Module 37, Architectural Reasoning Threads and Integration

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Abstract

This module provides methods and techniques to integrate insights across views. Lines and Threads of reasoning form the main framework.

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Qualities as Integrating Needles

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Abstract

Many stakeholder concerns can be specified in terms of qualities. These qualities can be viewed from all 5 “CAFCR” viewpoints. In this way qualities can be used to relate the views to each other.
The meaning of qualities for the different views is described. A checklist of qualities is provided as a means for architecting. All qualities in the checklist are described briefly.

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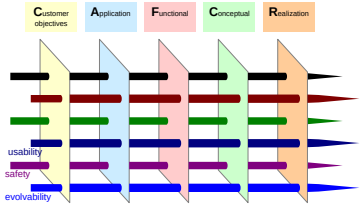
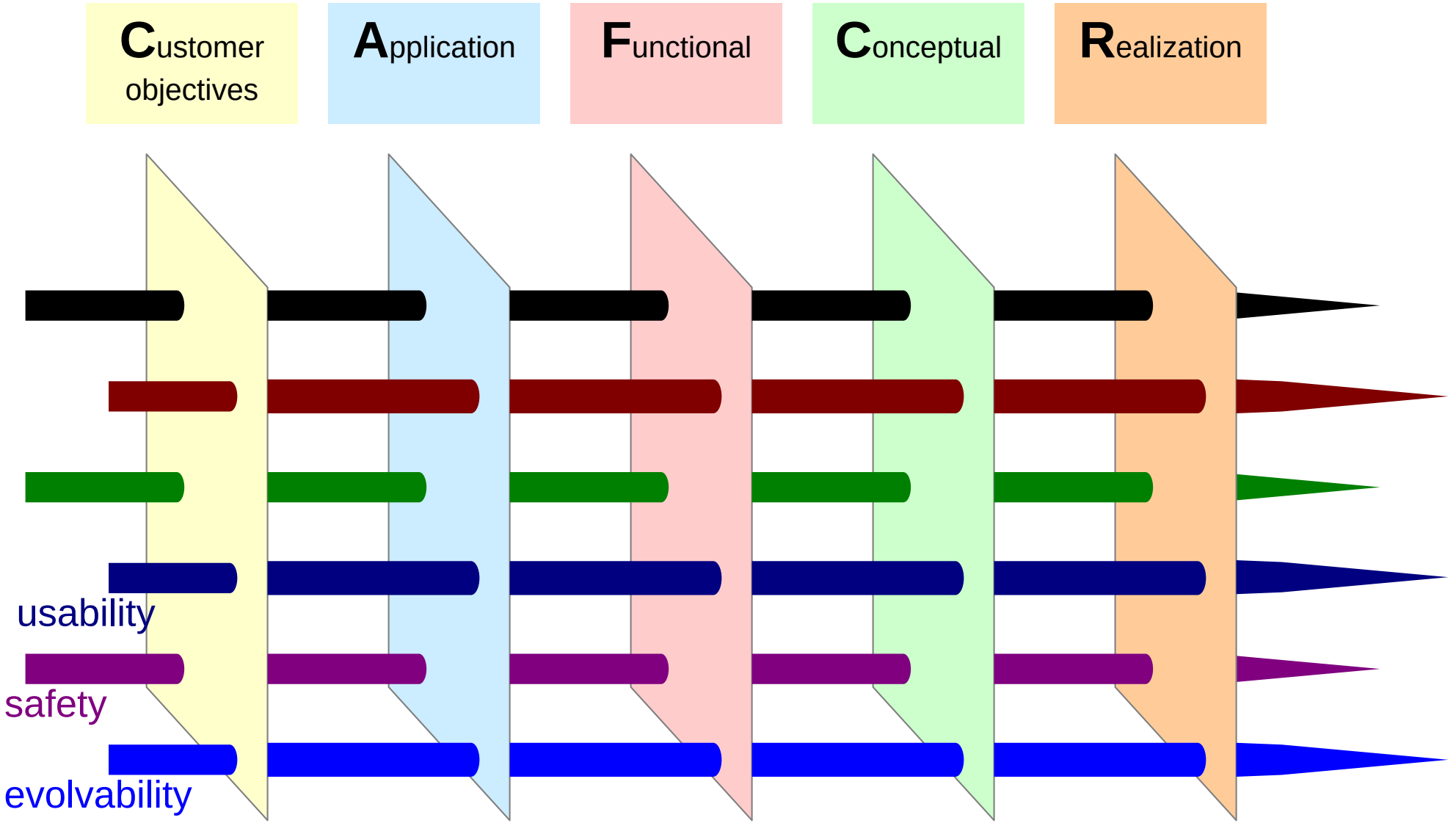


Quality needles as generic integrating concepts



Security as example through all views

Customer objectives	**A**pplication	**F**unctional	**C**onceptual	**R**ealization
sensitive information  trusted	selection classification people information authentication badges passwords locks / walls guards administrators	functions for administration authentication intrusion detection logging quantification	cryptography firewall security zones authentication registry logging	*specific* algorithms interfaces libraries servers storage protocols
	desired characteristics, specifications & mechanisms			
 not trusted	social contacts open passwords blackmail burglary fraud unworkable procedures	missing functionality wrong quantification	holes between concepts	bugs buffer overflow non encrypted storage poor exception handling
			threats	

Quality 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

Exercise Line of Reasoning

Make a **line of reasoning** for one of the dominant qualities.

- in the CA views; determine what customers do to achieve their goal
- in the F view determine the specification of your system supporting this quality
- in the CR views determine the relevant concepts and technologies
- Take the reverse viewpoints as well: what threatens this quality?

Threads of Reasoning

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Abstract

A method of reasoning is described, which addresses cross-cutting issues. The basis is fast iteration in the problem and solution space.
A thread of reasoning is a set of highly relevant related issues, which are addressed by articulating the problem in terms of tension and analyzing it in the CAFCR framework.

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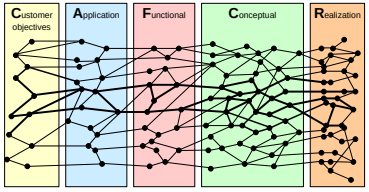
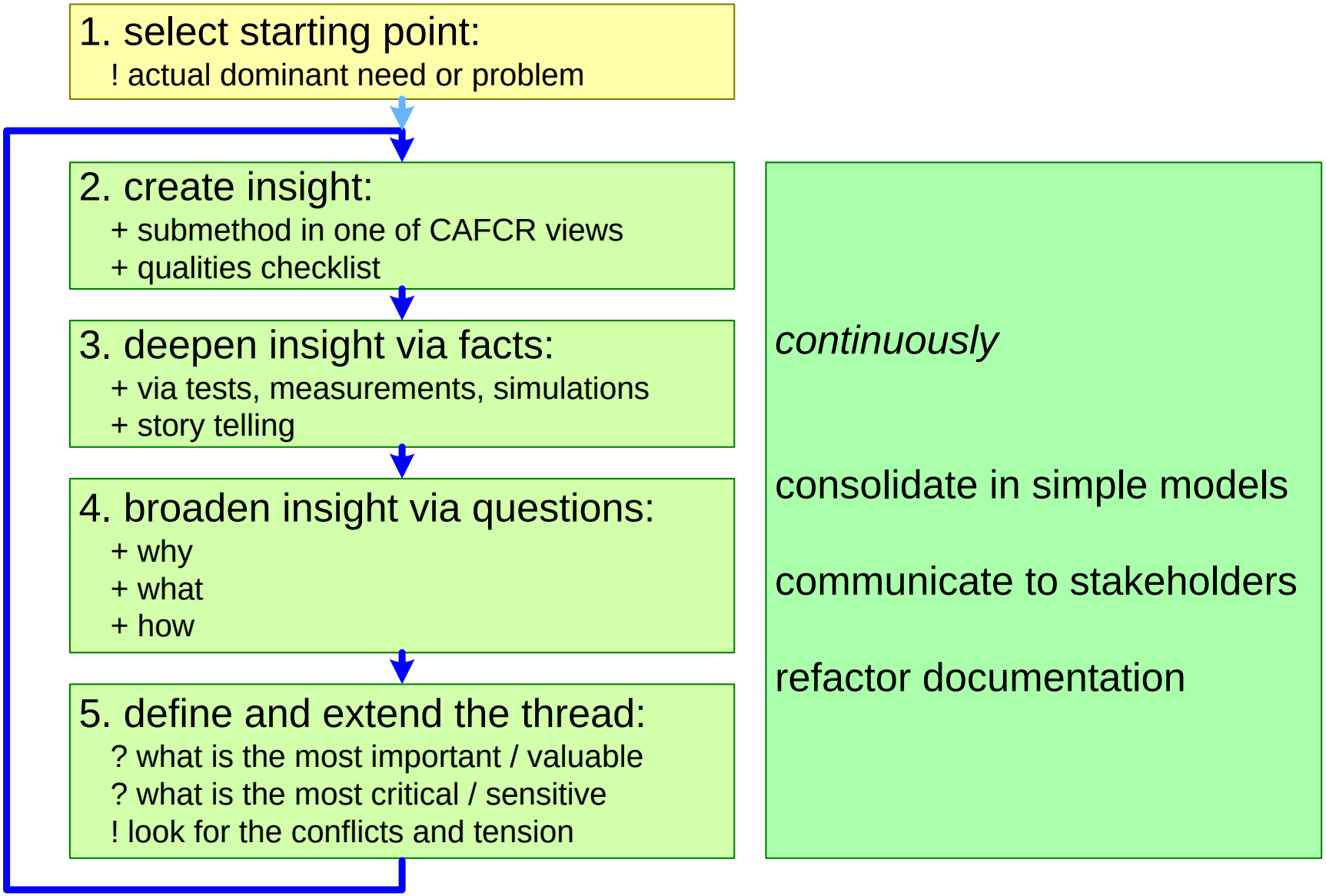
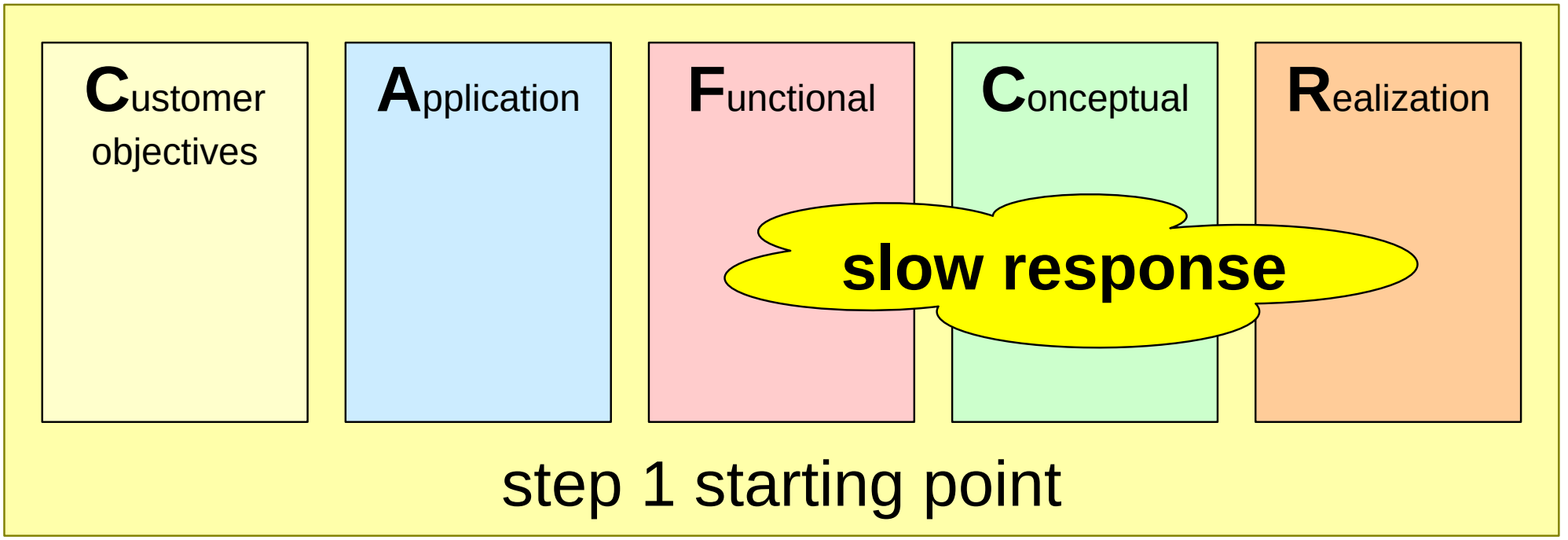


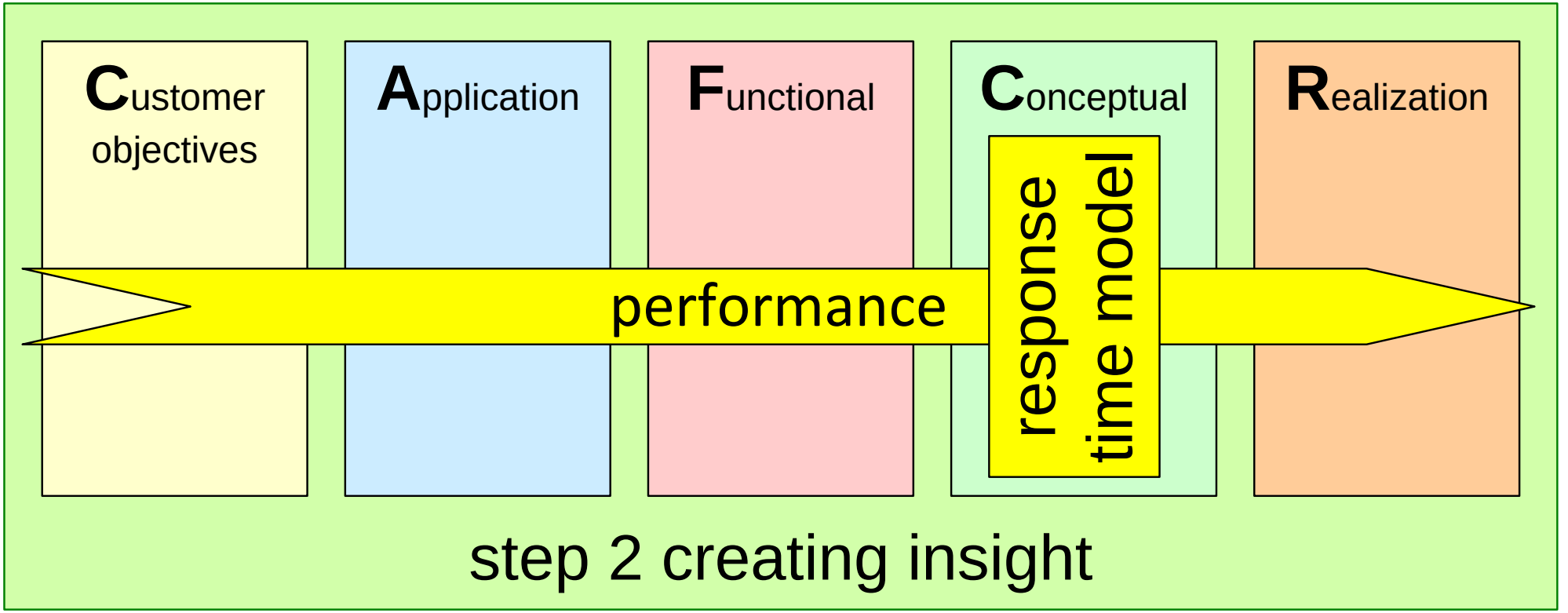
Overview of the reasoning approach



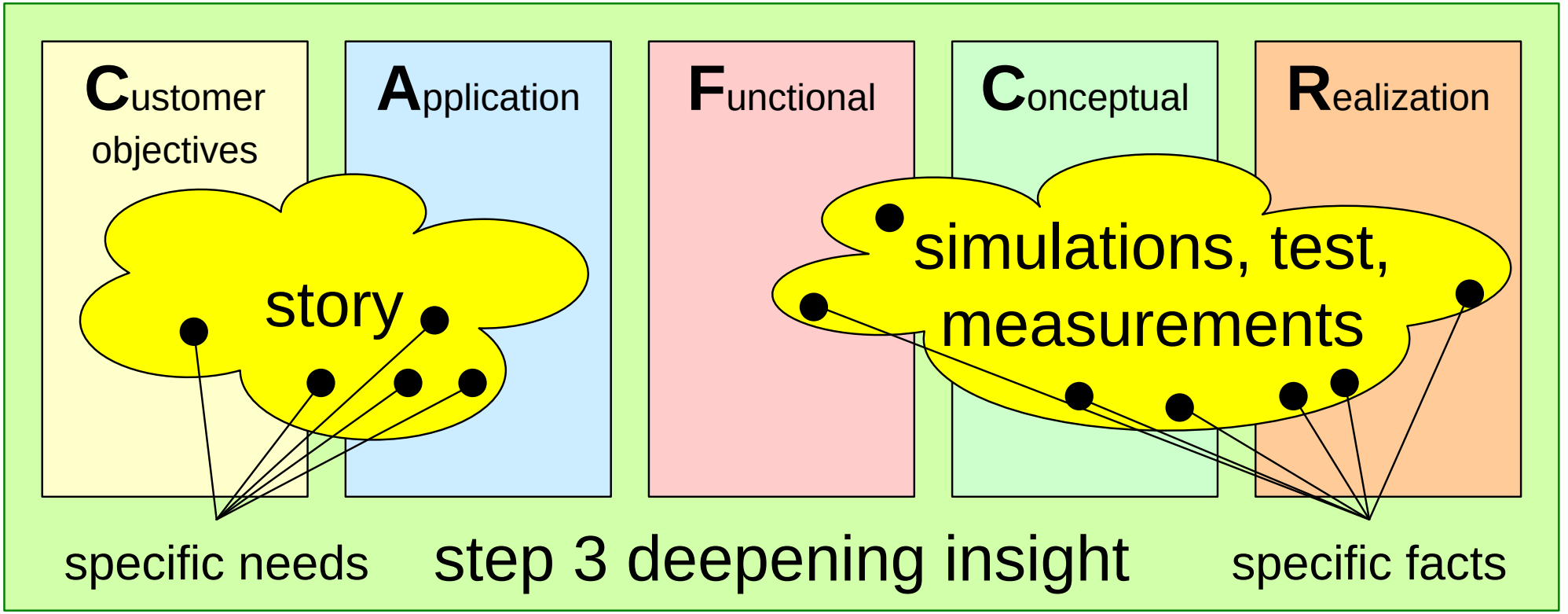
From starting point to insight



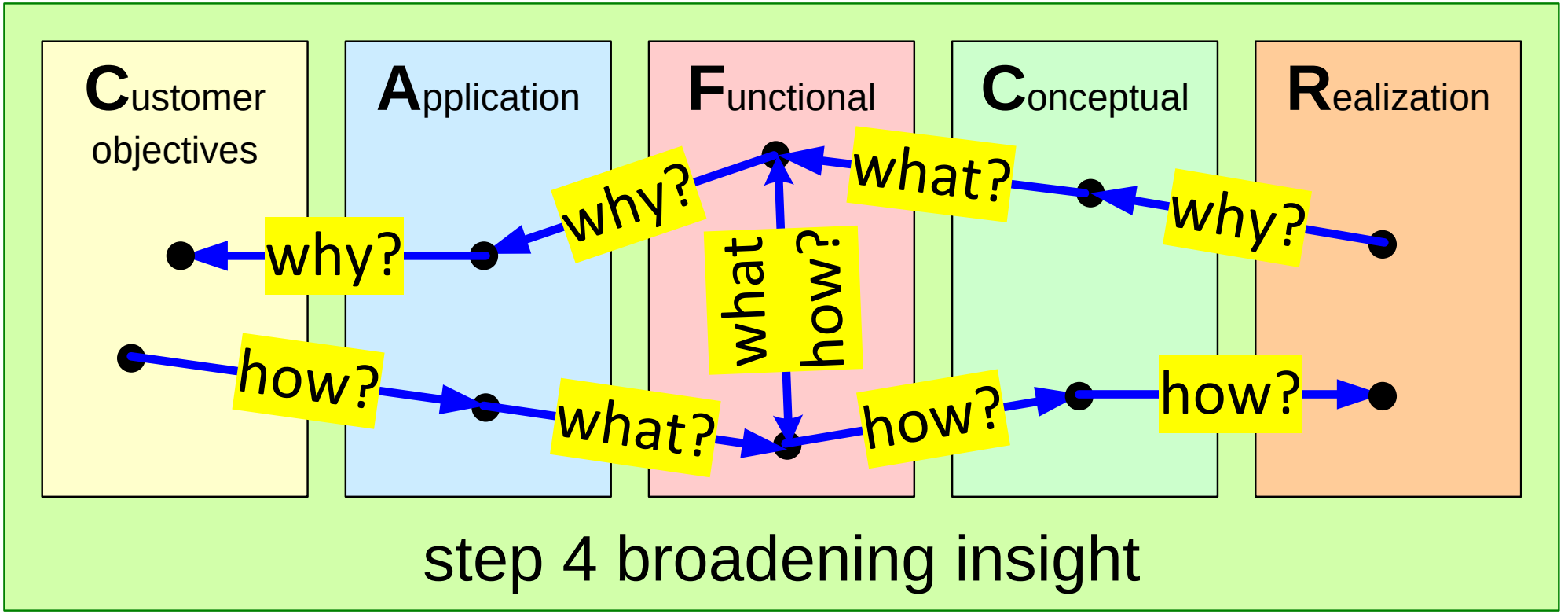
Creating Insight



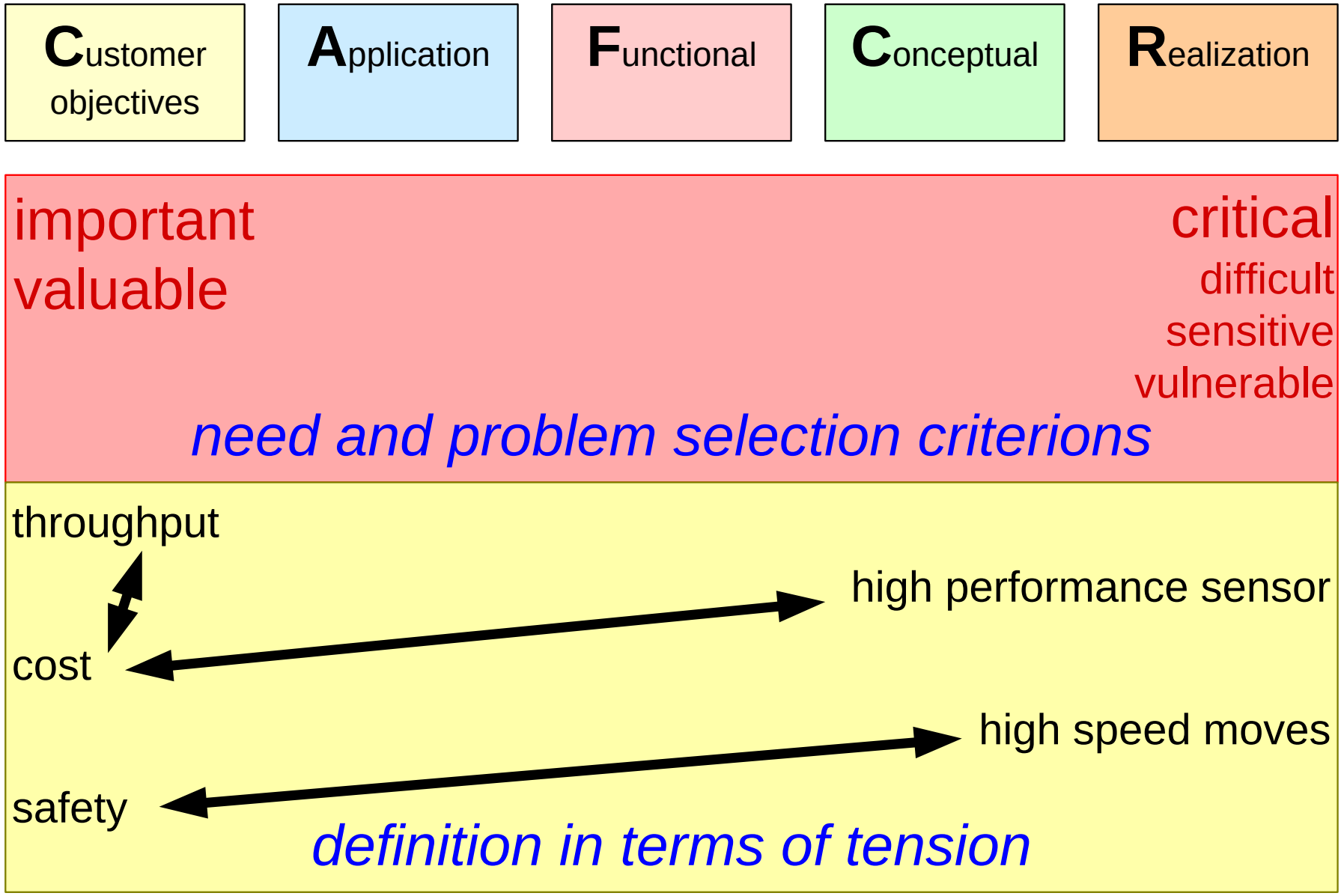
Deepening Insight



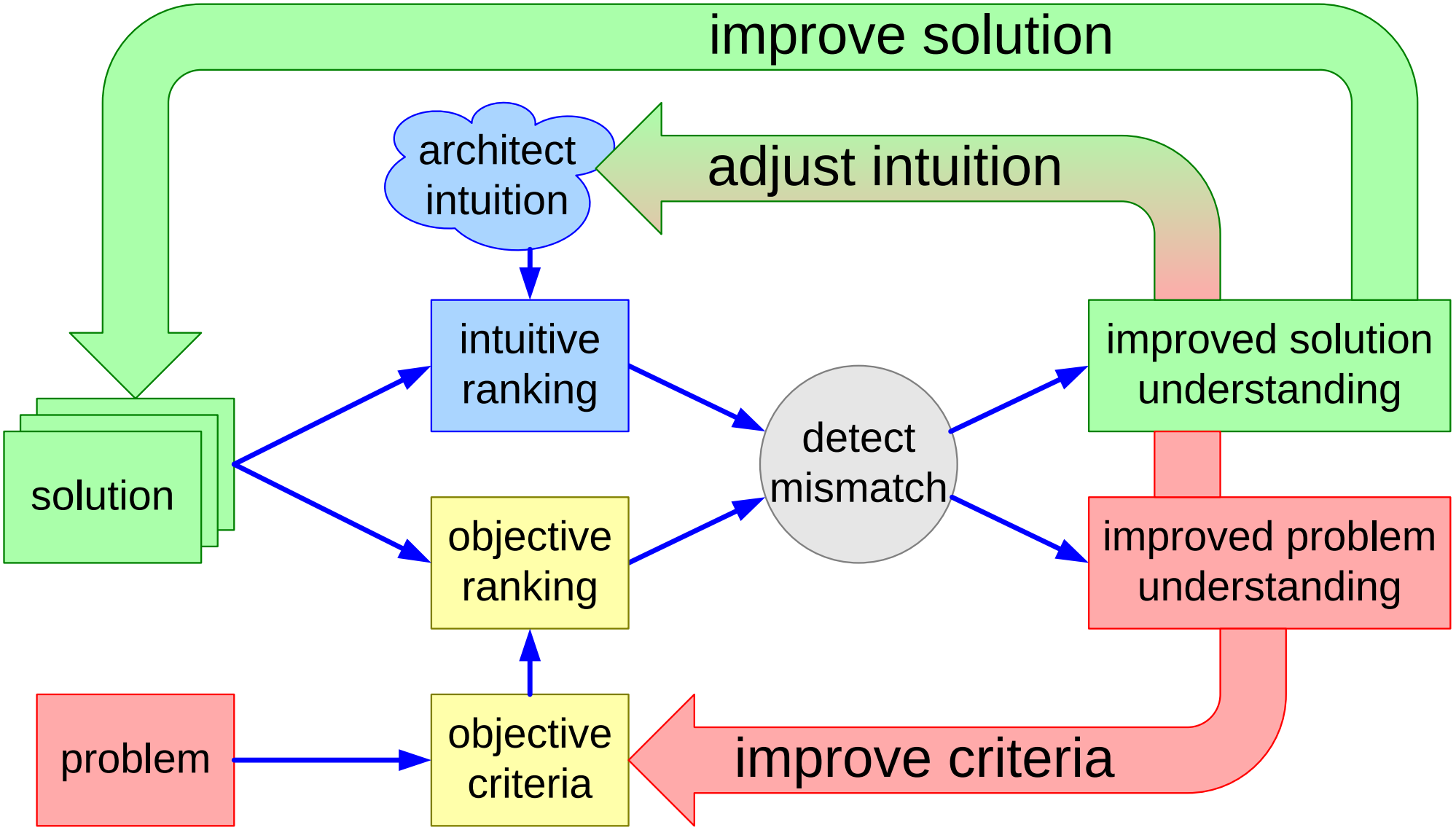
Broadening Insight



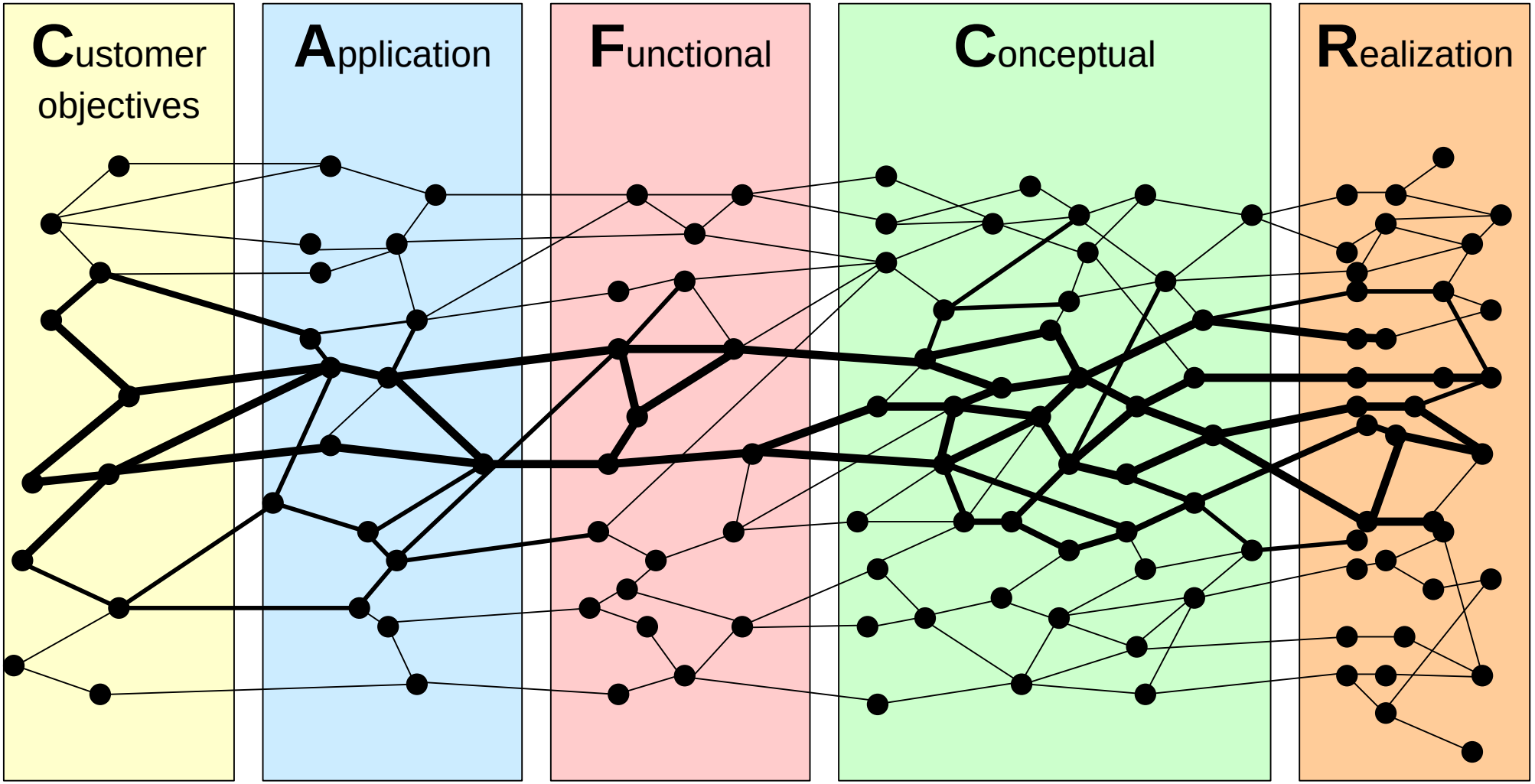
Problem identification and articulation



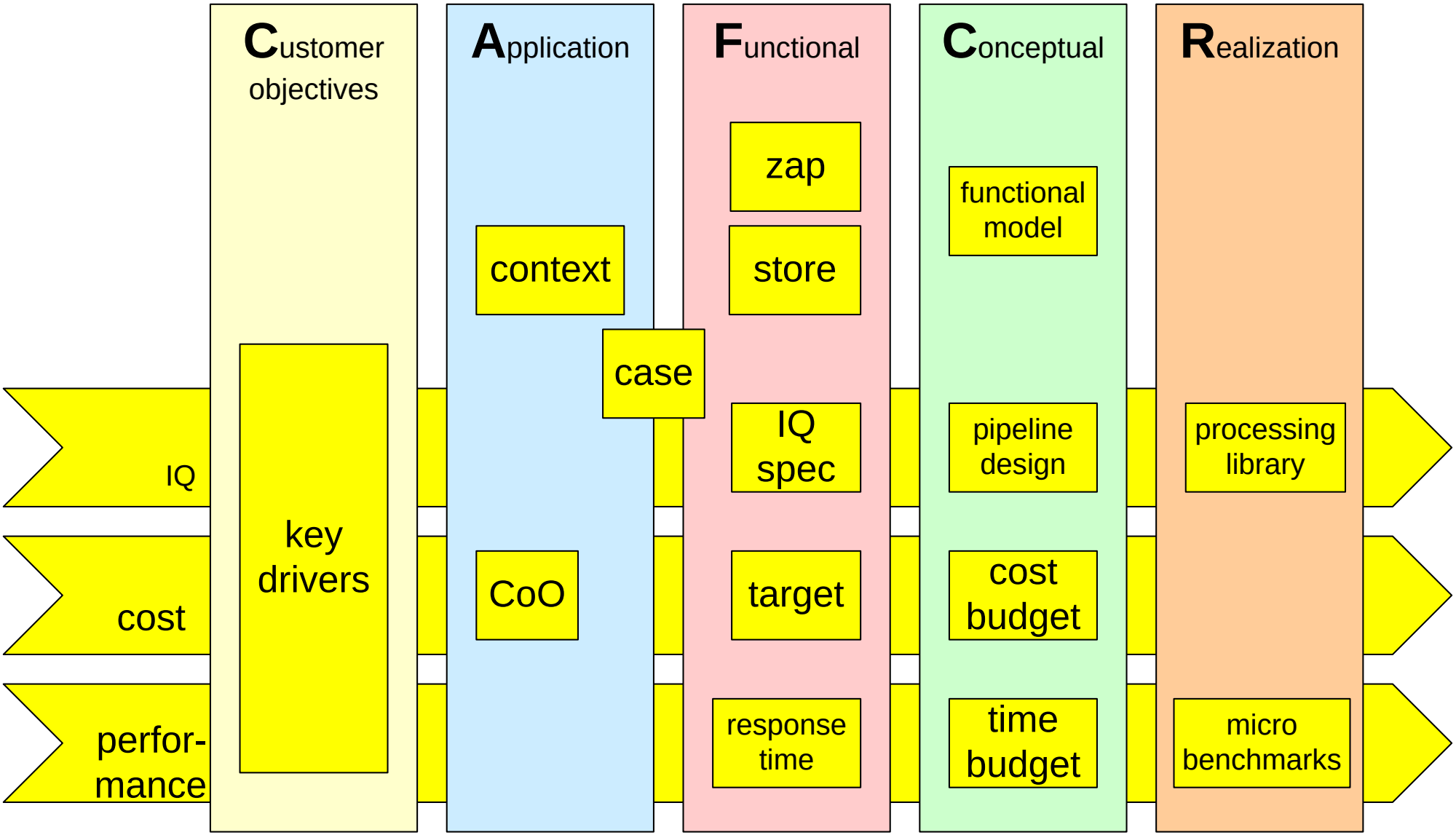
Iteration during the analysis



Thread of related issues



Documentation and communication structure



Threads of reasoning illustrated by medical imaging case

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Abstract

The medical imaging workstation case is introduced. An architecting method based on the CAFCR viewpoints is explained, consisting of 4 elements:

- the CAFCR viewpoints
- qualities as integrating needles
- story telling
- threads of reasoning

A thread of reasoning is build up in steps, based on this case. The underlying reasoning is explained.

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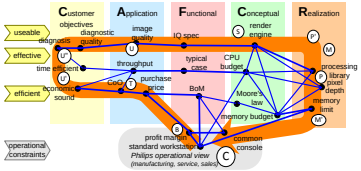
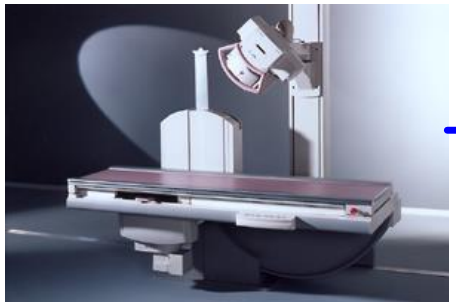
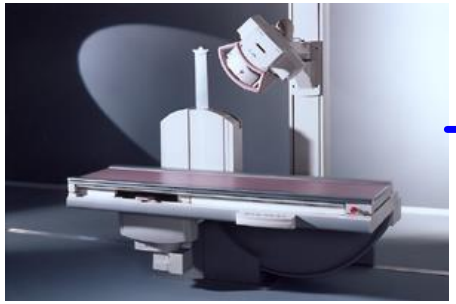
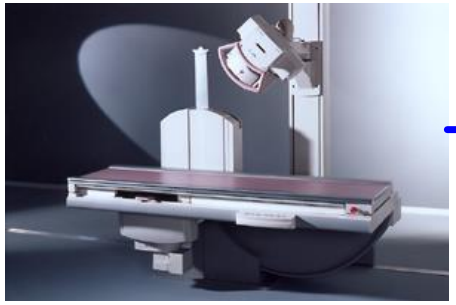


cost revisited in context of clinical needs and realization constraints; note: original threads are significantly simplified

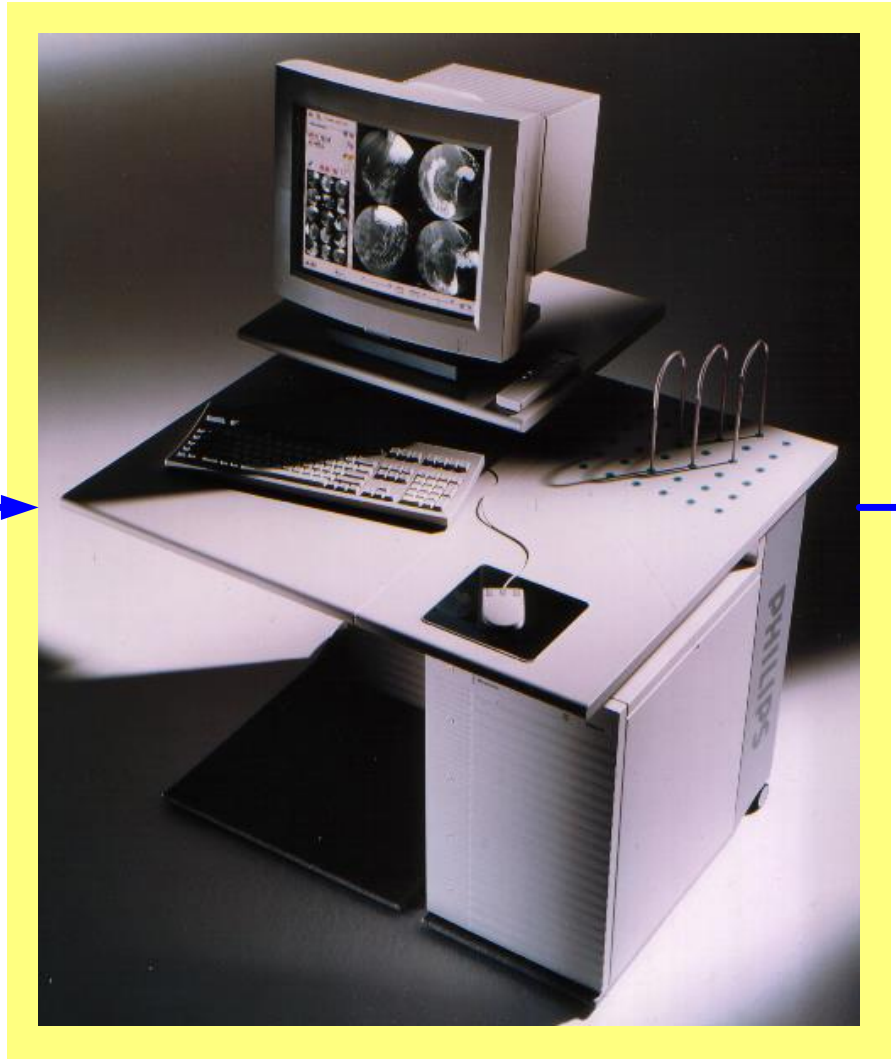
Easyvision serving three URF examination rooms







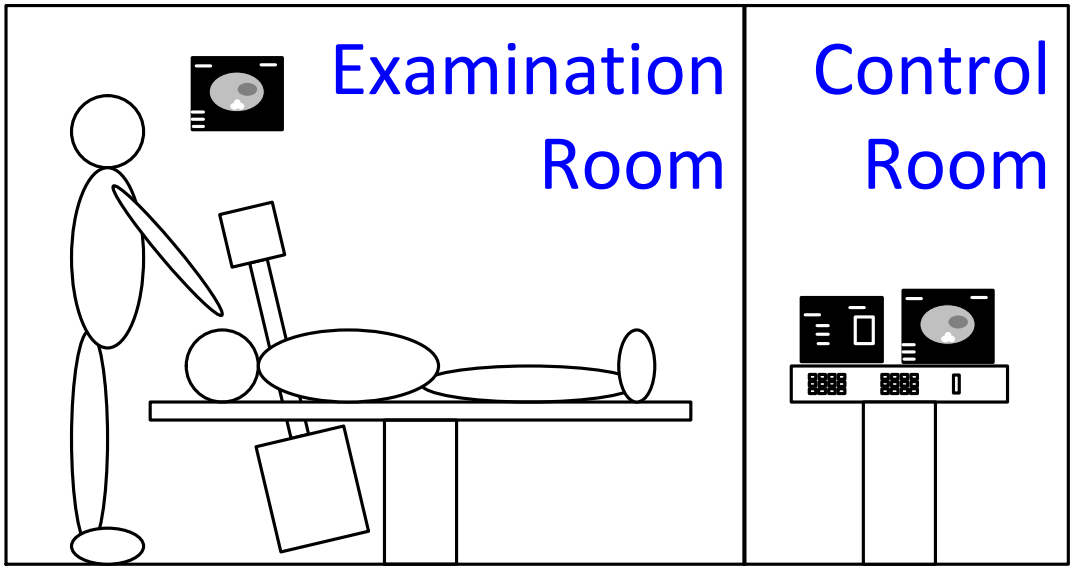
URF-systems

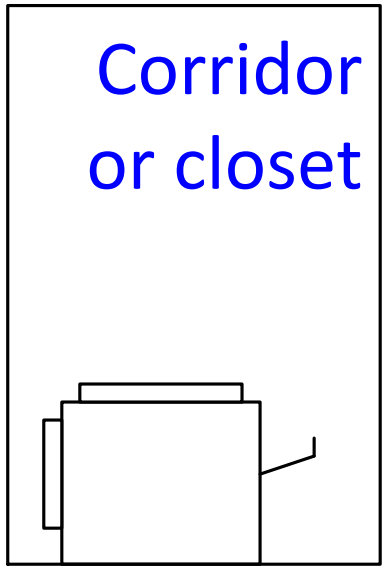


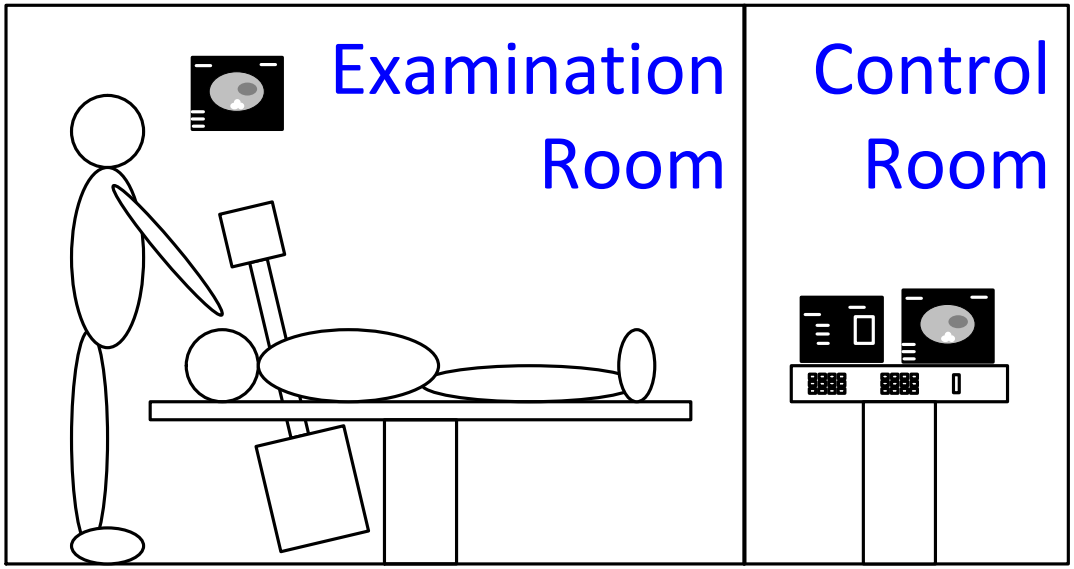
EasyVision: Medical Imaging Workstation

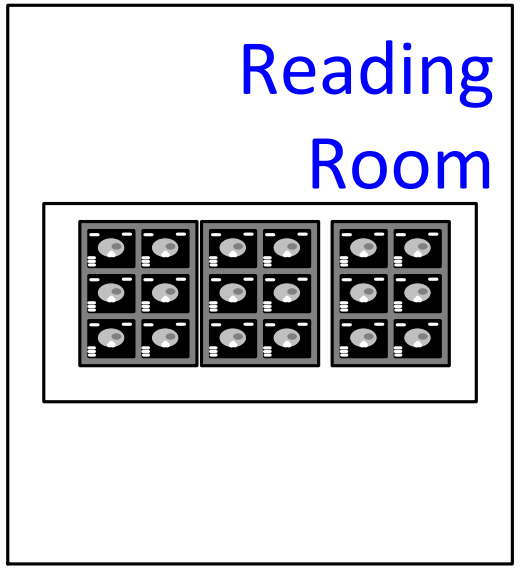
typical clinical image (intestines)

X-ray rooms from examination to reading around 1990

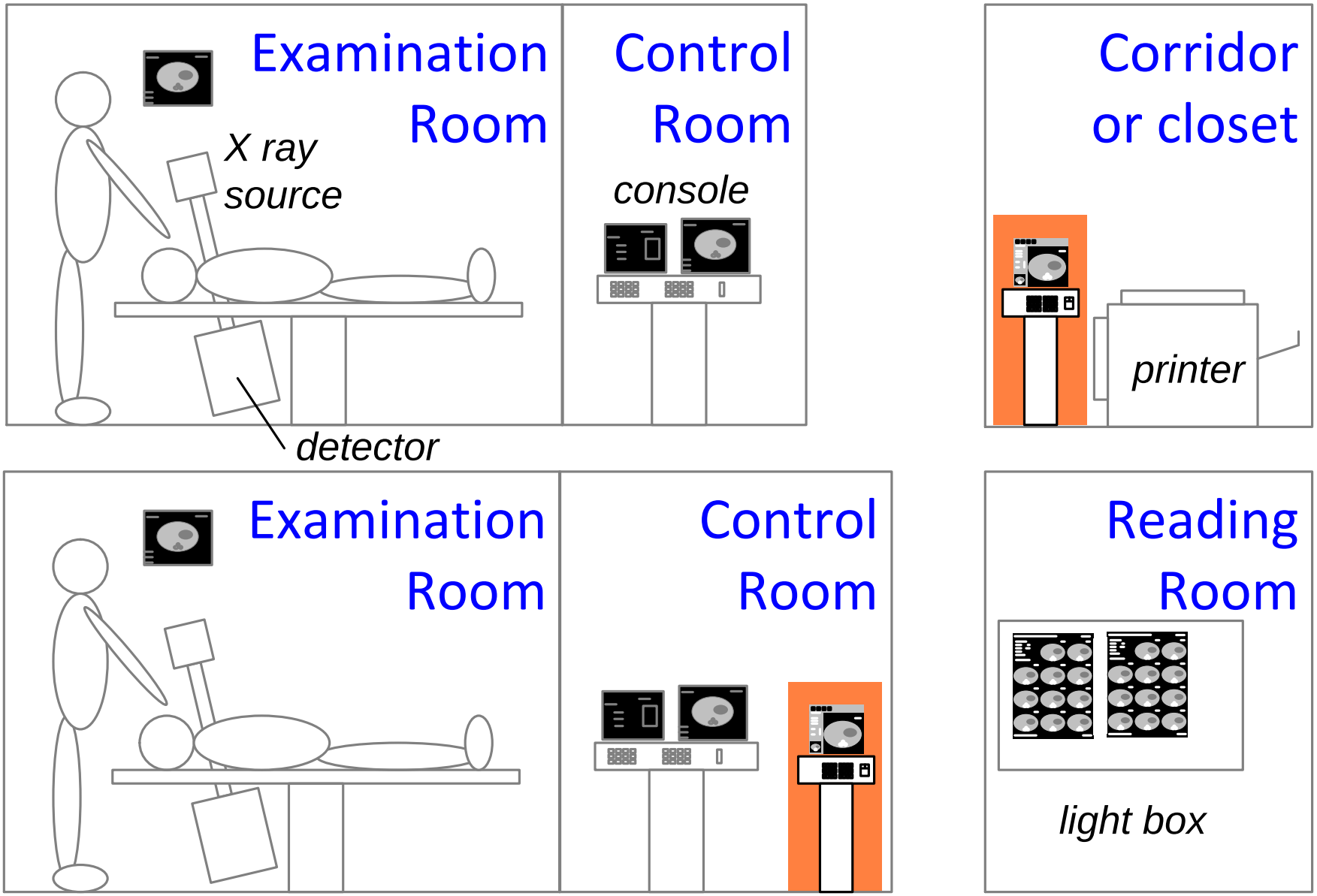




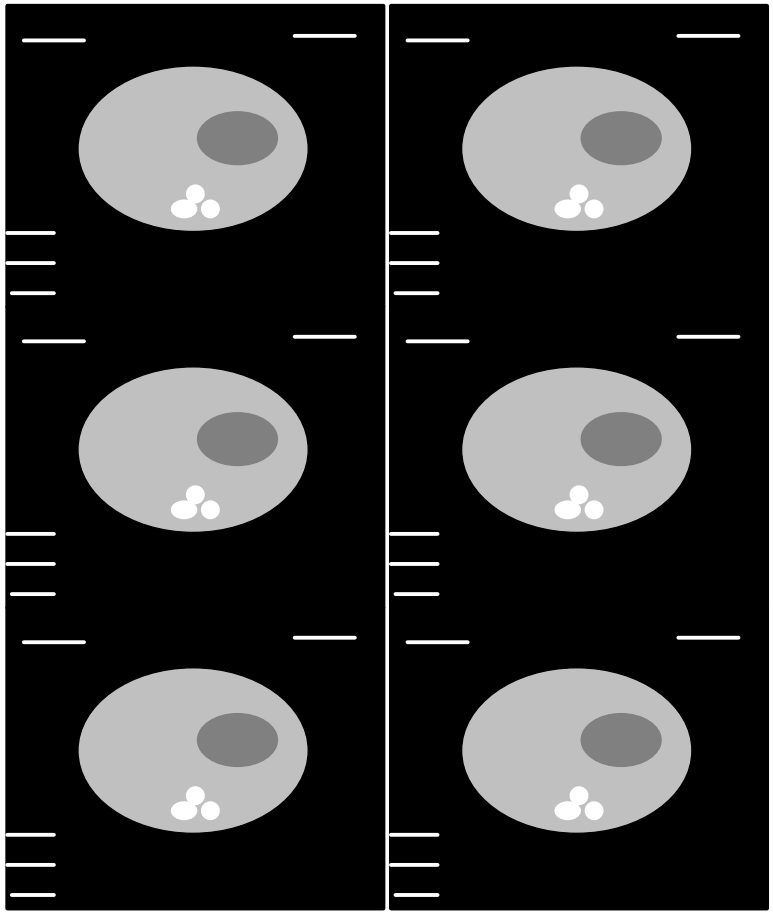




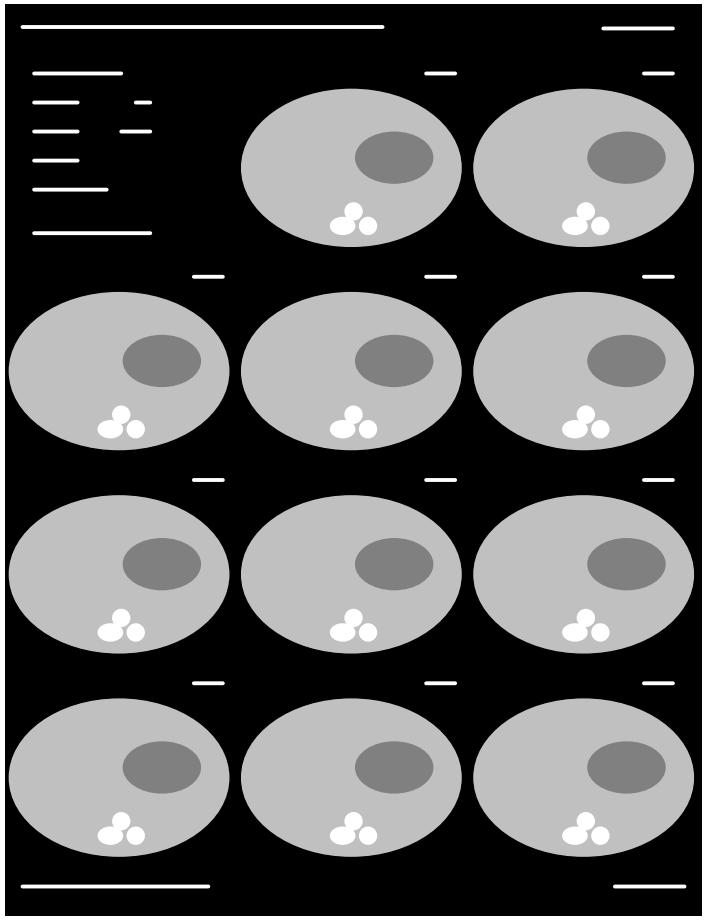
X-ray rooms with Easyvision applied as printserver



Comparison screen copy versus optimized film



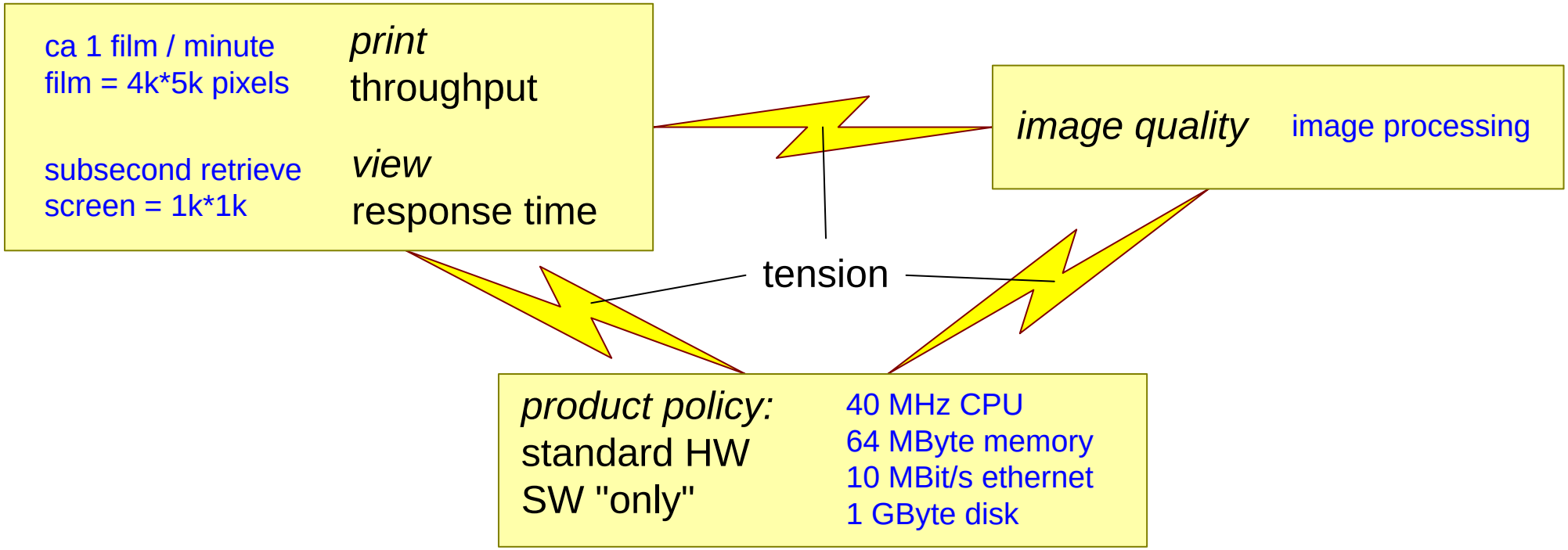
old: screen copy



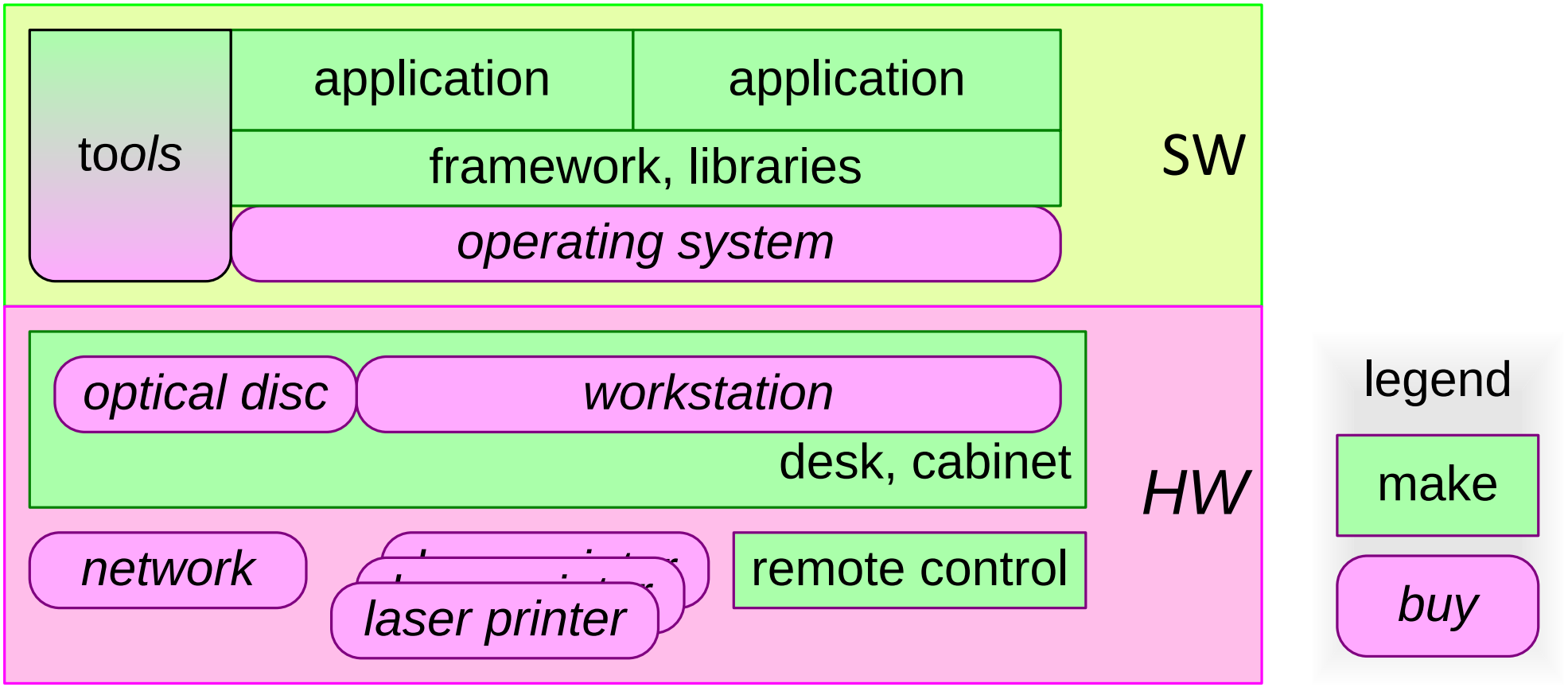
new: SW formatting

20 to 50% less film needed

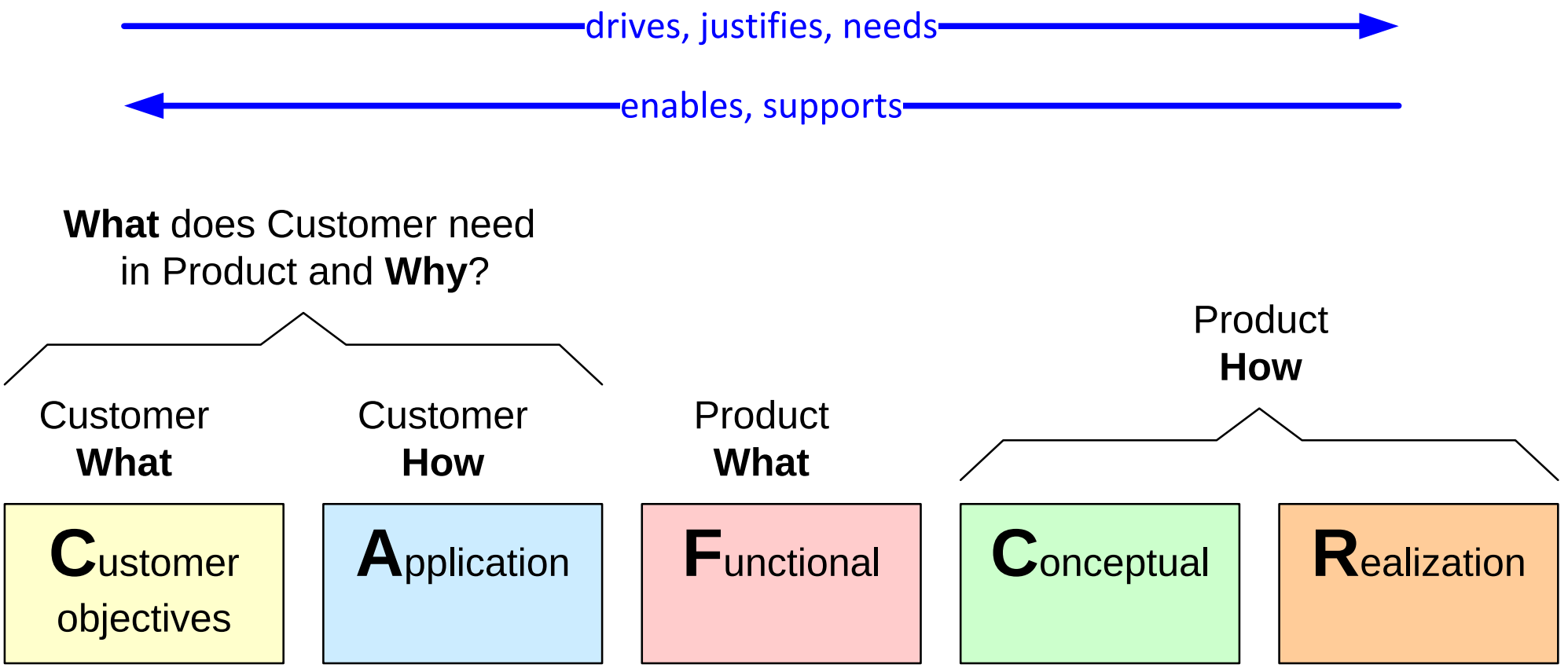
Challenges for product creation



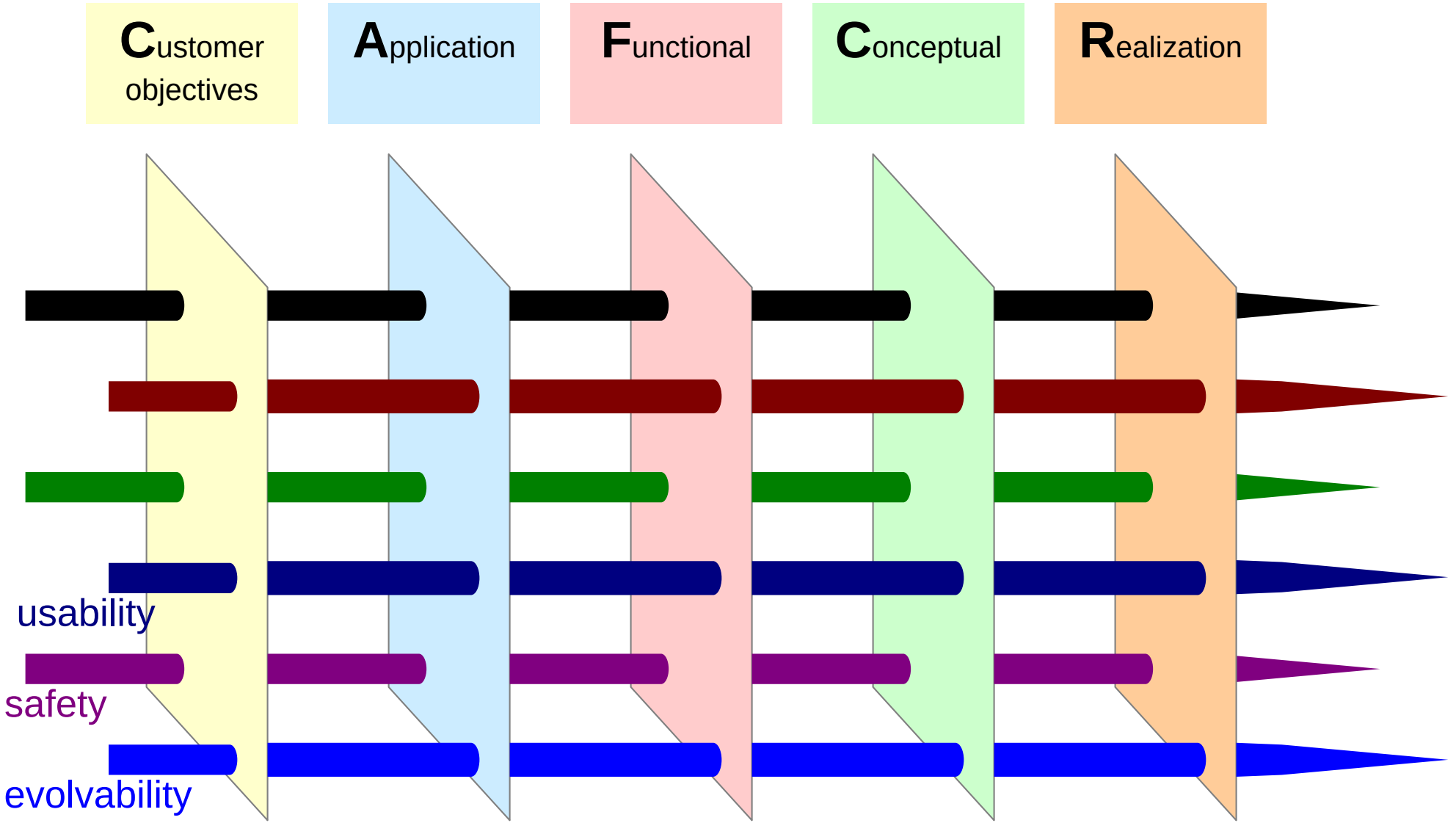
Top level decomposition



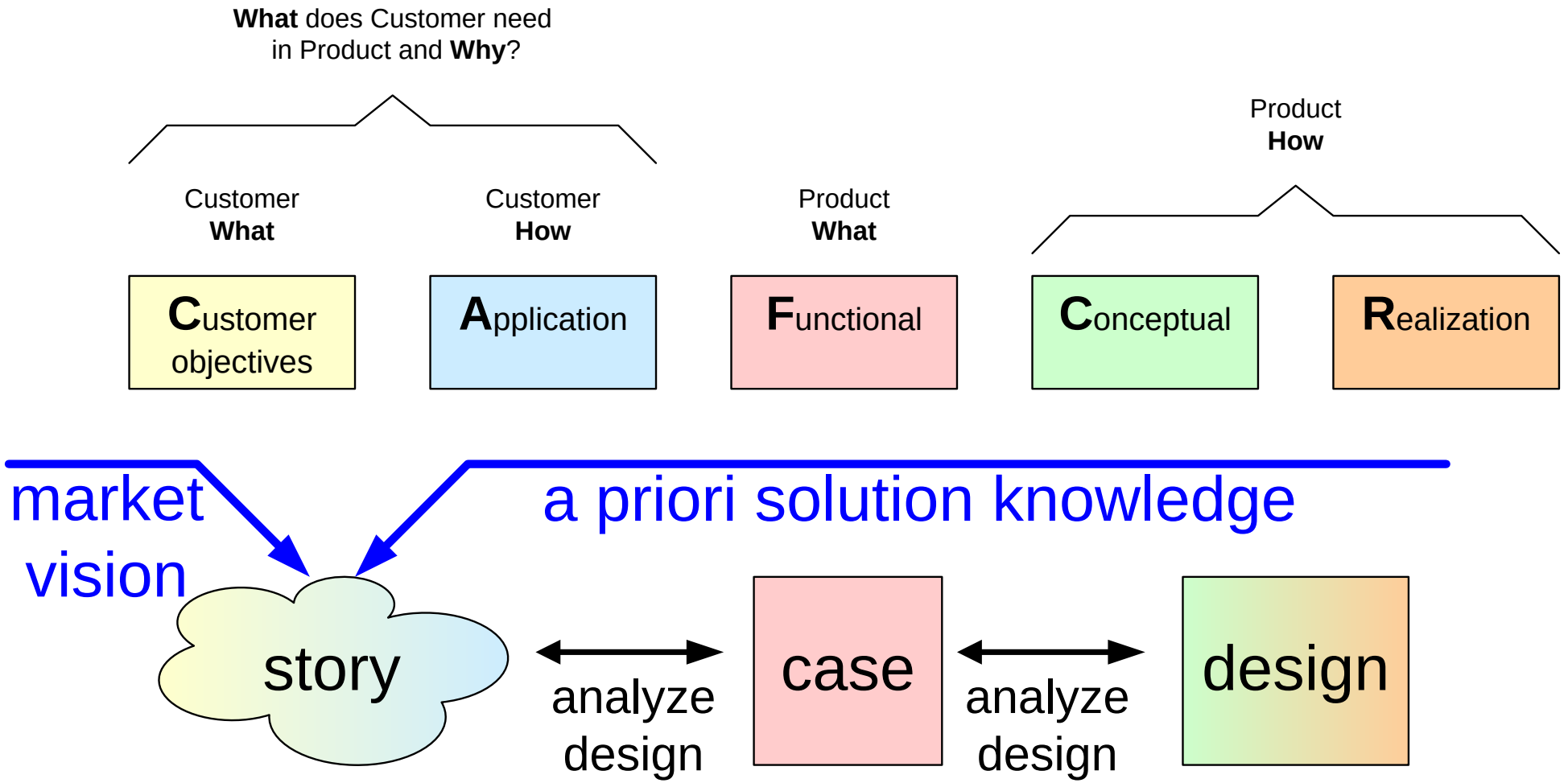
CAFCR viewpoints



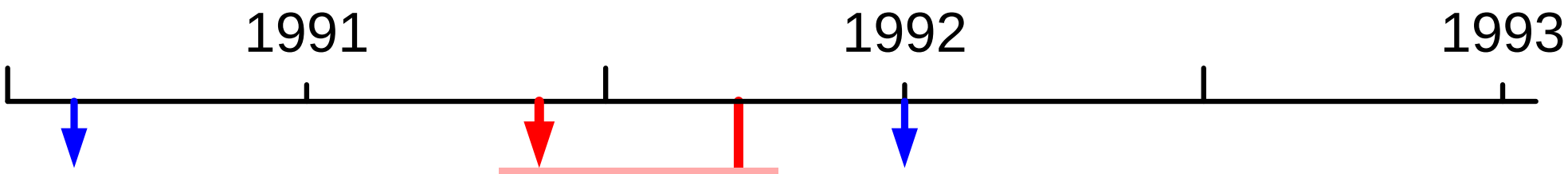
Quality needles as generic integrating concepts



From story to design



Chronology of Easyvision RF R1 development



basic application
toolboxes
100 kloc

interactive viewing

performance
problems

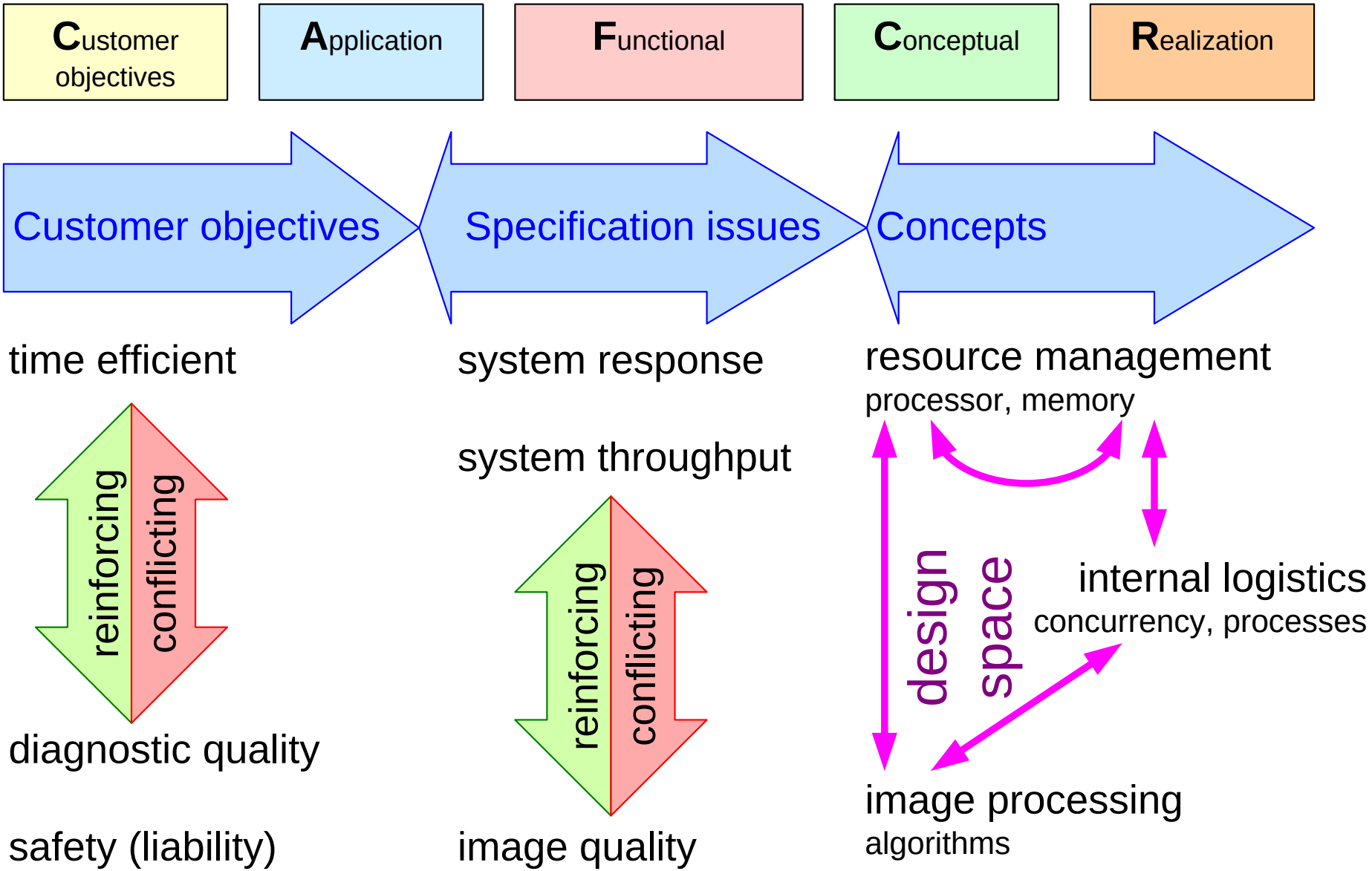
IQ
problems

Easyvision RF
integrated product
360 kloc

print server +
communication +
interactive viewing

marketing opinion:
"All the functionality is available,
we only have to provide a clinical UI"

Thread of reasoning based on efficiency-quality tension

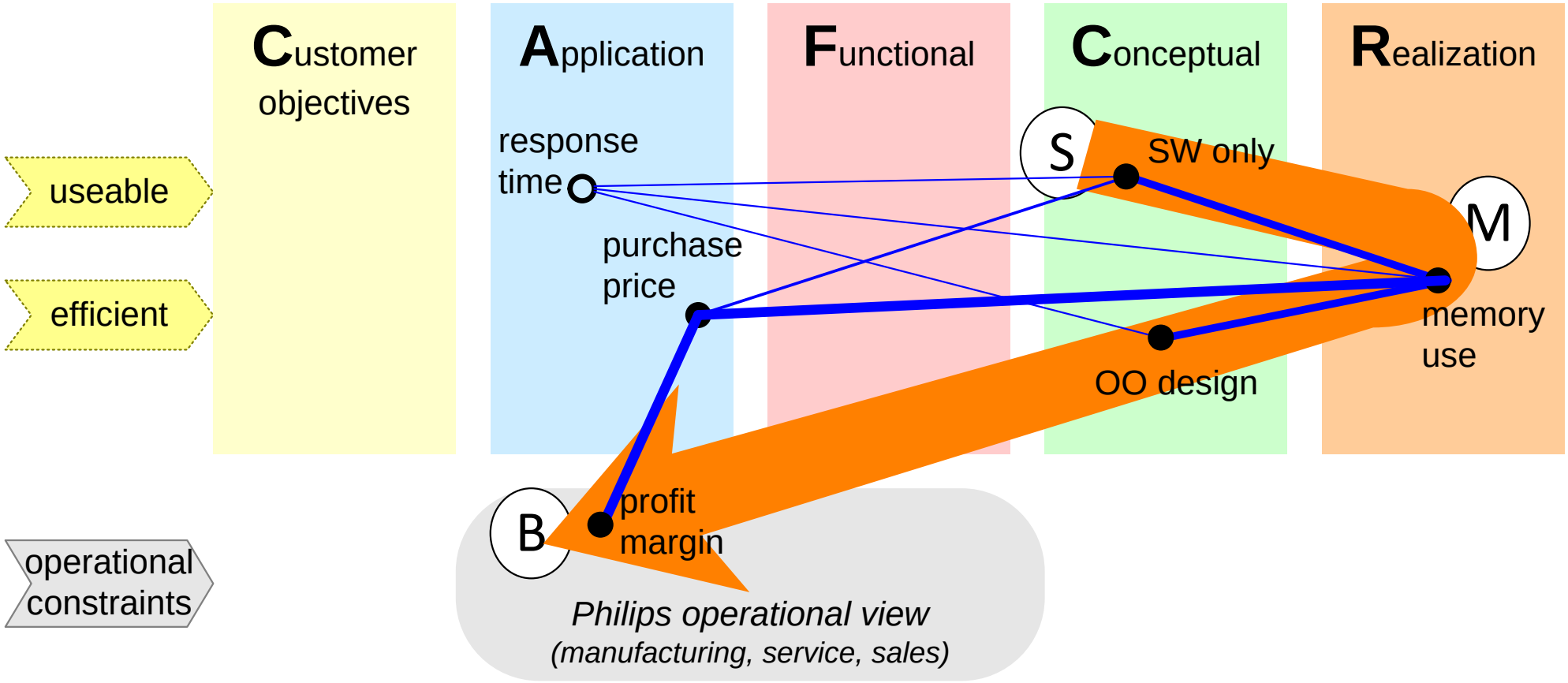


Technology innovations

performance
cost

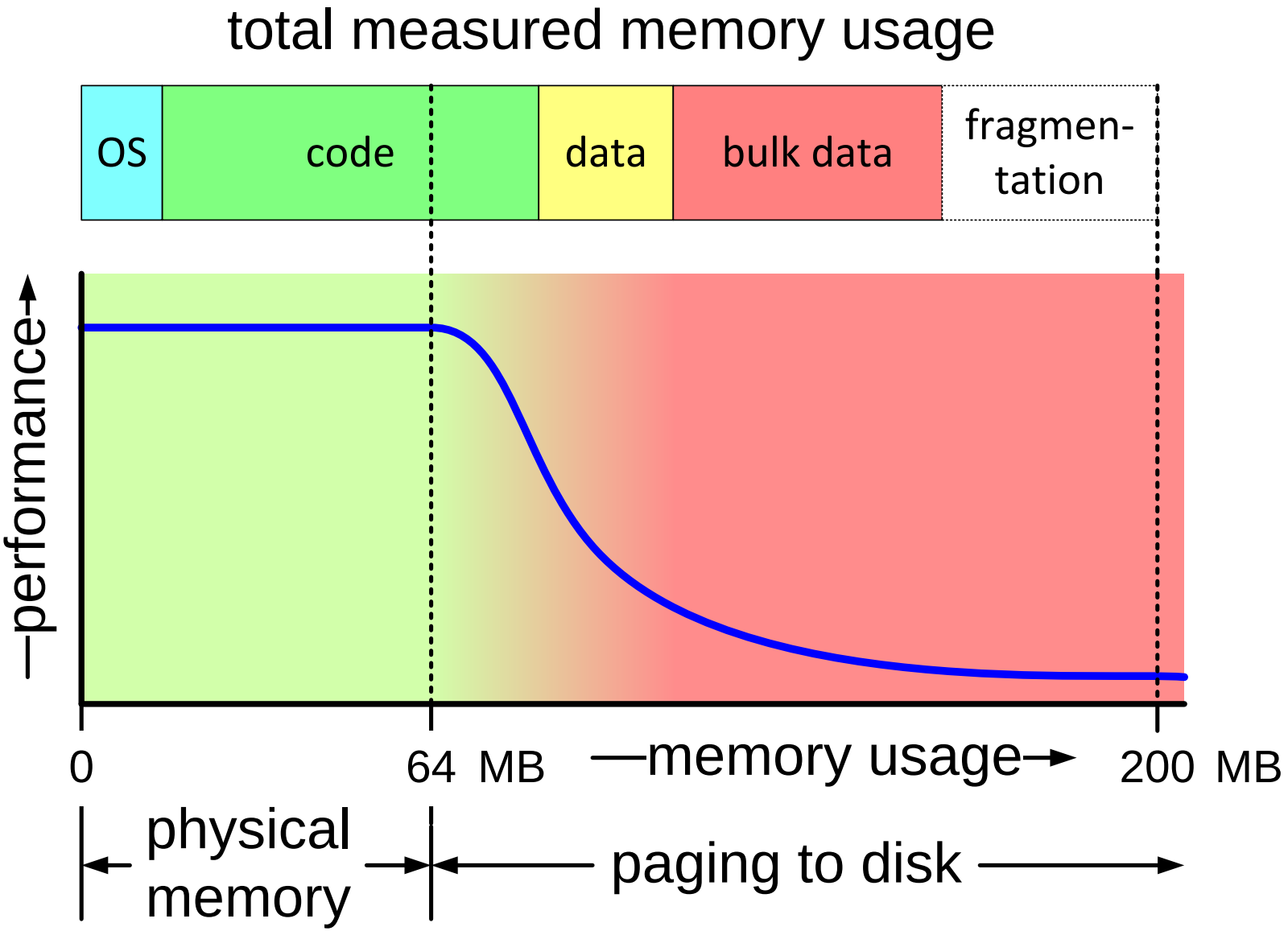
- standard UNIX based workstation
- full SW implementation, more flexible
- object oriented design and implementation (Objective-C)
- graphical User Interface, with windows, mouse etcetera
- call back scheduling, fine-grained notification
- data base engine, fast, reliable and robust
- extensive set of toolboxes
- property based configuration
- multiple coordinate spaces

Thread of reasoning; introvert phase

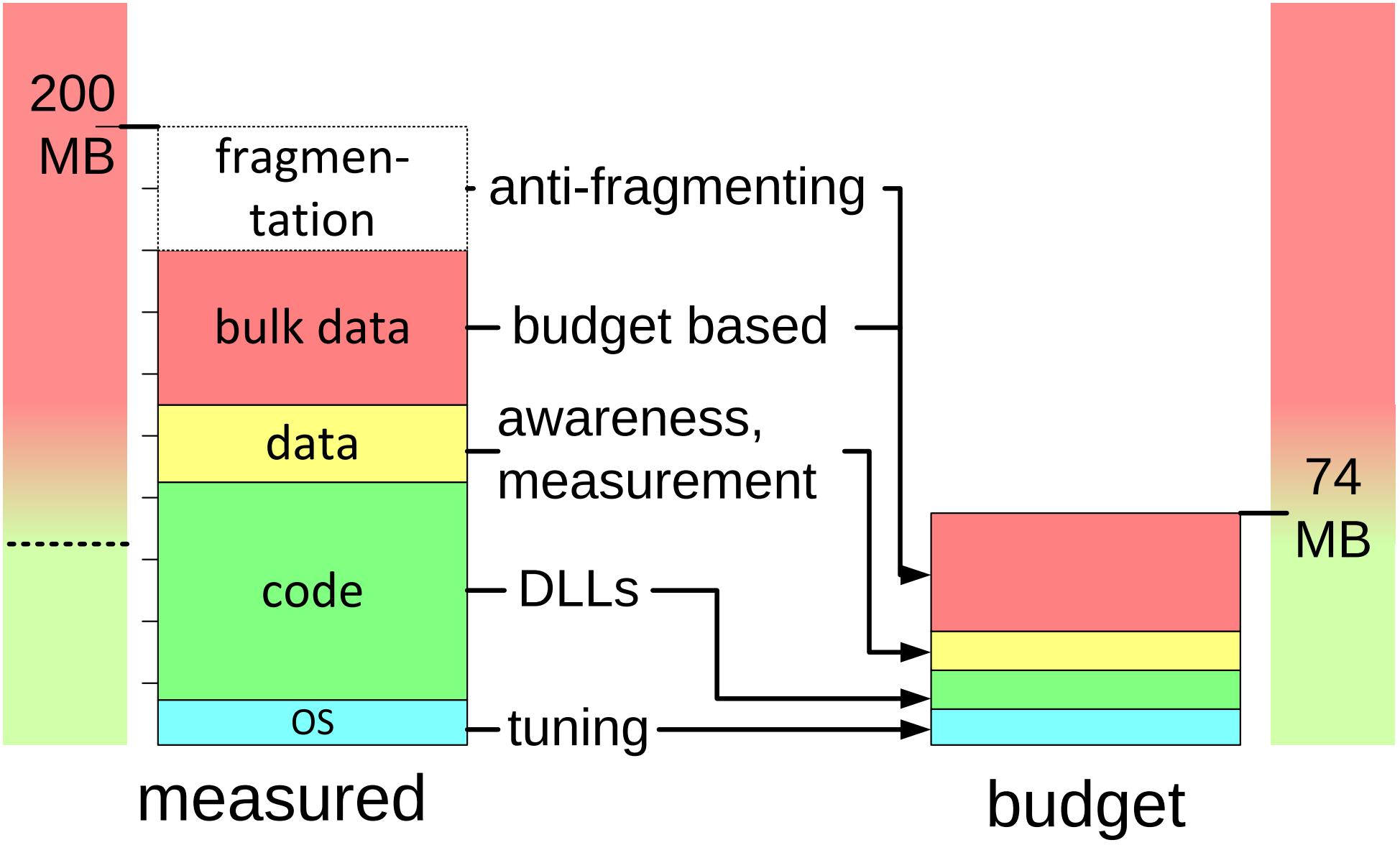


Introvert view: cost and impact of new technologies

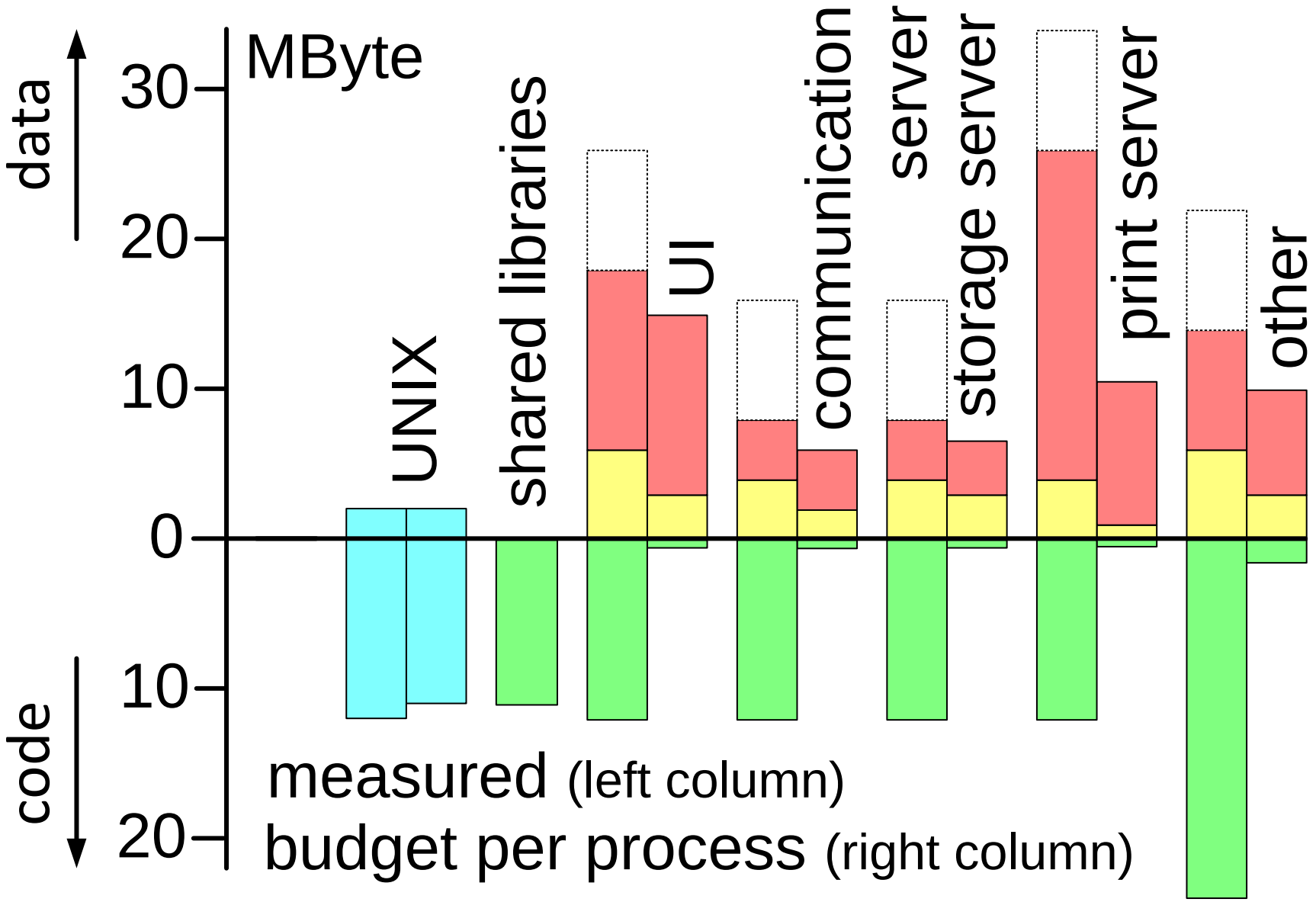
Memory usage half way R1



Solution of memory performance problem

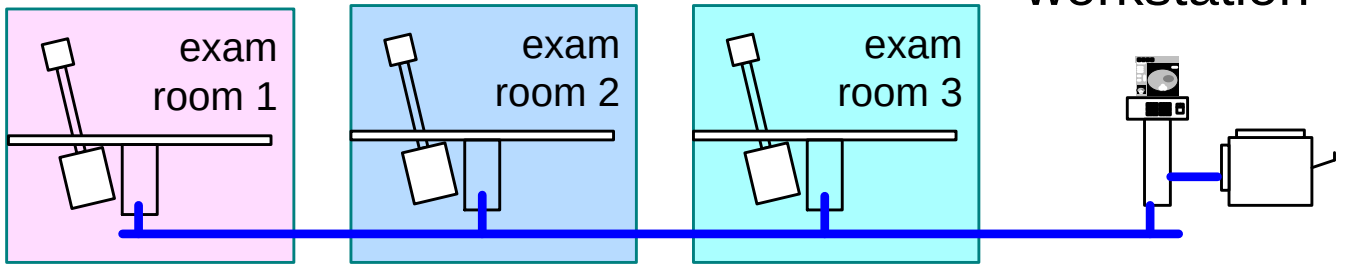


Visualization memory use per process



Typical case URF examination

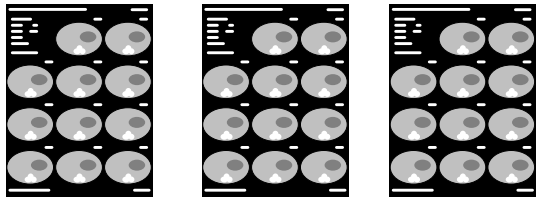
3 examination rooms connected to 1 medical imaging workstation + printer



examination room: average 4 interleaved examinations / hour

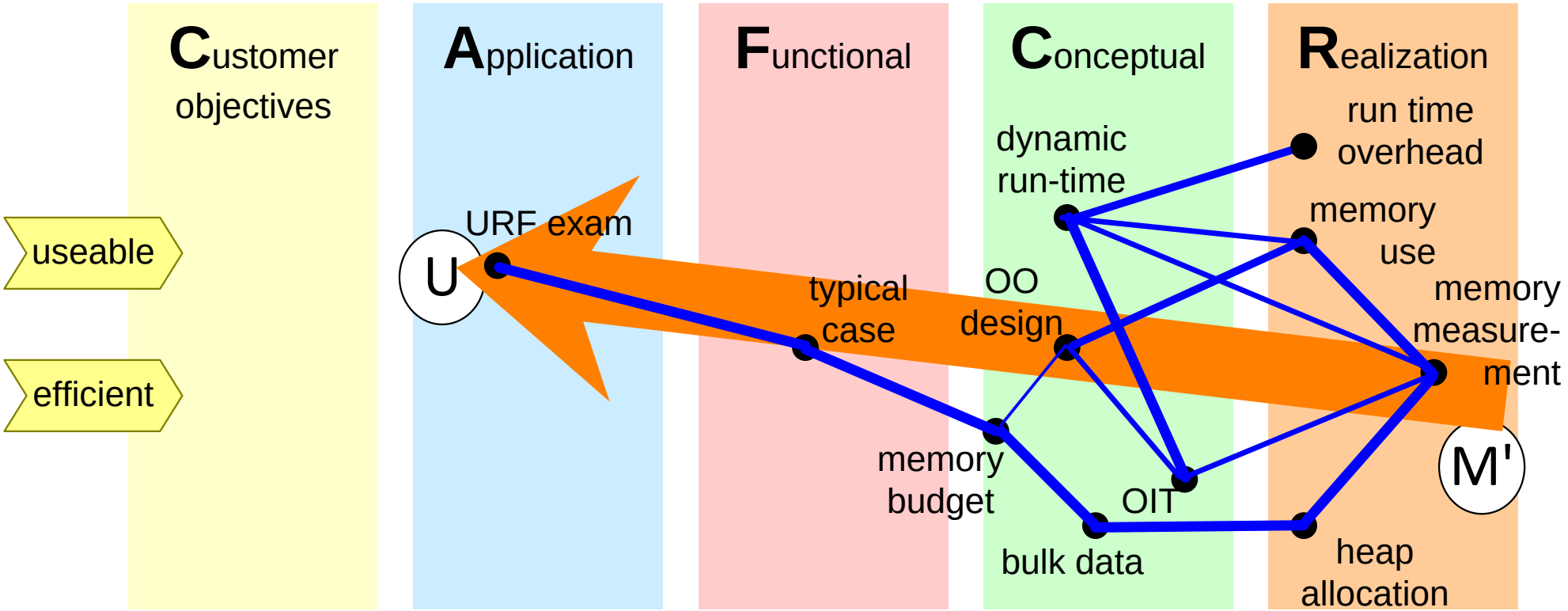
image production: 20 1024^2 8 bit images per examination

film production: 3 films of 4k*5k pixels each



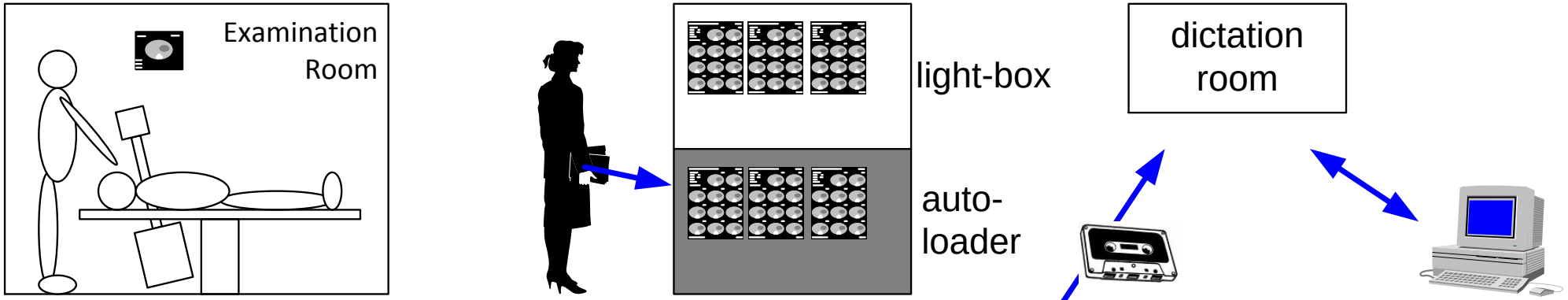
high quality output
(bi-cubic interpolation)

Thread of reasoning; phase 2



How to measure memory, how much is needed?
from introvert to extrovert

Radiologist workspots and activities



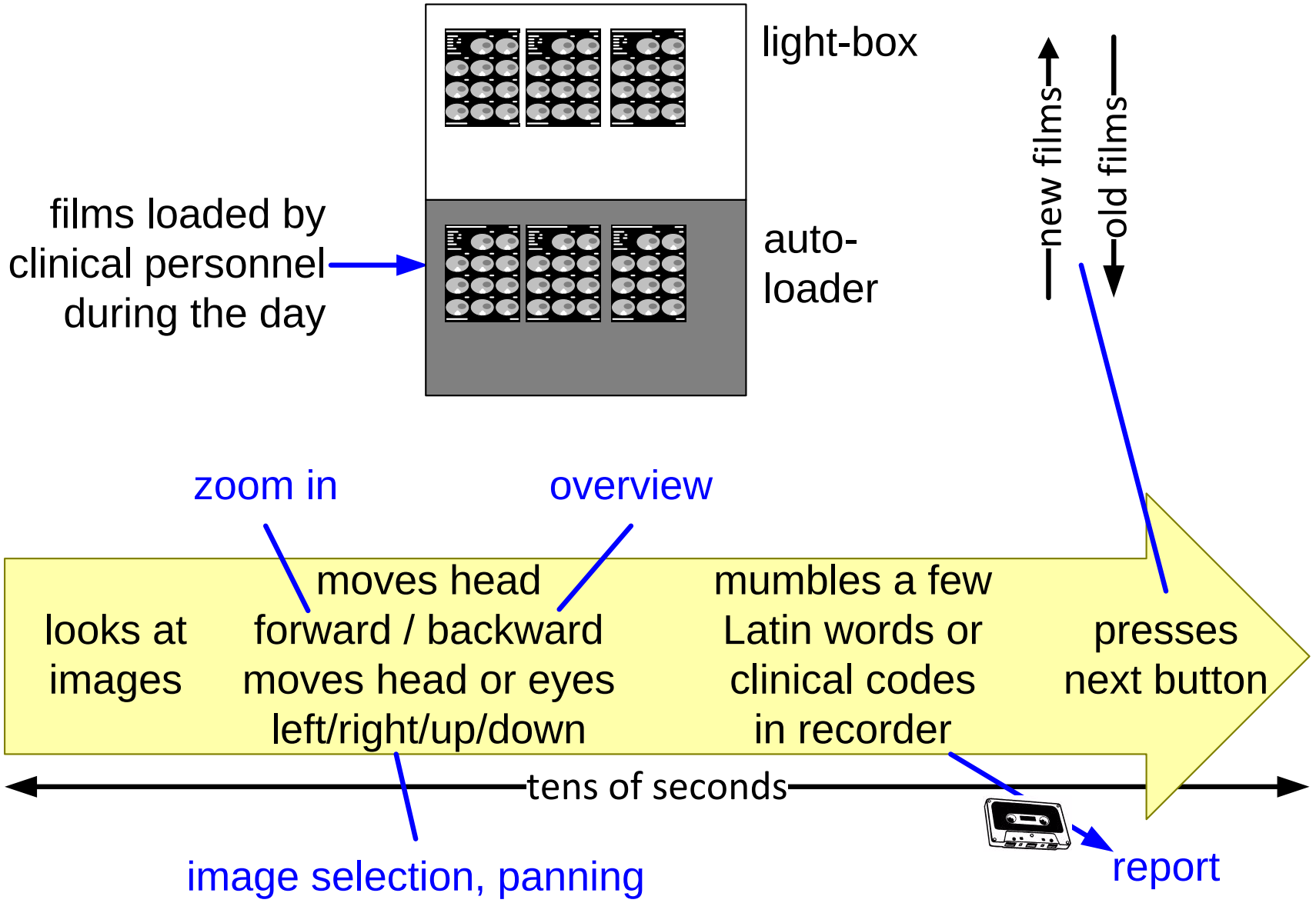
supervision of the examination

view and diagnose, dictate report

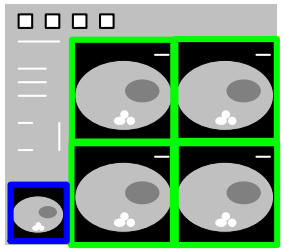
verify and authorise report

activities of the radiologist

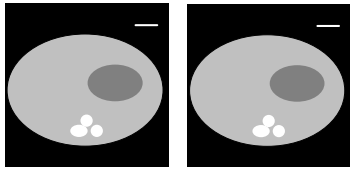
Diagnosis in tens of seconds



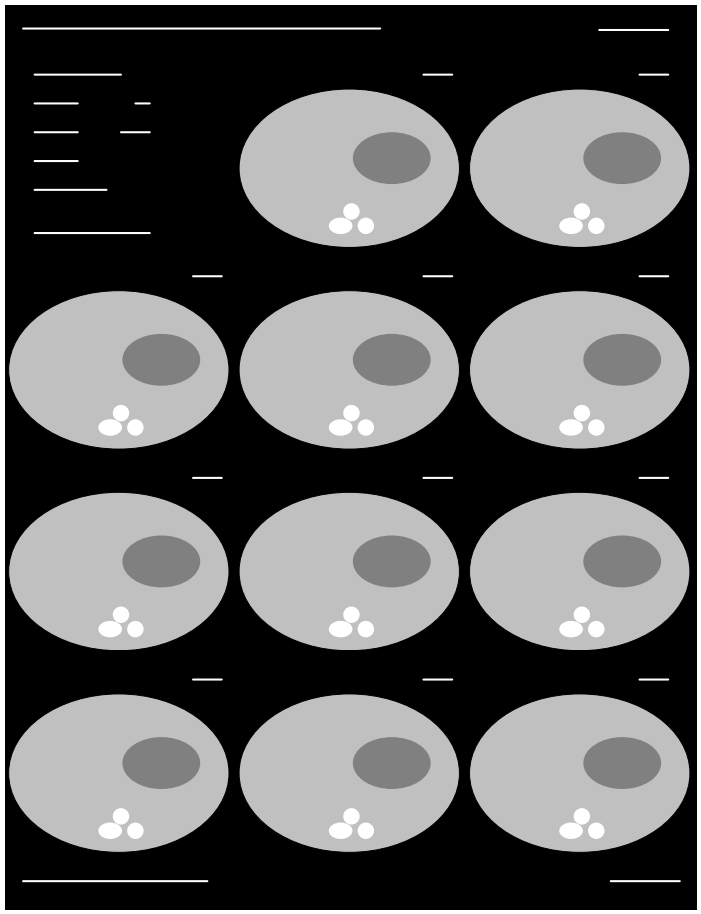
Rendered images at different destinations



Screen:
low resolution
fast response

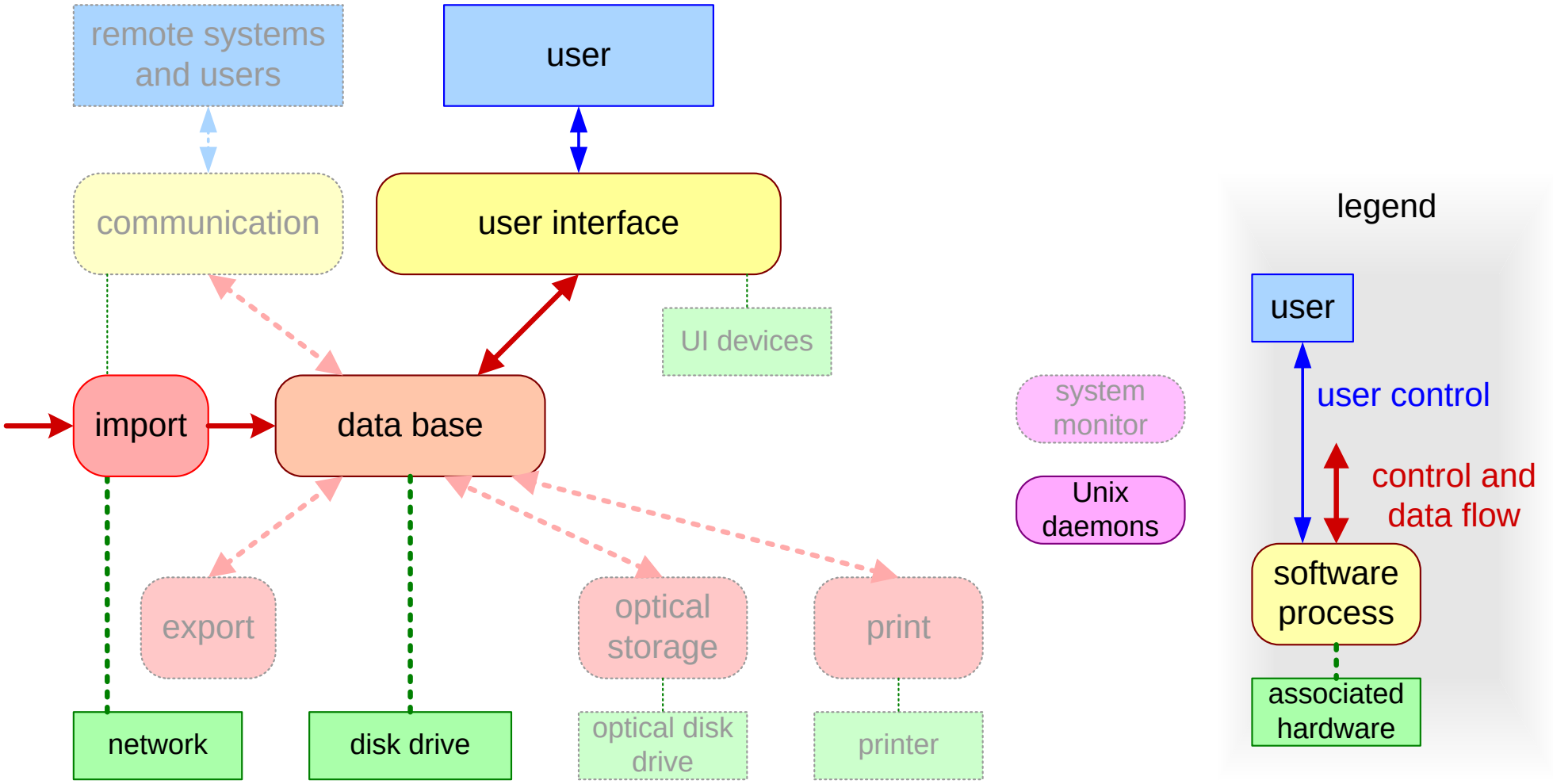


Network:
medium resolution
high throughput

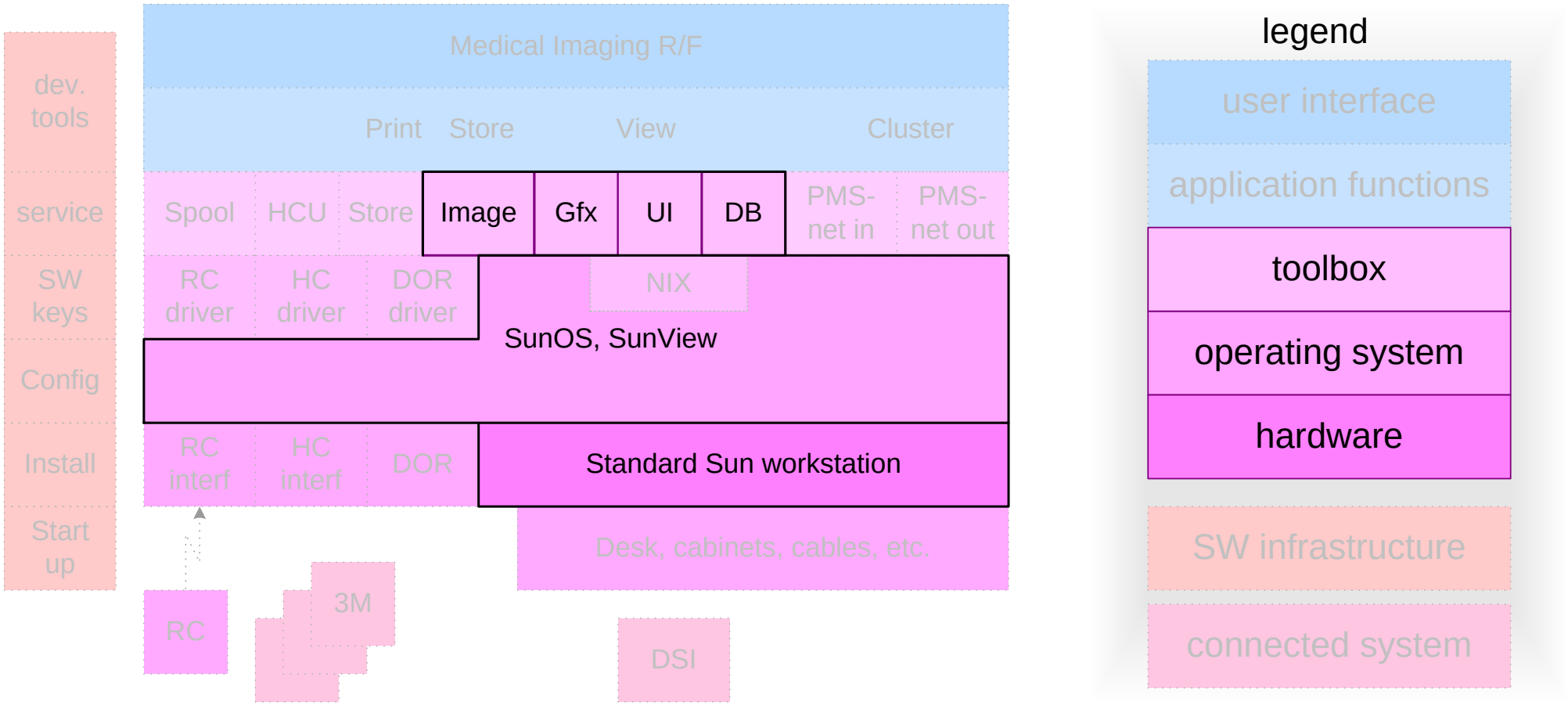


Film:
high resolution
high throughput

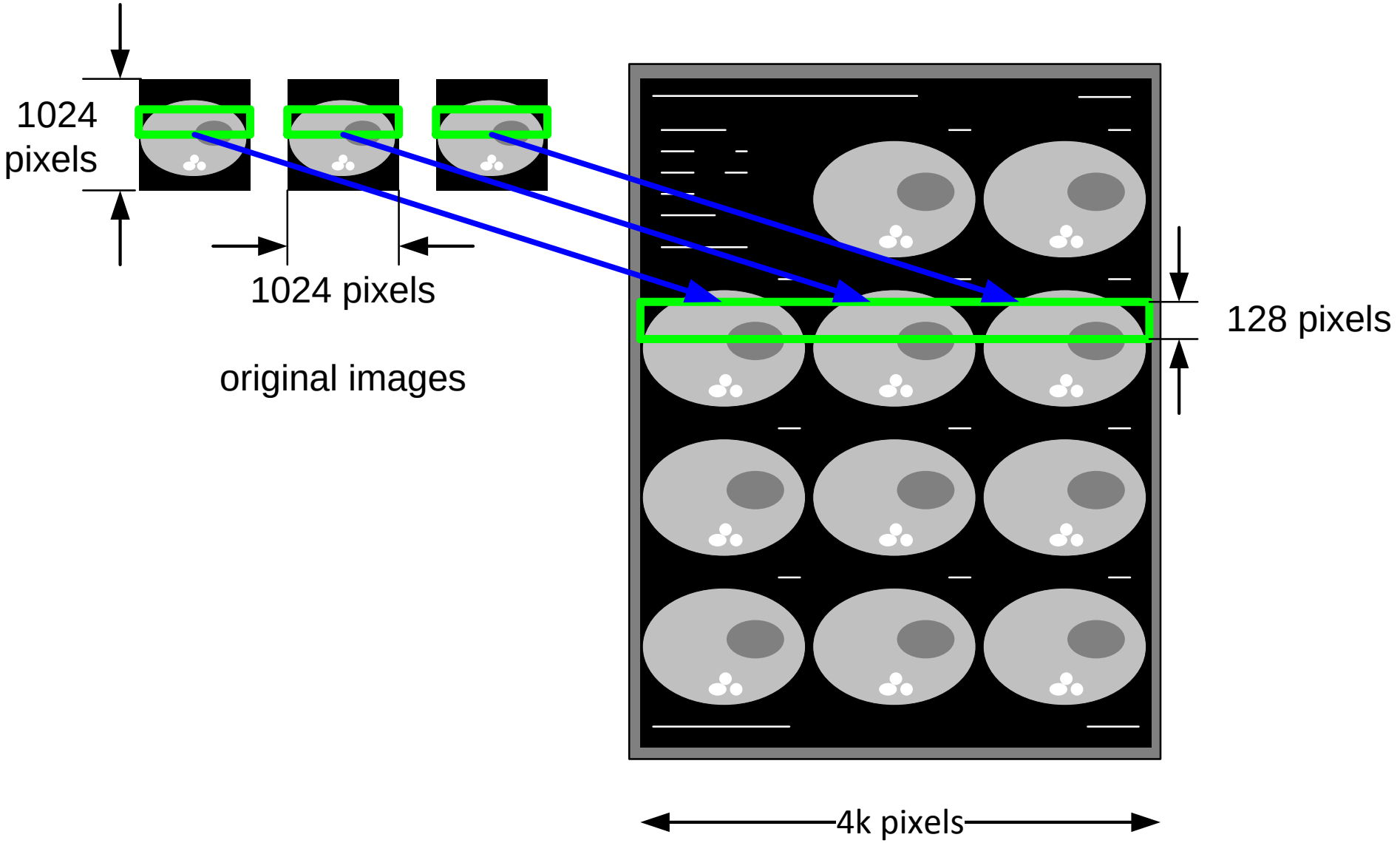
SW Process structure 1991



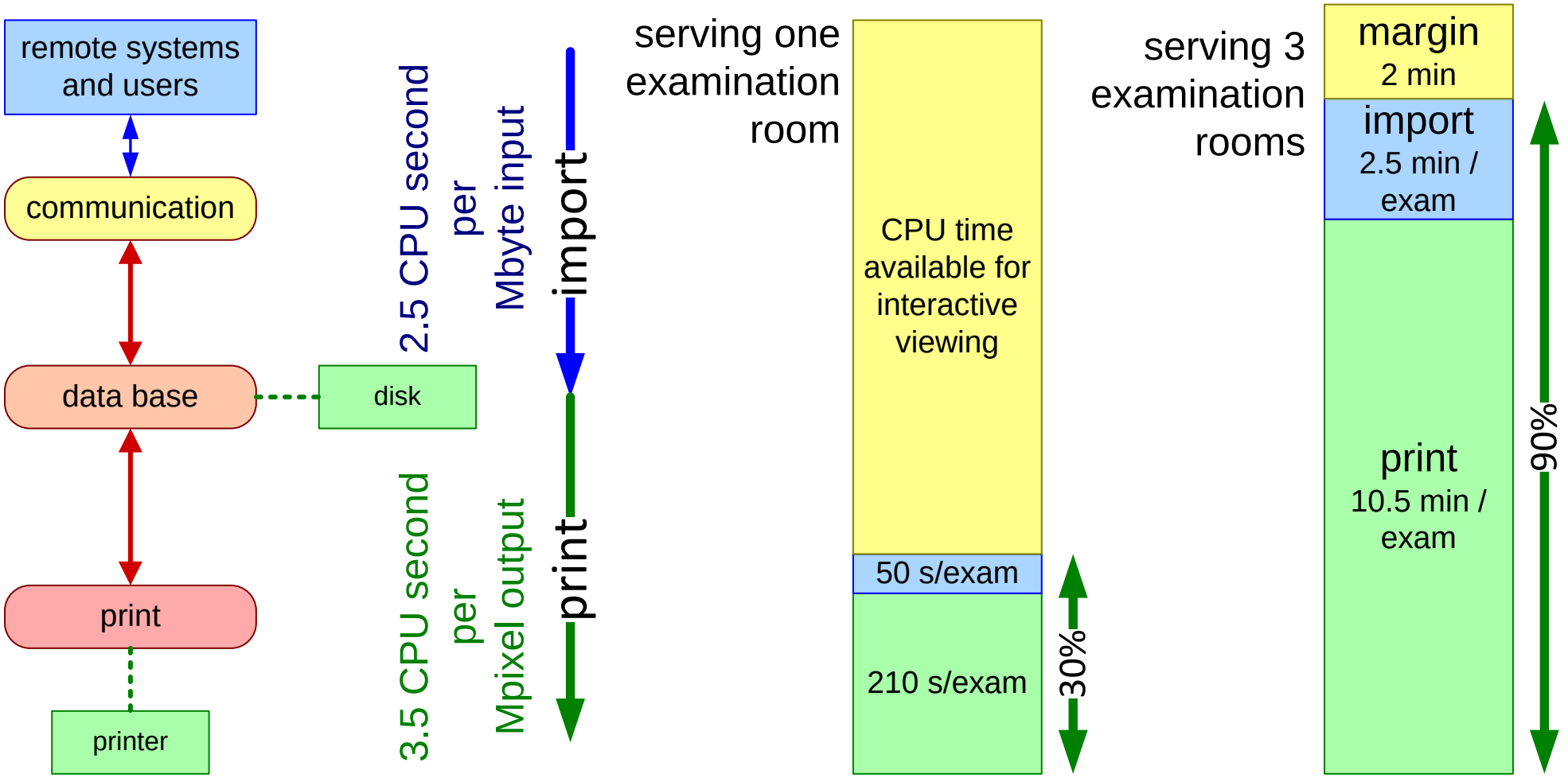
SW layers 1991



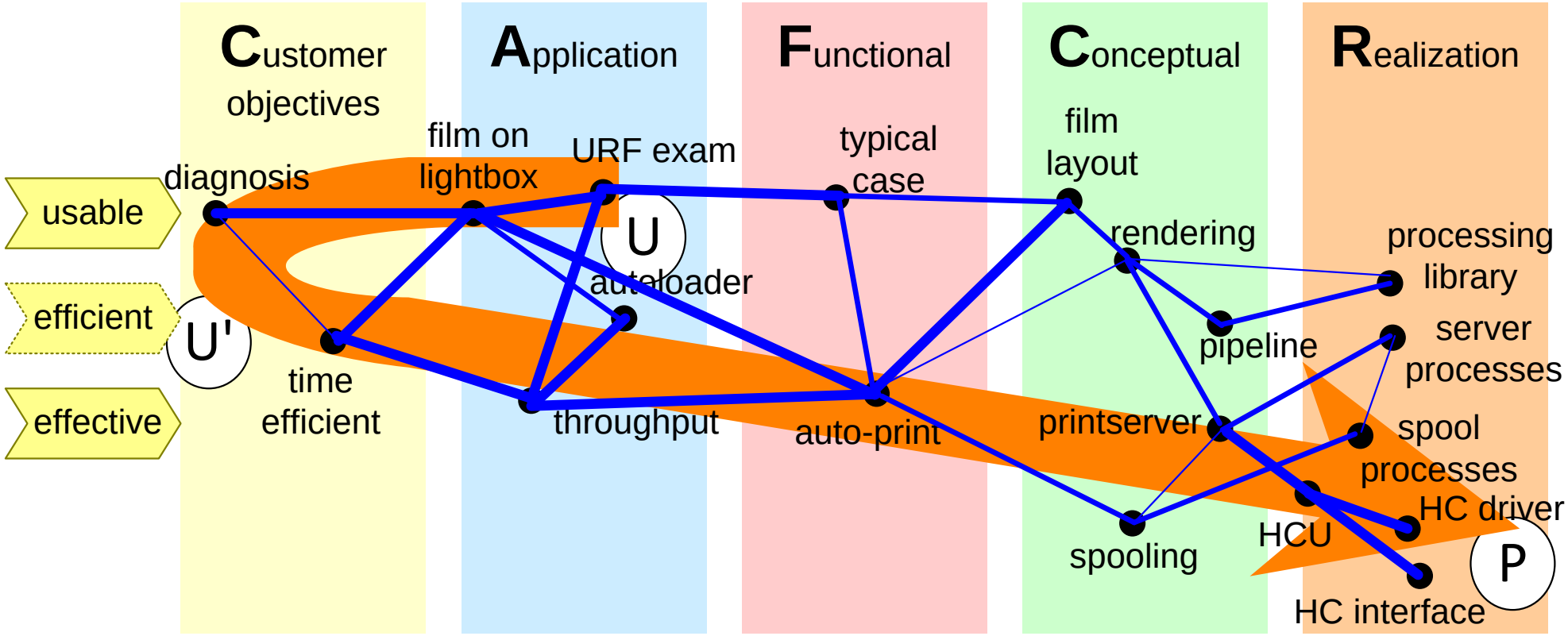
Print server is based on banding



Server CPU load



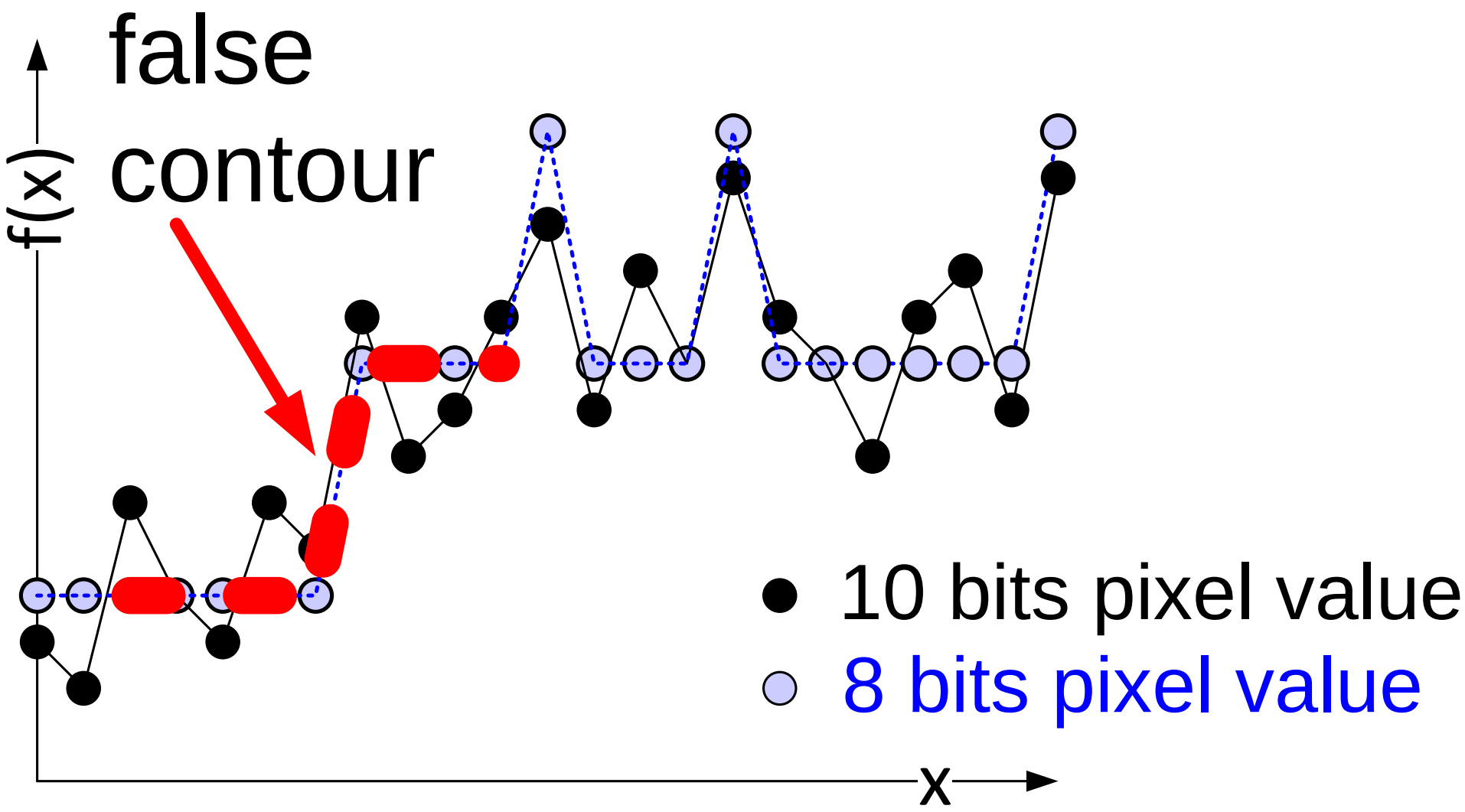
Thread of reasoning; phase 3



Philips operational view
(manufacturing, service, sales)

Radiologists diagnose from film, throughput is important
Extrovert view shows conceptual and realization gaps!

Image quality and safety problem



Presentation pipeline for X-ray images

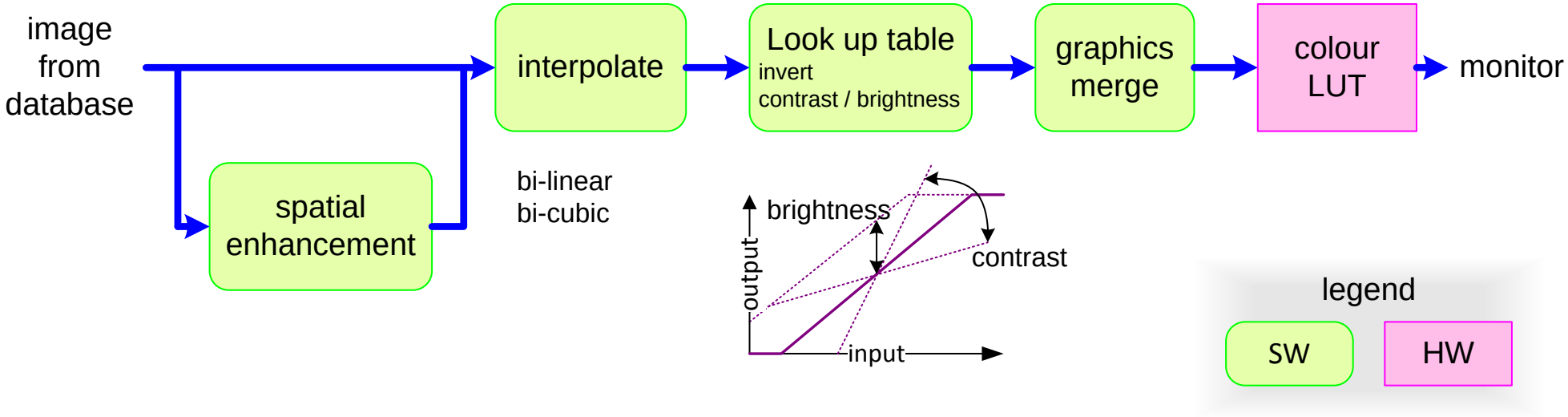
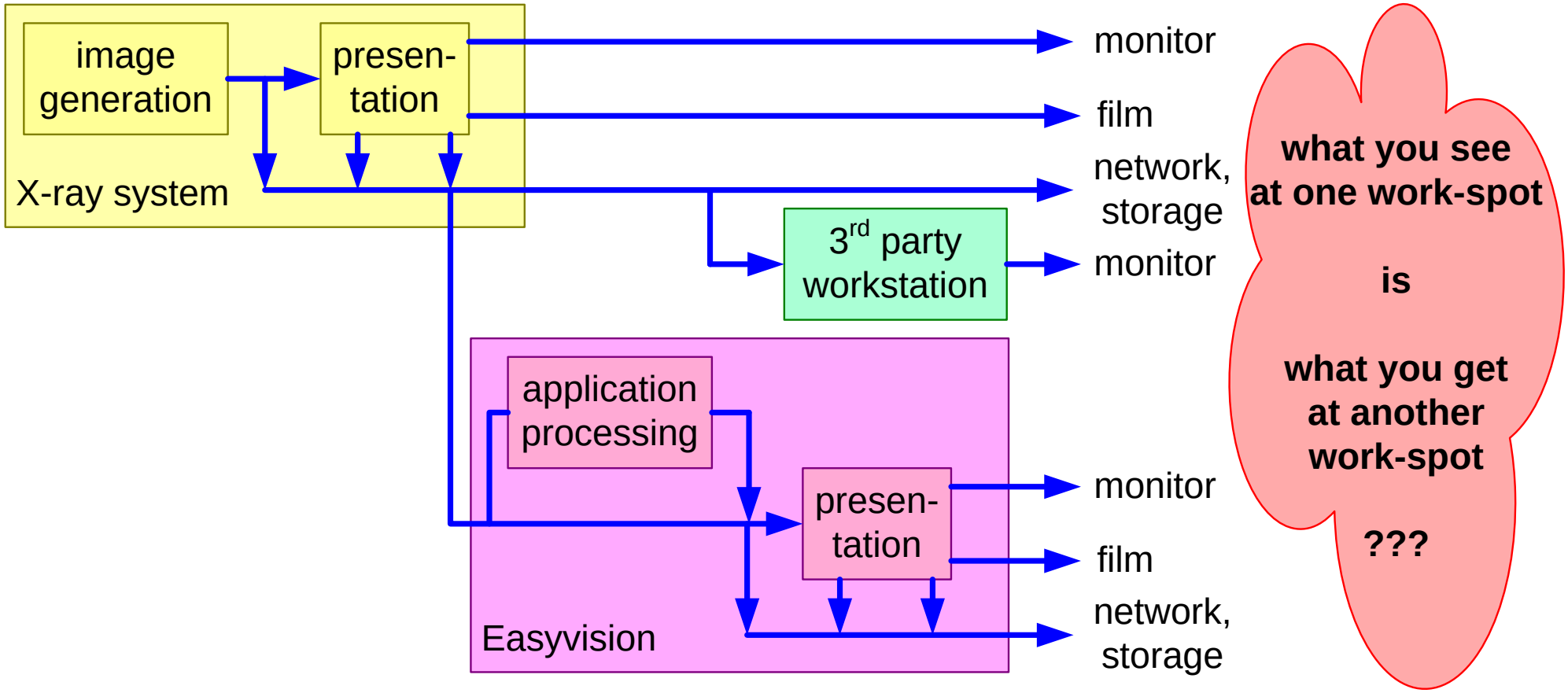
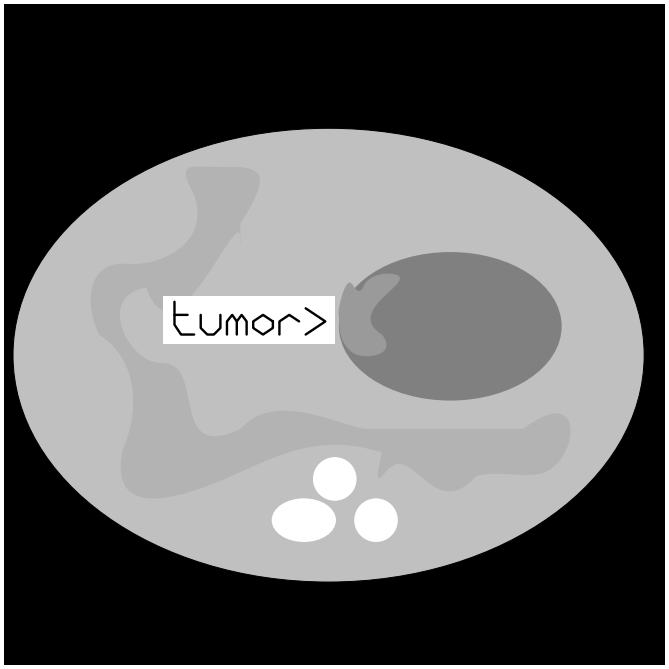


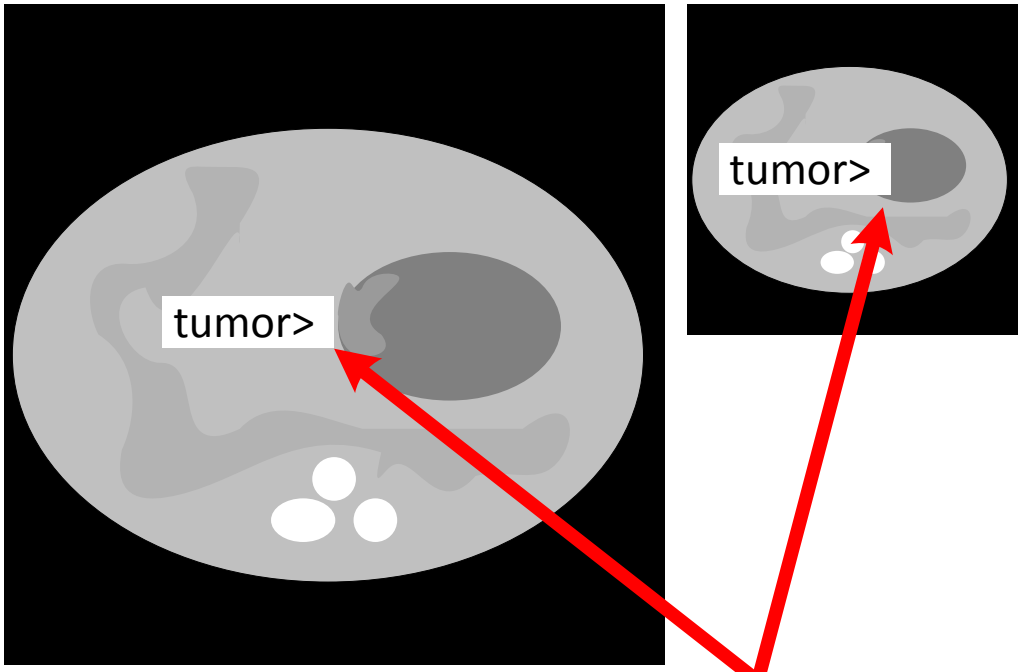
Image Quality expectation WYSIWYG



Safety problem



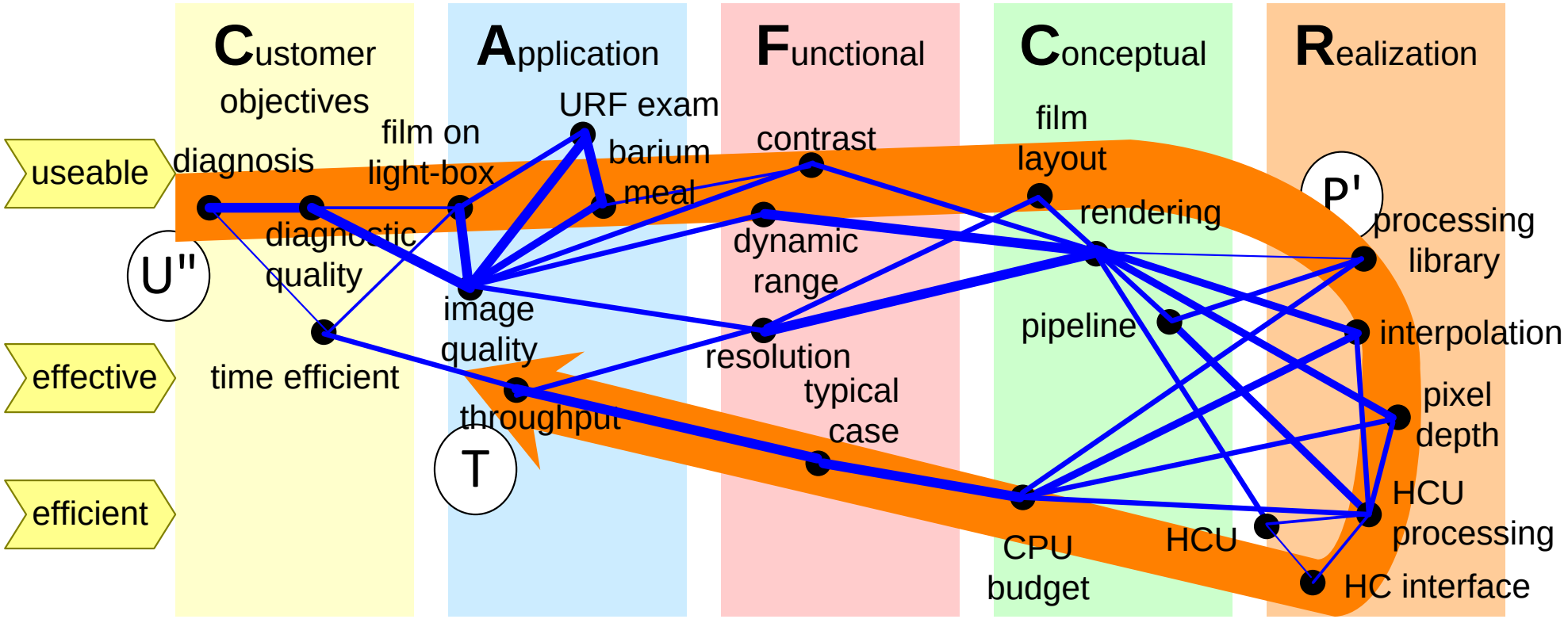
URF monitor output:
fixed size letters at fixed grid



for user readability the font-size was determined "intelligently"; causing a dangerous mismatch between text and image

EV output: scaleable fonts in graphics overlay

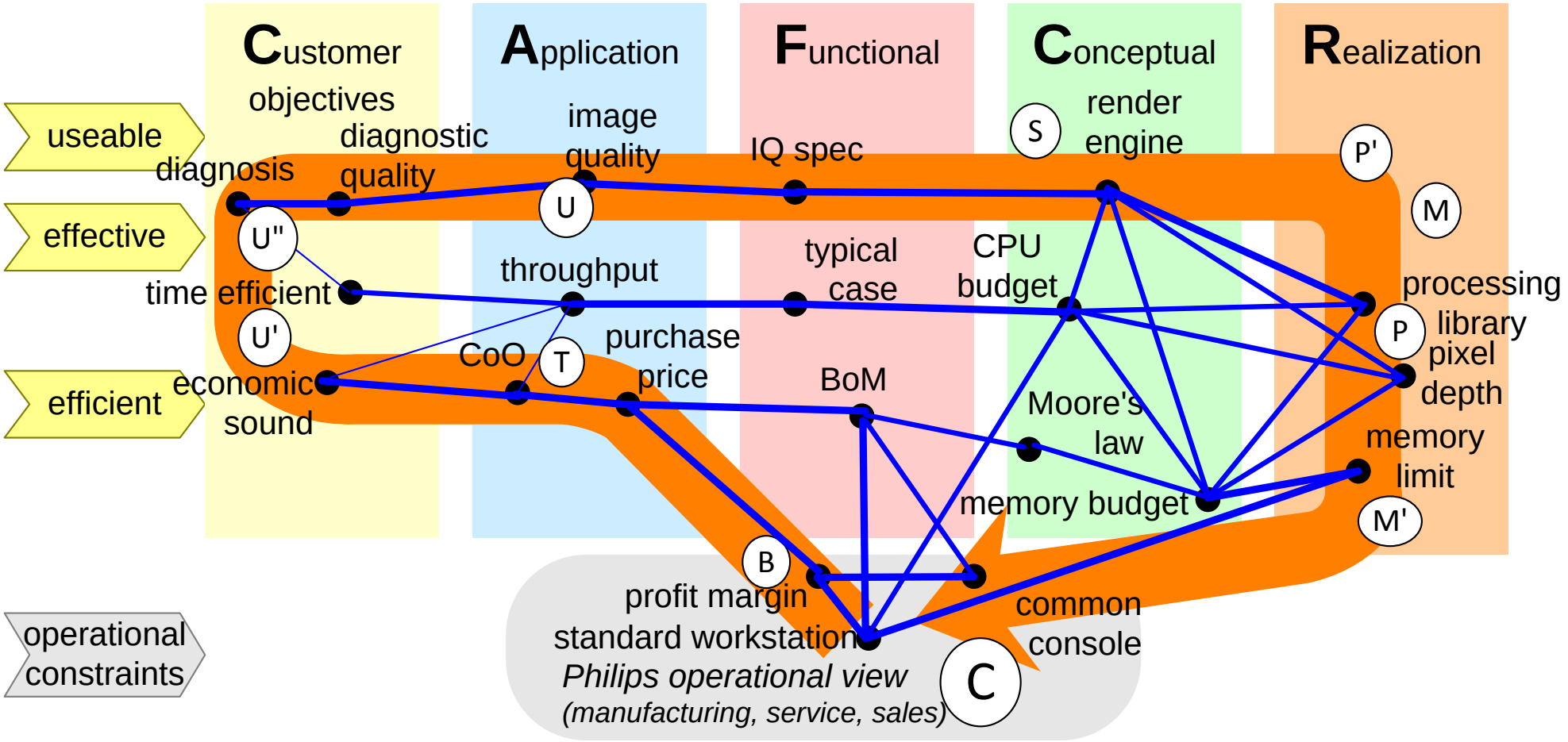
Thread of reasoning; phase 4



Philips operational view
(manufacturing, service, sales)

from extrovert diagnostic quality, via image quality, algorithms and load, to extrovert throughput

Thread of reasoning; phase 5

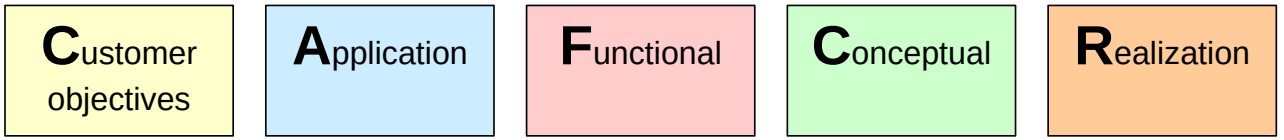


cost revisited in context of clinical needs and realization constraints; note: original threads are significantly simplified

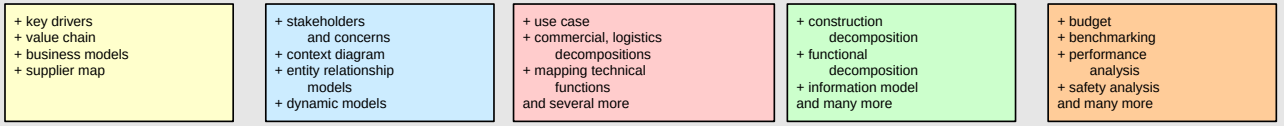
Overview of architecting method

method outline *method visualization*

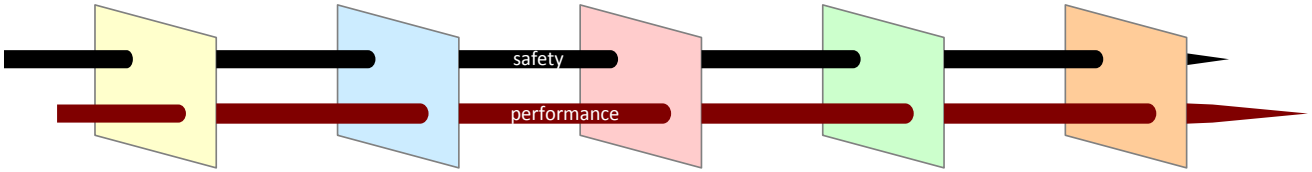
framework



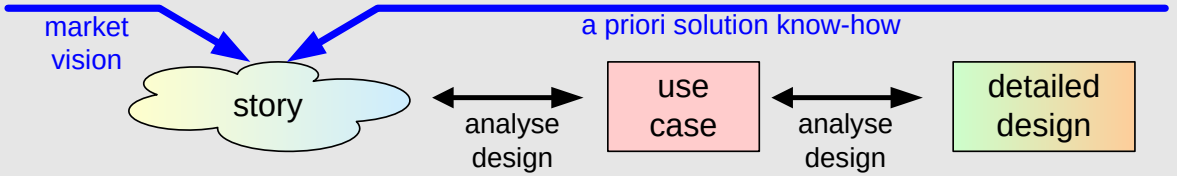
submethods



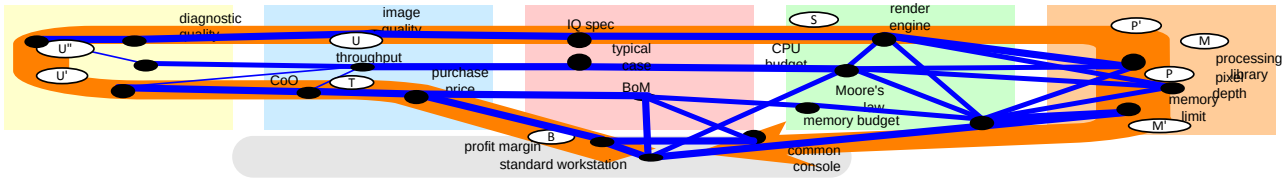
integration via qualities



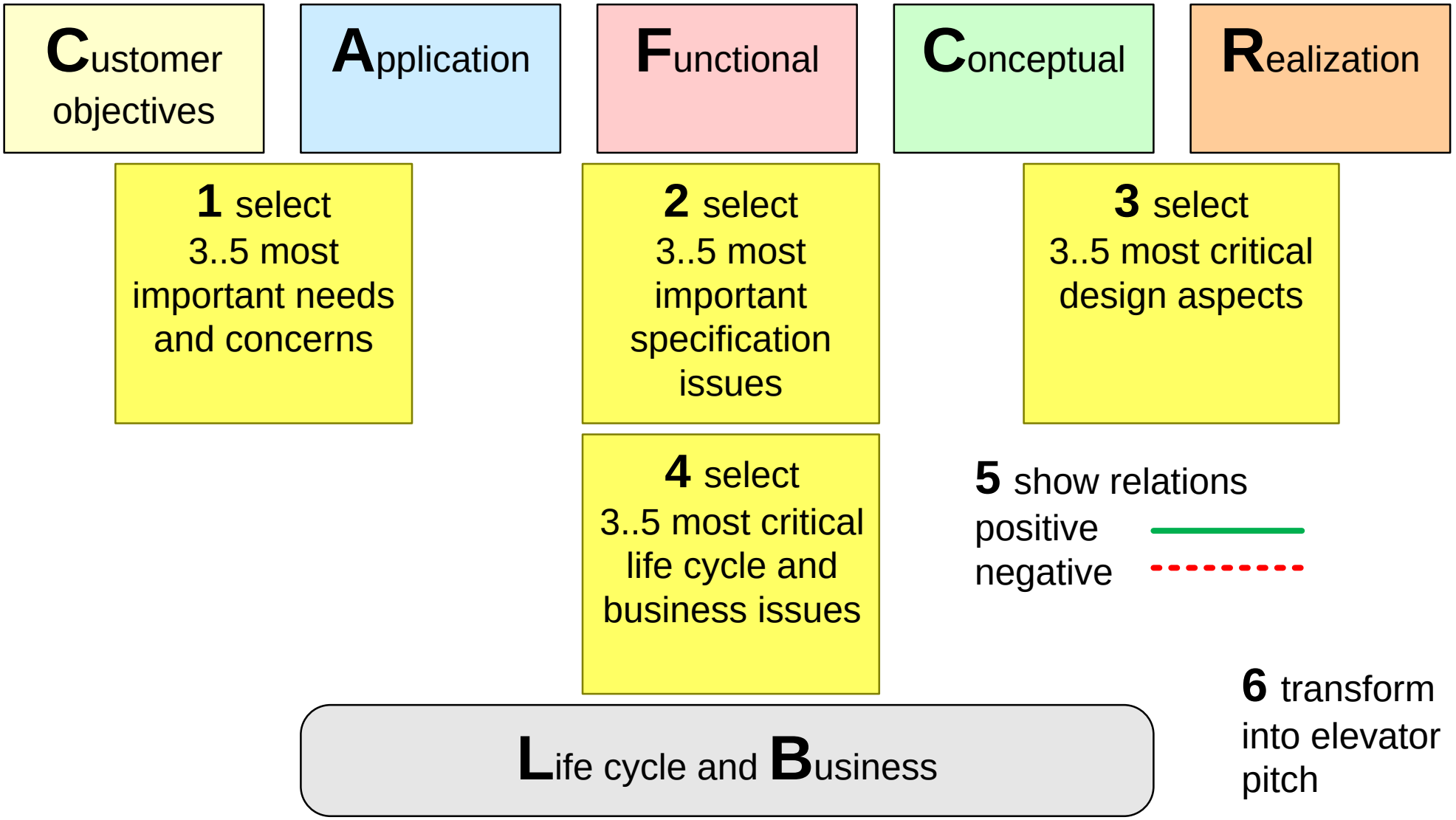
explore specific details



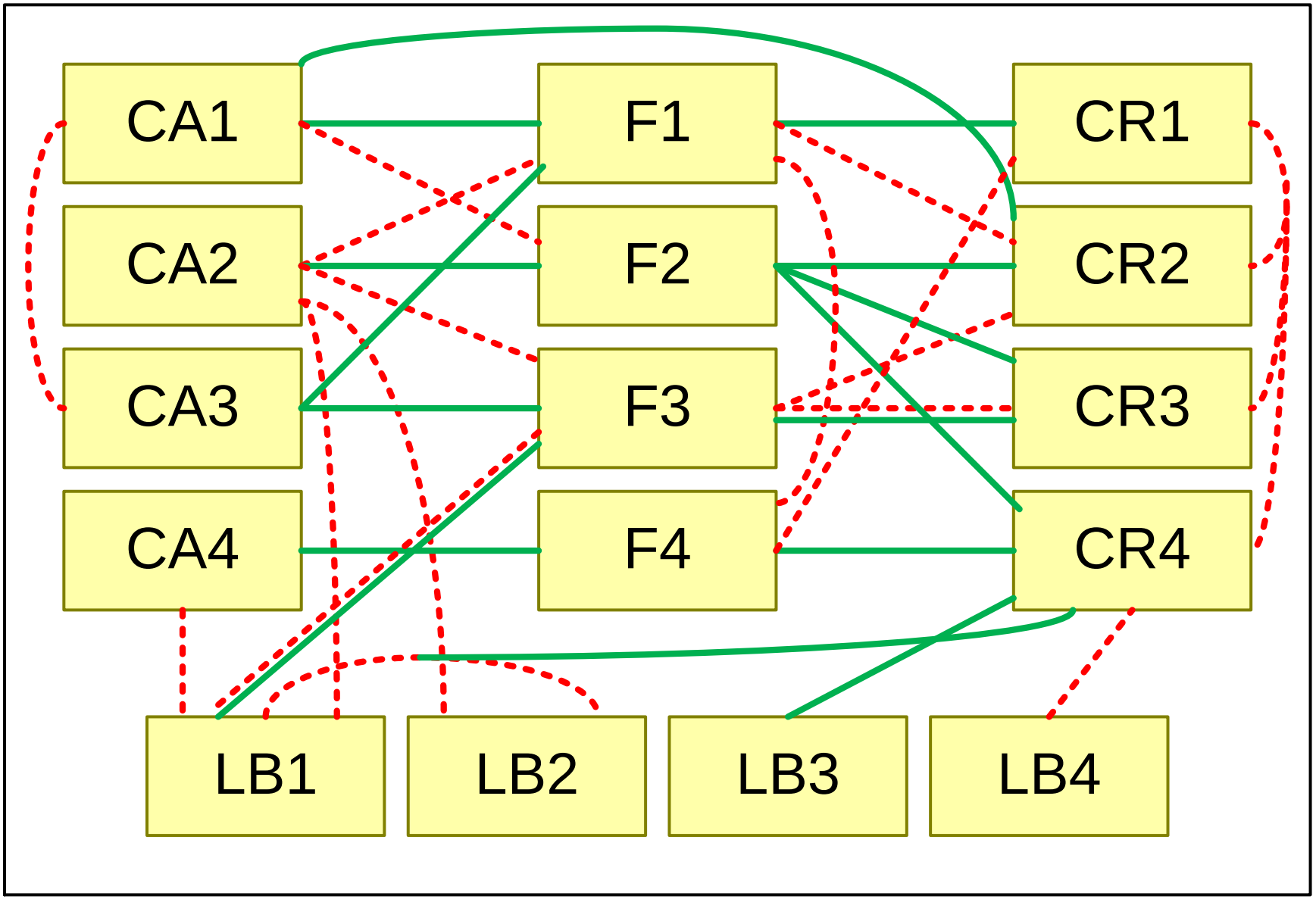
reasoning



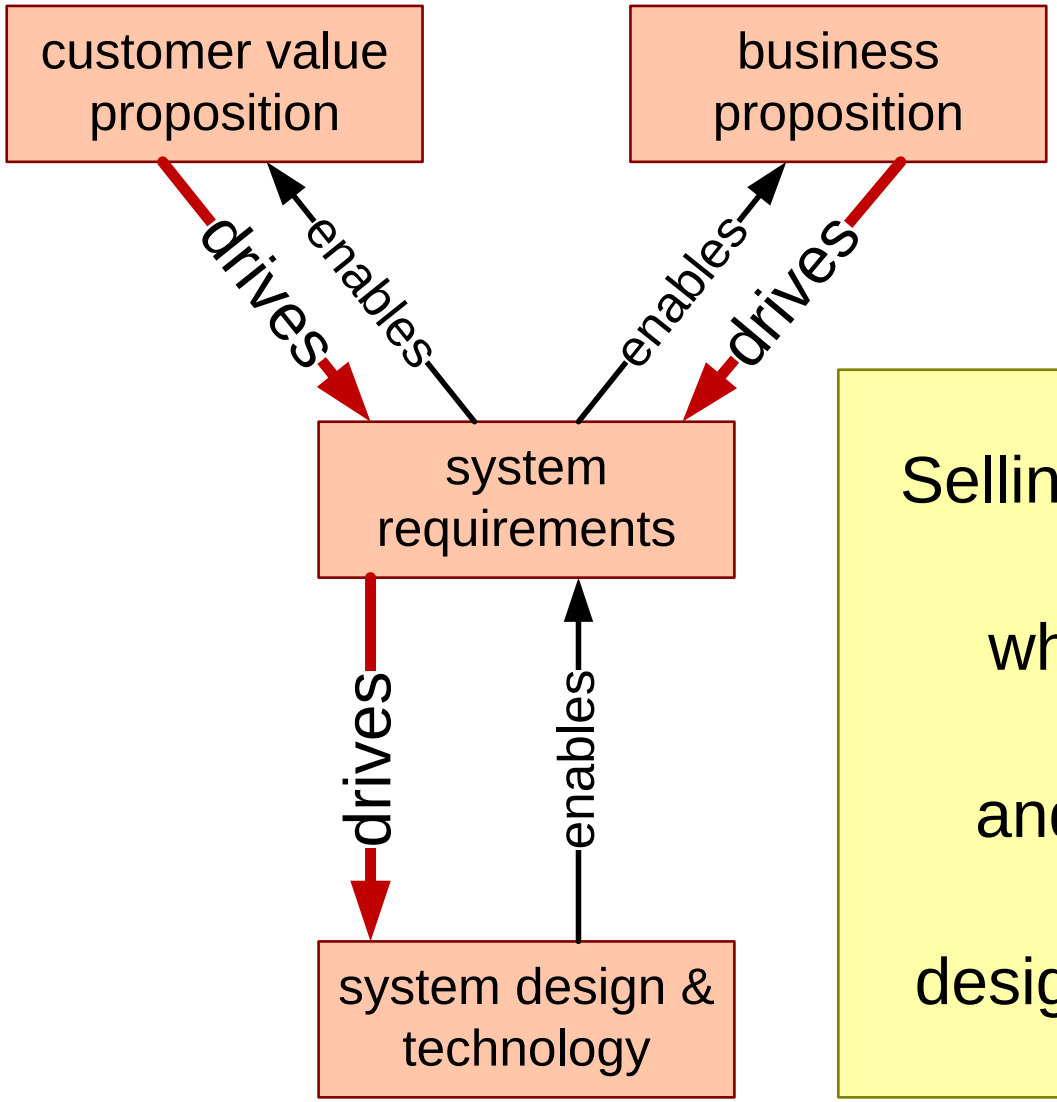
Exercise Threads of Reasoning



“Spaghetti” after Step 5



Elevator Pitch of about 90 seconds



Selling and explaining the proposal

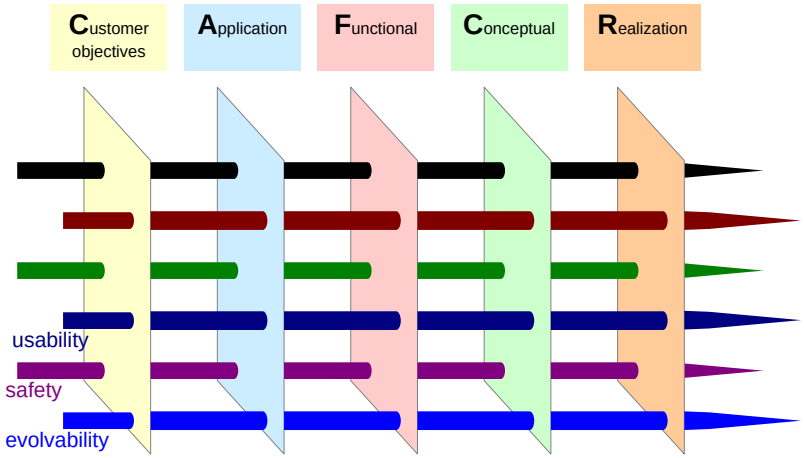
while managing expectations

and engaging management in

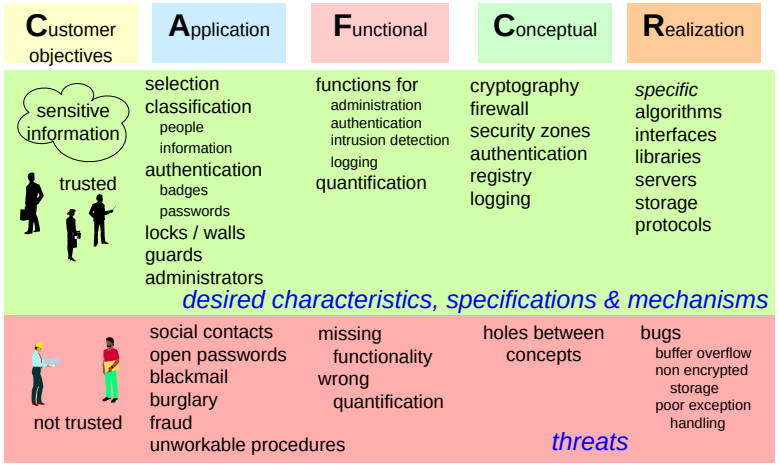
design and technology challenges

Integration via Qualities

Qualities Connect all Views



Look Positive and Negative



Many, Many Qualities

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

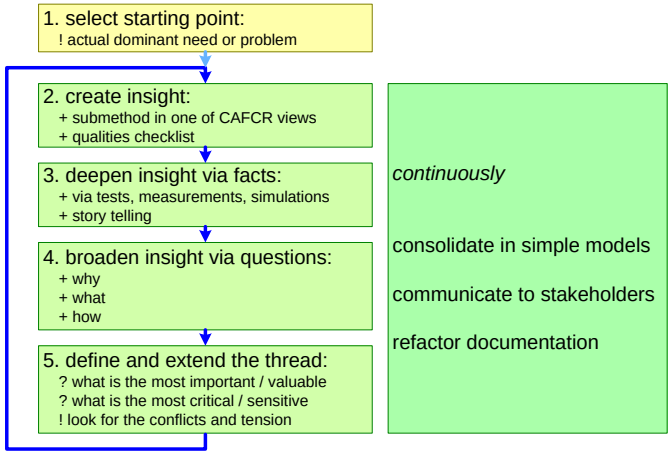
ecological
- ecological footprint
- contamination
- noise
- disposability

down to earth attributes
- cost price
- power consumption
- consumption rate (water, air, chemicals, et cetera)
- size, weight
- accuracy

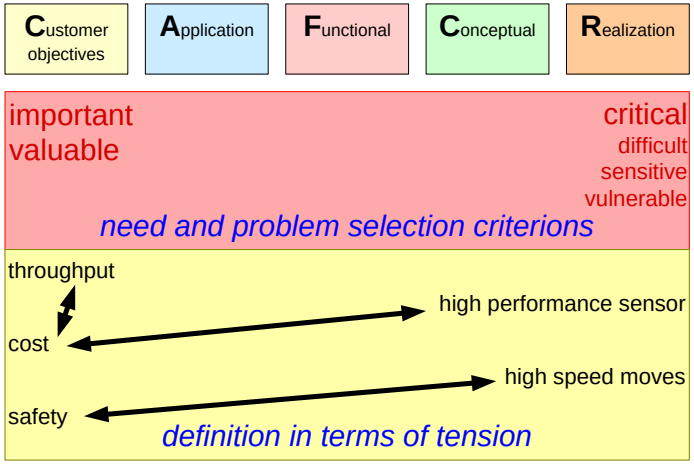
intentionally left blank

Threads of Reasoning

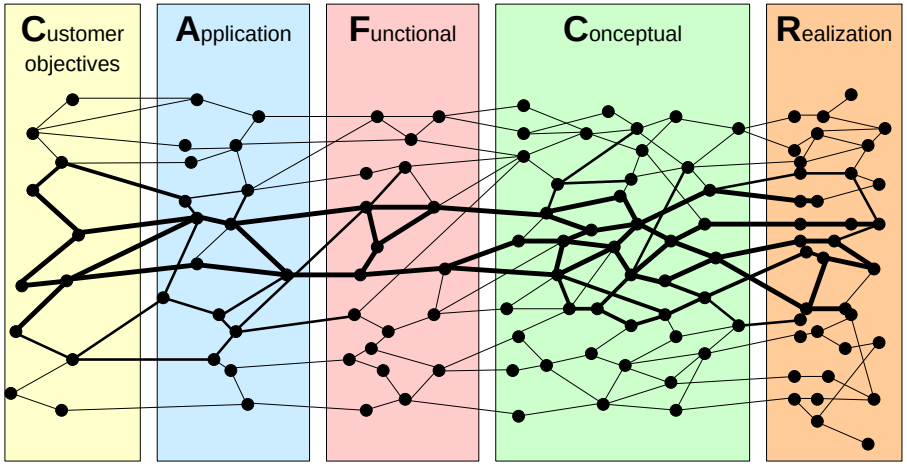
Diverge, Converge, Zoom-in, Zoom-out



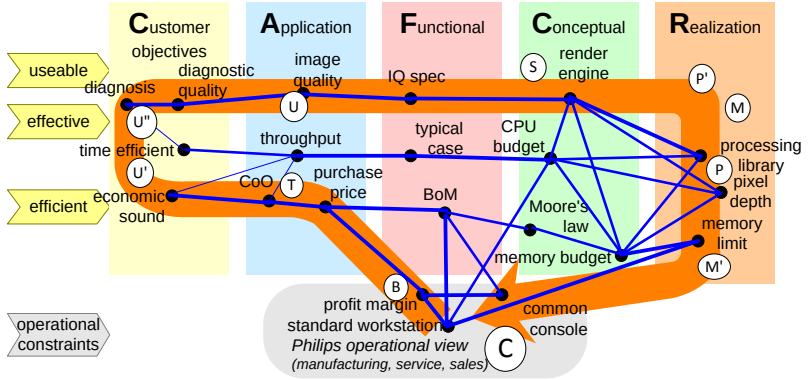
Identify Most Relevant Issues



All Issues are Interrelated



Reconstruct the “Big Picture”



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