

# 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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June 23, 2016  
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version: 1.4

# Basic Working Methods of a System Architect

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## Abstract

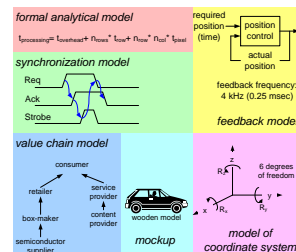
The challenge for the architect is to cover a wide range of subjects, with many unknowns and uncertainties, while decisions are required all the time.

The basic working methods, such as viewpoint hopping, modelling, handling uncertainties and WWHWWW questions are described.

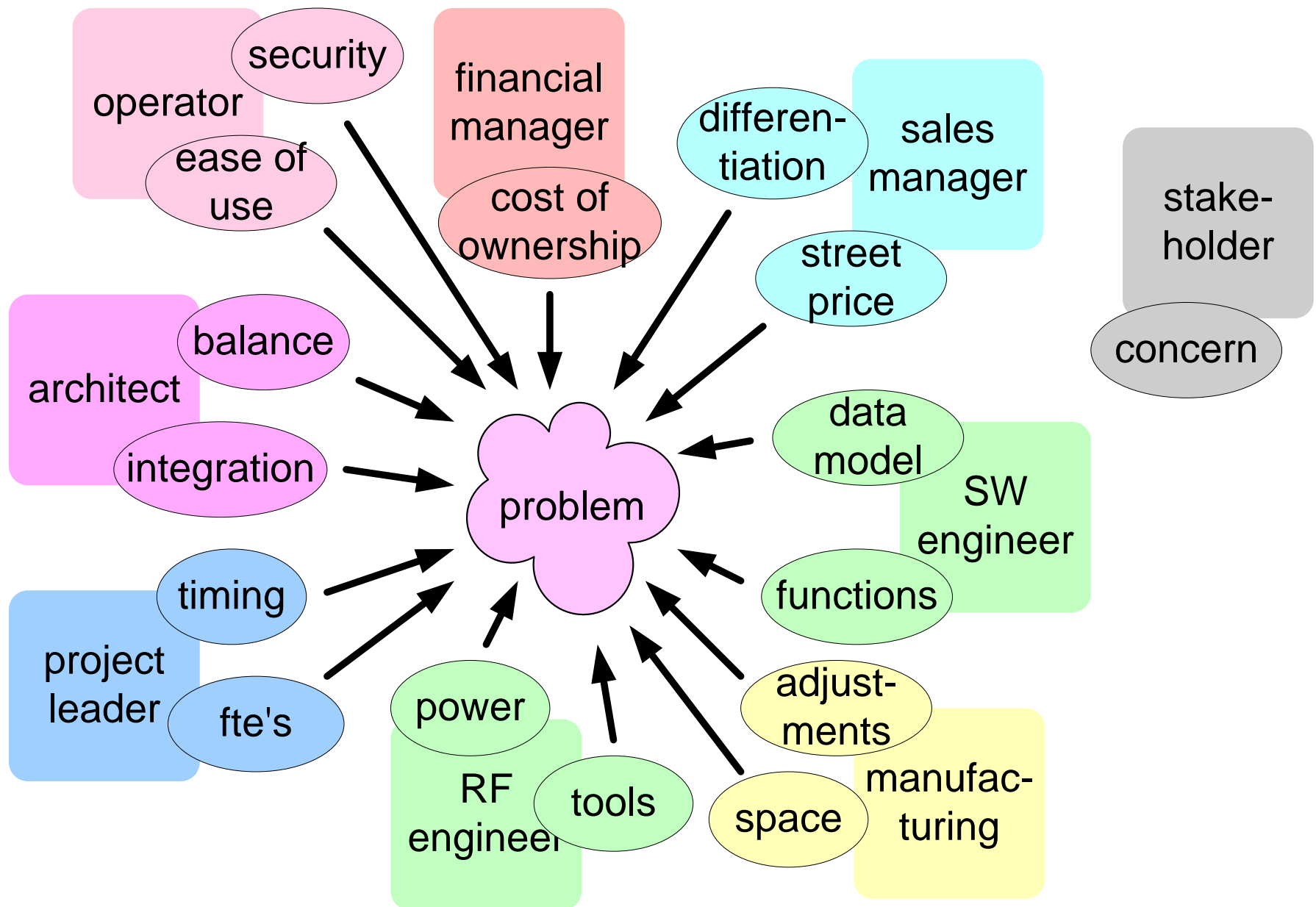
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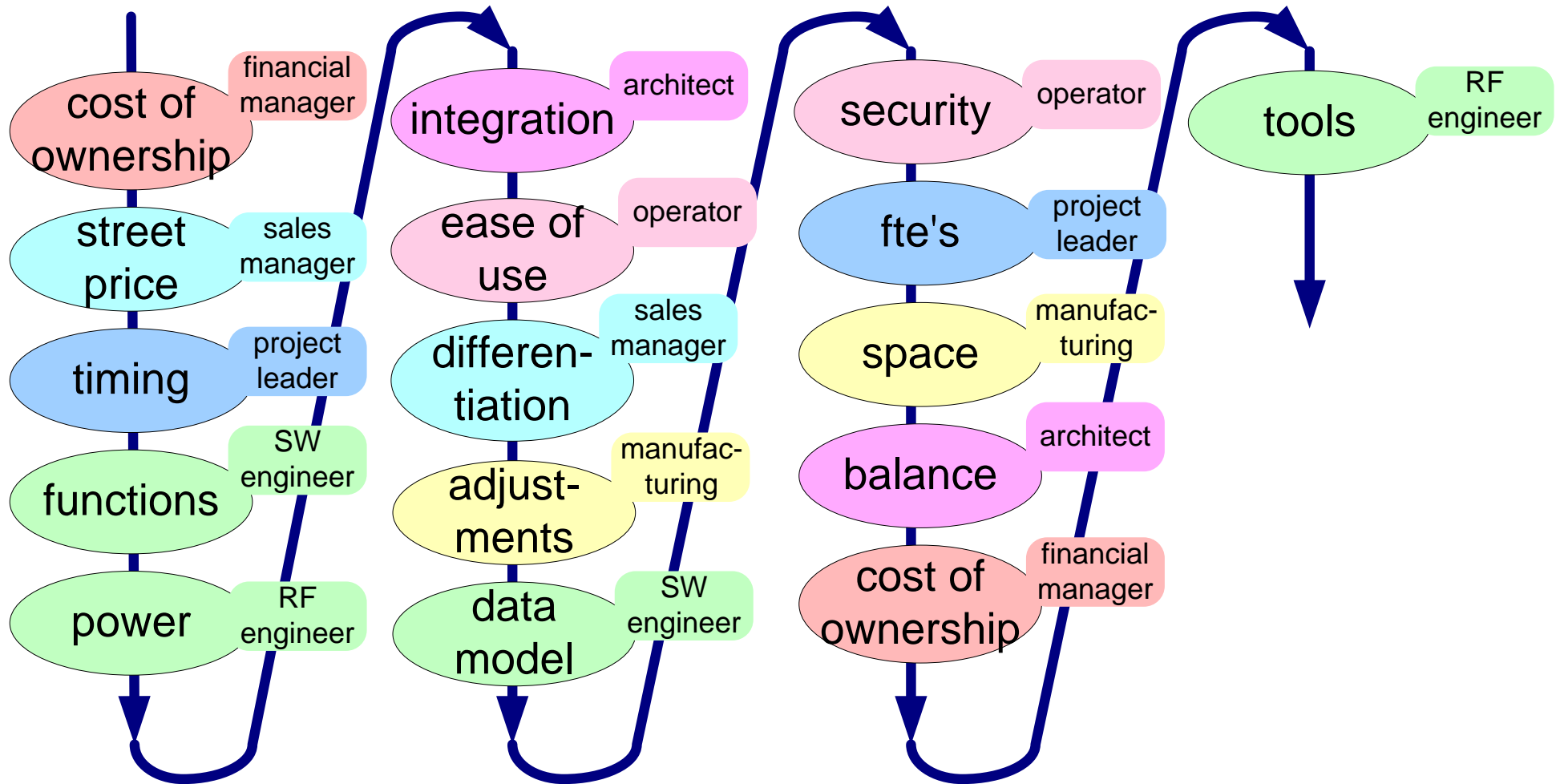
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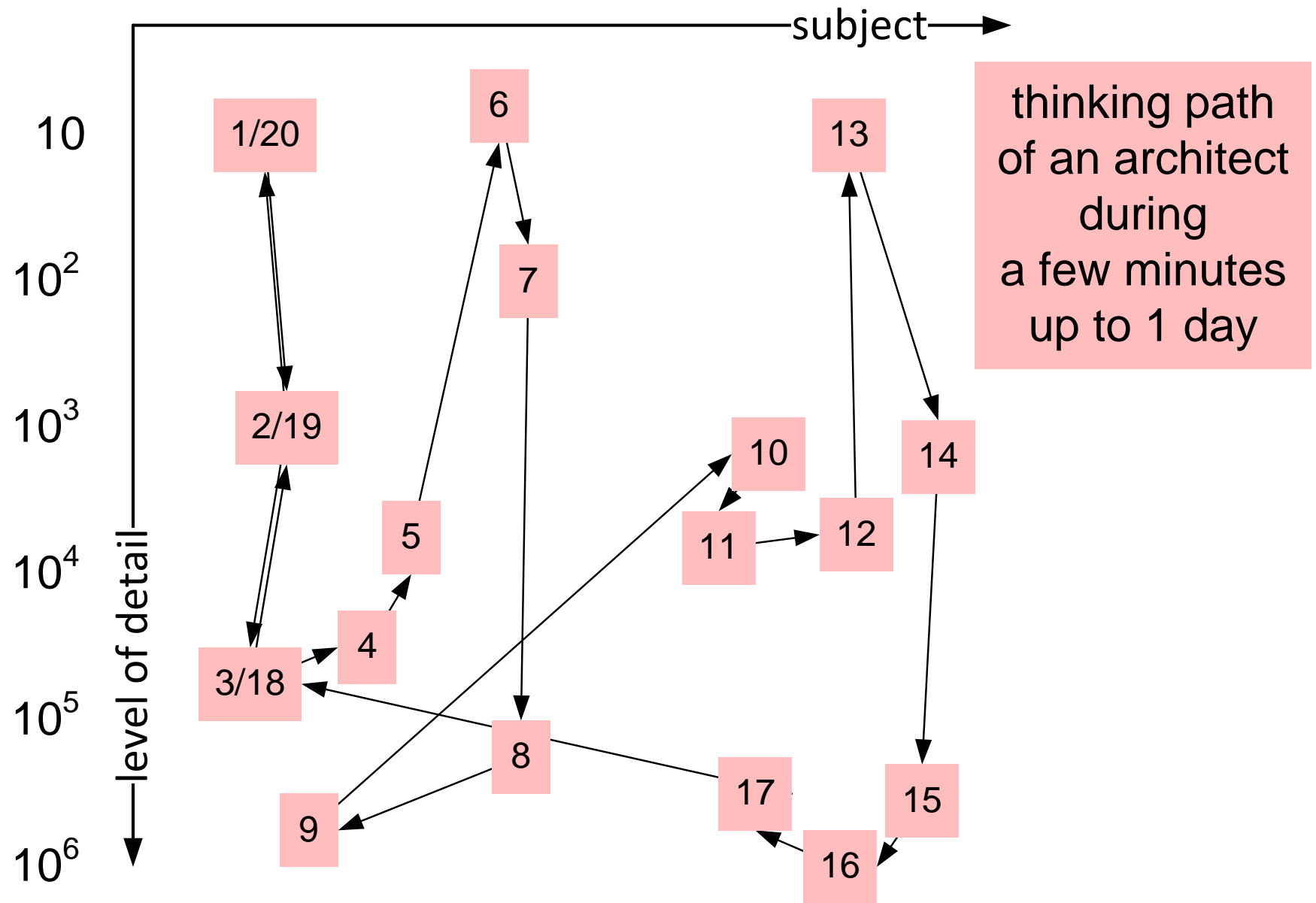
# Many viewpoints



# Viewpoint Hopping



# The seemingly random exploration path



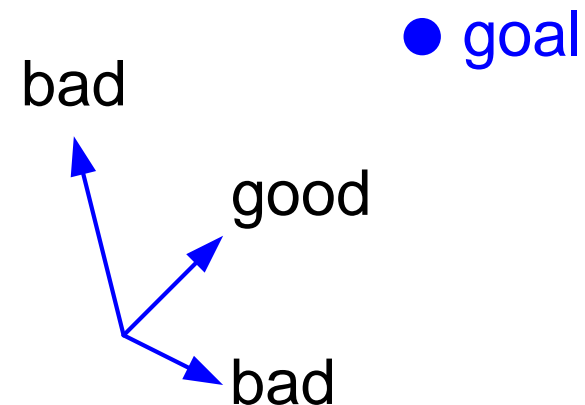
# Scanning modes of the architect

open  
perceptive  
scanning



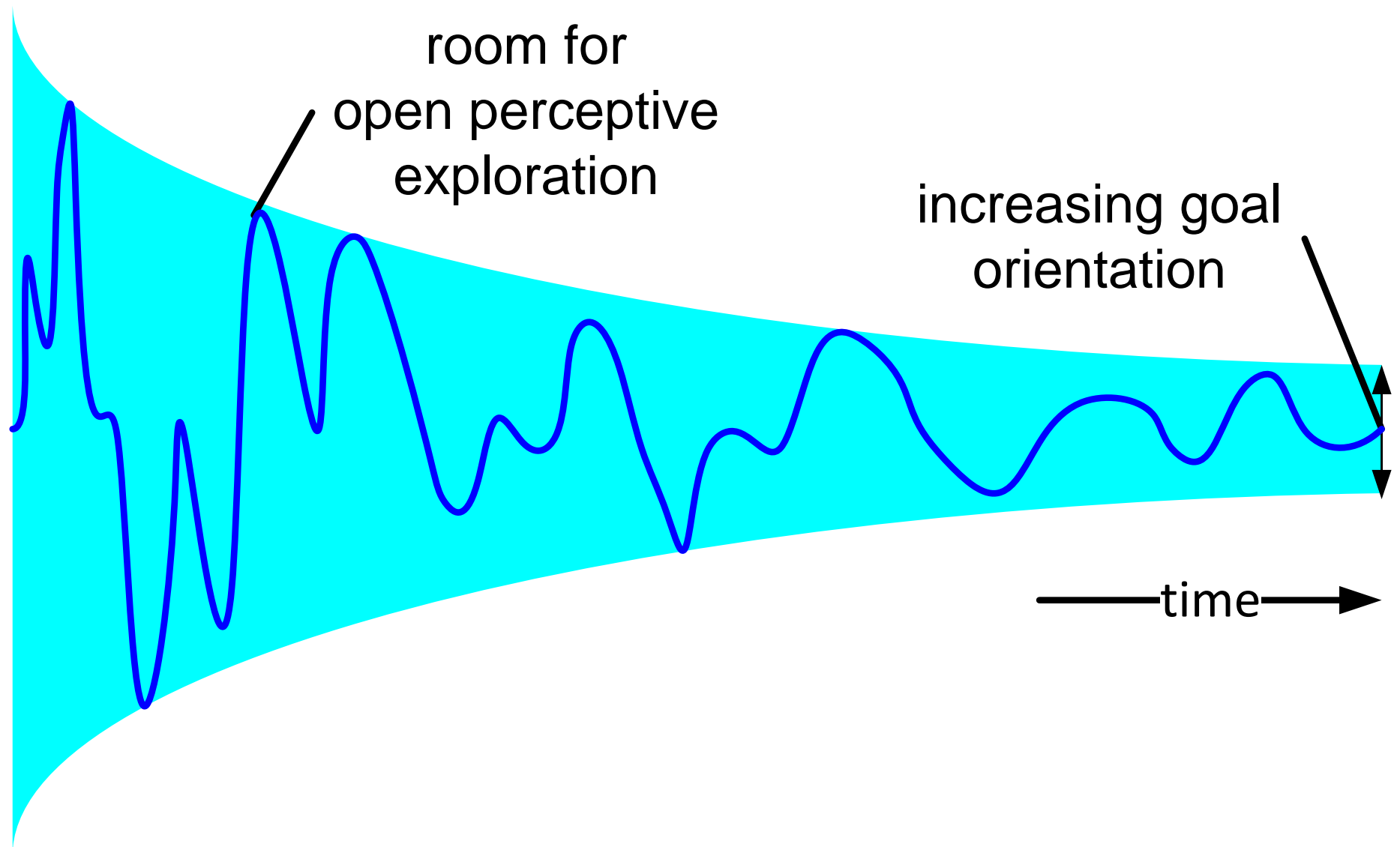
*drunkard's walk*  
the world is full  
of interesting  
needs, technologies, ...

scanning  
while  
structuring  
and judging

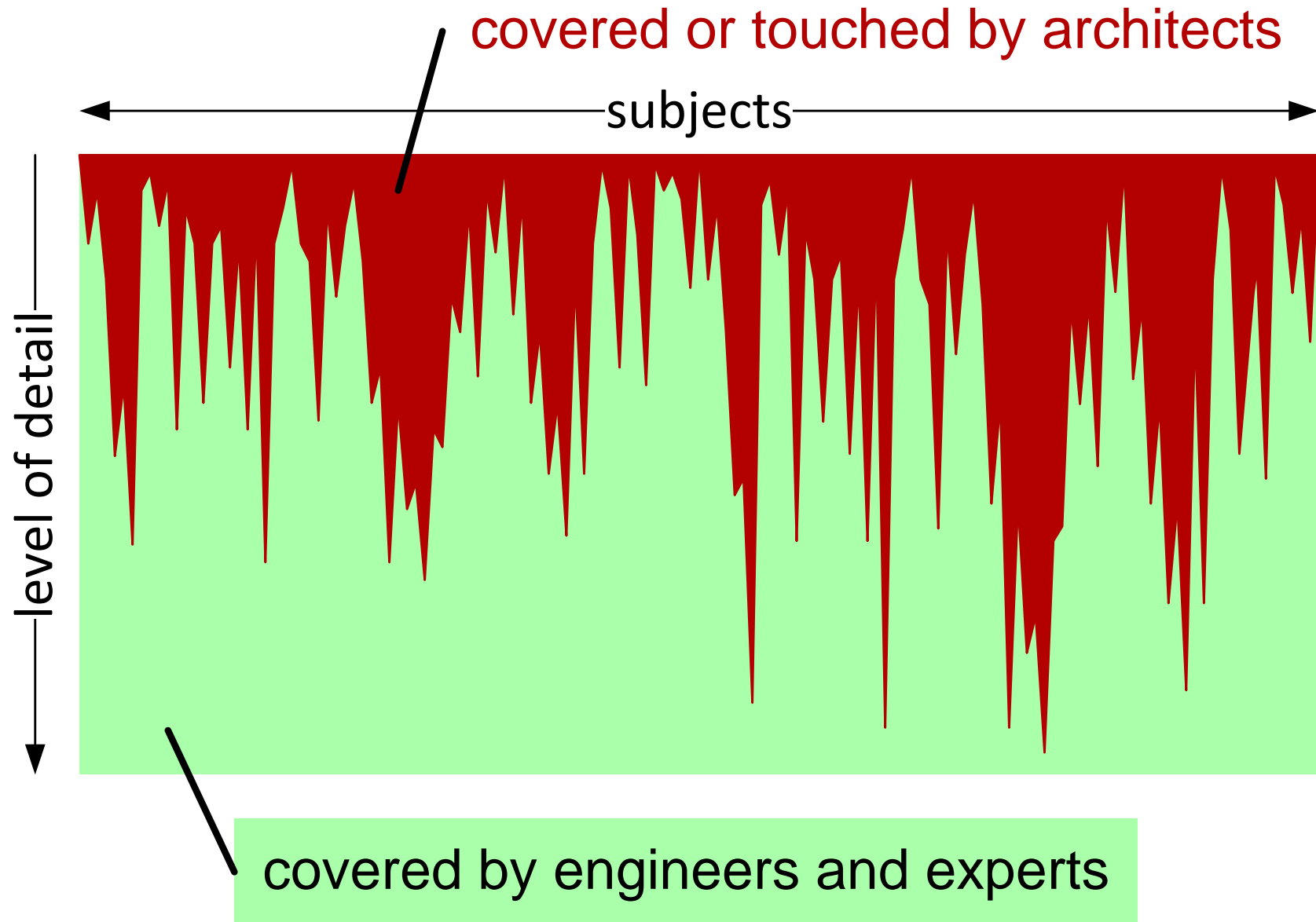


*straight for the goal*  
ignore everything  
that is not contributing  
directly to the goal

# Combined open perceptive and goal oriented scanning

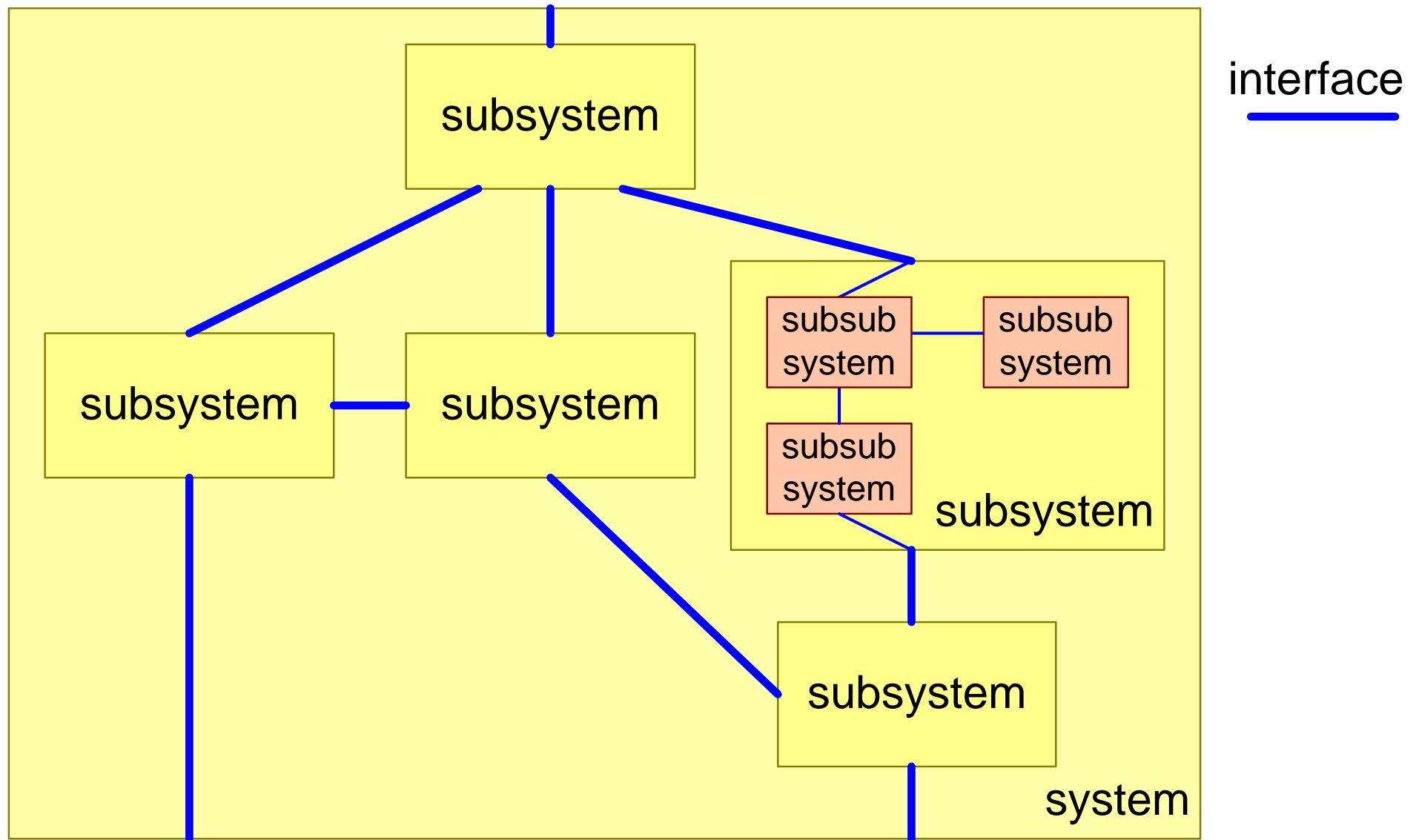


# Coverage of problem and solution space

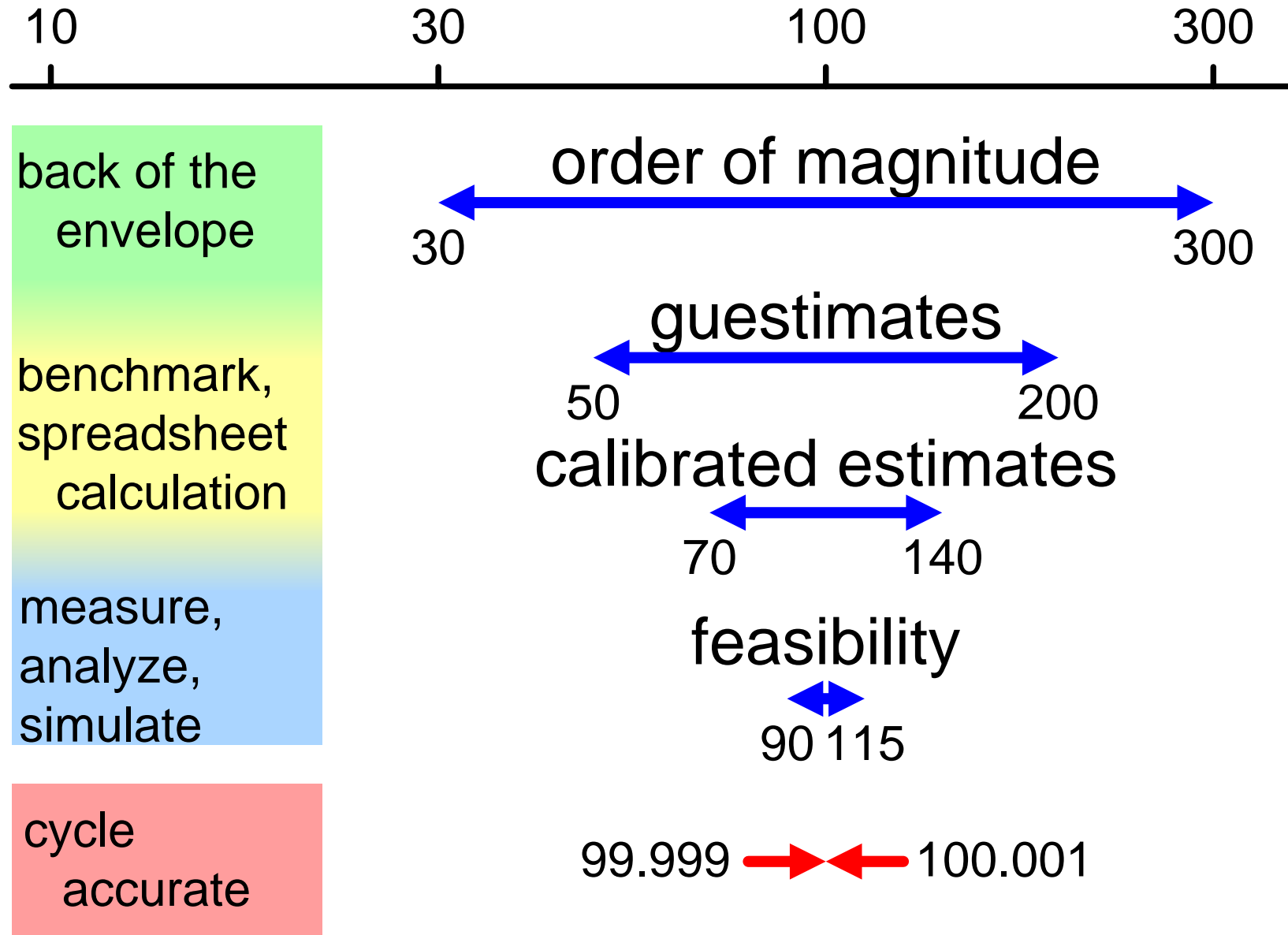




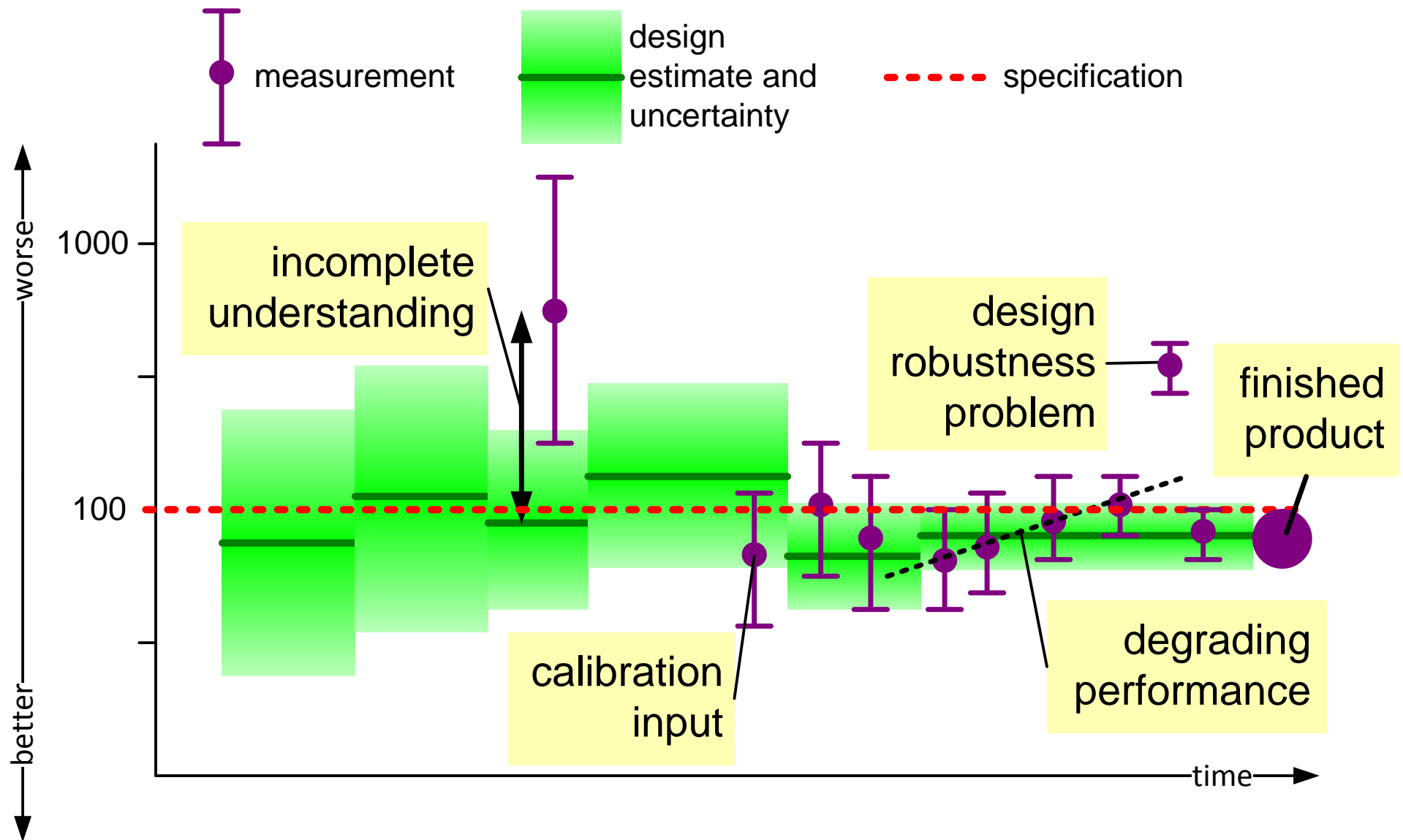
# Decomposition, interfaces and integration



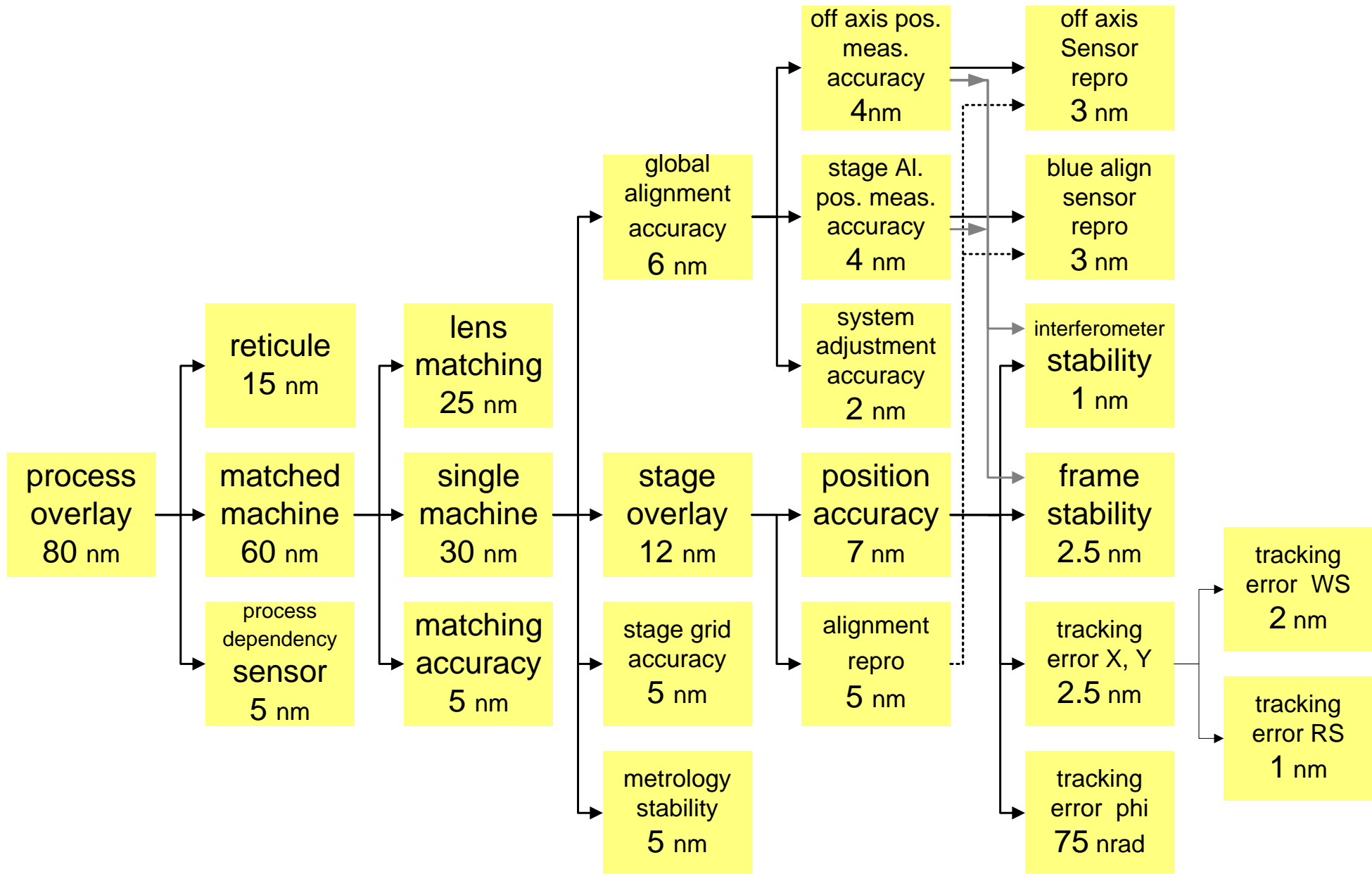
# Successive quantification refinement



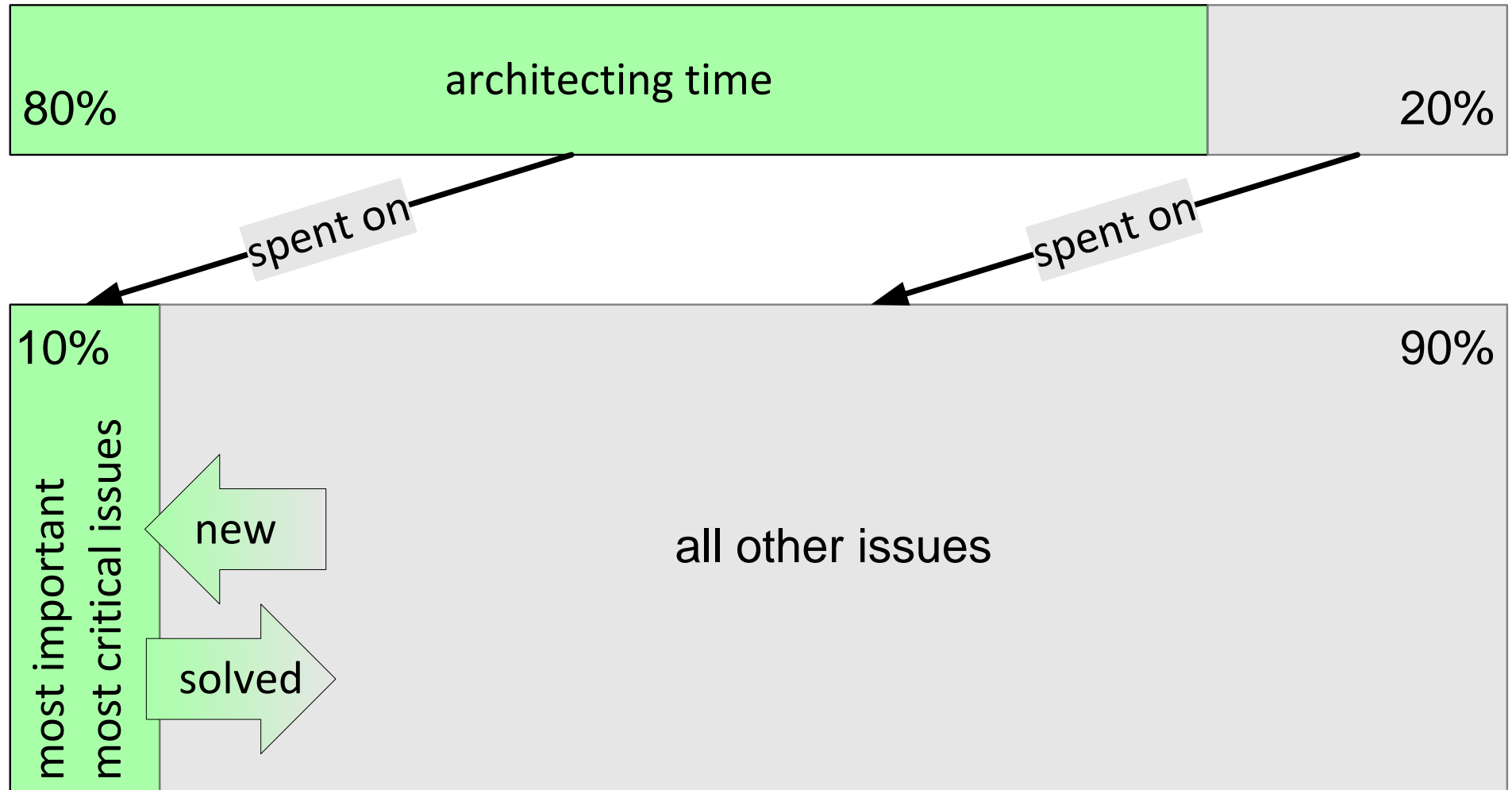
# Example evolution of quantification



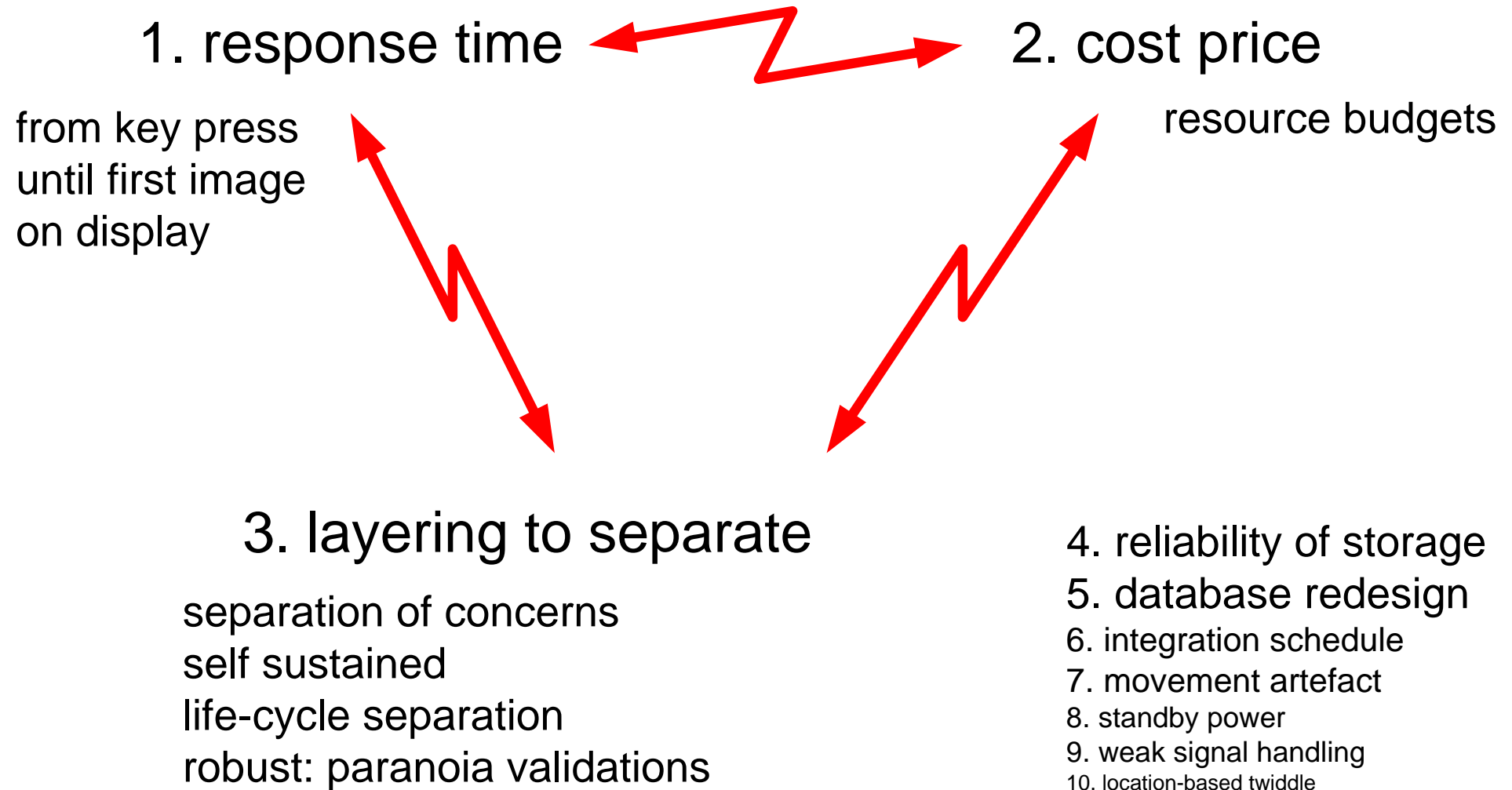
# Quantified understanding of waferstepper overlay



# Architect focus on important issues



# Architect “worry” list



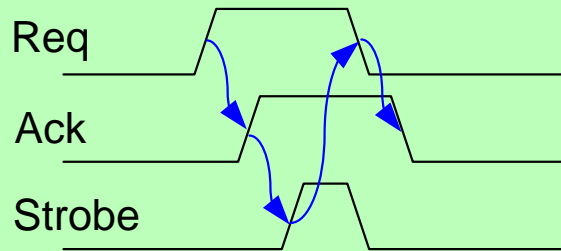
A **model** is  
a **simplified** representation of  
*part* of the **real world** used for:  
  
communication, documentation  
analysis, simulation,  
decision making, verification

# Some examples of models

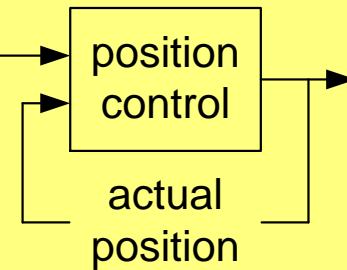
## formal analytical model

$$t_{\text{processing}} = t_{\text{overhead}} + n_{\text{rows}} * t_{\text{row}} + n_{\text{row}} * n_{\text{col}} * t_{\text{pixel}}$$

## synchronization model



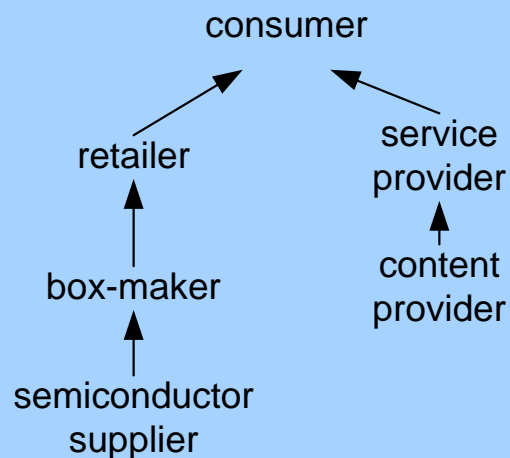
required  
position  
(time)



feedback frequency:  
4 kHz (0.25 msec)

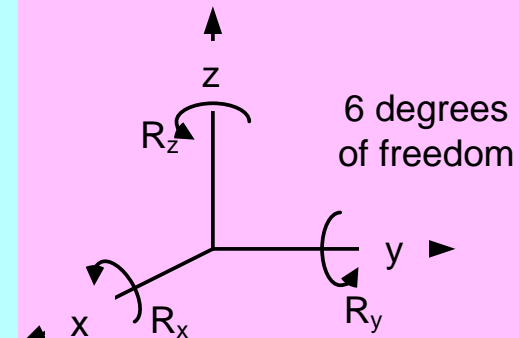
## feedback model

## value chain model



wooden model

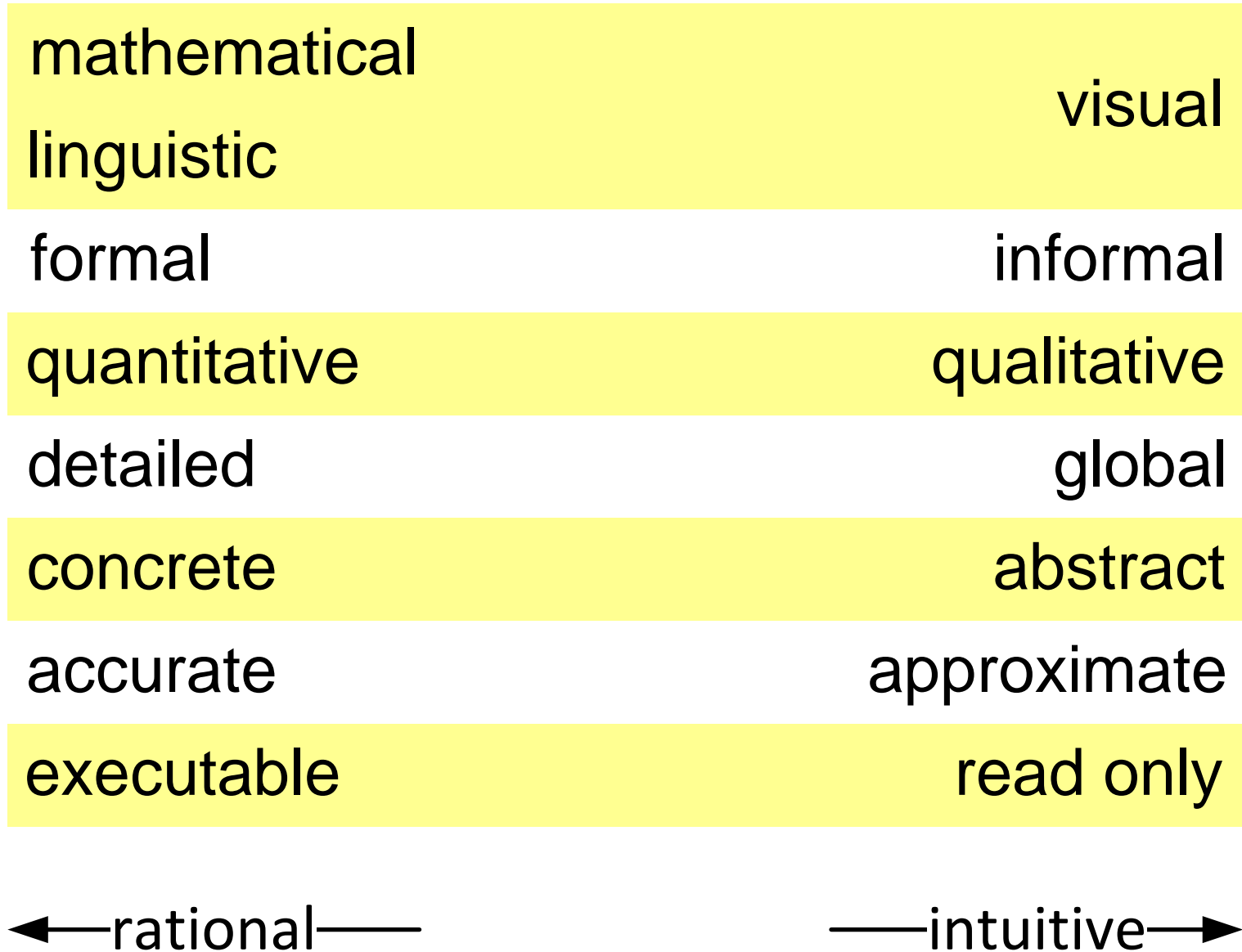
## mockup



## model of coordinate system



# Types of models



Why

Who

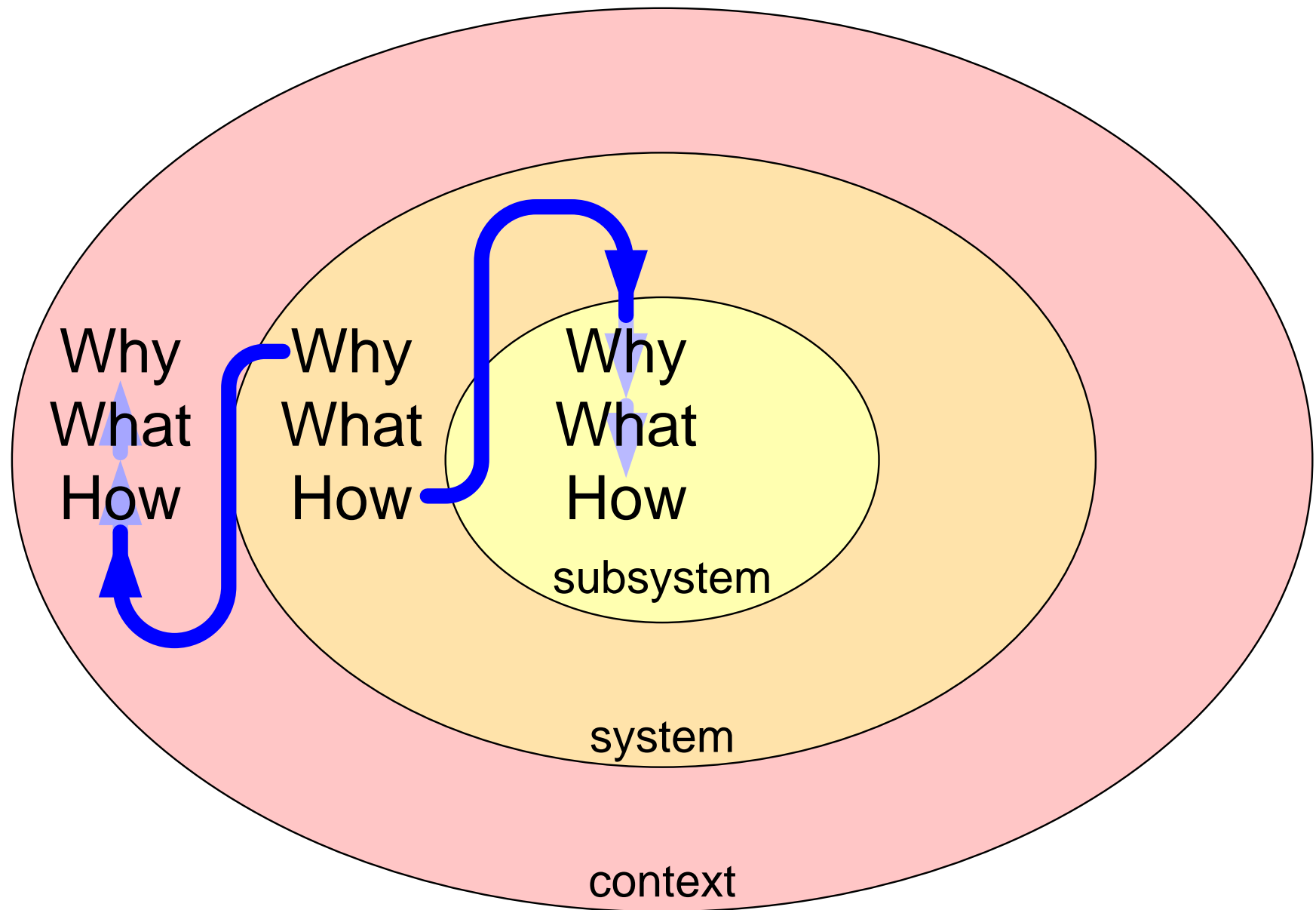
What

When

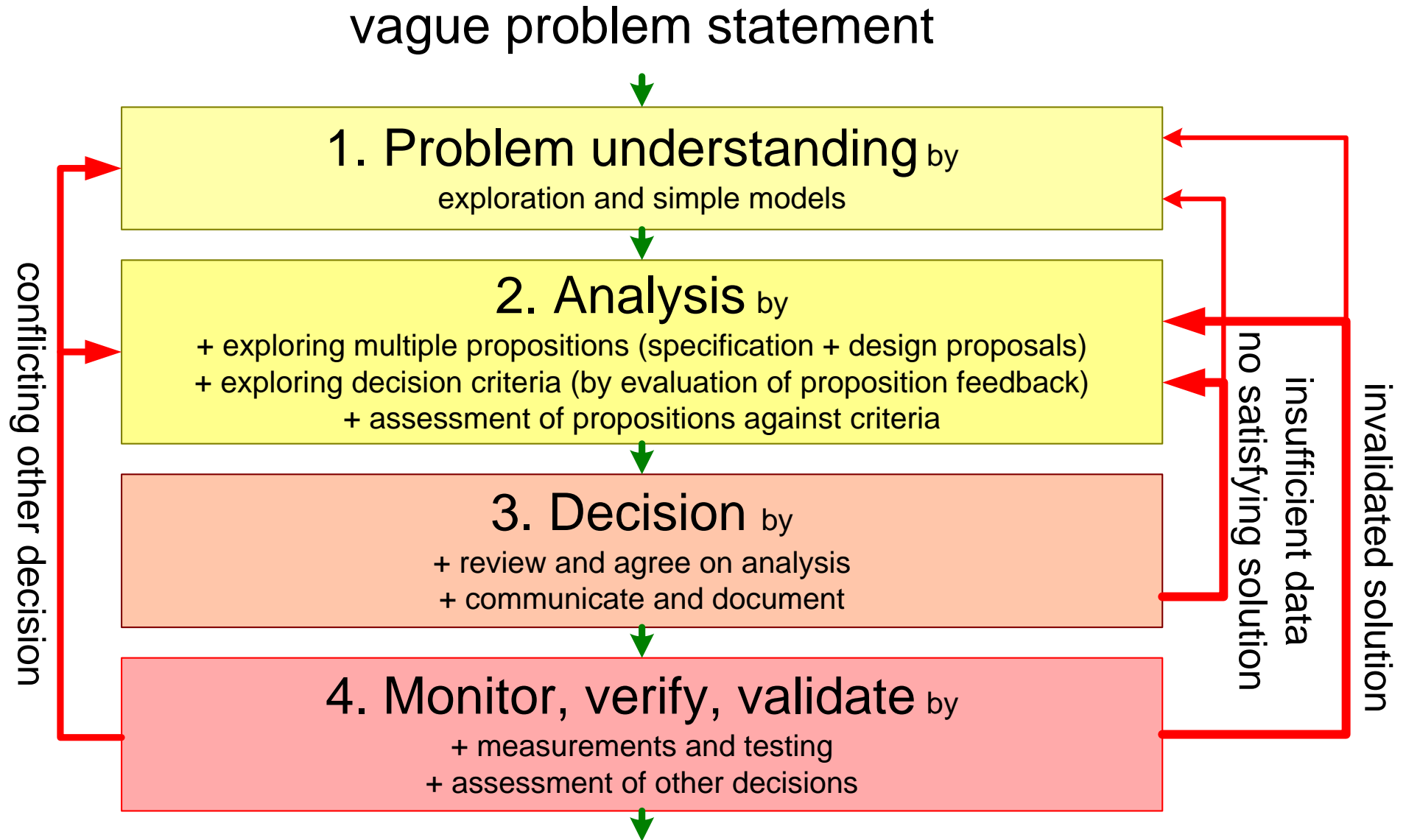
How

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*

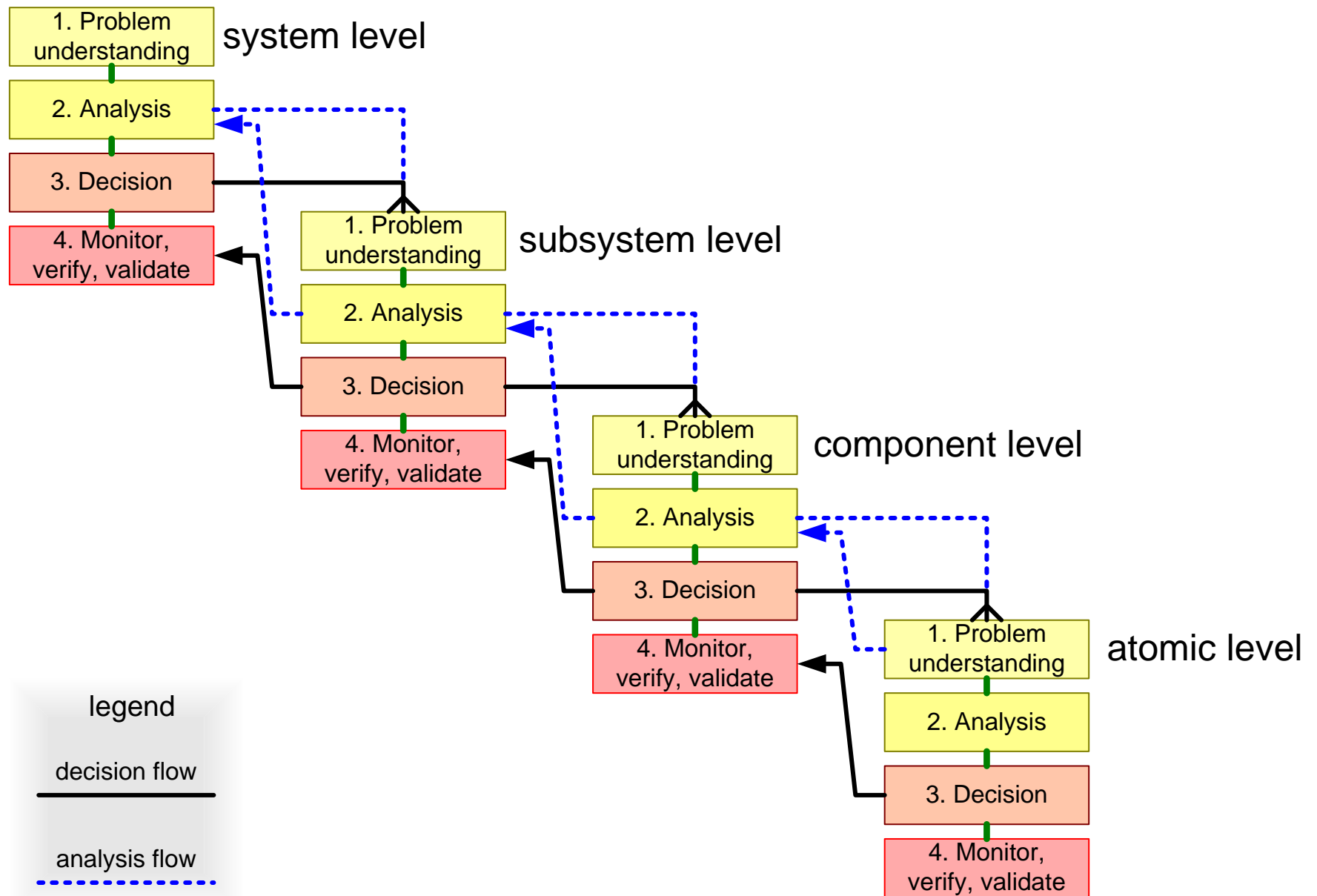
throughput	25 p/m	highperformance sensor	200 ns
cost	7 k\$	high-speed moves	12 m/s
safety		additional collision detector	

*high cost and performance*

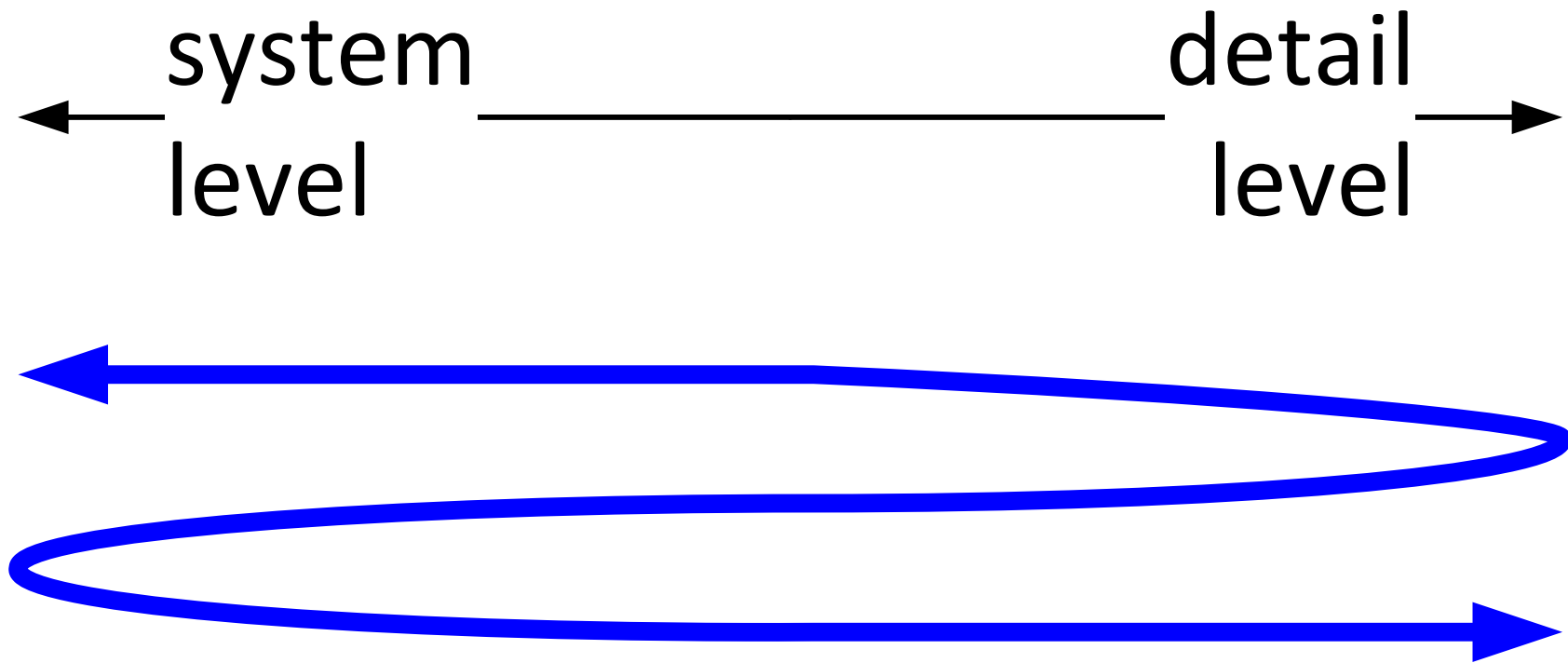
# Assessment of propositions

<i>criteria</i>	<i>weight</i>	<i>low cost and performance 1</i>	<i>low cost and performance 2</i>	<i>high cost and performance</i>
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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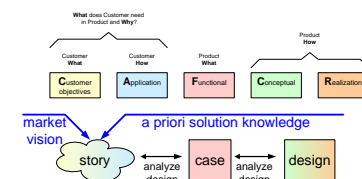
## Abstract

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.

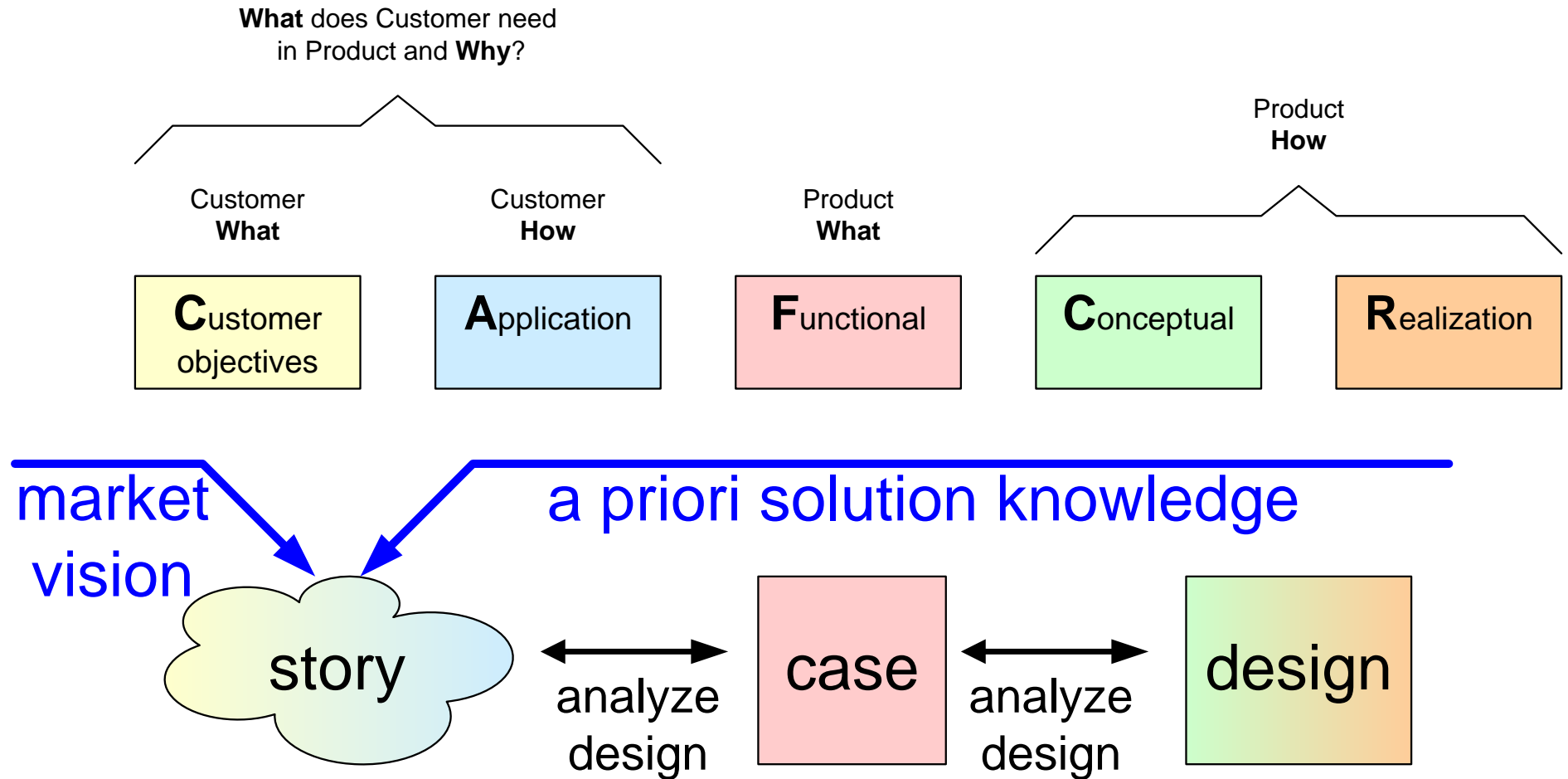
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# From story to design



# Example story layout

ca. half a page of  
plain English text

## A day in the life of Bob

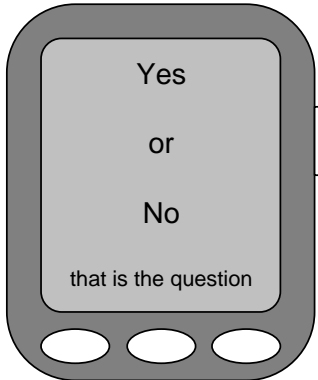
bla blah bla, rabarber music  
bla bla composer bla bla  
qwwwety30 zeps.

nja nja njet njippie est quo  
vadis? Pjotr jaleski bla bla  
bla brree fgfg gsg hgrg

mjmm bas engel heeft een  
interessant excuus, lex stelt  
voor om vanavond door te  
werken.

In the middle of the night he  
is awake and decides to  
change the world forever.

The next hour the great  
event takes place:



This brilliant invention will change the world foreverbecause it is so unique and  
valuable that nobody beliefs the feasibility. It is great and WOW at the same time,  
highly exciting.

Vtables are seen as the soltution for an indirection problem. The invention of Bob will  
obsolete all of this in one incredibke move, which will make him famous forever.

He opens his PDA, logs in and enters his provate secure unque non trivial password.  
followed by a thorough authentication. The PDA asks for the fingerprint of this little left  
toe and to pronounce the word shit. After passing this test Bob can continue.

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

**C**ustomer objectives  
**A**pplication

- accessible, understandable

"Do you see it in front of you?"

**C**ustomer objectives  
**A**pplication

- valuable, appealing

attractive, important

"Are customers queuing up for this?"

**C**onceptual  
**R**ealization

- critical, challenging

"What is difficult in the realization?"

"What do you learn w.r.t. the design?"

**A**pplication

- frequent, no exceptional niche

"Does it add significantly to the bottom line?"

**A**pplication  
**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

**C**ustomer objectives  
**A**pplication

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

**C**onceptual  
**R**ealization

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**

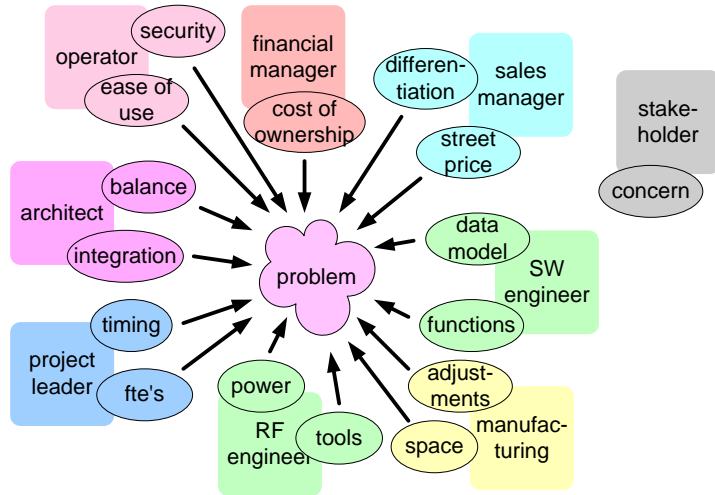
Create a story for a personal multi media appliance.

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

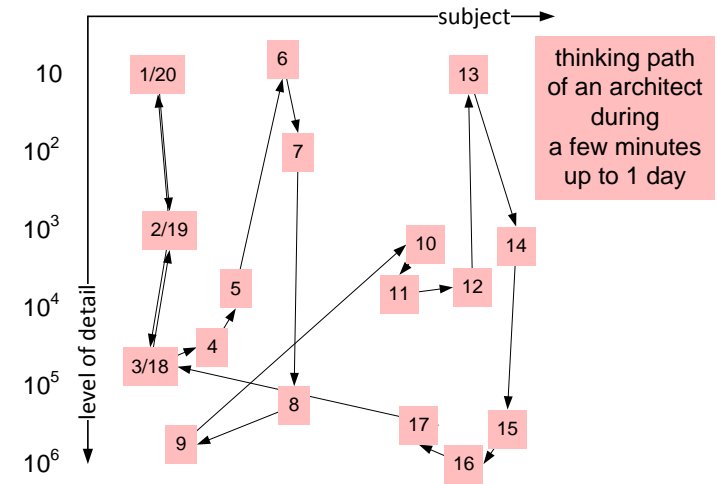


# Architect Way of Working

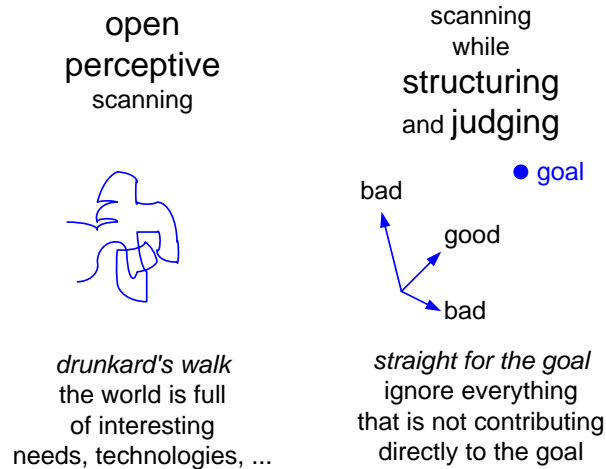
## Viewpoint Hopping



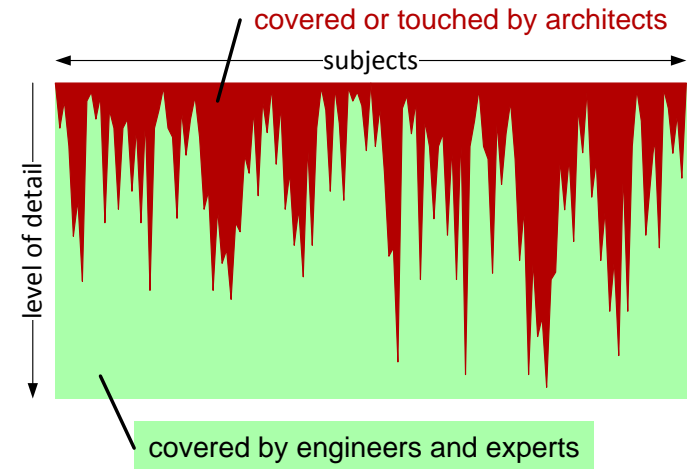
## Chaotic Path



## Perceptive vs Judging

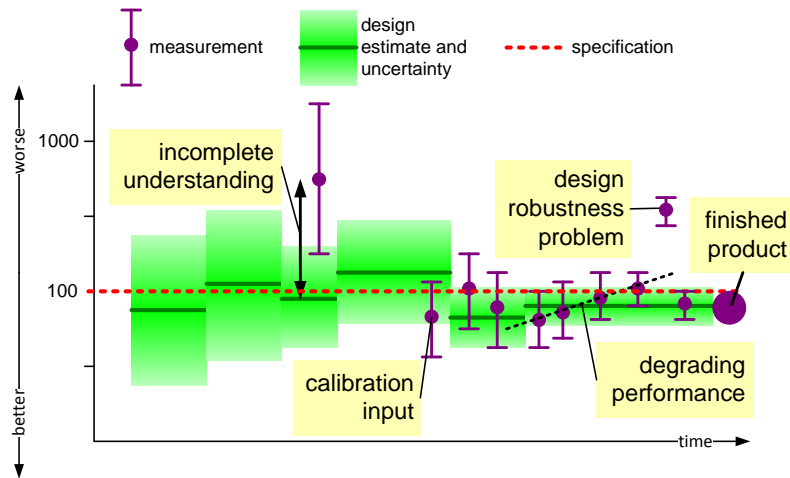


## Varying Depth

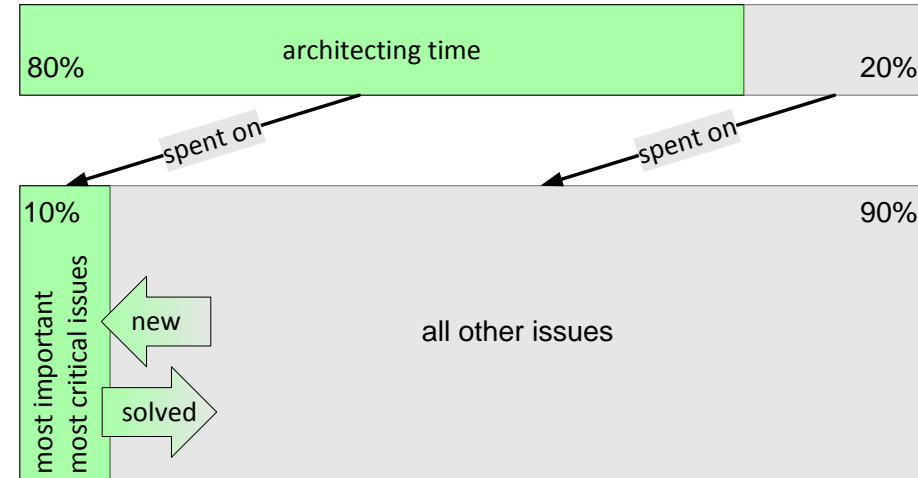


# Some Architecting Means

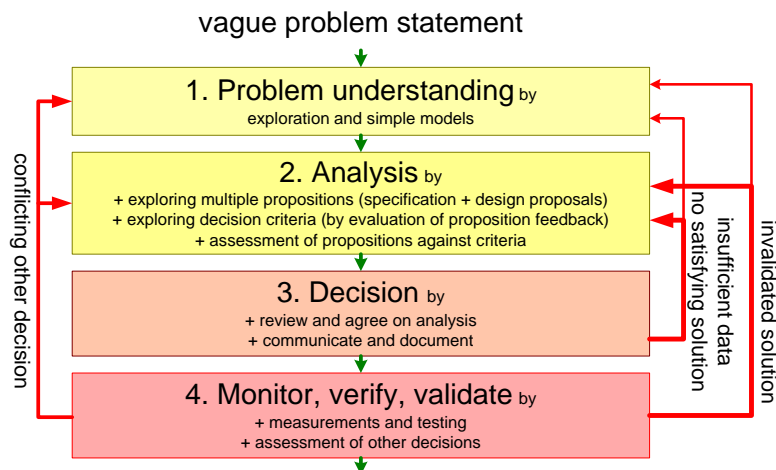
## Quantification and Margins



## Focus on Key Issues



## Phased Problem Solving



## Story Telling

