Module System Architect Toolkit

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Abstract

This module addresses tools and techniques available to the System Architect. It explains the basic CAFCR method and addresses story telling as method.

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Basic Working Methods of a System Architect

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Abstract

The challenge for the architect is to cover a wide range of subjects, with many unknowns and uncertainties, while decisions are required all the time.
The basic working methods, such as viewpoint hopping, modelling, handling uncertainties and WWHWWW questions are described.

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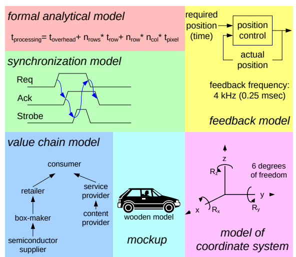
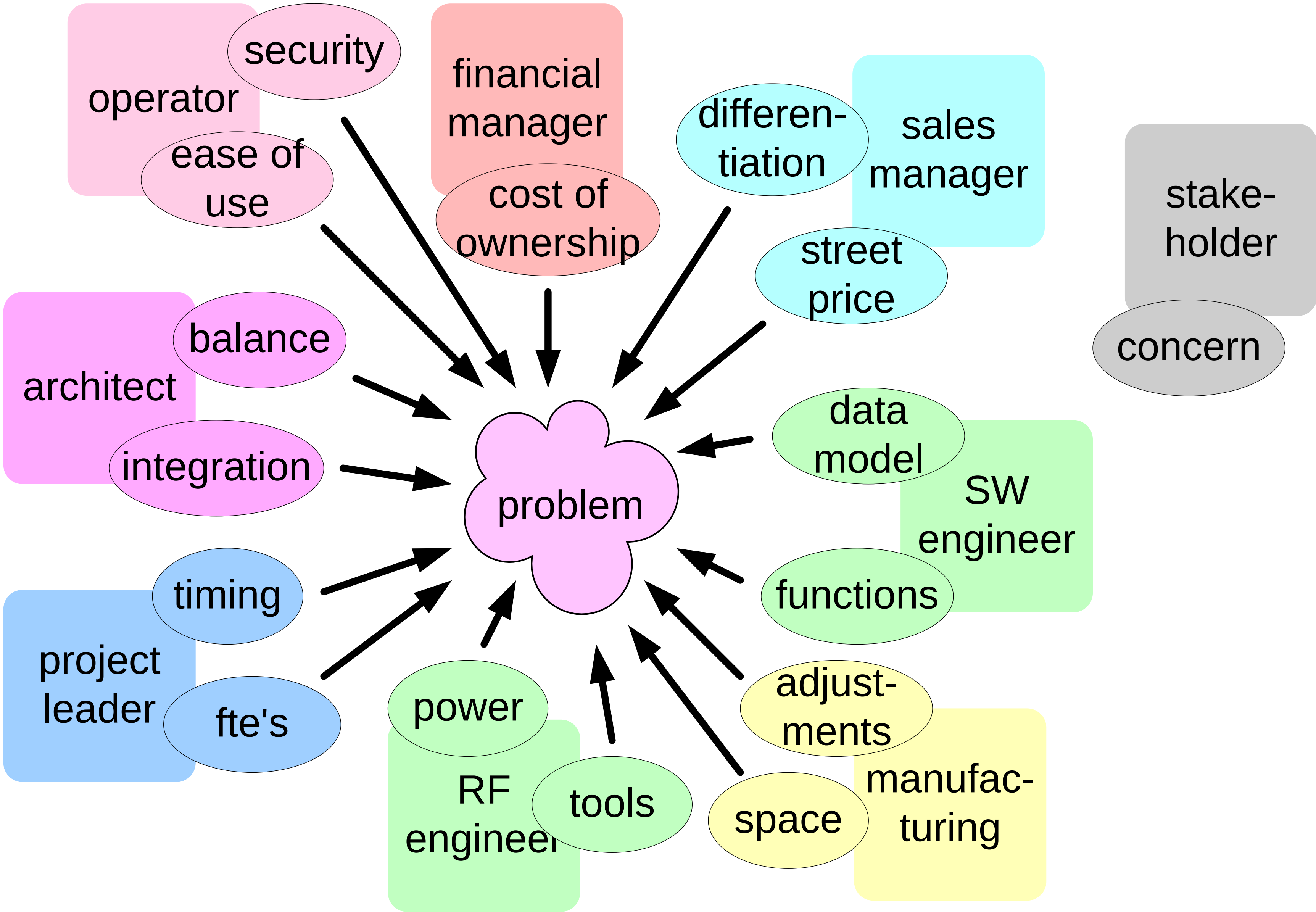
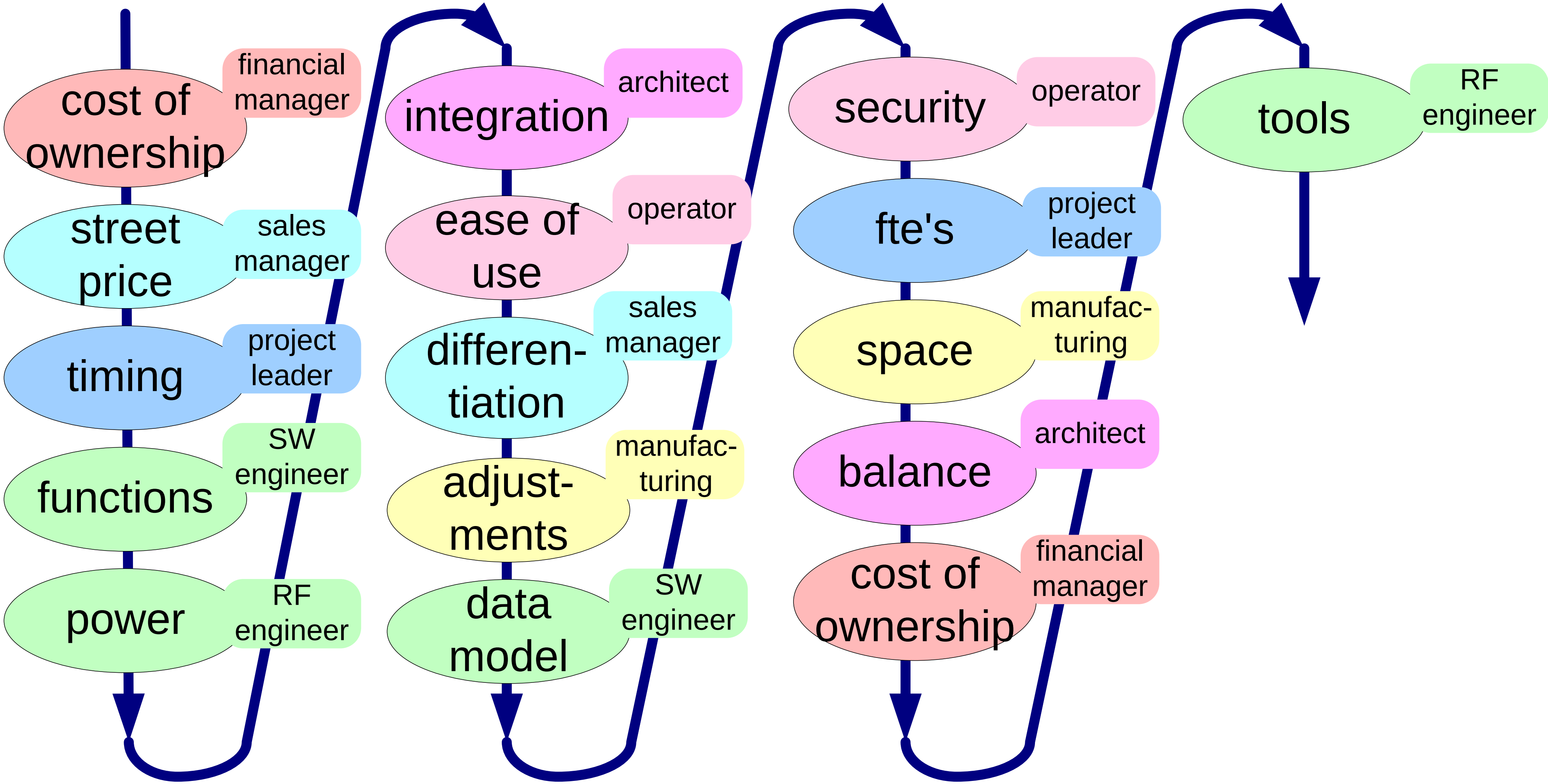


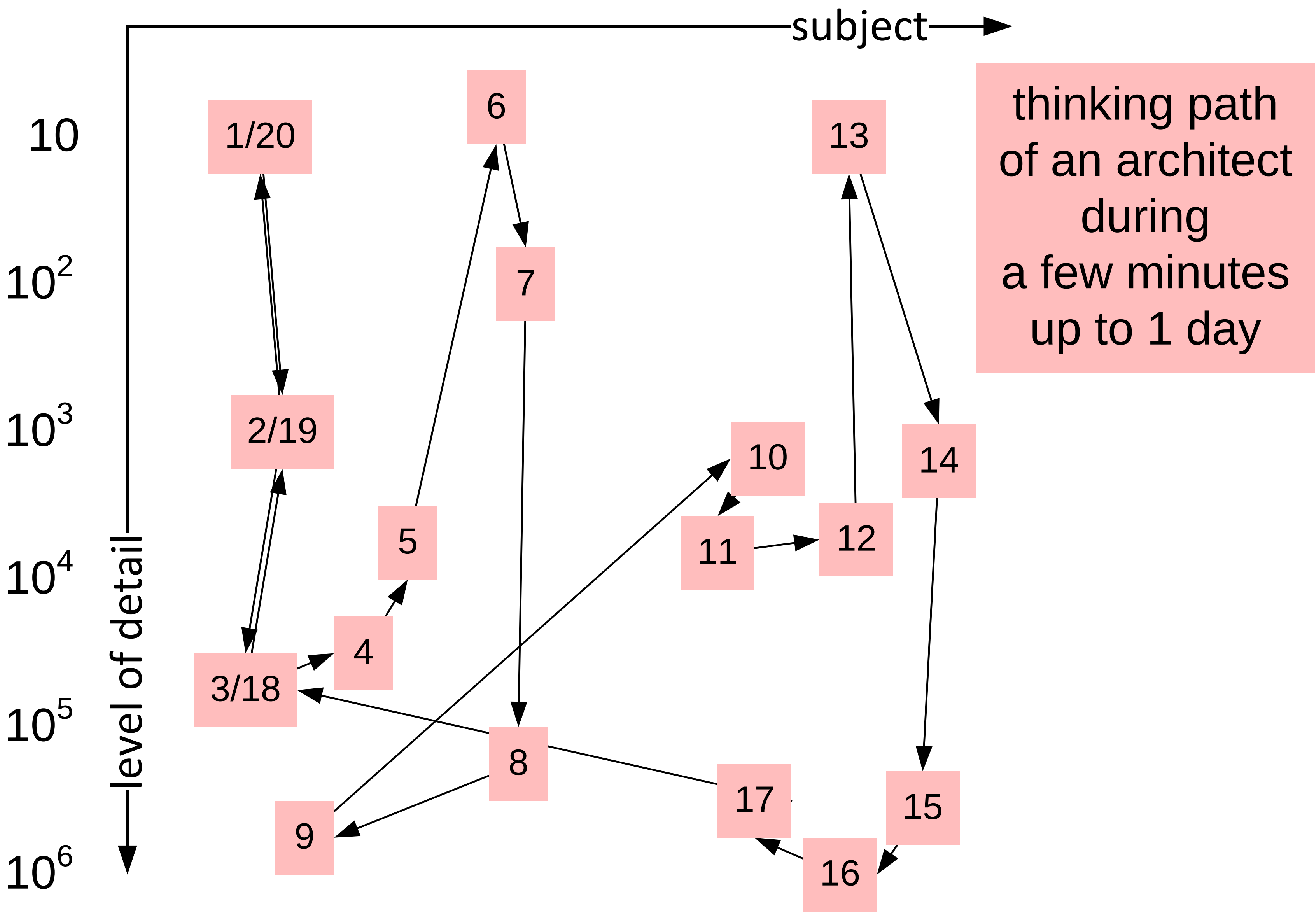
Many viewpoints



Viewpoint Hopping

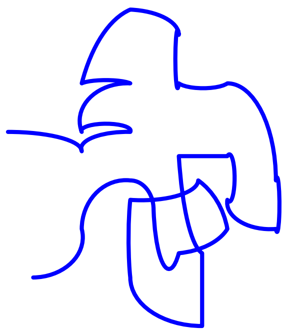


The seemingly random exploration path



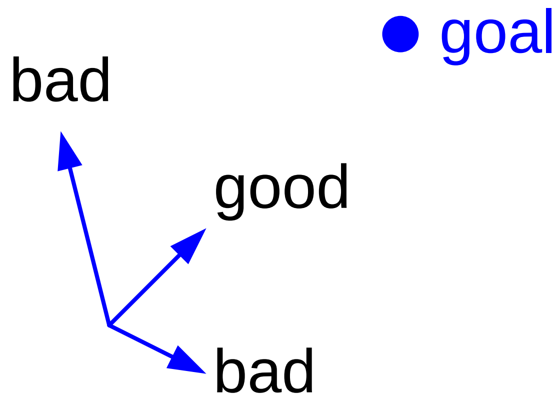
Scanning modes of the architect

open
perceptive
scanning



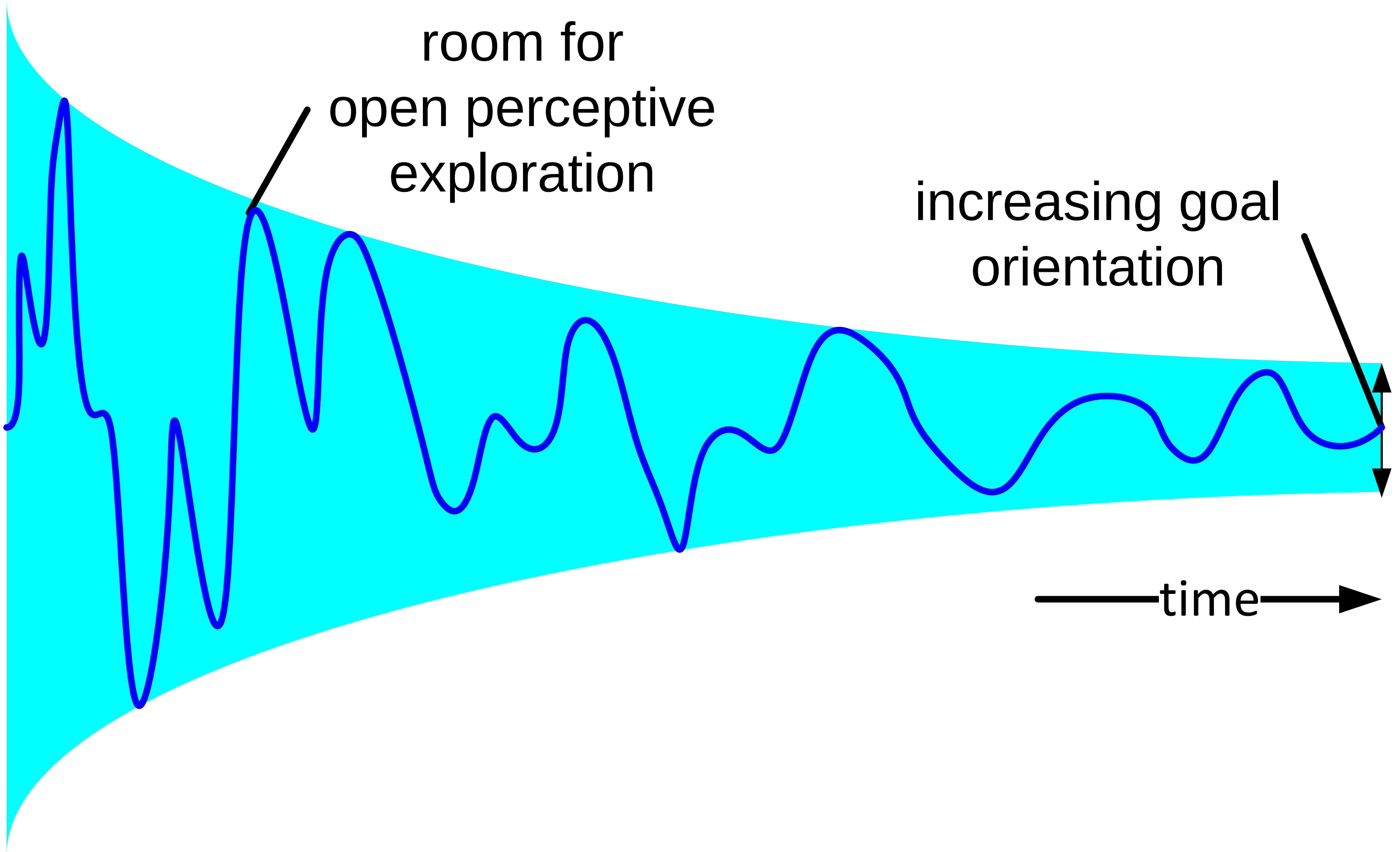
drunkard's walk
the world is full
of interesting
needs, technologies, ...

scanning
while
structuring
and judging

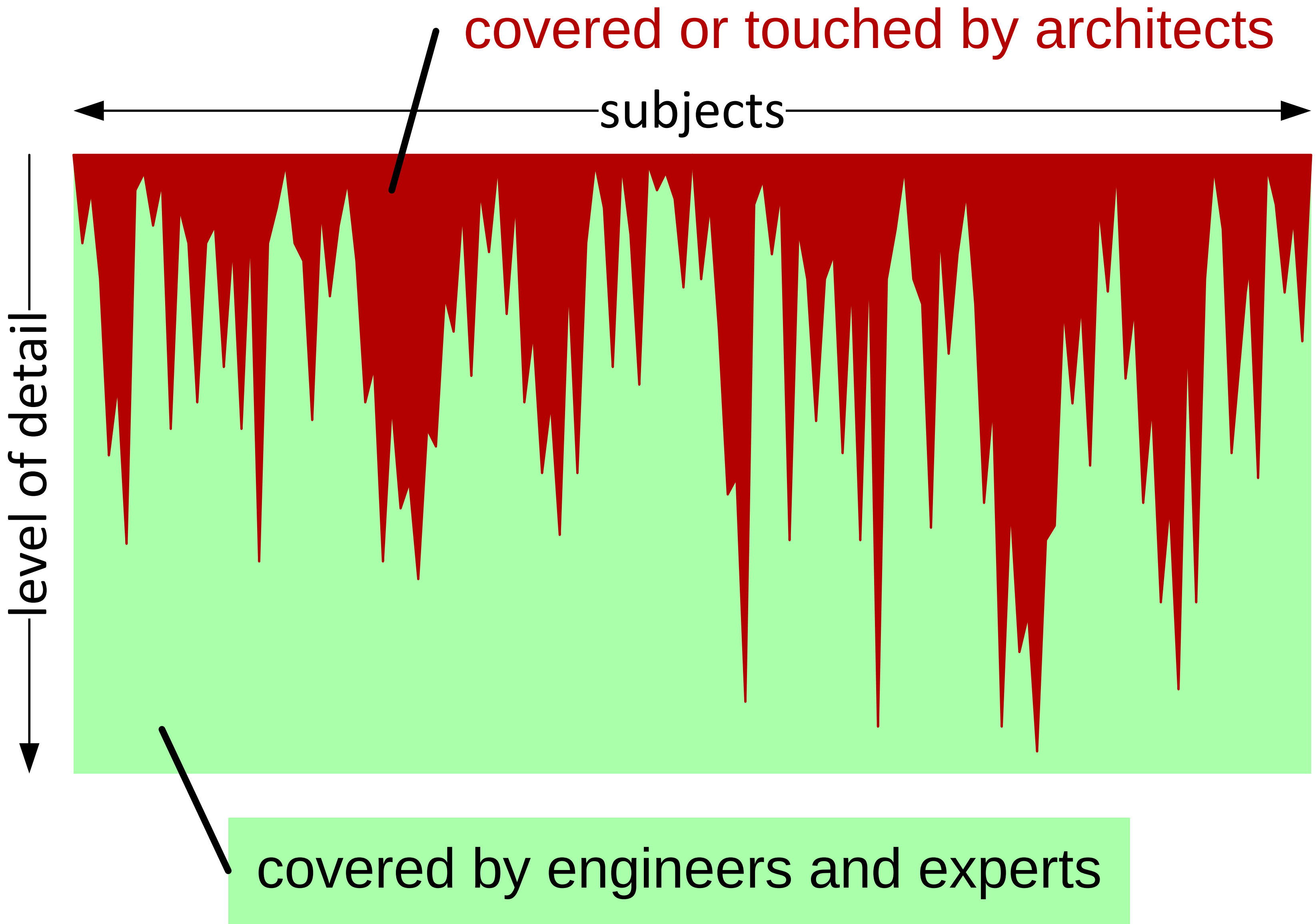


straight for the goal
ignore everything
that is not contributing
directly to the goal

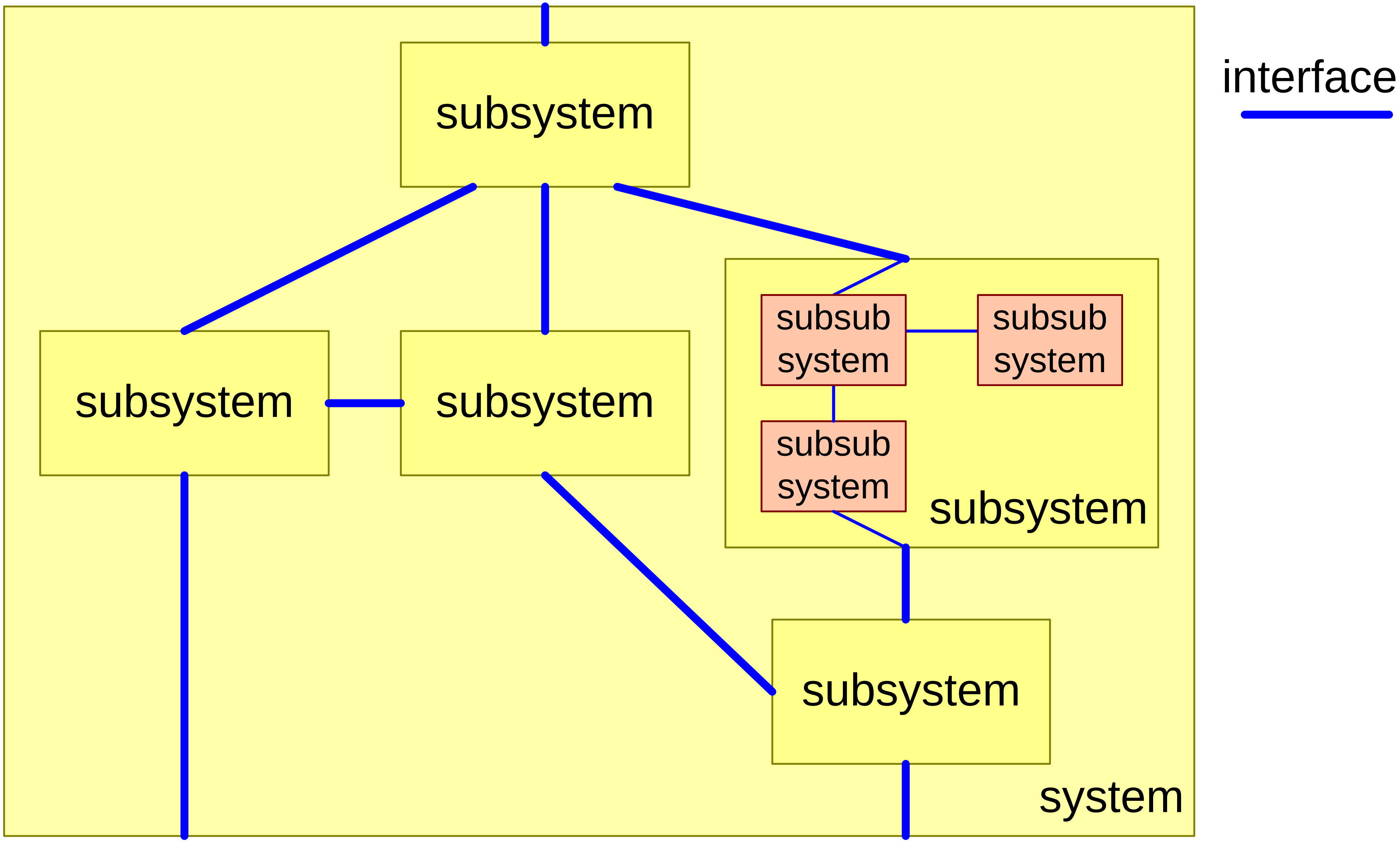
Combined open perceptive and goal oriented scanning



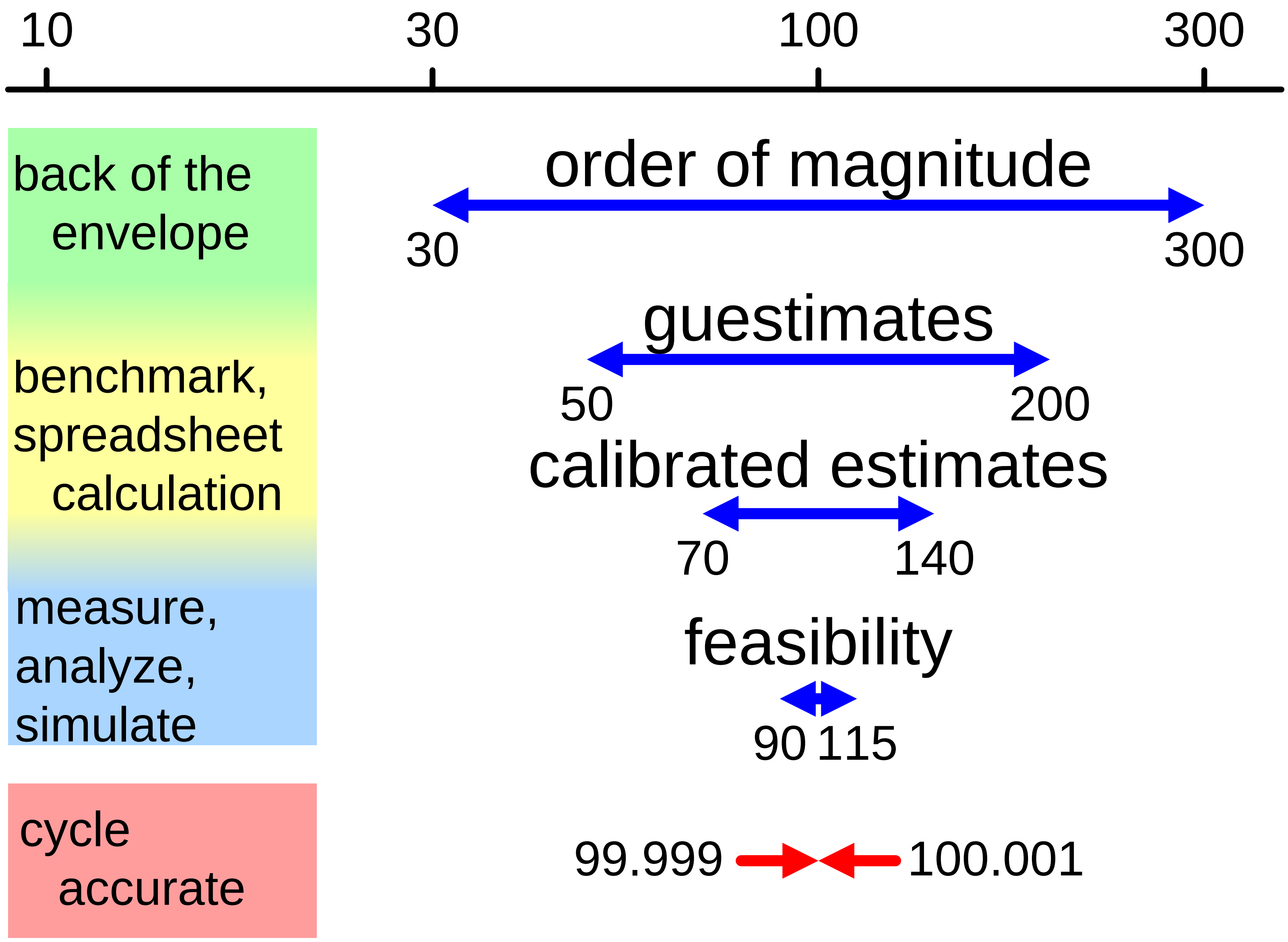
Coverage of problem and solution space



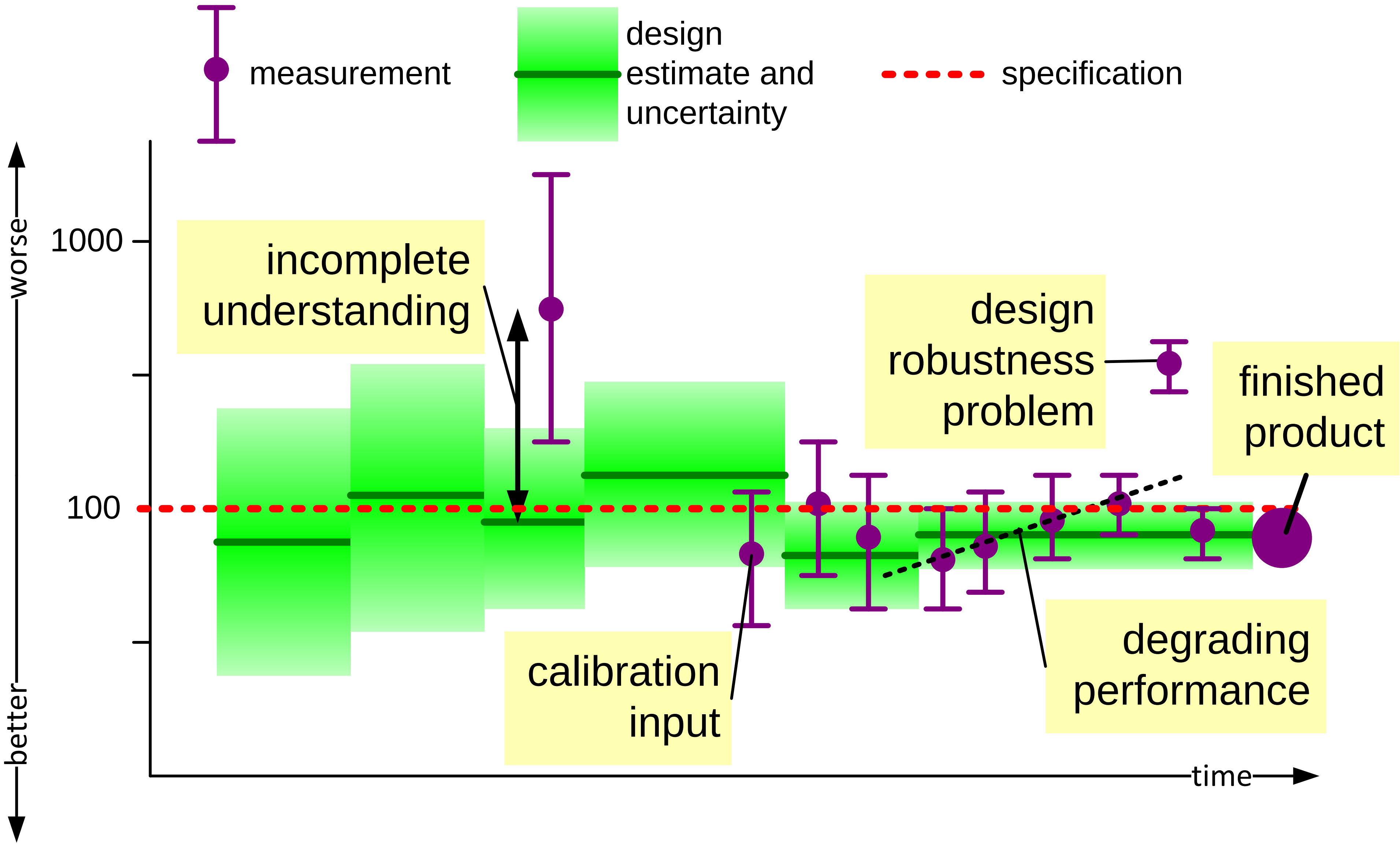
Decomposition, interfaces and integration



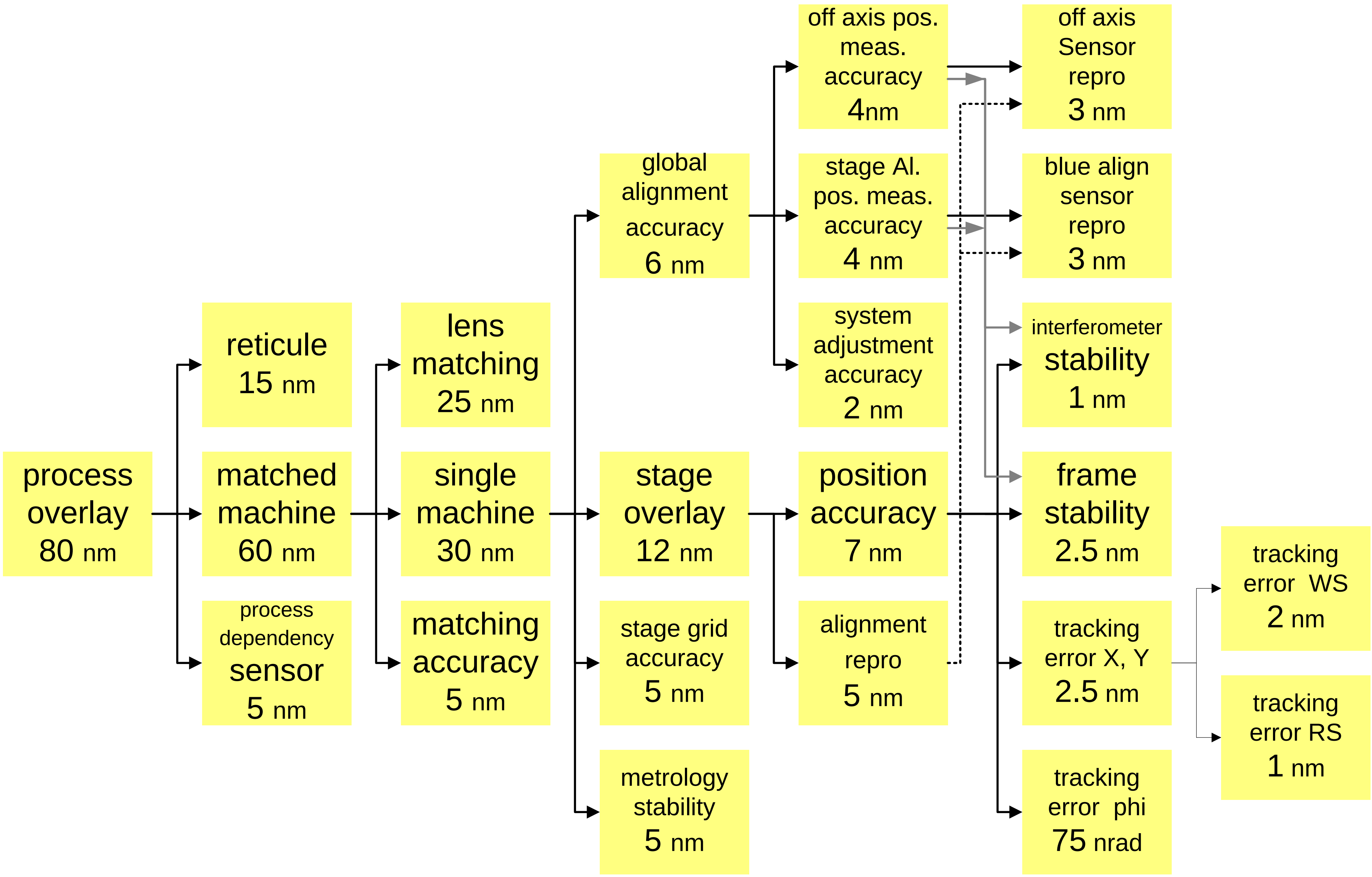
Successive quantification refinement



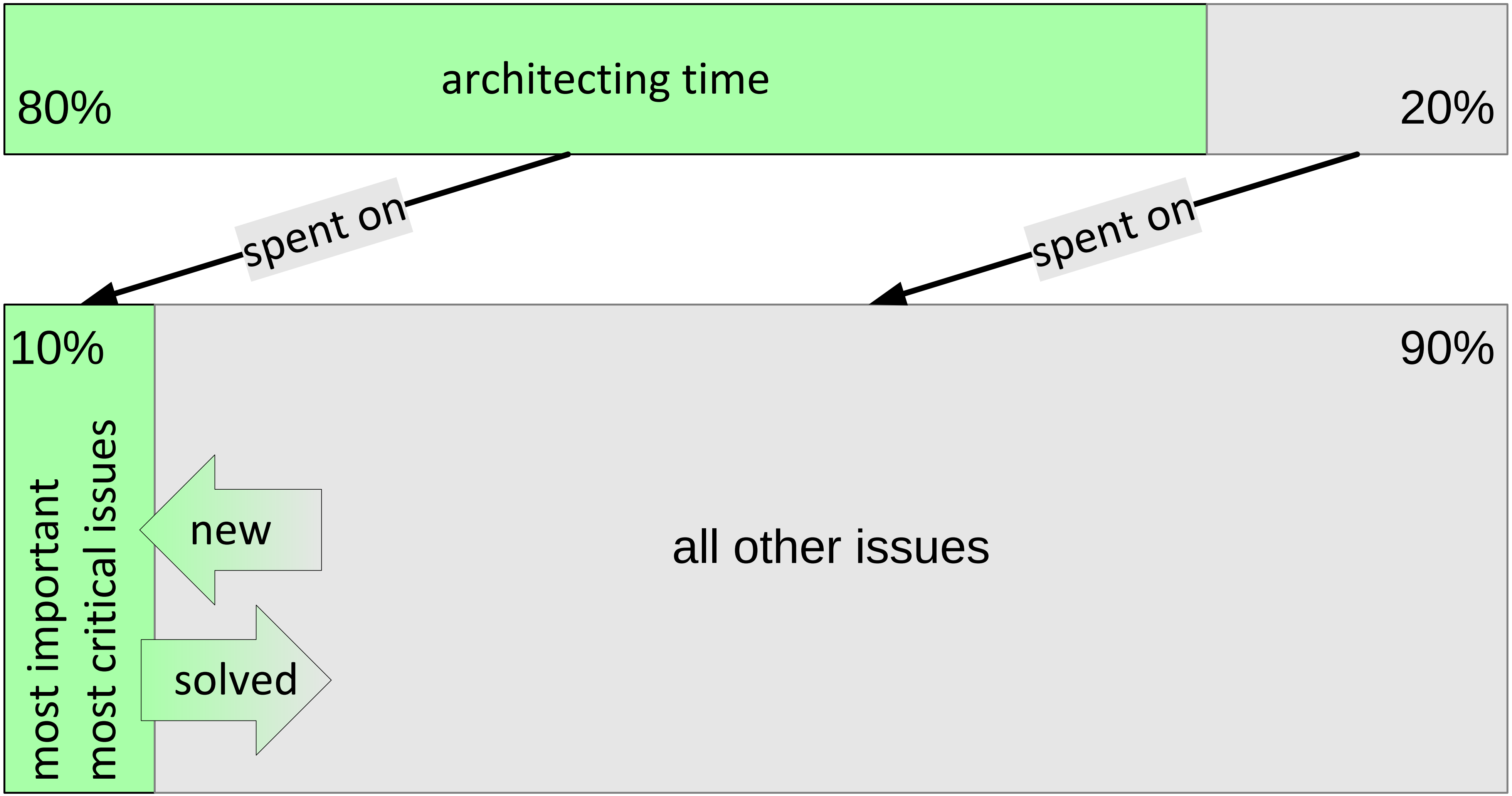
Example evolution of quantification



Quantified understanding of waferstepper overlay



Architect focus on important issues



Architect “worry” list

1. response time

from key press
until first image
on display

2. cost price

resource budgets

3. layering to separate

separation of concerns
self sustained
life-cycle separation
robust: paranoia validations

4. reliability of storage
5. database redesign
6. integration schedule
7. movement artefact
8. standby power
9. weak signal handling
10. location-based twiddle

A **model** is

a **simplified** representation of

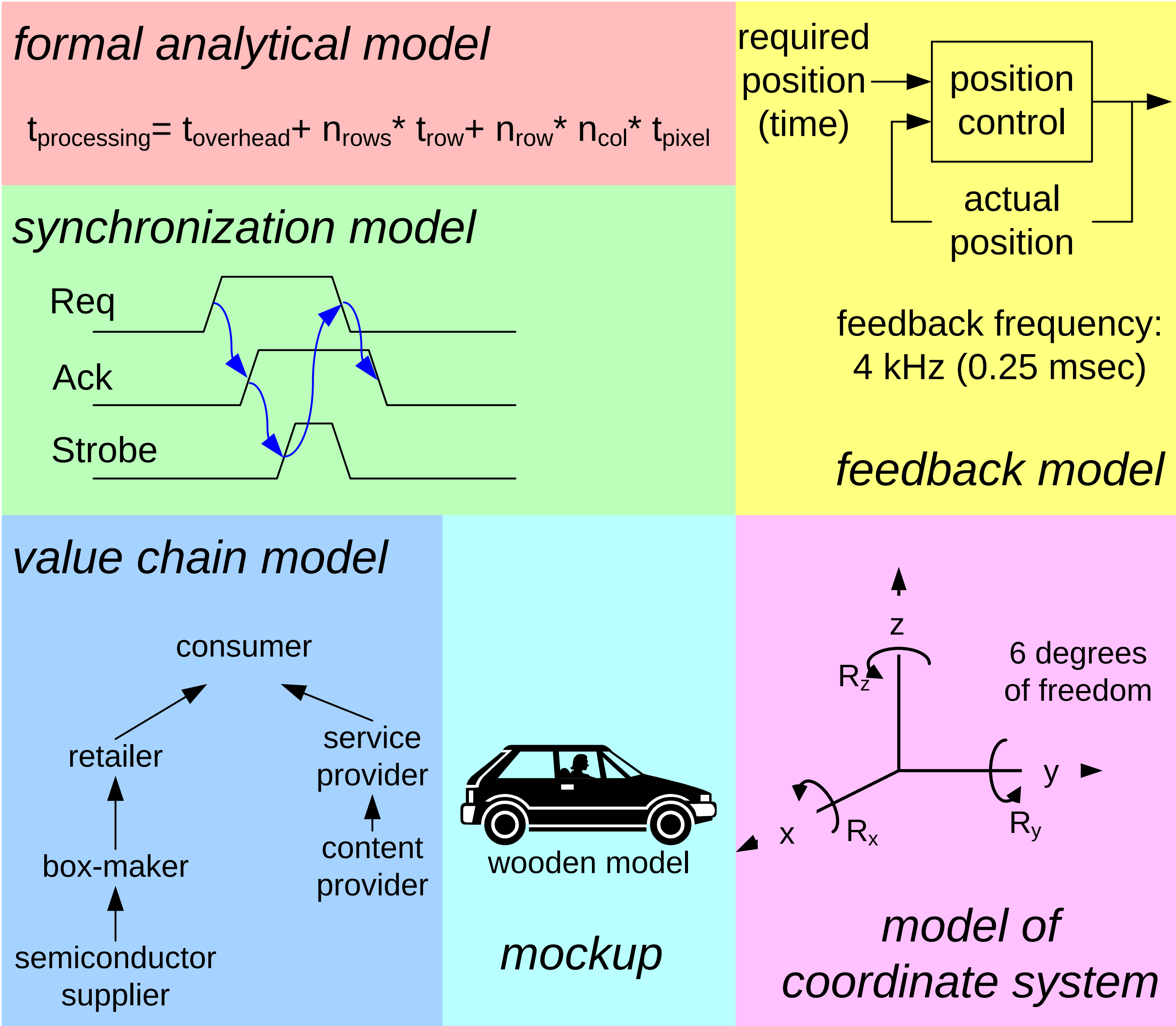
part of the **real world** used for:

communication, documentation

analysis, simulation,

decision making, verification

Some examples of models



Types of models

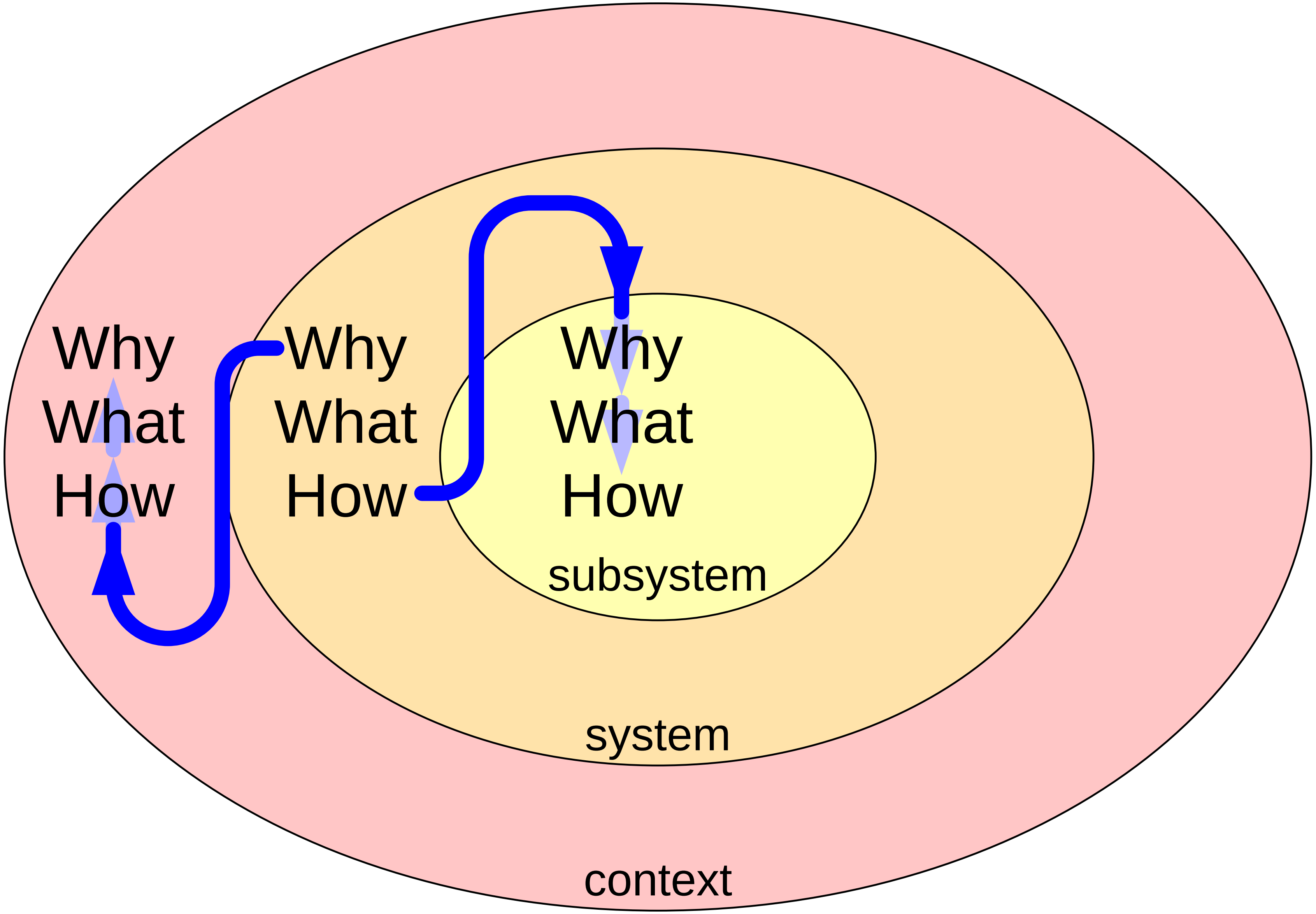
mathematical linguistic	visual
formal	informal
quantitative	qualitative
detailed	global
concrete	abstract
accurate	approximate
executable	read only

←rational—— ——intuitive→

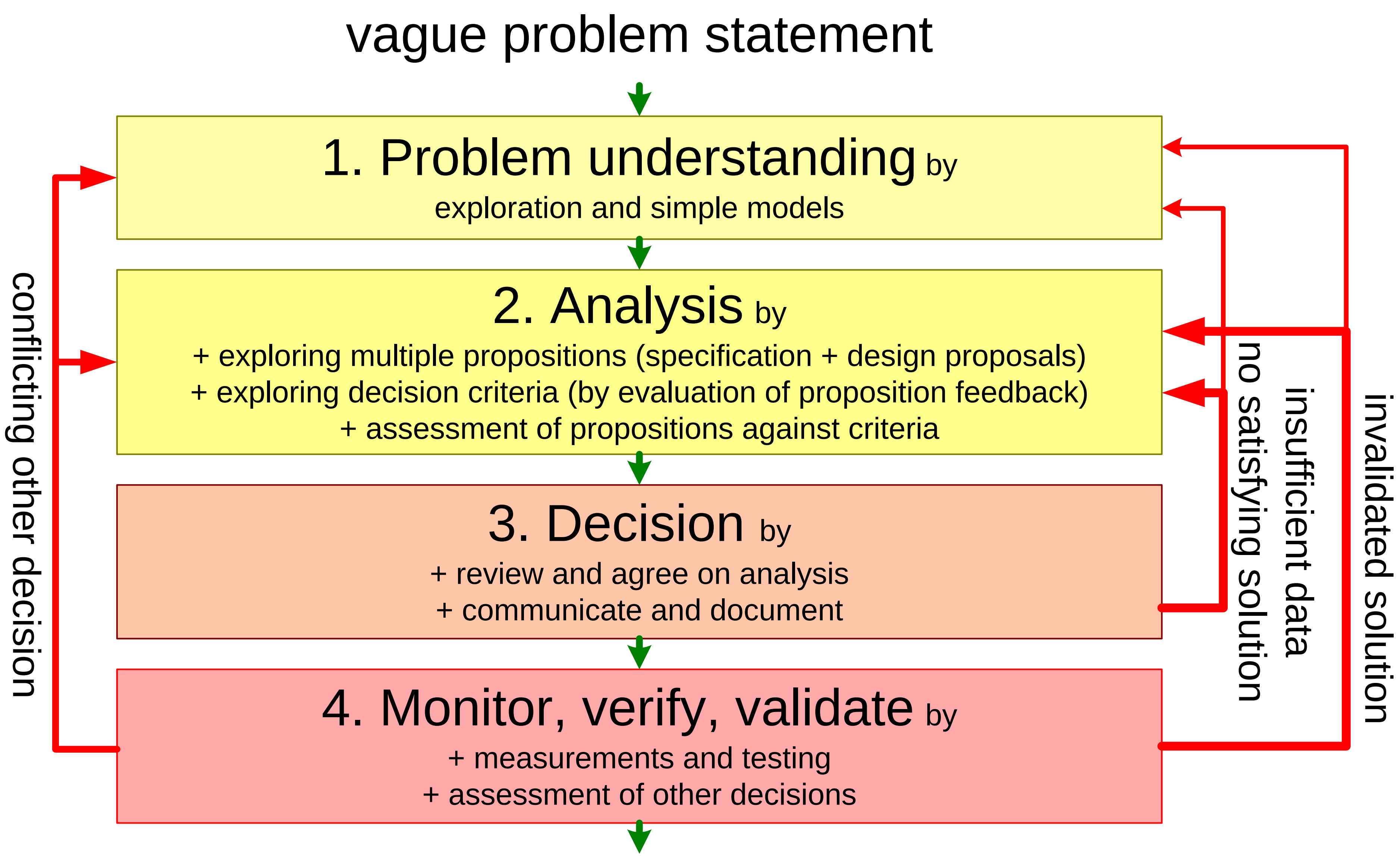
Questions

Why	Who
What	When
How	Where

Why broadens scope, How opens details



Flow from problem to solution



Multiple propositions

throughput	20 p/m	high-performance sensor	350 ns
cost	5 k$	high-speed moves	9 m/s
safety		additional pipelining	

low cost and performance 1

throughput	20 p/m	high-performance sensor	300 ns
cost	5 k$	high-speed moves	10 m/s
safety			

low cost and performance 2

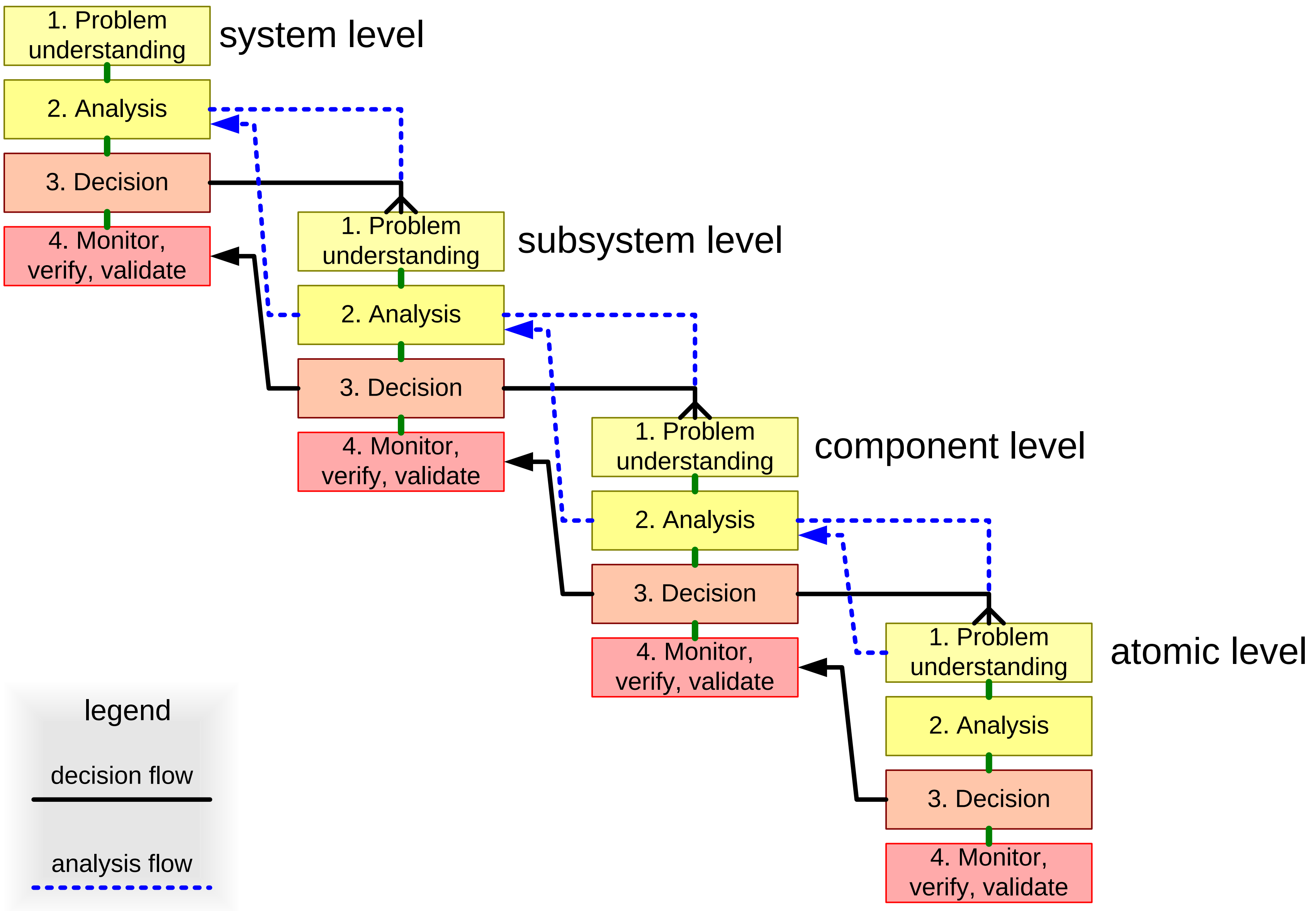
throughput	25 p/m	highperformance sensor	200 ns
cost	7 k$	high-speed moves	12 m/s
safety		additional collision detector	

high cost and performance

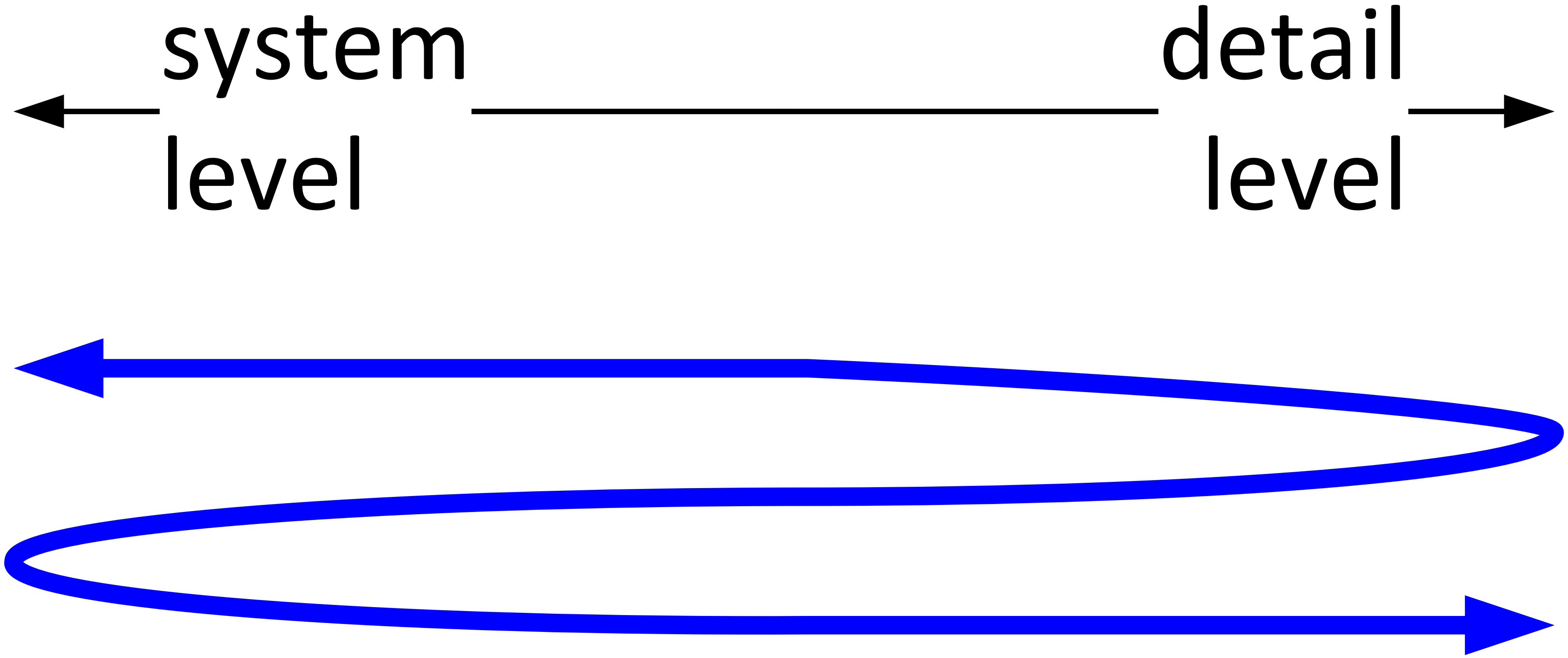
Assessment of propositions

criterions	*criterion weight*	*low cost and performance 1*	*low cost and performance 2*	*high cost and performance*
throughput	5	2	2	3
cost	5	3	3	2
safety	5	5	5	5
future proof	2	2	3	3
effort	4	5	4	4
dev. time	5	5	4	4
risk	4	4	3	3
maintenance	3	2	3	3

Recursive and concurrent application of flow



Exploration by rapid iteration



Story How To

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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.

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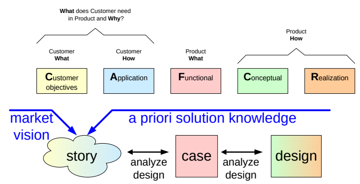
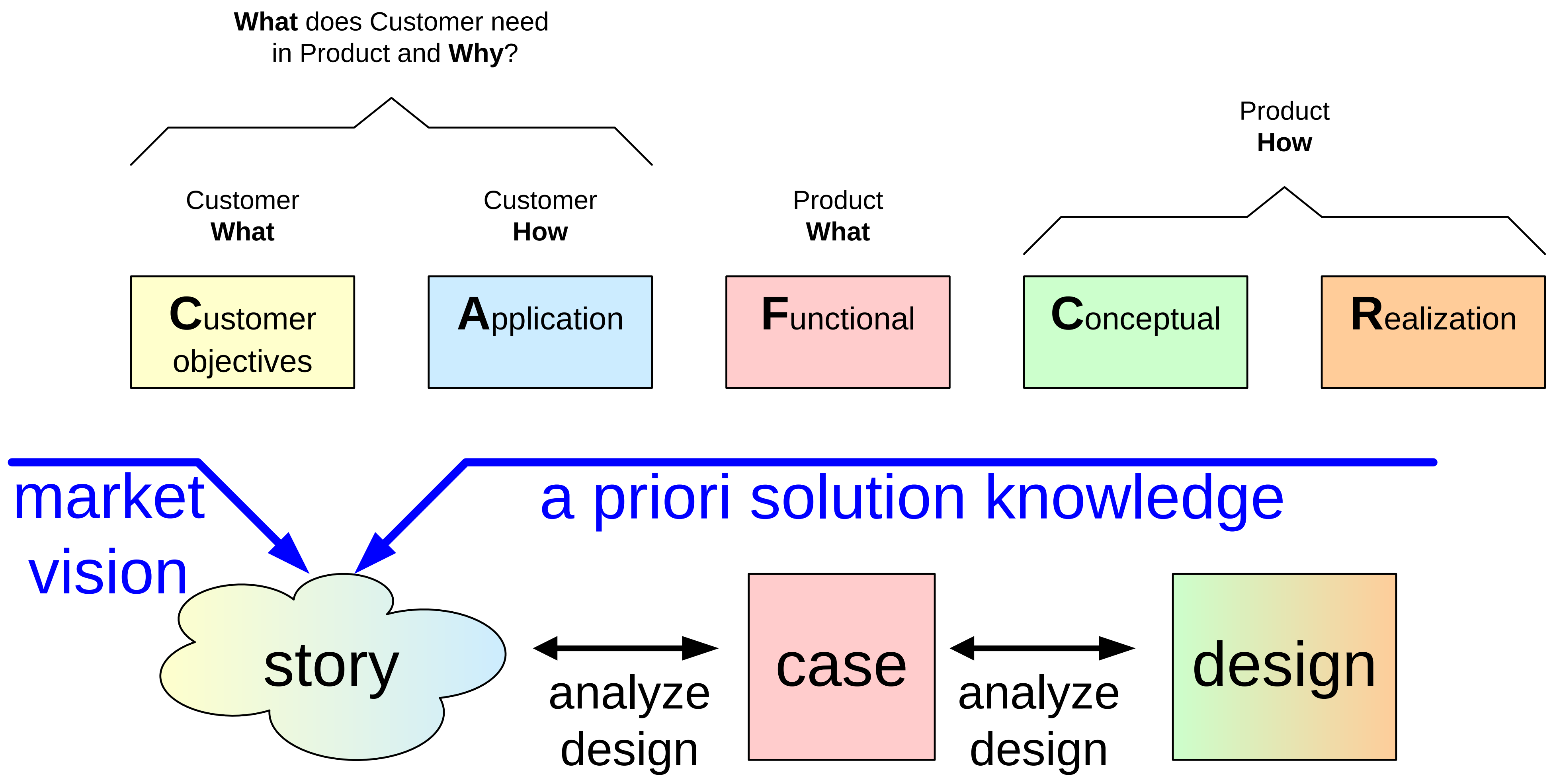
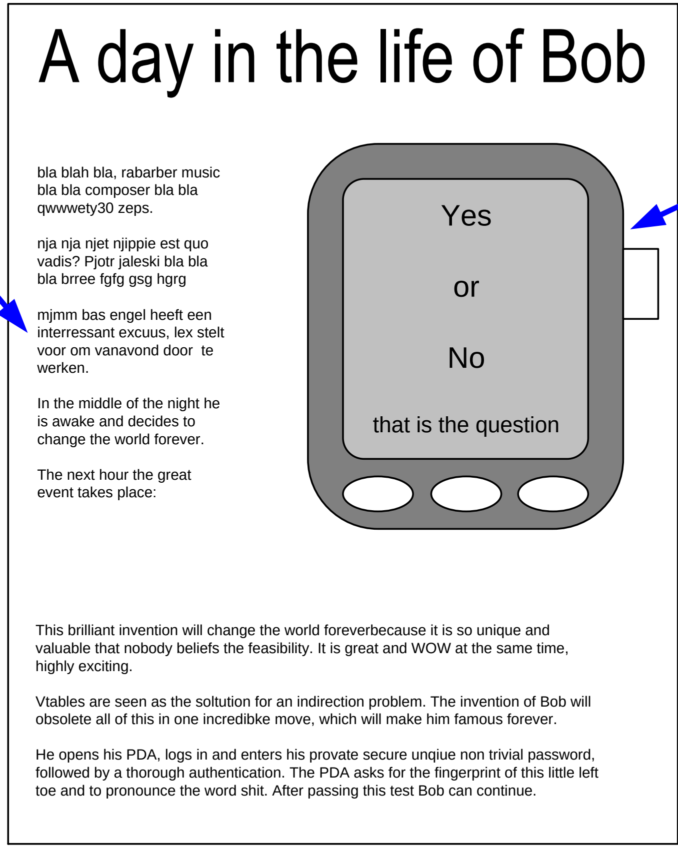


From story to design



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 **A**pplication	• accessible, understandable "Do you see it in front of you?"
Customer objectives **A**pplication	• valuable, appealing attractive, important "Are customers queuing up for this?"
Conceptual **R**ealization	• 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 **F**unctional	• 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

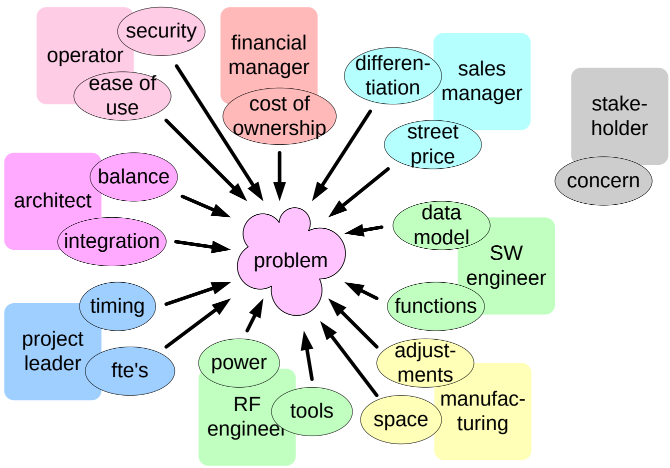
Personal multi media appliance

Create a story for a personal multi media appliance.

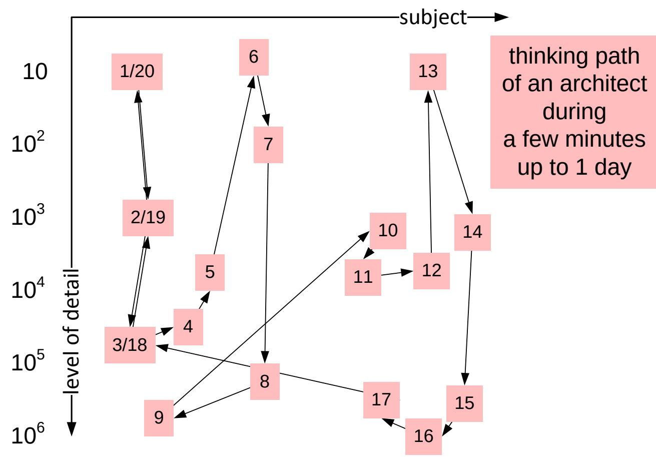
Derive a case description from the story, with functions and quantative requirements.

Architect Way of Working

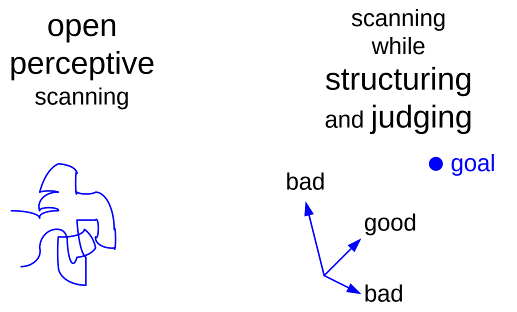
Viewpoint Hopping



Chaotic Path



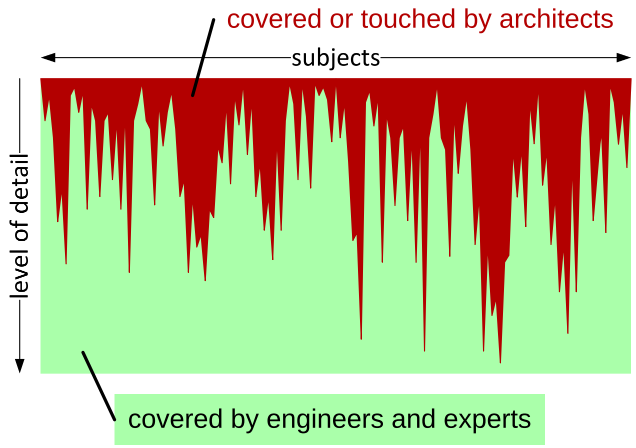
Perceptive vs Judging



drunkard's walk
the world is full
of interesting
needs, technologies, ...

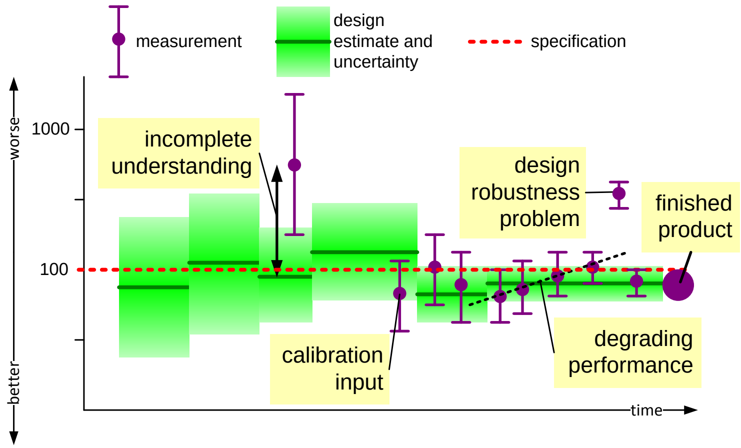
straight for the goal
ignore everything
that is not contributing
directly to the goal

Varying Depth

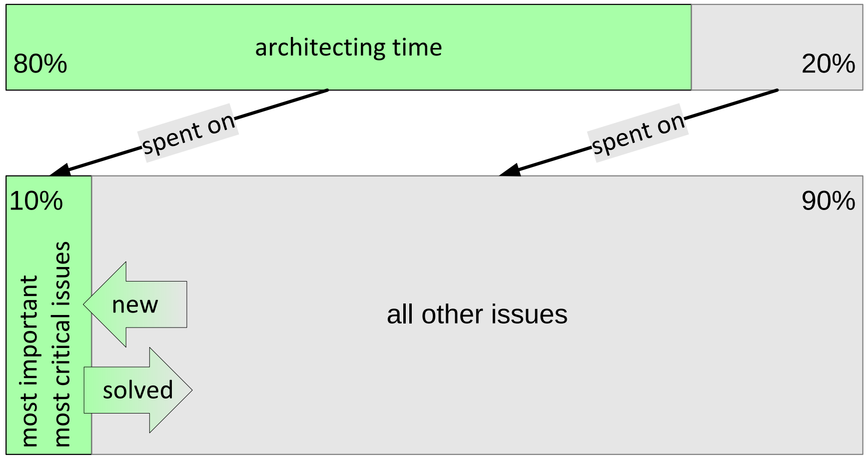


Some Architecting Means

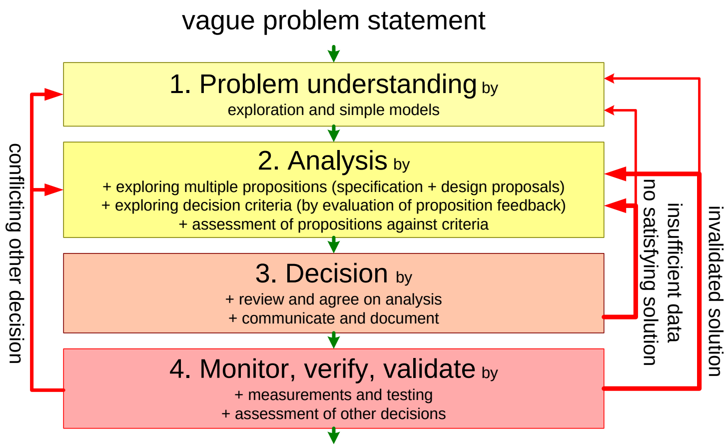
Quantification and Margins



Focus on Key Issues



Phased Problem Solving



Story Telling