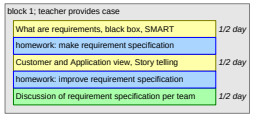
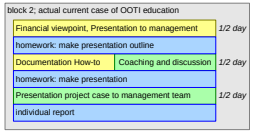
Lecture Requirements Engineering

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

Abstract

This article describes the Requirements Engineering session part of the Software Engineering block in the OOTI curriculum of the Technical University Eindhoven. The focus of this course is on capturing and managing requirements. The notion of key drivers and story telling will be introduced as a means to capture and manage. During the course an exercise is used based on video distribution via satellite. The students have to elicit the requirements for the required systems, working in teams of 4 students. Every student writes an individual report about the exercise.





March 27, 2021
status: finished
version: 1.1

Program

time	subject
Session 1	What are requirements, black box, SMART
Session 2	Customer and Application view, Story telling
Session 3	Discussion of requirement specification per team
Session 4	Financial viewpoint, Presentation to management
Session 5	Documentation How-to, Coaching and discussion session
Session 6	Presentation of project case to management team

Schedule

block 1; teacher provides case

What are requirements, black box, SMART	*1/2 day*
homework: make requirement specification	
Customer and Application view, Story telling	*1/2 day*
homework: improve requirement specification	
Discussion of requirement specification per team	*1/2 day*

block 2; actual current case of OOTI education

Financial viewpoint, Presentation to management		*1/2 day*
homework: make presentation outline		
Documentation How-to	Coaching and discussion	*1/2 day*
homework: make presentation		
Presentation project case to management team		*1/2 day*
individual report		

Case Instructions

1. Block 1 session 1: Make an initial requirements specification
2. Block 1 session 2: Improve and complete requirements specification
3. Block 2 session 4: Make an outline of a presentation of maximum 10 minutes, target audience: management team of your company
4. Block 2 session 5: Prepare and exercise presentation
5. Block 2 session 6: Write an individual report reflecting on: requirement specification, management presentation, lessons learned and how to do it next time.

Case: Recommended Steps

1. Make a black box view of the system
2. Make some initial drafts and designs to explore the problem.
3. Make a story which helps to understand the products, make sure to use the criterions for a story.
4. Look from all stakeholder points of view towards the problem and identify what they need and what they expect.
5. Analyze the information obtained so far and extract the underlying requirements.
6. Abstract the key drivers behind the requirements.
7. Make a top-down description of the requirements.

Case: Questions for Individual Report

- What are the most important lessons you learned from these exercise (requirement specification, management presentation)?
- Which roles did the members of the group play during the exercise?
- How would you approach such a problem the next time?
- Which stakeholders understand your group presentation? Are they happy with the presentation?

Submission of Homework

Homework instructions

specification minimum 4 hours work/person, maximum 8 hours

maximum 6 A4 pages

presentation minimum 2 days work/ person, maximum 5 days

filename: [OOTI<year>] spec|presentation <team id>.<version number>

e.g. [OOTI2008] spec team1.1.doc

all team members on front page

email to: <gerrit • muller@ gmail • com>

subject: [OOTI<year>] spec|presentation <team id>

from/cc: <all email addresses of team members>

when: 48 hours before next lecture

Module Requirements

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

Abstract

This module addresses requirements: What are requirements? How to find, select, and consolidate requirements?

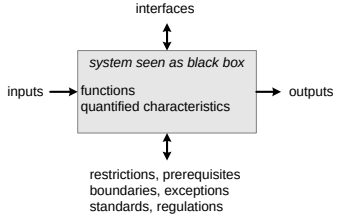
March 27, 2021
status: concept
version: 1.4

Fundamentals of Requirements Engineering

by *Gerrit Muller* USN-SE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

Requirements engineering is one of the systems engineering pillars. In this document we discuss the fundamentals of systems engineering, such as the transformation of needs into specification, the need to prescribe *what* rather than *how*, and the requirements when writing requirements.



March 27, 2021
status: concept
version: 0.1

Definition of “Requirement”

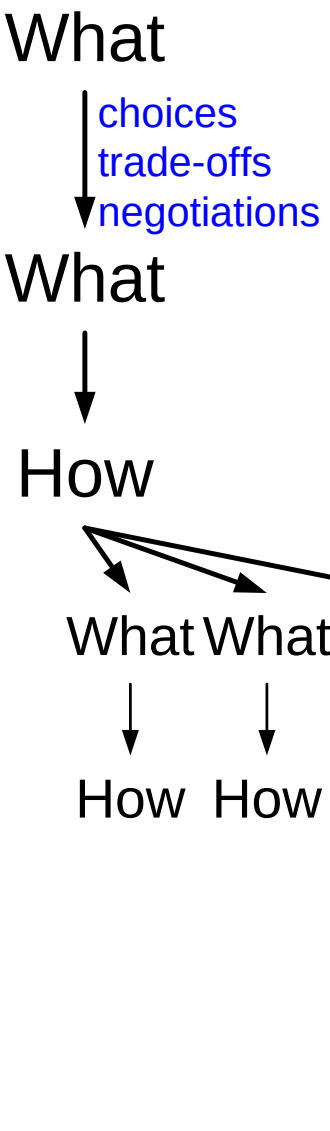
Requirements describing the needs of the customer: ***Customer Needs***

Requirements describing the characteristics of the final resulting system (product): ***System (Product) Specification***

The ***requirements management process*** recursively applies this definition for every level of decomposition.

Requirements describing the needs of the company itself over the life cycle: ***Life Cycle Needs***

Flow of Requirements



customer needs:
What is needed by the customer?

product specification:
What are we going to realize?

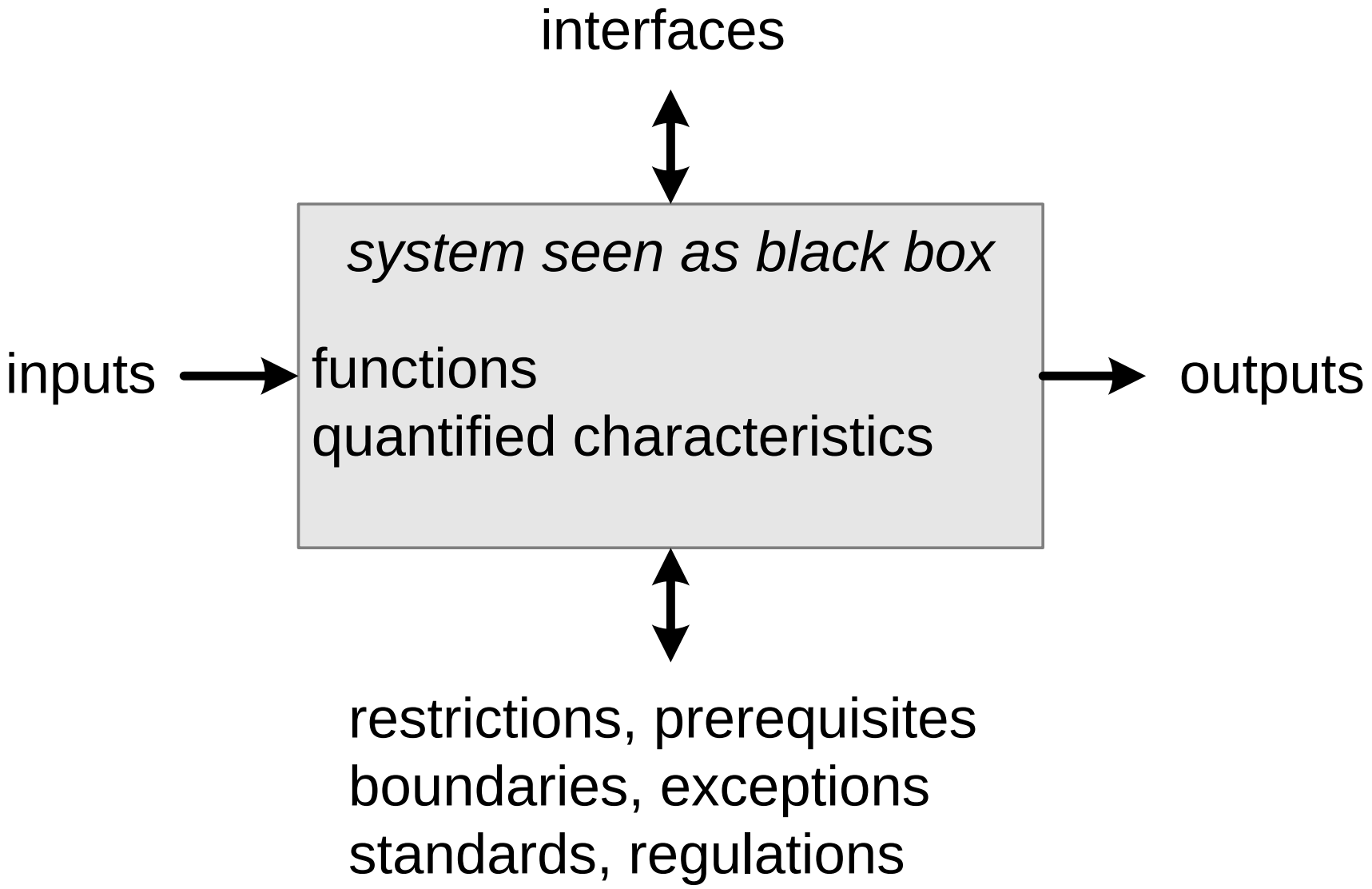
system design:
How are we going to realize the product?

What are the subsystems we will realize?

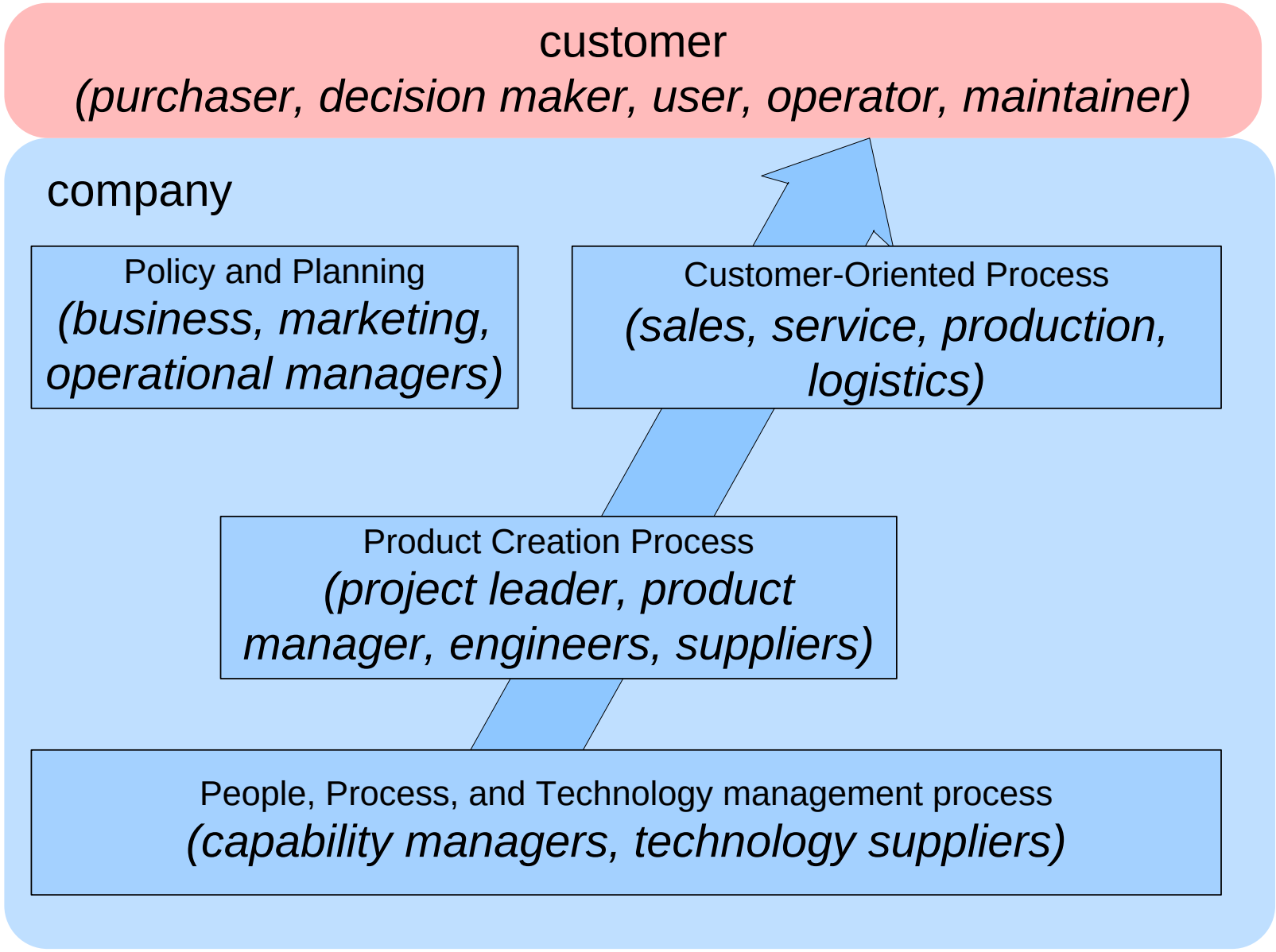
How will the subsystems be realized?

up to "atomic" components

System as a Black Box



Stakeholders w.r.t. Requirements



The “Formal” Requirements for Requirements

Specific

Unambiguous

Verifiable

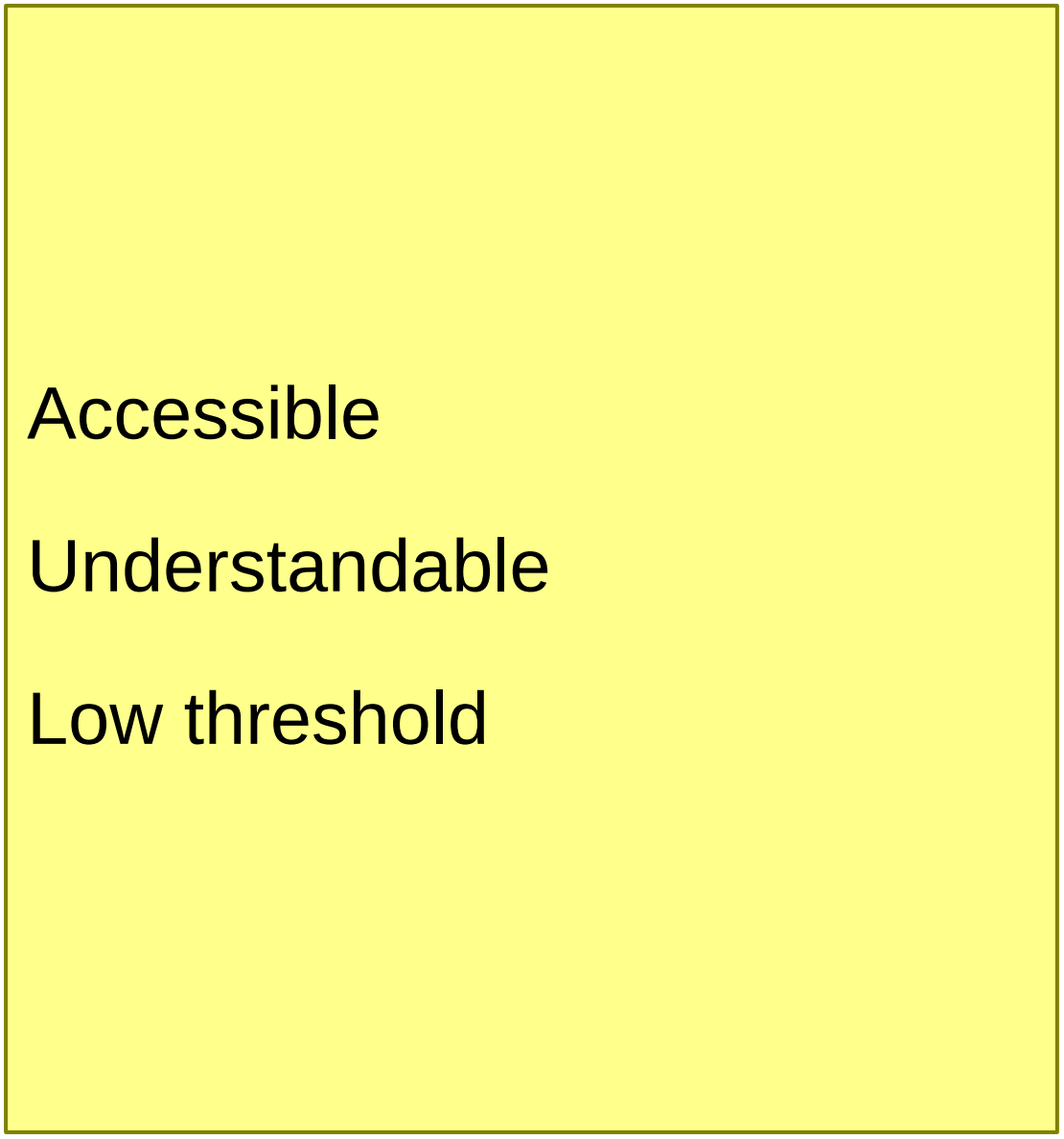
Quantifiable

Measurable

Complete

Traceable

The Requirements to Enable Human Use



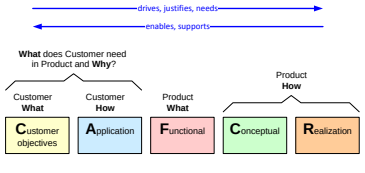
Short introduction to basic “CAFCR” model

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

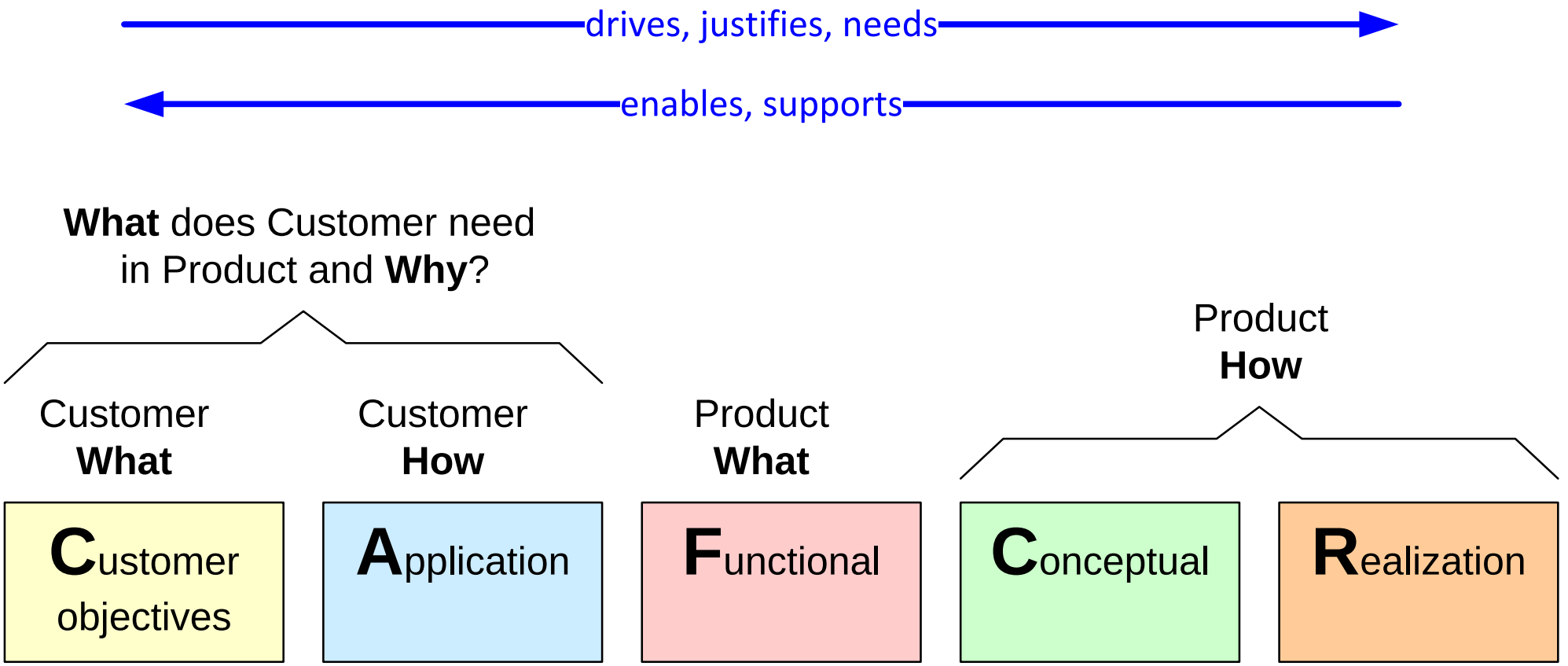
Abstract

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.

March 27, 2021
status: draft
version: 0.4

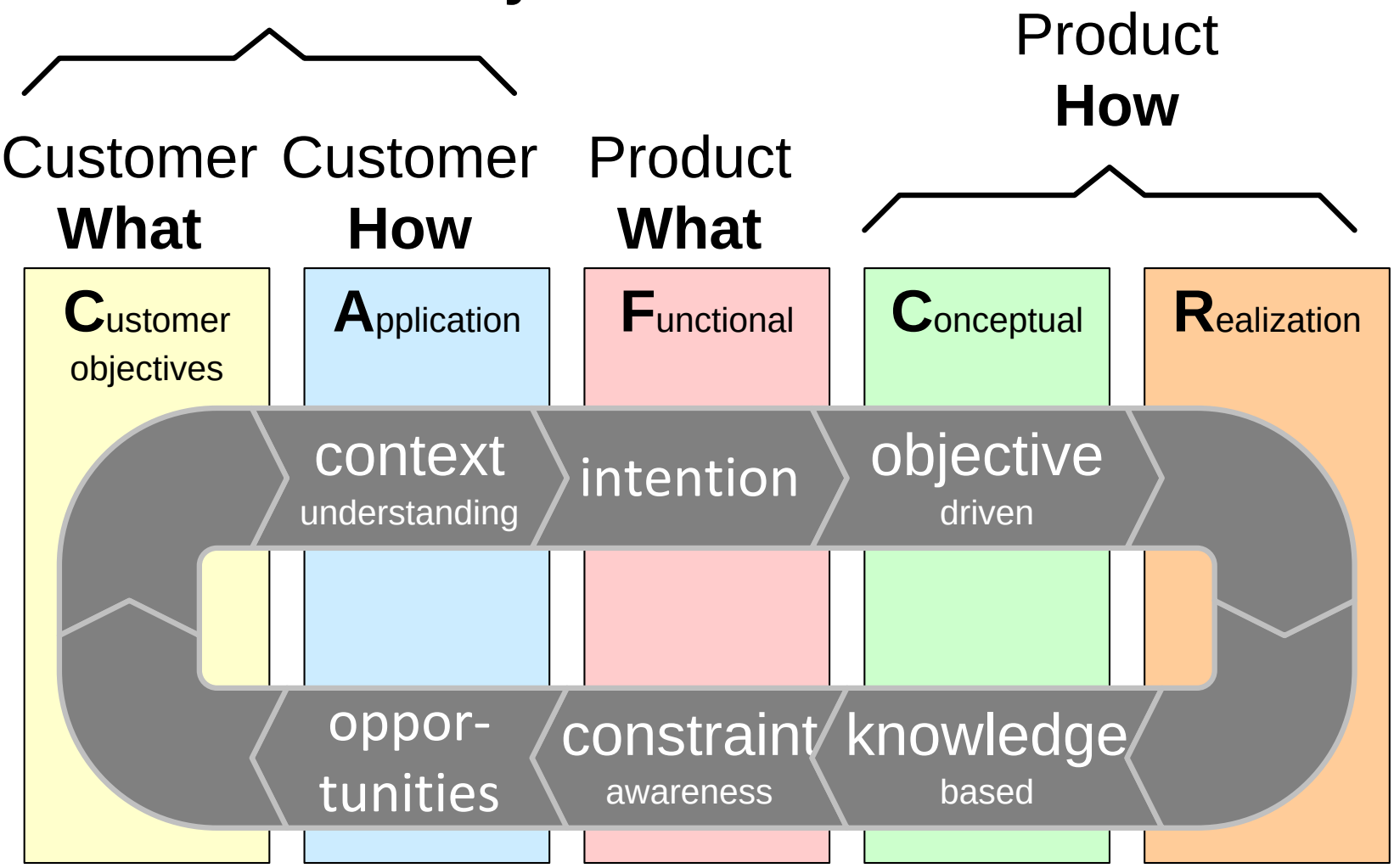


The “CAFCR” model

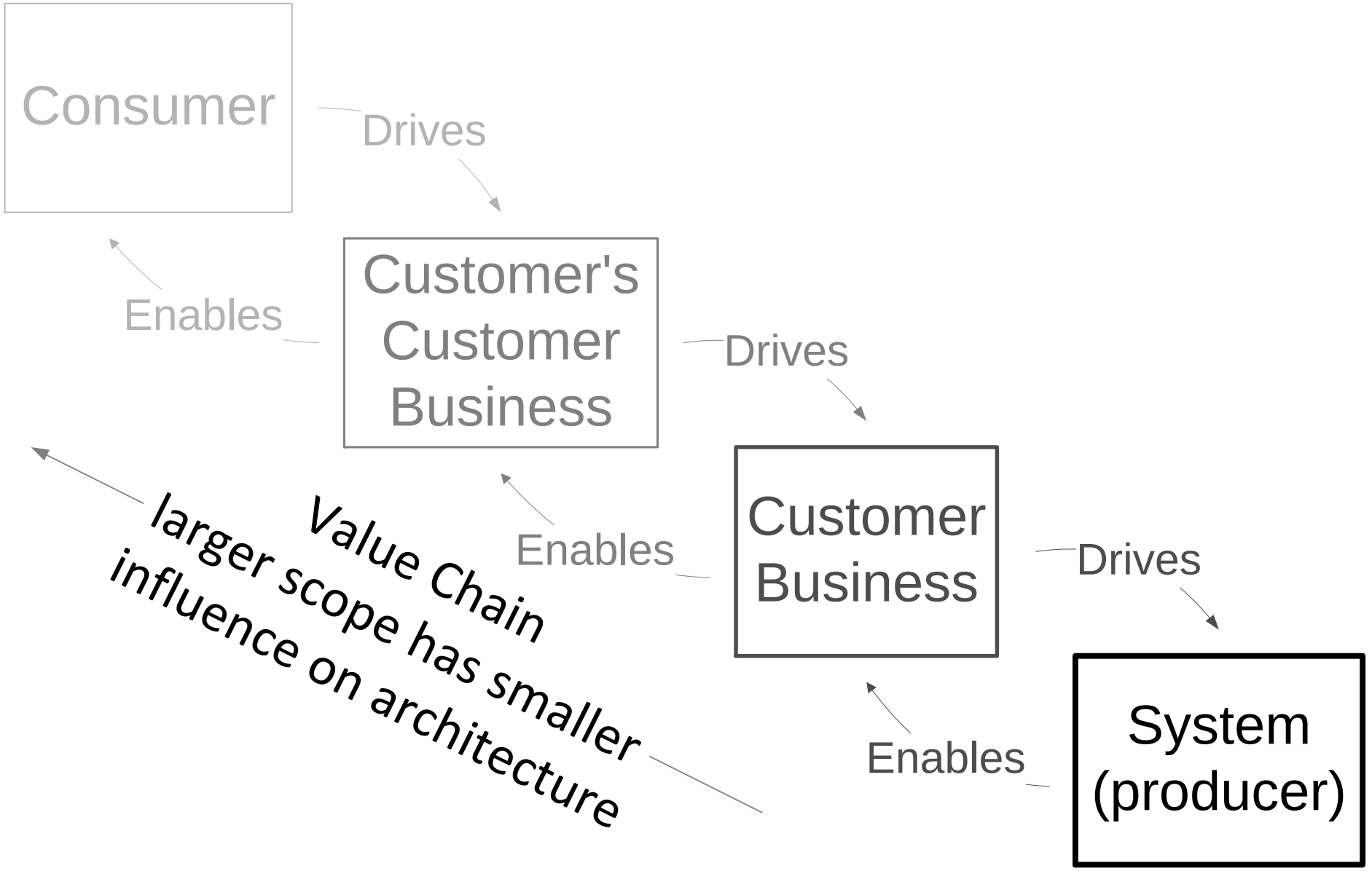


Integrating CAFCR

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



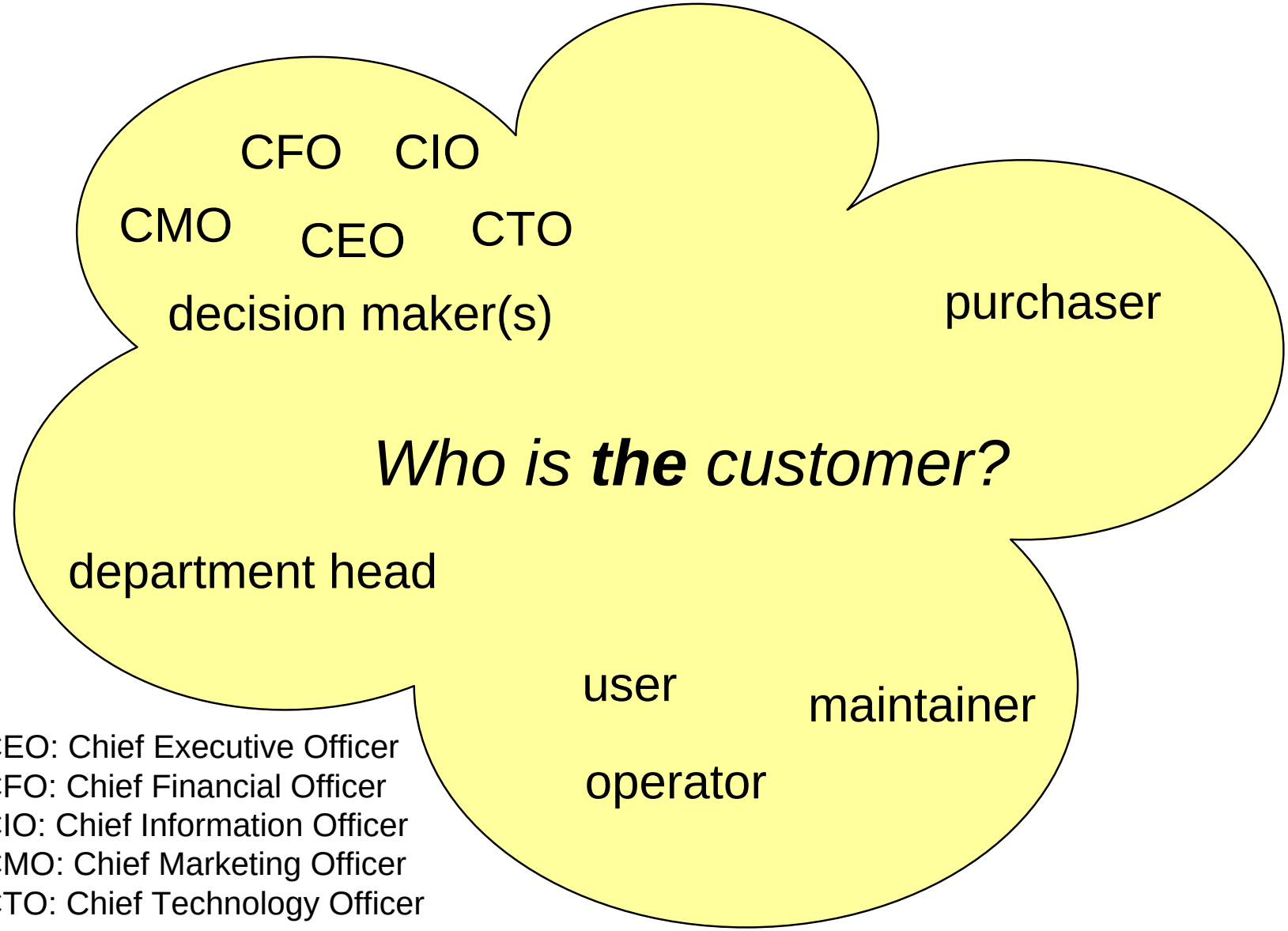
CAFCR can be applied recursively



Market segmentation

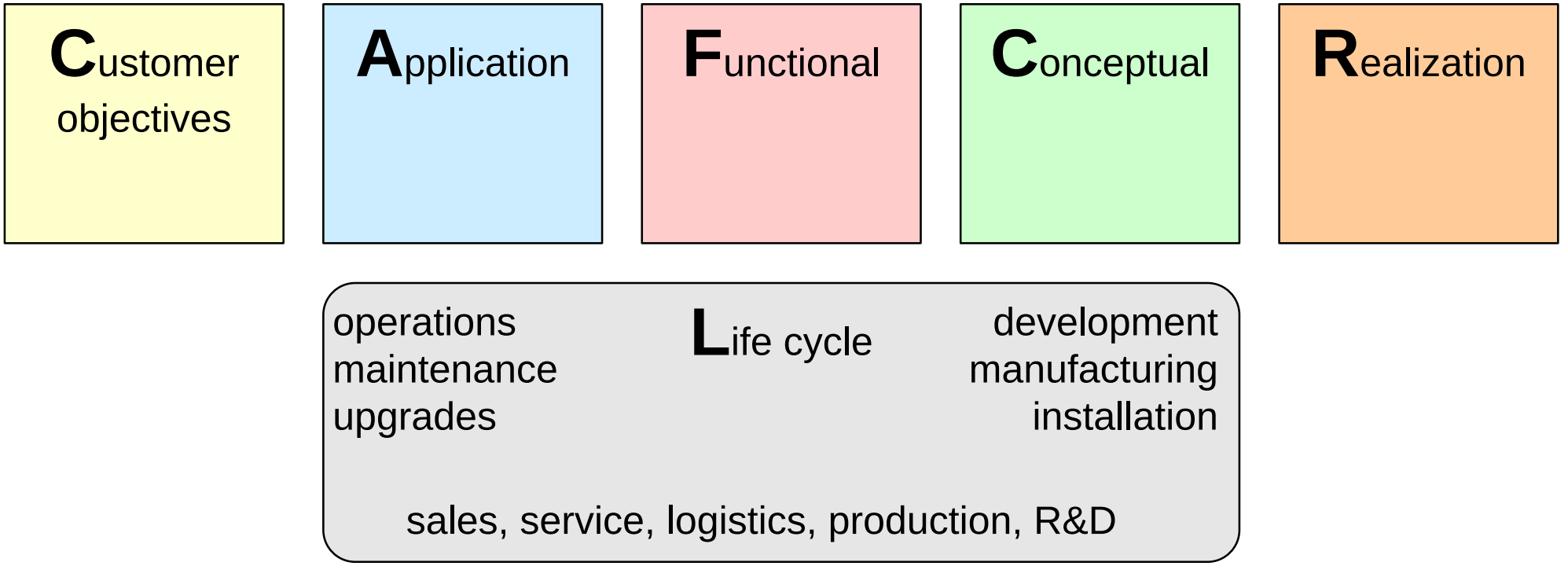
segmentation axis	examples
geographical	USA, UK, Germany, Japan, China
business model	profit, non profit
economics	high end versus cost constrained
consumers	youth, elderly
outlet	retailer, provider, OEM, consumer direct

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

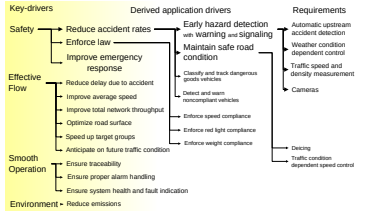


Key Drivers How To

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

Abstract

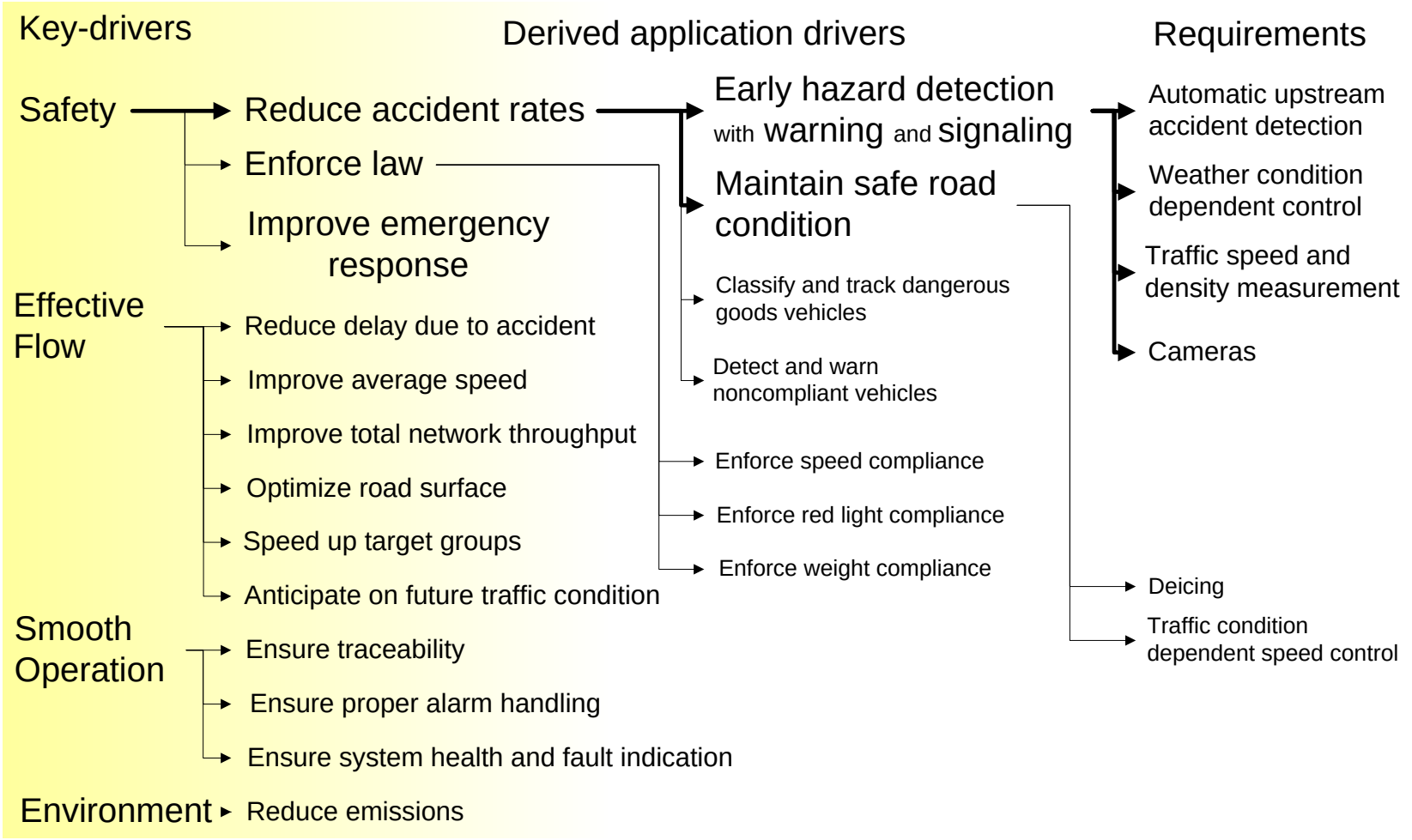
The notion of ”business key drivers” is introduced and a method is described to link these key drivers to the product specification.



Note: the graph is only partially elaborated for application drivers and requirements

March 27, 2021
status: draft
version: 0.2

Example Motorway Management Analysis



Note: the graph is only partially elaborated for application drivers and requirements

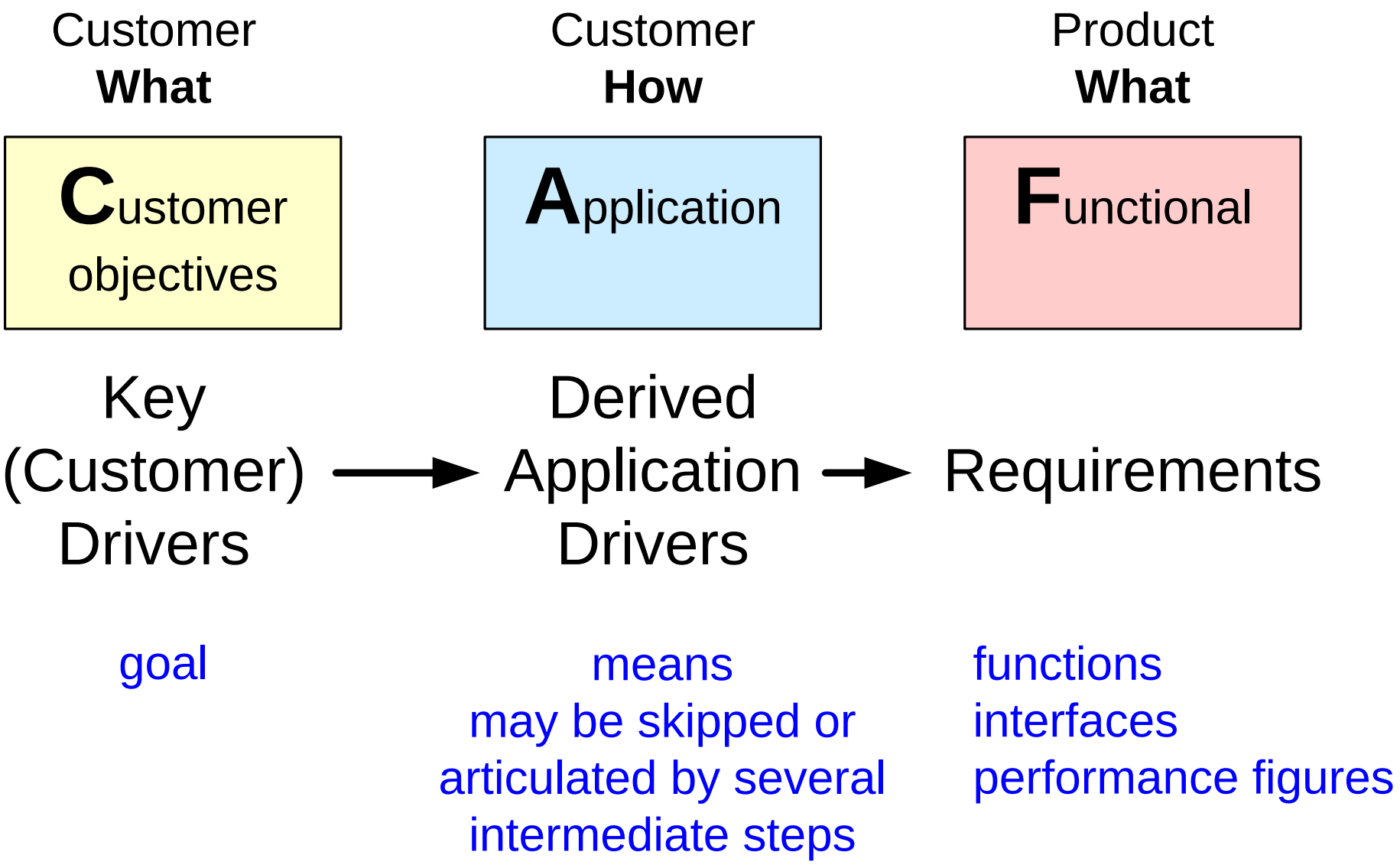
Method to create Key Driver Graph

• Define the scope specific.	in terms of stakeholder or market segments
• Acquire and analyze facts	extract facts from the product specification and ask why questions about the specification of existing products.
• Build a graph of relations between drivers and requirements by means of brainstorming and discussions	where requirements may have multiple drivers
• Obtain feedback	discuss with customers, observe their reactions
• Iterate many times	increased understanding often triggers the move of issues from driver to requirement or vice versa and rephrasing

Recommendation for the Definition of Key Drivers

• Limit the number of key-drivers	minimal 3, maximal 6
• Don't leave out the obvious key-drivers	for instance the well-known main function of the product
• Use short names, recognized by the customer.	
• Use market-/customer- specific names, no generic names	for instance replace "ease of use" by "minimal number of actions for experienced users", or "efficiency" by "integral cost per patient"
• Do not worry about the exact boundary between Customer Objective and Application	create clear goal means relations

Transformation of Key Drivers into Requirements



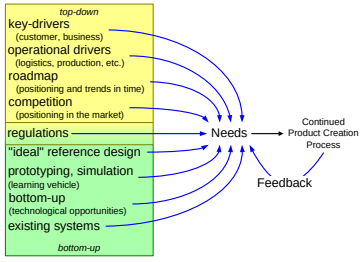
Requirements Elicitation and Selection

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

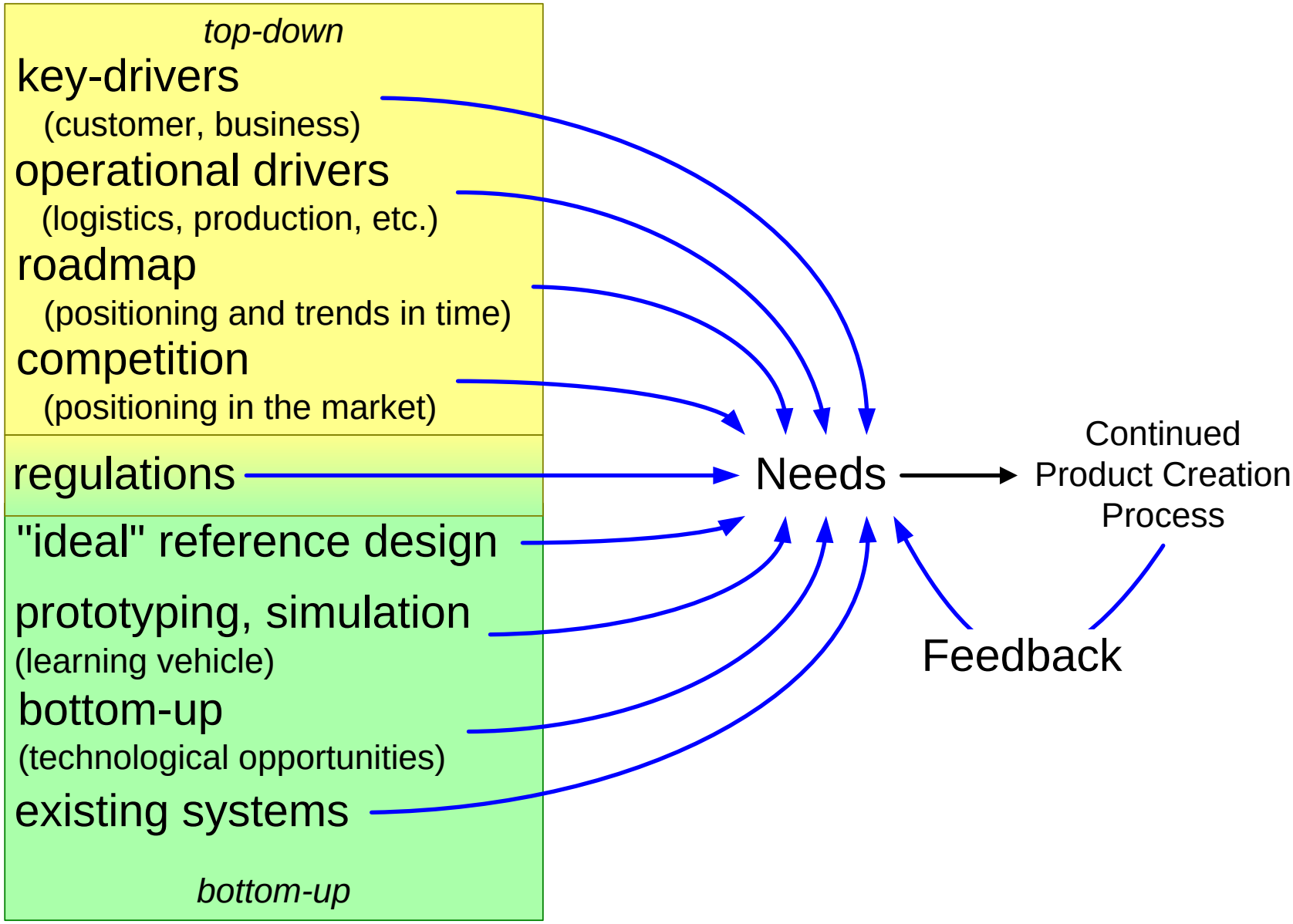
Abstract

An elicitation method for needs is described using many different viewpoints. A selection process with a coarse and a fine selection is described to reduce the specification to an acceptable and feasible subset.

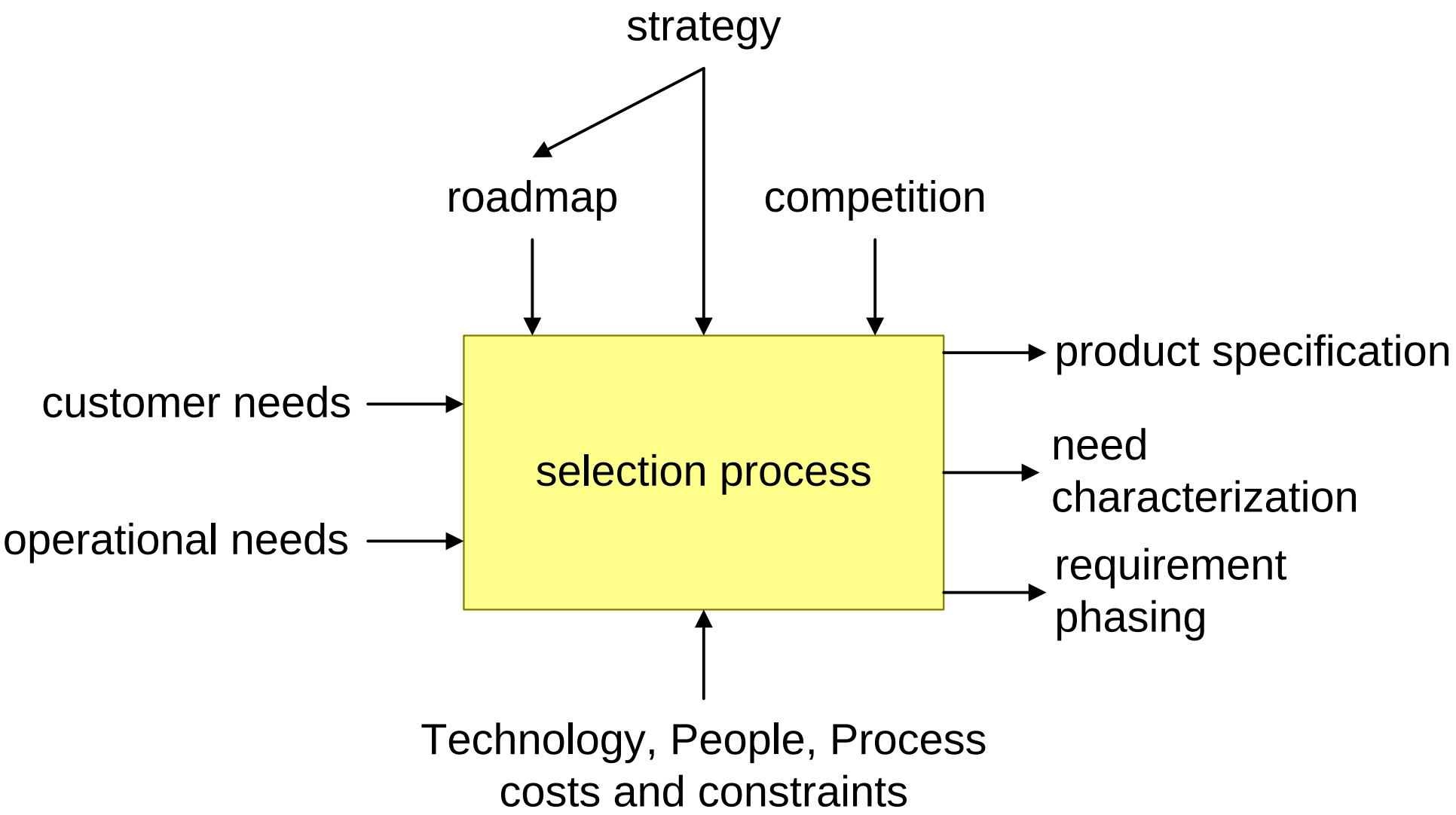
March 27, 2021
status: draft
version: 0



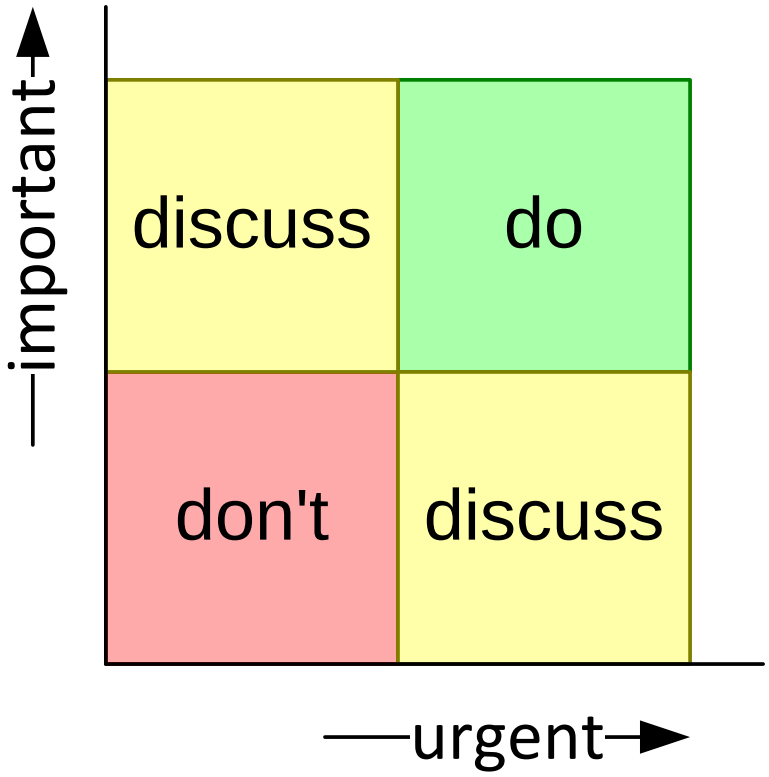
Complementary Viewpoints to Capture Requirements

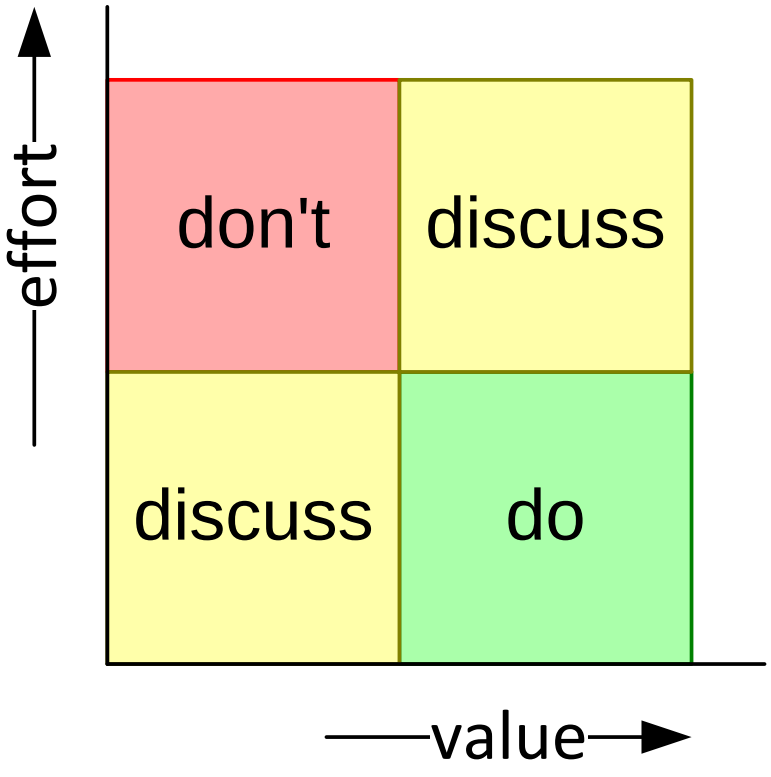


Requirement Selection Process



Simple Qualification Method





Examples of Quantifiable Aspects

- Value for the customer
- (dis)satisfaction level for the customer
- Selling value (How much is the customer willing to pay?)
- Level of differentiation w.r.t. the competition
- Impact on the market share
- Impact on the profit margin

Use relative scale, e.g. 1..5 1=low value, 5 -high value

Ask several knowledgeable people to score

Discussion provides insight (don't fall in spreadsheet trap)

Exercise Requirements Capturing

- Determine the key drivers for one particular product family.
- Translate these drivers into application drivers and derive from them the requirements.

Needs and Requirements

Needs, Specification, Requirements

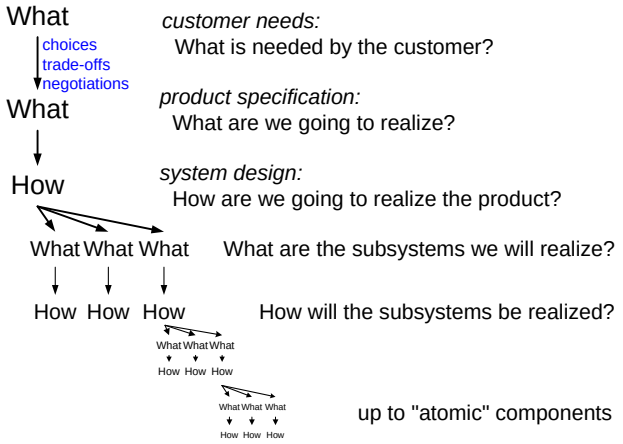
Requirements describing the needs of the customer: ***Customer Needs***

Requirements describing the characteristics of the final resulting system (product): ***System (Product) Specification***

The ***requirements management process*** recursively applies this definition for every level of decomposition.

Requirements describing the needs of the company itself over the life cycle: ***Life Cycle Needs***

Flow of Requirements



Requirements for Requirements

Specific

Unambiguous

Verifiable

Quantifiable

Measurable

Complete

Traceable

Enable Human Use

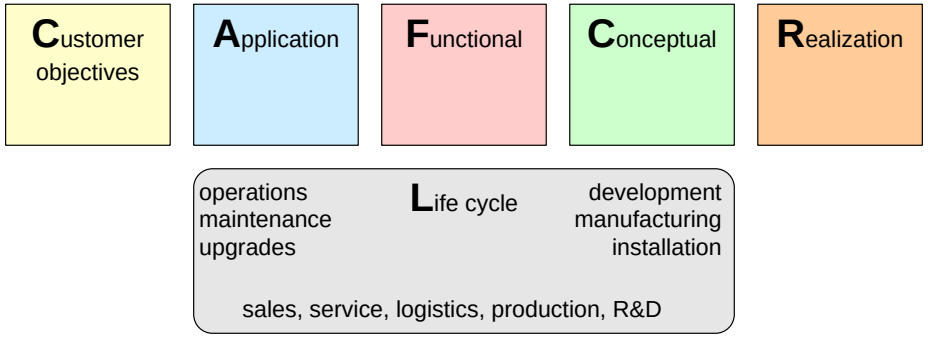
Accessible

Understandable

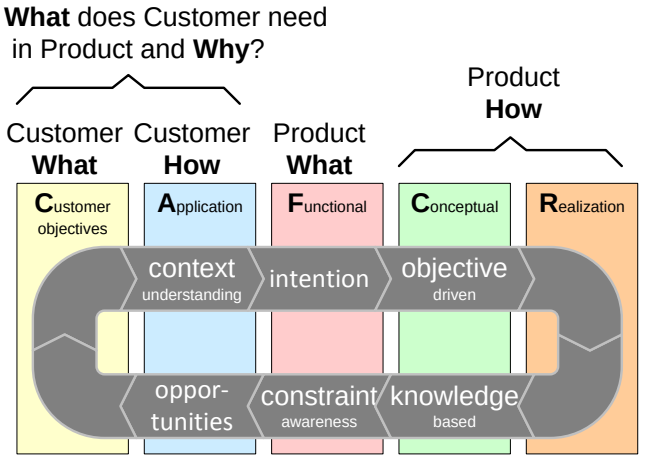
Low threshold

CAFCR, Customer Key Driver Graph

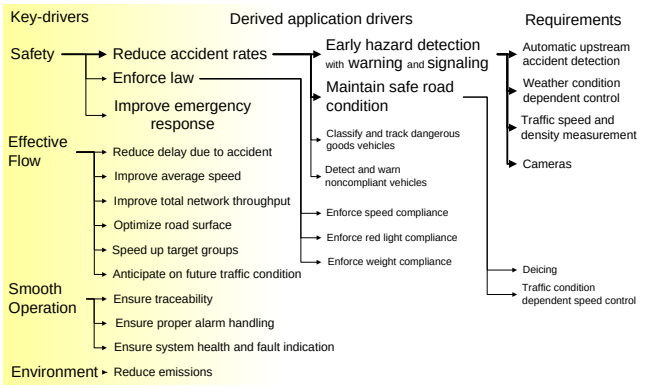
CAFCR+ Model



Iterate over Views

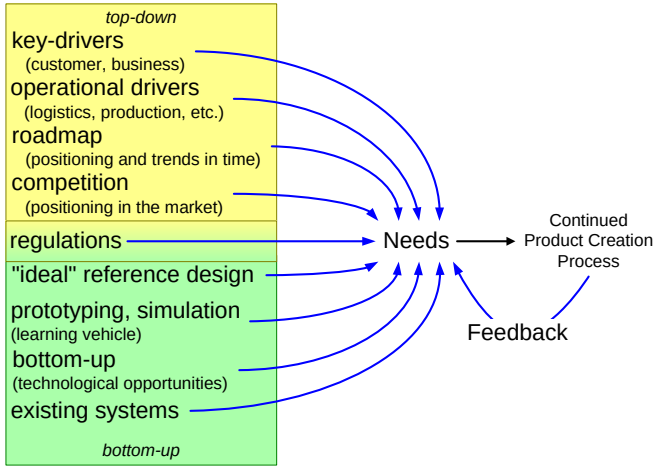


Example Key Driver Graph



Note: the graph is only partially elaborated for application drivers and requirements

Complementary Viewpoints



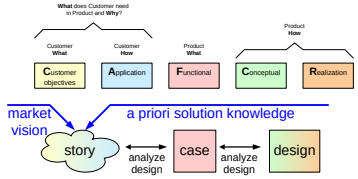
Story How To

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

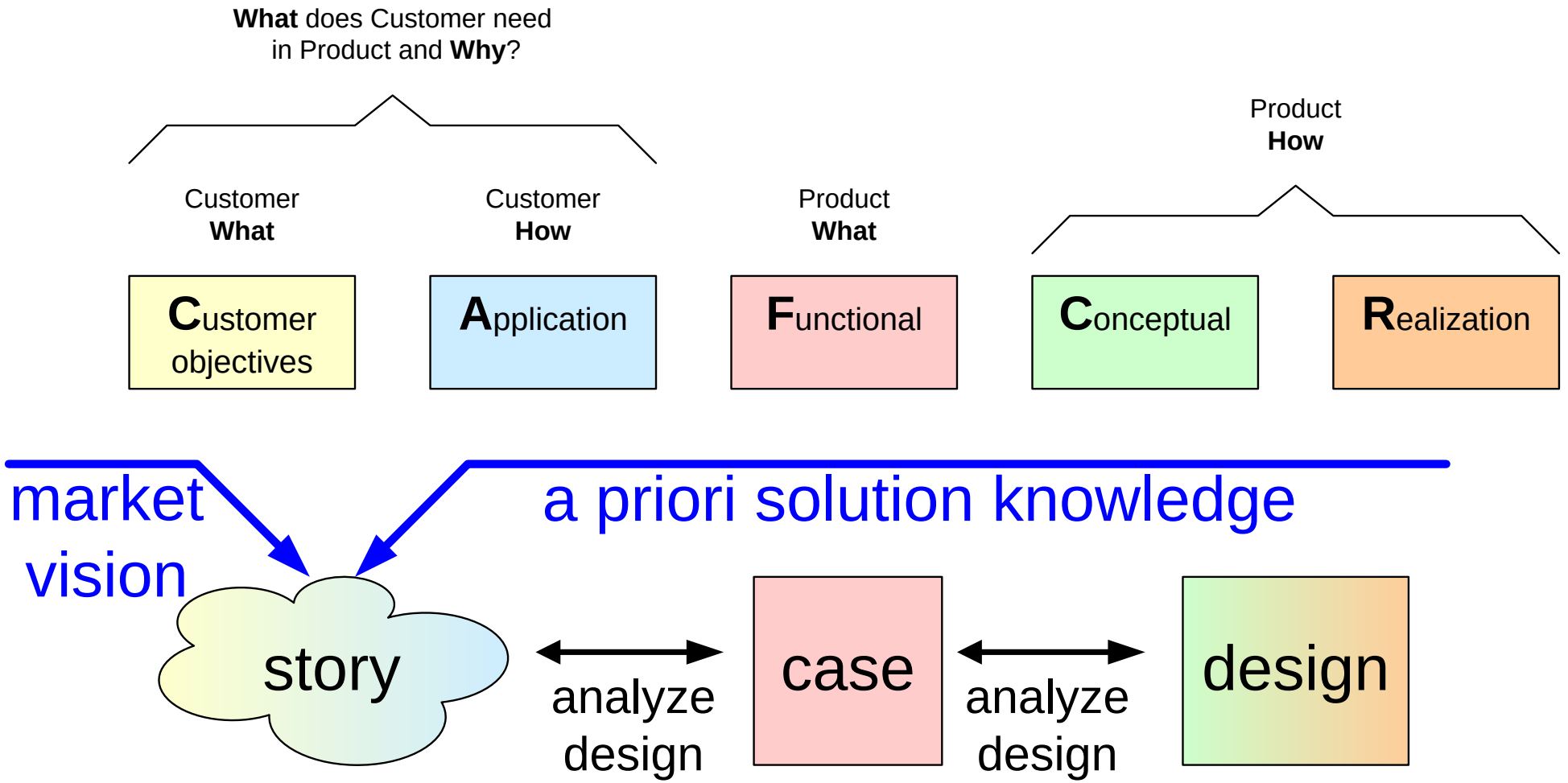
Abstract

A story is an easily accessible story or narrative to make an application live. A good story is highly specific and articulated entirely in the problem domain: the native world of the users. An important function of a story is to enable specific (*quantified, relevant, explicit*) discussions.

March 27, 2021
status: concept
version: 1.2

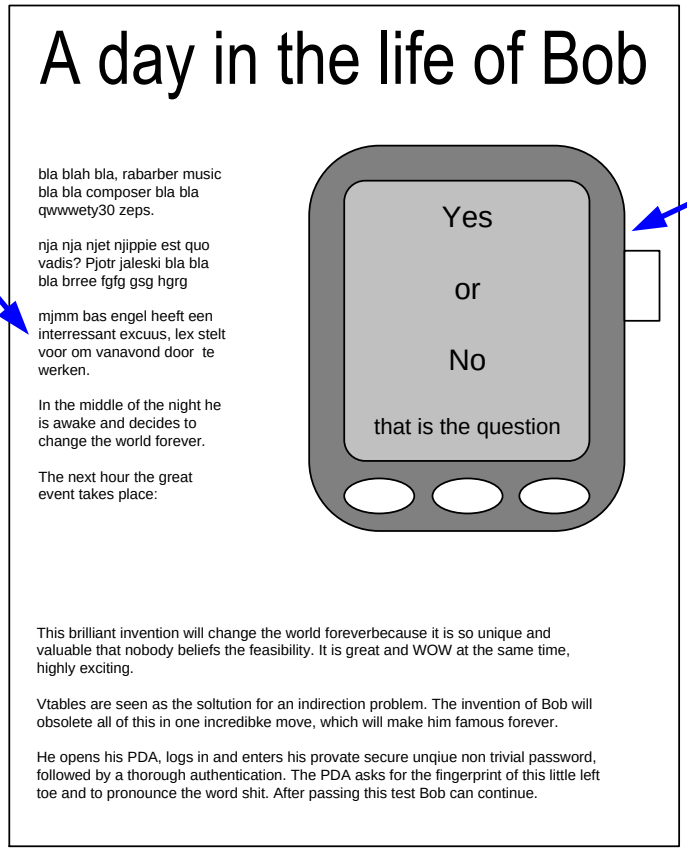


From story to design



Example story layout

ca. half a page of plain English text



draft or sketch of some essential appliance

Points of attention

- purpose — What do you need to know for specification and design?
- scope — “umbrella” or specific event?
- viewpoint, stakeholders — Define your stakeholder and viewpoint f.i. user, maintainer, installer
- visualization — Sketches or cartoon Helps to share and communicate ideas
- size (max 1 A4) — Can be read or told in few minutes
- recursive decomposition, refinement

Criteria for a good story

- Customer objectives / Application
  - accessible, understandable

    "Do you see it in front of you?"
- Customer objectives / Application
  - valuable, appealing

    attractive, important

    "Are customers queuing up for this?"
- Conceptual / Realization
  - critical, challenging

    "What is difficult in the realization?"

    "What do you learn w.r.t. the design?"
- Application
  - frequent, no exceptional niche

    "Does it add significantly to the bottom line?"
- Application / Functional
  - specific

    names, ages, amounts, durations, titles, ...

Example of a story

Betty is a 70-year-old woman who lives in Eindhoven. Three years ago her husband passed away and since then she lives in a home for the elderly. Her 2 children, Angela and Robert, come and visit her every weekend, often with Betty's grandchildren Ashley and Christopher. As so many women of her age, Betty is reluctant to touch anything that has a technical appearance. She knows how to operate her television, but a VCR or even a DVD player is way to complex.

When Betty turned 60, she stopped working in a sewing studio. Her work in this noisy environment made her hard-of-hearing with a hearing-loss of 70dB around 2kHz. The rest of the frequency spectrum shows a loss of about 45dB. This is why she had problems understanding her grandchildren and why her children urged her to apply for hearing aids two years ago. Her technophobia (and her first hints or arthritis) inhibit her to change her hearing aids' batteries. Fortunately her children can do this every weekend.

This Wednesday Betty visits the weekly Bingo afternoon in the meetingplace of the old-folk's home. It's summer now and the tables are outside. With all those people there it's a lot of chatter and babble. Two years ago Betty would never go to the bingo: "I cannot hear a thing when everyone babbles and clatters with the coffee cups. How can I hear the winning numbers?!". Now that she has her new digital hearing instruments, even in the bingo cacophony, she can understand everyone she looks at. Her social life has improved a lot and she even won the bingo a few times.

That same night, together with her friend Janet, she attends Mozart's opera The Magic Flute. Two years earlier this would have been one big low rumbly mess, but now she even hears the sparkling high piccolos. Her other friend Carol never joins their visits to the theaters. Carol also has hearing aids, however hers only "work well" in normal conversations. "When I hear music it's as if a butcher's knife cuts through my head. It's way too sharp!". So Carol prefers to take her hearing aids out, missing most of the fun. Betty is so happy that her hearing instruments simply know where they are and adapt to their environment.

source: Roland Mathijssen
Embedded Systems Institute
Eindhoven

Value and Challenges in this story

Customer objectives

Application

Value proposition in this story:

quality of life:

active participation in different social settings

usability for nontechnical elderly people:

"intelligent" system is simple to use

loading of batteries

Conceptual

Realization

Challenges in this story:

Intelligent hearing instrument

Battery life — at least 1 week

No buttons or other fancy user interface on the hearing instrument, other than a robust On/Off method

The user does not want a technical device but a solution for a problem

Instrument can be adapted to the hearing loss of the user

Directional sensitivity (to prevent the so-called cocktail party effect)

Recognition of sound environments and automatic adaptation (adaptive filtering)

source: Roland Mathijssen, Embedded Systems Institute, Eindhoven

Module Management Presentation

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

Abstract

This module addresses the presentation of architectural issues to higher management teams.

March 27, 2021
status: draft
version: 1.1

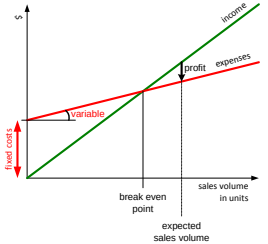
Simplistic Financial Computations for System Architects.

by *Gerrit Muller* USN-SE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

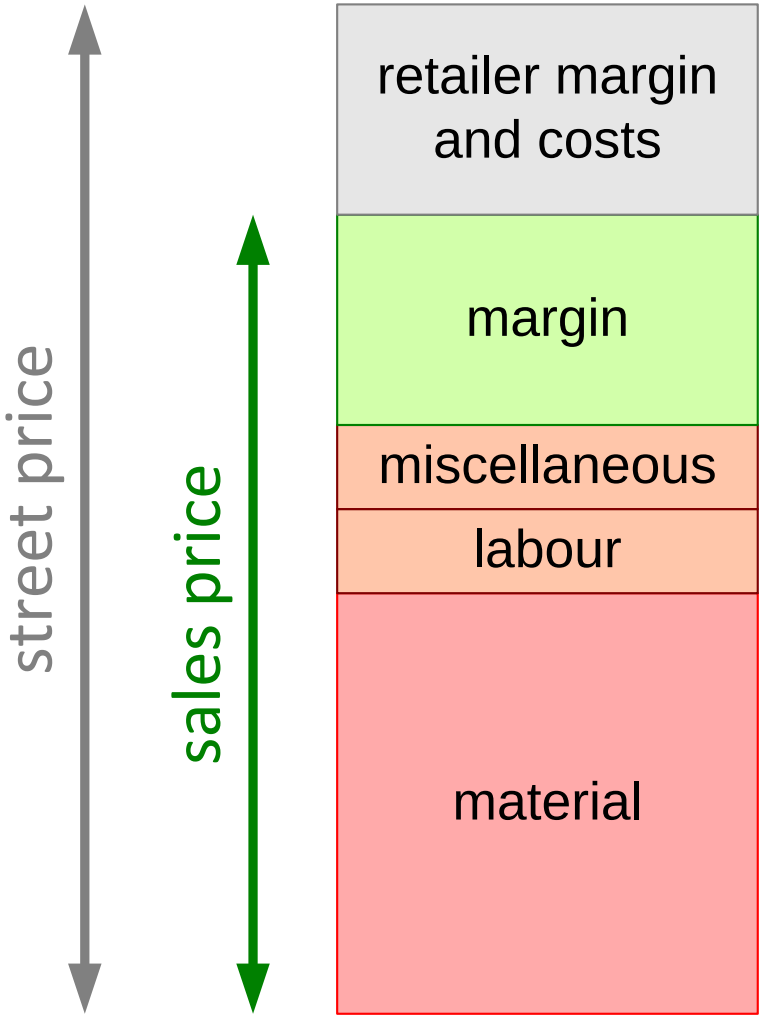
Abstract

This document explains how simple financial estimates can be made by system architects. These simplistic estimates are useful for an architect to perform sanity checks on proposals and to obtain understanding of the financial impact of proposals. Note that architects will never have full fledged financial controller know how and skills. These estimates are zero order models, but real business decisions will have to be founded on more substantial financial proposals.

March 27, 2021
status: preliminary draft
version: 1.3



Product Margin = Sales Price - Cost



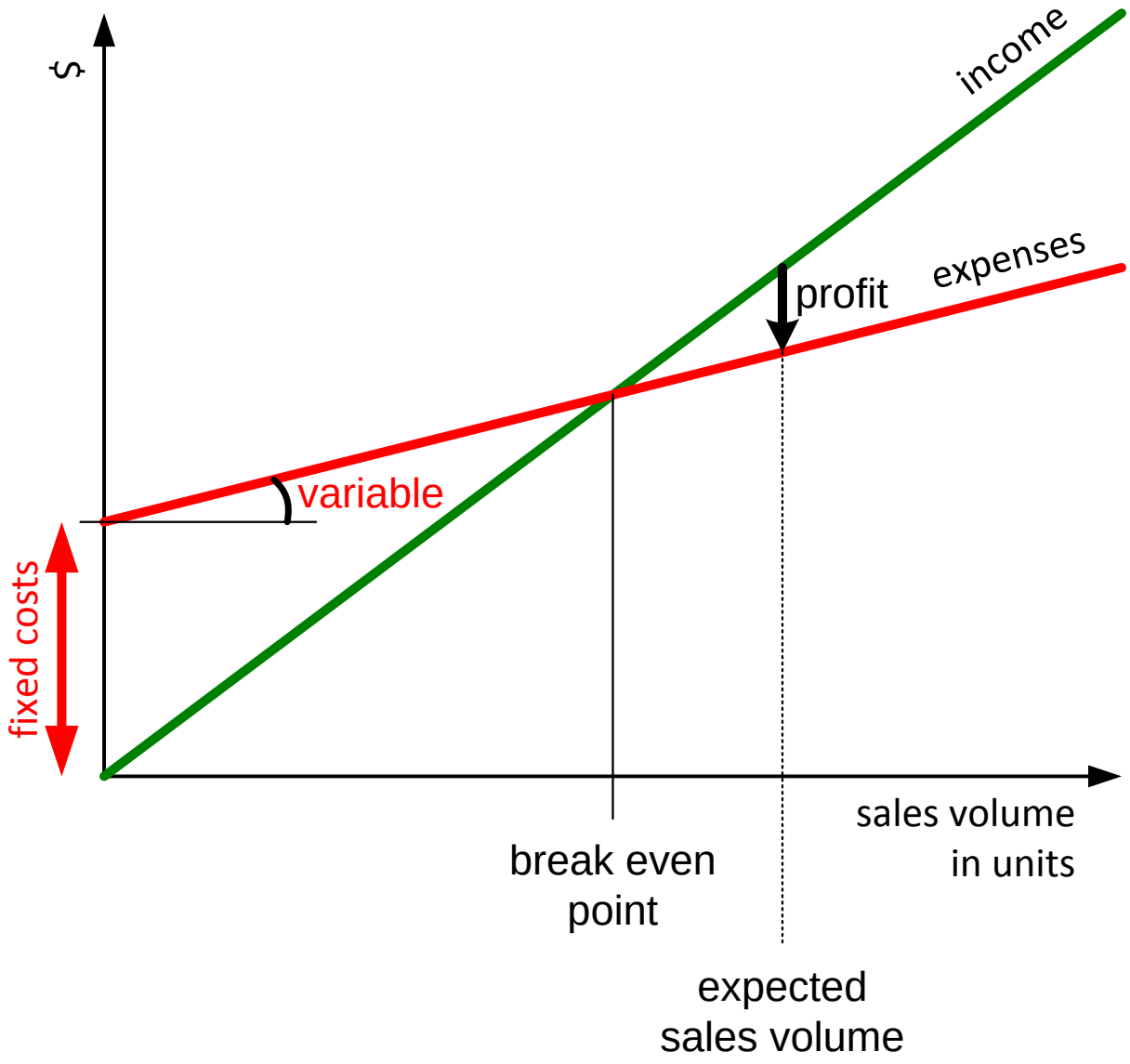
Margin per product.
The margin over the sales volume,
must cover the fixed costs, and generate profit

transportation, insurance,
royalties per product, ...

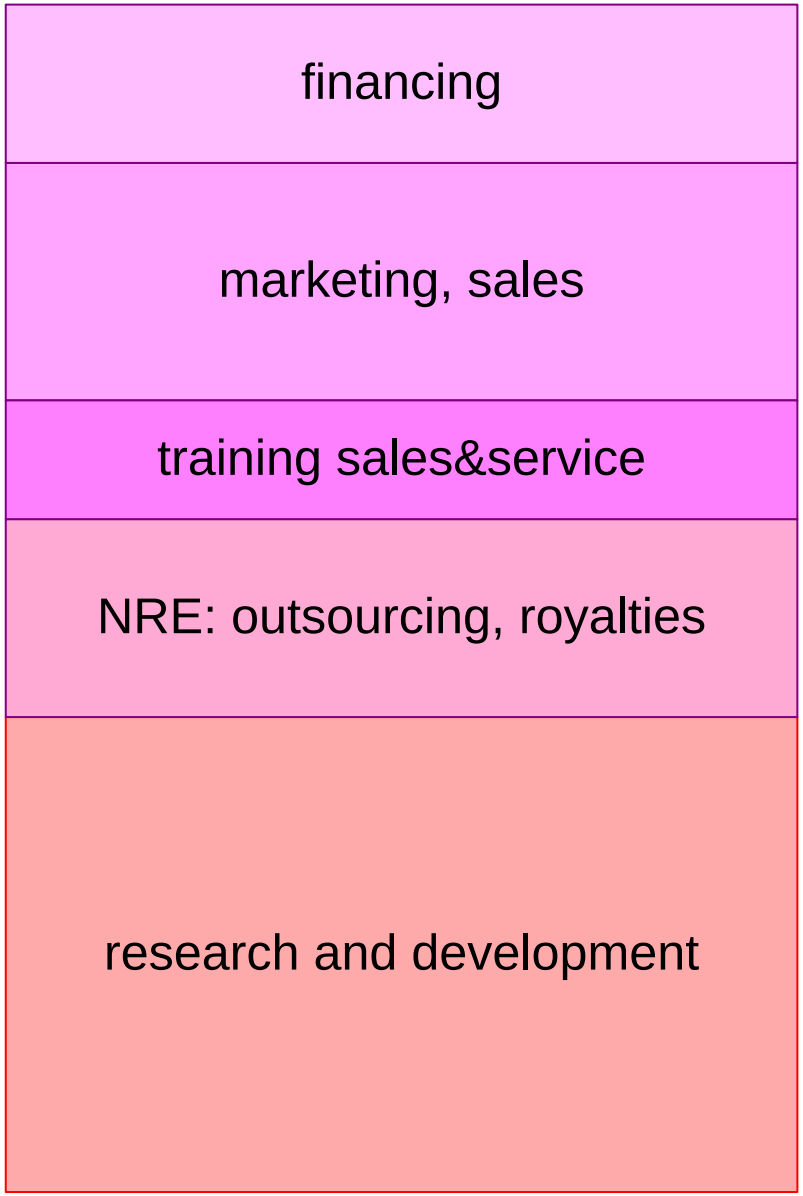
Cost per product,
excluding fixed costs

purchase price of components may cover
development cost of supplier

Profit as function of sales volume



Investments, more than R&D



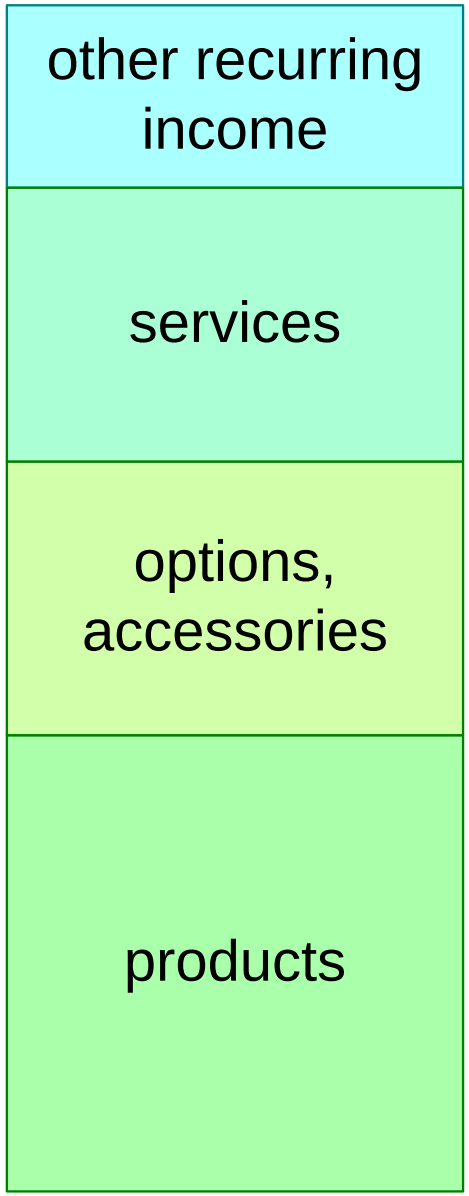
business dependent:
pharmaceutics industry
sales cost >> R&D cost

strategic choice:
NRE or per product

including:
- staff, training, tools, housing
- materials, prototypes
- overhead
- certification

often a standard staffing rate is used
that covers most costs above:
R&D investment = Effort * rate

Income, more than product sales only



$$\sum_{\text{services}} \text{income}_{\text{service}}$$

$$\sum_{\text{options}} \text{sales price}_{\text{option}} * \text{volume}_{\text{option}}$$

$$\text{sales price}_{\text{product}} * \text{volume}_{\text{product}}$$

license fees
pay per movie

content, portal
updates
maintenance

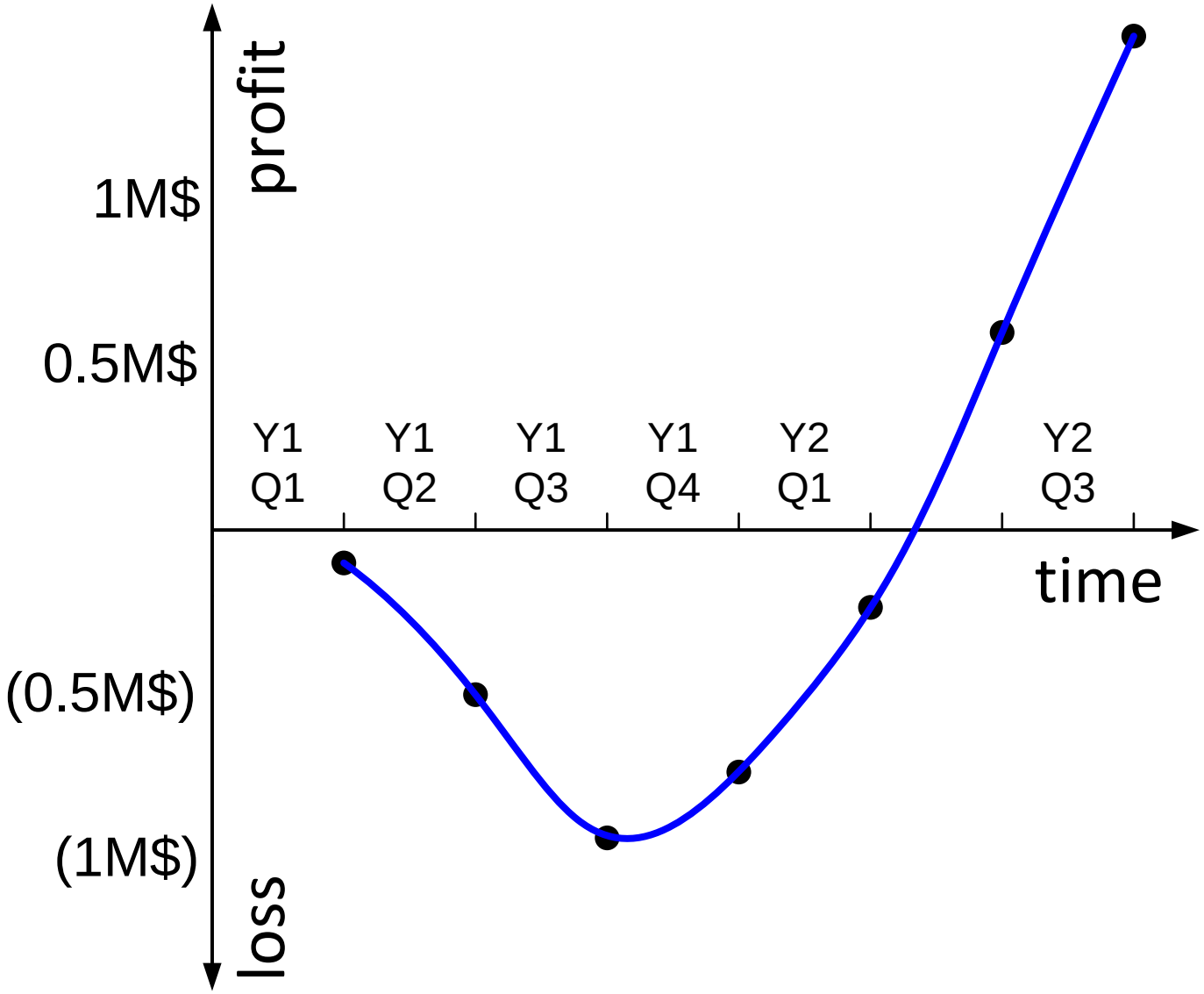
The Time Dimension

	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3
investments	100k$	400k$	500k$	100k$	100k$	60k$	20k$
sales volume (units)	-	-	2	10	20	30	30
material & labour costs	-	-	40k$	200k$	400k$	600k$	600k$
income	-	-	100k$	500k$	1000k$	1500k$	1500k$
quarter profit (loss)	(100k$)	(400k$)	(440k$)	200k$	500k$	840k$	880k$
cumulative profit	(100k$)	(500k$)	(940k$)	(740k$)	(240k$)	600k$	1480k$

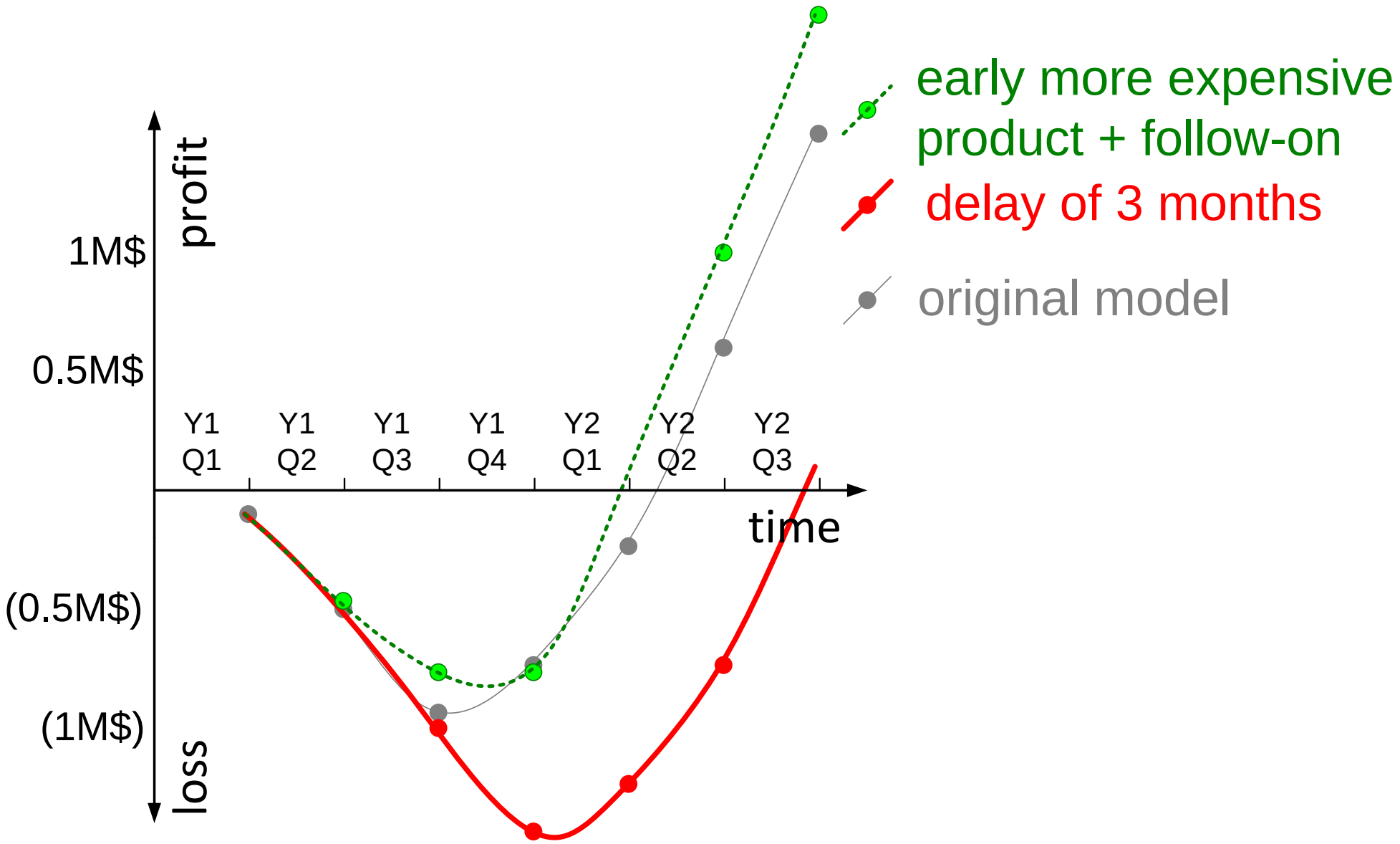
cost price / unit = 20k$
sales price / unit = 50k$

variable cost = sales volume * cost price / unit
income = sales volume * sales price / unit
quarter profit = income - (investments + variable costs)

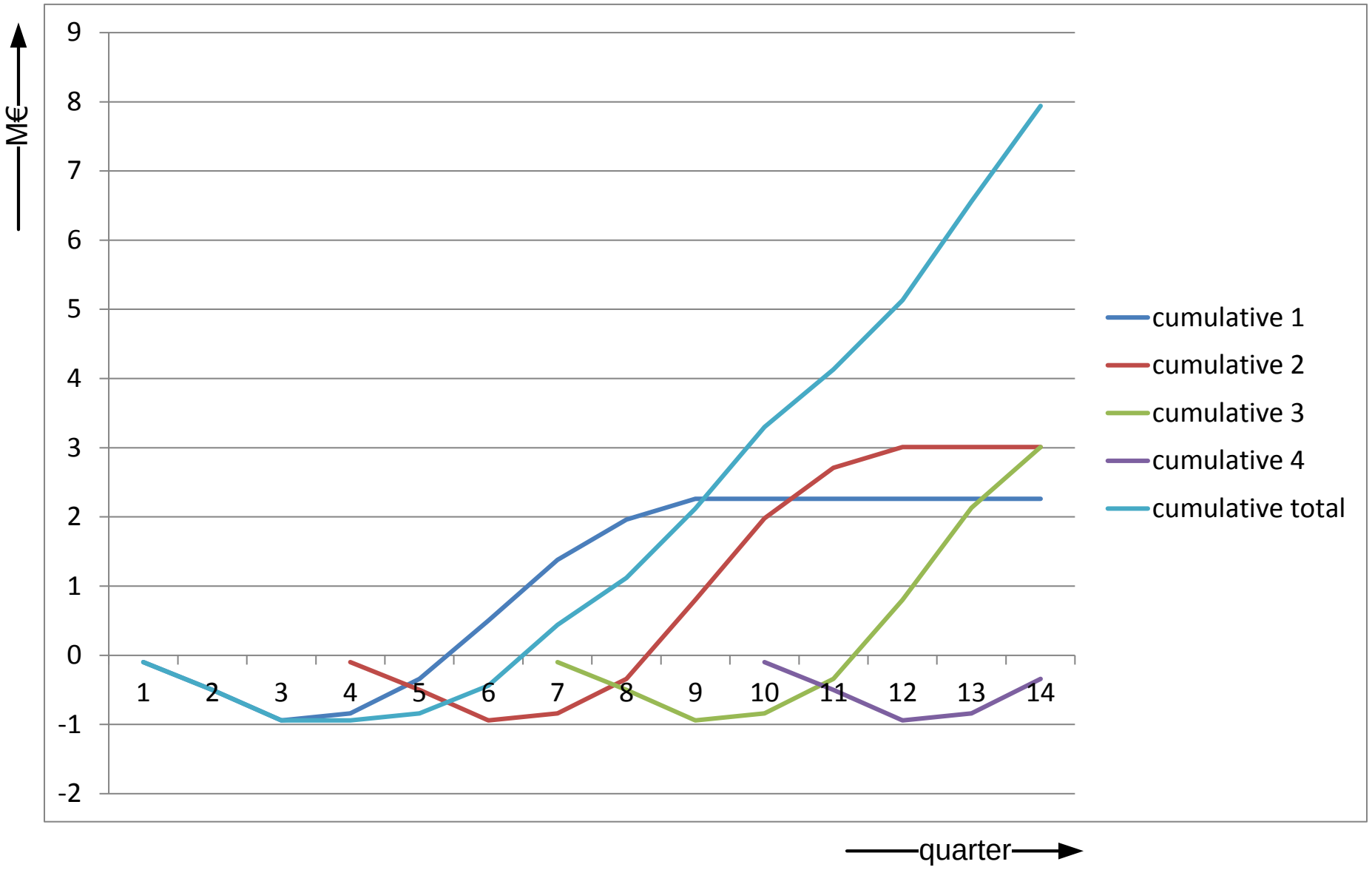
The “Hockey” Stick



What if ...?


profit
1M$
0.5M$
(0.5M$)
(1M$)
loss
Y1 Q1
Y1 Q2
Y1 Q3
Y1 Q4
Y2 Q1
Y2 Q2
Y2 Q3
time
early more expensive product + follow-on
delay of 3 months
original model

Stacking Multiple Developments



Fashionable financial yardsticks

Return On Investments (ROI)

Net Present Value

Return On Net Assets (RONA) leasing reduces assets, improves RONA

turnover / fte outsourcing reduces headcount, improves this ratio

market ranking (share, growth) "only numbers 1, 2 and 3 will be profitable"

R&D investment / sales in high tech segments 10% or more

cash-flow fast growing companies combine profits with negative cash-flow, risk of bankruptcy

How to present architecture issues to higher management

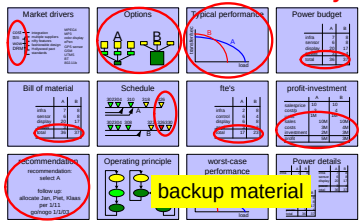
by *Gerrit Muller* USN-SE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

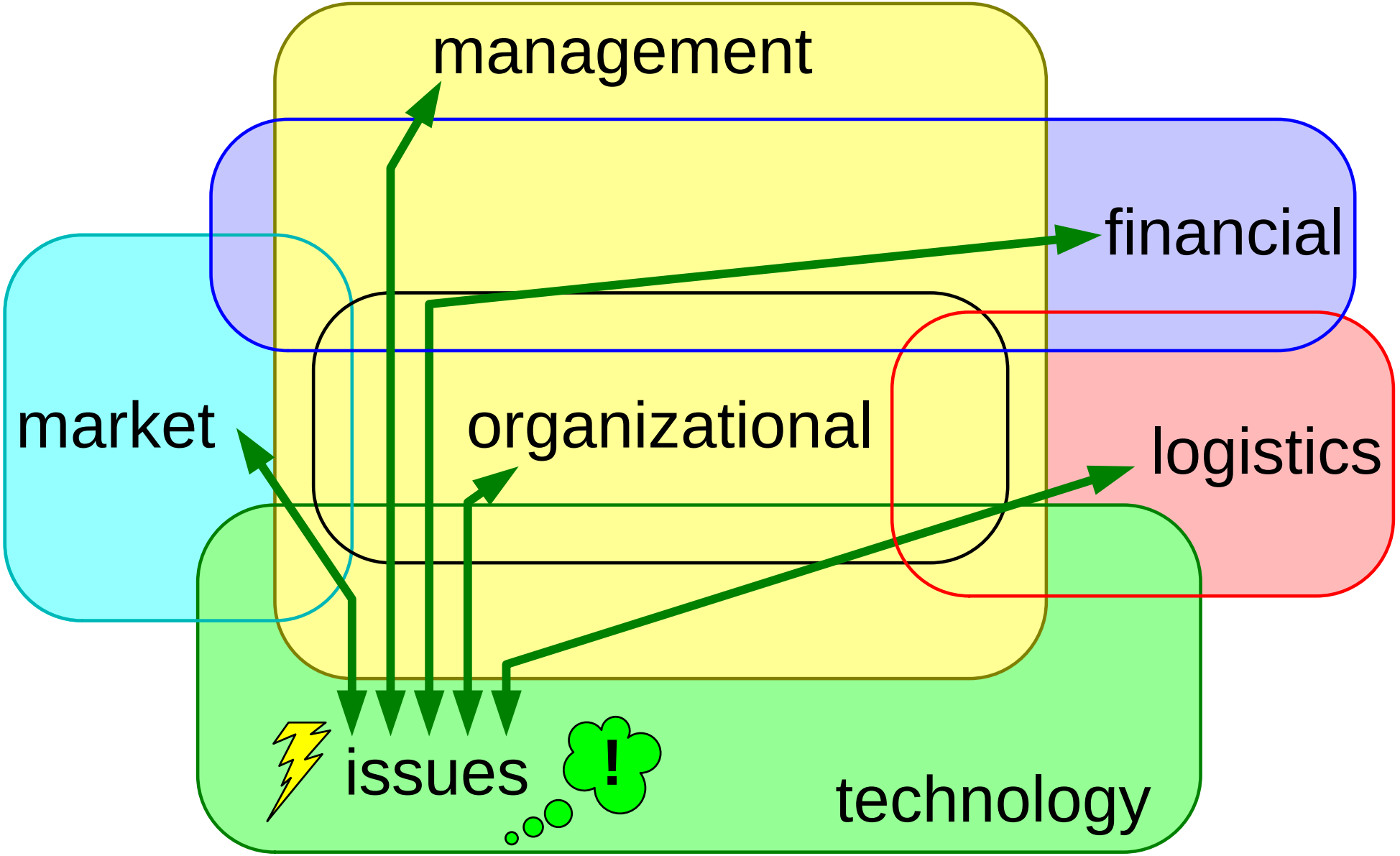
Architects struggle with their visibility at higher management echelons. The introvert nature of architects is a severe handicap. Participation of architects in management teams is important for balanced technical sound decisions and strategy. Improved managerial communication skills of architects are required.
This article describes how to give a more effective presentation to higher management teams. Subjects discussed are the preparation, content and form, do and don't advise.

March 27, 2021
status: concept
version: 0.1

mention the red information only



Architectural issues related to managerial viewpoints



Characteristics of managers in higher management teams

common characteristics

+ action-oriented
+ solution rather than problem
+ impatient, busy
+ want facts not beliefs
+ operate in a political context
+ bottom-line oriented:
  profit, return on investment,
  market share, etc.

highly variable characteristics

? technology knowledge
  from extensive to shallow

? style from power play to
  inspirational leadership

How to prepare

Always prepare with small team!

content ⟷ mutual interaction ⟷ understand audience

70% of effort

+ gather facts
+ perform analysis
+ identify goal and message
+ make presentation
+ polish presentation form

30% of effort

+ gather audience background
+ analysis audience interests
+ identify expected responses
+ simulate audience, exercise presentation

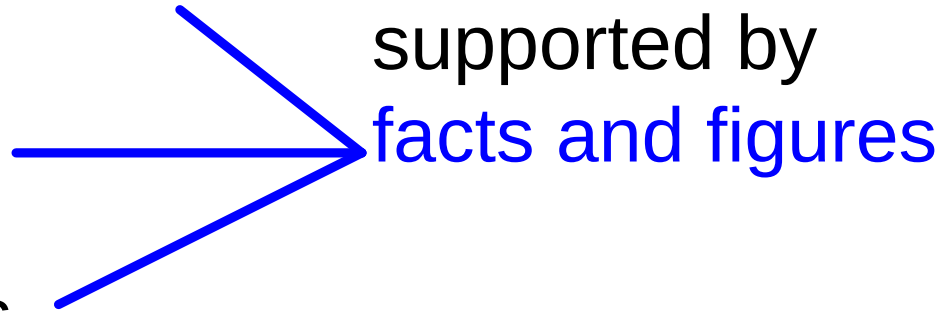
Recommended content

+ clear problem statement (what, why)

+ solution exploration (how)

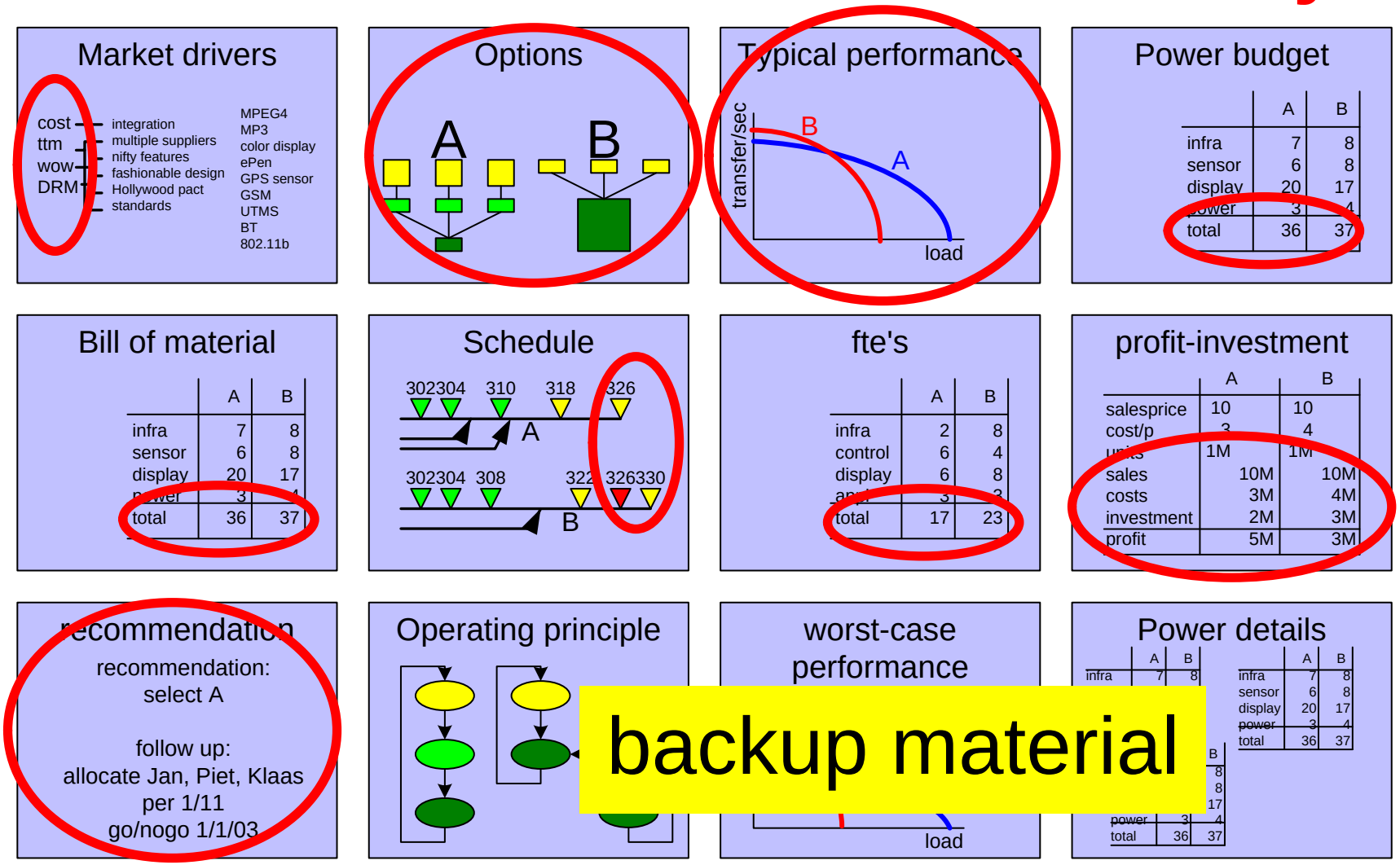
+ options, recommendations

+ expected actions or decisions



Mentioned info, shown info and backup info

mention the red information only



Form is important

poor form can easily distract from purpose and content

presentation material

+ professional
+ moderate use of color and animations
+ readable
+ use demos and show artifacts

presenter's appearance

+ well dressed
+ self confident but open

but stay yourself, stay authentic

Don’t force your opinion, understand the audience

do not	*do*
- preach beliefs	+ quantify, show figures and facts
- underestimate technology knowledge of managers	+ create faith in your knowledge
- tell them what they did wrong	+ focus on objectives
- oversell	+ manage expectations

How to cope with managerial dominance

do not	*do*
- let one of the managers hijack the meeting	+ maintain the lead
- build up tensions by withholding facts or solutions	+ be to the point and direct
- be lost or panic at unexpected inputs or alternatives	+ acknowledge input, indicate consequences (facts based)

Exercise presentation to higher management

+ Bring a clear architecture message to

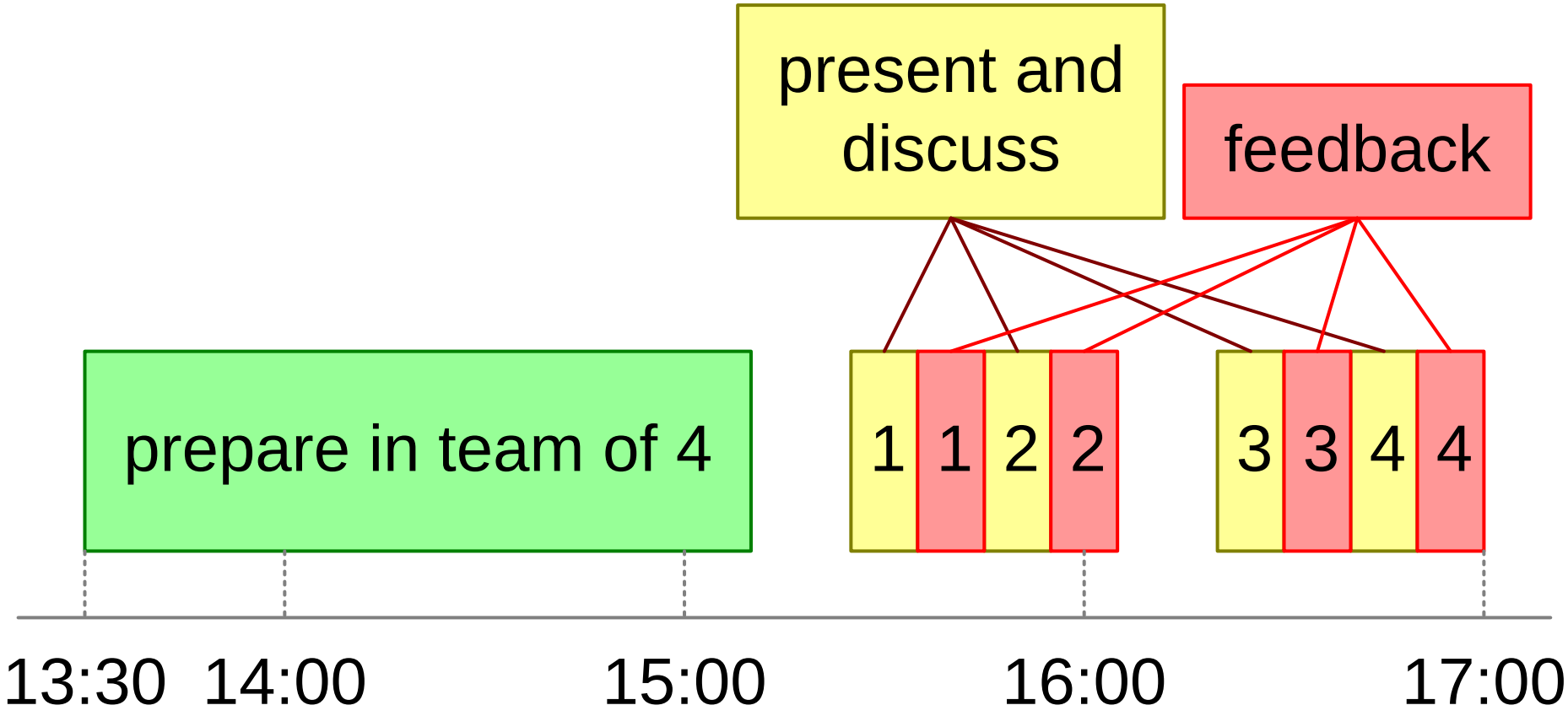
+ a Management team at least 2 hierarchical levels higher

+ with 10 minutes for presentation including discussion
(no limitation on number of slides)

* architecture message =
technology options in relation with market/product

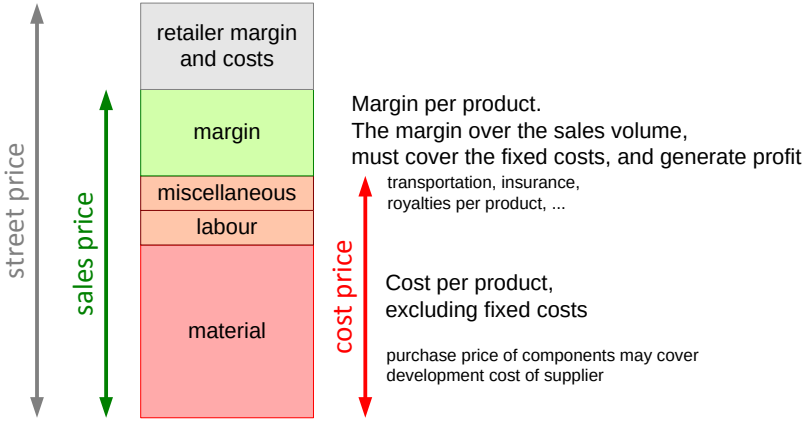
* address the concerns of the management stakeholders:
translation required from technology issues into
business consequences (months, fte's, turnover, profit, investments)

Exercise schedule

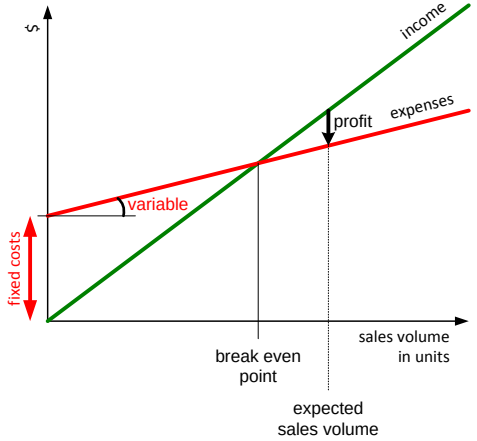


Simplistic Financial Computations

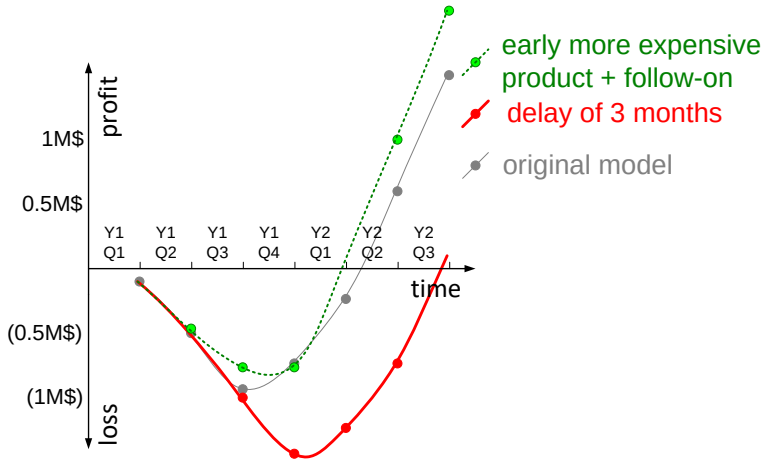
Product Margin = Sales Price - Cost



Profit as function of sales volume



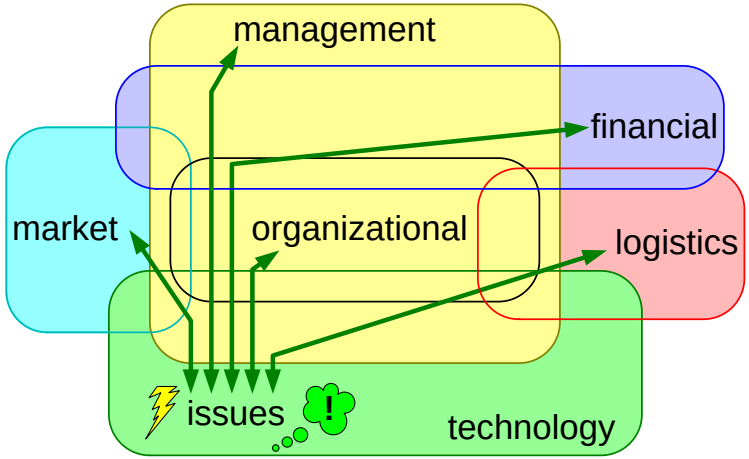
Hockey stick and scenarios



intentionally left blank

Presentation to Management

Managerial Viewpoints



Prepare Content, Understand Audience

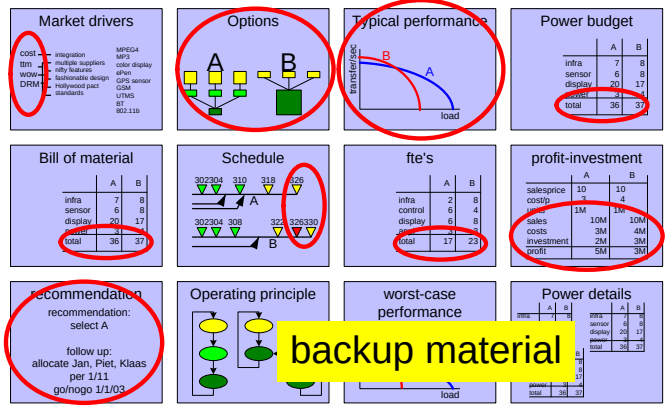
Always prepare with small team!

content (70% of effort)	understand audience (30% of effort)
+ gather facts	+ gather audience background
+ perform analysis	+ analysis audience interests
+ identify goal and message	+ identify expected responses
+ make presentation	+ simulate audience, exercise presentation
+ polish presentation form	

mutual interaction

Show underlying info

mention the red information only



Form, do and do not

poor form can easily distract from purpose and content

presentation material	presenter's appearance
+ professional	+ well dressed
+ moderate use of color and animations	+ self confident but open
+ readable	
+ use demos and show artifacts	

but stay yourself, stay authentic

Module Supporting Processes

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

Abstract

This module addresses supporting processes, for instance documentation, templates, and reviewing.

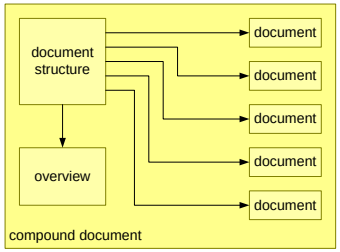
March 27, 2021
status: draft
version: 1.4

Granularity of Documentation

by *Gerrit Muller* USN-SE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

The design of documentation is discussed, with emphasis on the requirements, the need for decomposition, the measures needed to maintain overview and criteria for granularity.



March 27, 2021
status: concept
version: 1.2

Requirements for the Entire Documentation Structure

Accessibility for the readers

Low threshold for the readers

Low threshold for the authors

Completeness

Consistency

Maintainability

Scalability

Evolvability

Process to ensure the quality of the information

Requirements from Reader Point of View

Convenient

easy

fast

viewing

printing

searching

Requirements per Document

High cohesion (within the unit)

Low coupling (outside of the unit)

Accessibility for the readers

Low threshold for the reader

Low threshold for the author

Manageable steps to create, review, and change

Clear responsibilities

Clear position and relation with the context

Well-defined status of the information

Timely availability

Accessibility Requirements

Ease of reading, “juiciness”

High signal-to-noise ratio: information should not be hidden in a sea of words.

Understandability

Reachability in different ways, e.g., by hierarchical or full search

Reachability in a limited number of steps

Responsibility Requirements

single author

limited amount of reviewers

Scalability Requirements

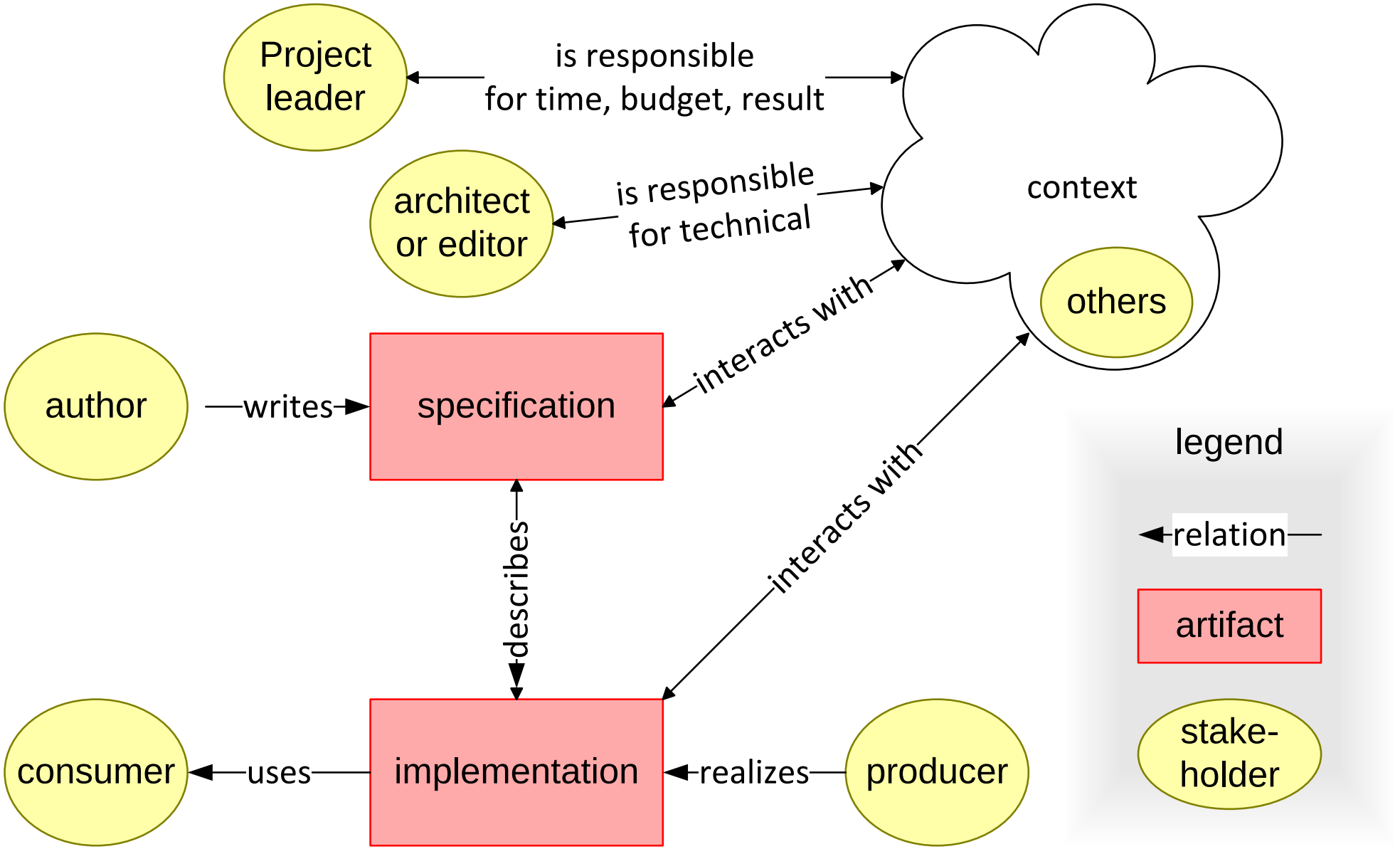
well defined documentation structure

overview specifications at higher aggregation levels

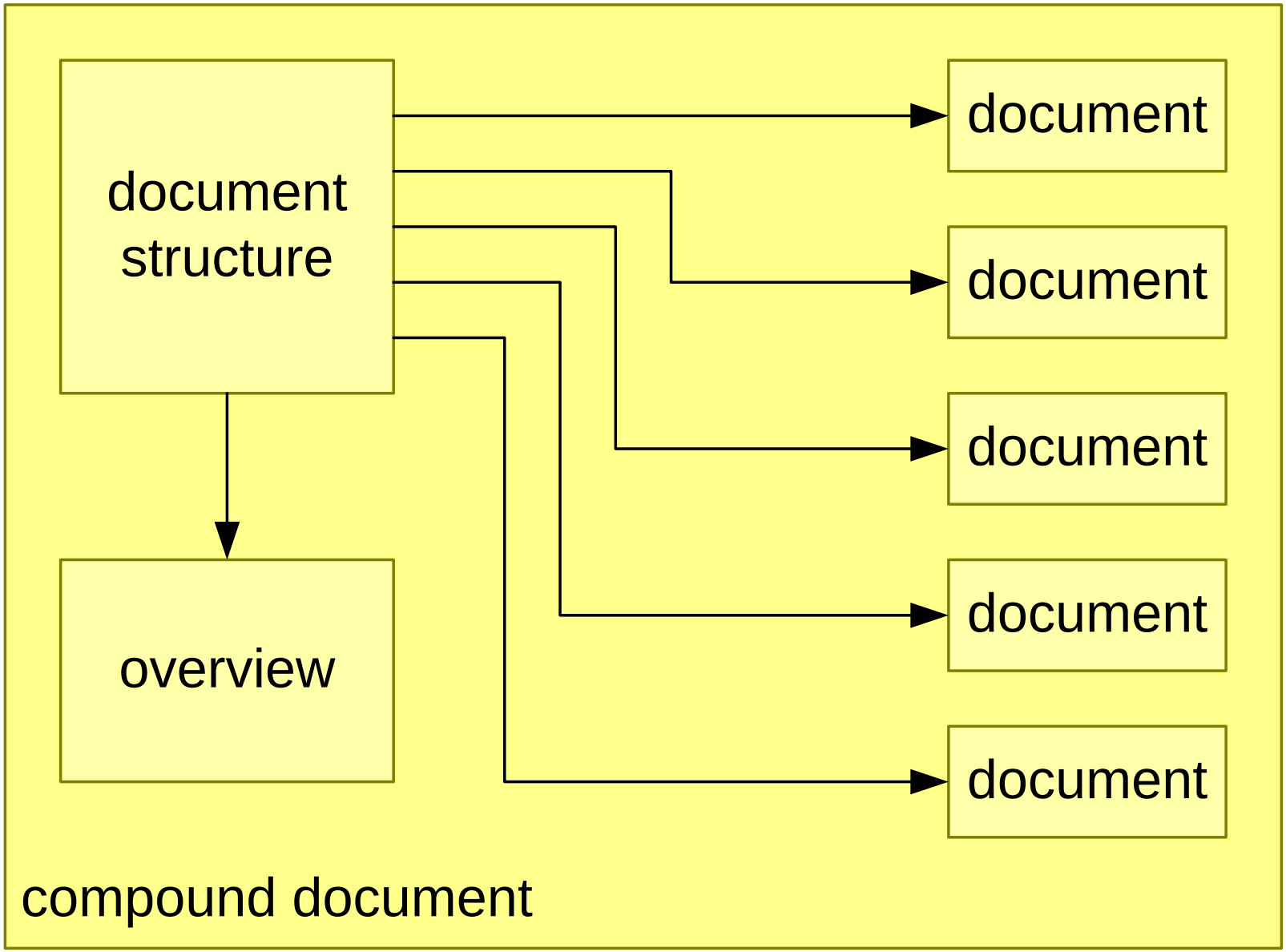
recursive application of structure and overview

delegation of review process

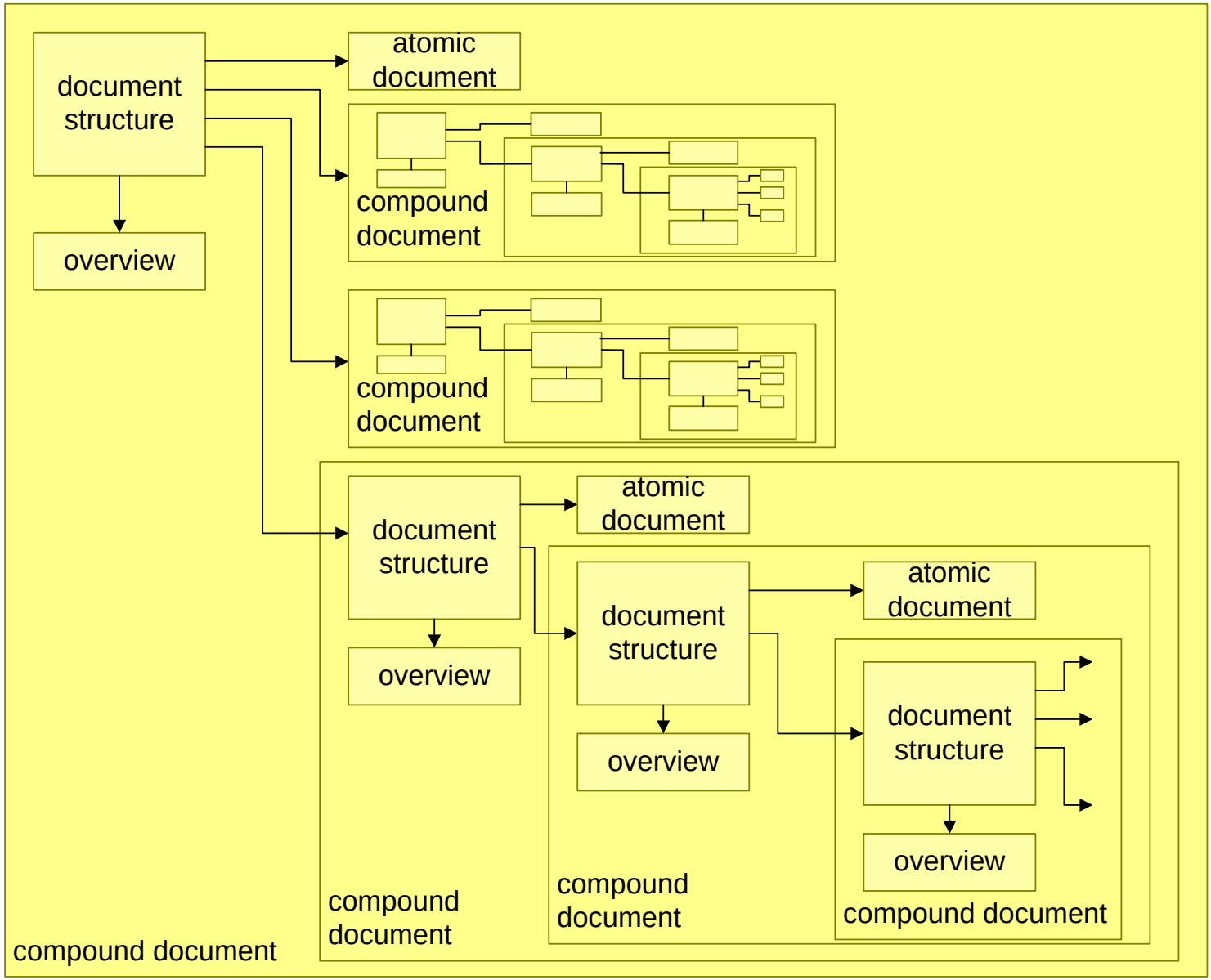
The Stakeholders of a Single Document



Decomposition of Large Documents



Documentation Tree by Recursive Decomposition

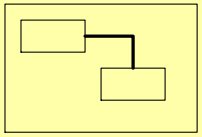


Payload: the Ratio between Content and Overhead

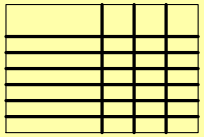
front page

title
identification
author
distribution
status
review

history
changes



diagrams



tables

1. aap
2. noot
3. mies

lists

and ca 50%
text

meta information
max 2 pages

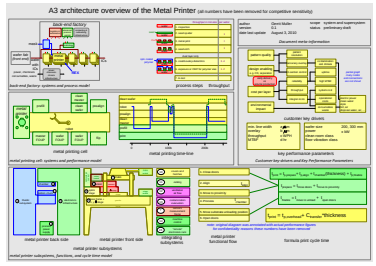
contents
2..18 pages

LEAN and A3 Approach to Supporting Processes

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

Abstract

LEAN product development is in the process and means area pragmatic. Low tech tools, such as paper, pen and magnets, with very direct interaction are used. For communication the use of single A3-size documents is promoted, because this is a manageable amount of information.



March 27, 2021
status: draft
version: 0.1

Characteristics of LEAN

A holistic, systems approach to product development including people, processes, and technology.

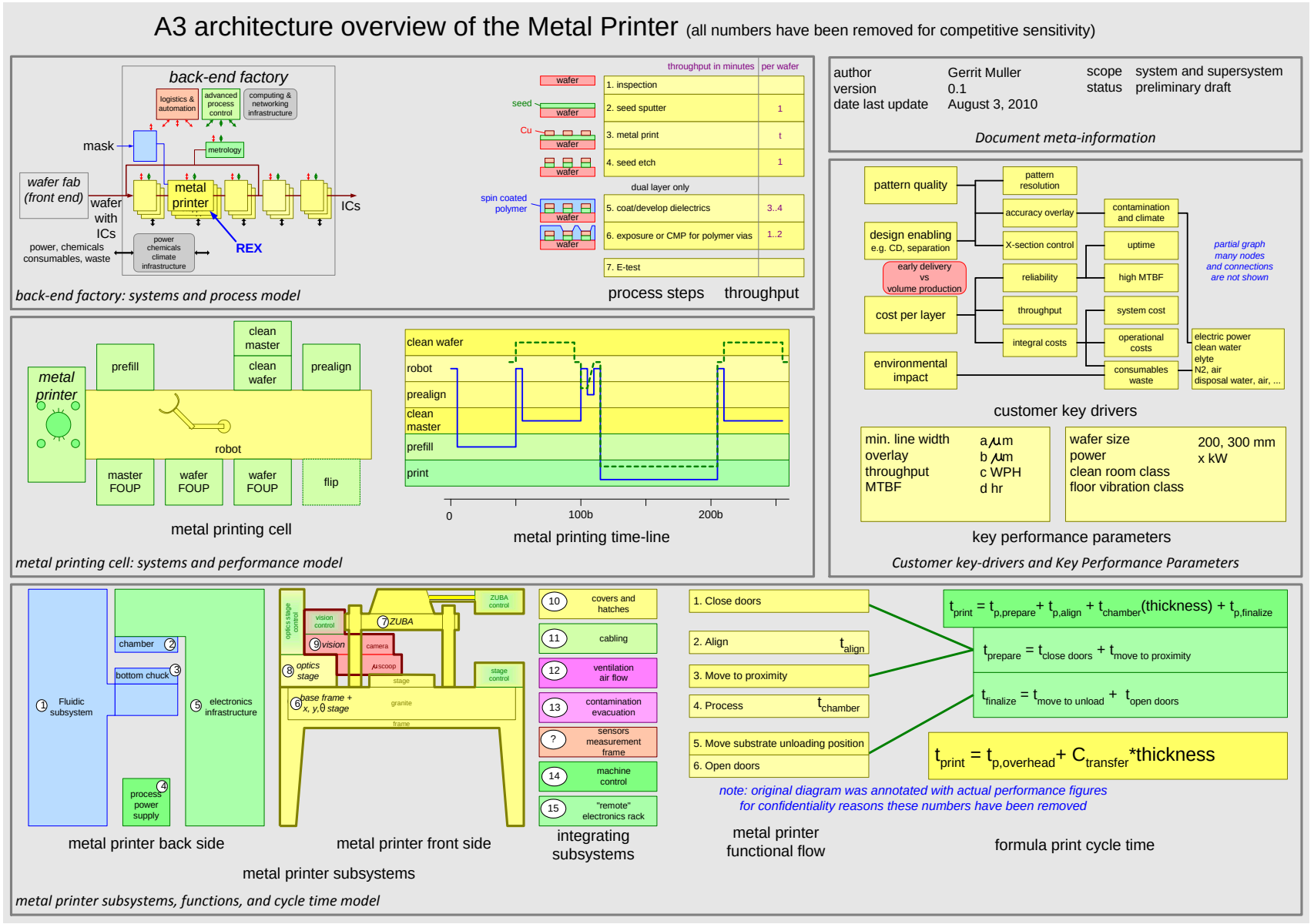
Multi-disciplinary from the early start, with a drive to be fact based.

Customer understanding as the the starting point.

Continuous improvement and learning as cultural value.

Small distance between engineers and real systems, including manufacturing, sales and service and the system of interest.

Example of A3 Architecture Overview

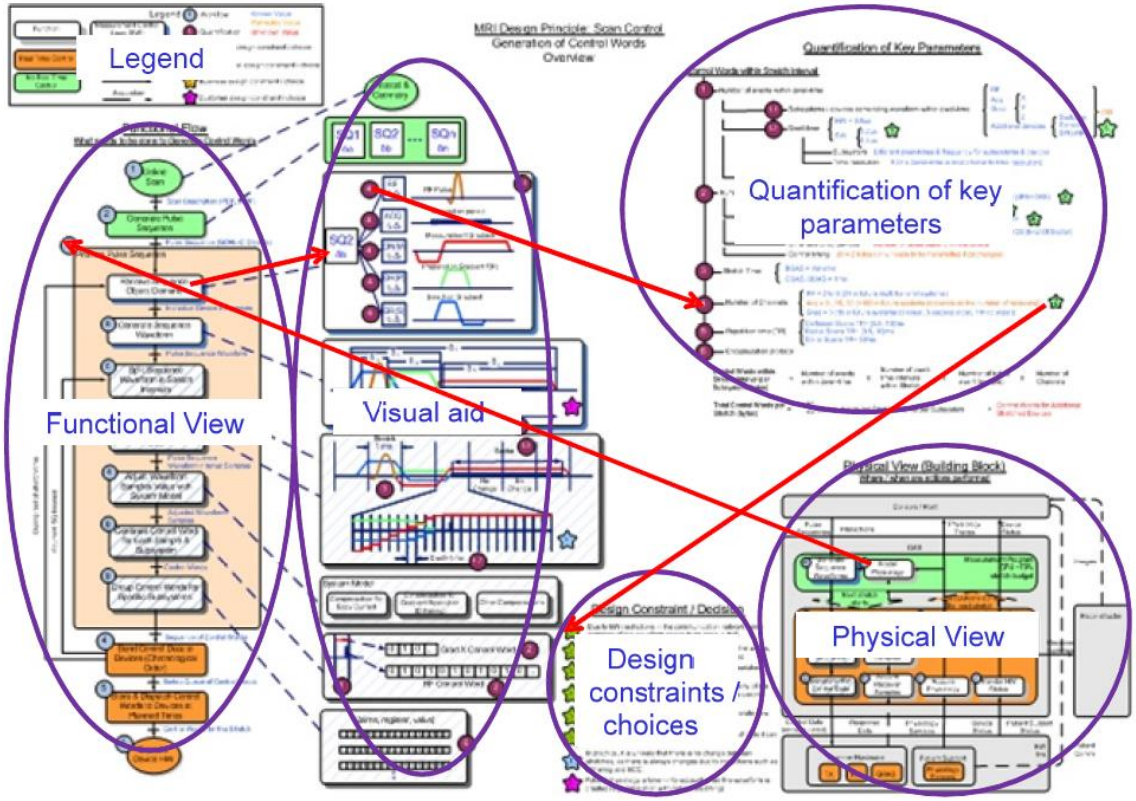


multiple related views

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

Light Weight Review Process

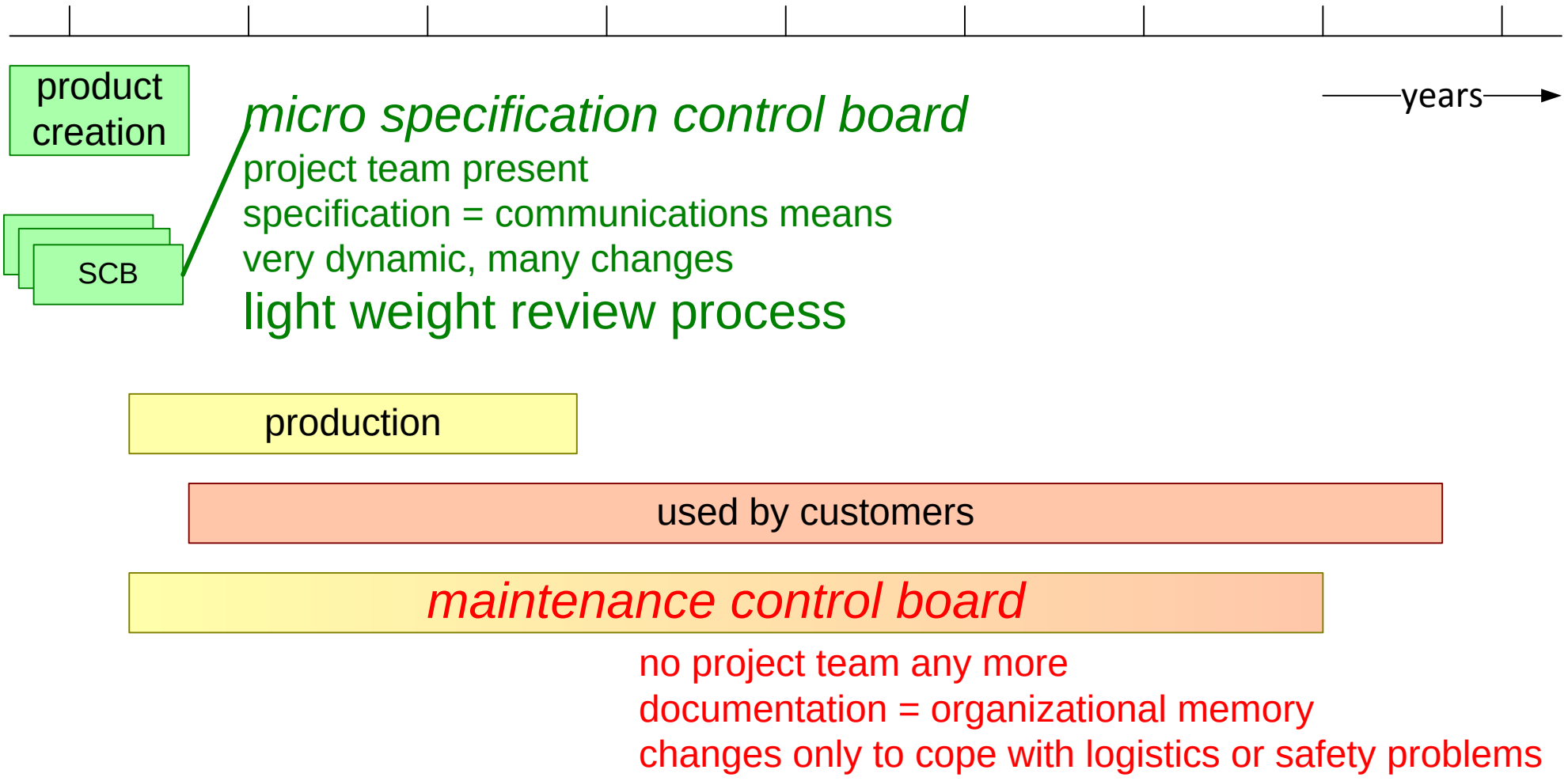
by *Gerrit Muller* University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

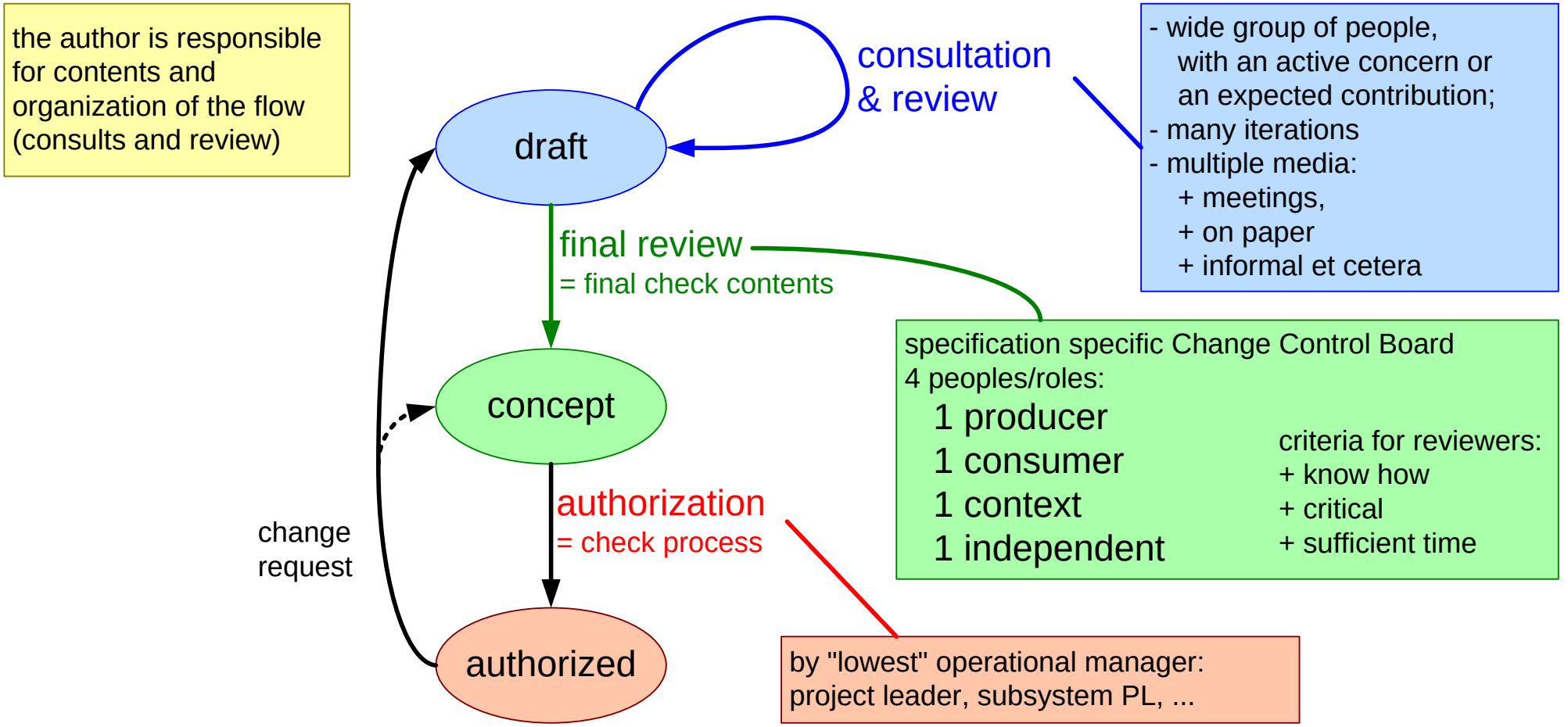
A light weight review process is described that can be used for documents made during product creation. This review process is focused on improving the contents of specifications as early as possible. The process is light weight to increase the likelihood that it is performed *de facto* instead of *pro forma*.

March 27, 2021
status: preliminary draft
version: 0

Product Life Cycle and Change Management



Light Weight Specification Review Process

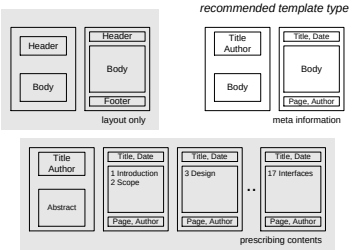


Template How To

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

Abstract

The introduction of a new process (way of working) is quite often implemented by supplying ready-to-go tools and templates. This implementation mainly serves the purpose of a smooth introduction of the new process.
Unfortunately the benefits of templates are often cancelled by unforeseen side-effects, such as unintended application, inflexibility, and so on. This intermezzo gives hints to avoid the **Template Trap**, so that templates can be used more effectively to support introduction of new processes.



March 27, 2021
status: draft
version: 1.6

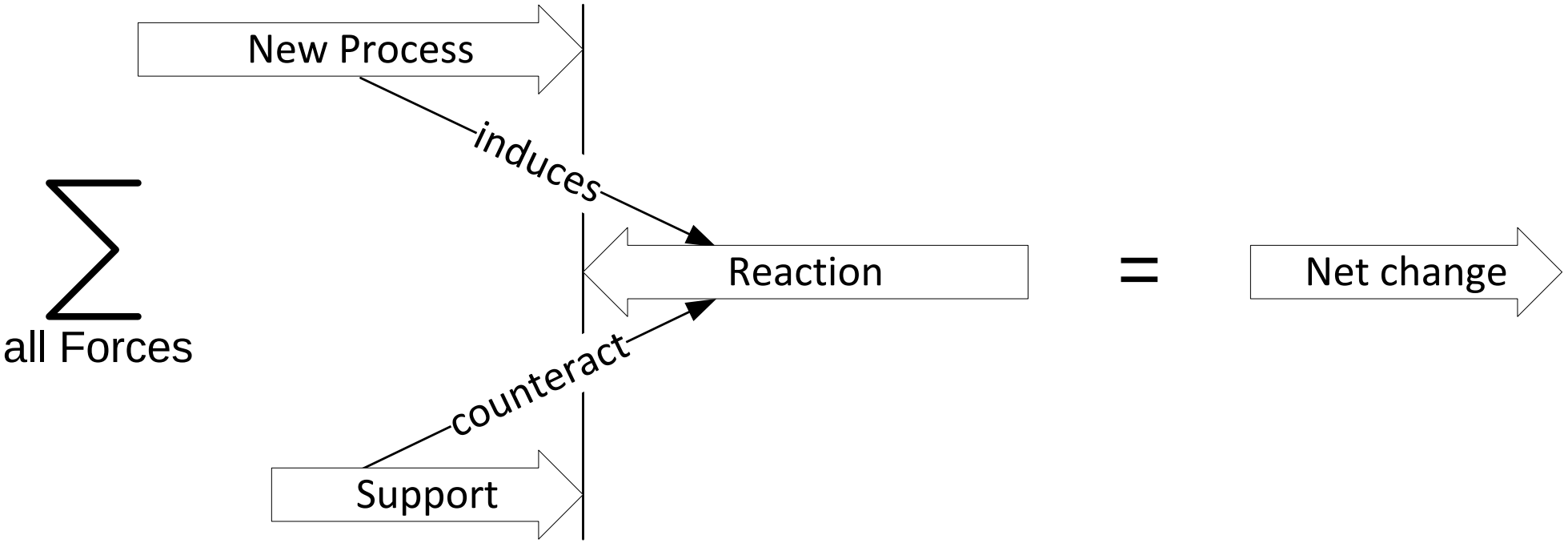
Rationale for Templates

- Low threshold to apply a (new) process (1)
- Low effort to apply a (new) process (2)
- No need to know low level implementation details (3)
- Means to consolidate and reuse experiences (4)

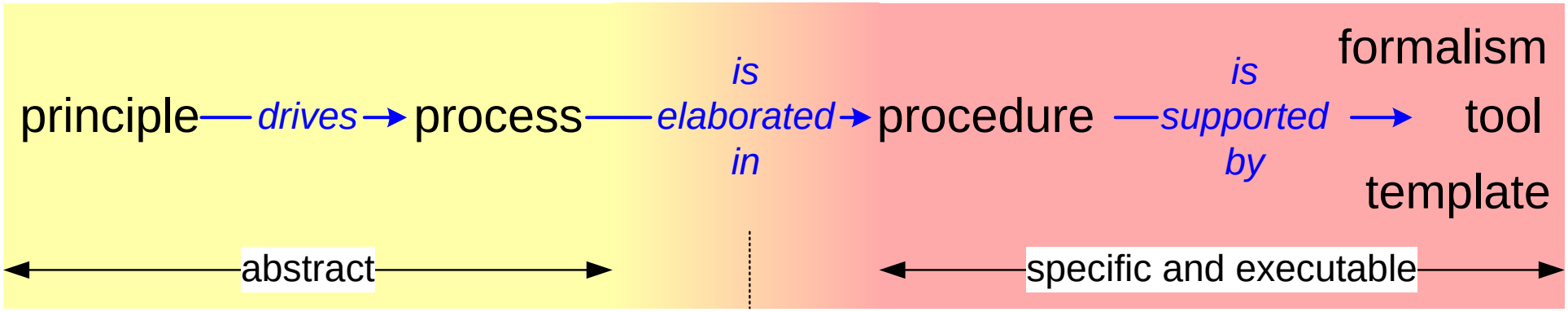
Bogus Arguments for Templates

- Obtain a uniform look (5)
- Force the application of a (new) process (6)
- Control the way a new process is applied (7)

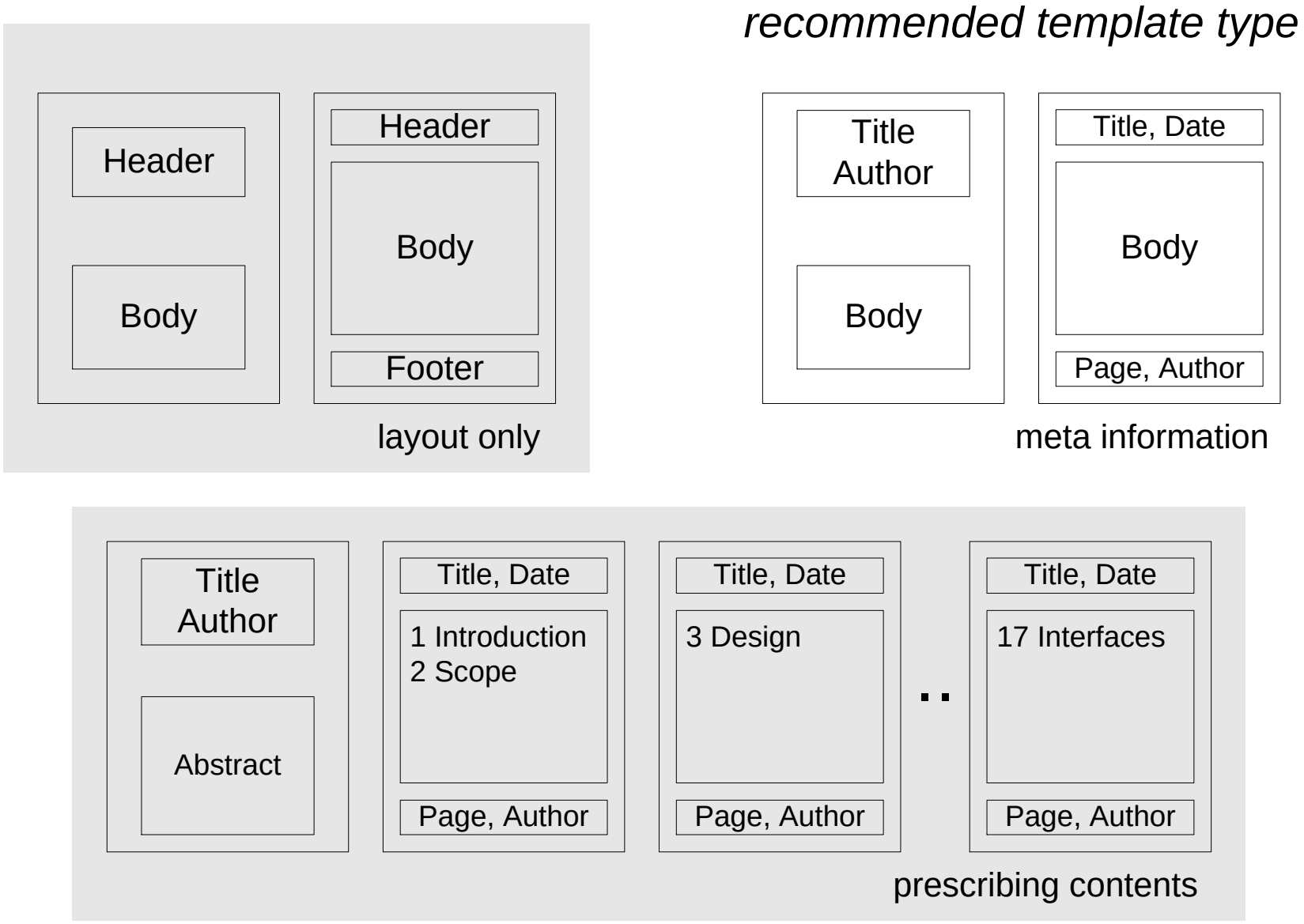
Forces of Change: Action = - Reaction



Template as Support for Process



Types of Templates



Recommendation

template type	context knowhow	value
layout only	no	low
meta information	process	high
prescribing content	process and domain	constraining

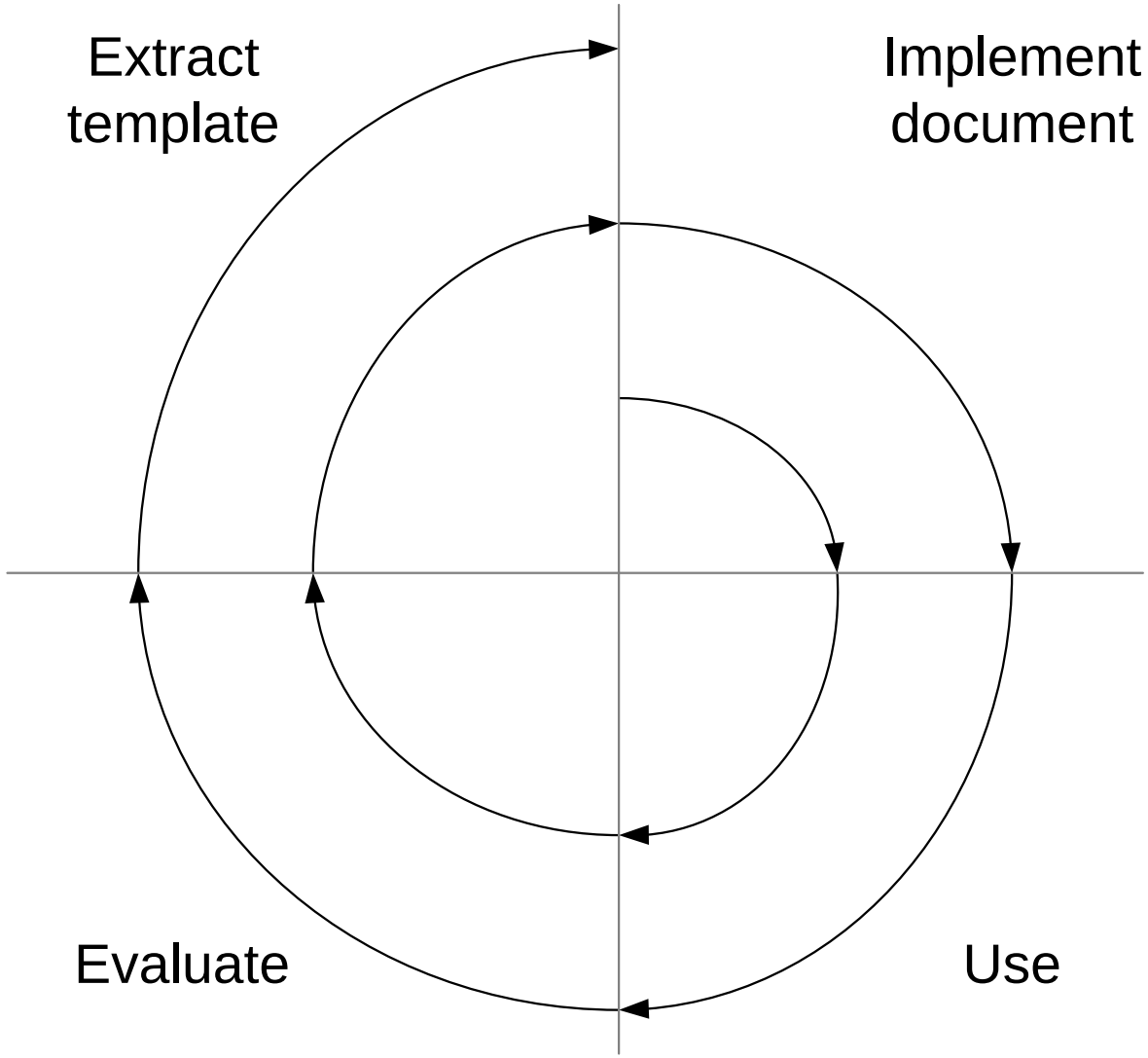
- Use templates for meta-information.
- Use checklists for structure and contents.

Template Development

Templates are an optimization of the Copy Paste Modify pattern:

- Look for a similar problem
- Copy its implementation
- Modify the copy to fulfil the new requirements

Spiral model: Use before Re-use



Example Guidelines Meta Information(1)

Mandatory per page:

- Author
- Title
- Status
- Version
- Date of last update
- Unique Identification
- Business Unit
- Page number

Example Guidelines Meta Information(2)

Mandatory per document:

- Distribution (Notification) list
- Reviewers and commentators
- Document scope (Product family, Product, Subsystem, Module as far as applicable)
- Change history

Example Guidelines Meta Information(3)

Recommended Practice:

- Short statement on frontpage stating what is expected from the addressed recipients, for example:
  - Please send comments before february 29, this document will be reviewed on that date
  - This document is authorized, changes are only applied via a change request
- See Granularity of Documentation [**?**] for guidelines for modularization and contents

Template Pitfalls

- Author follows template instead of considering the purpose of the document.
- Template is too complex.
- There is an unmanageable number of variants.
- Mandatory use of templates results in:
  - no innovation of templates (= no learning)
  - no common sense in deployment
  - strong dependency on templates

Recommendation:

- Enforce the procedure *(what)*
- Provide the template *(how)* as supporting means.

Summary

- Templates support (new) processes
- Use templates for layout and meta information support
- Do not use templates for documents structure or contents
- Stimulate evolution of templates, keep them alive
- Keep templates simple
- Standardize on **what** (process or procedure), not on **how** (tool and template)
- Provide (mandatory) guidelines and recommended practices
- Provide templates as a supportive choice, don't force people to use templates

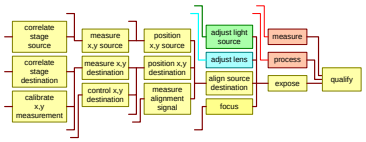
System Integration How-To

by *Gerrit Muller* USN-SE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

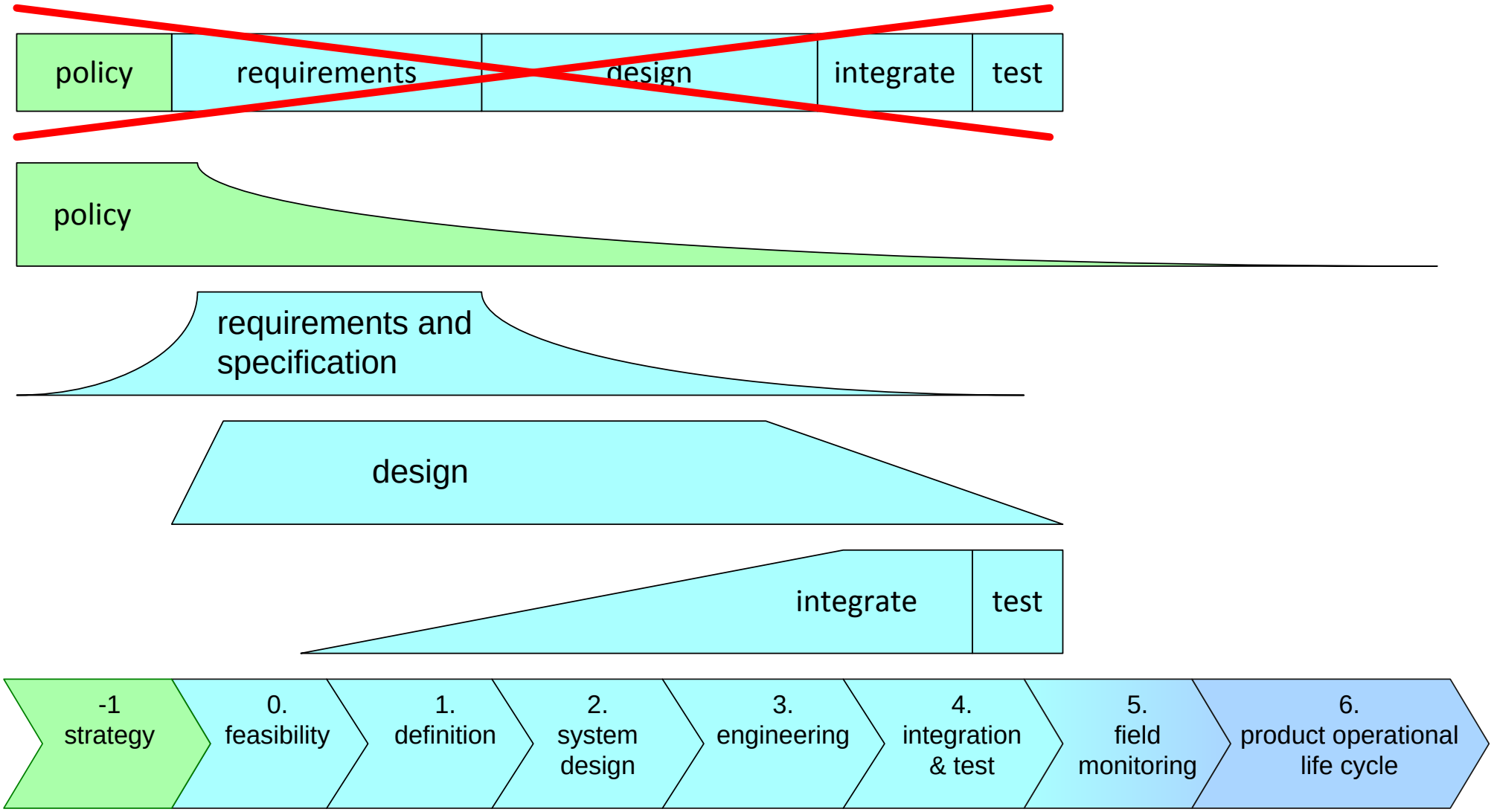
Abstract

In this document we will discuss the full integration flow. We will discuss the goal of integration, the relation between integration and testing, what is integration and how to integrate, an approach to integration, scheduling and dealing with disruptive events, roles and responsibilities, configuration management aspects, and typical order of integration problems occurring in real life.

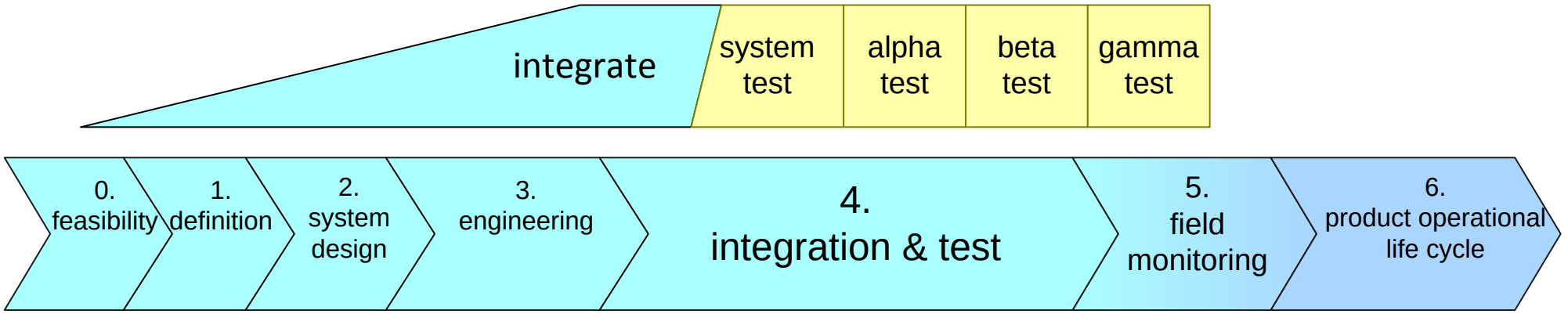
March 27, 2021
status: concept
version: 0.2



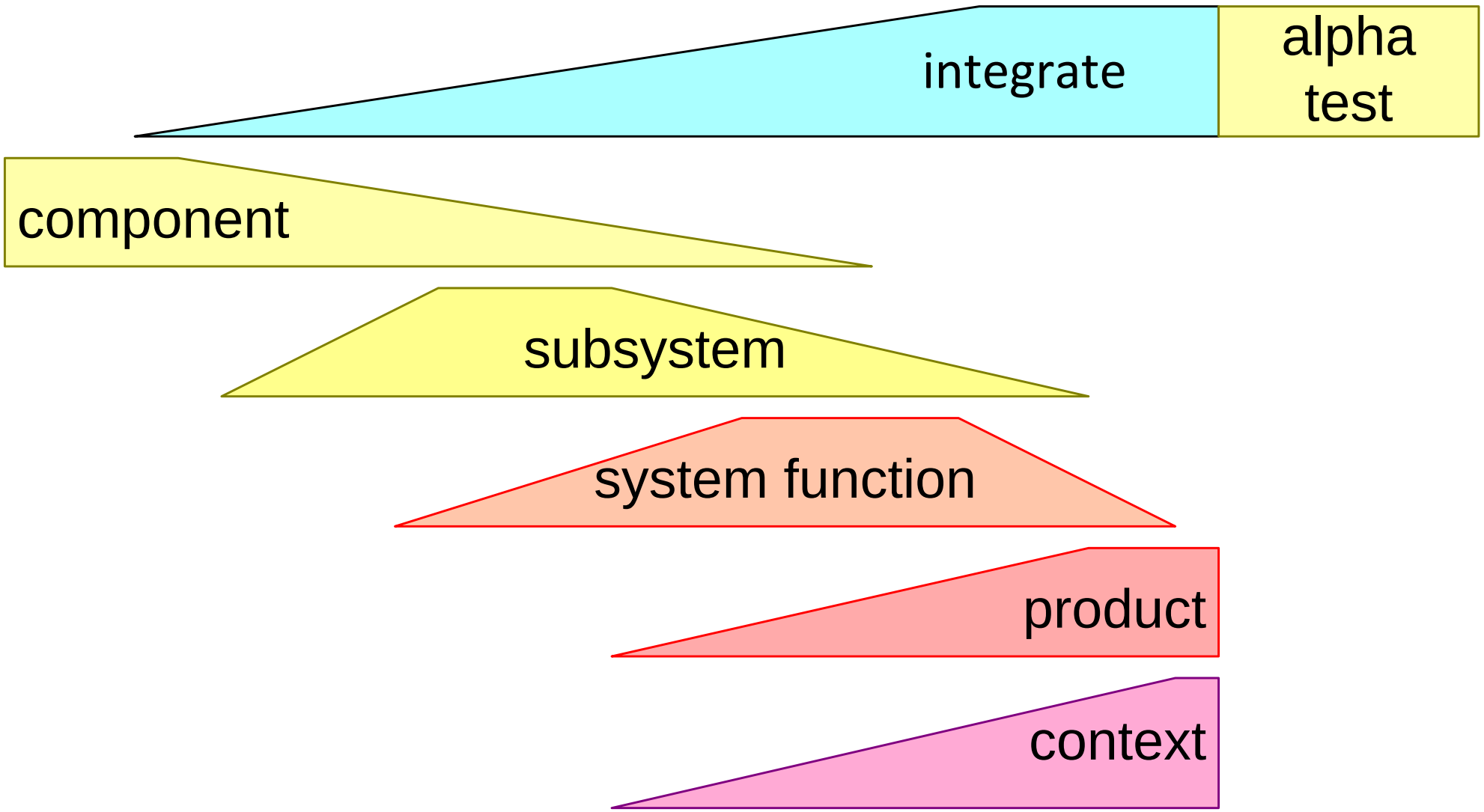
Typical Concurrent Product Creation Process



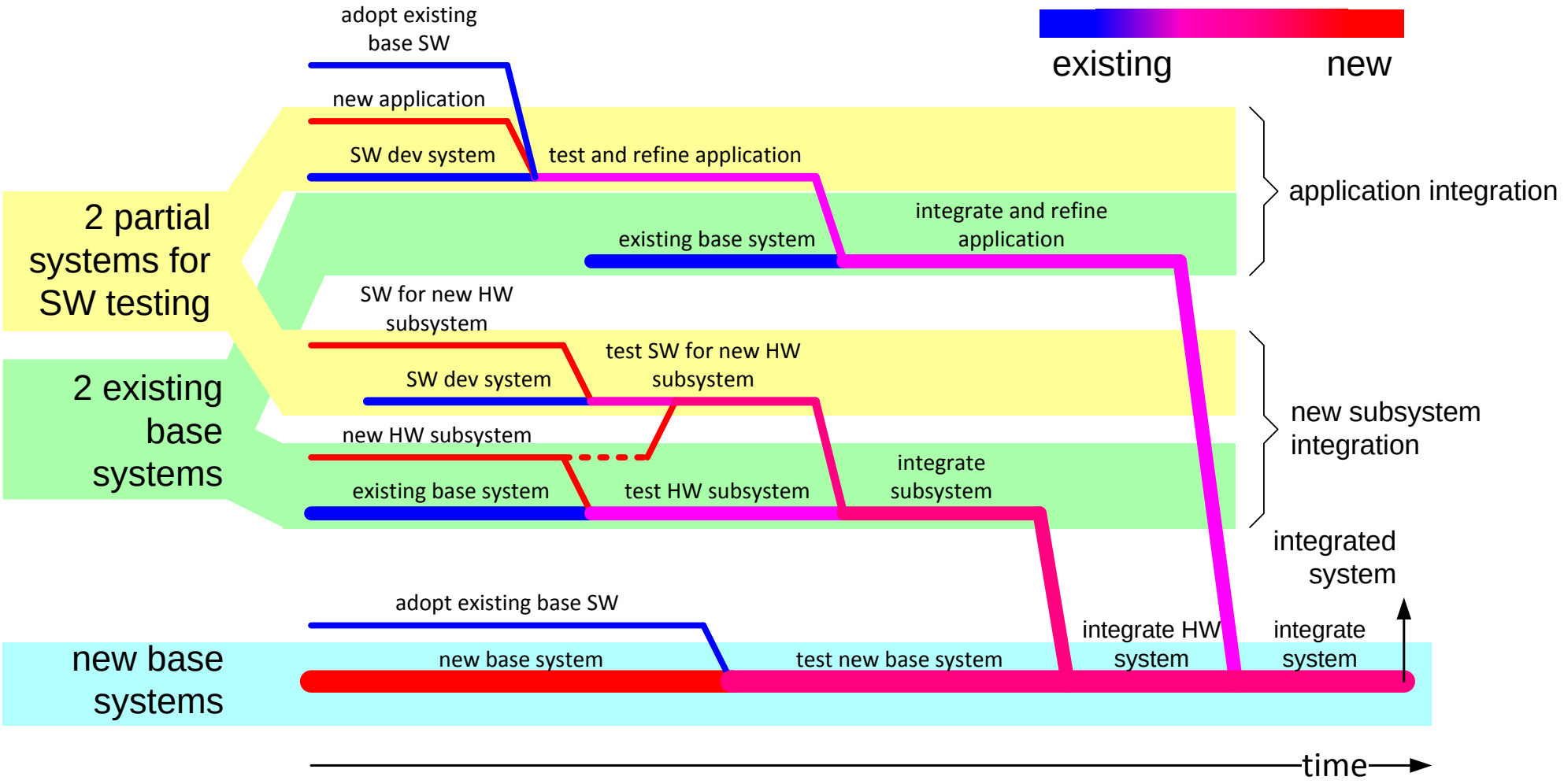
Zooming in on Integration and Tests



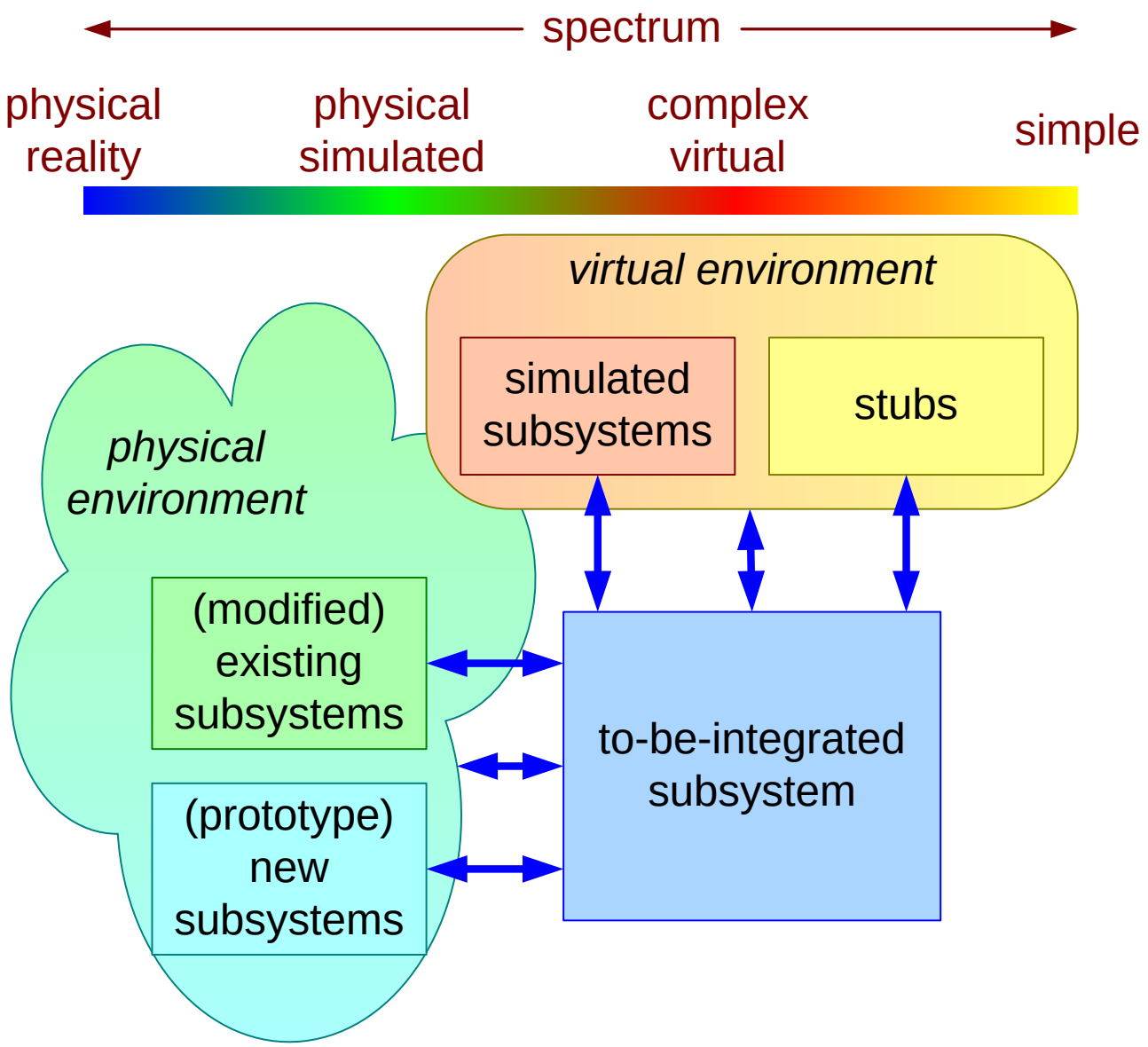
Integration Takes Place in a Bottom-up Fashion



Transition from Previous System to New System



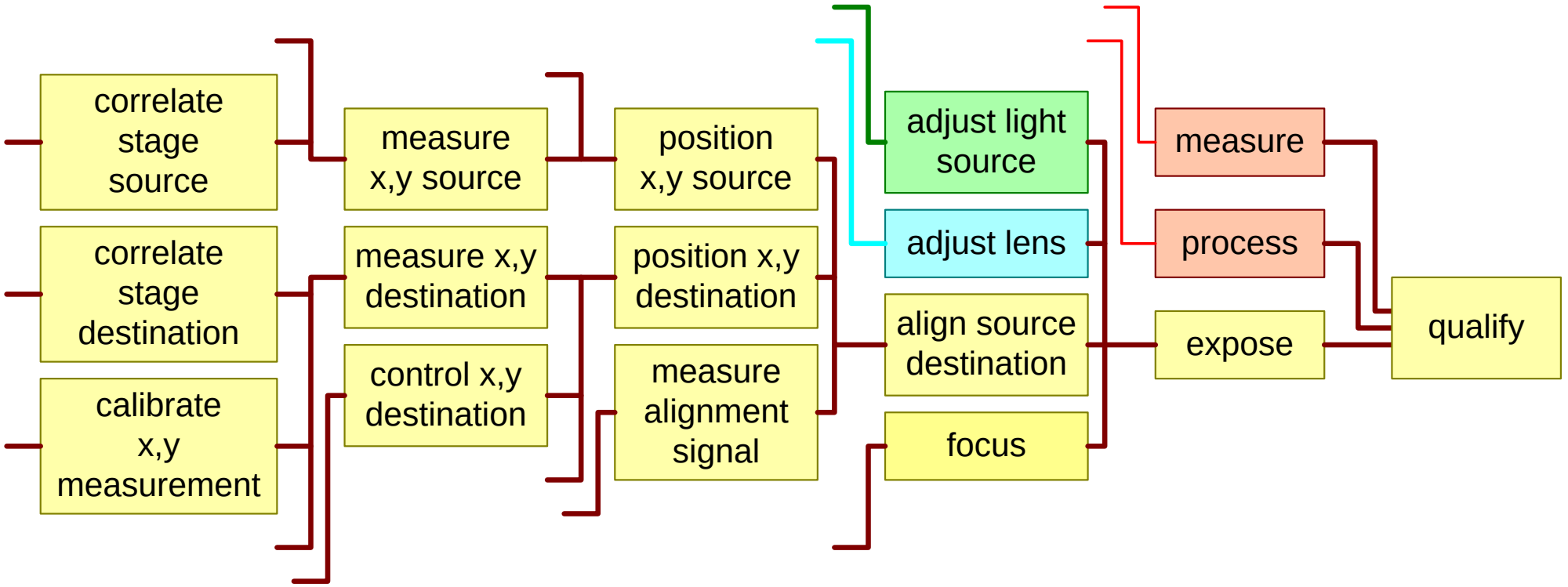
Alternatives to Integrate a Subsystem Early in the Project



Stepwise Integration Approach

1	Determine most critical system performance parameters.
2	Identify subsystems and functions involved in these parameters.
3	Work towards integration configurations along these chains of subsystems and functions.
4	Show system performance parameter as early as possible; start with showing "typical" system performance.
5	Show "worst-case" and "boundary" system performance.
6	Rework manual integration tests in steps into automated regression tests.
7	Monitor regression results with human-driven analysis.
8	Integrate the chains: show system performance of different parameters simultaneously on the same system.

Order of Functions Required for the IQ of a Waferstepper



Roles and Responsibilities During the Integration Process

project leader

organization
resources
schedule
budget

systems architect/ engineer/integrator

system requirements
design inputs
test specification
schedule rationale
troubleshooting
participate in test

system tester

test
troubleshooting
report

logistics and administrative support

configuration
orders
administration

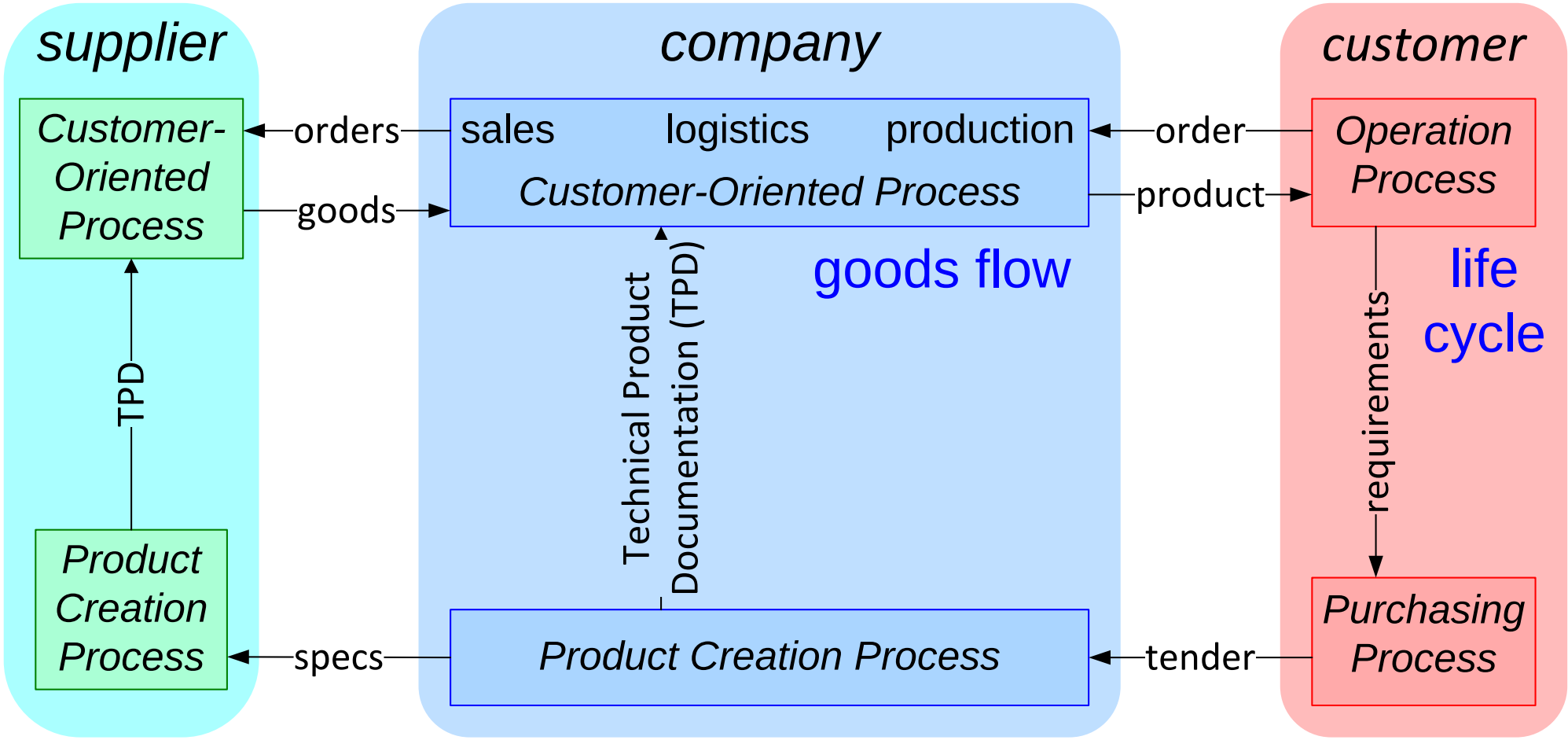
engineers

design
component test
troubleshooting
participate in test

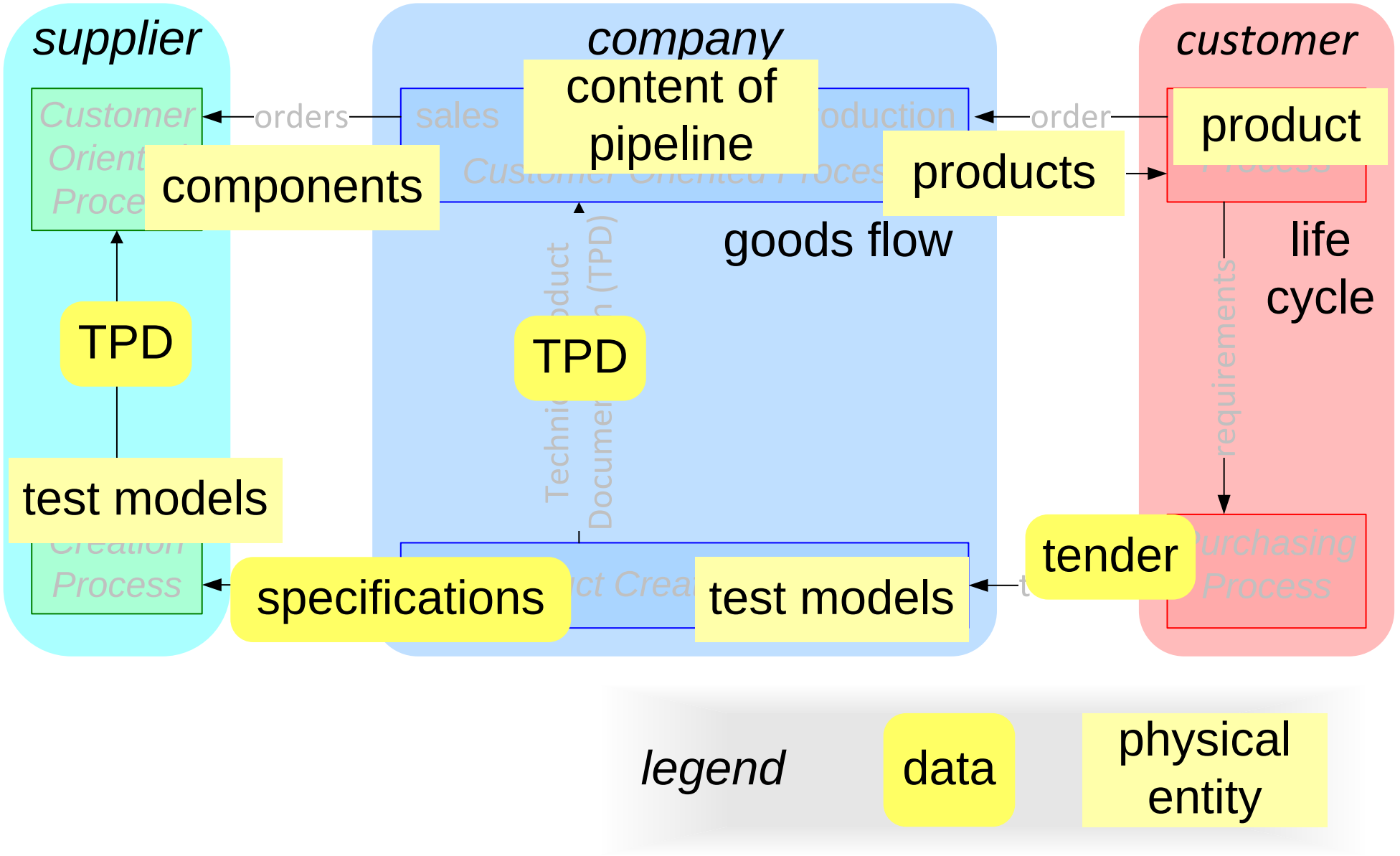
machine owner

maintain test model
support test

Simplified Process Diagram



Configuration Management Entities



Typical Order of Integration Problems

1. The (sub)system does not build.
2. The (sub)system does not function.
3. Interface errors.
4. The (sub)system is too slow.
5. Problems with the main performance parameter, such as image quality.
6. The (sub)system is not reliable.

Exercise Documentation

Make a design for the documentation structure of the case, take into account a.o.:

- target audience per documentation module
- lifecycle
- author
- size (budget)

Present (max 1 flip) the proposed documentation structure and the rationale.

Documentation

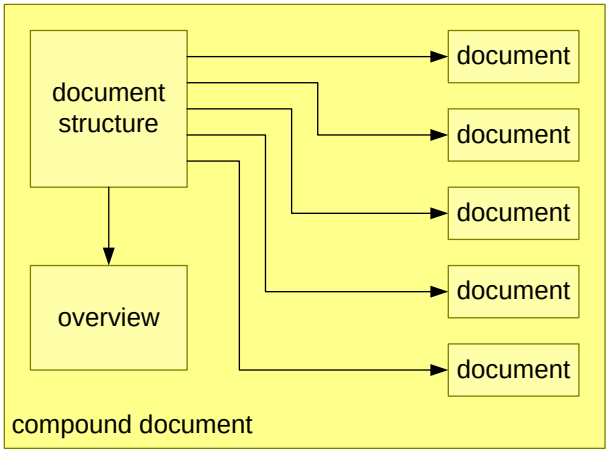
Requirements Entire Documentation

- Accessibility for the readers
- Low threshold for the readers
- Low threshold for the authors
- Completeness
- Consistency
- Maintainability
- Scalability
- Evolvability
- Process to ensure the quality of the information

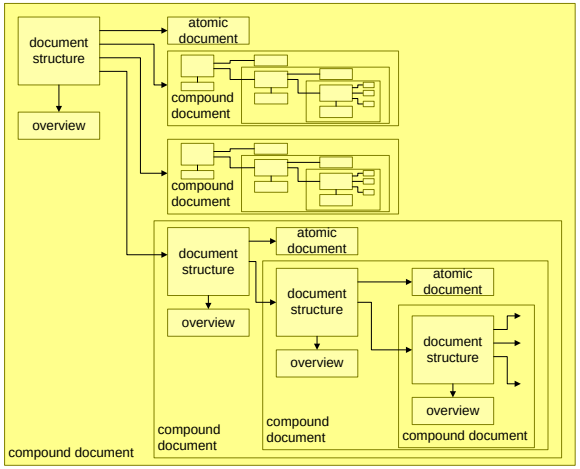
Requirements per Document

- High cohesion (within the unit)
- Low coupling (outside of the unit)
- Accessibility for the readers
- Low threshold for the reader
- Low threshold for the author
- Manageable steps to create, review, and change
- Clear responsibilities
- Clear position and relation with the context
- Well-defined status of the information
- Timely availability

Decompose Large Documents



Recursive Decomposition



Documentation

Maximize Payload

front page

title identification author distribution status review	history changes	diagrams tables	1. aap 2. noot 3. mies lists and ca 50% text

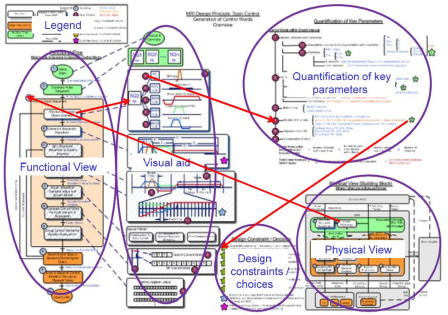
meta information max 2 pages ← → contents 2..18 pages

A3s

multiple related views — quantifications

one topic per A3

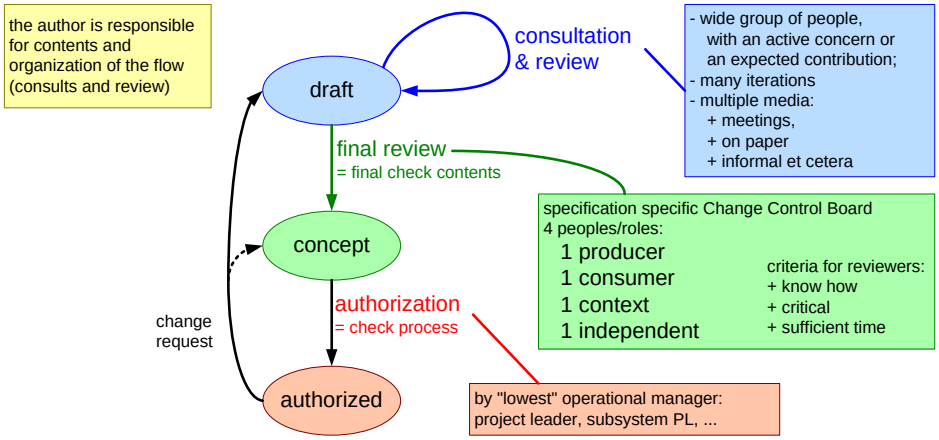
capture "hot" topics



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

digestable (size limitation) — practical close to stakeholder experience

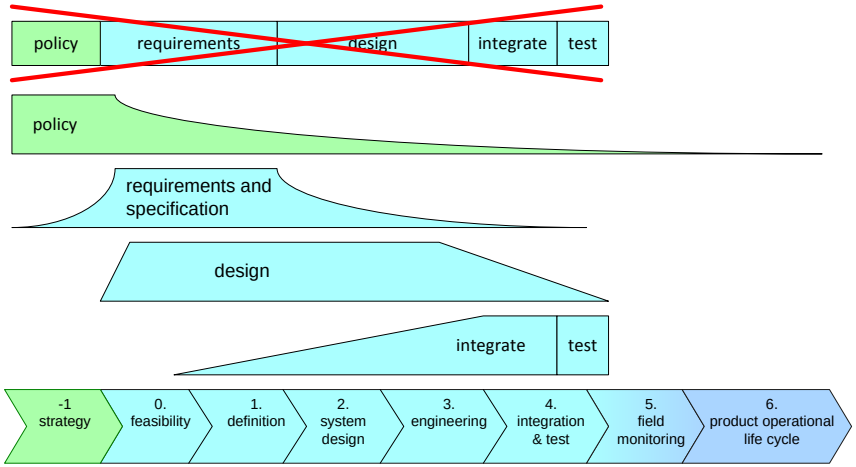
Light Weight Review



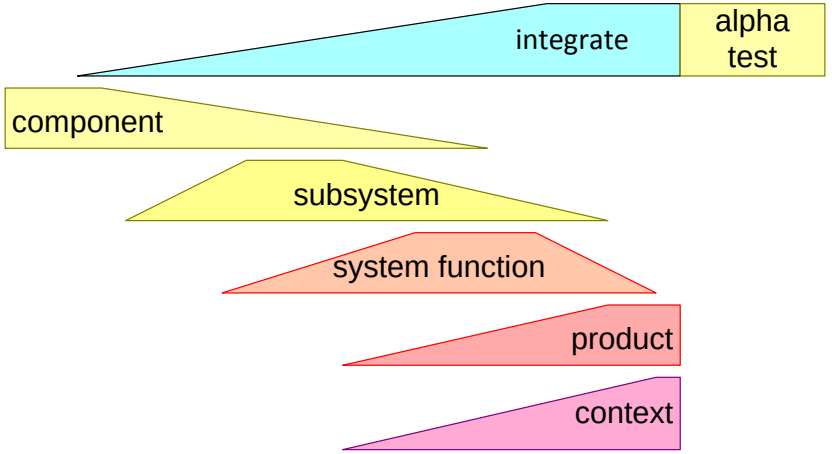
intentionally left blank

Systems Integration

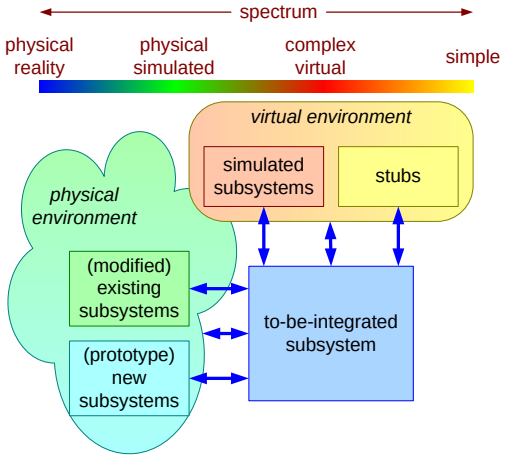
Integration Starts at Feasibility



Bottom-up



Alternatives for Early Integration



Propagation of Configuration Issues