Module 31, Architectural Reasoning Case Exploration

by *Gerrit Muller* University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

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

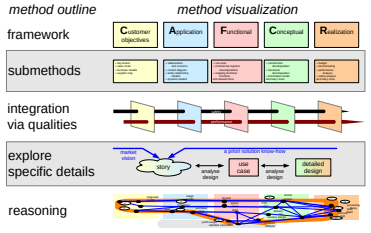
August 21, 2020
status: preliminary draft
version: 1.0

SEMA Methods Overview

by *Gerrit Muller* University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

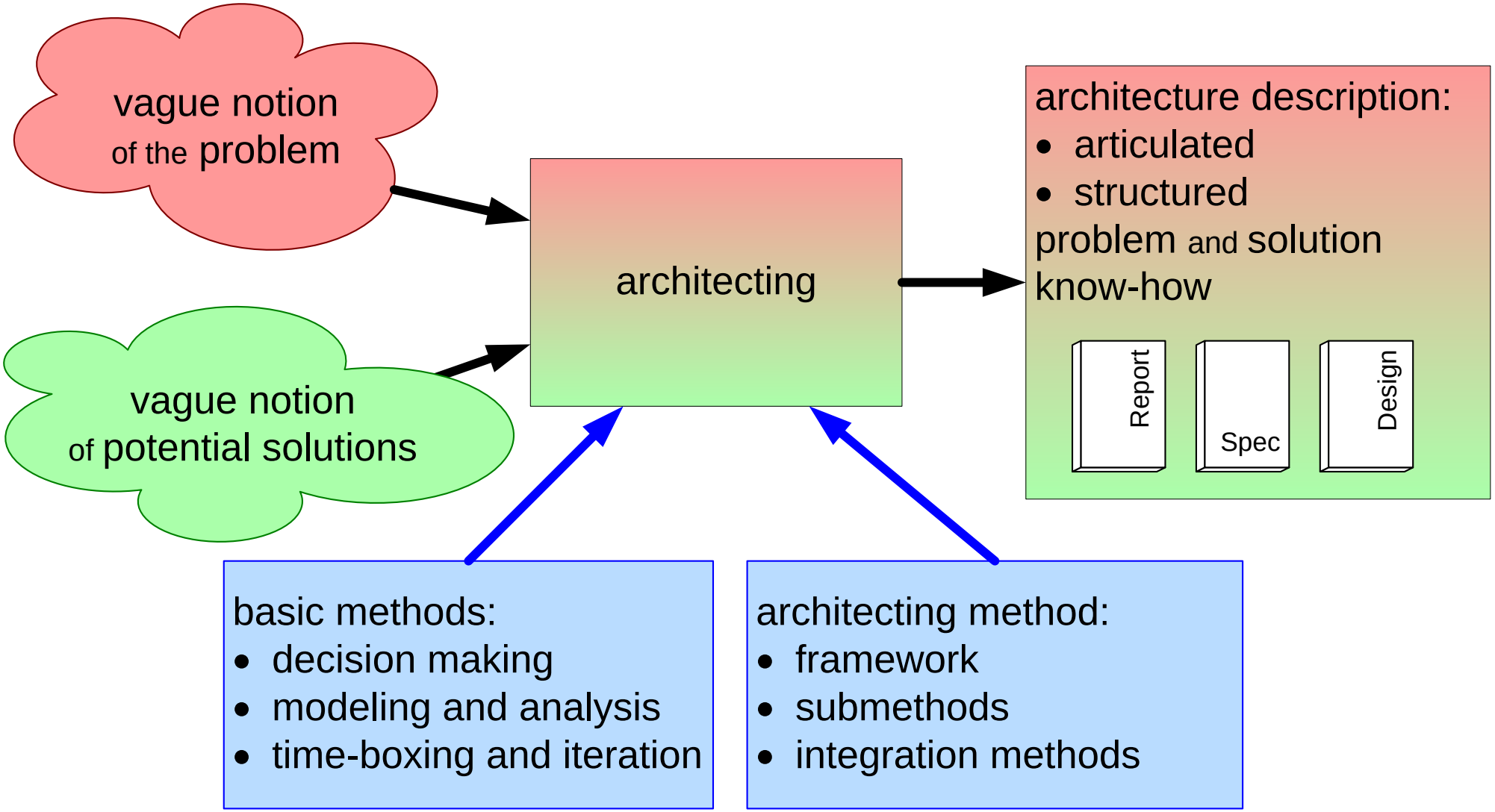
Abstract

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.



August 21, 2020
status: preliminary draft
version: 0

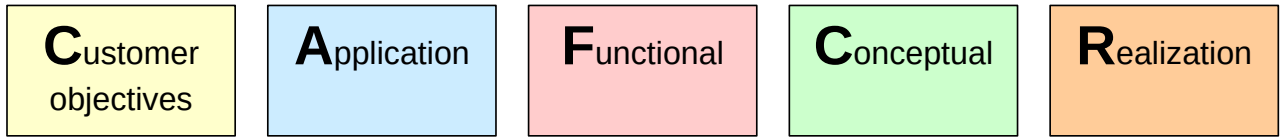
From vague notions to articulate and structured



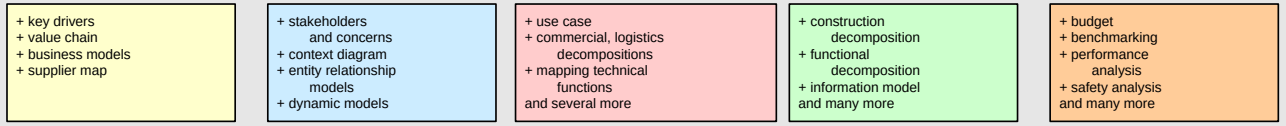
Overview of architecting method

method outline *method visualization*

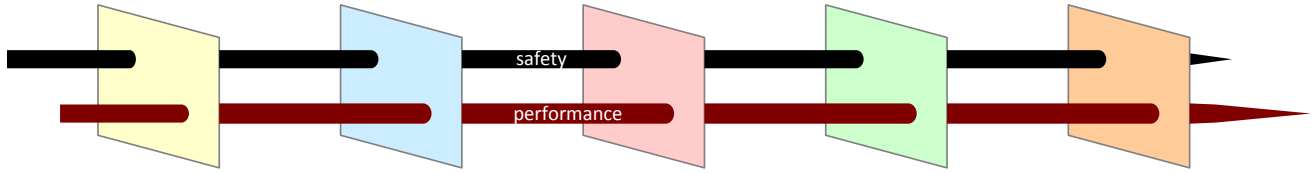
framework



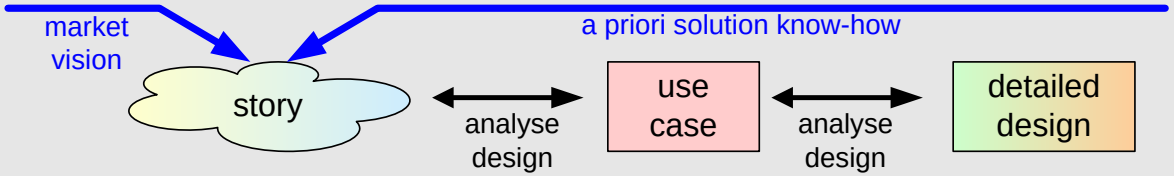
submethods



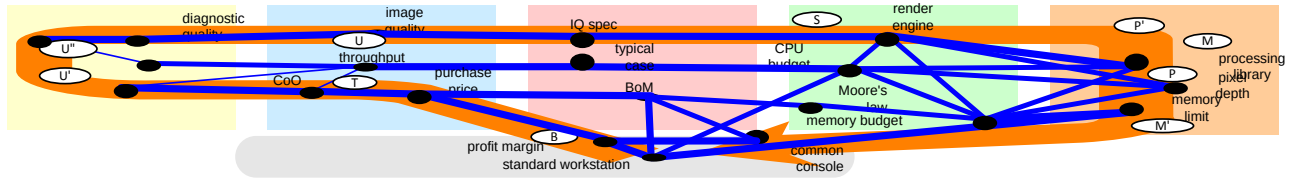
integration via qualities



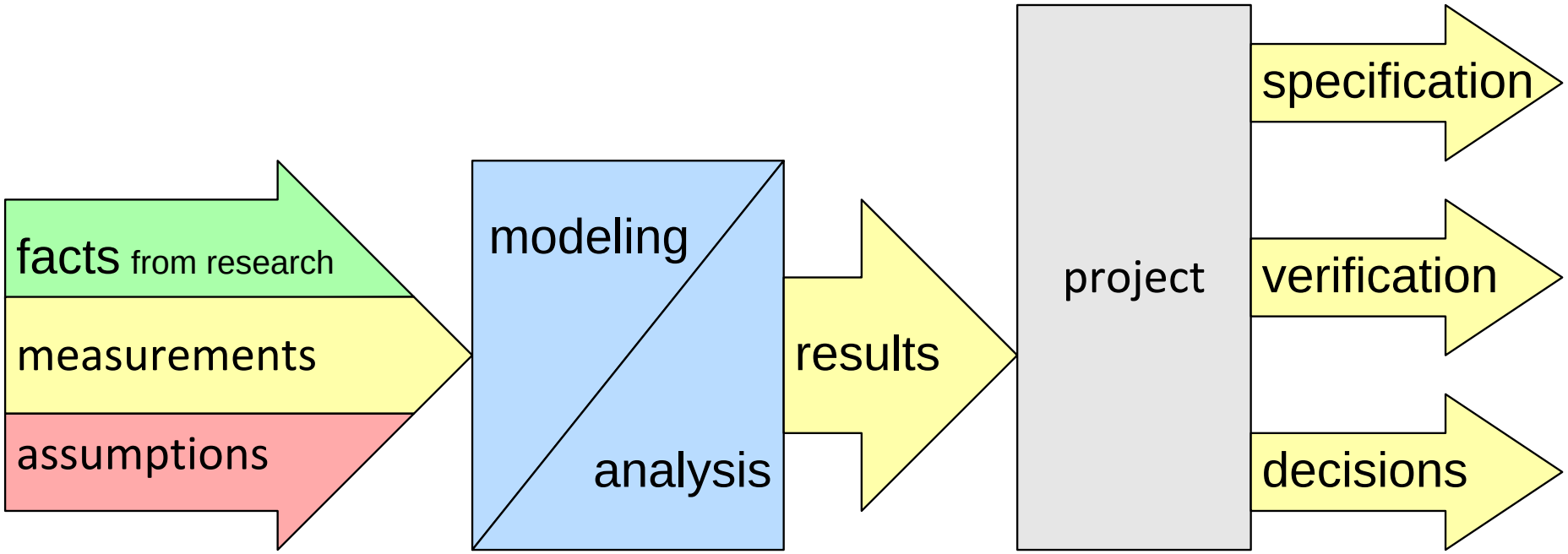
explore specific details



reasoning



Purpose of Modeling



uncertainties
unknowns
errors

→

accuracy
working range
credibility

→

risk
customer satisfaction
time, cost, effort
profit margin

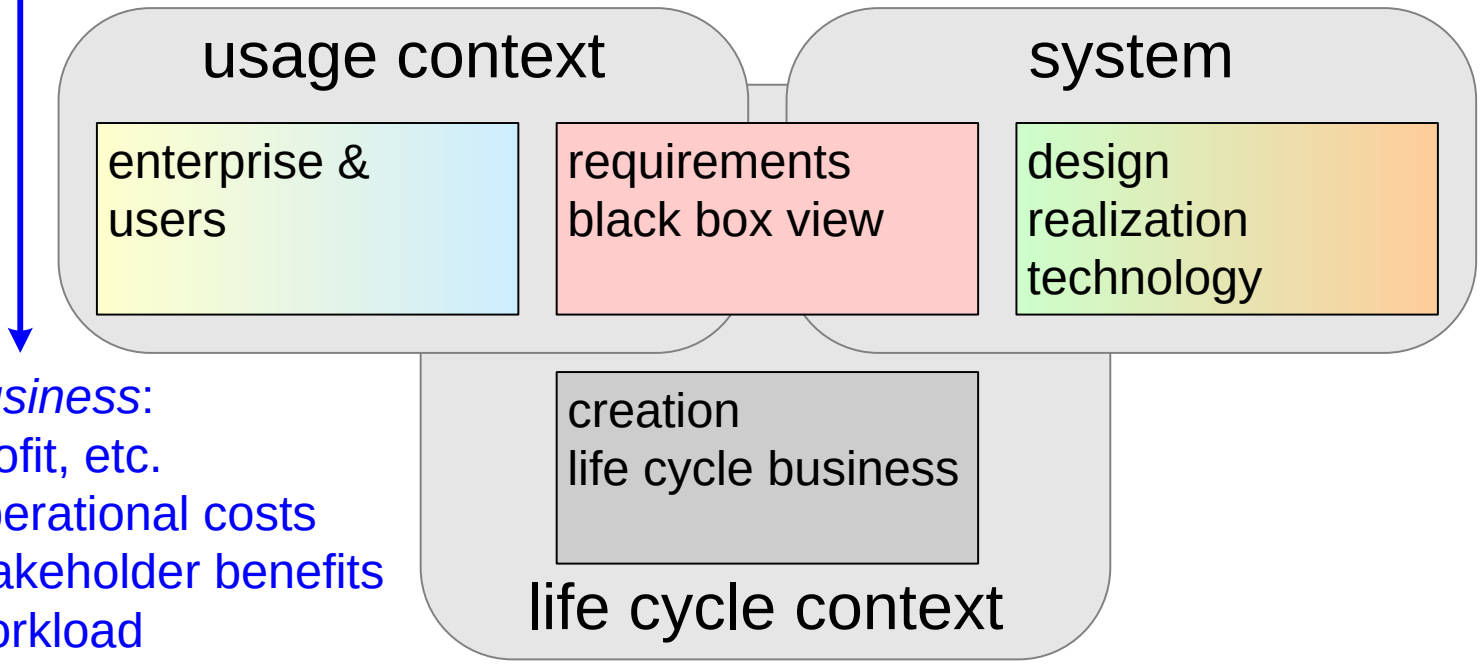
What to Model?

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

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

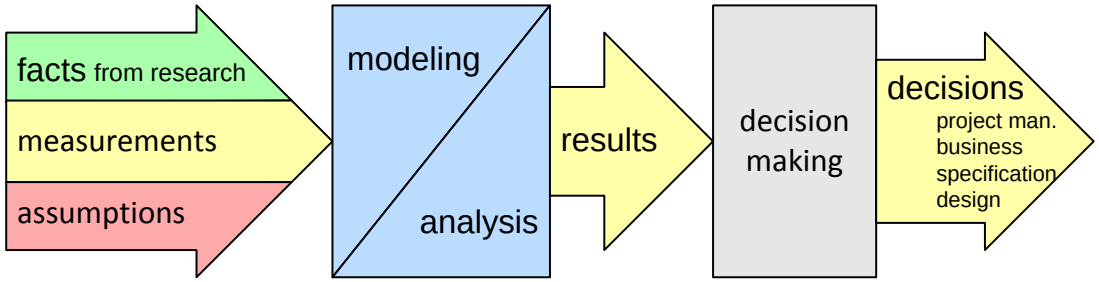
(emerging?) properties:
resource utilization
load
latency, throughput
quality, accuracy
...

and their mutual relations



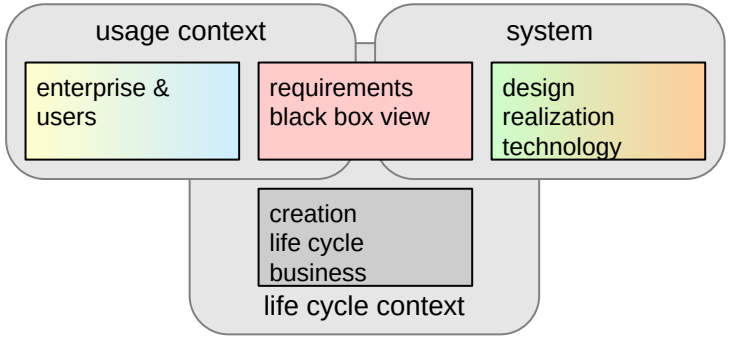
business:
profit, etc.
operational costs
stakeholder benefits
workload
risks

Overview of Modeling Approach



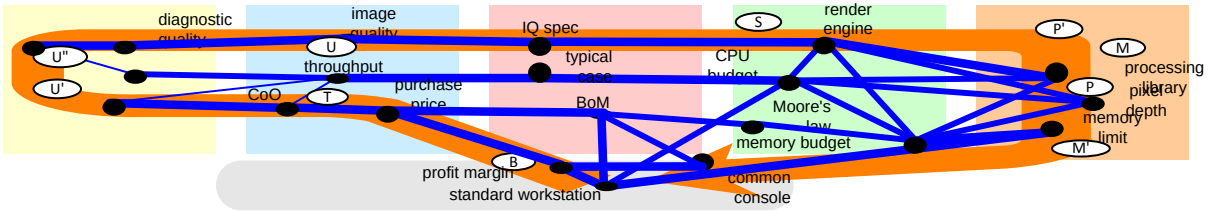
collect input data

model and analyse relevant issues



for different stakeholders& concerns

integration and reasoning



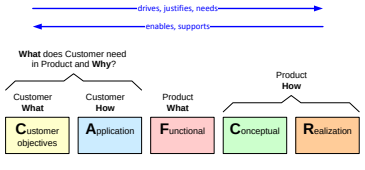
Short introduction to basic “CAFCR” model

by *Gerrit Muller* University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

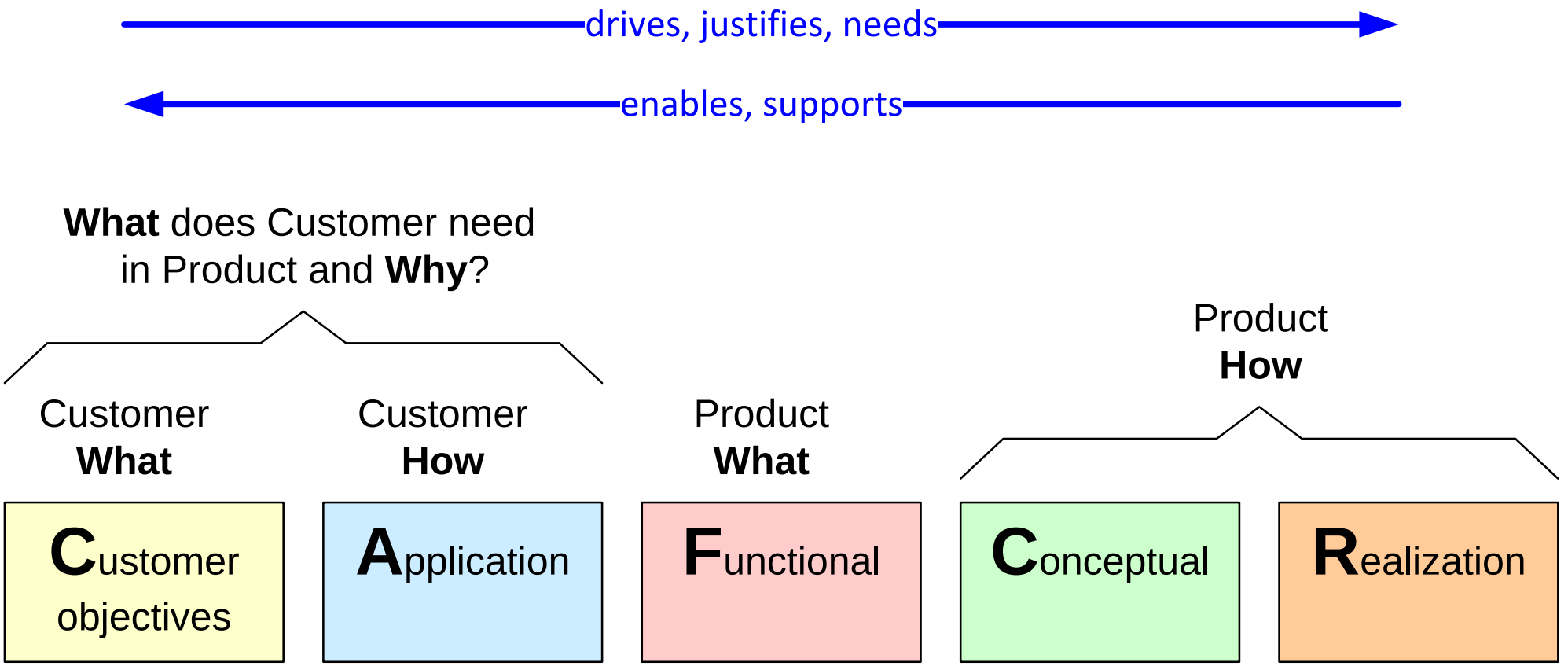
Abstract

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.

August 21, 2020
status: draft
version: 0.4

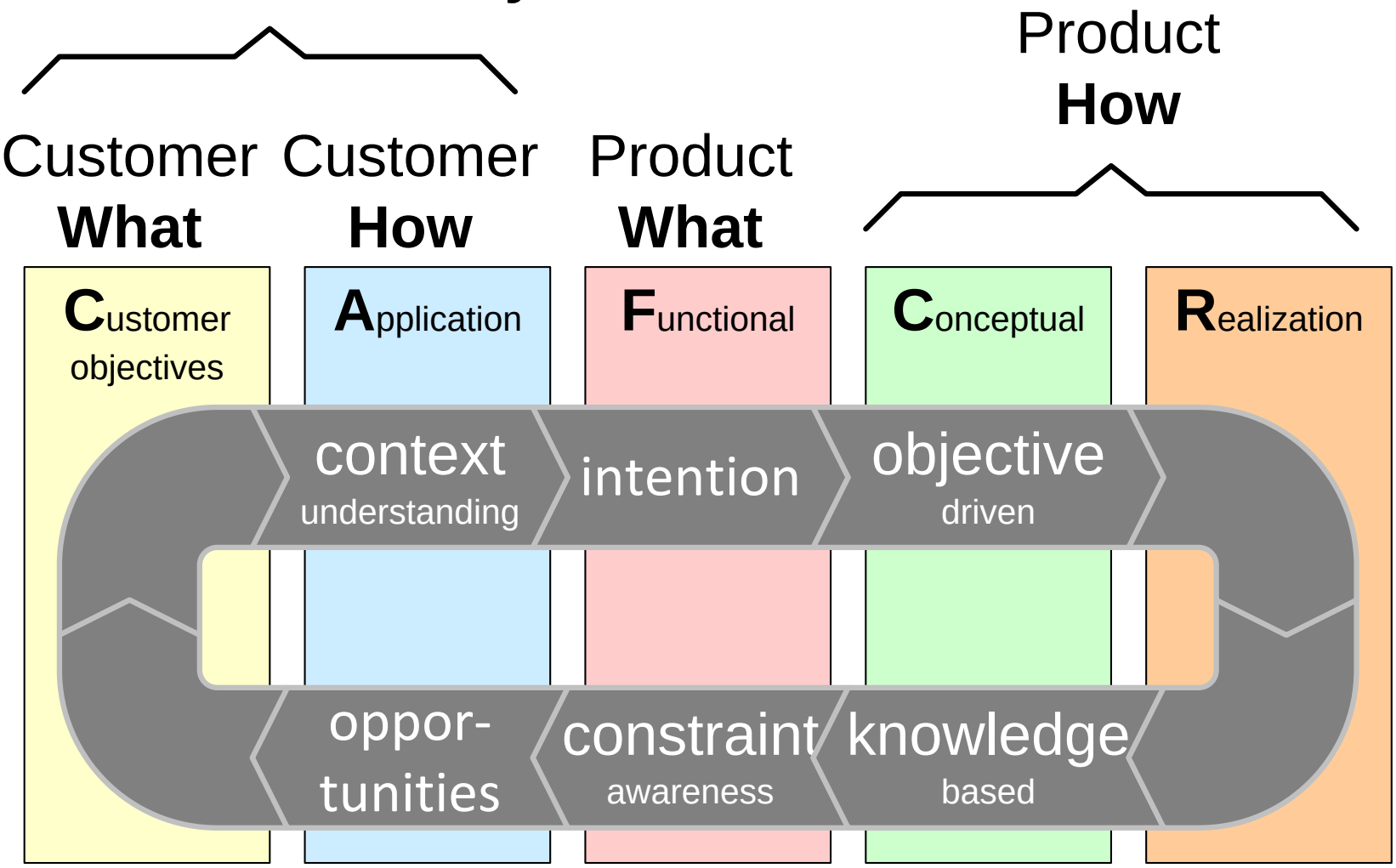


The “CAFCR” model

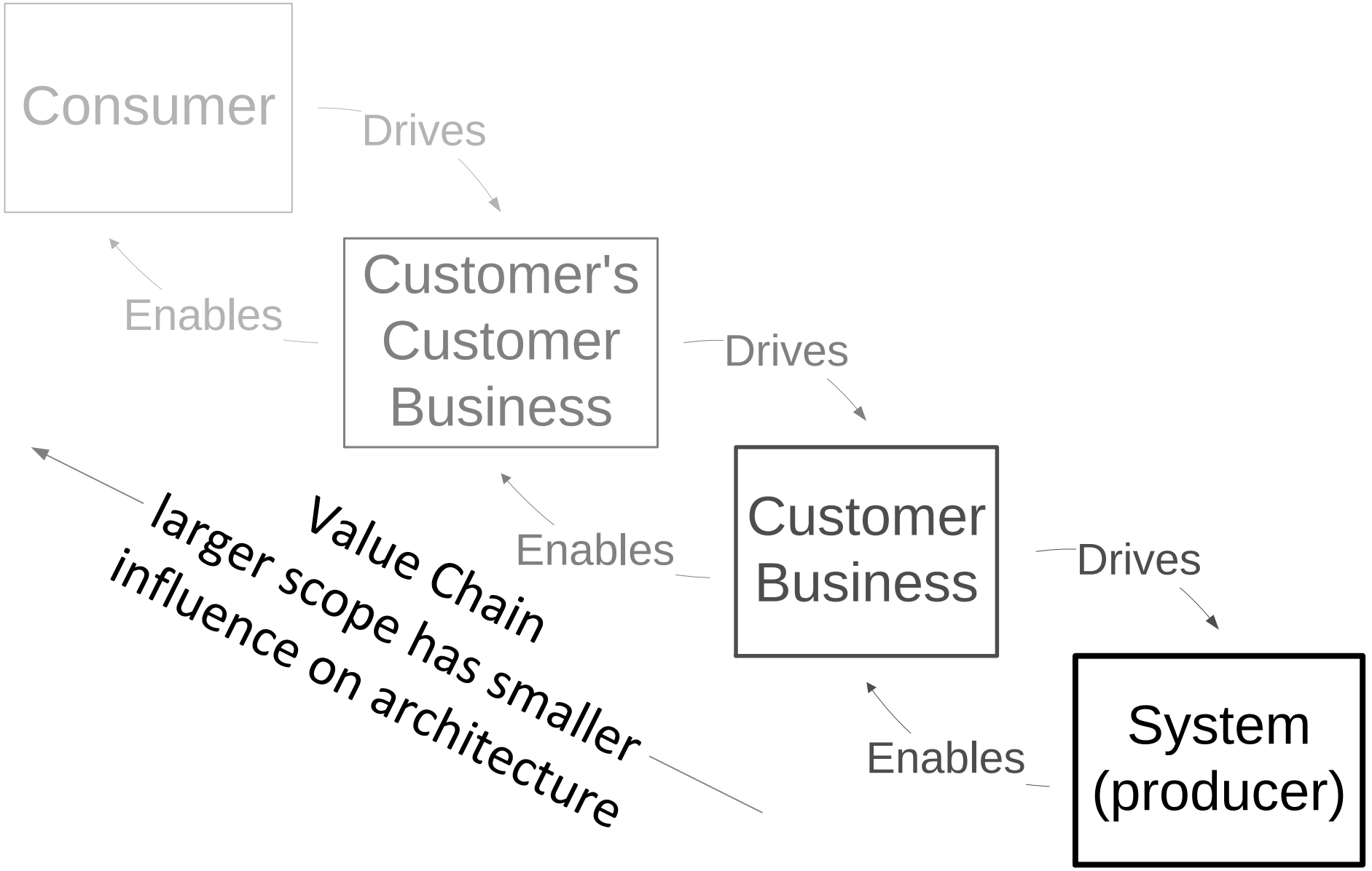


Integrating CAFCR

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



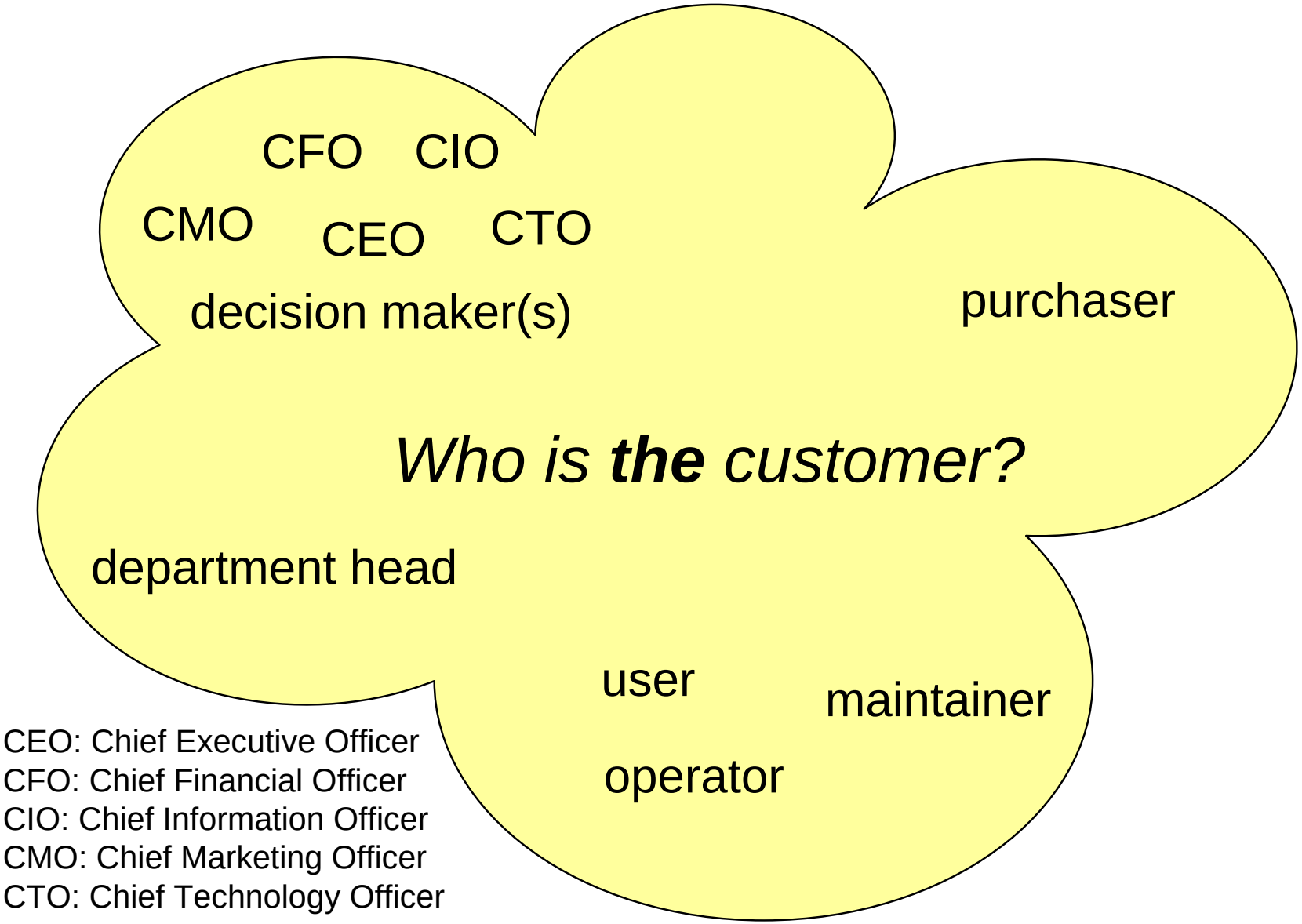
CAFCR can be applied recursively



Market segmentation

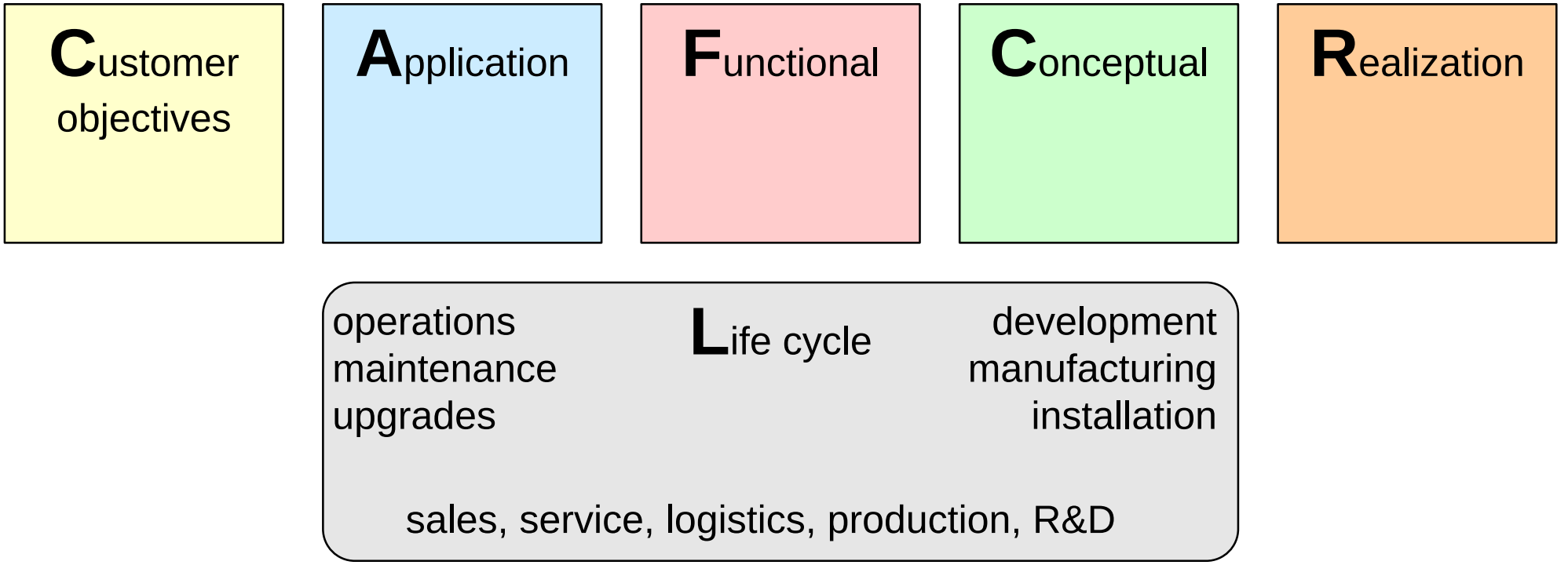
segmentation axis	examples
geographical	USA, UK, Germany, Japan, China
business model	profit, non profit
economics	high end versus cost constrained
consumers	youth, elderly
outlet	retailer, provider, OEM, consumer direct

Example of a small buying organization



CEO: Chief Executive Officer
CFO: Chief Financial Officer
CIO: Chief Information Officer
CMO: Chief Marketing Officer
CTO: Chief Technology Officer

CAFCR+ model; Life Cycle View



Initial CAFCR scan

by *Gerrit Muller* University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

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.

August 21, 2020
status: preliminary draft
version: 0.4

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

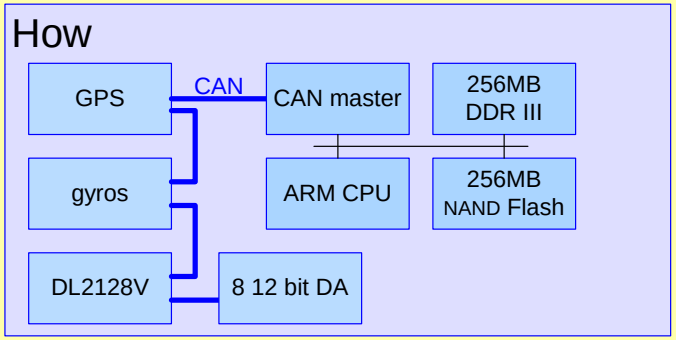
show the most dominant decomposition of that view, as diagram or as a list; some more guidance will be given per step.

Do and Don't

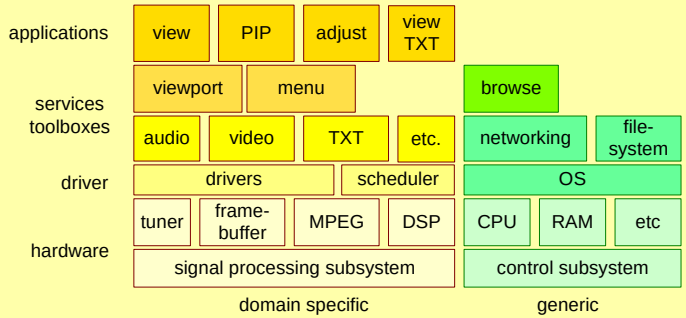
Do	Do **not**	Because
• start sketching/drawing as soon as possible	• write long texts .	• sketches stimulate sharing and discussion
• use shared large sheets of paper (e.g. flip-over)	• immediately capture electronic	• sharing and discussion help to explore faster
• number the flip-overs and add a title		• remembering the order gets challenging
• annotate (add notes) during discussions	• have nice but volatile discussions	• information and insight is quickly lost
• use yellow note stickers and flip-over markers	• write with pen or pencil	• stickers are easily (re)moved
• be open for ideas and surprises	• Do not stick to the first solution	• you hopefully discover a lot; increased insight will change problem and solution

Step 1: Realization View

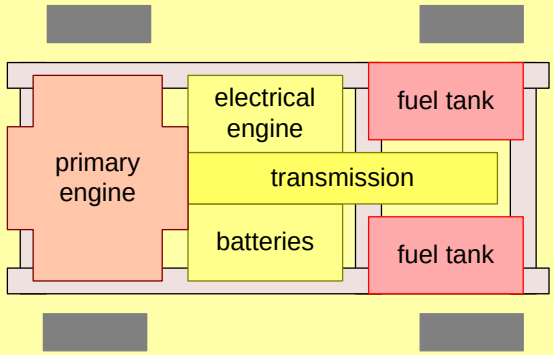
Choose 1 or 2 items from below



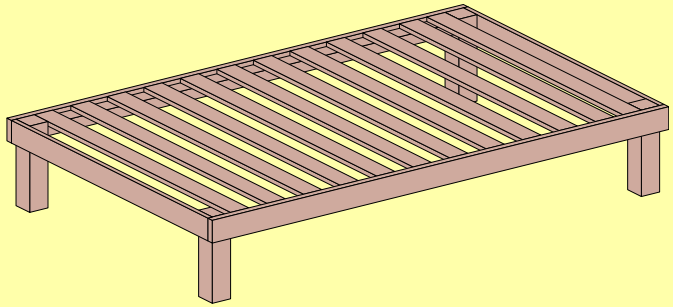
HW block diagram



SW layer diagram



2D layout of system internals



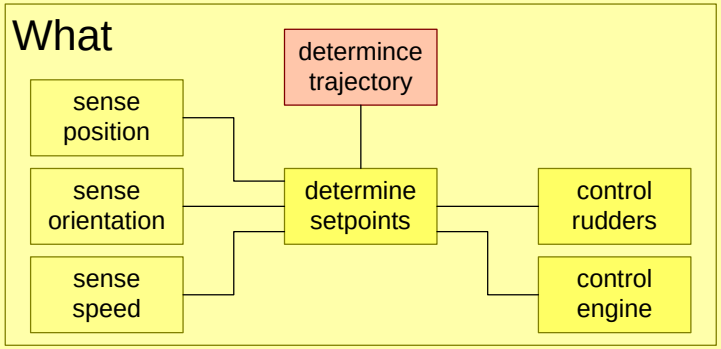
3D sketch of system internals

Annotate/mark most critical technologies or characteristics

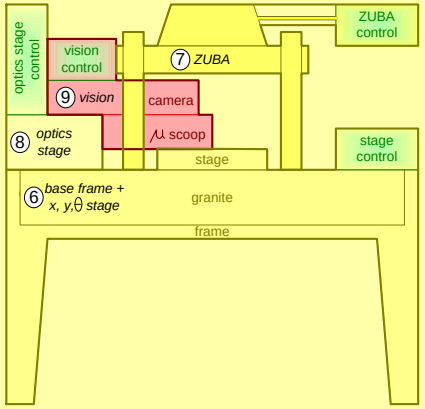
Step 2: Conceptual View

Chose 1 or 2 items from below

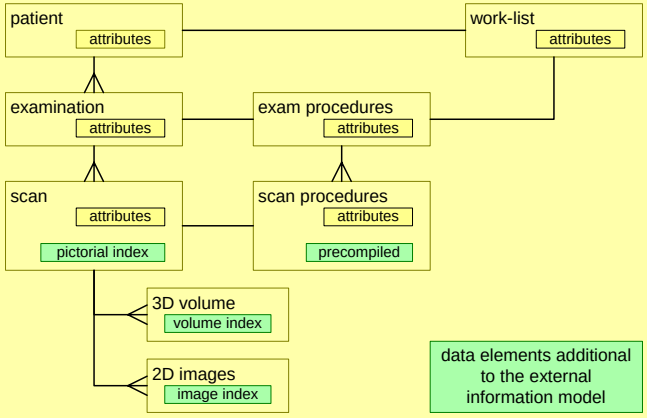
functional model



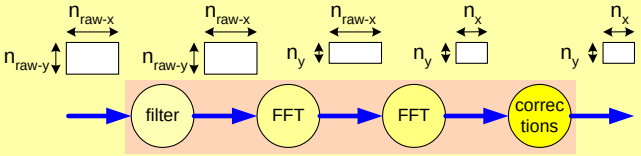
subsystem decomposition



information model



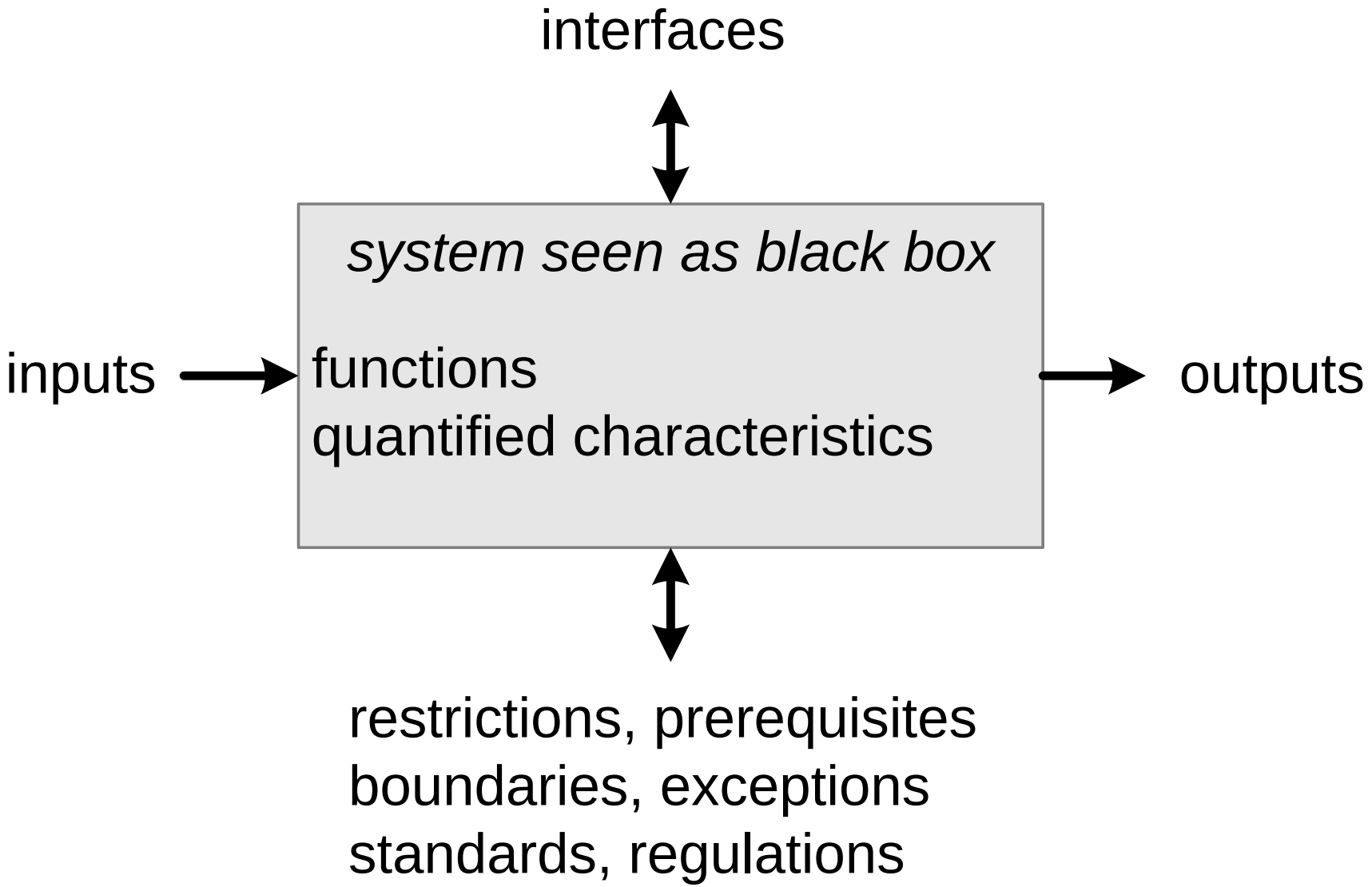
performance model



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

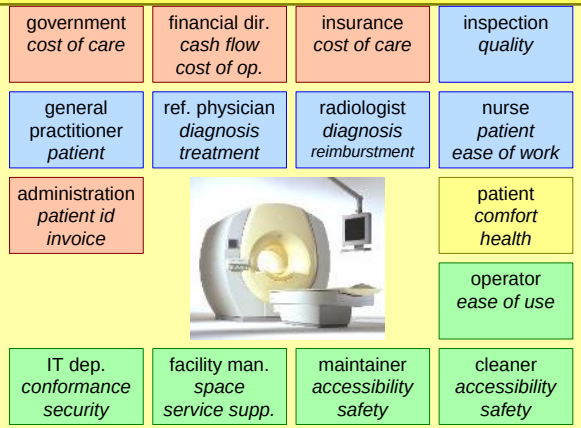
$$t_{fft}(n) = c_{fft} * n * \log(n)$$

Step 3: Functional View; Top level Spec

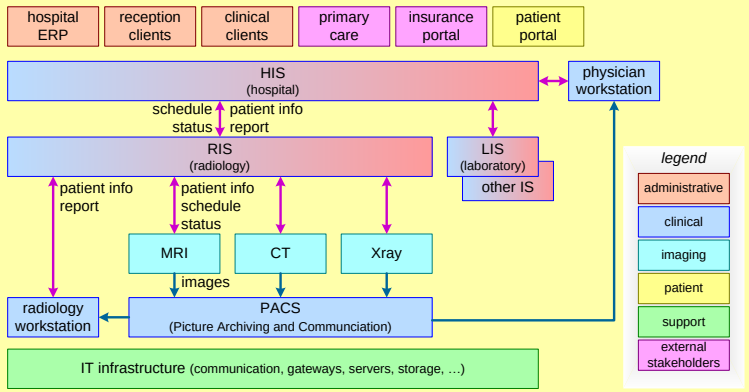


Step 4: Application View

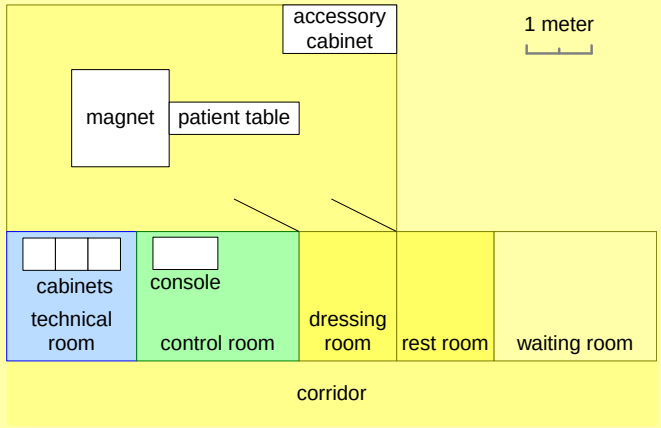
Chose 1 or 2 items from below



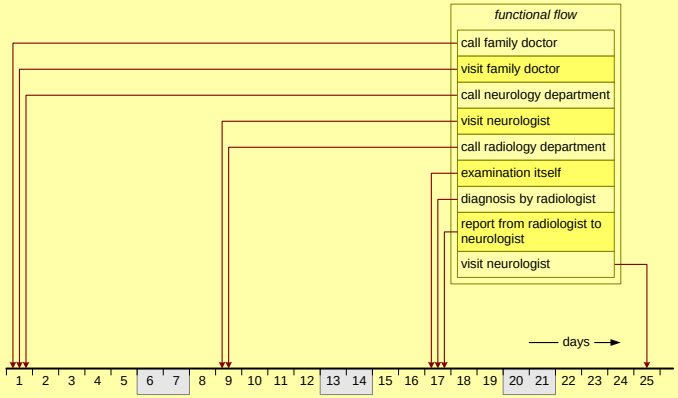
stakeholders and concerns (who)



system context

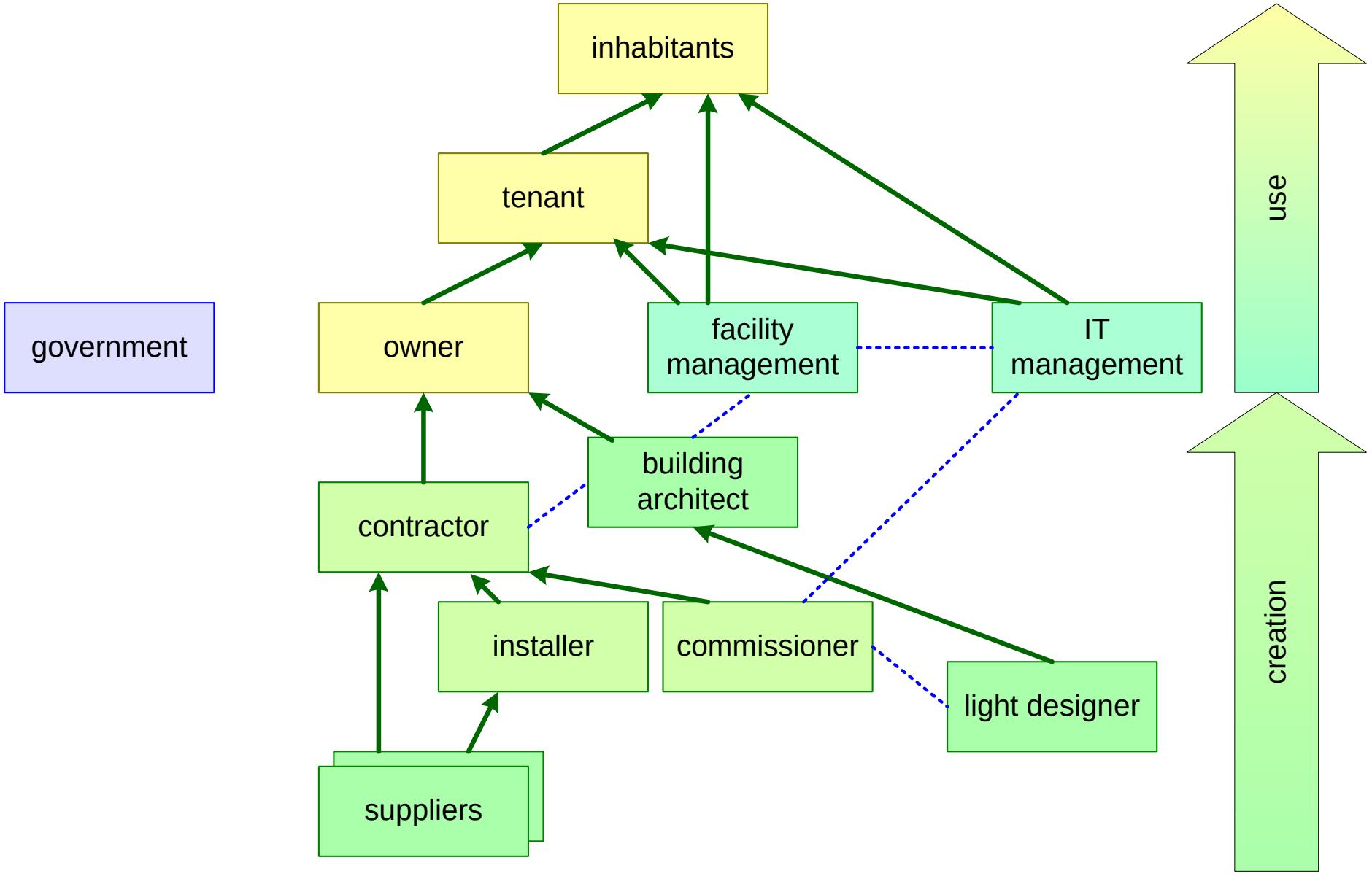


2D map (where)



work flow & time line (what, when)

Step 5: Customer Objectives View; Value Network



Step 6: Qualities

Determine the 5 most relevant qualities from the checklist

- Make the chosen qualities as specific as possible
- Explain for each quality why it is relevant

Step 6: Qualities Checklist

usable
- usability
- attractiveness
- responsiveness
- image quality
- wearability
- storability
- transportability

dependable
- safety
- security
- reliability
- robustness
- integrity
- availability

effective
- throughput or productivity

interoperable
- connectivity
- 3rd 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

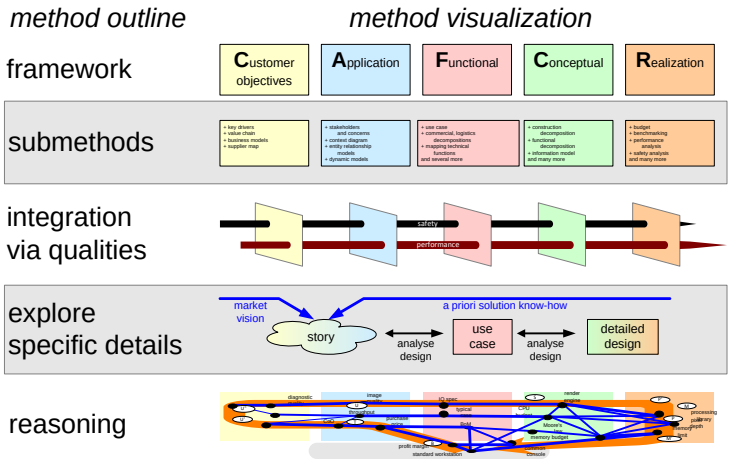
Present the results top-down

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

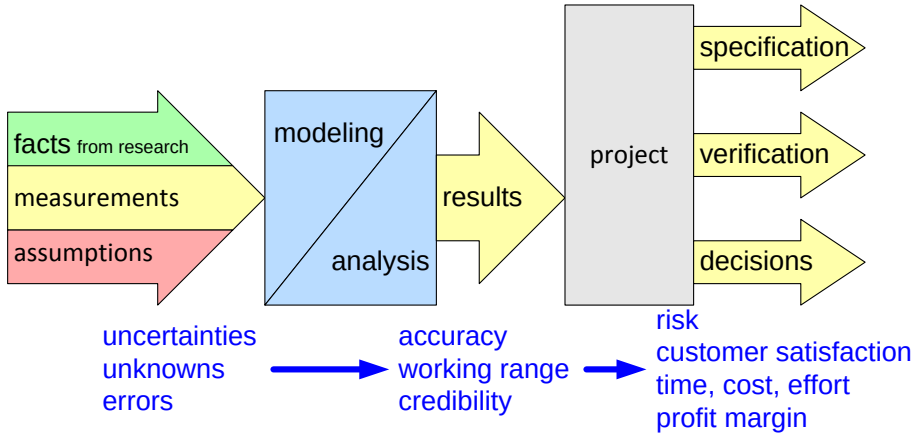
Explain in five minutes the needs of the customer, the system, and the major design choices.

Method Overview

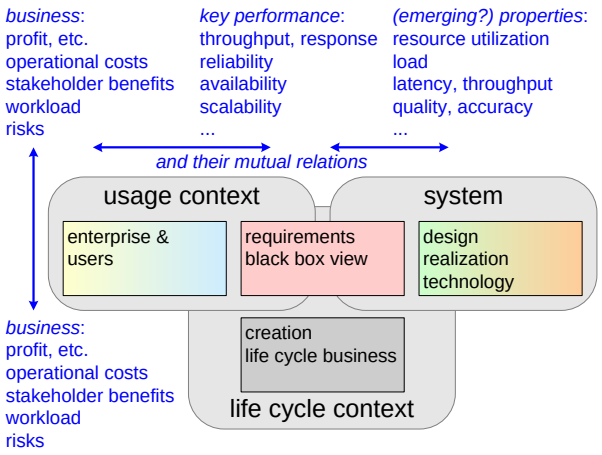
Architecting Method Overview



Modeling Method Overview

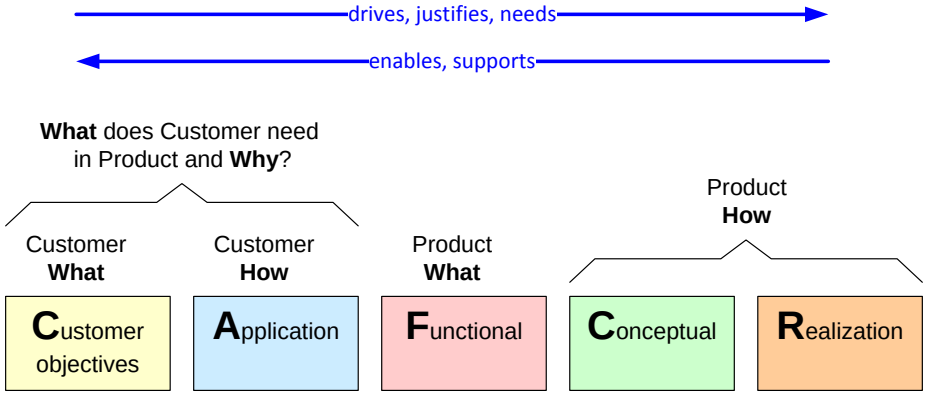


Modeling Scope

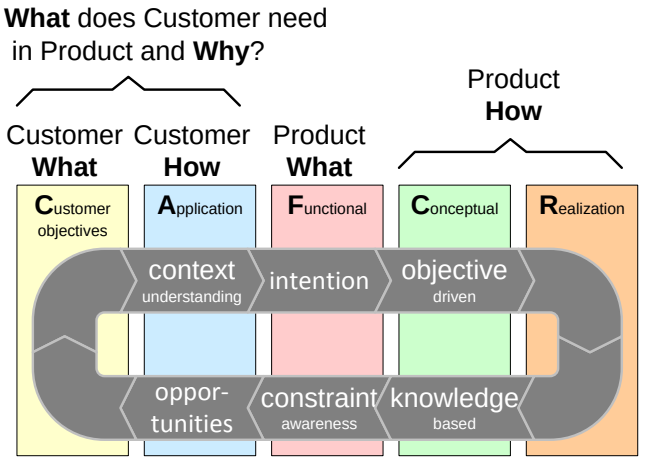


intentionally left blank

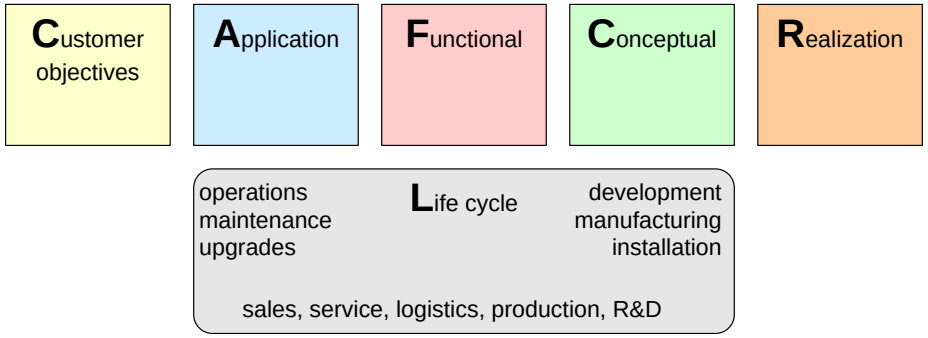
CAFCR views



Integrate and Iterate



Plus Life Cycle view



Sketch on Flips, Use Note stickers

Do	Do **not**	Because
• start sketching/drawing as soon as possible	• write long texts .	• sketches stimulate sharing and discussion
• use shared large sheets of paper (e.g. flip-over)	• immediately capture electronic	• sharing and discussion help to explore faster
• number the flip-overs and add a title		• remembering the order gets challenging
• annotate (add notes) during discussions	• have nice but volatile discussions	• information and insight is quickly lost
• use yellow note stickers and flip-over markers	• write with pen or pencil	• stickers are easily (re)moved
• be open for ideas and surprises	• Do not stick to the first solution	• you hopefully discover a lot; increased insight will change problem and solution