

# Module 31, Architectural Reasoning Case Exploration

by *Gerrit Muller* HBV-NISE

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## Abstract

This module introduces the case exploration used in the course Architectural Reasoning using Conceptual Modeling.

### Distribution

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draft

version: 1.0

# SEMA Methods Overview

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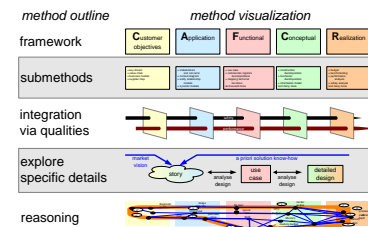
## Abstract

This presentation provides an overview of the SEMA course: Architectural Reasoning Using Conceptual Modeling. This course uses the CAFCR+ model with 6 views. Qualities connect all views. Threads-of-reasoning capture the architectural reasoning across views and qualities. Conceptual models visualize and capture the context, the system and its design. Quantification is a means to make problem and solution space tangible.

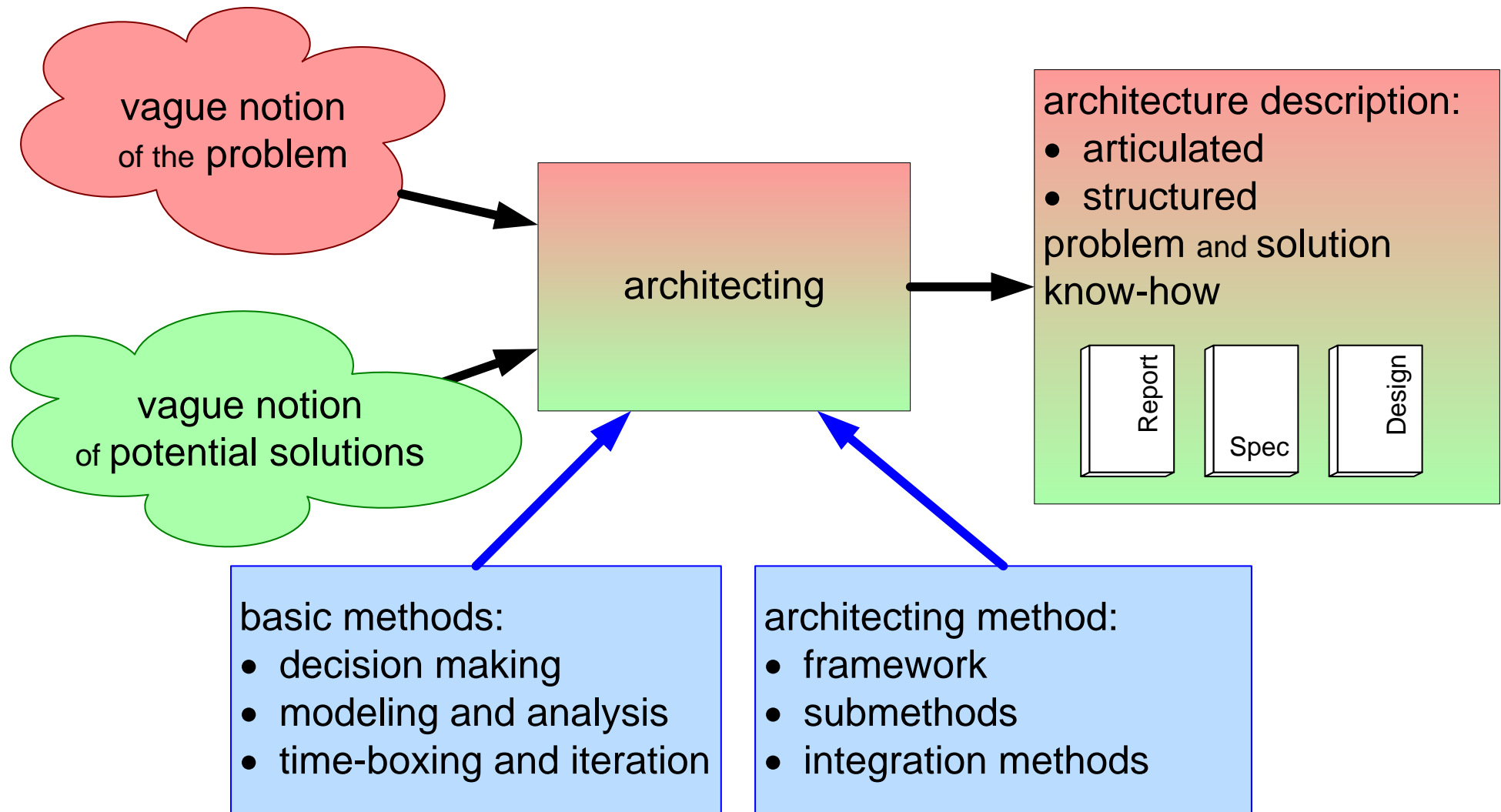
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# From vague notions to articulate and structured



# Overview of architecting method

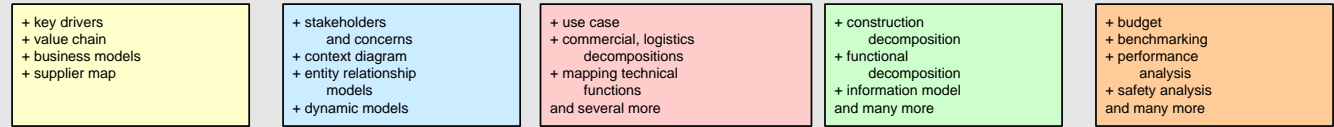
## method outline

## method visualization

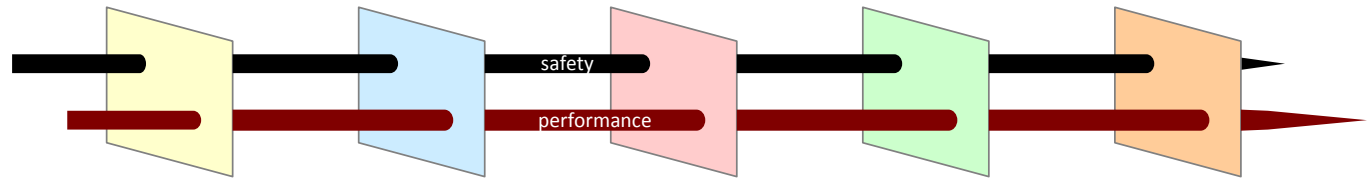
### framework



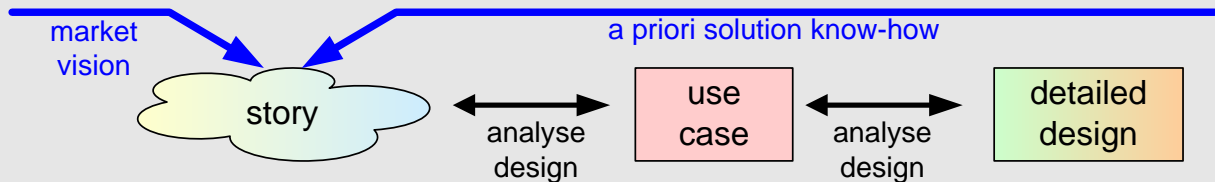
### submethods



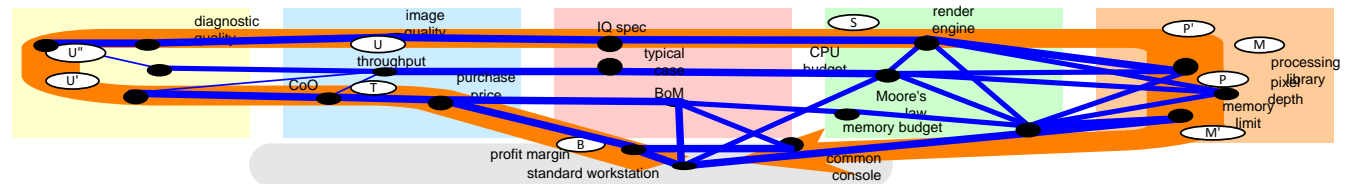
### integration via qualities



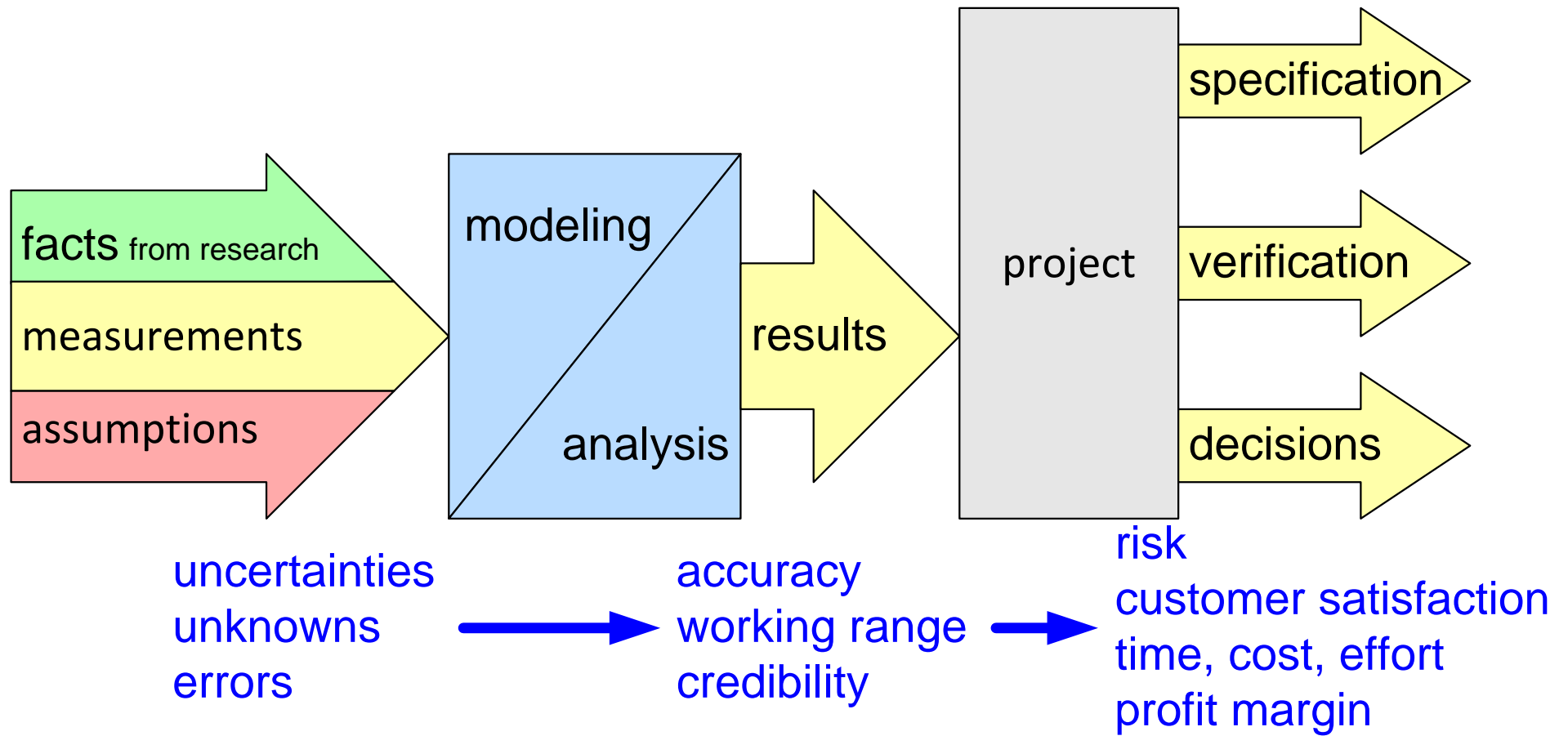
### explore specific details



### reasoning



# Purpose of Modeling



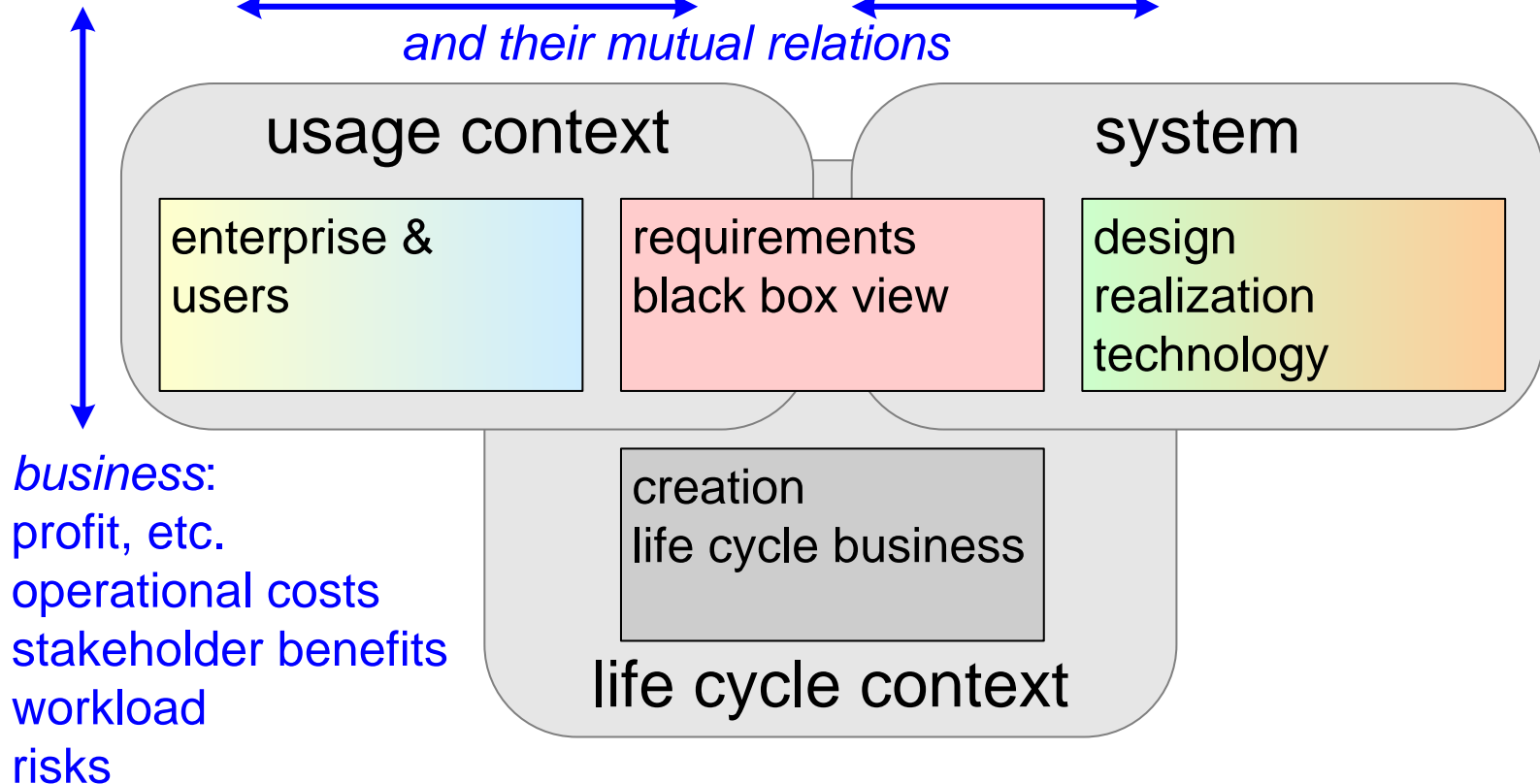
# What to Model?

*business:*  
profit, etc.  
operational costs  
stakeholder benefits  
workload  
risks

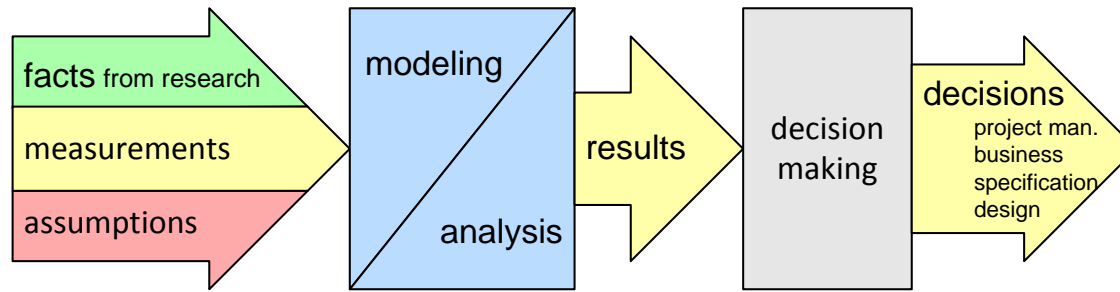
*key performance:*  
throughput, response  
reliability  
availability  
scalability  
...

*(emerging?) properties:*  
resource utilization  
load  
latency, throughput  
quality, accuracy  
...

← and their mutual relations →

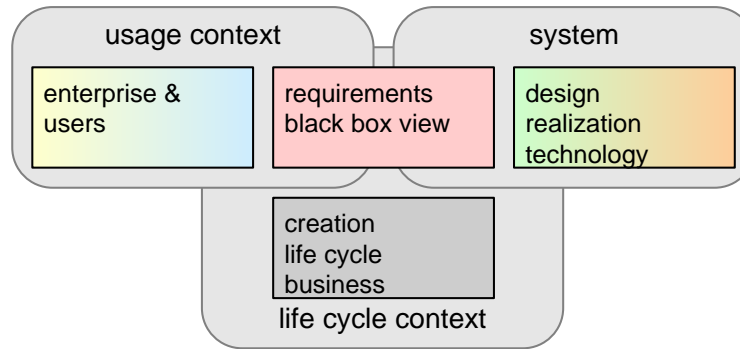


# Overview of Modeling Approach



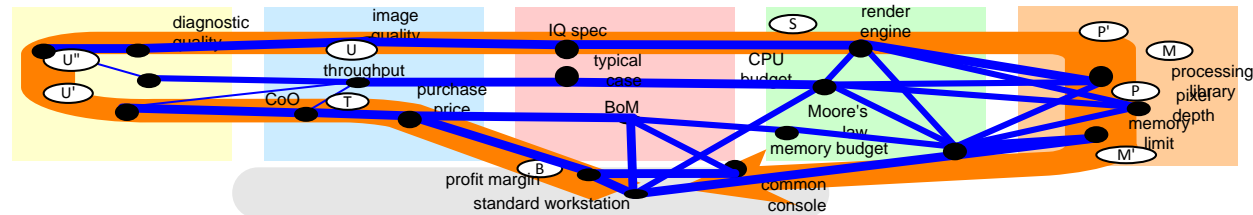
collect input data

model and analyse relevant issues



for different stakeholders & concerns

integration and reasoning



# Short introduction to basic “CAFCR” model

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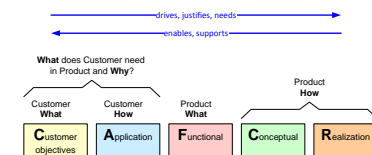
## Abstract

The basic “CAFCR” reference model is described, which is used to describe a system in relation to its context. The main stakeholder in the context is the customer. The question “Who is the customer?” is addressed.

## Distribution

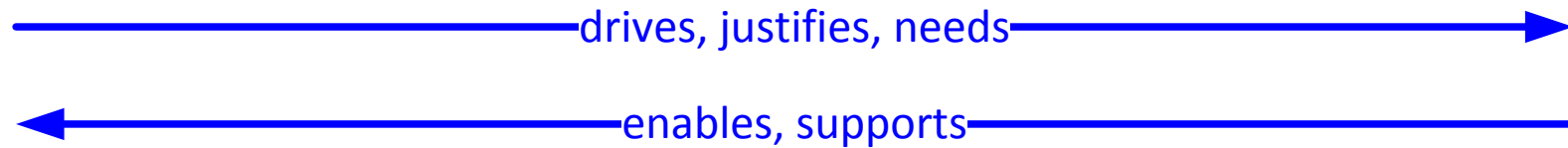
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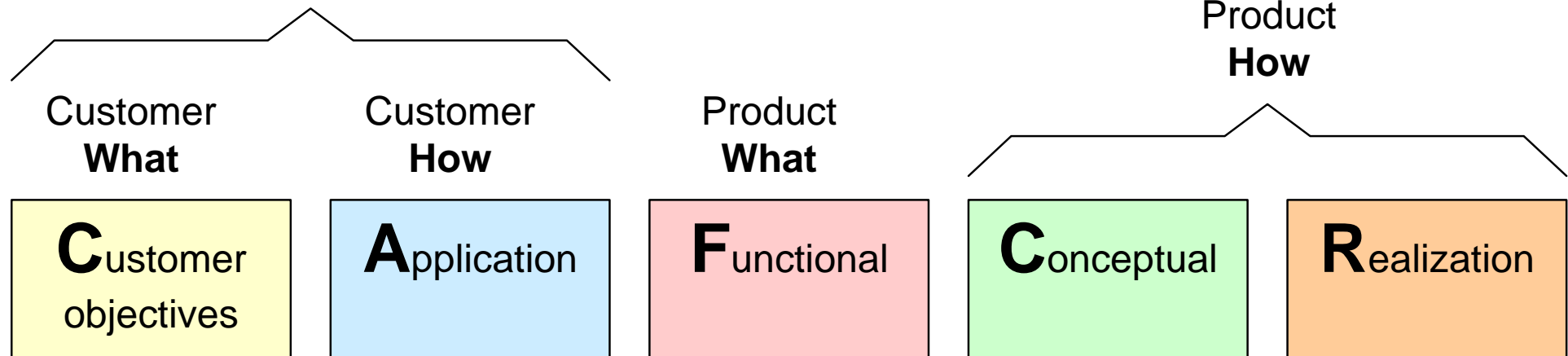




# The “CAFCR” model

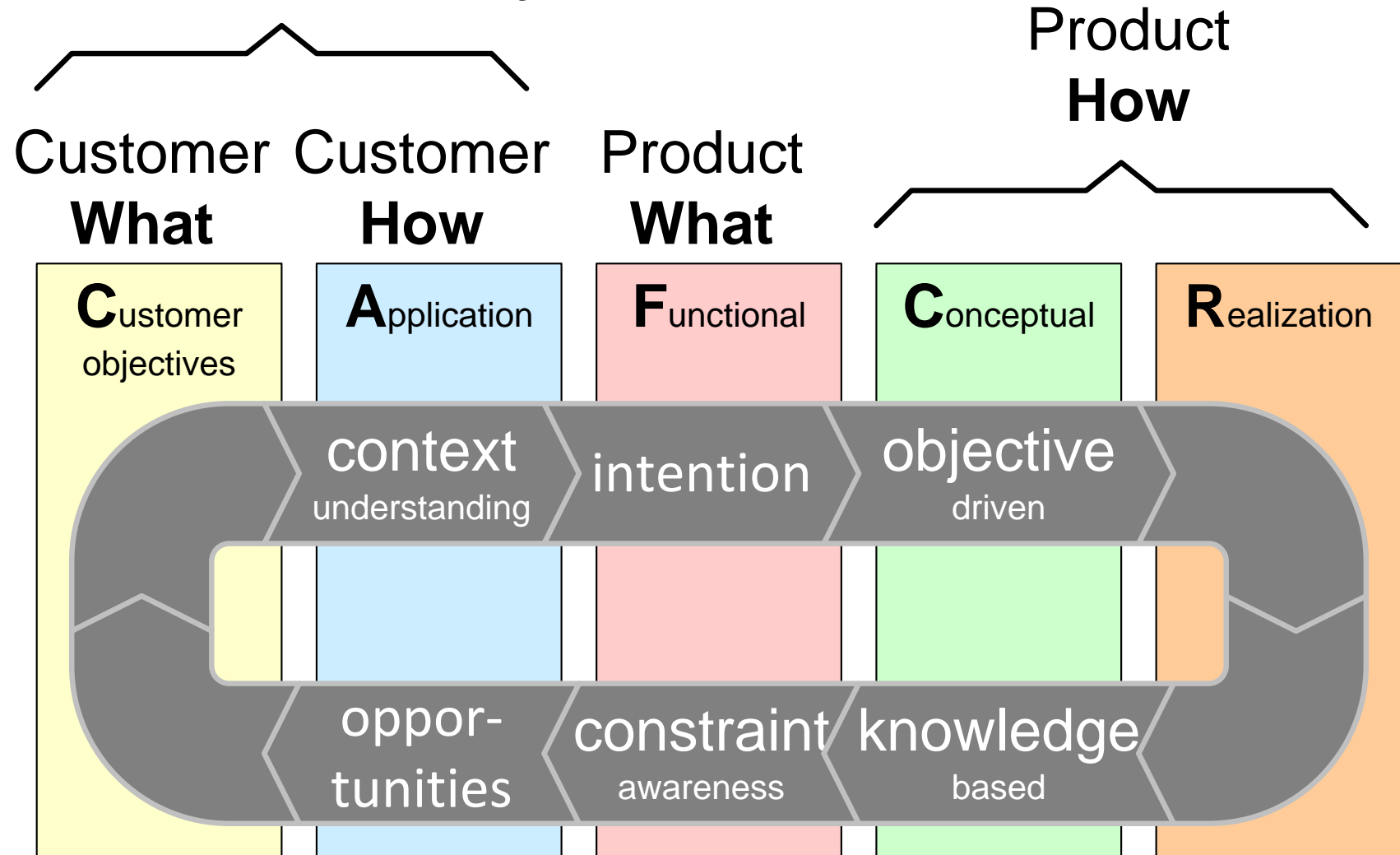


**What** does Customer need  
in Product and **Why?**

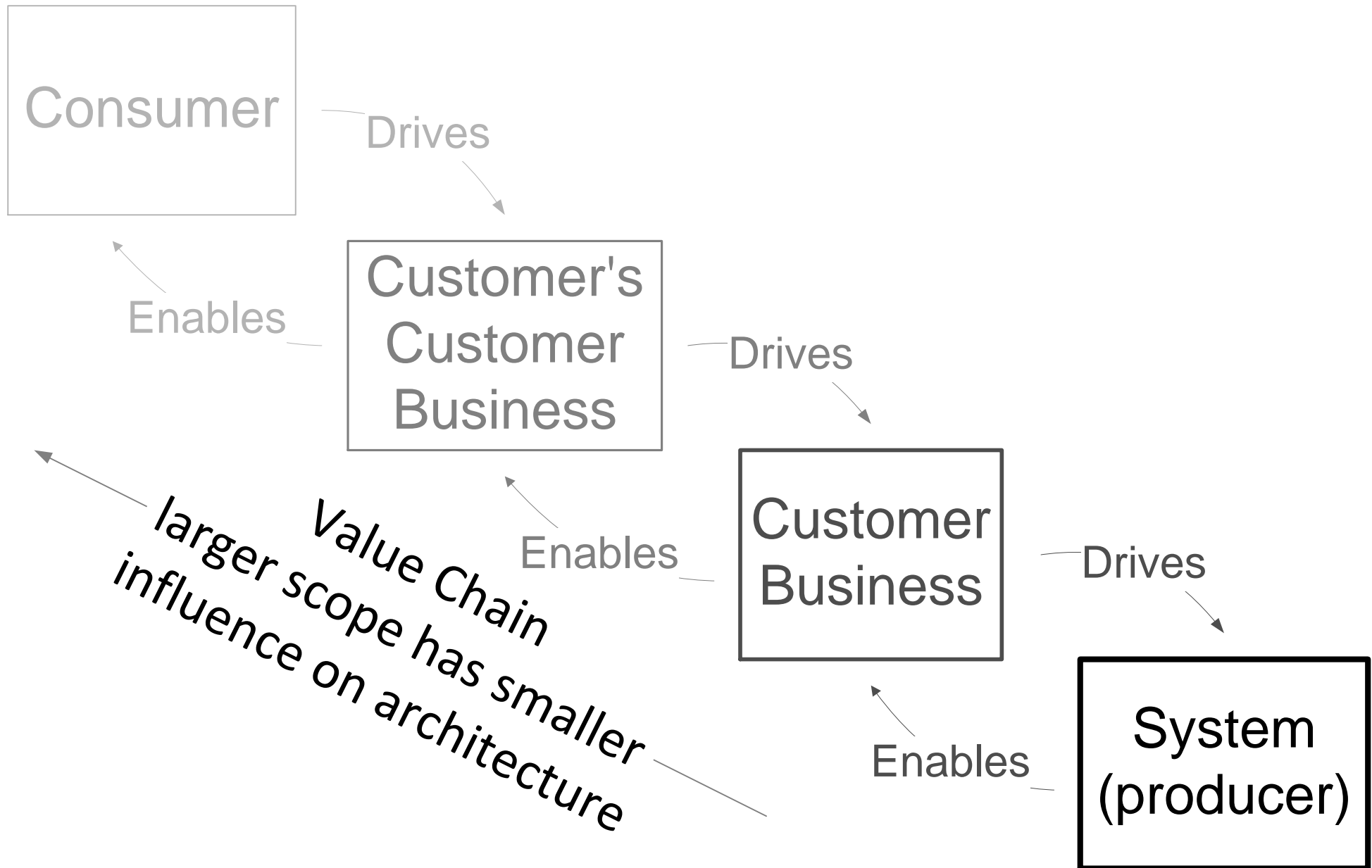


# Integrating CAFCR

**What** does Customer need  
in Product and **Why?**



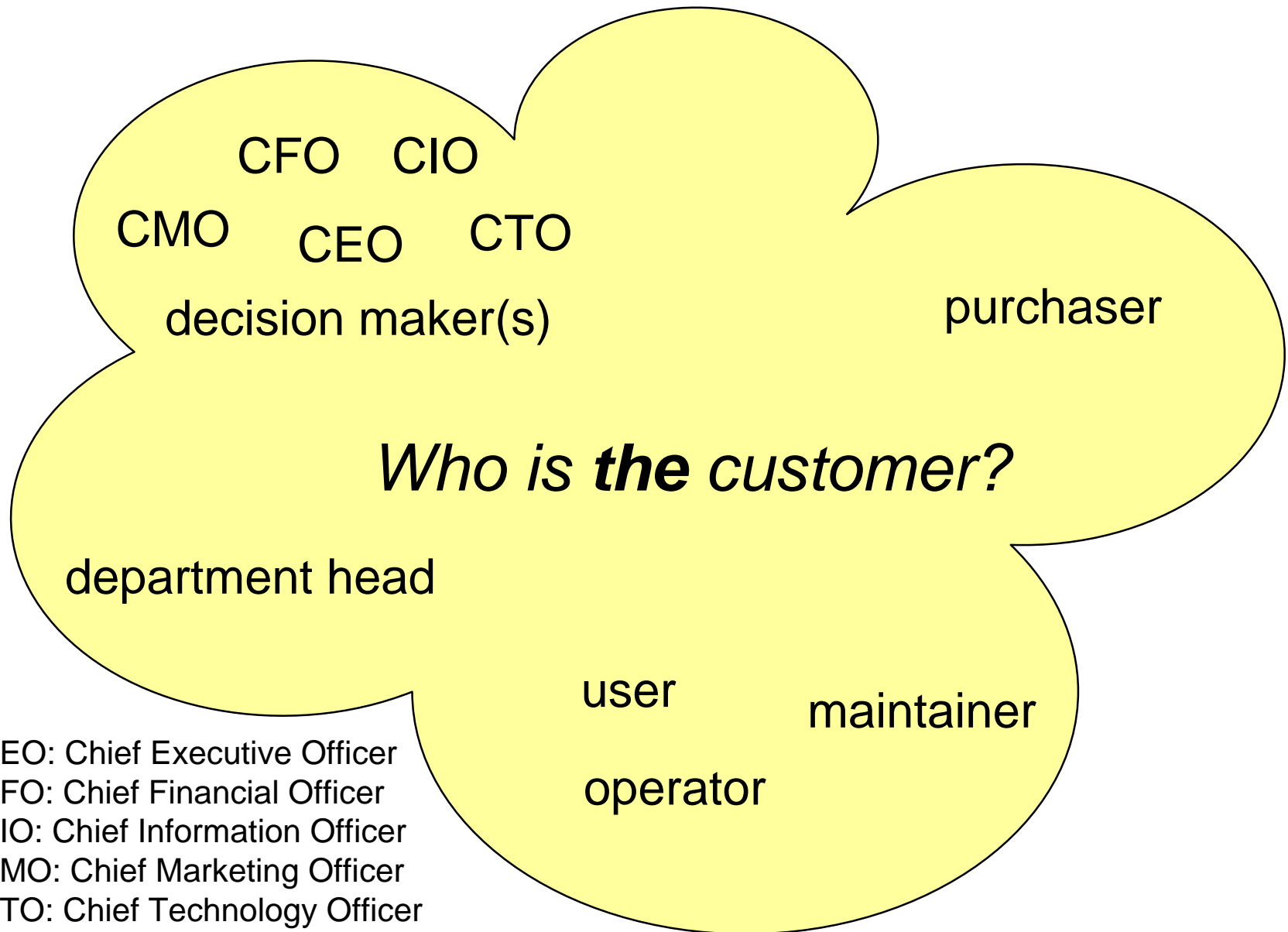
# CAFCR can be applied recursively



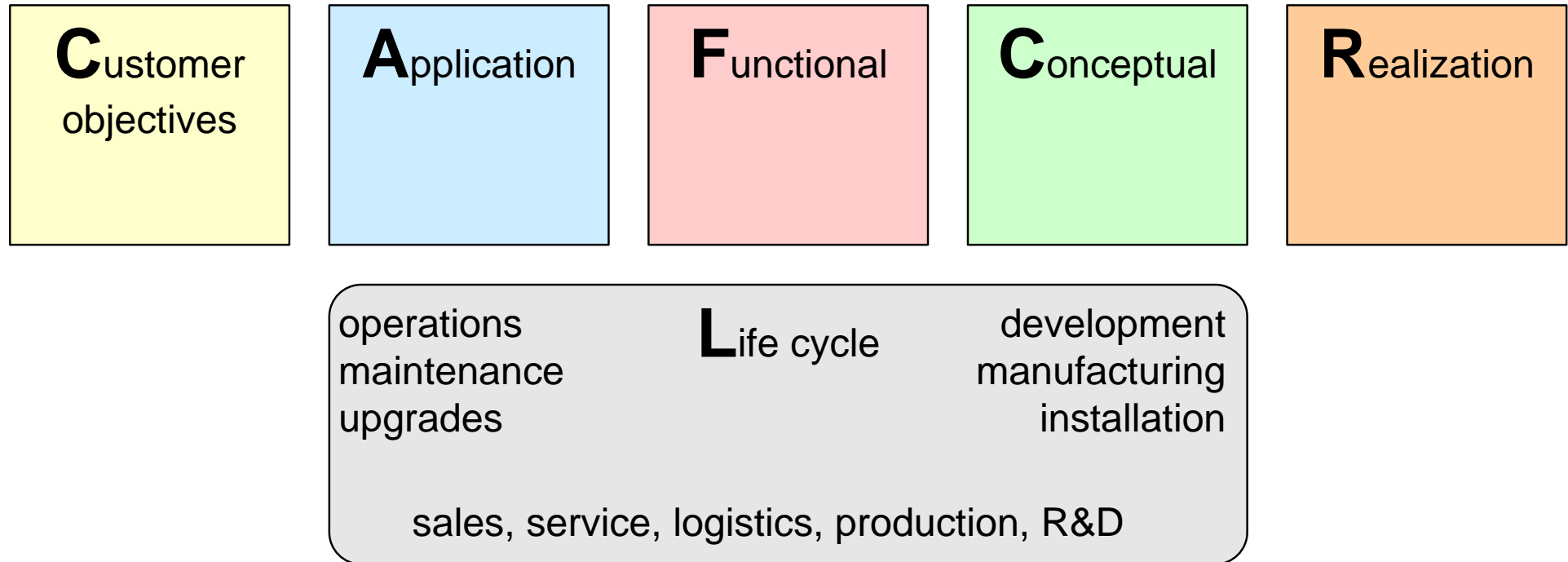
# Market segmentation

segmentation axis	examples
geographical	USA, UK, Germany, Japan, China
business model	profit, non profit
economics	high end versus cost constrained
consumers	youth, elderly
outlet	retailer, provider, OEM, consumer direct

# Example of a small buying organization



# CAFCR+ model; Life Cycle View



# Initial CAFCR scan

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## Abstract

This presentation guides a team through a quick CAFCR scan. Such quick scan with typically 15 minutes per view helps to build an initial overview of the problem and solution space.

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make a bottom-up analysis of your product:

1. realization
2. conceptual
3. functional
4. application
5. customer objectives
6. qualities

use time boxes of 15 minutes per view  
show the most dominant decomposition of that view, as diagram or as a list; some more guidance will be given per step.

# Exercise Bottom-up Scan CAFCR

make a bottom-up analysis of your product:

1. realization
2. conceptual
3. functional
4. application
5. customer objectives
6. qualities

use time boxes of 15 minutes per view

show the most dominant decomposition of that view, as diagram or as a list; some more guidance will be given per step.

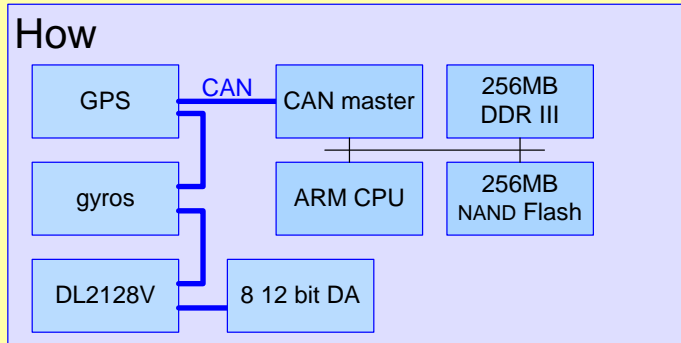


# Do and Don't

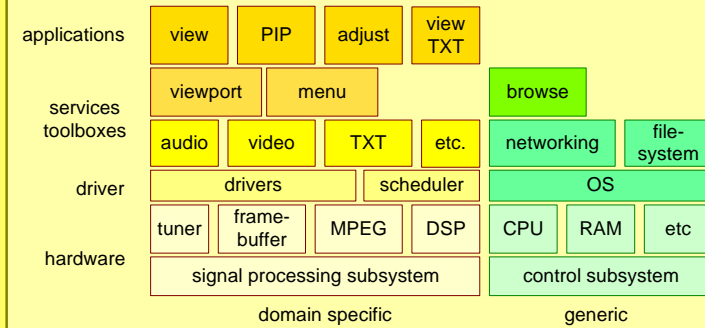
Do	Do not	Because
<ul style="list-style-type: none"><li>• start sketching/drawing as soon as possible</li><li>• use shared large sheets of paper (e.g. flip-over)</li><li>• number the flip-overs and add a title</li><li>• annotate (add notes) during discussions</li><li>• use yellow note stickers and flip-over markers</li><li>• be open for ideas and surprises</li></ul>	<ul style="list-style-type: none"><li>• write long texts</li><li>• immediately capture electronic</li><li>• have nice but volatile discussions</li><li>• write with pen or pencil</li><li>• Do not stick to the first solution</li></ul>	<ul style="list-style-type: none"><li>• sketches stimulate sharing and discussion</li><li>• sharing and discussion help to explore faster</li><li>• remembering the order gets challenging</li><li>• information and insight is quickly lost</li><li>• stickers are easily (re)moved</li><li>• you hopefully discover a lot; increased insight will change problem and solution</li></ul>

# Step 1: Realization View

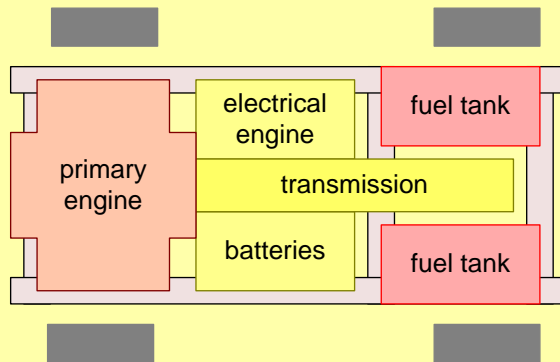
Choose 1 or 2 items from below



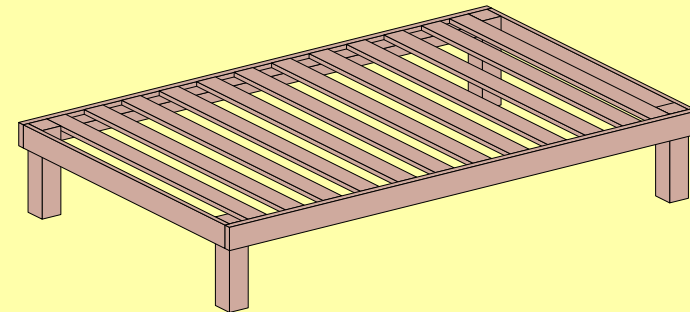
HW block diagram



SW layer diagram



2D layout of system internals



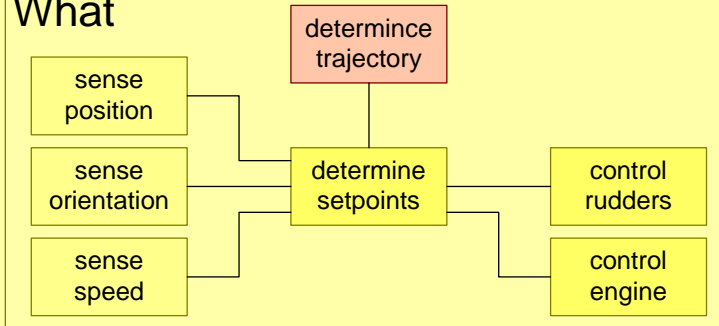
3D sketch of system internals

Annotate/mark most critical technologies or characteristics

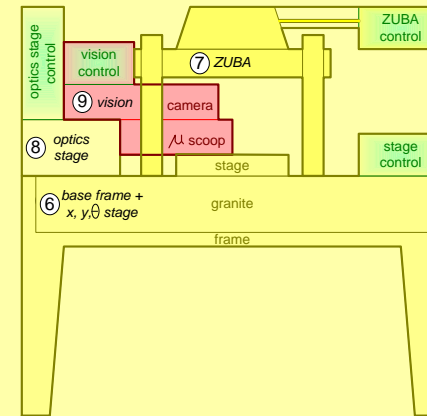
# Step 2: Conceptual View

Chose 1 or 2 items from below

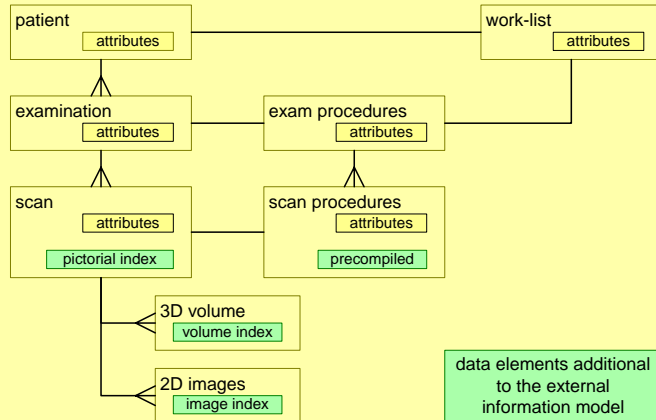
What



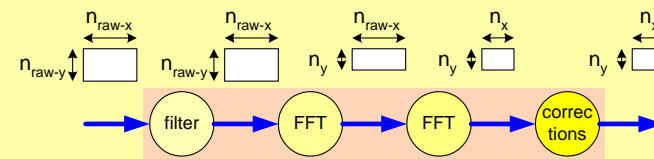
functional model



subsystem decomposition



information model

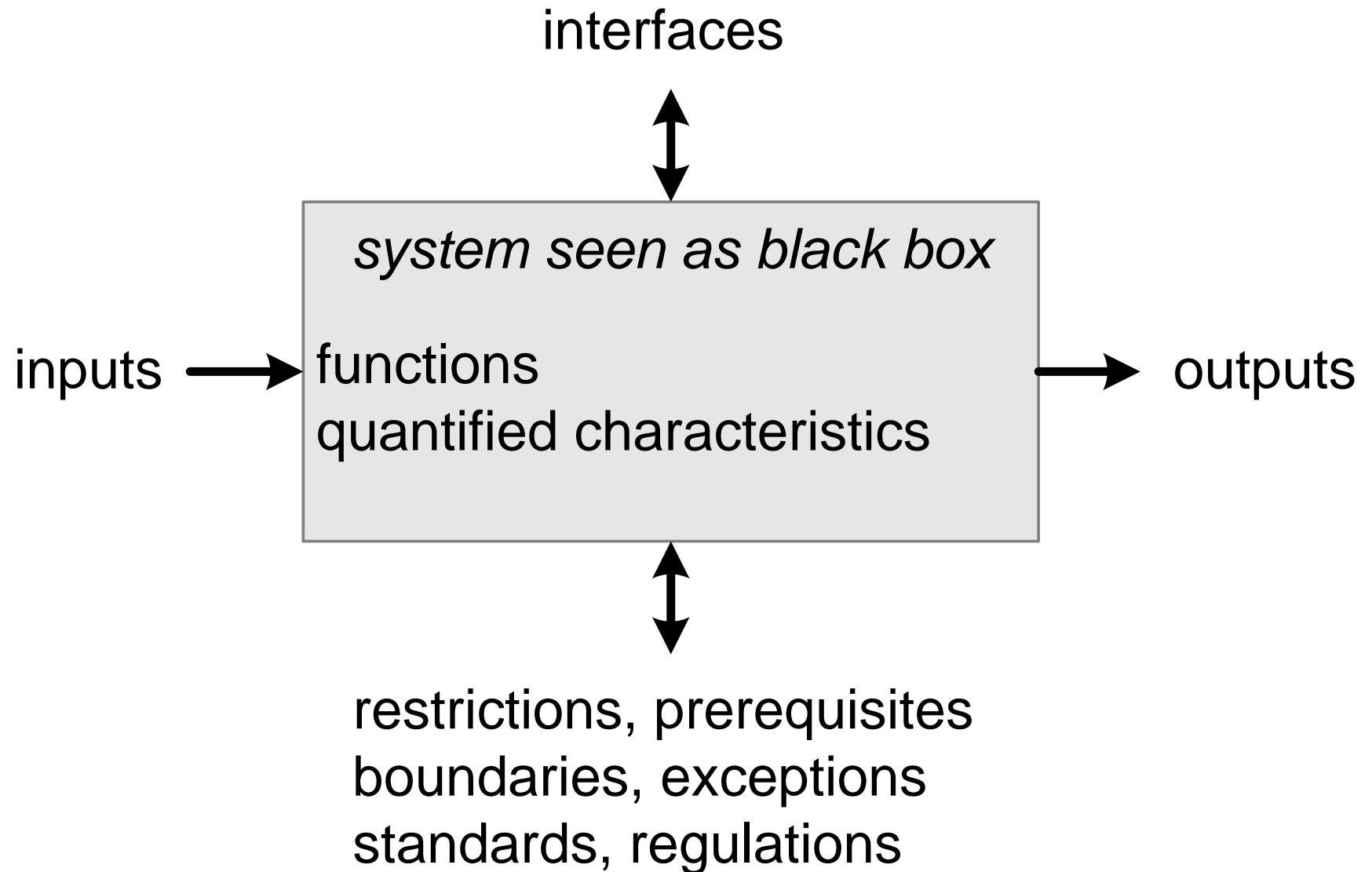


$$\begin{aligned}
 t_{recon} &= t_{filter}(n_{raw-x}, n_{raw-y}) + \\
 & n_{raw-x} * (t_{fft}(n_{raw-y}) + t_{col-overhead}) + \\
 & n_y * (t_{fft}(n_{raw-x}) + t_{row-overhead}) + \\
 & t_{corrections}(n_x, n_y) + \\
 & t_{control-overhead}
 \end{aligned}$$

$$t_{fft}(n) = c_{fft} * n * \log(n)$$

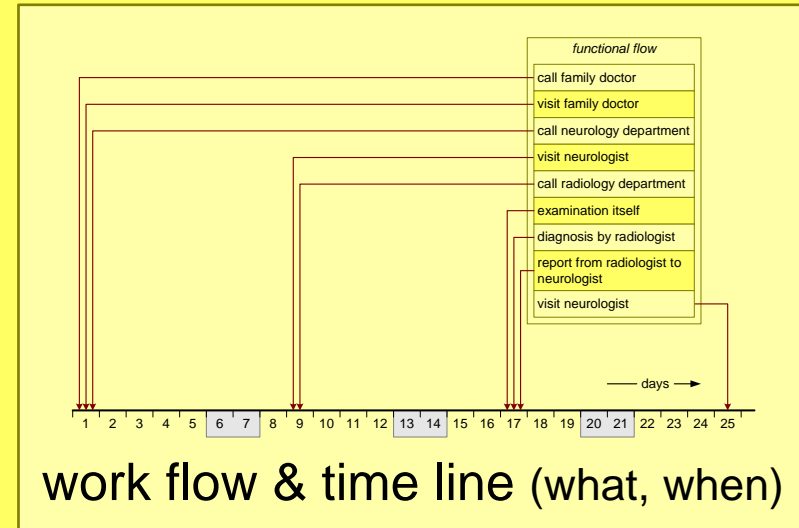
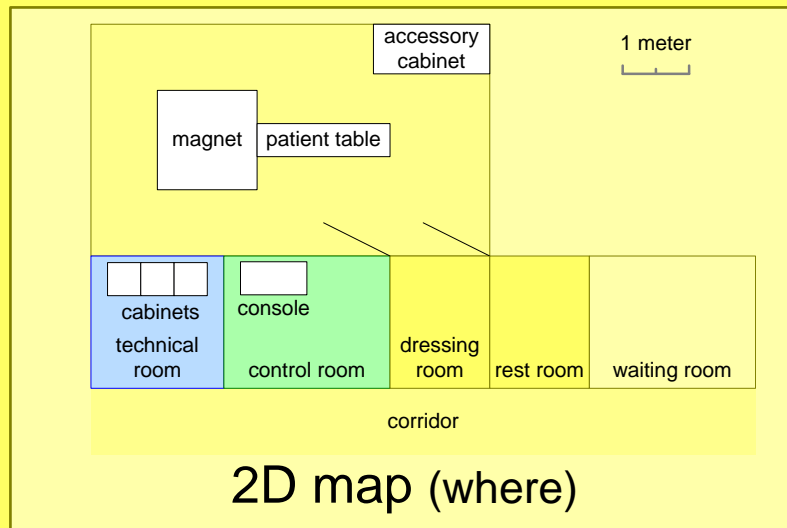
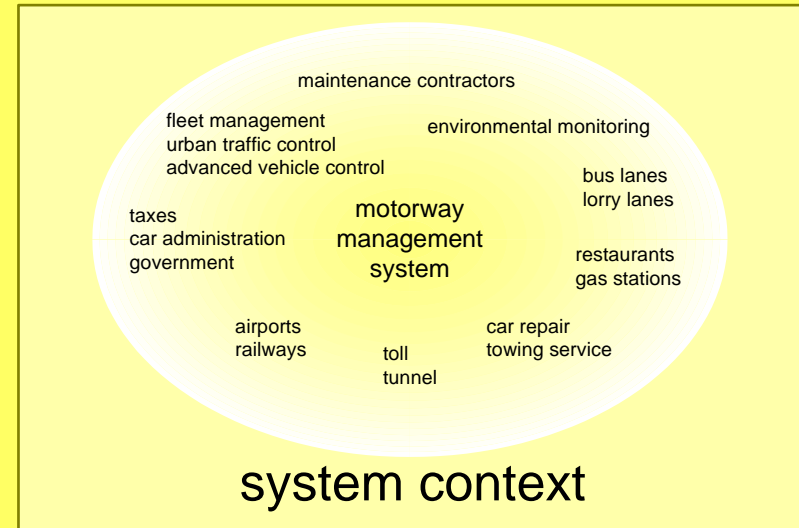
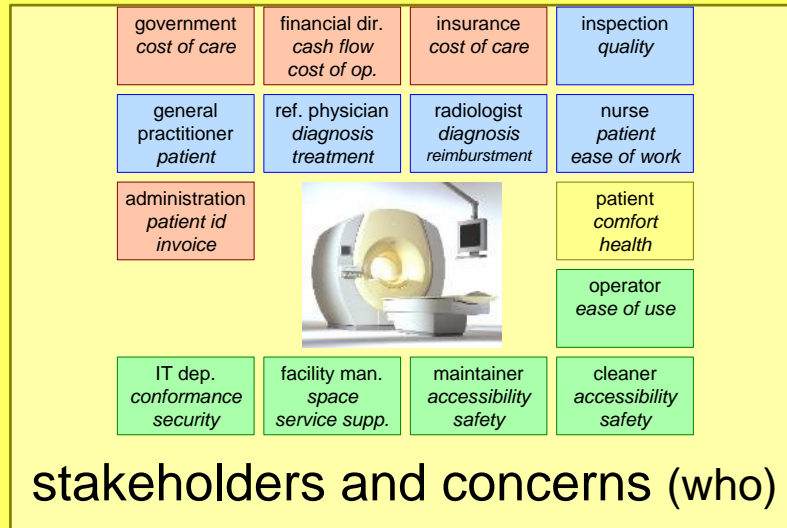
performance model

# Step 3: Functional View; Top level Spec

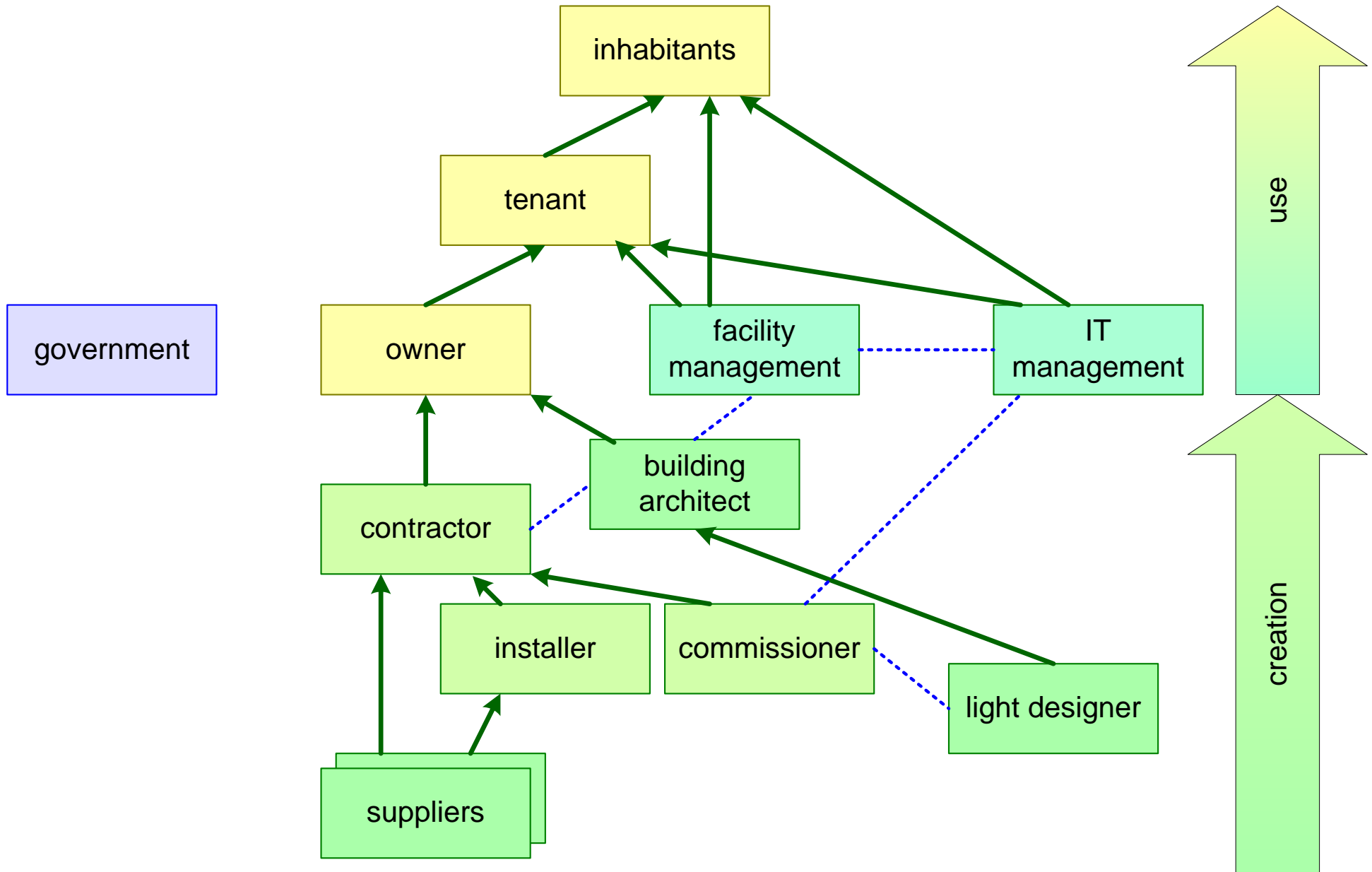


# Step 4: Application View

Chose 1 or 2 items from below



# Step 5: Customer Objectives View; Value Network



# Step 6: Qualities

## usable

usability  
attractiveness  
responsiveness  
image quality  
wearability  
storability  
transportability

## dependable

safety  
security  
reliability  
robustness  
integrity  
availability

## effective

throughput or  
productivity

## interoperable

connectivity  
3<sup>rd</sup> party extendible

## liable

liability  
testability  
traceability  
standards compliance

## efficient

resource utilization  
cost of ownership

## consistent

reproducibility  
predictability

## serviceable

serviceability  
configurability  
installability

## future proof

evolvability  
portability  
upgradeability  
extendibility  
maintainability

## logistics friendly

manufacturability  
logistics flexibility  
lead time

## ecological

ecological footprint  
contamination  
noise  
disposability

## down to earth attributes

cost price  
power consumption  
consumption rate  
(water, air,  
chemicals,  
et cetera)  
size, weight  
accuracy

# Presentation

Present the results top-down

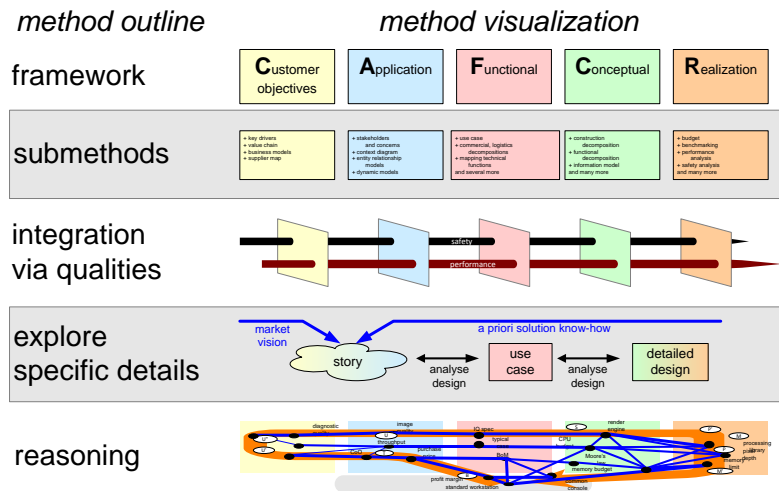
Use two to three flip charts of the six that have been created.

Explain in five minutes the needs of the customer, the system, and the major design choices.

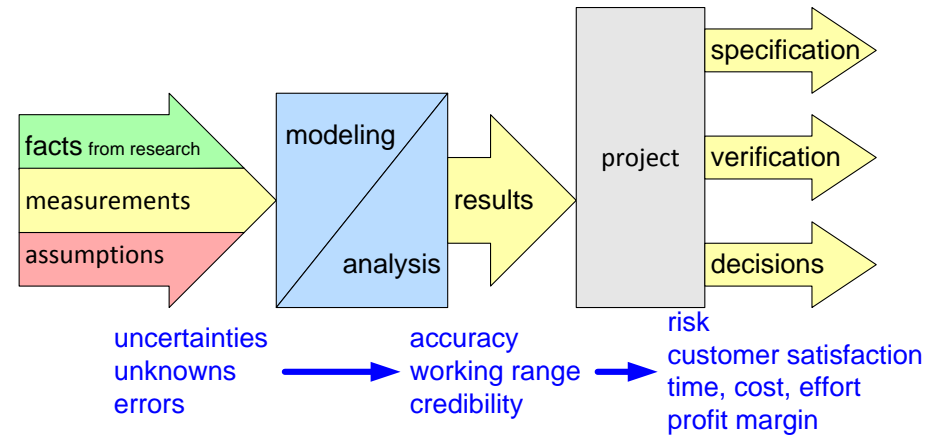


# Method Overview

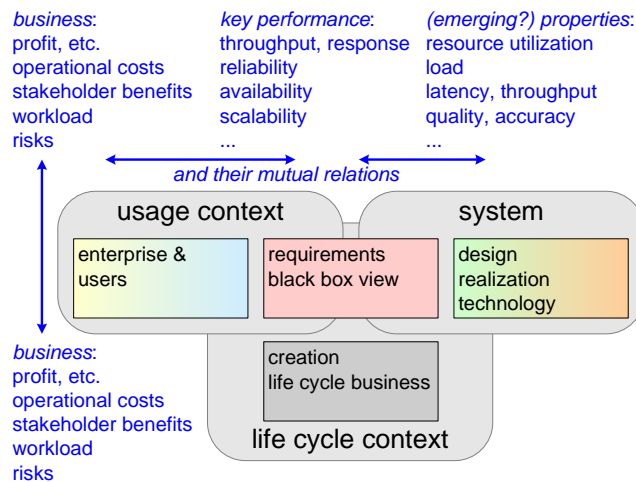
## Architecting Method Overview



## Modeling Method Overview

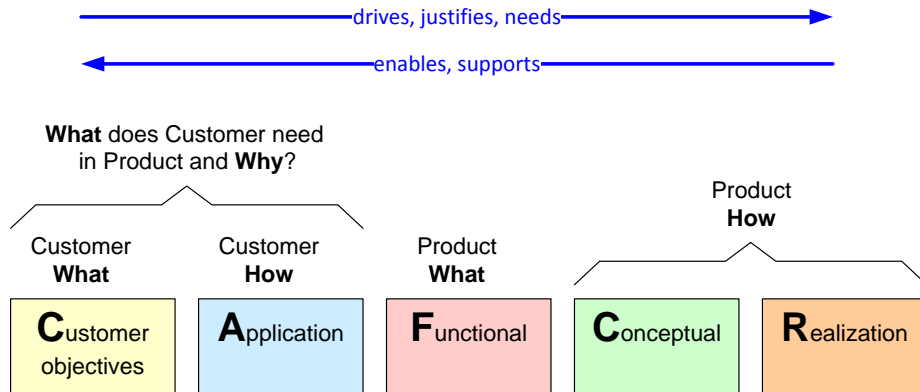


## Modeling Scope

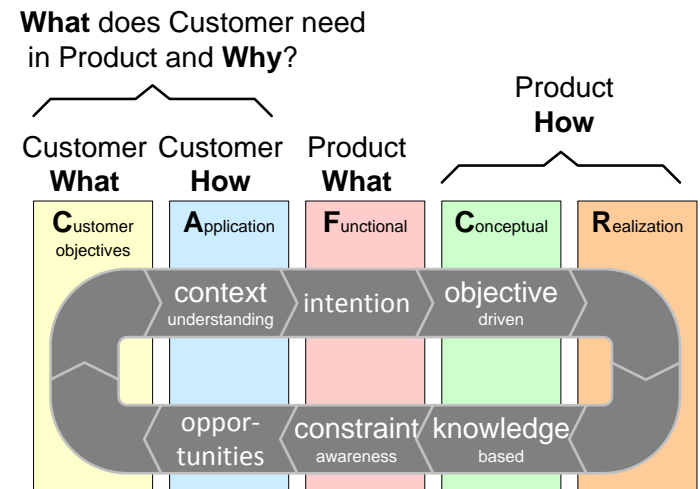


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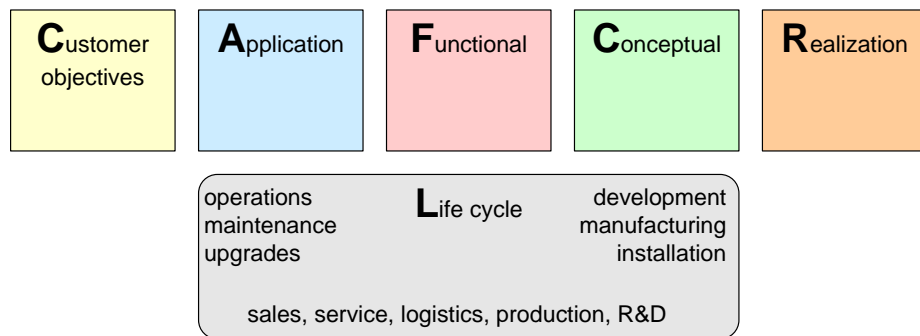
## CAFCR views



## Integrate and Iterate



## Plus Life Cycle view



## Sketch on Flips, Use Note stickers

Do	Do not	Because
<ul style="list-style-type: none"> <li>start sketching/drawing as soon as possible</li> <li>use shared large sheets of paper (e.g. flip-over)</li> <li>number the flip-overs and add a title</li> <li>annotate (add notes) during discussions</li> <li>use yellow note stickers and flip-over markers</li> <li>be open for ideas and surprises</li> </ul>	<ul style="list-style-type: none"> <li>write long texts</li> <li>immediately capture electronic</li> <li>have nice but volatile discussions</li> <li>write with pen or pencil</li> <li>Do not stick to the first solution</li> </ul>	<ul style="list-style-type: none"> <li>sketches stimulate sharing and discussion</li> <li>sharing and discussion help to explore faster</li> <li>remembering the order gets challenging</li> <li>information and insight is quickly lost</li> <li>stickers are easily (re)moved</li> <li>you hopefully discover a lot; increased insight will change problem and solution</li> </ul>