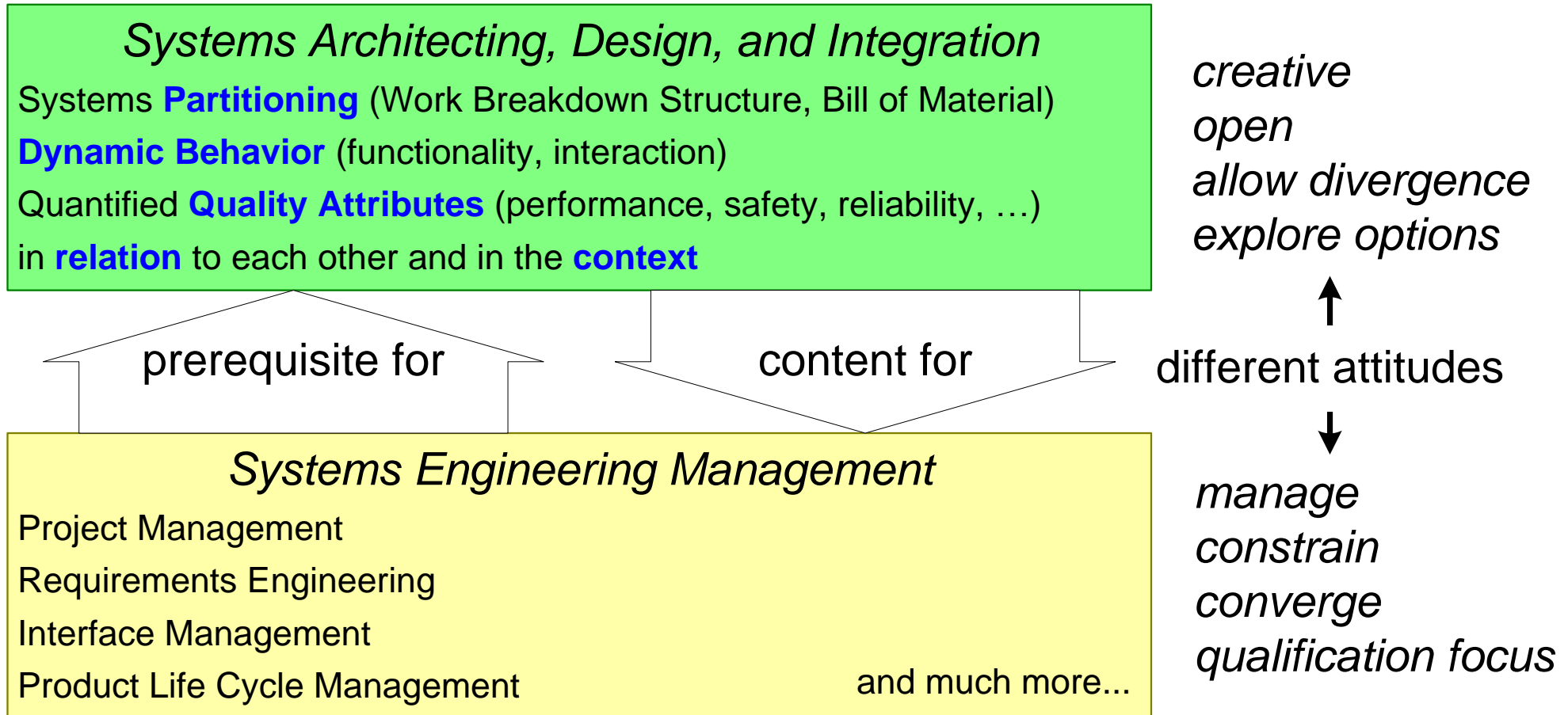
support communication
facilitate reasoning
support decision making
create understanding
maintain insight
overview

**Conceptual**, e.g. human understandable, **models** are the means for this.  
Most team members and stakeholders **get lost in details** **without** guiding overview

# Figure of Content



# Architecting and Engineering Management are Complementing



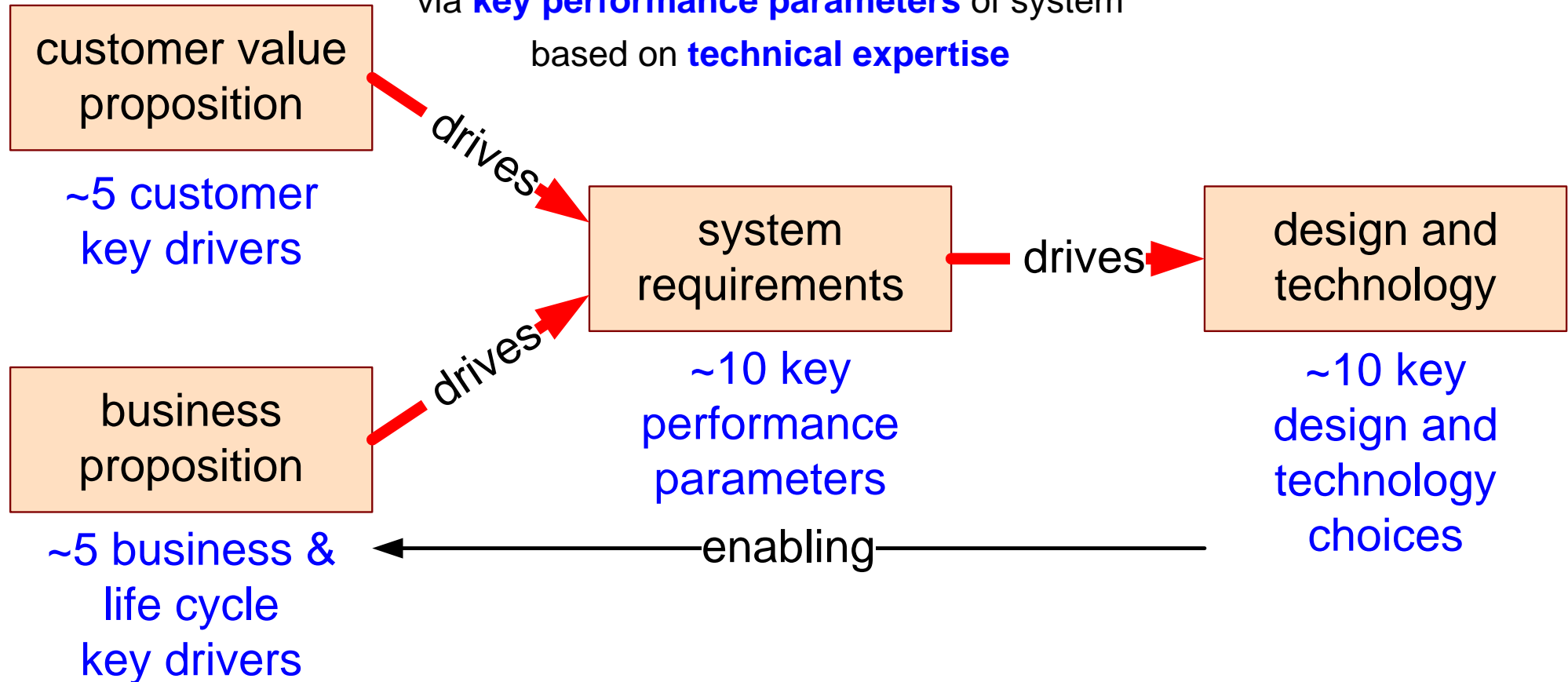
# Architects Must Own This Overview

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

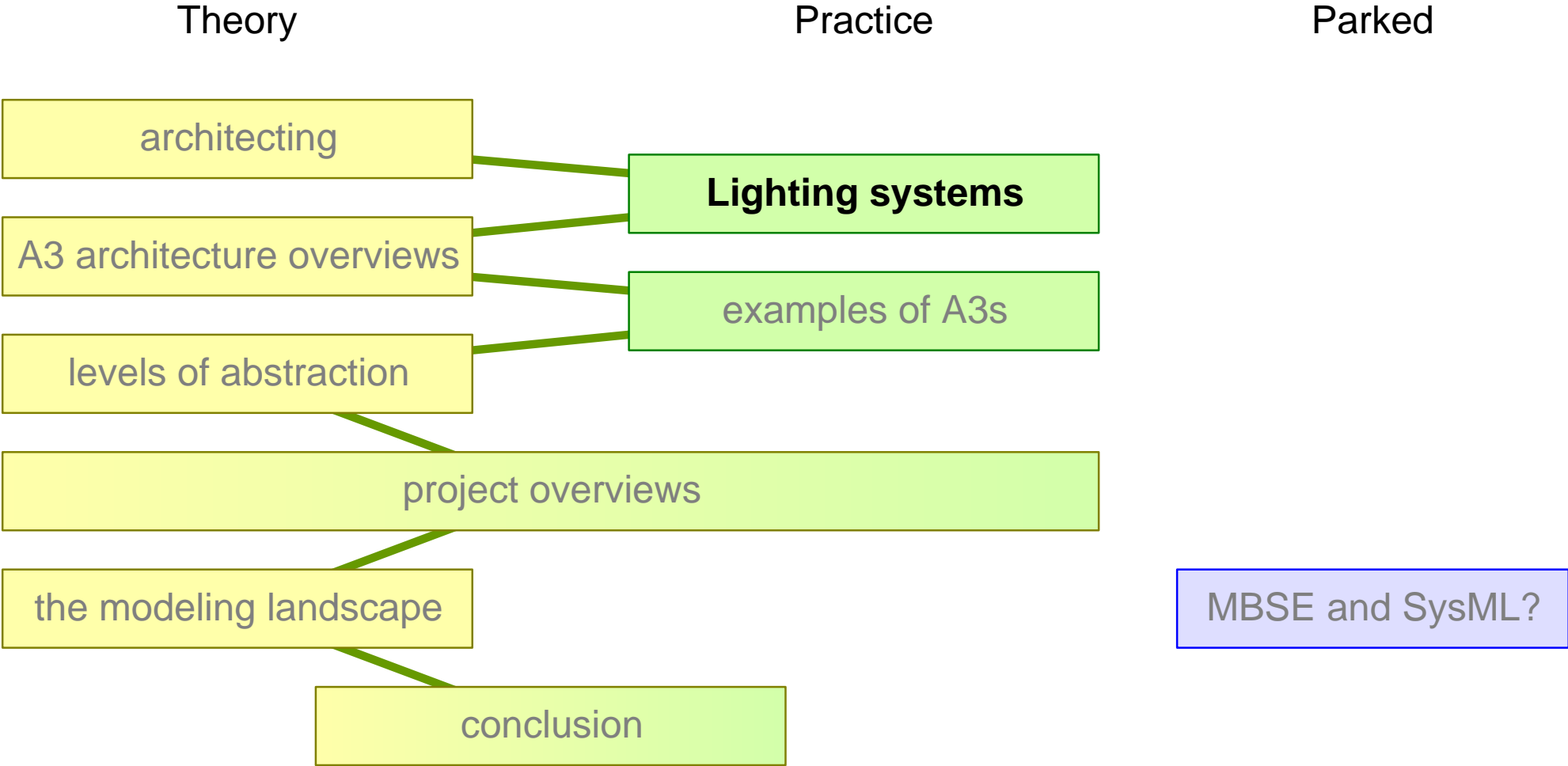
Achieving **customer** and **business key drivers**

via **key performance parameters** of system

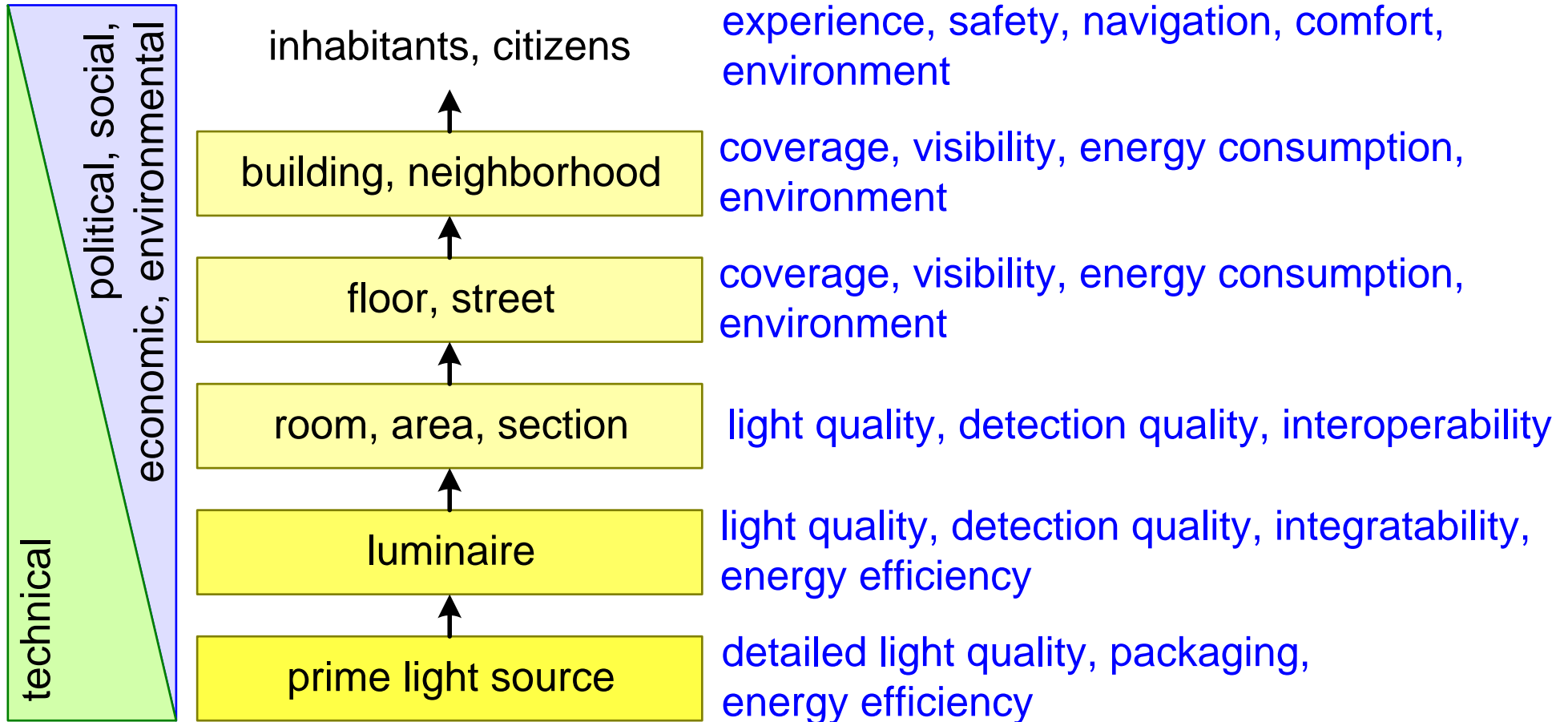
based on **technical expertise**



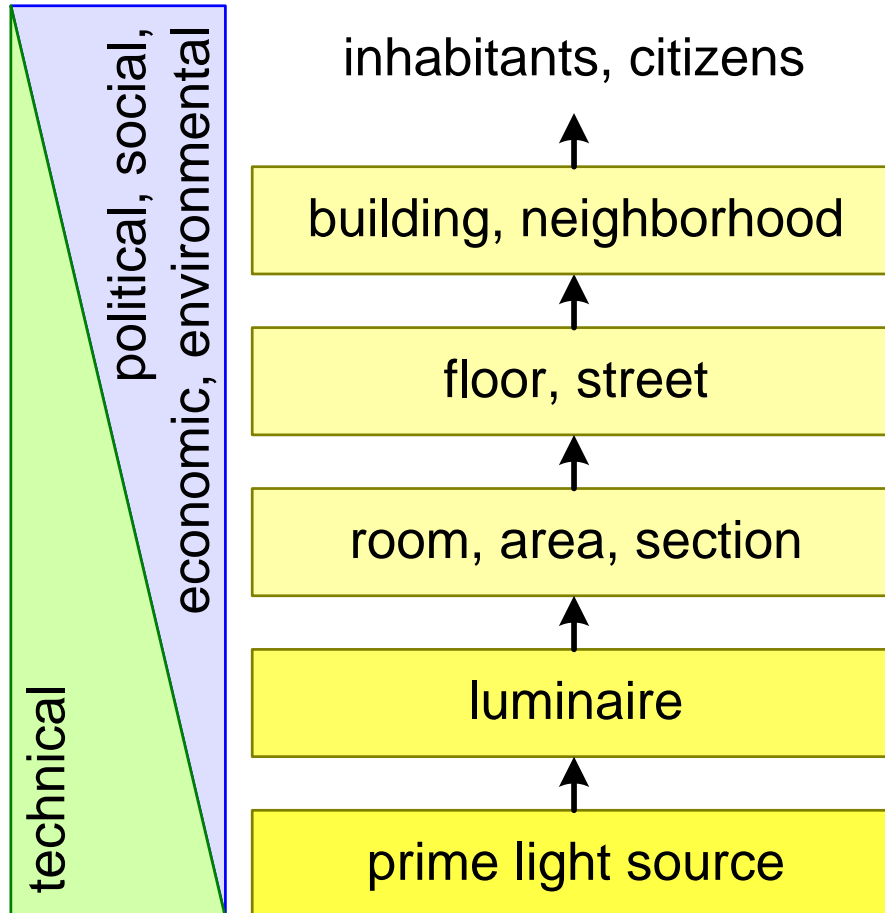
# Figure of Content



# Perspective Changes when Zooming out



# What is the System-of-Interest you are working on?

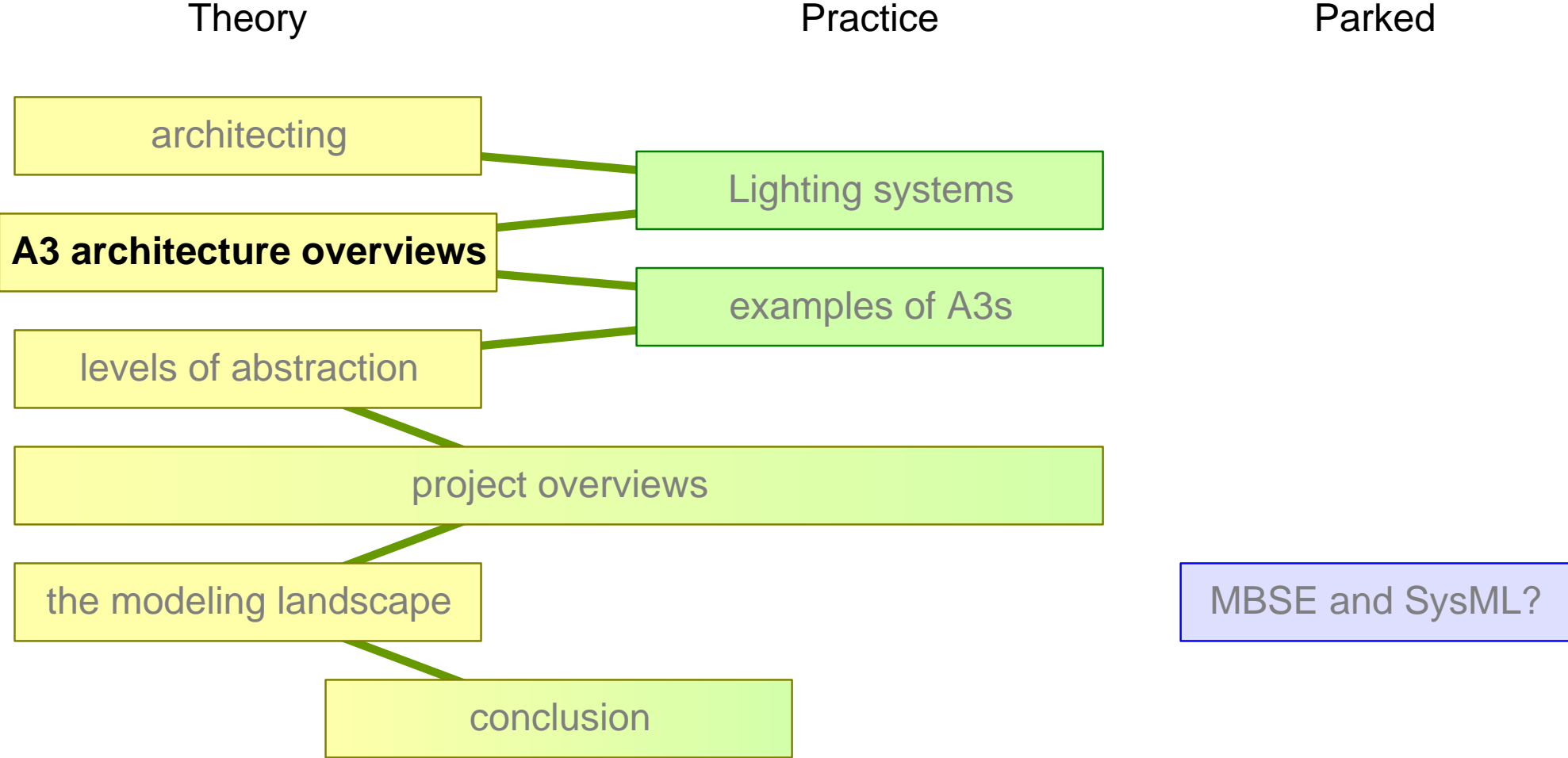


At what level is your **system-of-interest**?

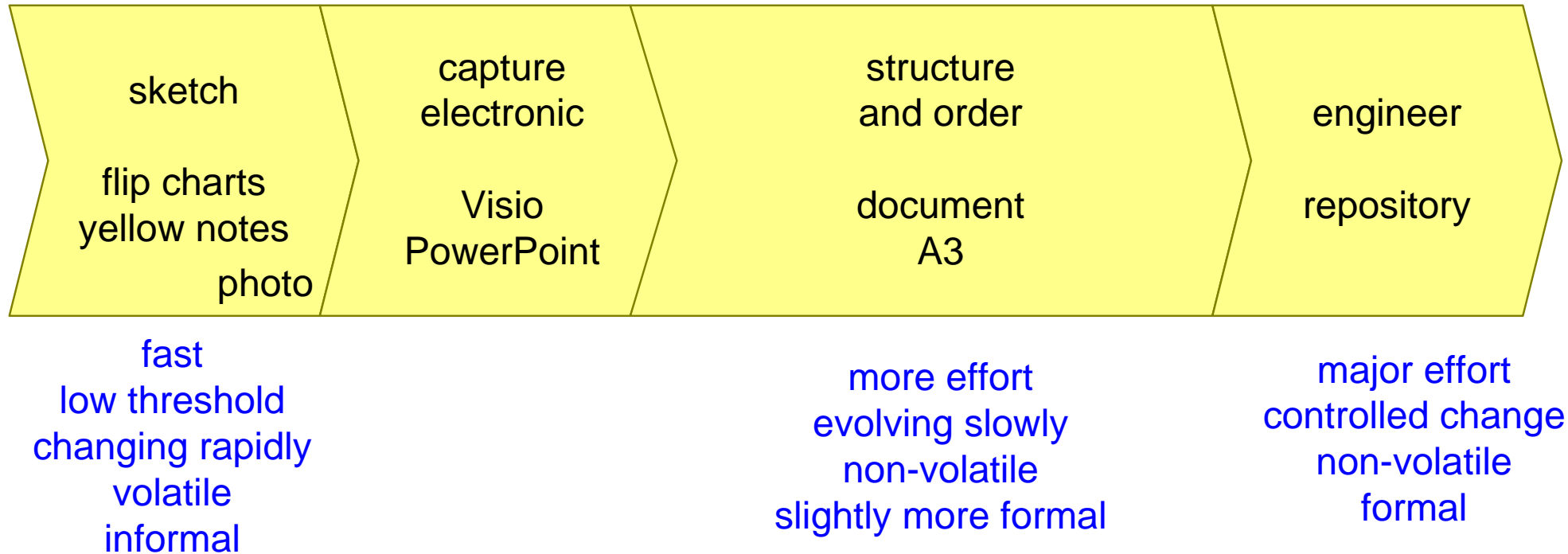
What are its ~5 **key performance parameters**

What are the ~5 **key drivers** of its **supersystem**?

# Figure of Content



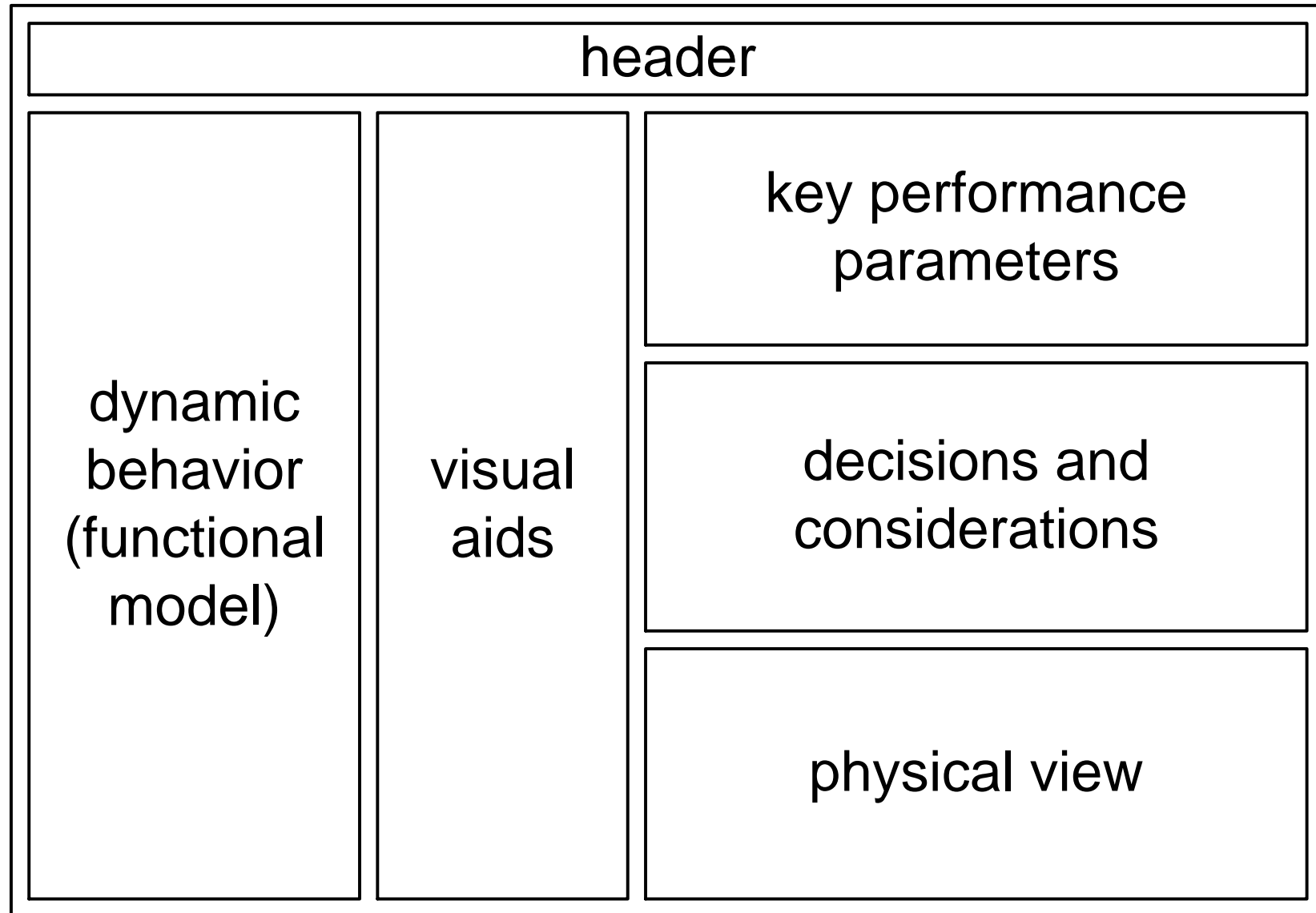
# Maturing an Architecture Description



# 3-Day Workshop Results in 20 Flipover Sheets



# Architecture Overview A3



simplified from <http://www.gaudisite.nl/BorchesCookbookA3architectureOverview.pdf>

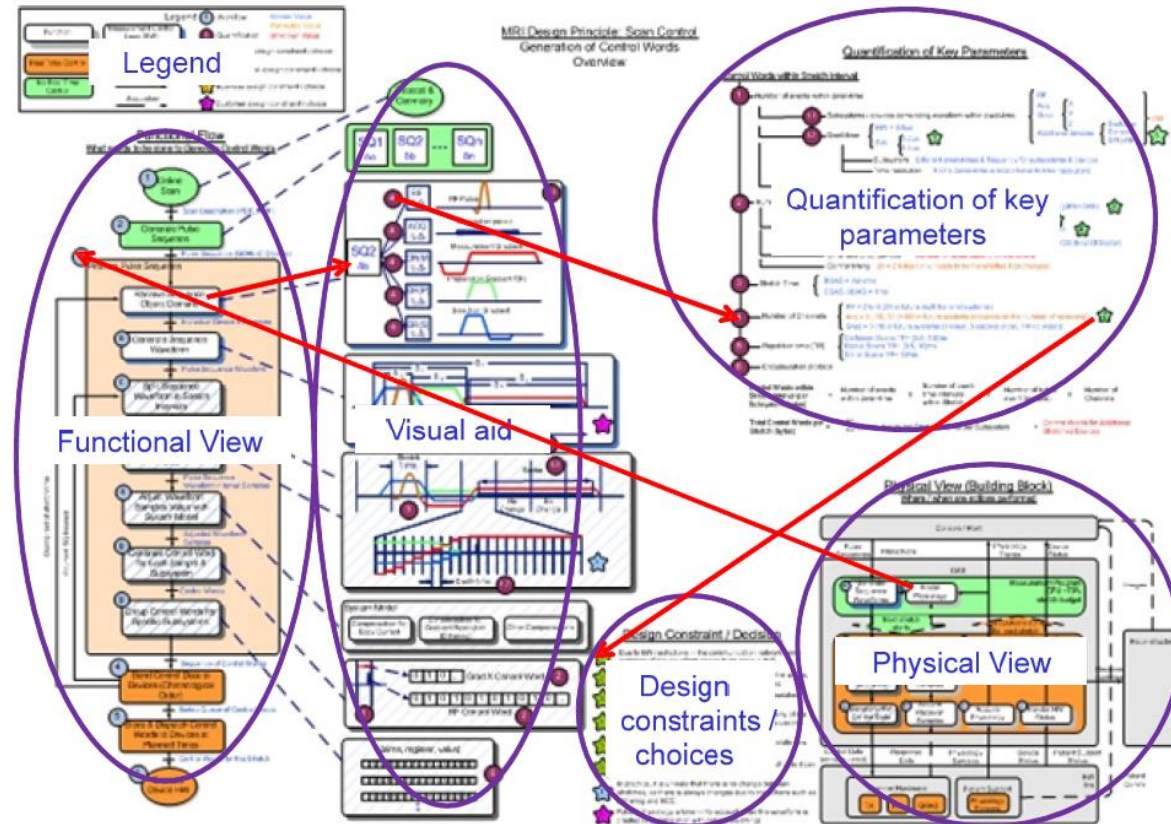
# A3s to Capture Architecture Overviews

multiple related views

quantifications

one topic per A3

capture "hot" topics

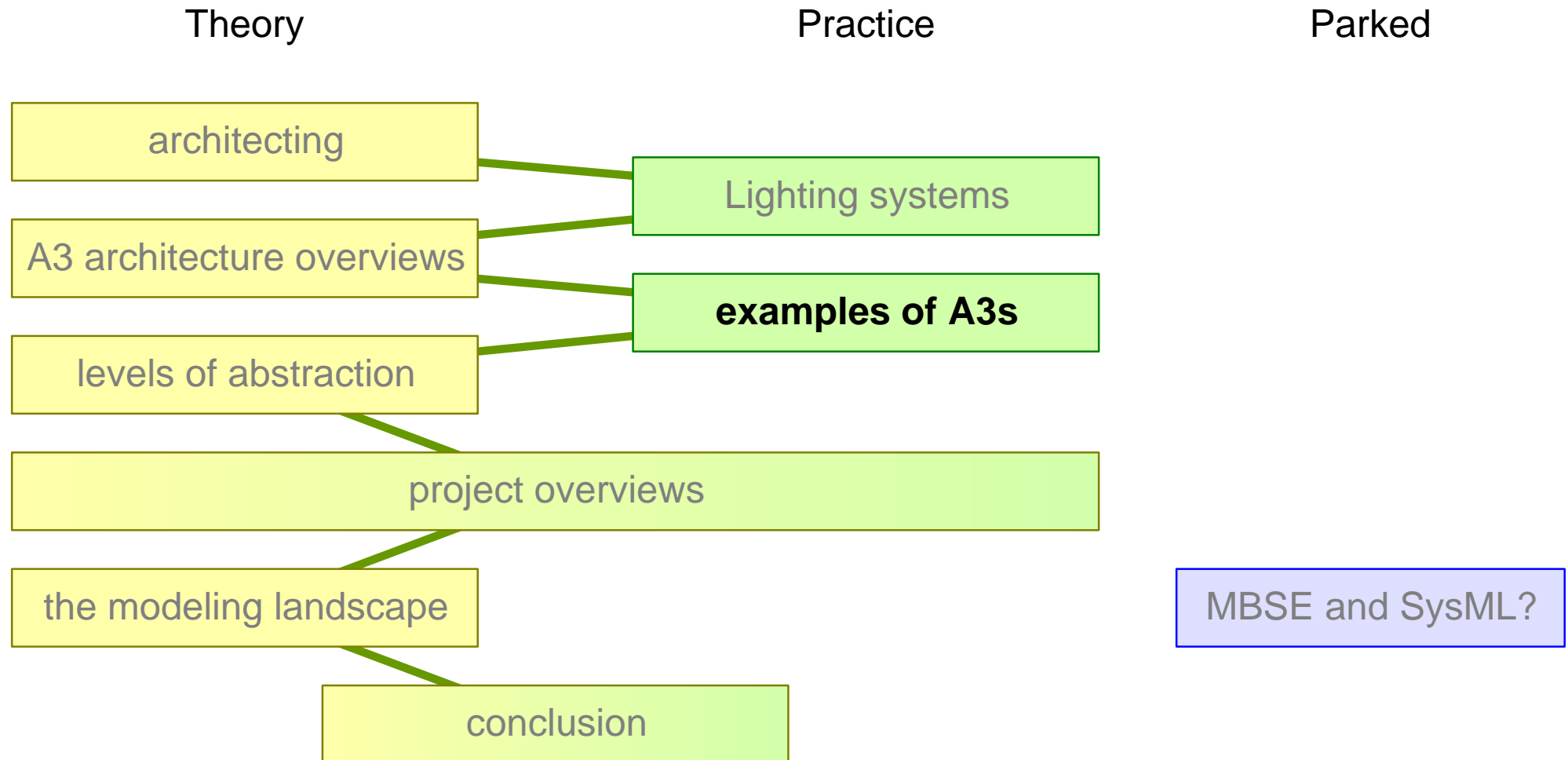


source: PhD thesis Daniel Borches <http://doc.utwente.nl/75284/>

digestible  
(size limitation)

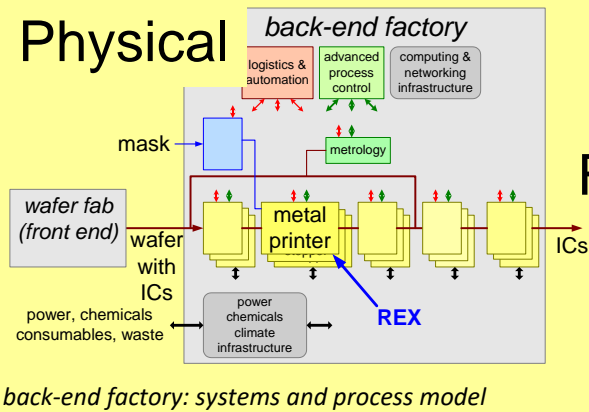
practical  
close to stakeholder experience

# Figure of Content



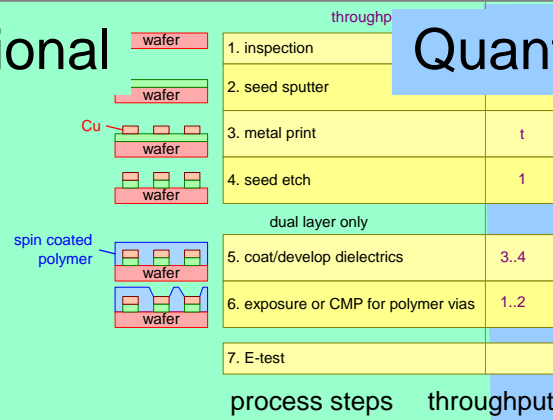
# Metal Printer: 3 Levels of Systems on 1 A3 (all numbers have been removed for competitive sensitivity) CTEAMetalPrinterA3

## Physical



## Functional

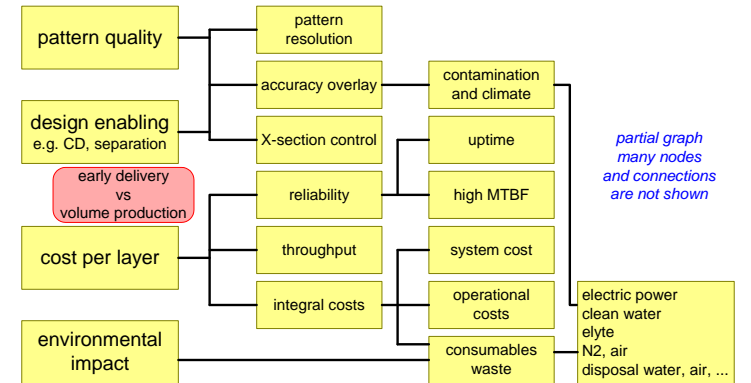
### Fab



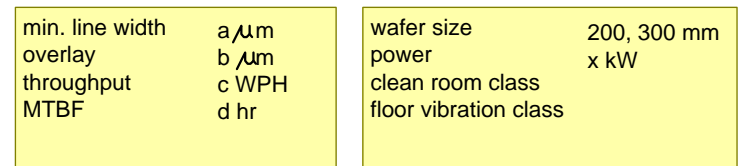
## Quantified

Gerrit Muller  
0.1  
scope system and supersystem  
status preliminary draft  
update August 3, 2010

### Document meta-information

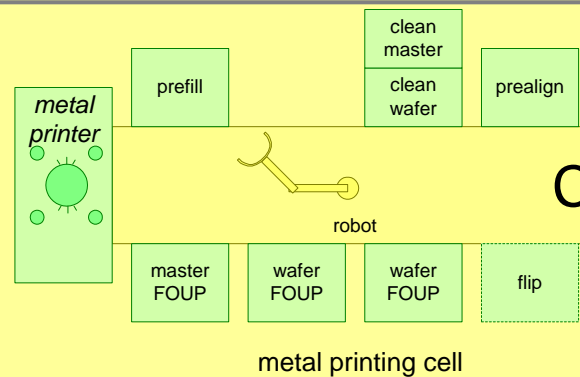


### customer key drivers

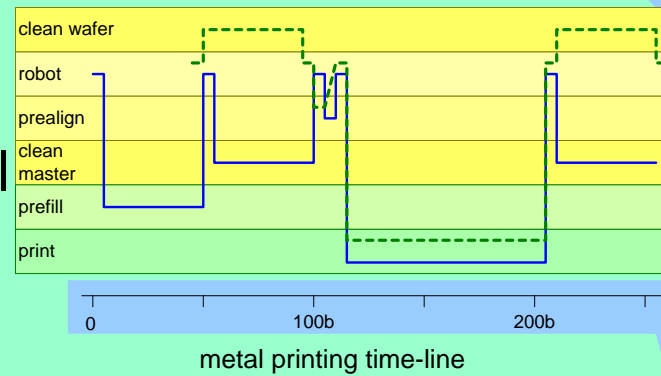


### key performance parameters

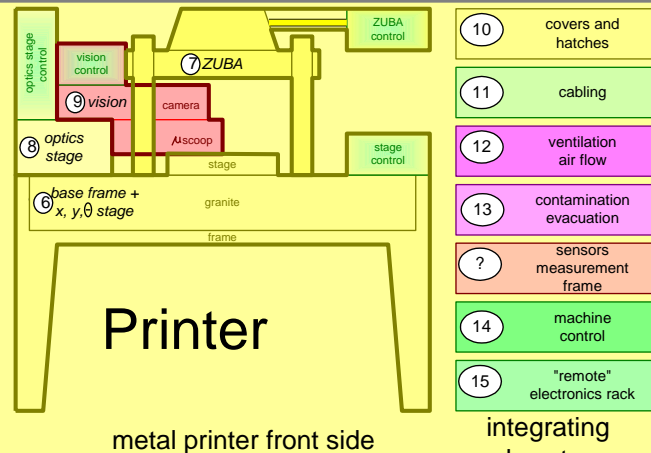
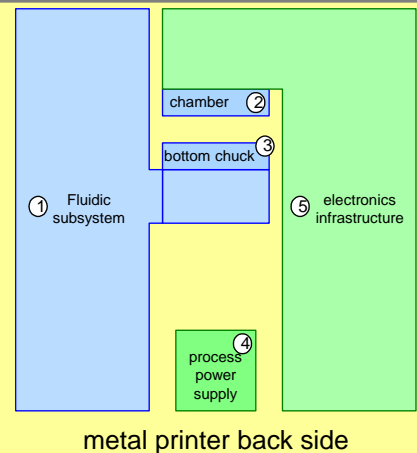
### Customer key-drivers and Key Performance Parameters



### Cell



### metal printing cell: systems and performance model

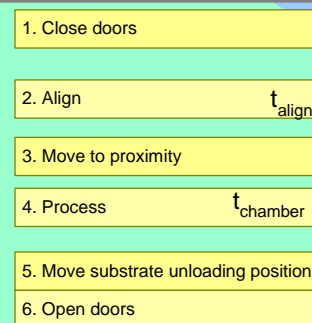


## Printer

### metal printer subsystems

### integrating subsystems

### metal printer subsystems, functions, and cycle time model



*note: original diagram was annotated with actual performance figures for confidentiality reasons these numbers have been removed*

$$t_{print} = t_{p,prepare} + t_{p,align} + t_{chamber}(thickness) + t_{p,finalize}$$

$$t_{prepare} = t_{close\ doors} + t_{move\ to\ proximity}$$

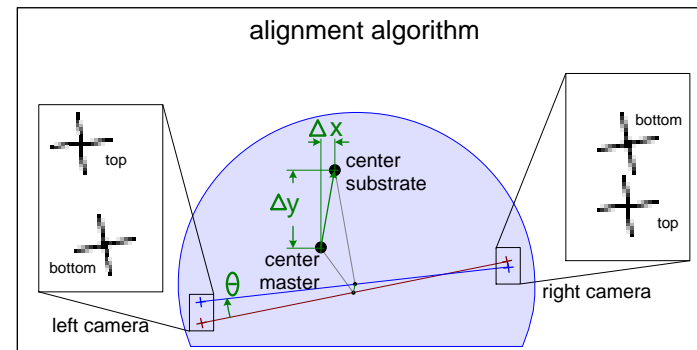
$$t_{finalize} = t_{move\ to\ unload} + t_{open\ doors}$$

$$t_{print} = t_{p,overhead} + C_{transfer} * thickness$$

### formula print cycle time

## KPPs

overlay	1 $\mu\text{m}$
$t_{\text{align}}$	10 s
$t_{\text{calibrate}}$	5 min.
Search field	20 * 20 mm
marker field	1 mm

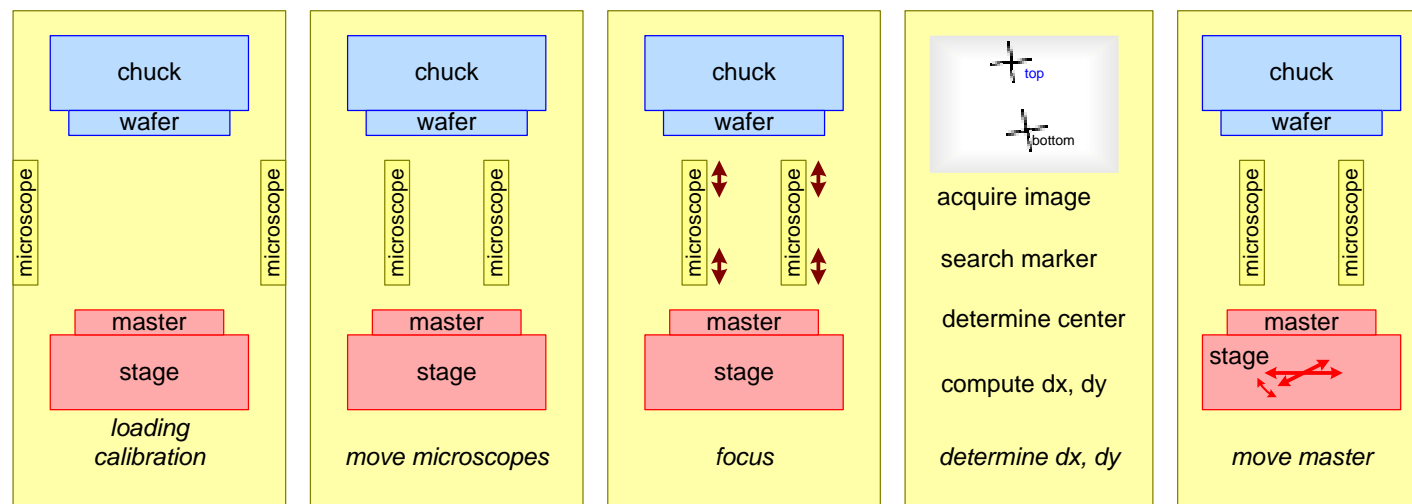


requires microscopes to be  $\varphi_x$  and  $\varphi_y$  corrected

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

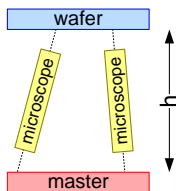
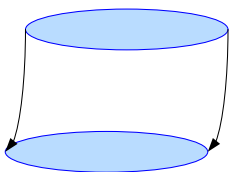
## workflow



## alignment challenge

1<sup>st</sup> order

ZuBa move imperfect  
Microscope not perfectly vertical



imperfect vertical axis causes dx, dy offsets

$$dx = \varphi_x * h$$

vertical move causes some translation and rotation causing

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

## physical diagram



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

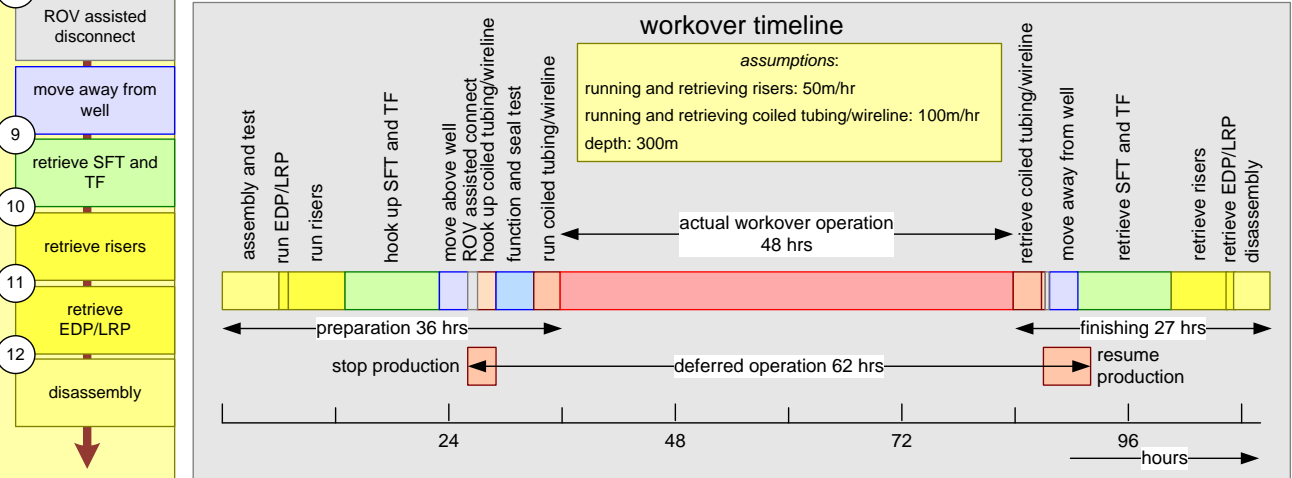
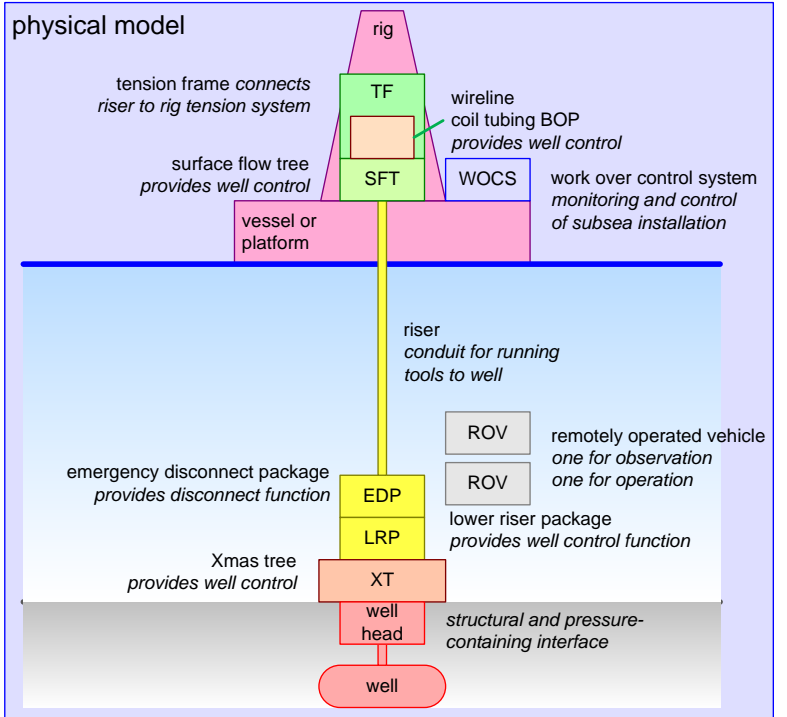
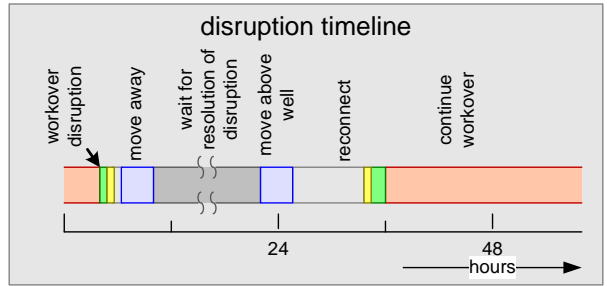
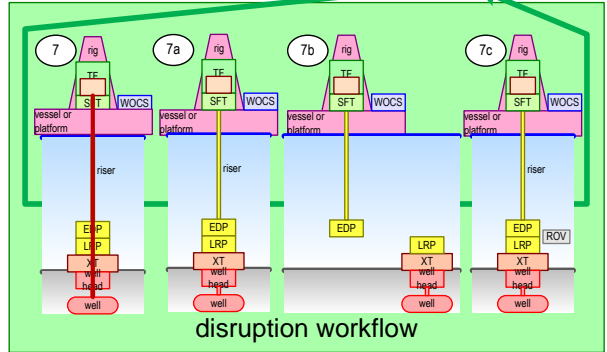
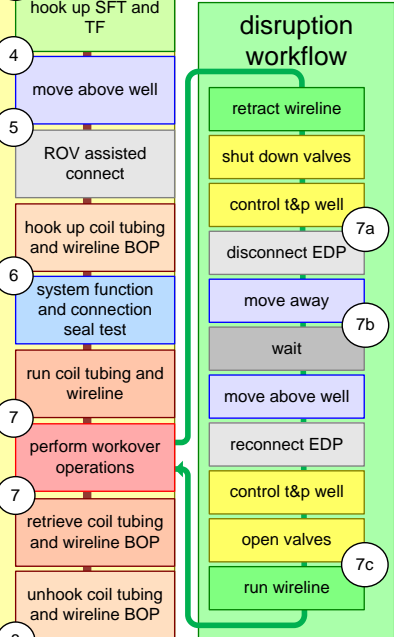
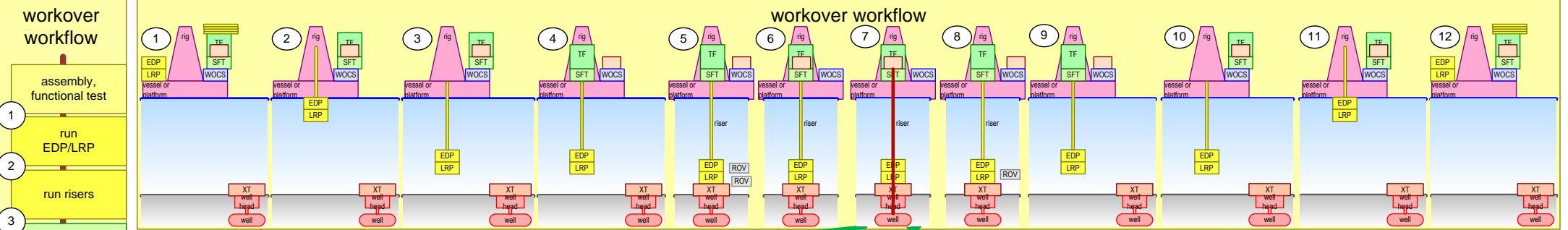
measurement accuracy determines required resolution

optical resolution magnification



DoF

displacement determines required Field of View



**0-order workover cost estimate**

workover cost per day	assumed cost (MNoK)	workover duration	estimated duration (hours)
platform, rig	2	transportation	24 <i>production loss</i>
equipment	0.2	preparation	36
crew	0.1	workover	48
<b>total</b>	<b>2.3 MNoK/day</b>	finishing	27
<i>deferred operation per day</i>	<i>assumed cost (MNoK)</i>	<b>total</b>	<b>135 (5.6 days) 62 (2.6 days)</b>
<i>production delay</i>	0.1		
<i>ongoing cost operation</i>	0.2		
<b>total</b>	<b>0.3 MNoK/day</b>		

**Cost =  $COST_{workover/day} * t_{workover} + COST_{deferred op./day} * t_{deferred op.}$**   
 $\sim 2.3 * 5.6 + 0.3 * 2.6 \sim 14$  MNoK / workover

### context

- 80 houses, old, large, barely insulated
  - country side
- envisioned future:
- large storage tank
  - heated during summer
  - used during winter
  - low temperature heat network to houses
  - solar panels for electricity and heating

### historic data

yearly energy consumption per large old house

$$E_{\text{electricity past}} = 3550 \text{ kWh}$$

$$V_{\text{gas heating}} = 3636 \text{ m}^3$$

$$V_{\text{gas hot water}} = 288 \text{ m}^3$$

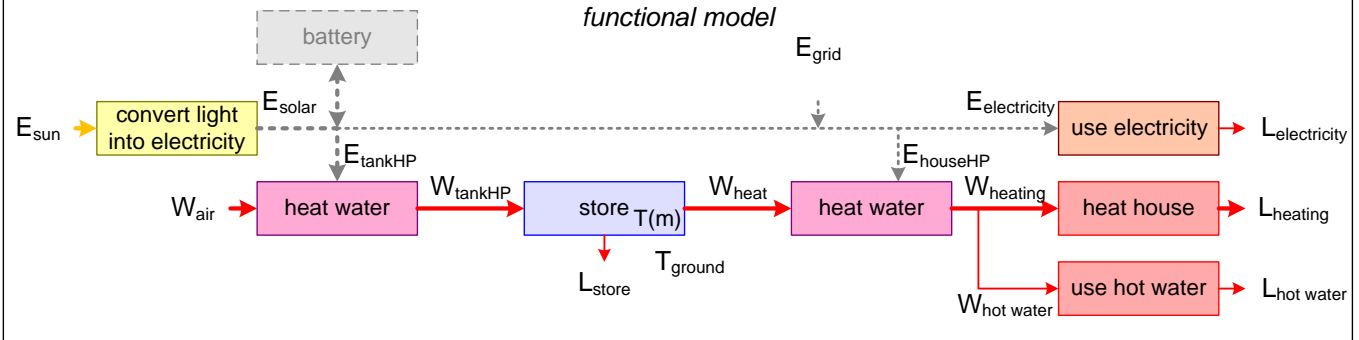
$$C_{\text{gas}} = 9 \text{ kWh/m}^3$$

$$C_{\text{solar}} = 0,913 \text{ kWh/W}_{\text{peak}}$$

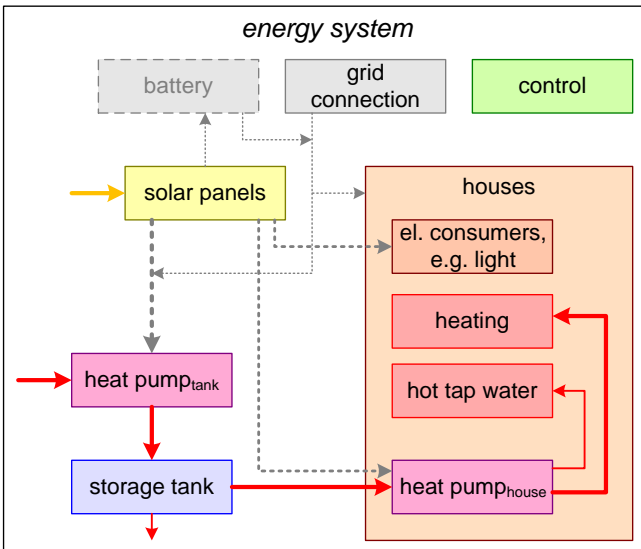
$$\text{capacity factor} = 11\%$$

<https://www.linkedin.com/pulse/waarom-wemoeten-en-kunnen-stoppen-met-het-van-hans-schneider/>

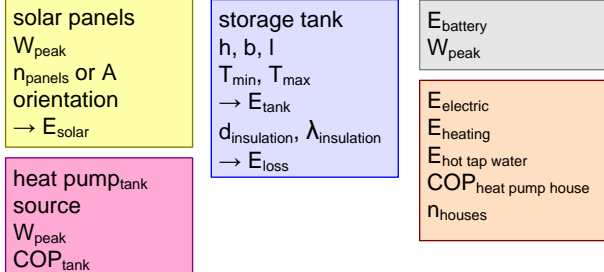
### functional model



### energy system



### design parameters



### in formulas

$$E_{\text{electricity}} = E_{\text{electricity past}}$$

$$W_{\text{heating}} = V_{\text{gas heating}} * C_{\text{gas}}$$

$$W_{\text{hot water}} = V_{\text{gas hot water}} * C_{\text{gas}}$$

$$E_{\text{solar}} = W_{\text{peak}} * C_{\text{solar}}$$

$$W_{\text{heat}} = (W_{\text{heating}} + W_{\text{hot water}}) - E_{\text{houseHP}}$$

$$E_{\text{houseHP}} = (W_{\text{heating}} + W_{\text{hot water}}) / \text{COP}_{\text{houseHP}}$$

$$E_{\text{tankHP}} = E_{\text{solar}} + E_{\text{grid}} - E_{\text{electricity}} - E_{\text{houseHP}}$$

$$E_{\text{grid}} = \text{energy in winter when solar is too low}$$

$$W_{\text{tankHP}} = E_{\text{tankHP}} * \text{COP}_{\text{tankHP}}$$

$$L_{\text{store}} = \sum_{\text{jan..dec}} A * h_{\text{month}} * \Delta T / R$$

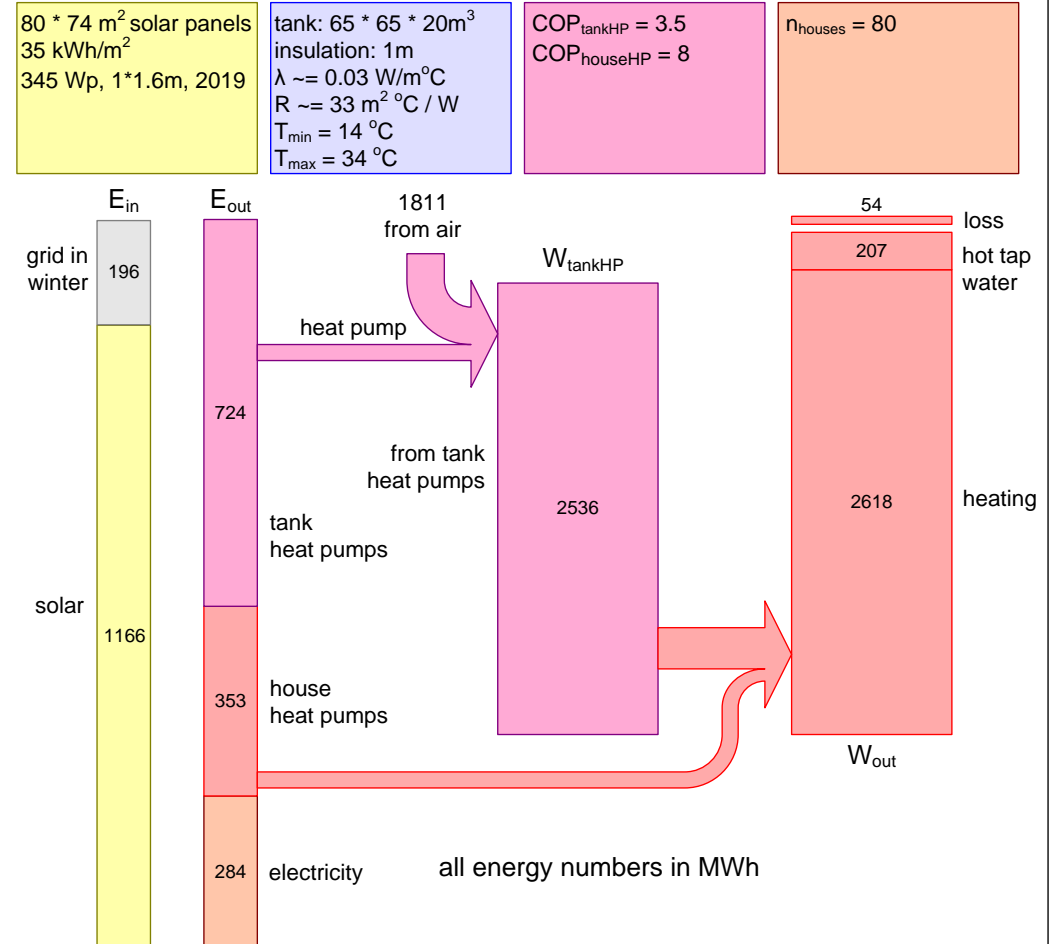
$$R = d / \lambda \approx d / 0.03 ; h_{\text{month}} = 720 \text{ hrs}$$

$$\Delta T = T(\text{month}) - T_{\text{ground}}$$

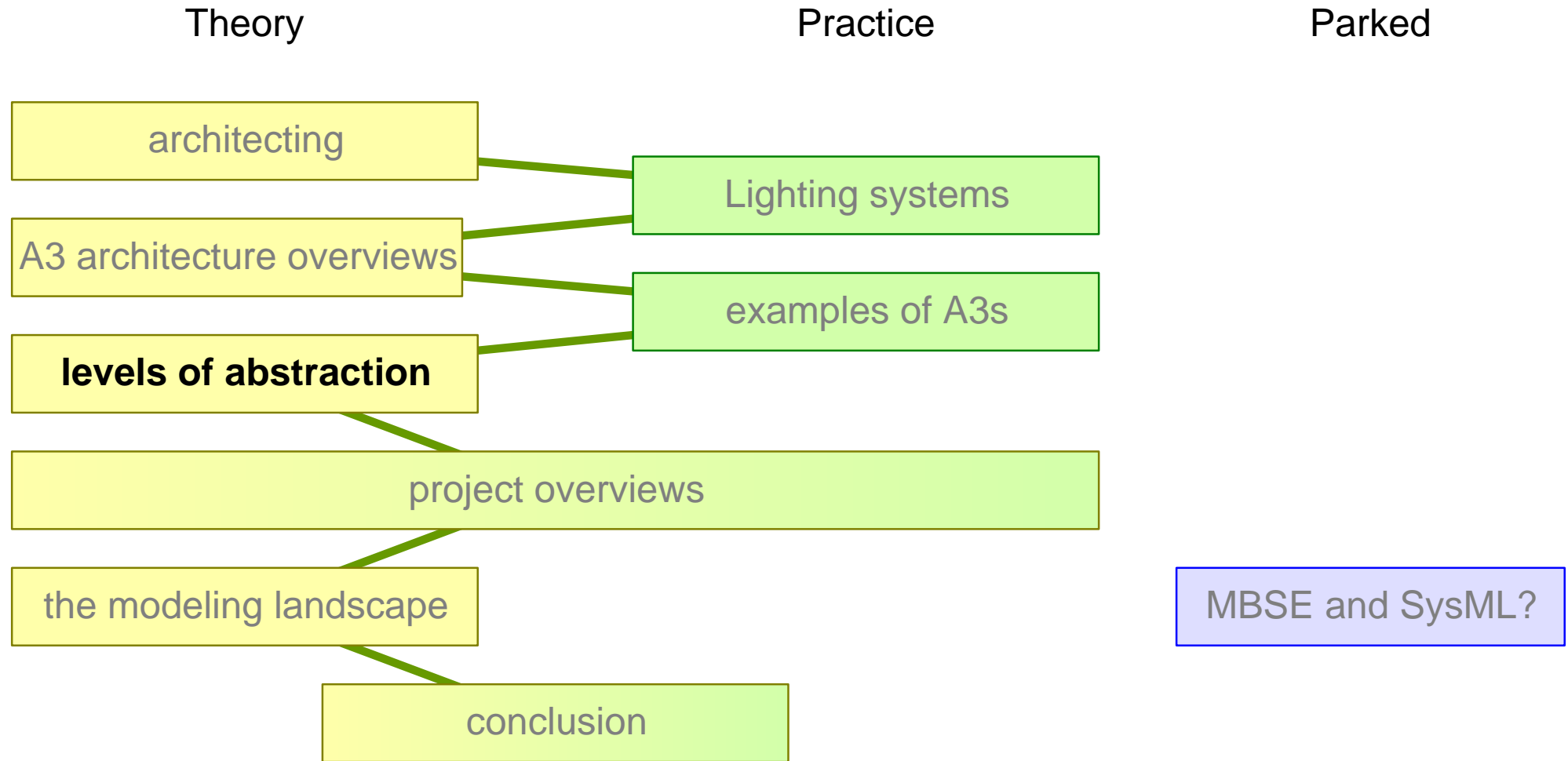
$$L_{\text{electricity}} = E_{\text{electricity}}, L_{\text{heating}} = W_{\text{heating}}$$

$$L_{\text{hot water}} = W_{\text{hot water}}$$

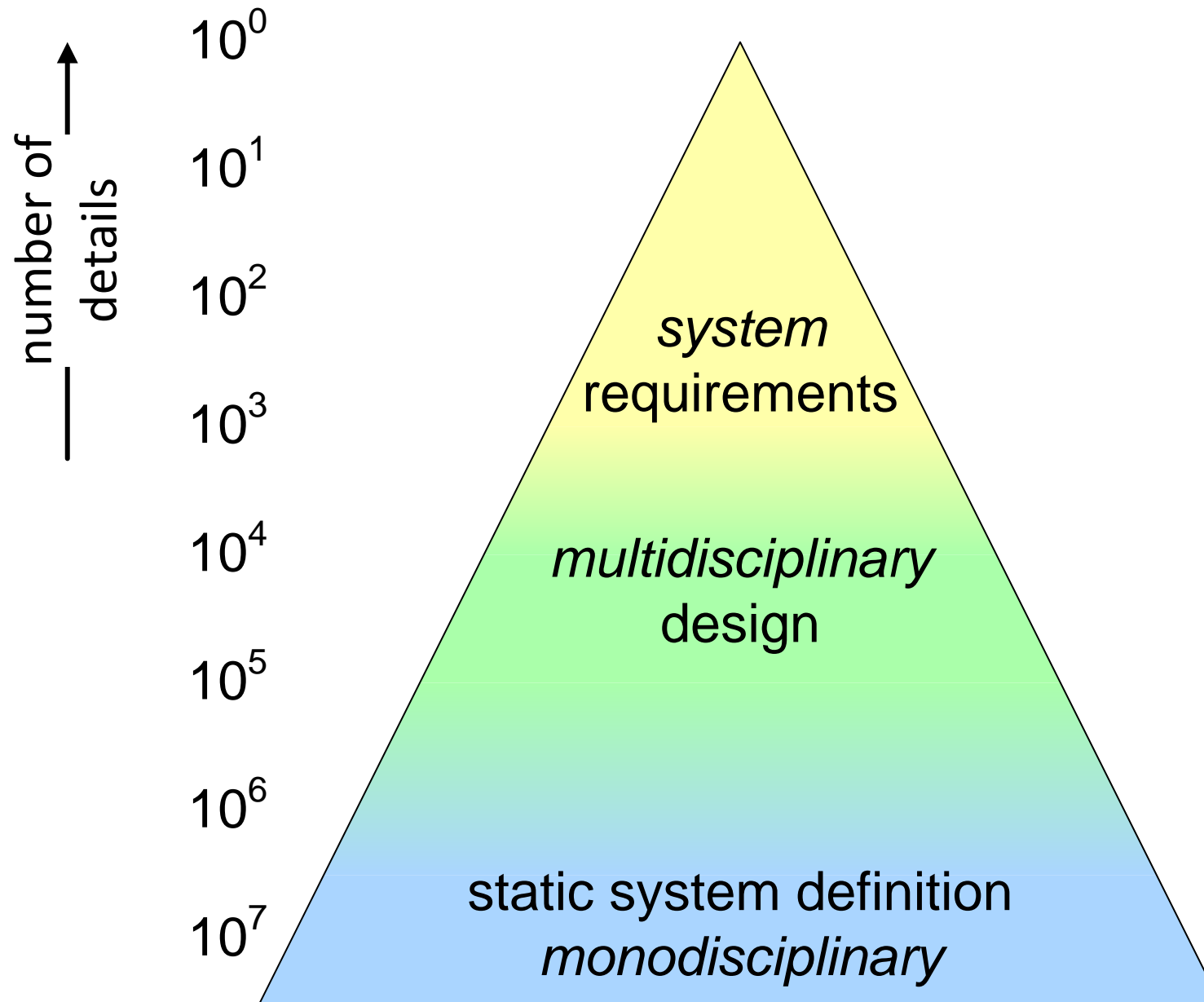
### base case scenario



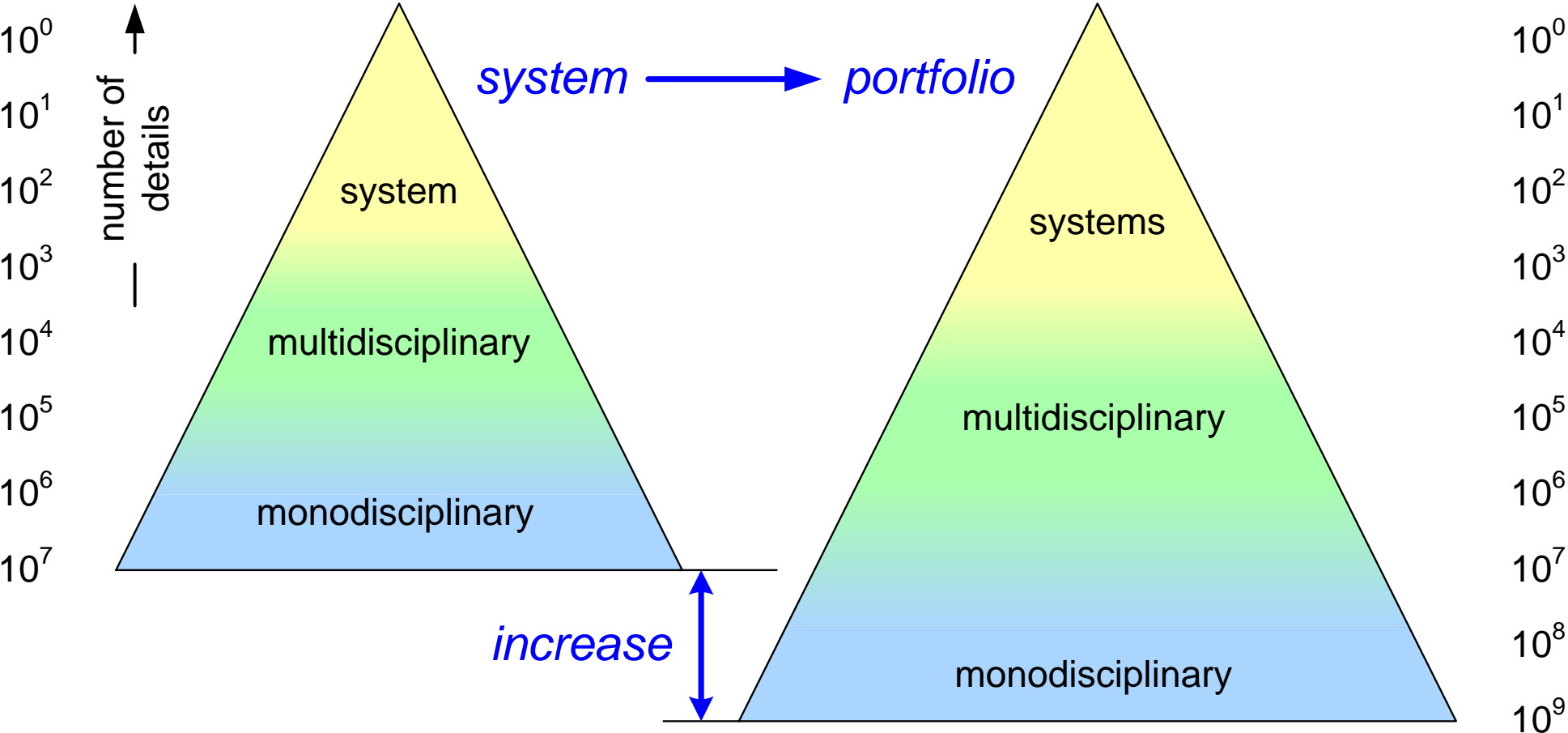
# Figure of Content



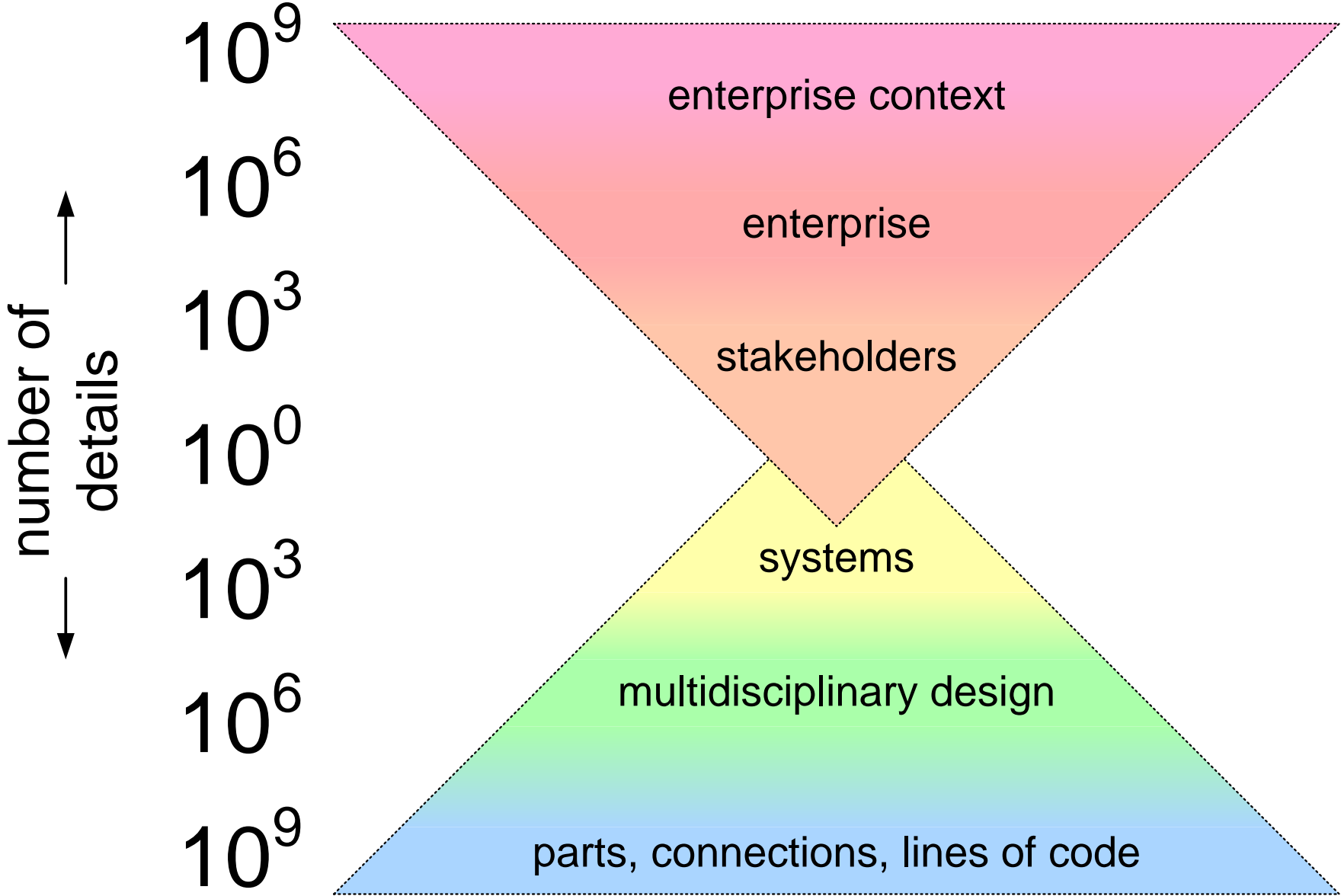
# Level of Abstraction Single System



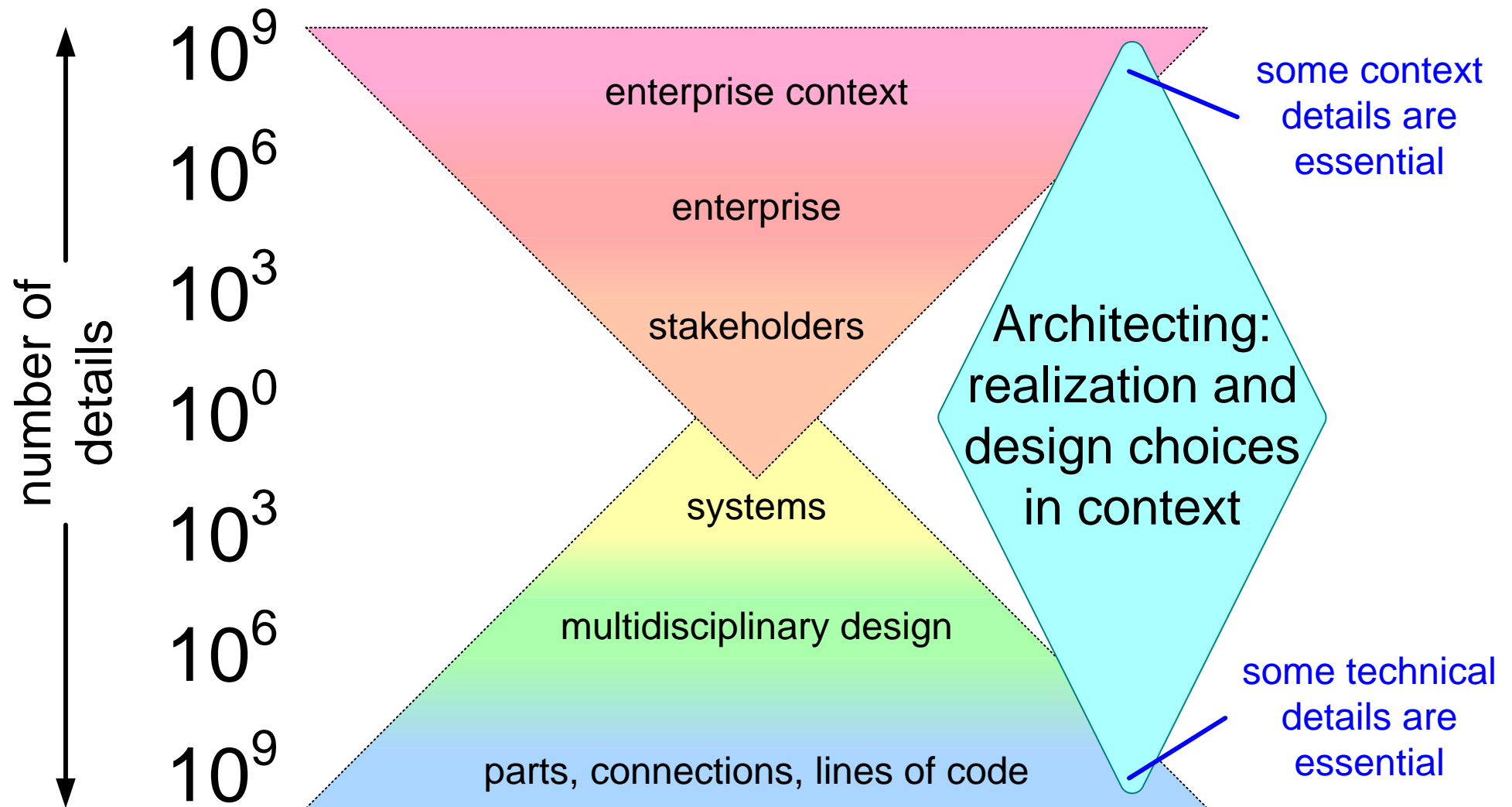
# Growth from System to Product Family



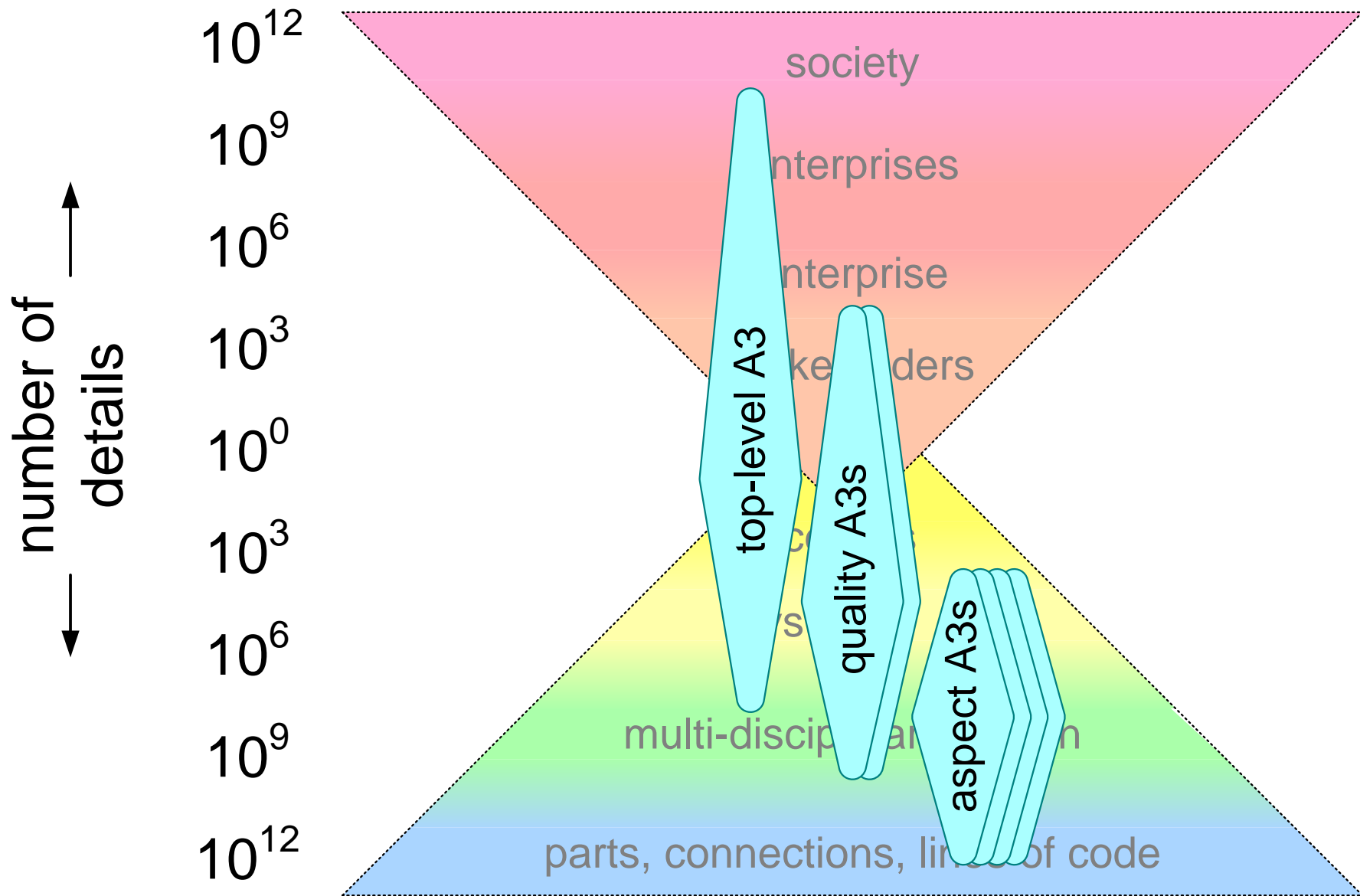
# Product Family in Context



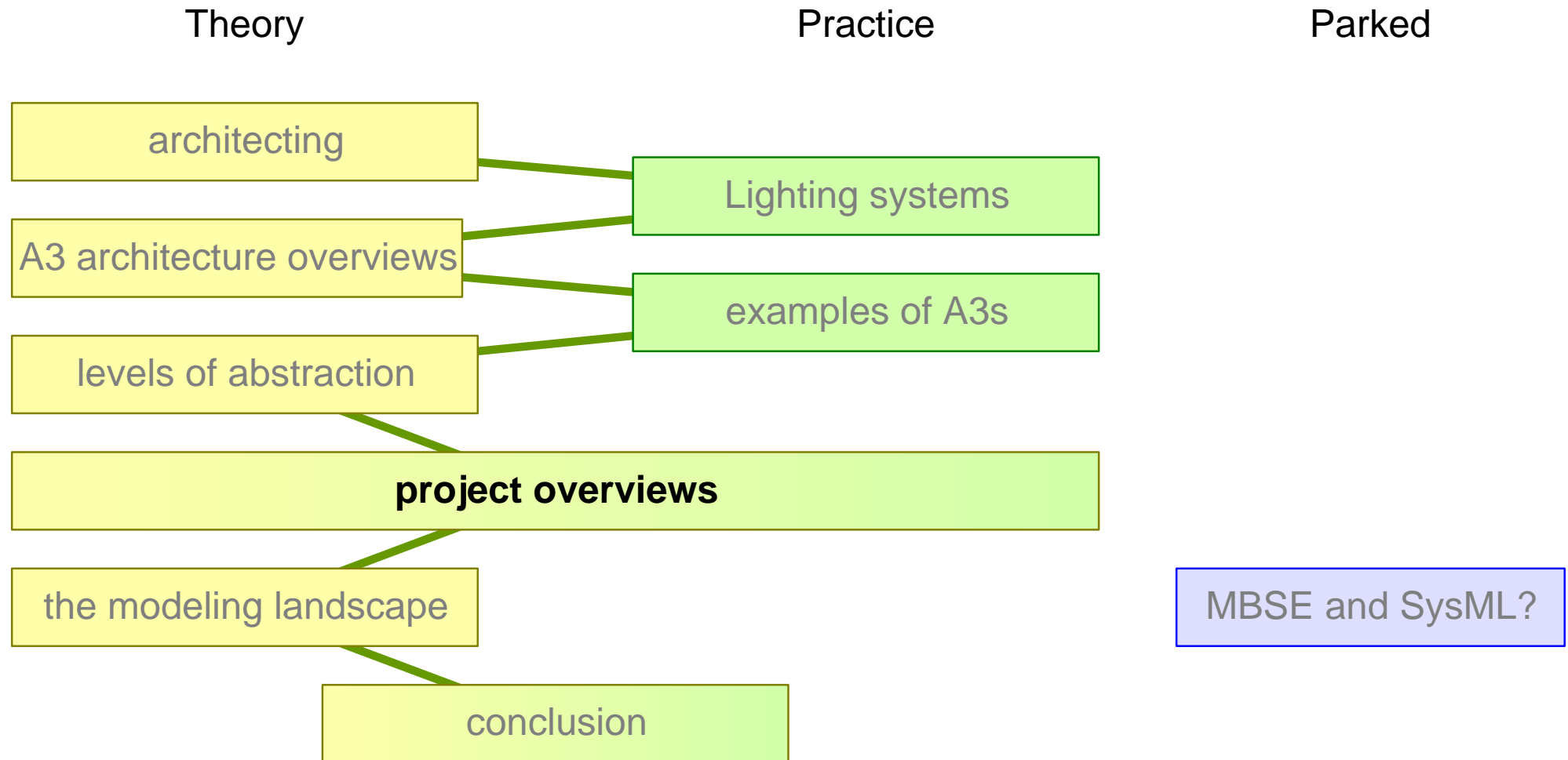
# Architecting Connects Context and System Design



# We Need Overview at Multiple Levels



# Figure of Content



# Project Overview Canvas; Project Definition

<i>Project Title</i>		meta information, e.g. version, date author, owner
<i>Project Goals</i> <ul style="list-style-type: none"><li>• specific and quantified</li></ul>	<i>system context</i> <ul style="list-style-type: none"><li>• visualization (drawing, block diagram, 3D model, or photo) of the system context</li><li>• indication of changes in the context</li></ul>	<i>system of interest</i> <ul style="list-style-type: none"><li>• visualization (drawing, block diagram, 3D model, or photo) of the system</li><li>• indication of changes in the system of interest</li></ul>
<i>Key Performance Parameters</i> <ul style="list-style-type: none"><li>• specific and quantified</li></ul>		
<i>project master plan with timeline</i> <ul style="list-style-type: none"><li>• timeline with 5 to 10 milestones, especially deliverables</li><li>• specific and quantified</li></ul>		<i>optional information, e.g.</i> <ul style="list-style-type: none"><li>• enabling systems</li><li>• stakeholders</li><li>• external or internal interfaces</li><li>• constraints, e.g. applicable legislation</li></ul>

# Example Project Overview

Project overview Metal Printer R2

version 2.0. January 22, 2023  
author: Gerrit Muller

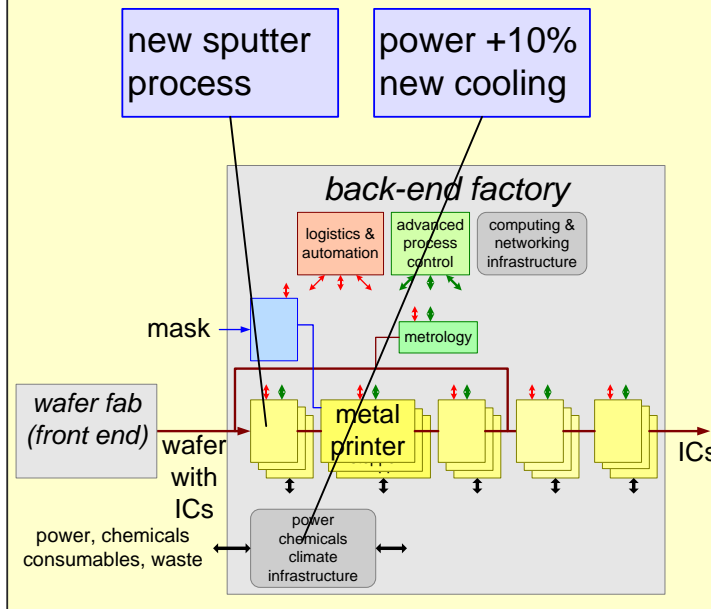
## Project Goals

support production of node 1C  
process development Q2 2022  
volume production Q2 2023  
productivity 30,000 W/m  
yield 95%

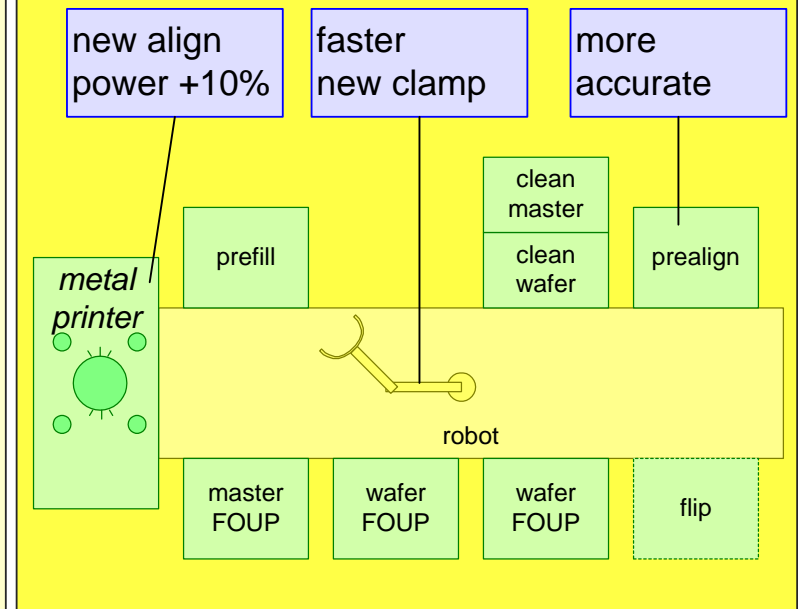
## Key Performance Parameters

min. line width 100 nm  
overlay 30 nm  
throughput 100 WPH  
MTBF 2000 hr  
wafer size 300 mm  
power 5 kW  
clean room class C  
floor vibration class D

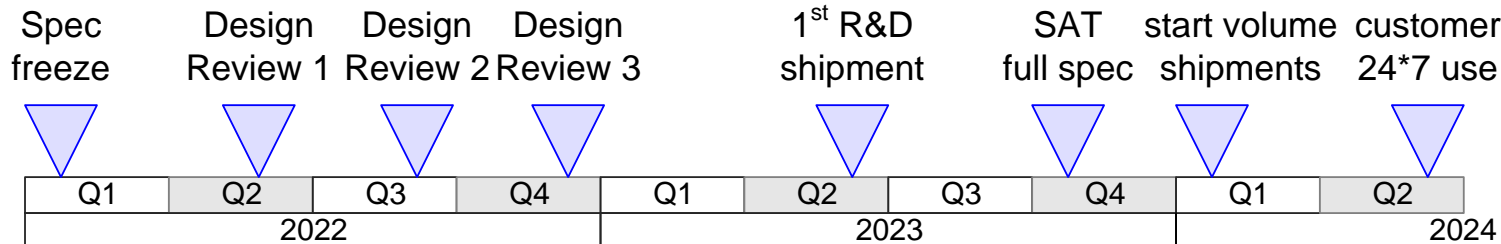
## system context



## system of interest



## project master plan



## changing enabling systems

conditioned transport  
calibration wafers  
calibration metrology

# Project Overview Canvas; Project Management

*Project Title*

meta information, e.g. version, date  
author, owner

*Work Breakdown Structure*

- visualization
- *builds upon the Product Breakdown Structure*

*Project Master Plan*

- PERT plan with major milestones

*project organization*

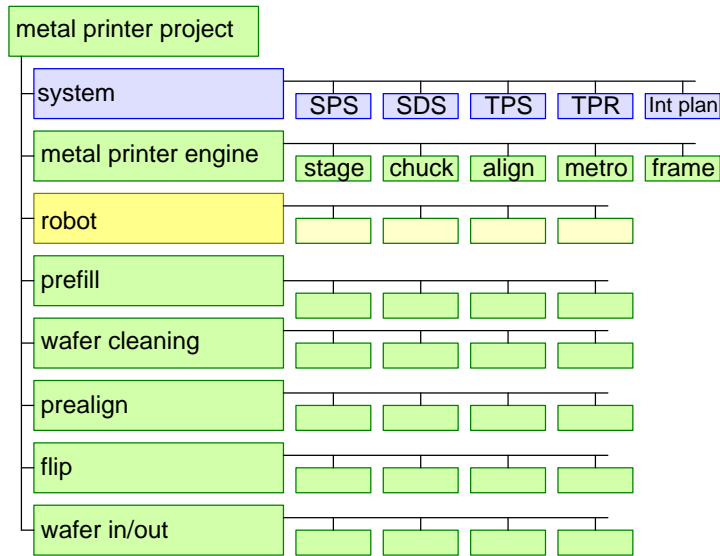
- allocation of roles
- specific additions or deviations

# Example Project Overview

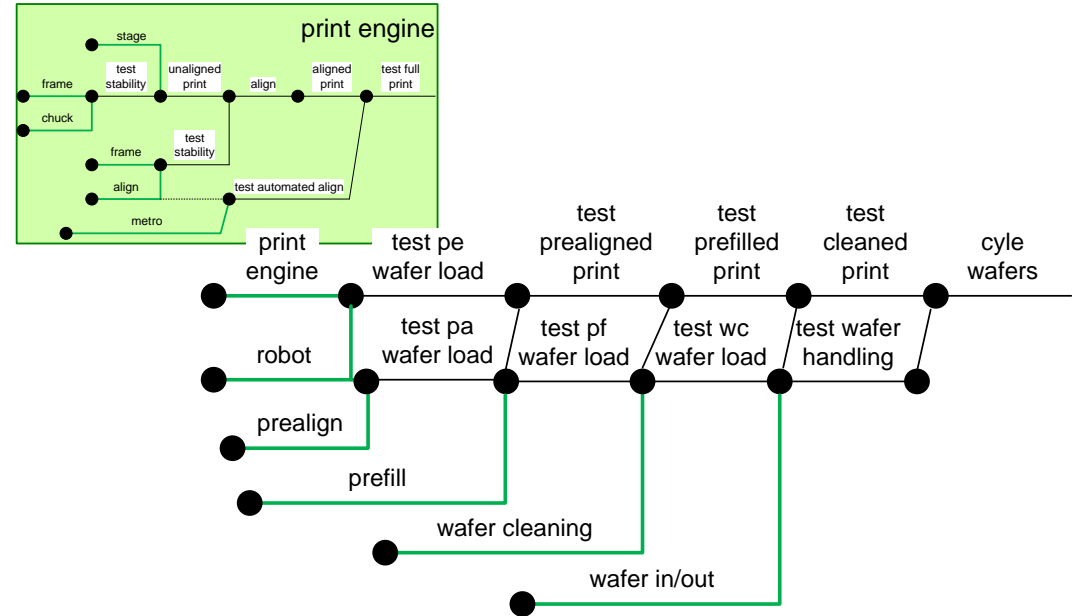
*Metal Printer*

version 0.1, 2023-02-11  
author: Gerrit Muller

## Work Breakdown Structure



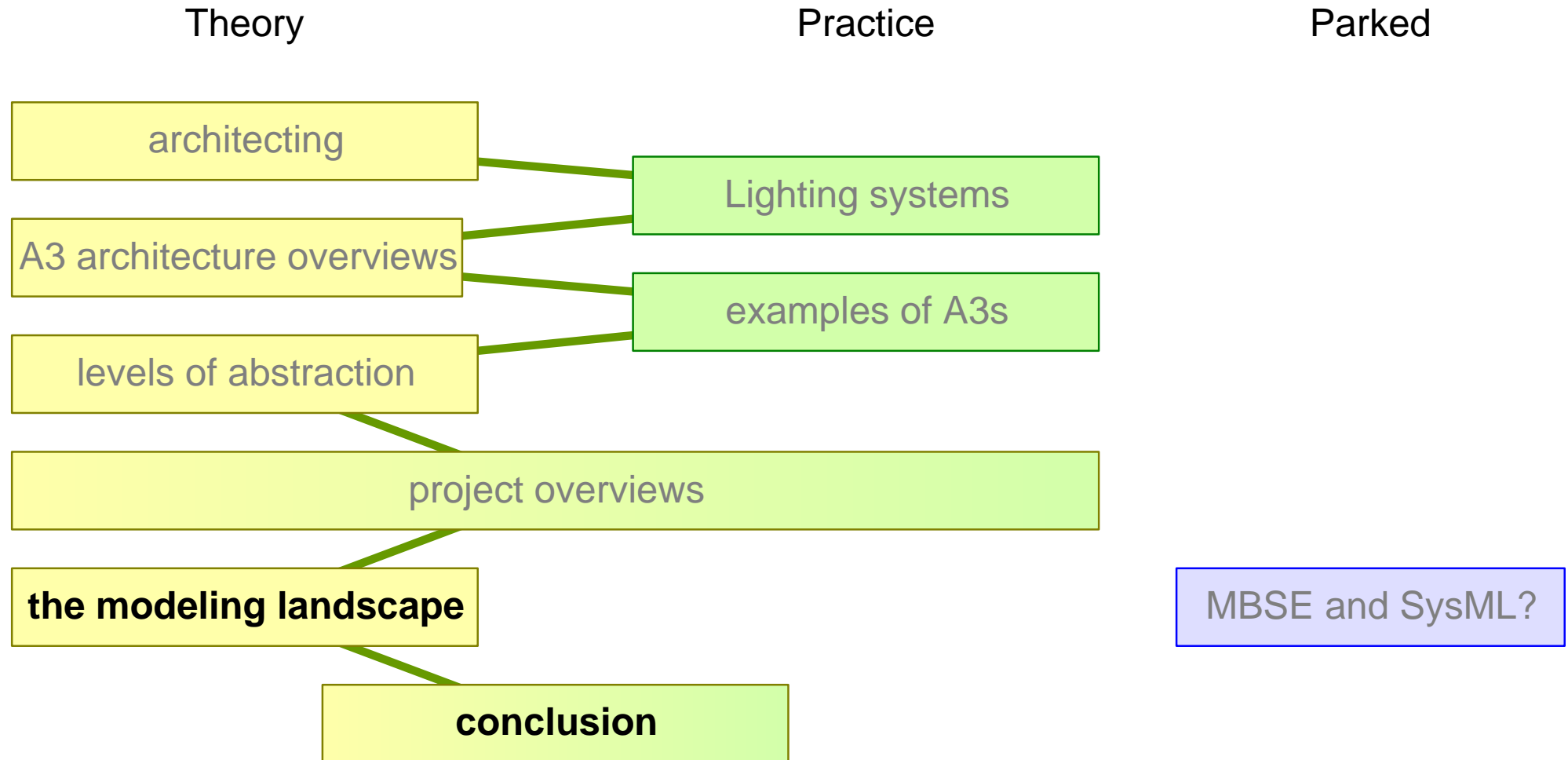
## Project Master Plan



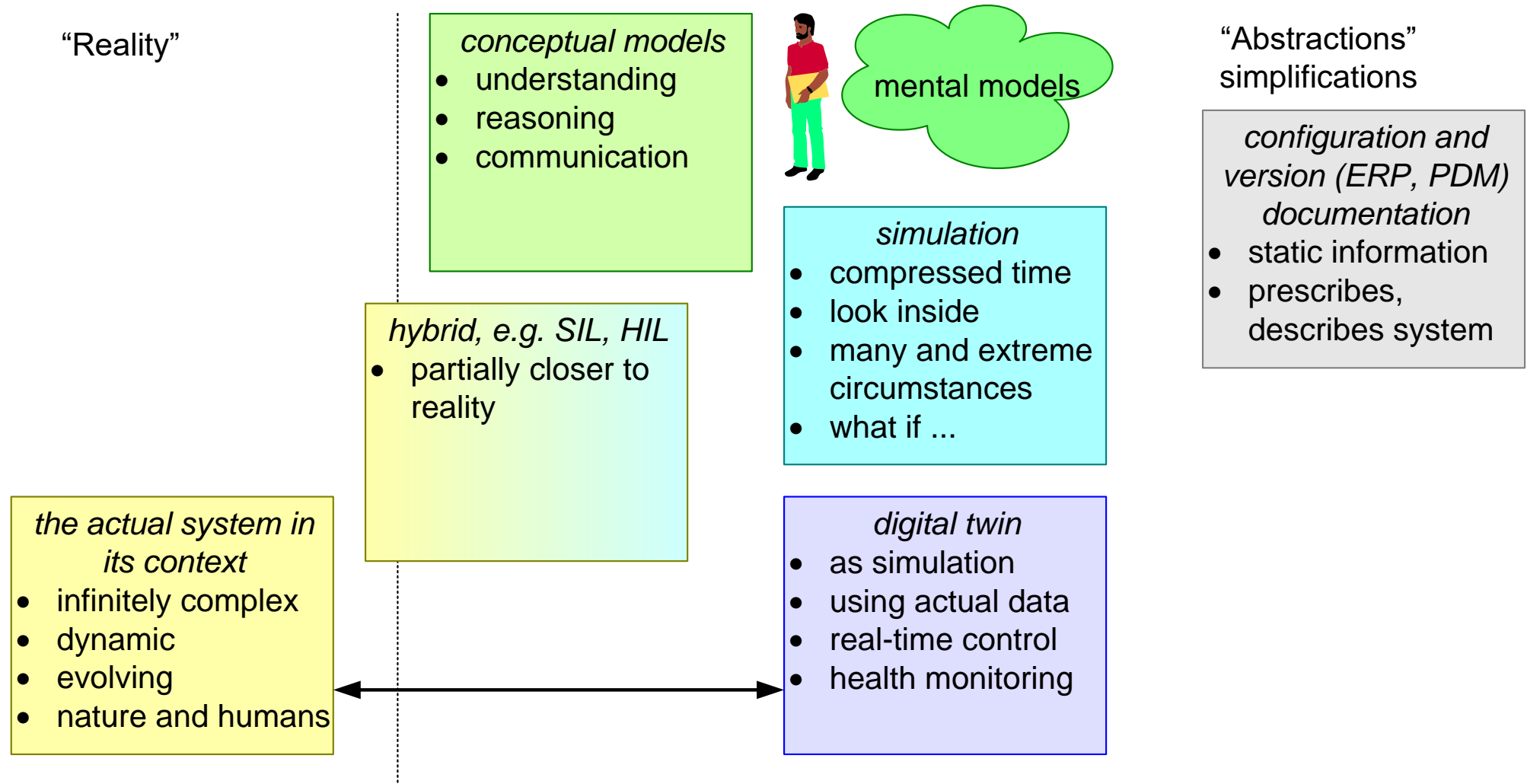
## project organization

Project Leader: P.L. Eader  
Product Manager: P.M. Anager  
Architect: Archie Tect

# Figure of Content



# The Bigger Landscape of Models



# Conclusion

A major task of the architect is to help the development team and its stakeholders to **navigate** the **problem and solution space** to

support communication

facilitate reasoning

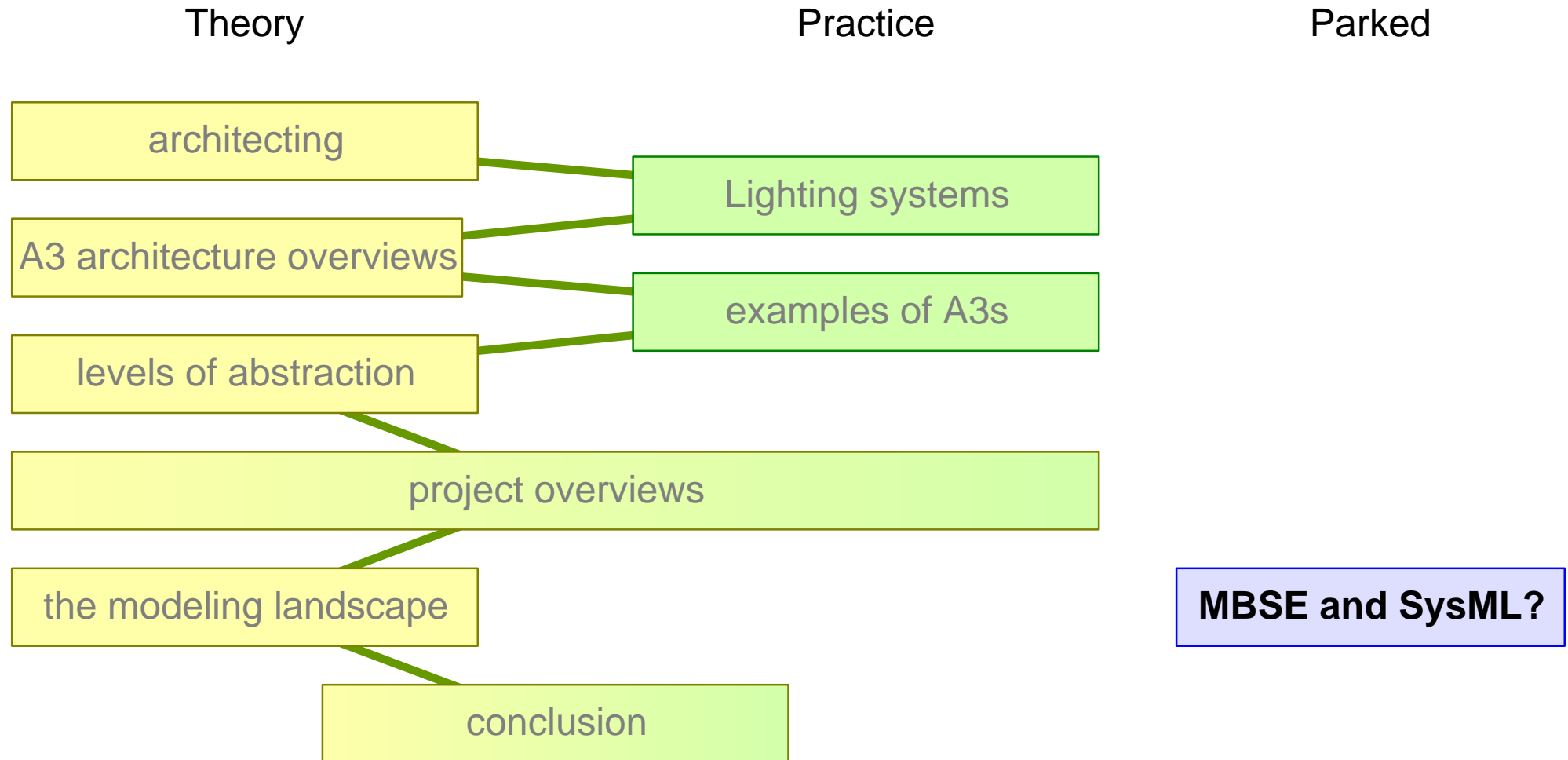
support decision making

create	understanding
maintain	insight
	overview

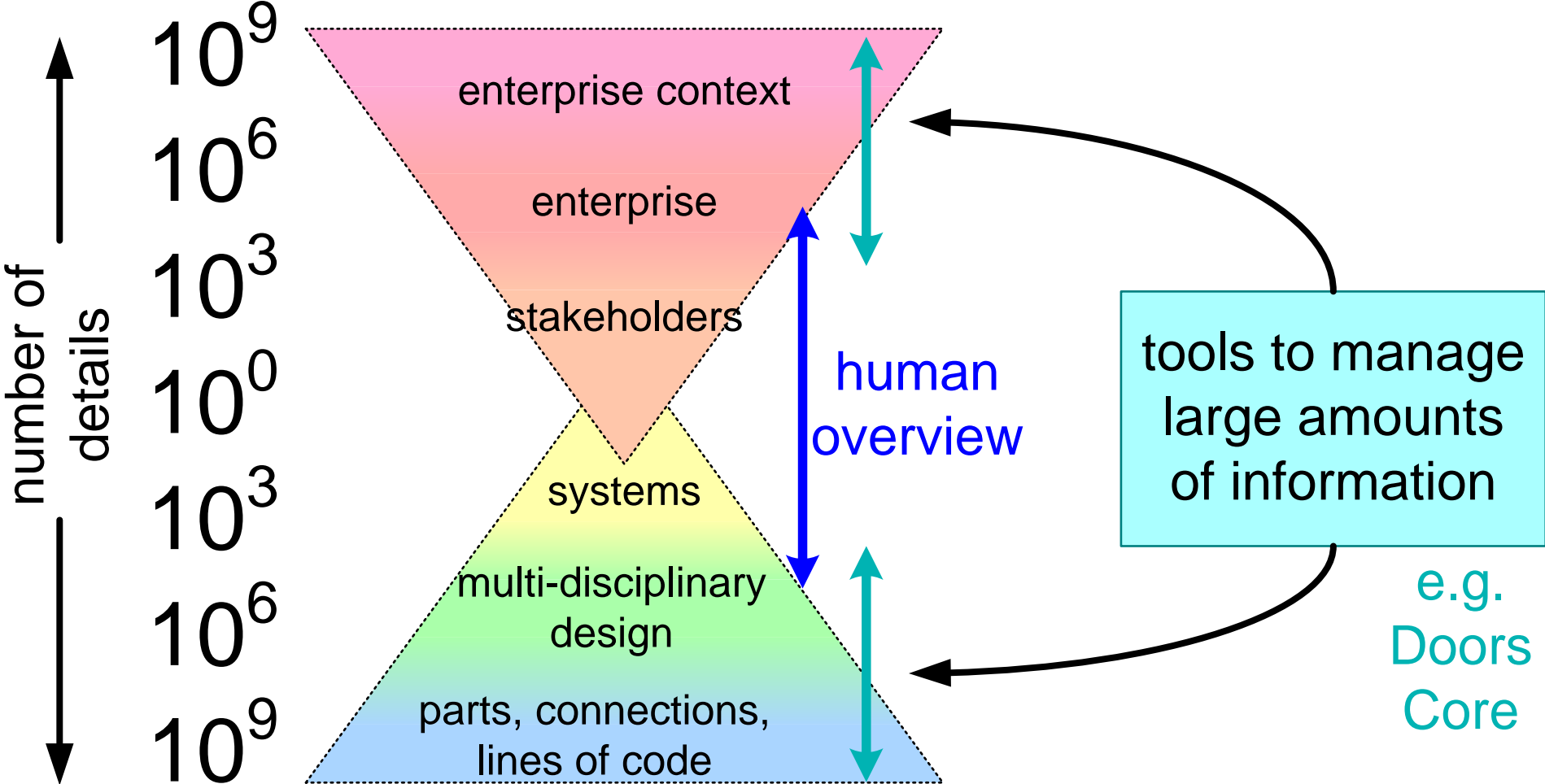
**Conceptual**, e.g. human understandable, **models** are the means for this.

Most team members and stakeholders **get lost in details** **without** guiding overview

# Figure of Content



# Computer Assistance Pays Back when Managing Much Data



# The definition of MBSE is broad and ambitious

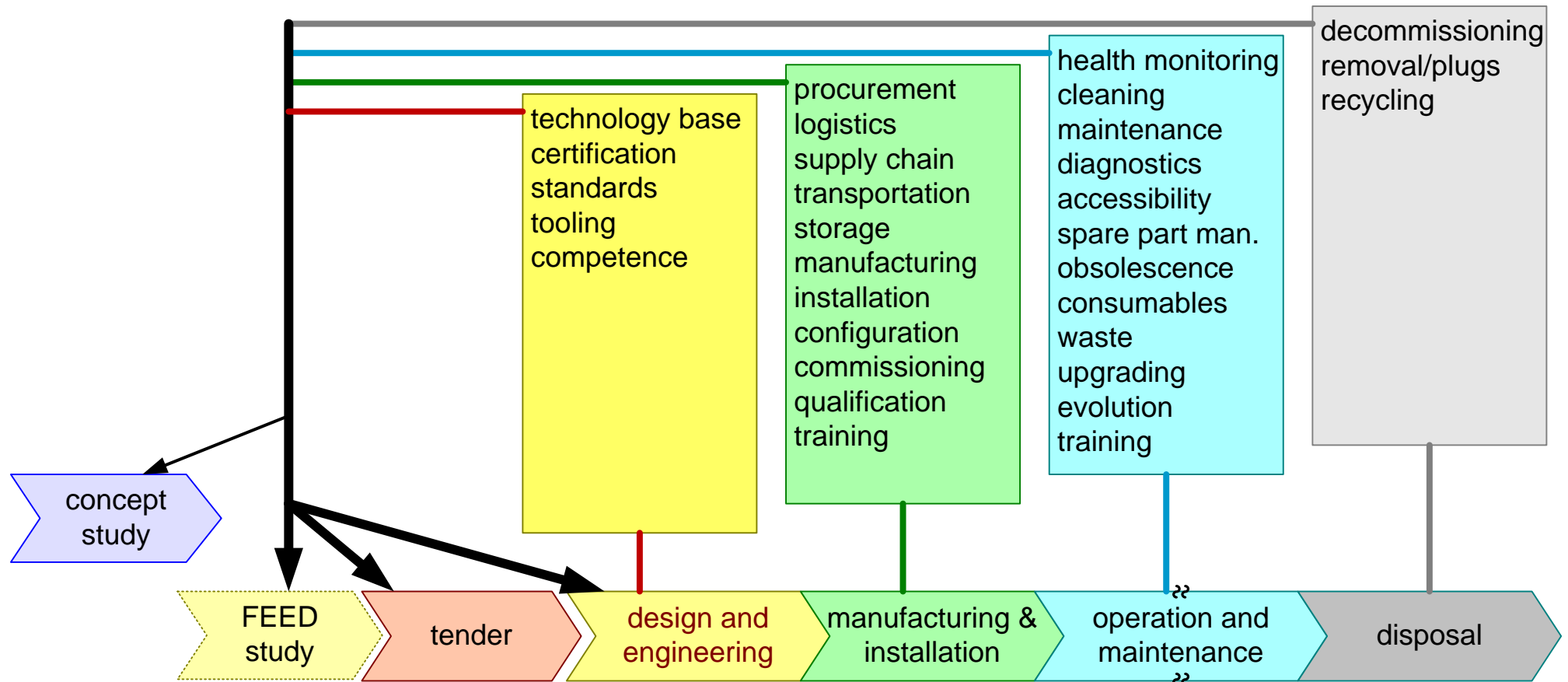
Model-based Systems Engineering [MBSE] is a paradigm that uses **formalized representations** of systems, known as models, **to support and facilitate** the performance of **Systems Engineering [SE] tasks throughout a system's life cycle**.

MBSE is frequently contrasted with legacy document-based approaches where systems engineering captures system design information via multiple independent documents in various non-standardized formats. MBSE consolidates system information in system design models, which provide primary SE artifacts. These system models, which are generally expressed in a standardized modelling language such as Systems Modeling Language [SysML®] express key system information in a **concise, consistent, correct,** and **coherent** format. When implemented properly, MBSE models permit the standardized consolidation and integration of system **knowledge** across engineering disciplines and subsystems and streamline key systems engineering tasks while also minimizing developmental risk.

From SEBoK:

[https://sebokwiki.org/wiki/Model-Based\\_Systems\\_Engineering\\_\(MBSE\)#:~:text=Model%2Dbased%20Systems%20Engineering%20%5BMBSE,throughout%20a%20system's%20life%20cycle.](https://sebokwiki.org/wiki/Model-Based_Systems_Engineering_(MBSE)#:~:text=Model%2Dbased%20Systems%20Engineering%20%5BMBSE,throughout%20a%20system's%20life%20cycle.)

# The life cycle has many information needs



# What is the real MBSE objective?

---

- to support **reuse** or a platform based product strategy
  - to configure, generate, compose, validate
- to **automate** or generate
  - **tests, simulations**
- to **trace** needs, requirements, or quality attributes throughout the design and engineering
  - especially regulated qualities like **safety**
- to function as **knowledge base** for development and engineering
- to **access component-data** based on the field configuration (digital shadow)
- to populate and update **PLM** systems, e.g. ERP (digital thread)

