Module Reasoning: Linking Business to Technology

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Abstract

This module addresses *Threads of Reasoning* as a means to connect business and operational needs to design and technology choices.

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version: 0.2

Module Content

goal of this module

Be able to relate *Customer* and *Operational* objectives to design and technology choices.

Be able to provide rationale for design decisions.

content of this module

Key driver method and recommendations

Threads of reasoning approach

Example in Health Care domain

exercise

Key driver graph

Key Drivers How To

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Abstract

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

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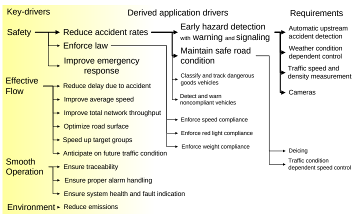
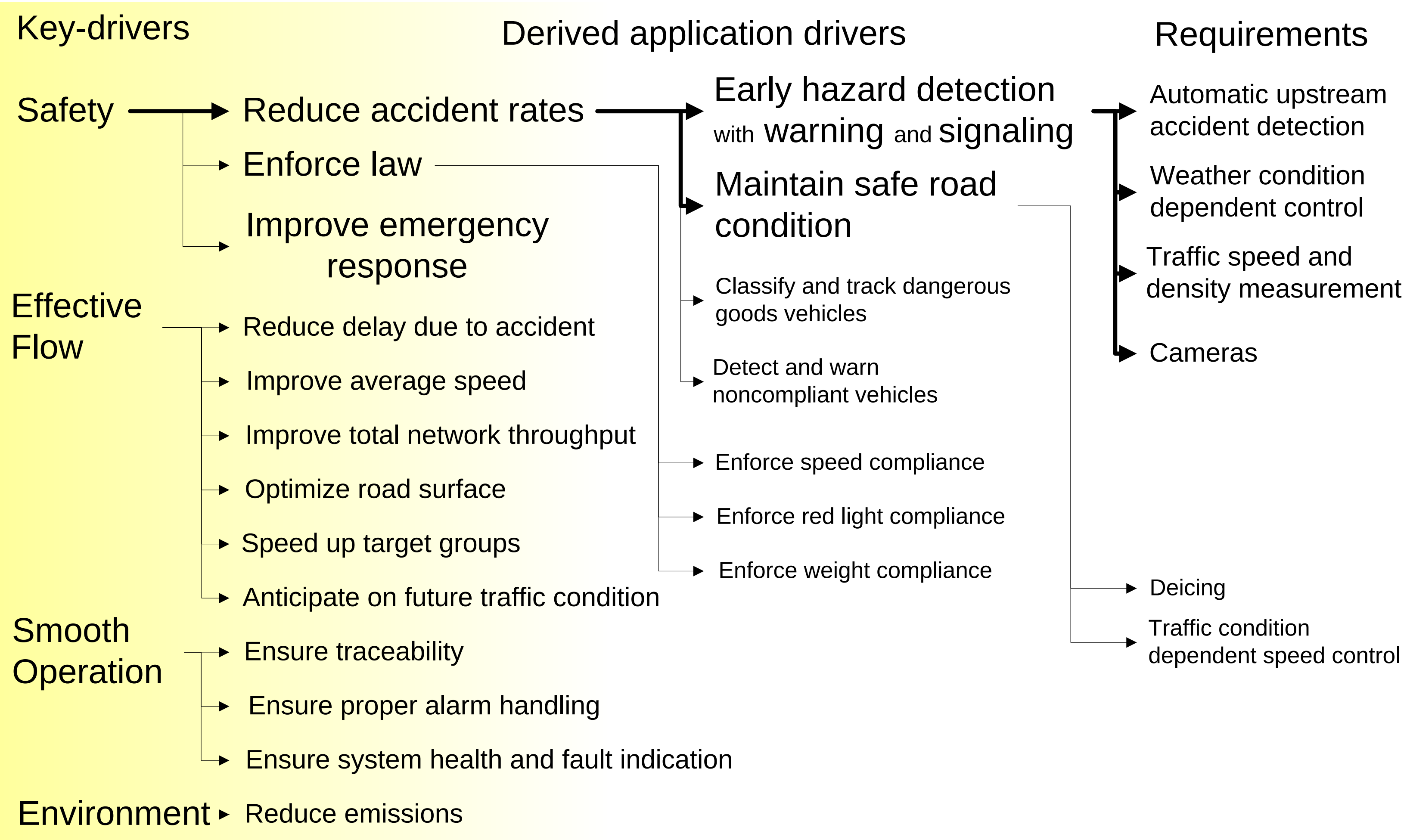


Note: the graph is only partially elaborated for application drivers and requirements

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

Customer **What**	Customer **How**	Product **What**
Customer objectives	**A**pplication	**F**unctional
Key (Customer) Drivers →	Derived Application Drivers →	Requirements
goal	means may be skipped or articulated by several intermediate steps	functions interfaces performance figures

Threads of Reasoning

by *Gerrit Muller* University of South-Eastern Norway-NISE
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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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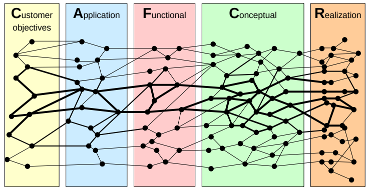


Overview of the reasoning approach

1. select starting point:
   ! actual dominant need or problem

2. create insight:
   + submethod in one of CAFCR views
   + qualities checklist

3. deepen insight via facts:
   + via tests, measurements, simulations
   + story telling

4. broaden insight via questions:
   + why
   + what
   + how

5. define and extend the thread:
   ? what is the most important / valuable
   ? what is the most critical / sensitive
   ! look for the conflicts and tension

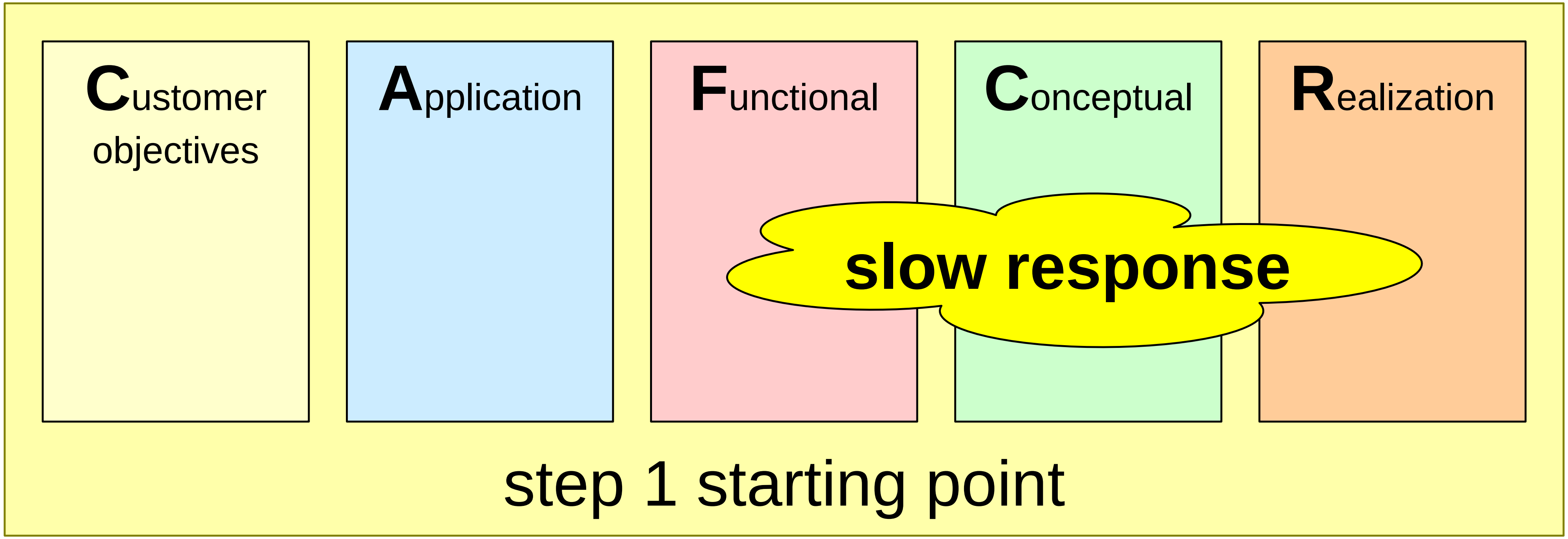
continuously

consolidate in simple models

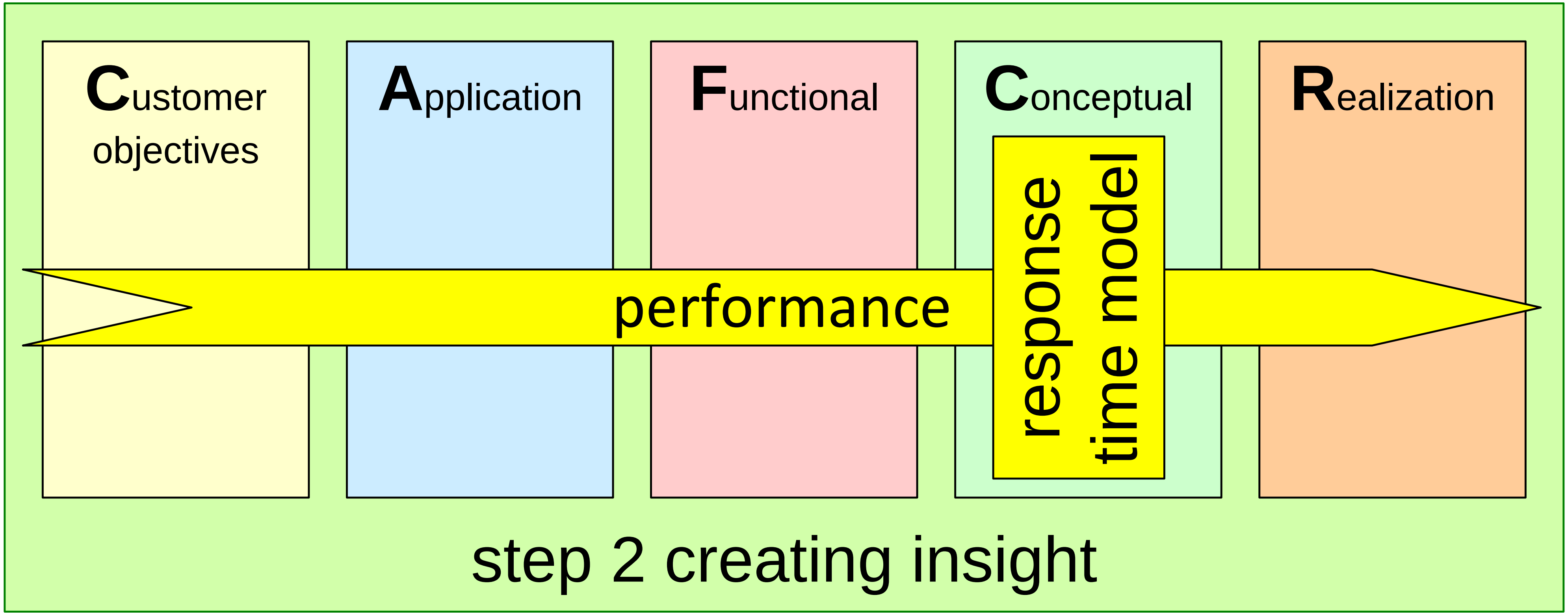
communicate to stakeholders

refactor documentation

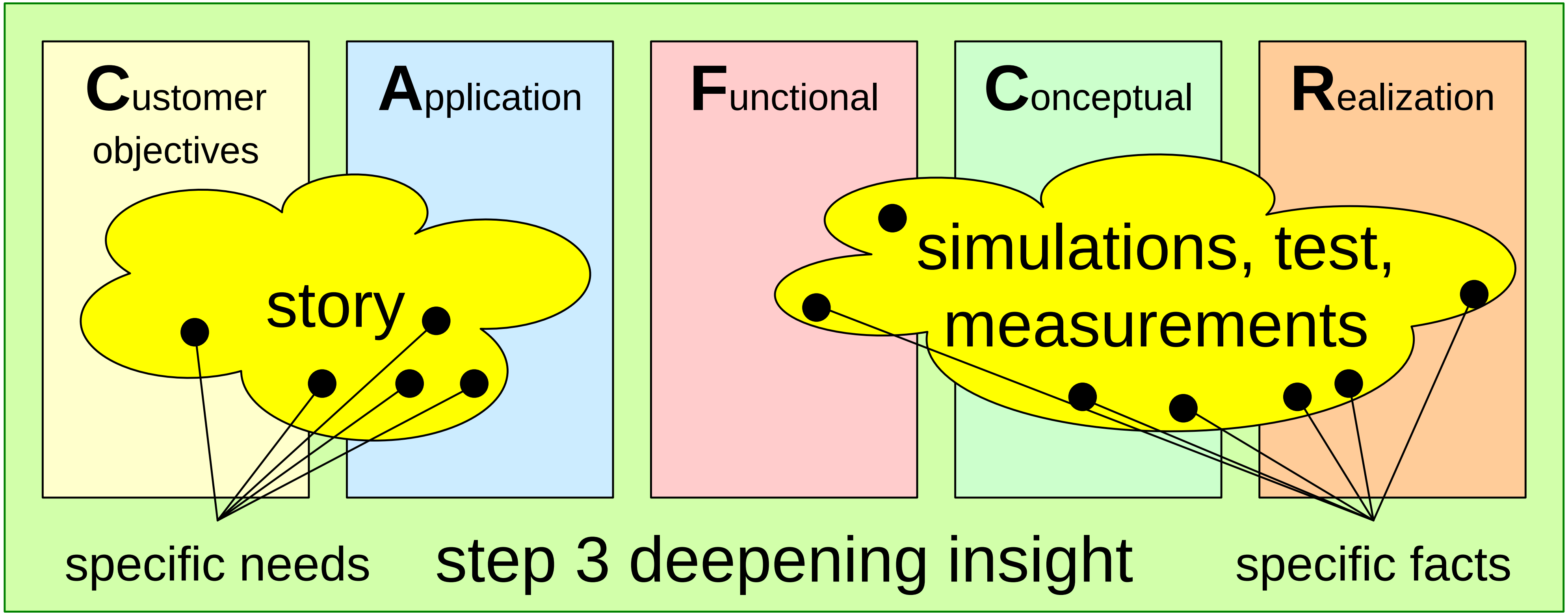
From starting point to insight



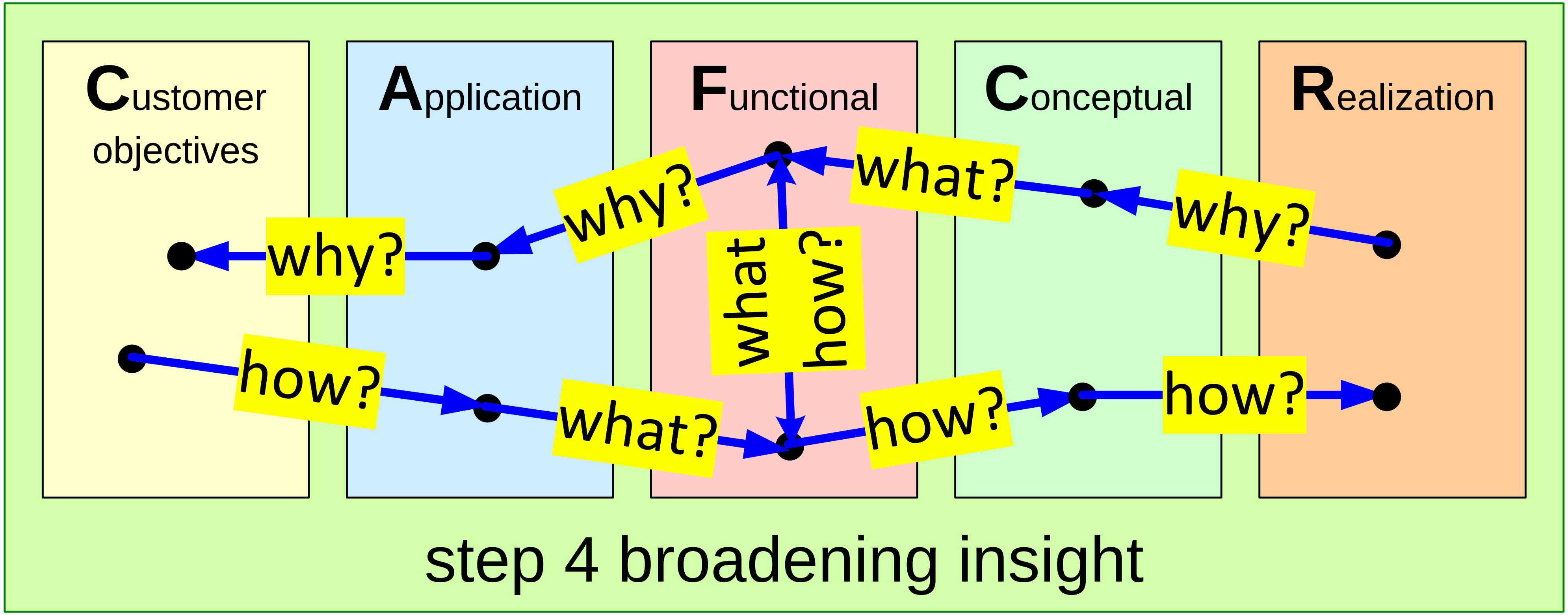
Creating Insight



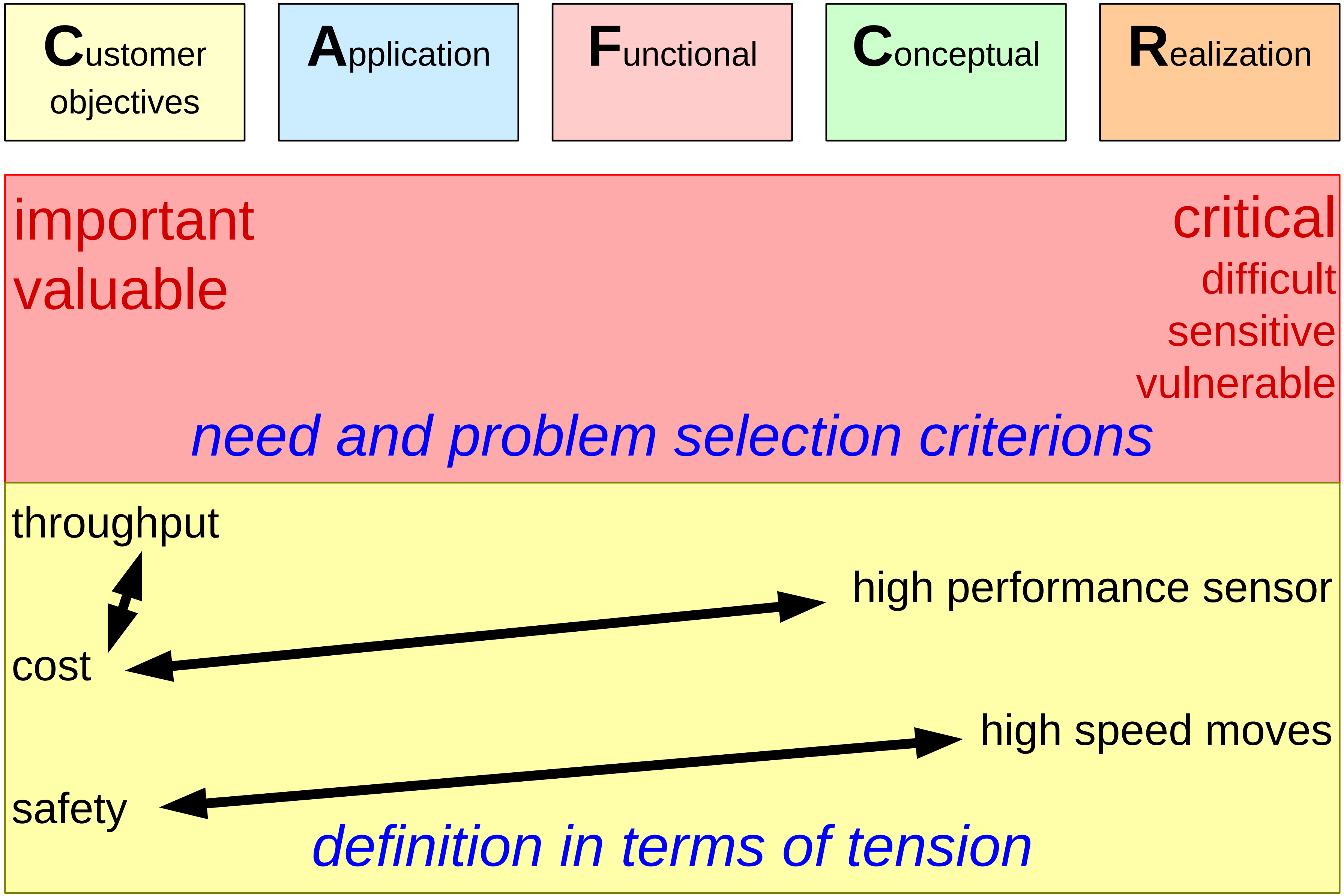
Deepening Insight



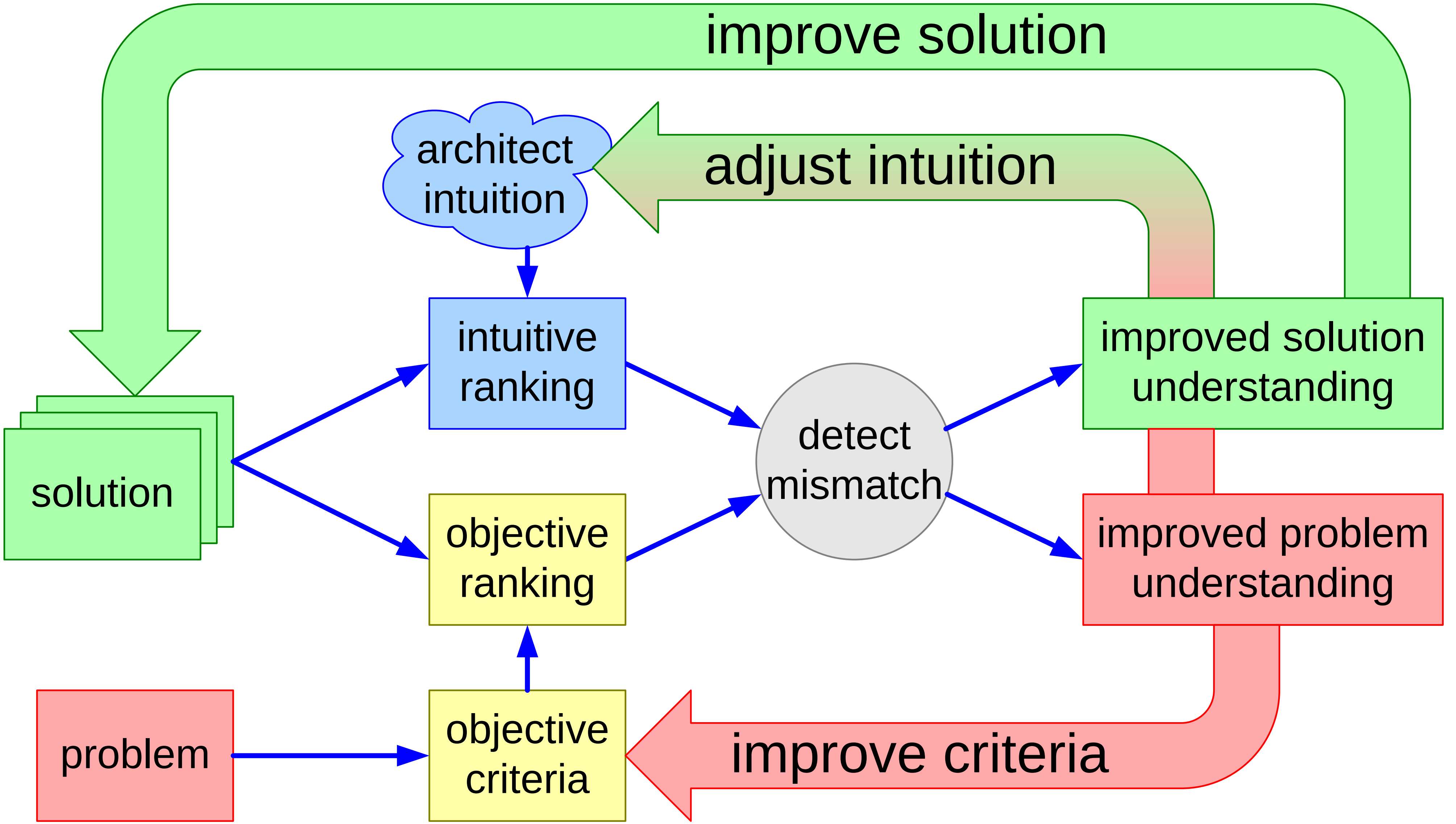
Broadening Insight



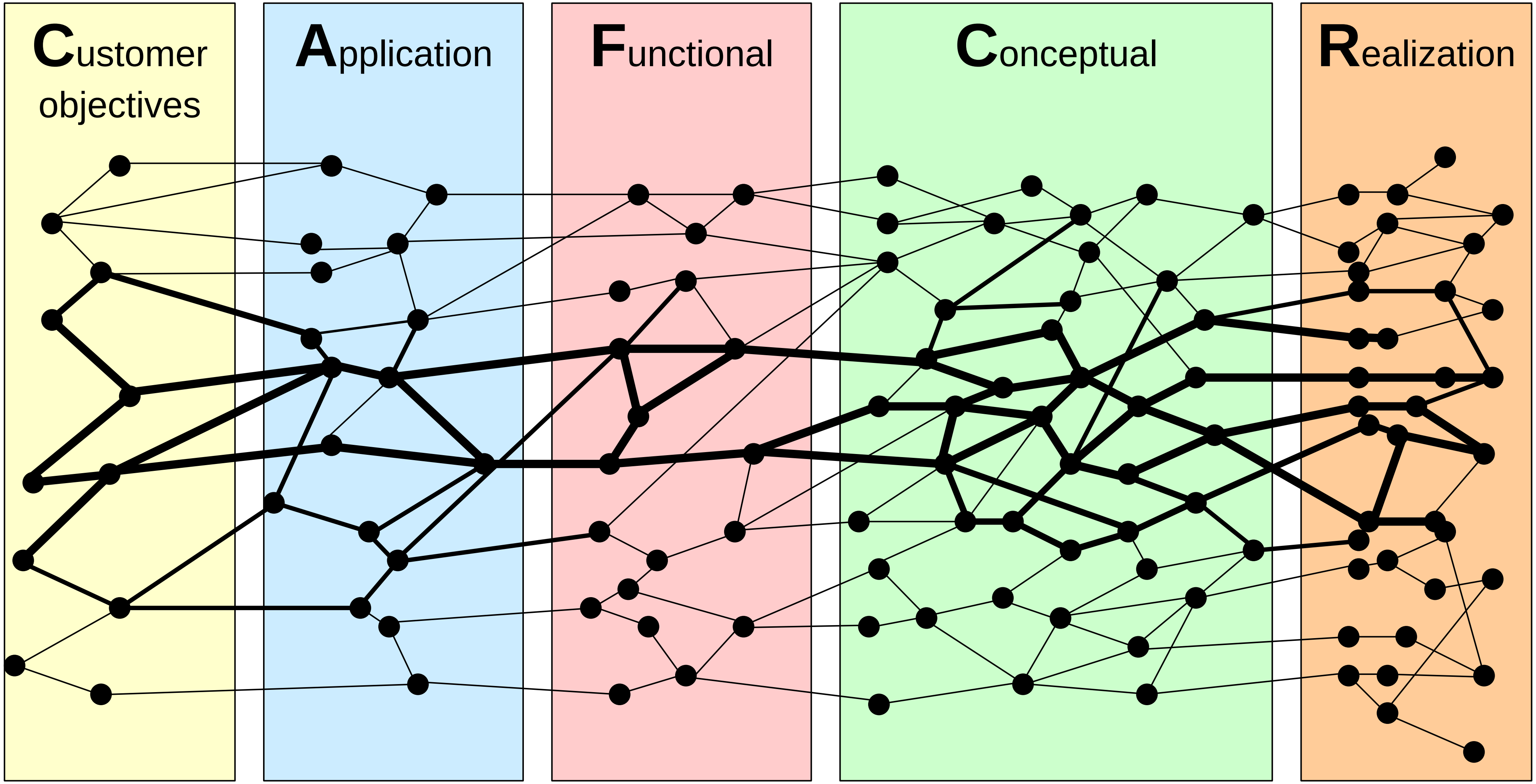
Problem identification and articulation



Iteration during the analysis



Thread of related issues



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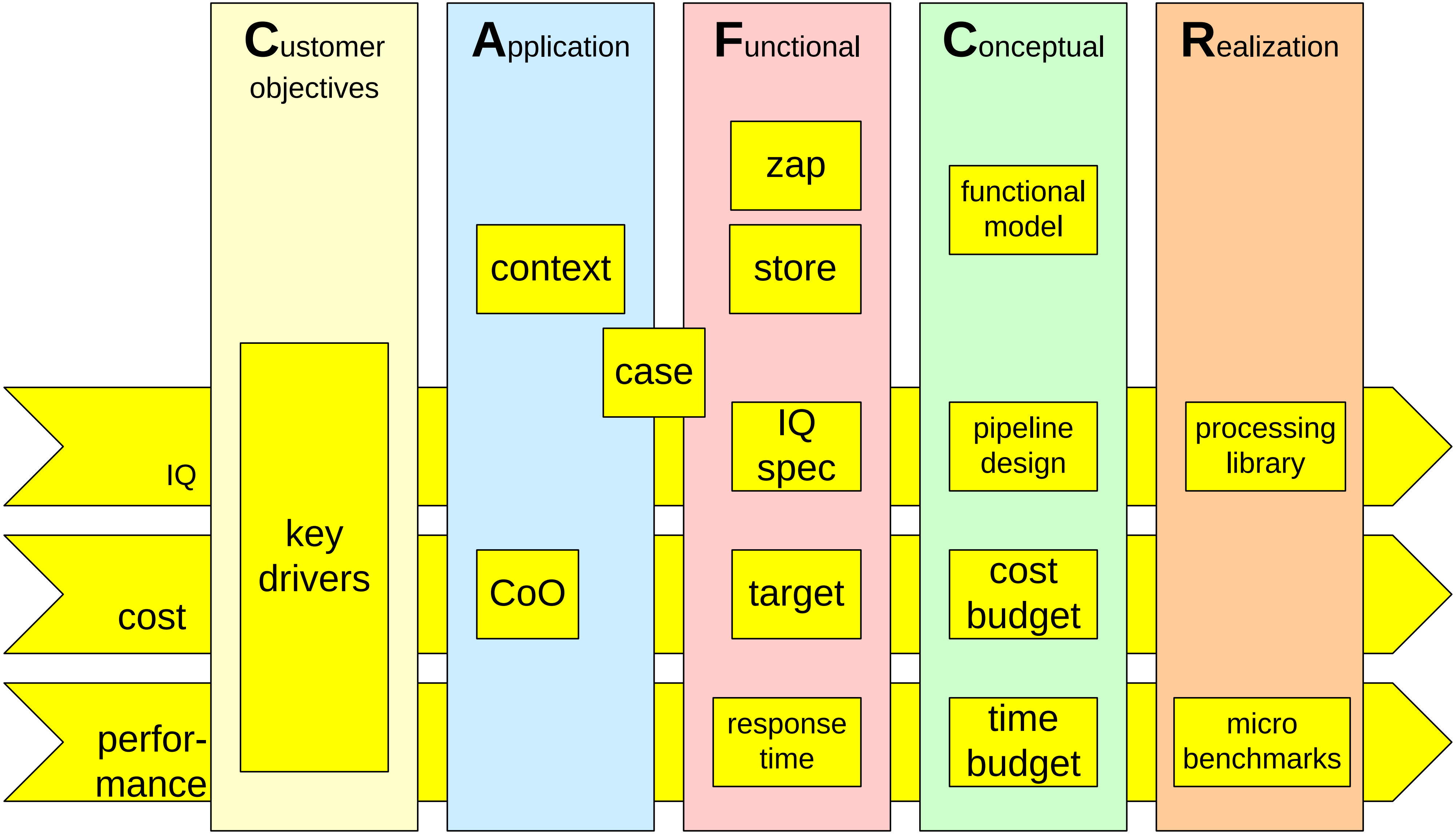
TORnetworkedIssues

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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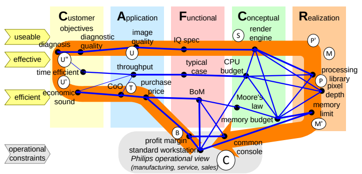
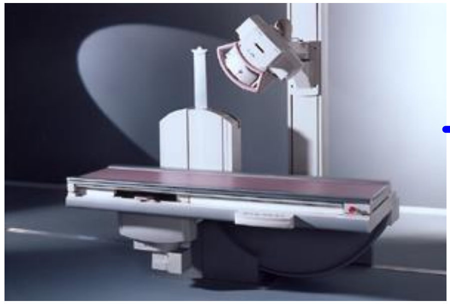
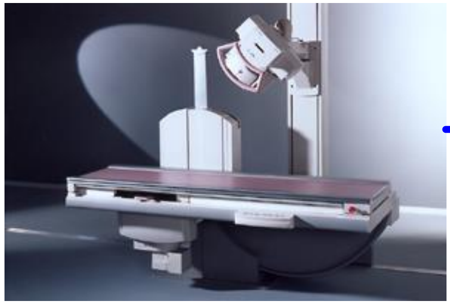
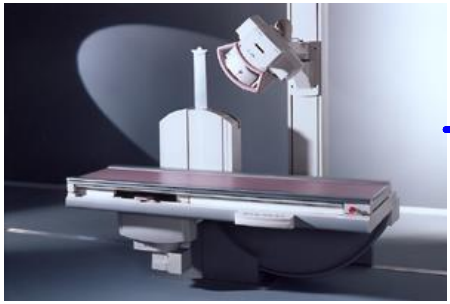


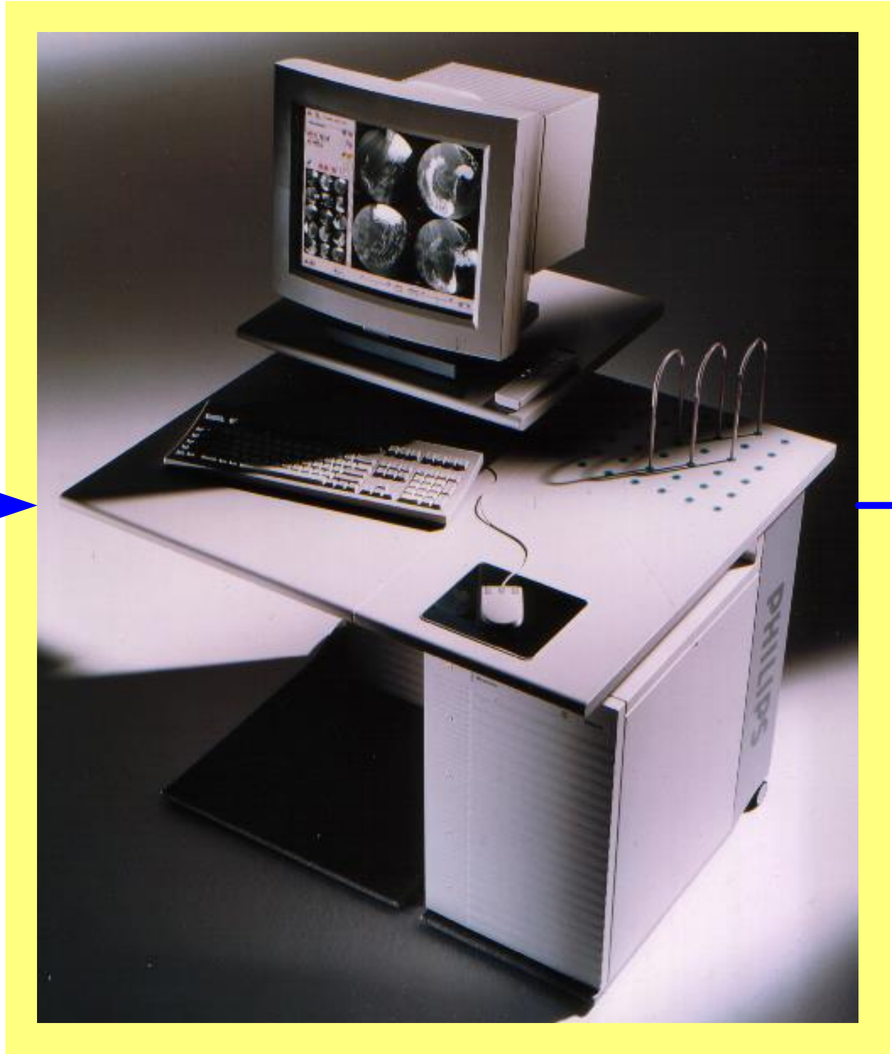
cost revisited in context of clinical needs and realization constraints; note: original threads are significantly simplified

Easyvision serving three URF examination rooms







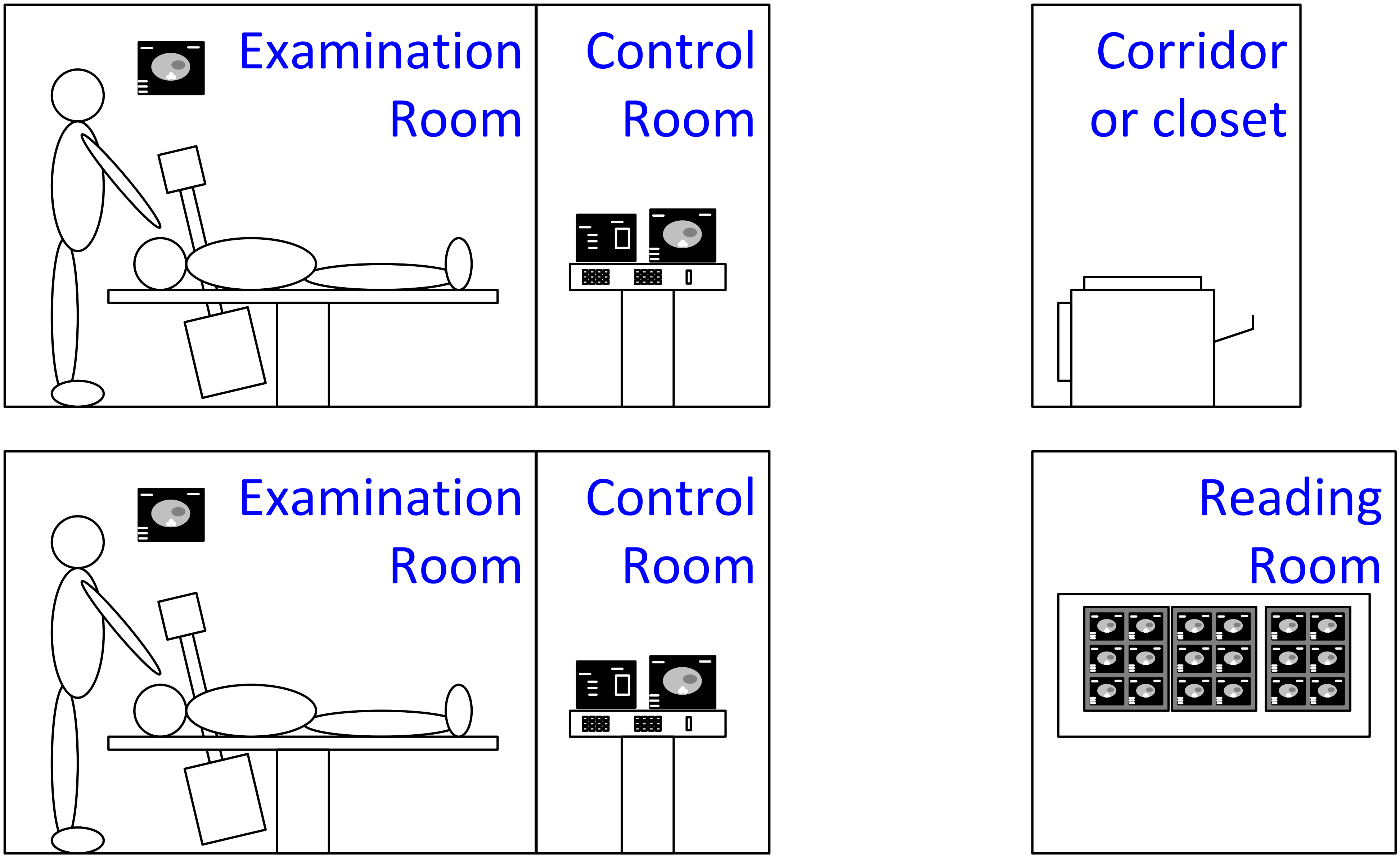


typical clinical image (intestines)

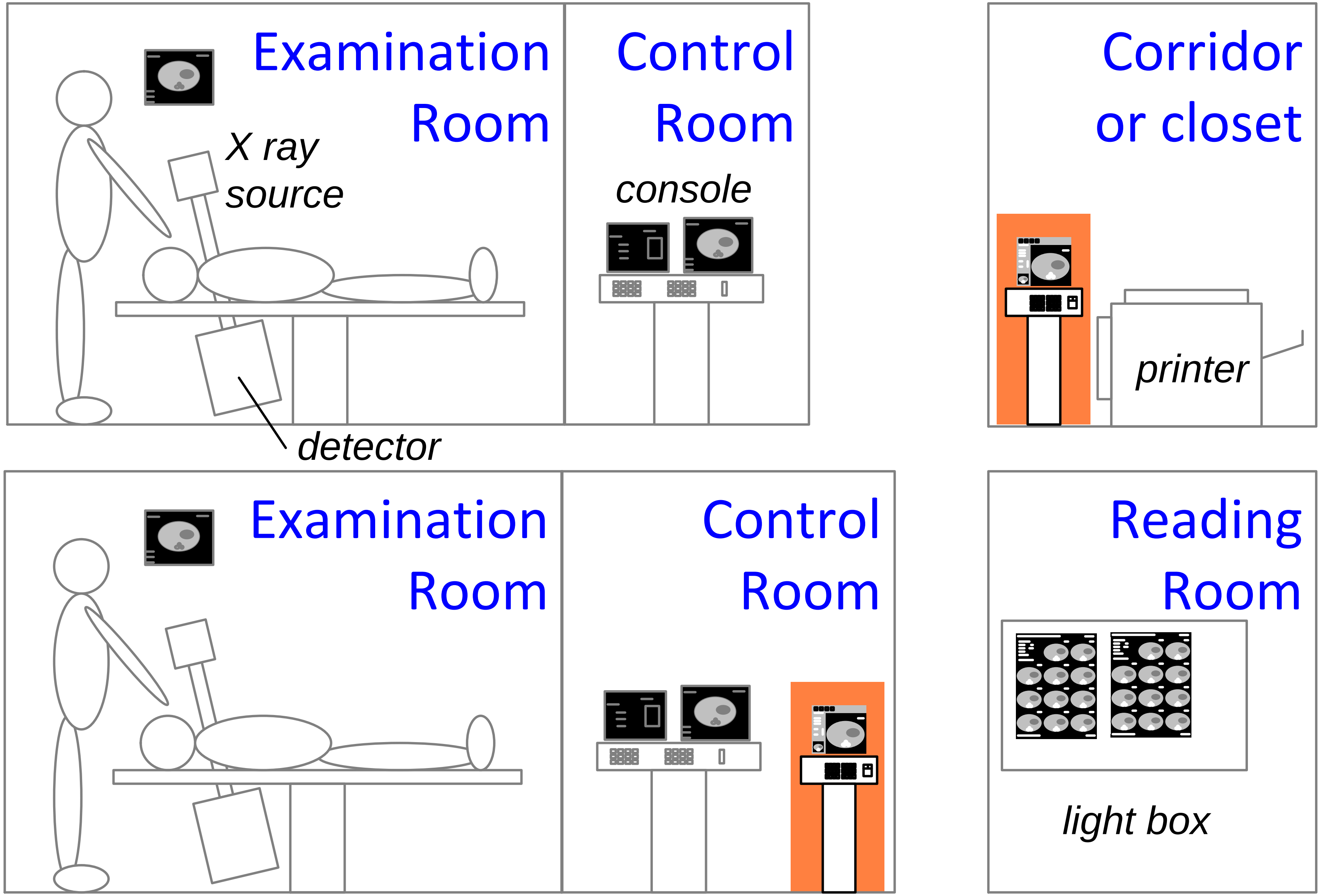
URF-systems

EasyVision: Medical Imaging Workstation

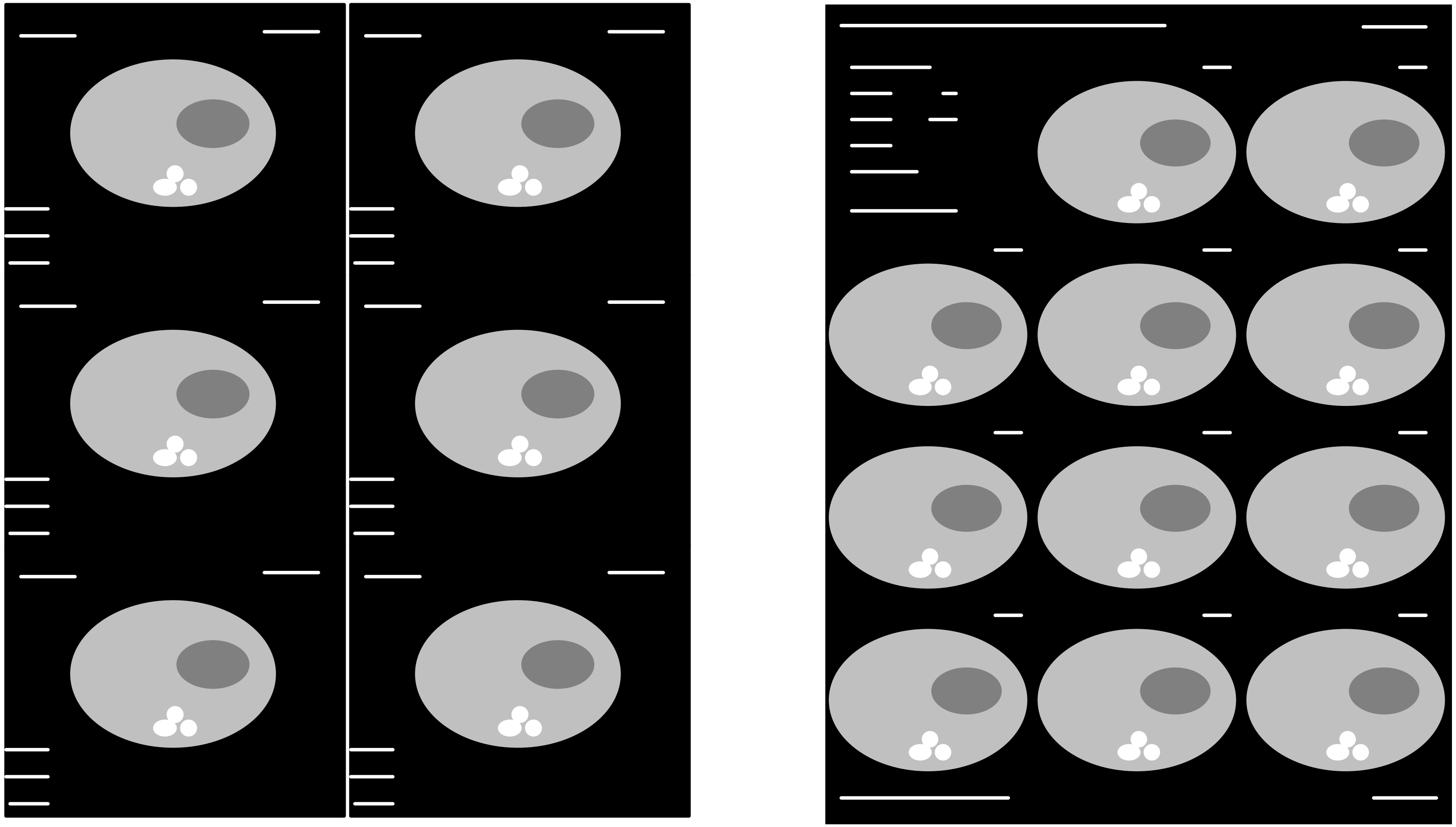
X-ray rooms from examination to reading around 1990



X-ray rooms with Easyvision applied as printserver



Comparison screen copy versus optimized film

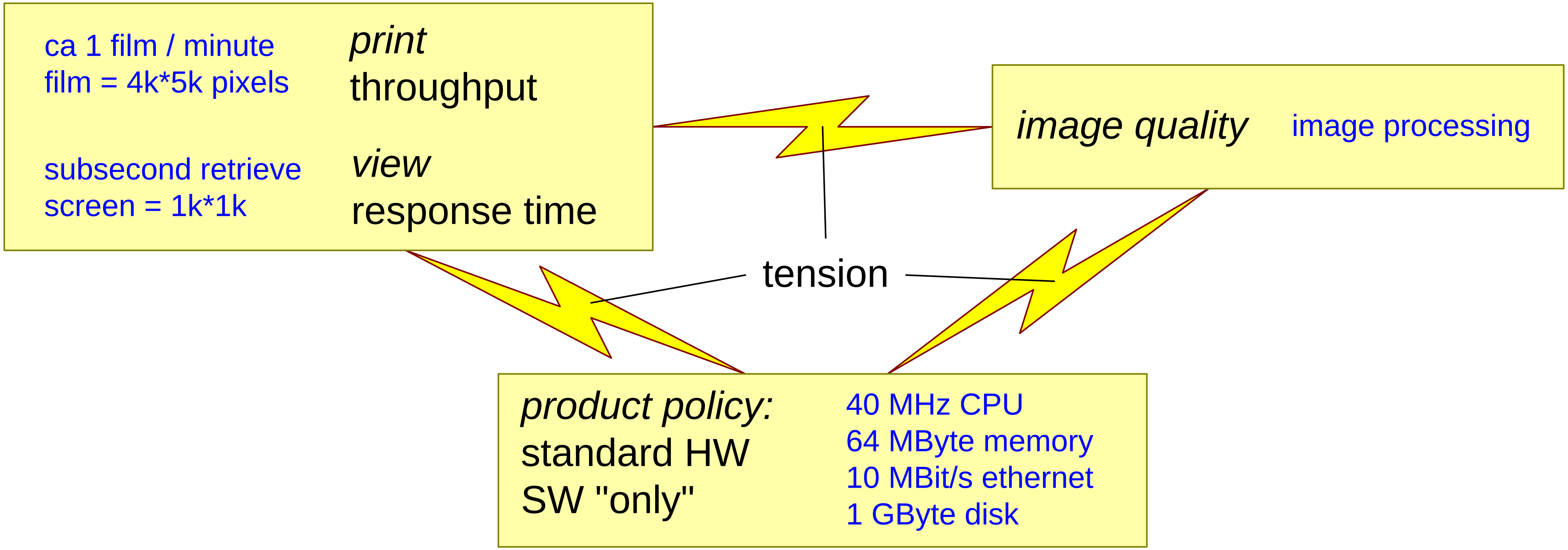


old: screen copy

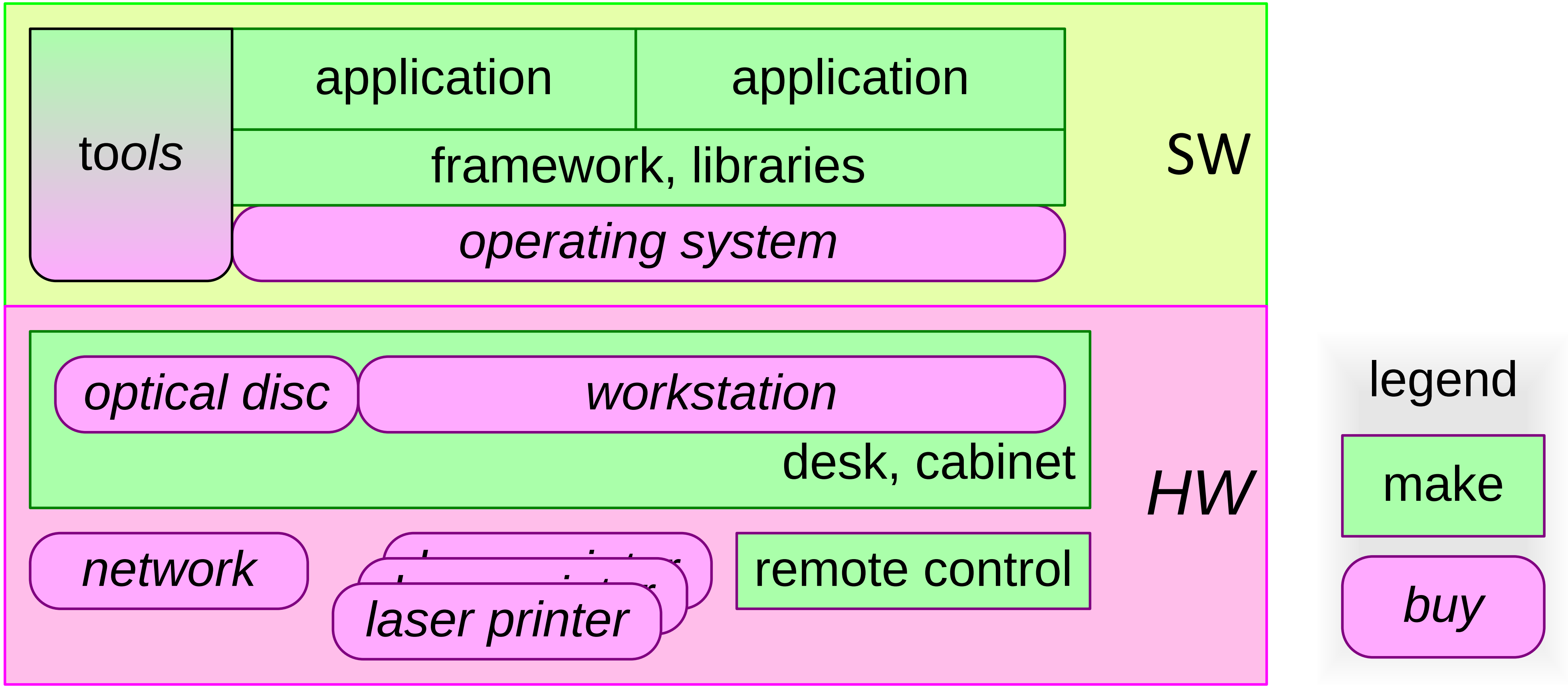
new: SW formatting

20 to 50% less film needed

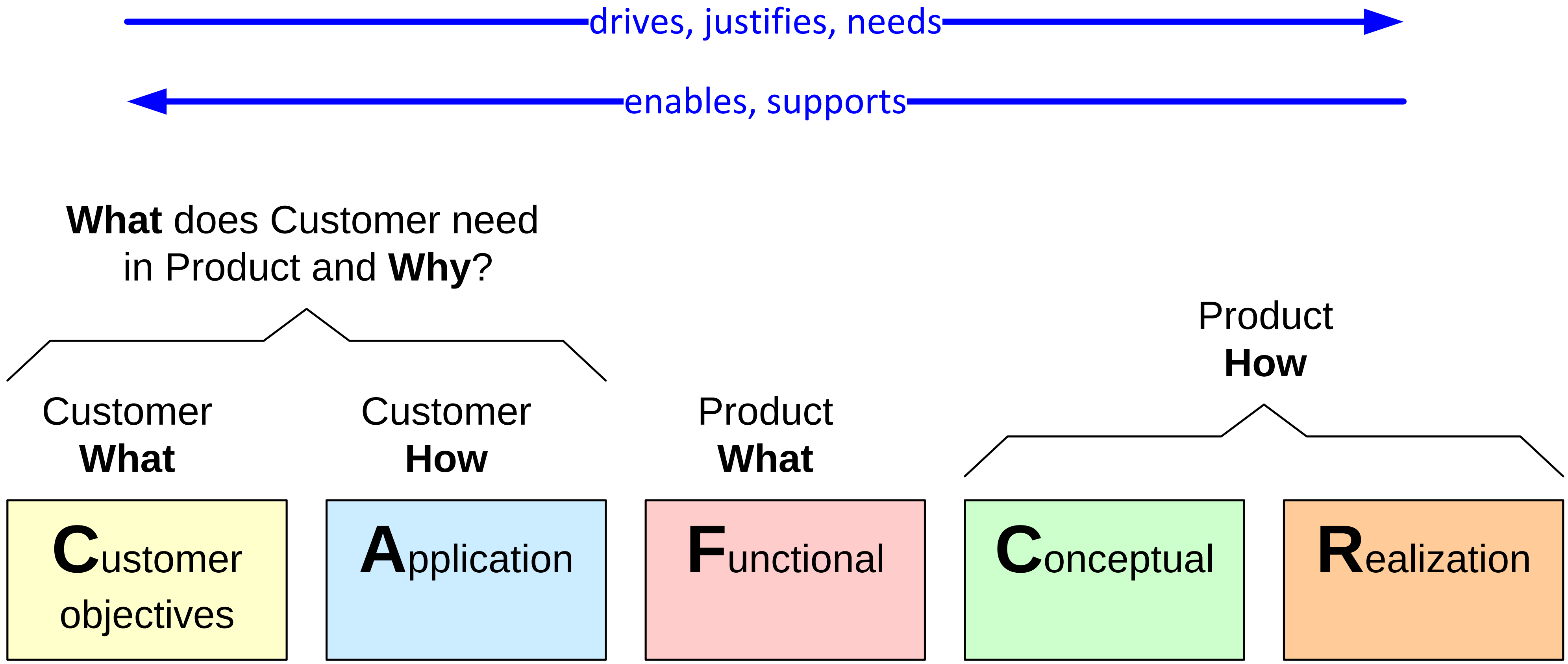
Challenges for product creation



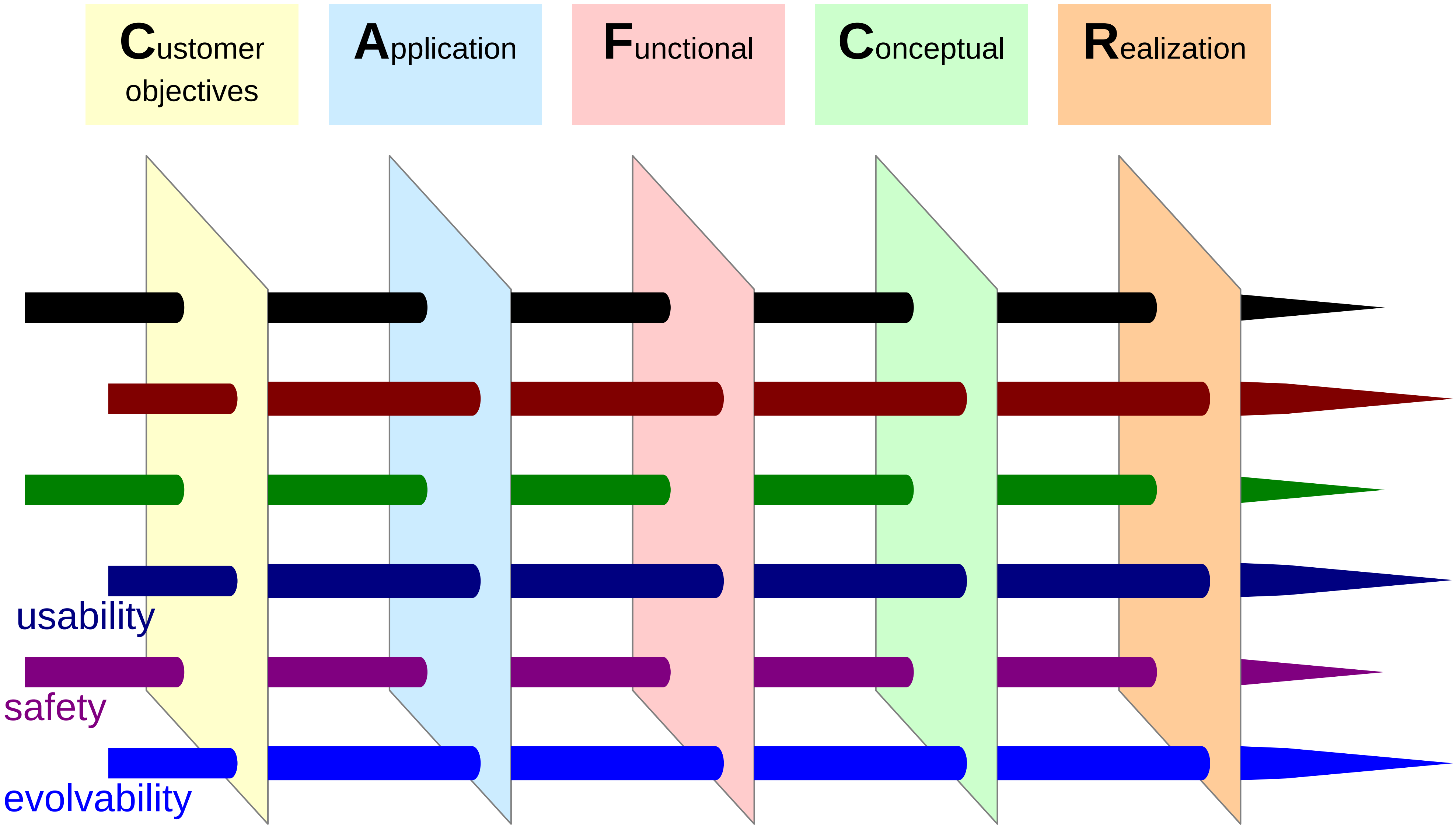
Top level decomposition



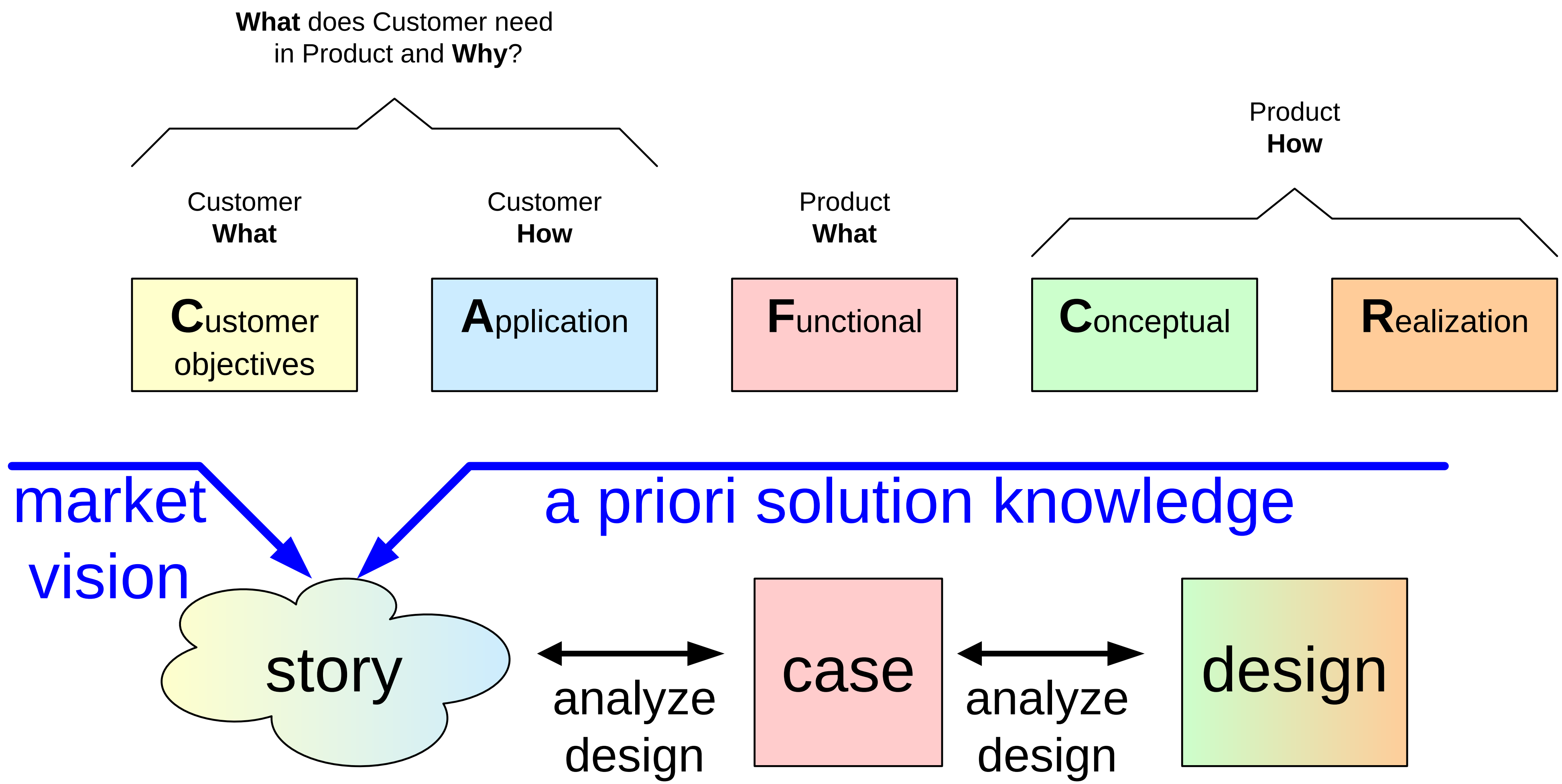
CAFCR viewpoints



Quality needles as generic integrating concepts



From story to design



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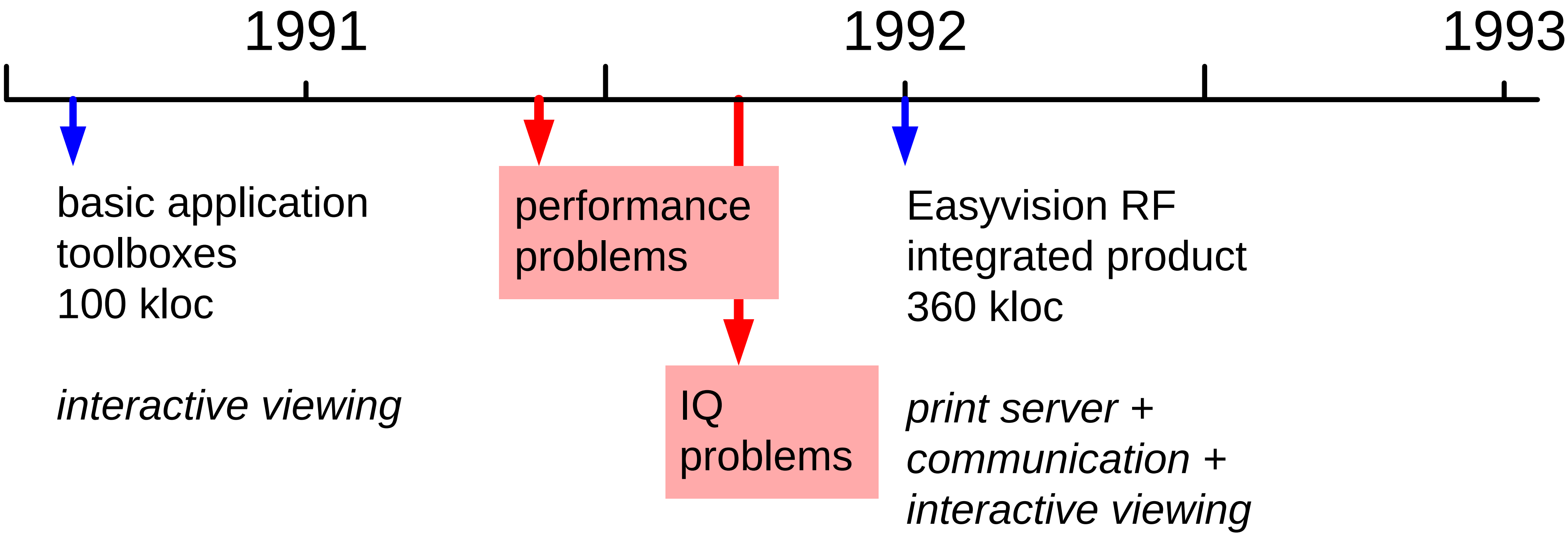
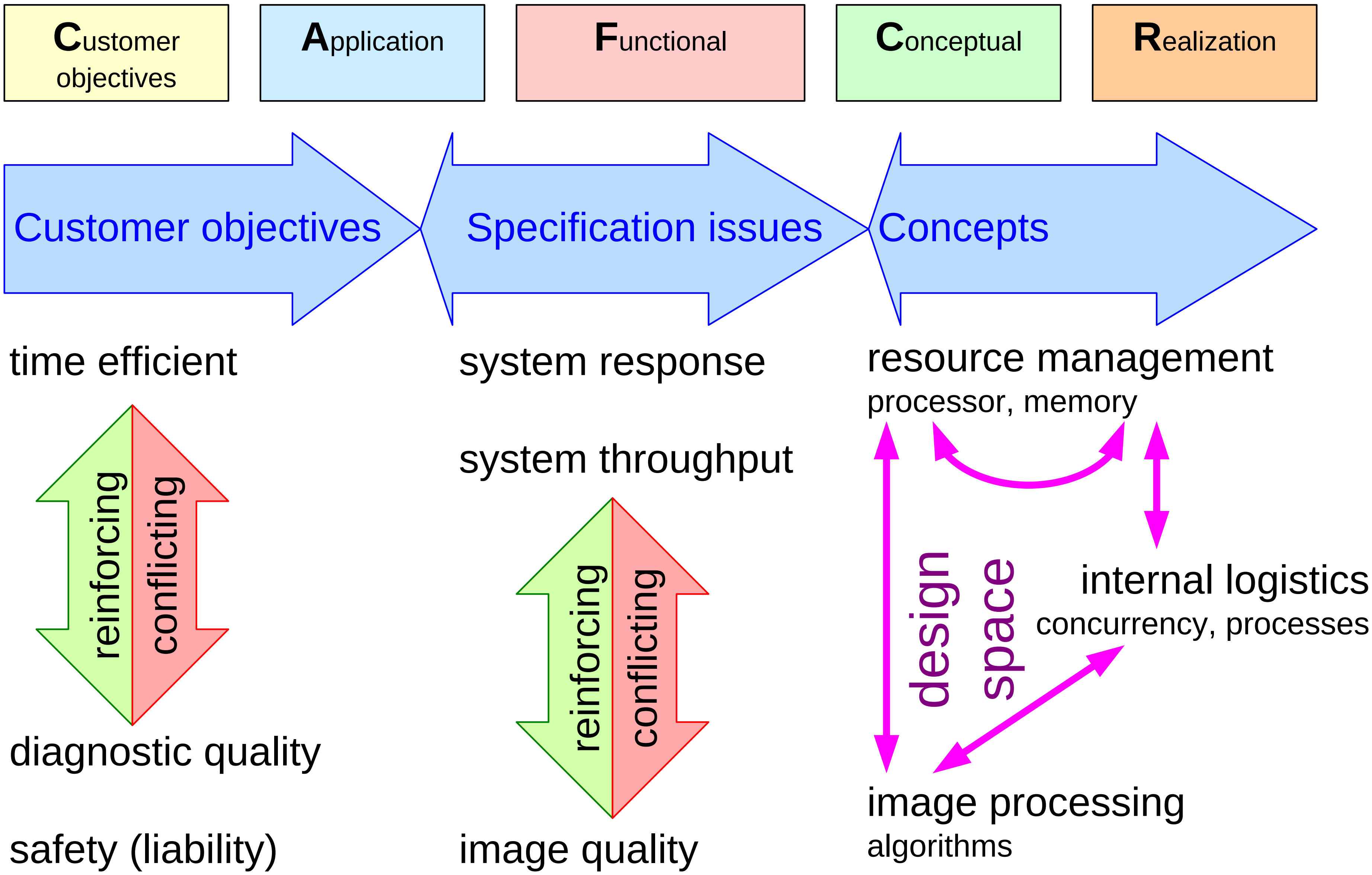
SHTfromStoryToDesign

Chronology of Easyvision RF R1 development



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

Thread of reasoning based on efficiency-quality tension

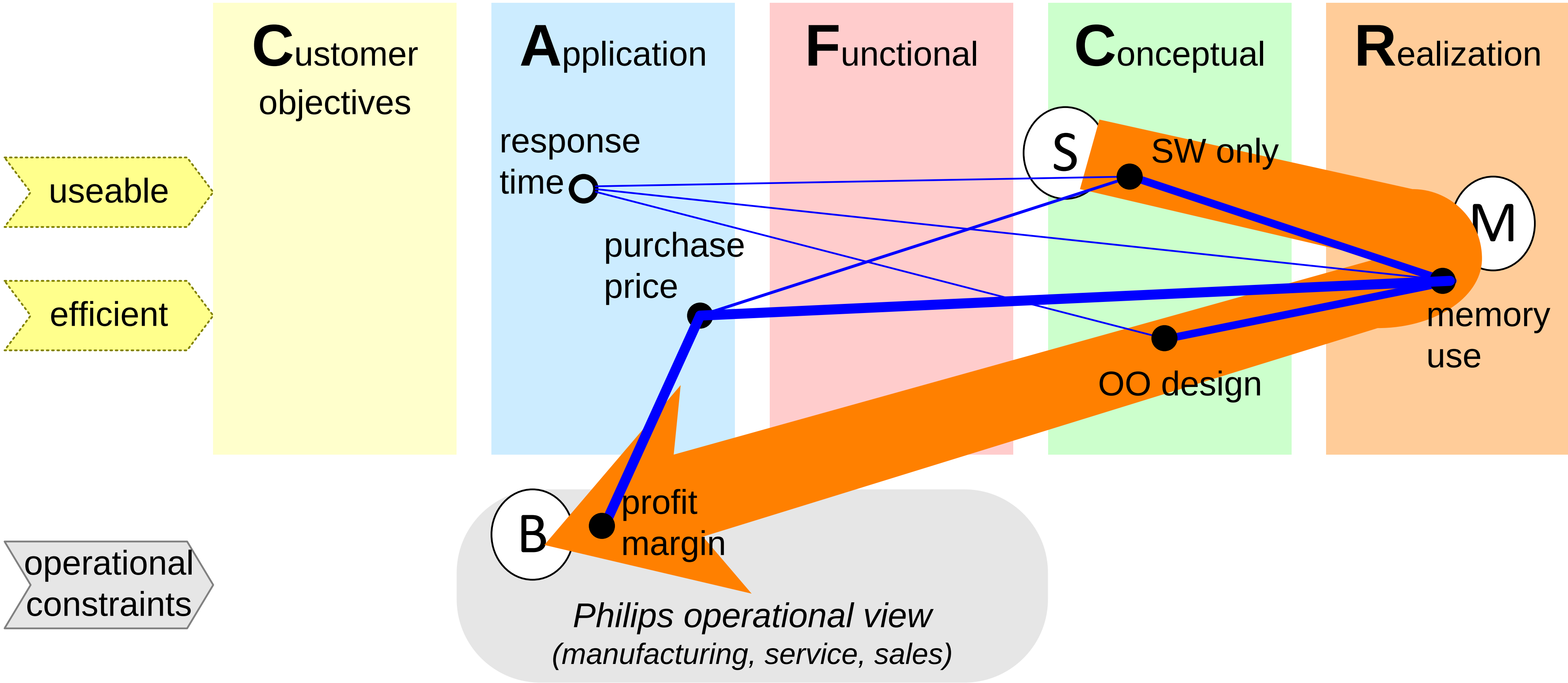


Technology innovations

performance
cost

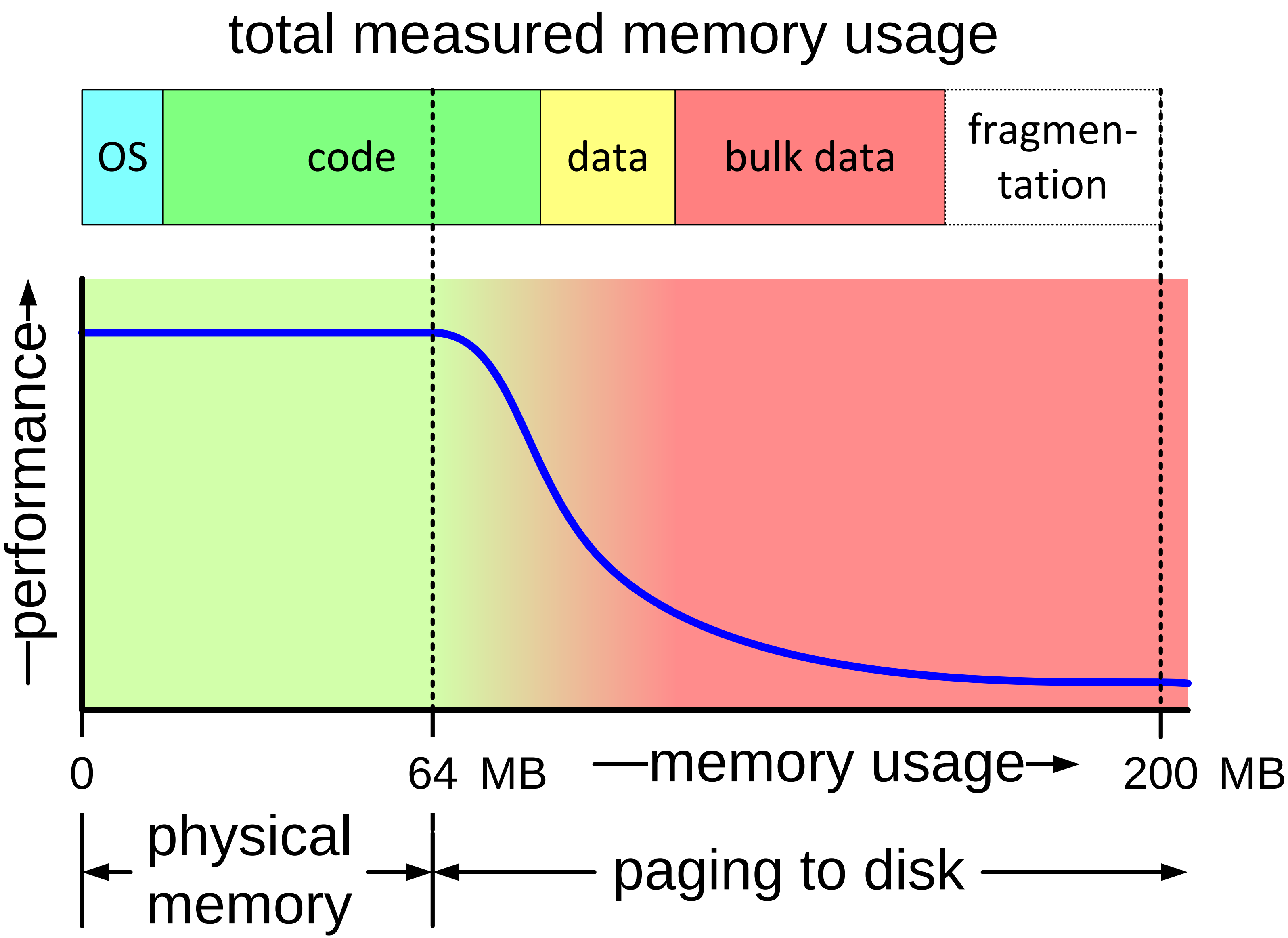
- standard UNIX based workstation
- full SW implementation, more flexible
- object oriented design and implementation (Objective-C)
- graphical User Interface, with windows, mouse etcetera
- call back scheduling, fine-grained notification
- data base engine, fast, reliable and robust
- extensive set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

Thread of reasoning; introvert phase

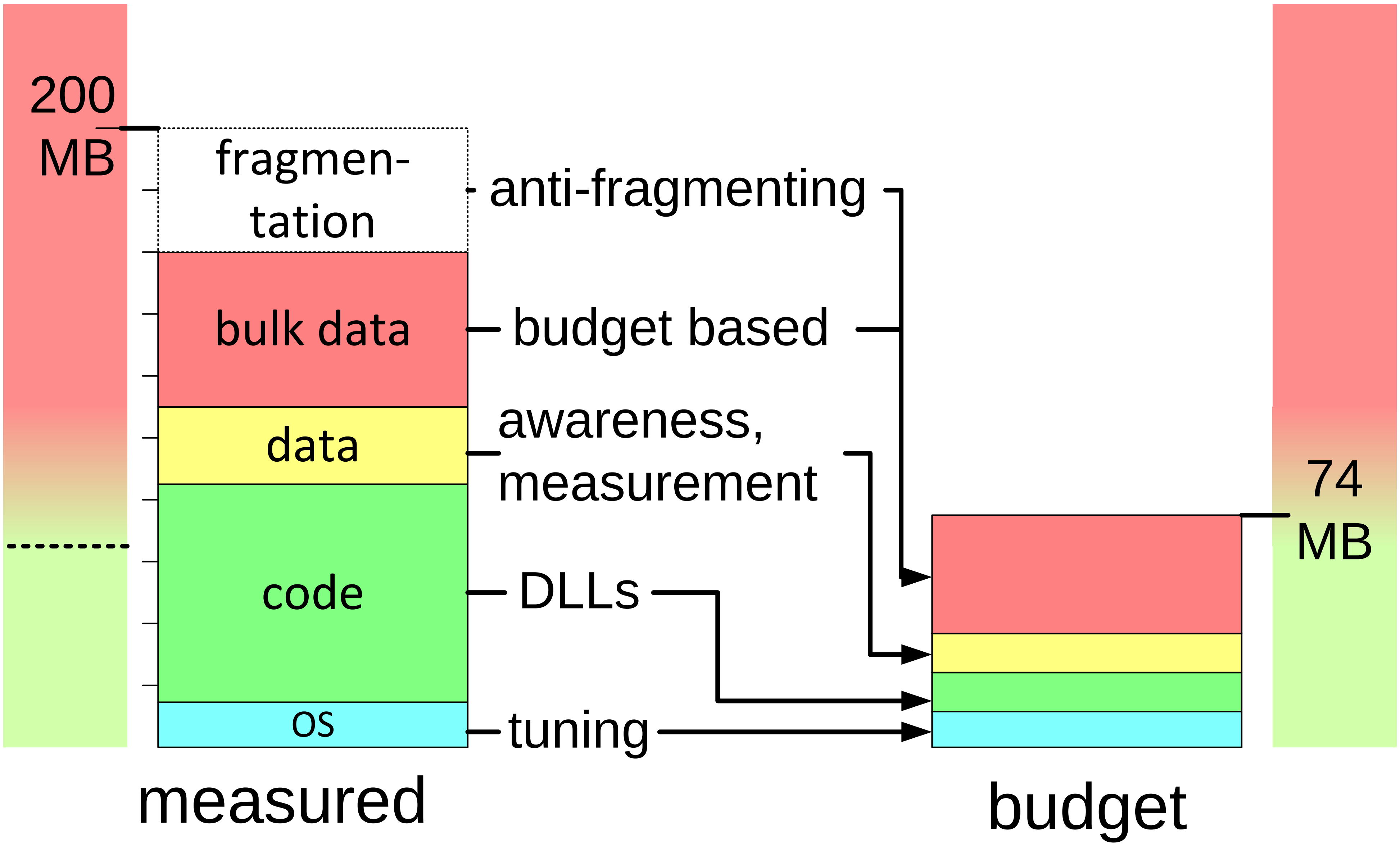


Introvert view: cost and impact of new technologies

Memory usage half way R1



Solution of memory performance problem



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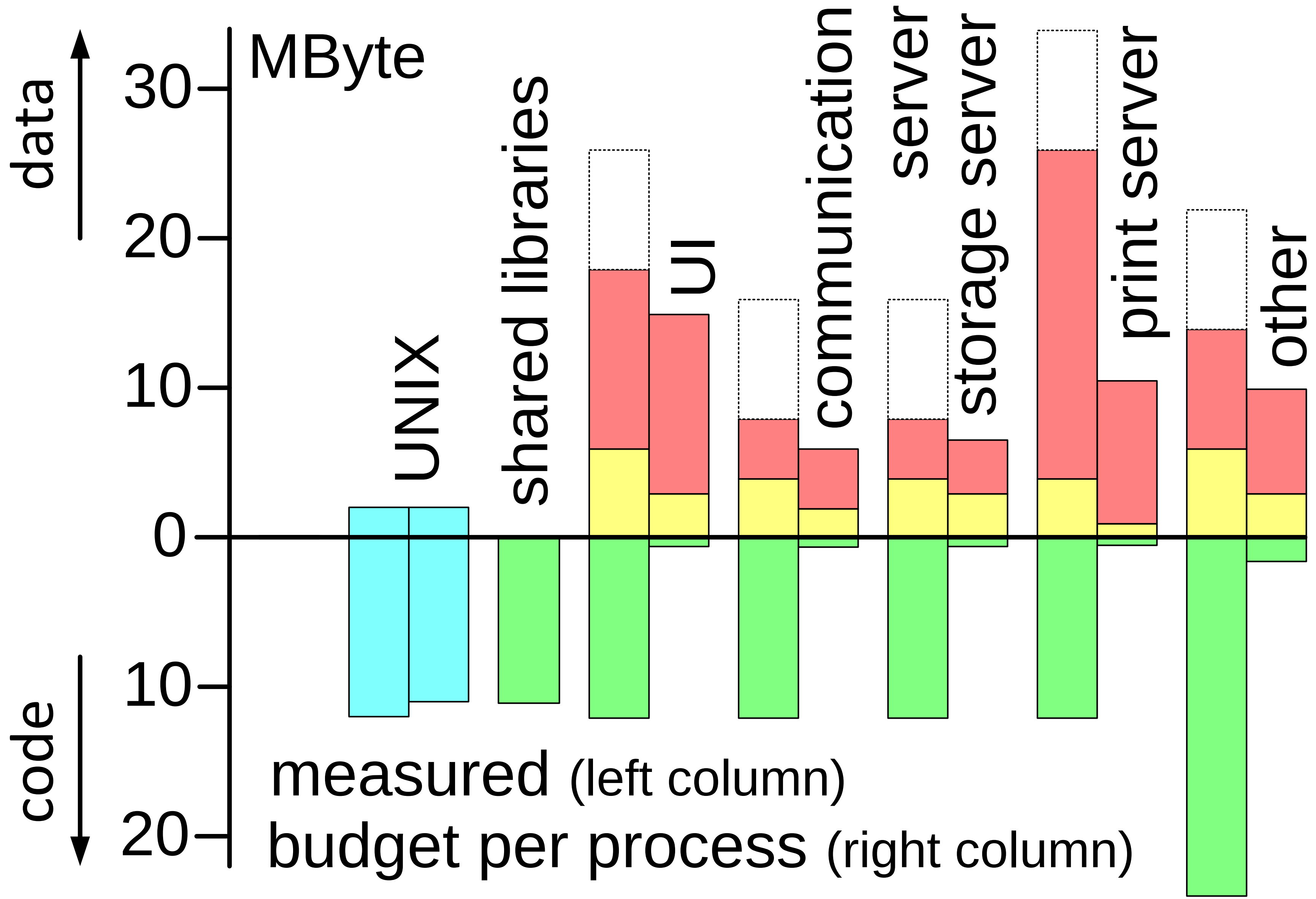
MSmemoryUsageReduction

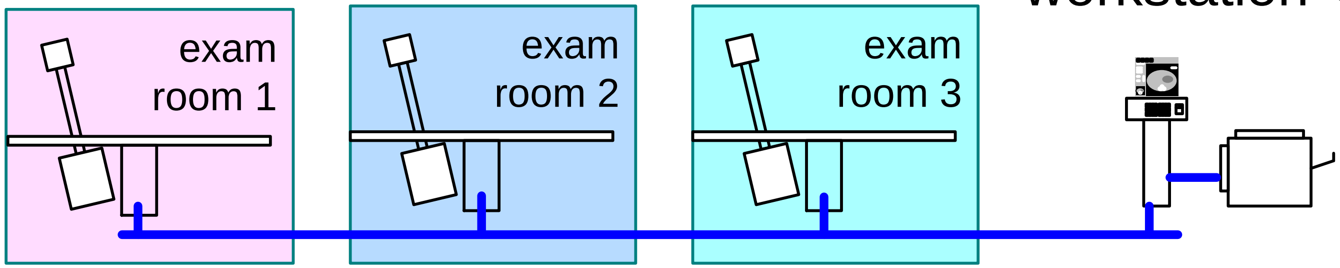
Visualization memory use per process



Typical case URF examination

3 examination rooms connected to

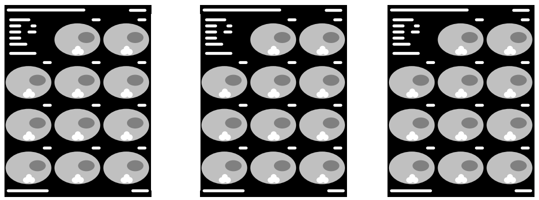
1 medical imaging workstation + printer



examination room: average 4 interleaved examinations / hour

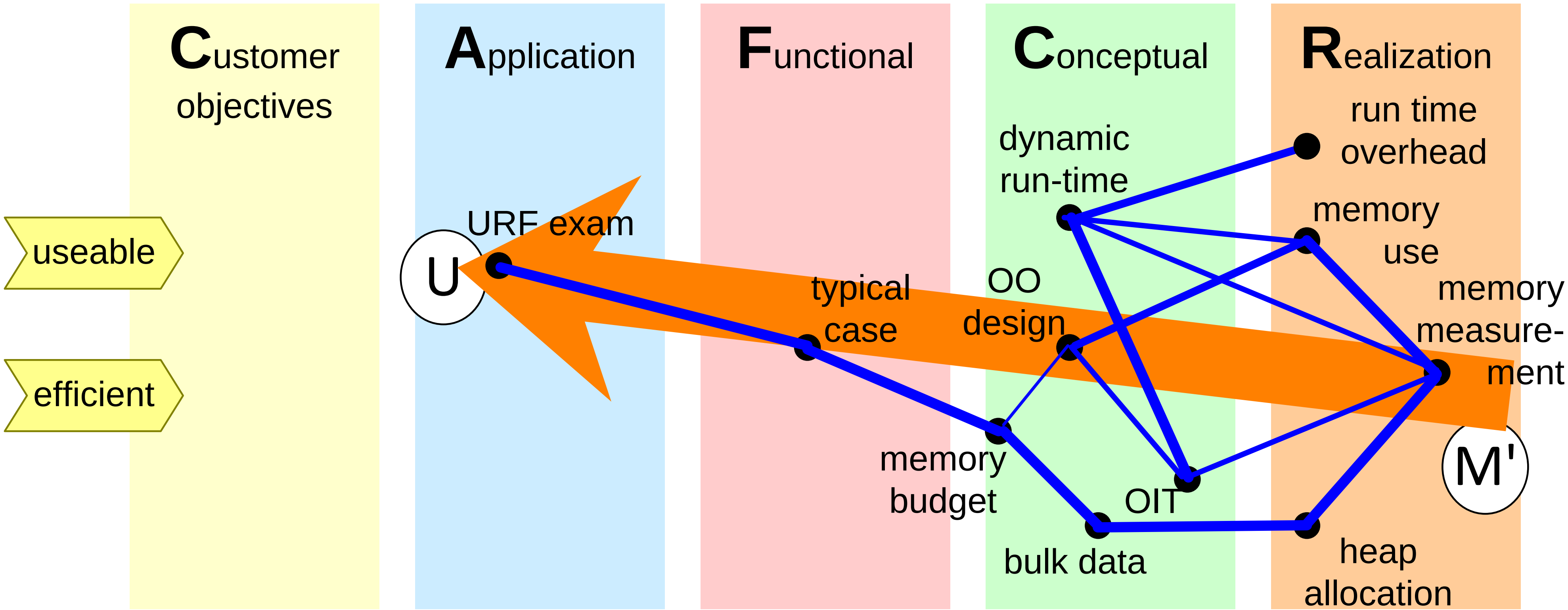
image production: 20 1024^2 8 bit images per examination

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



high quality output (bi-cubic interpolation)

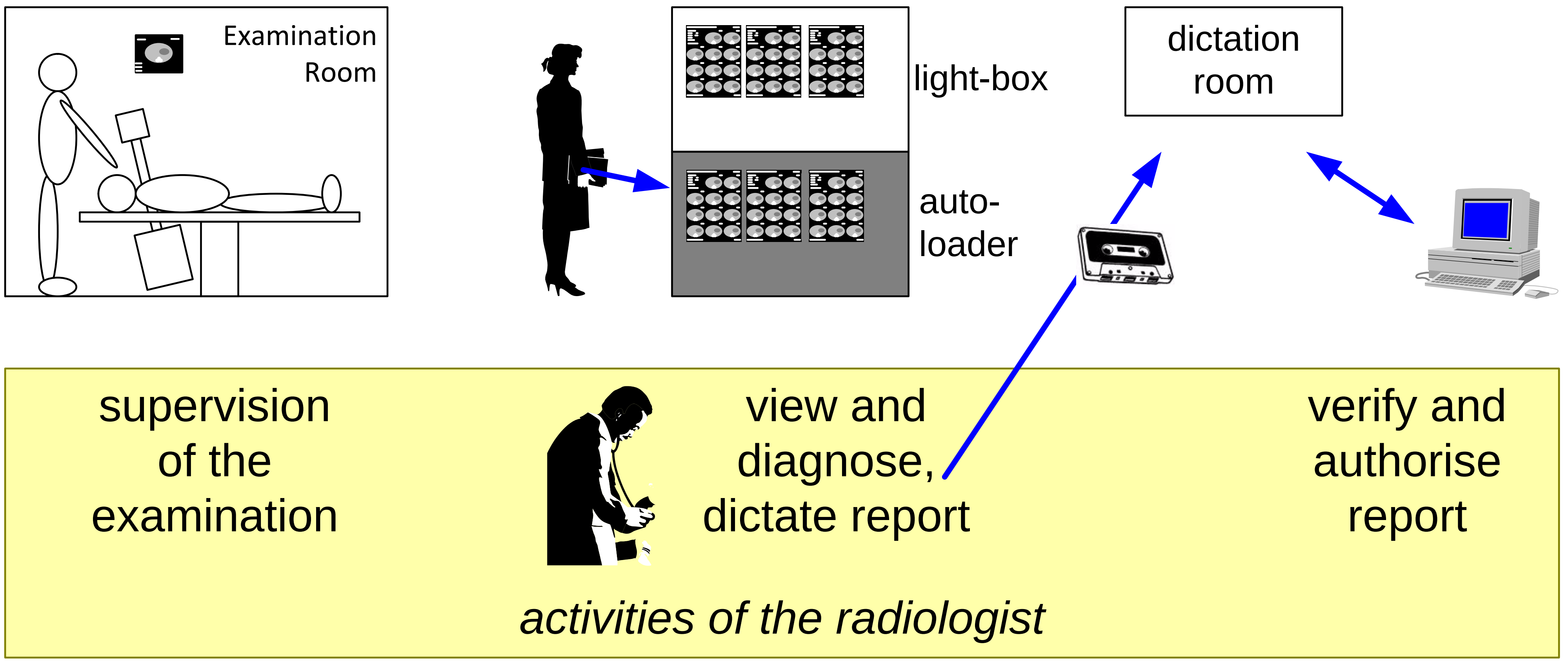
Thread of reasoning; phase 2



Philips operational view
(manufacturing, service, sales)

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

Radiologist workspots and activities



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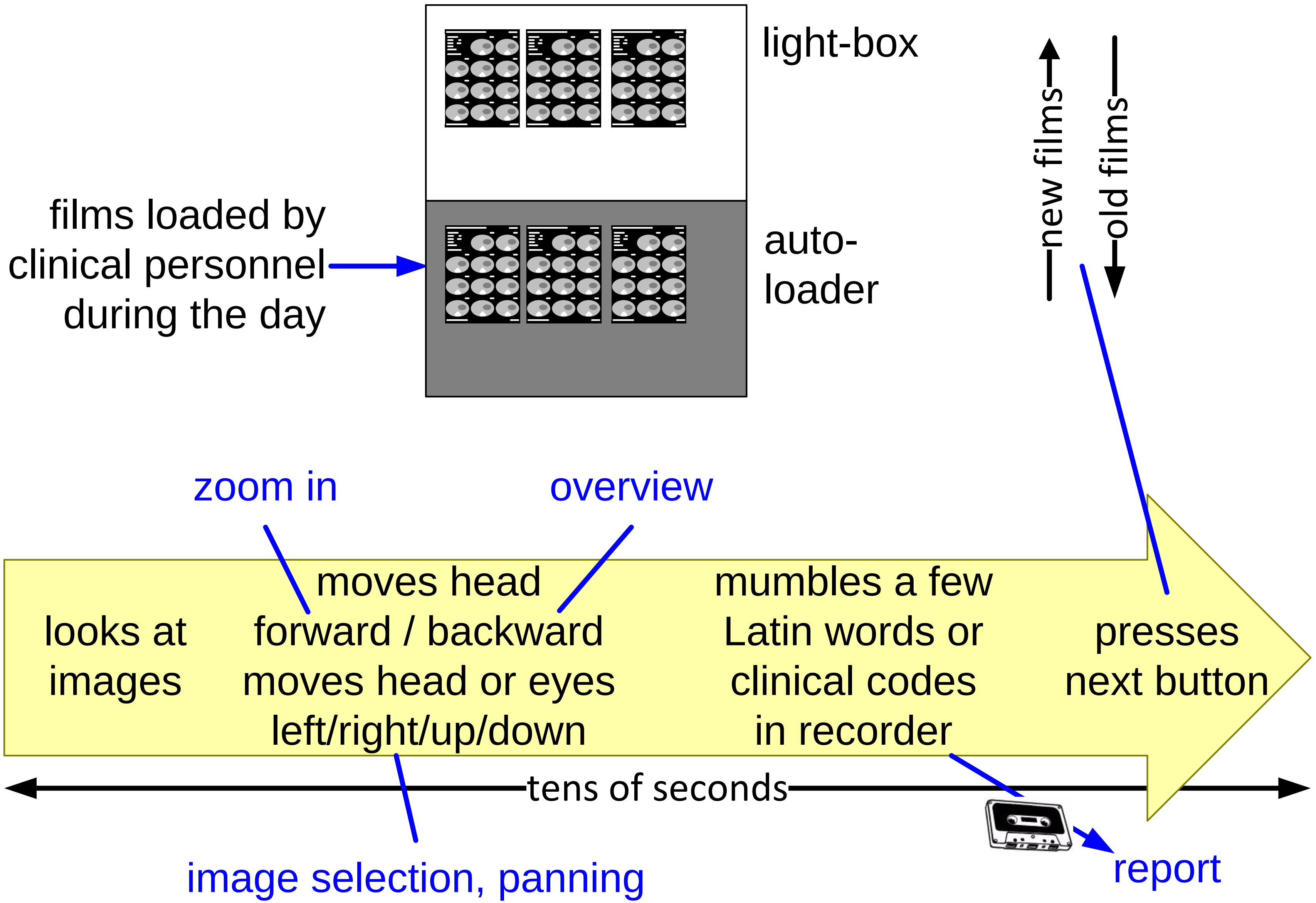
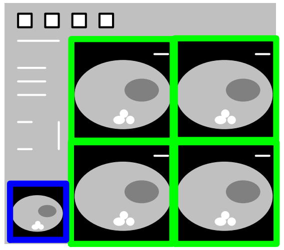
MISactivitiesRadiologist

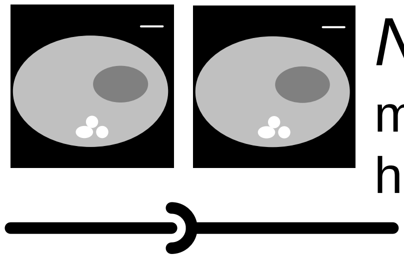
Diagnosis in tens of seconds



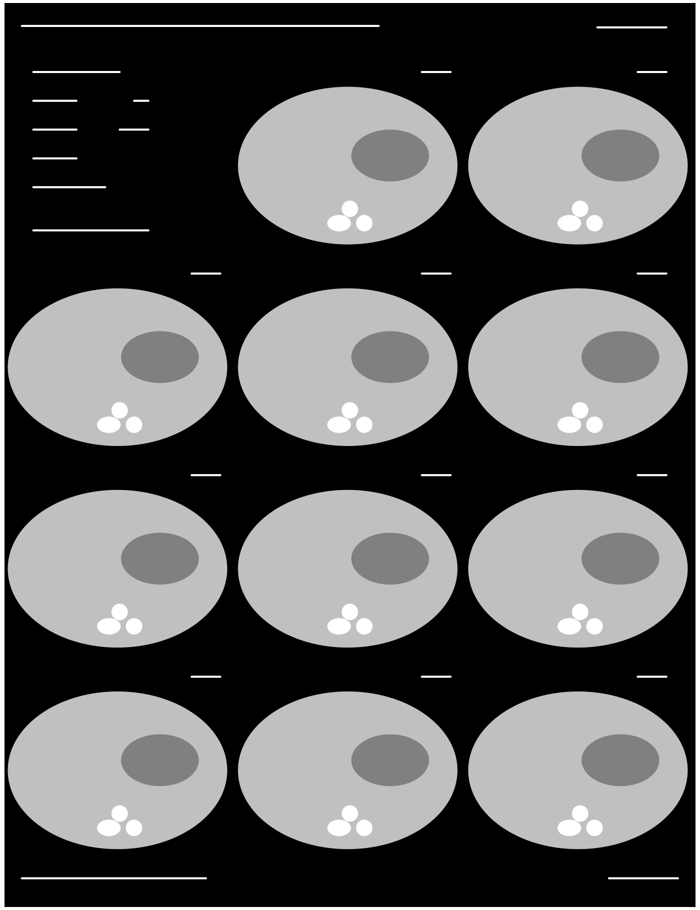
Rendered images at different destinations



Screen:
low resolution
fast response

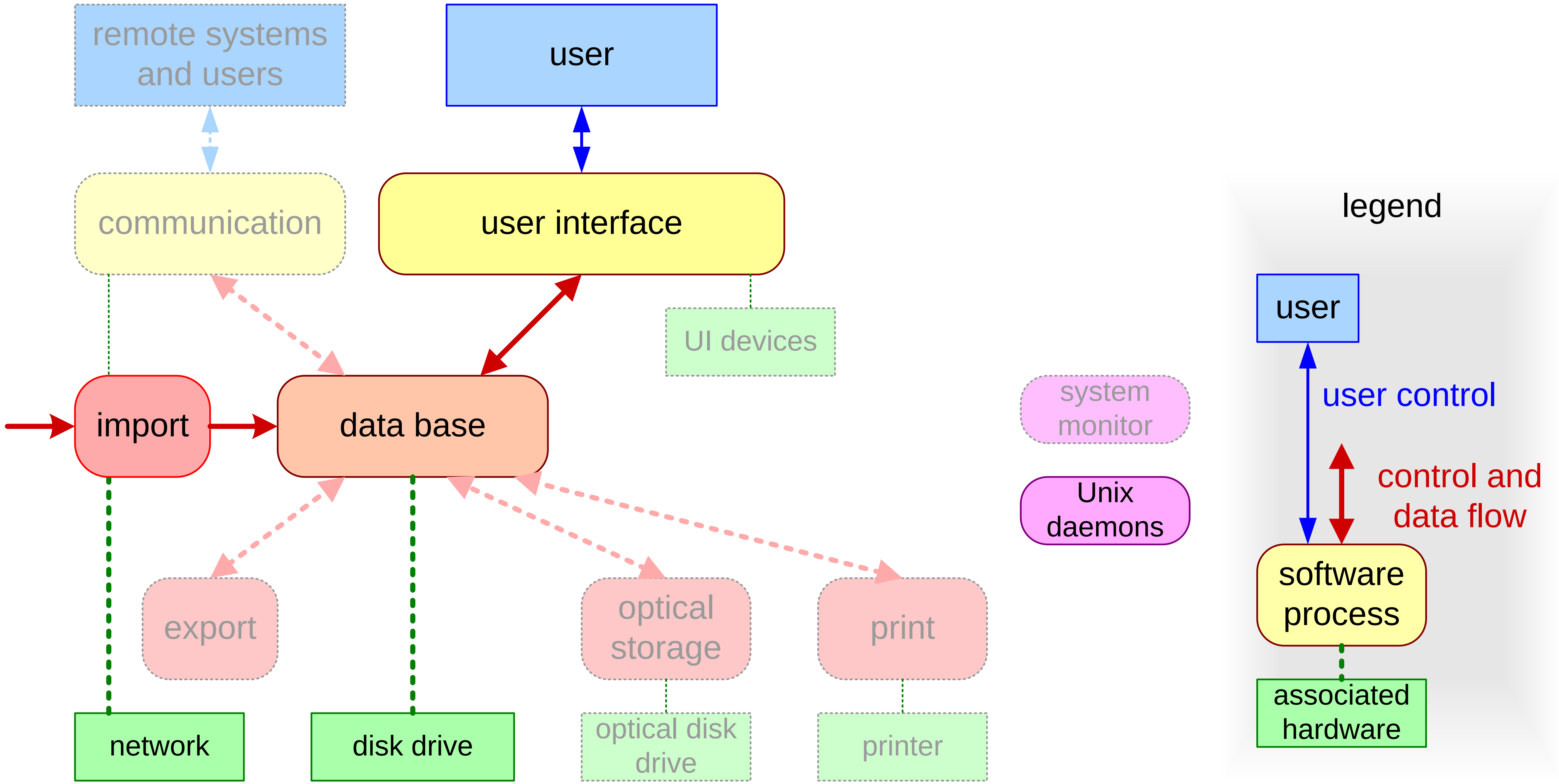


Network:
medium resolution
high throughput

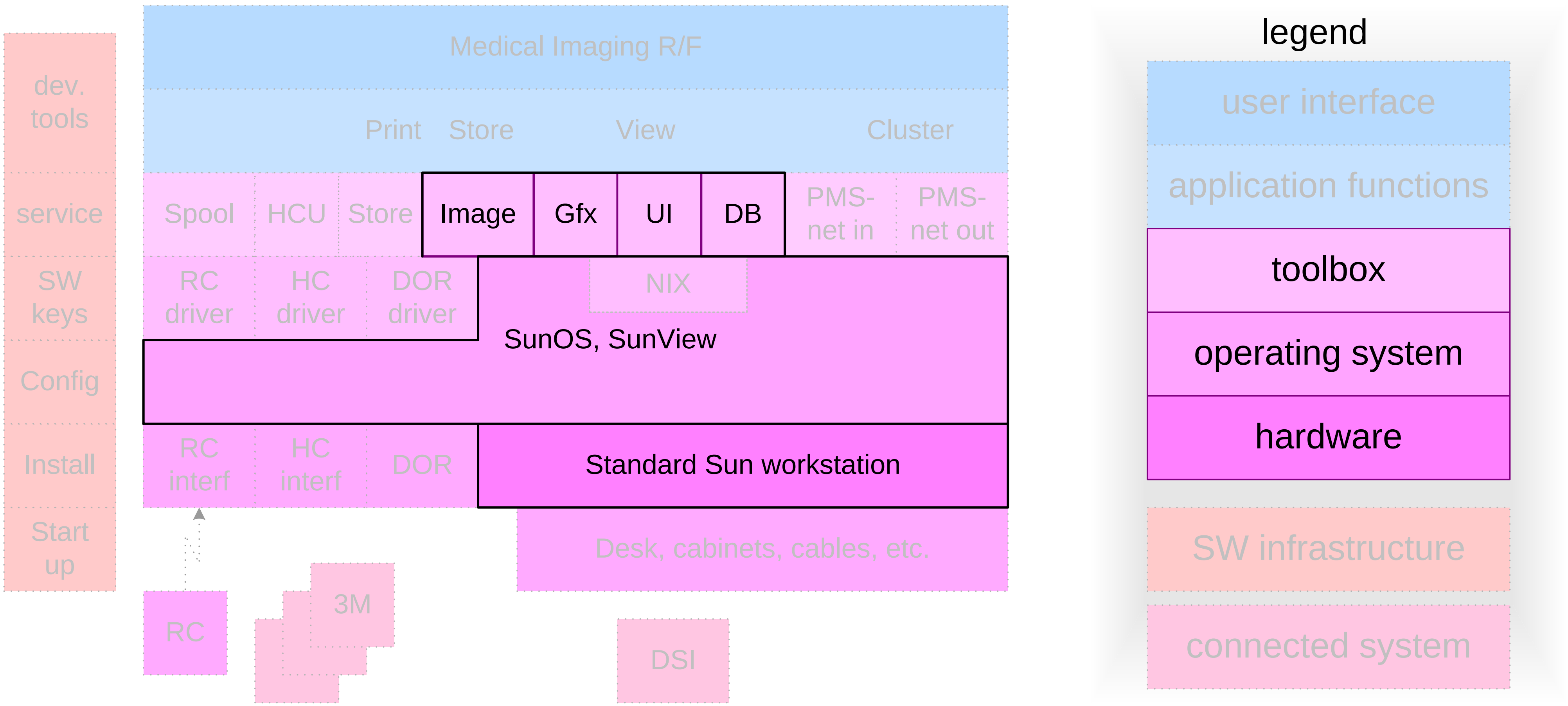


Film:
high resolution
high throughput

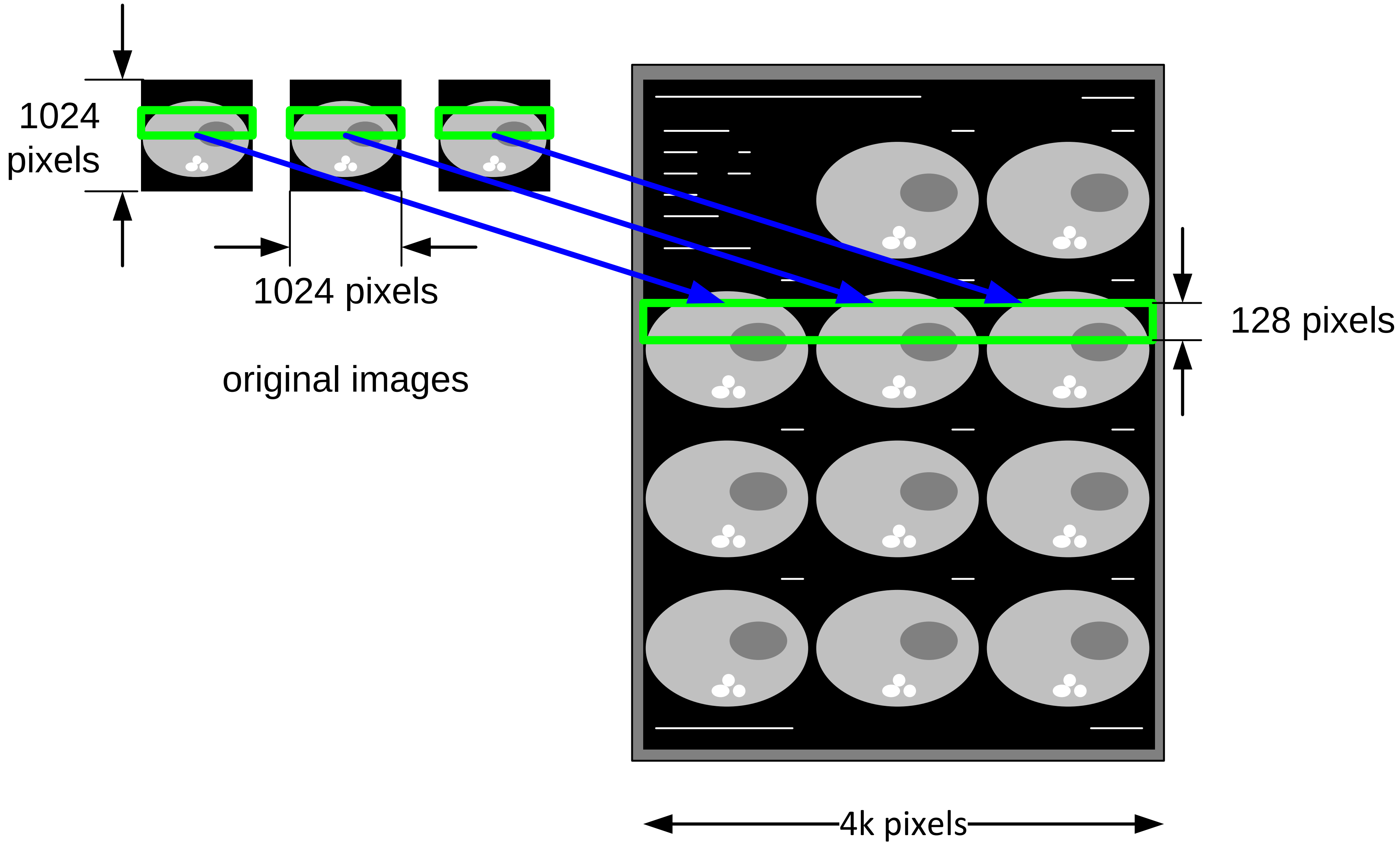
SW Process structure 1991



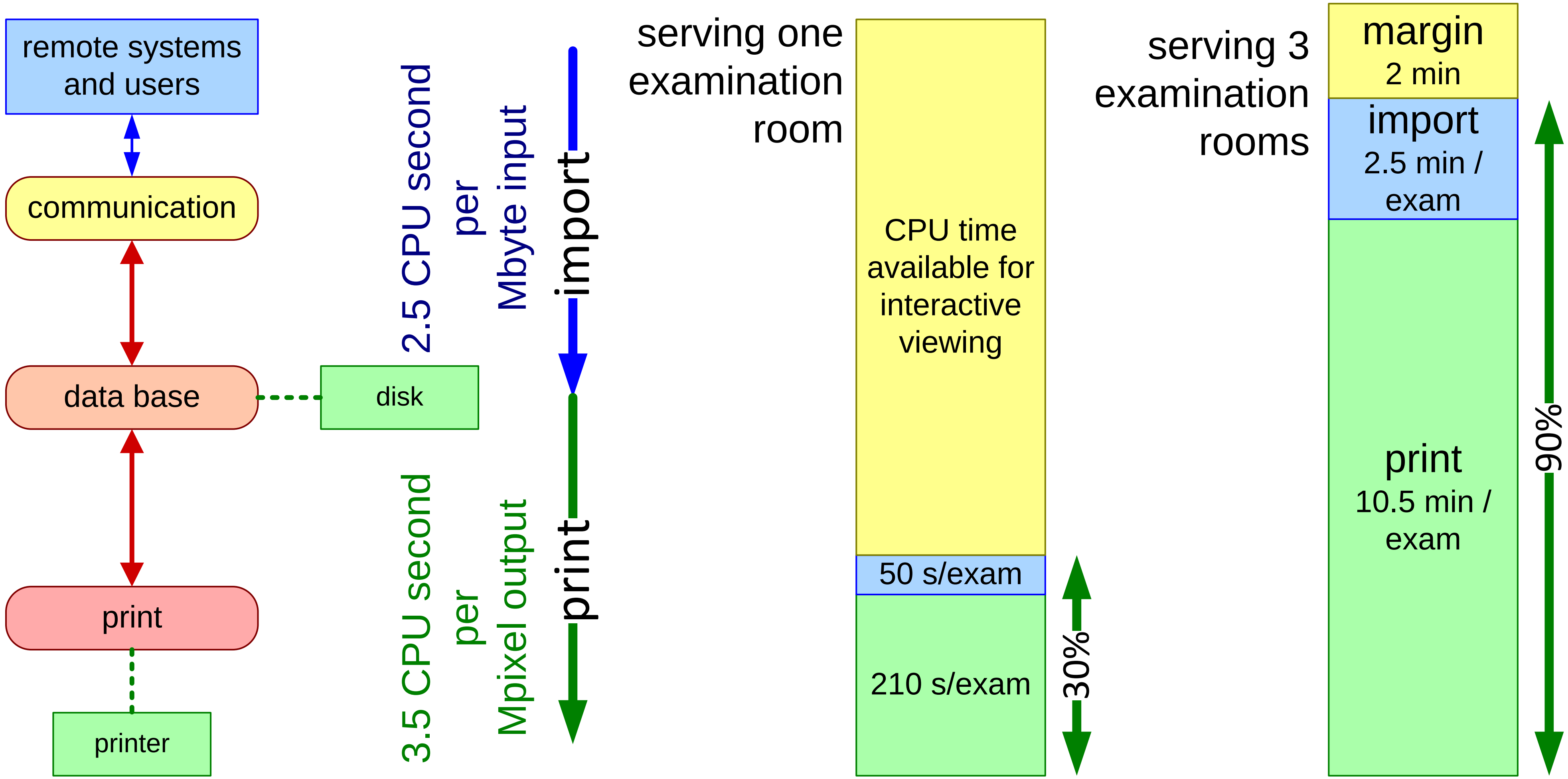
SW layers 1991



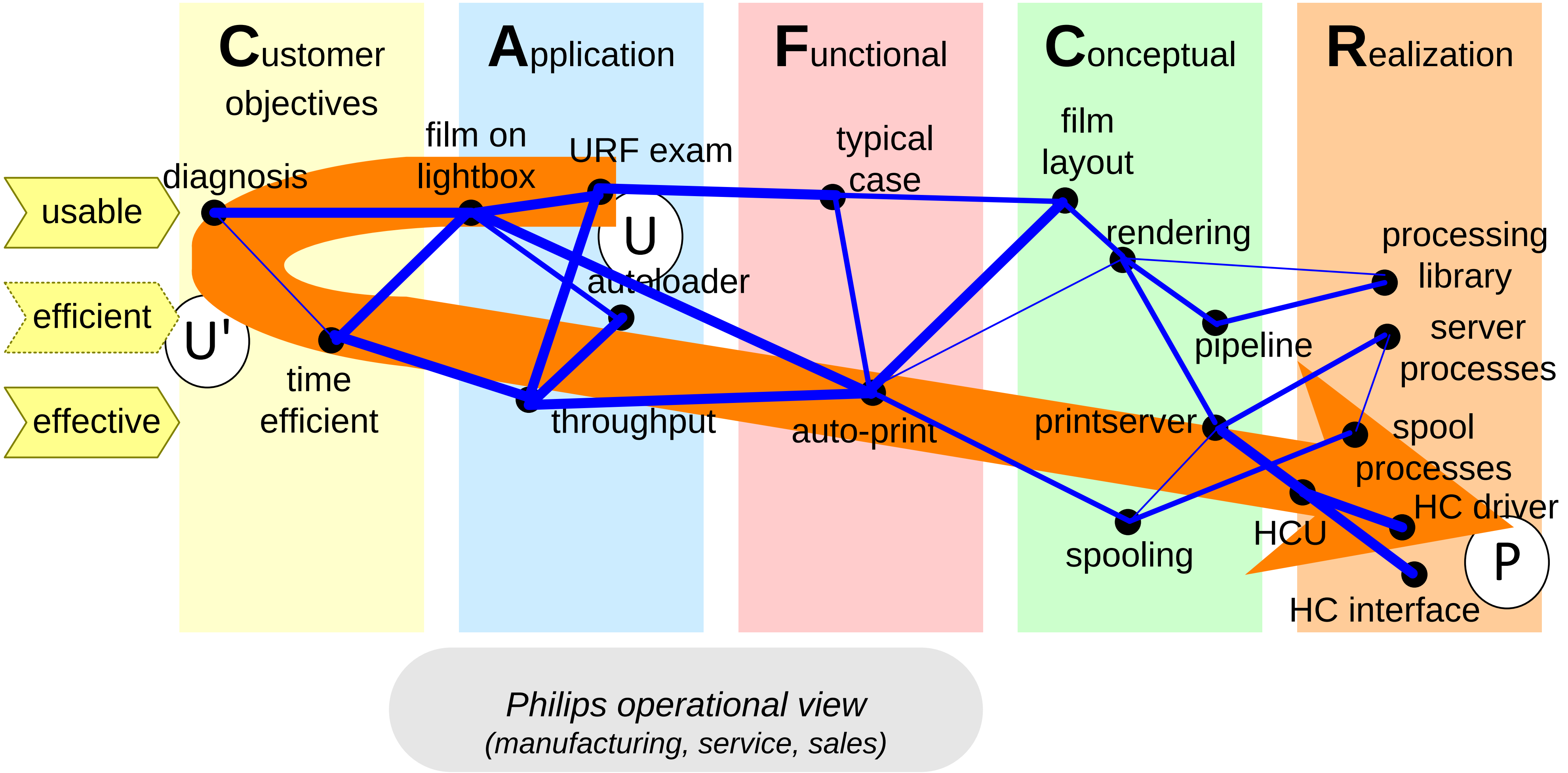
Print server is based on banding



Server CPU load

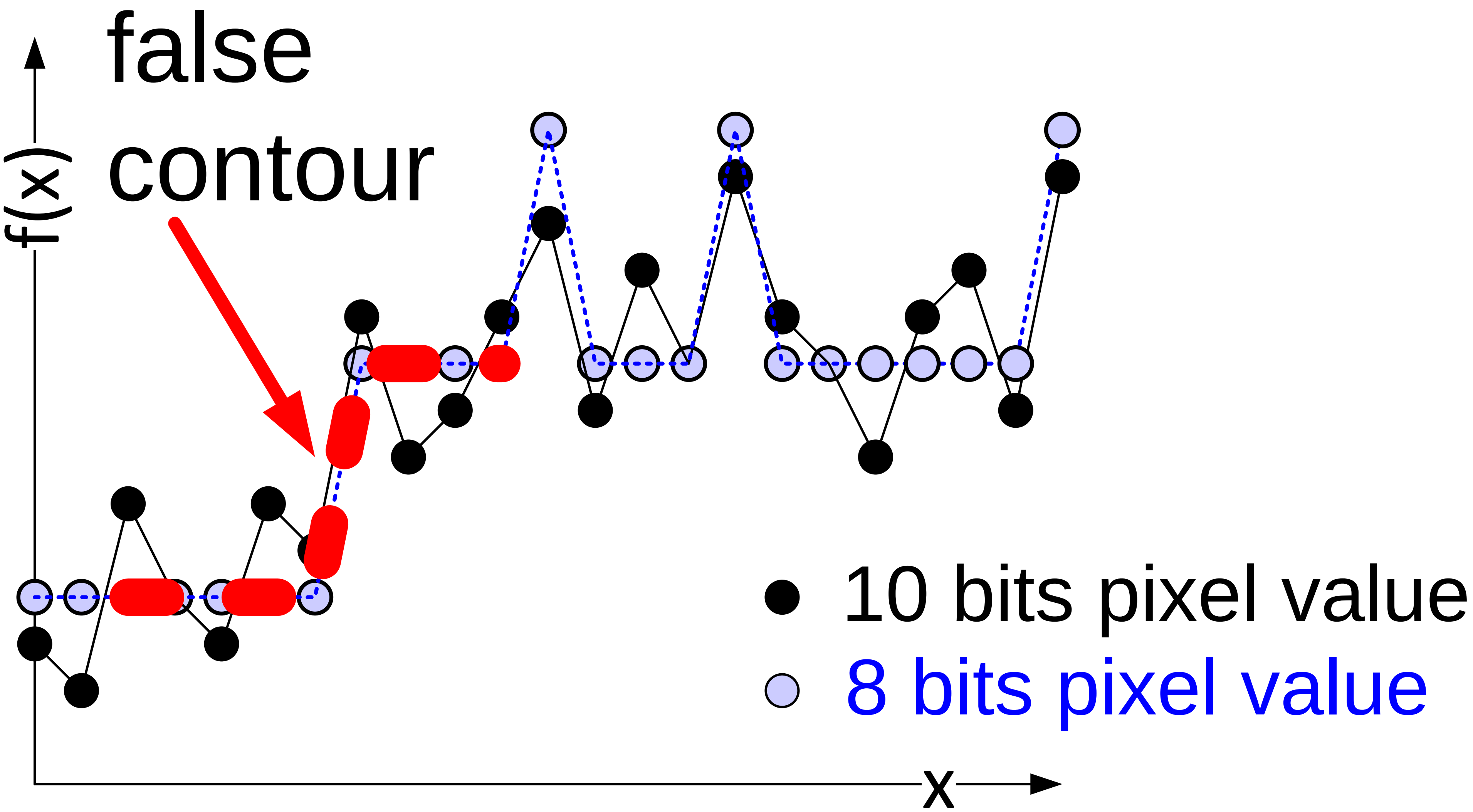


Thread of reasoning; phase 3



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

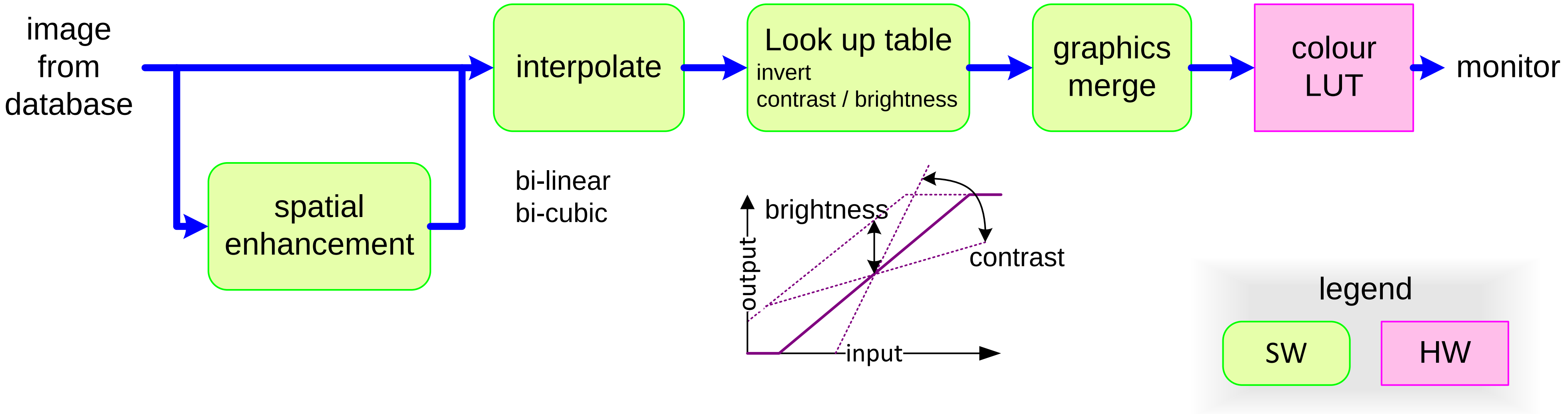
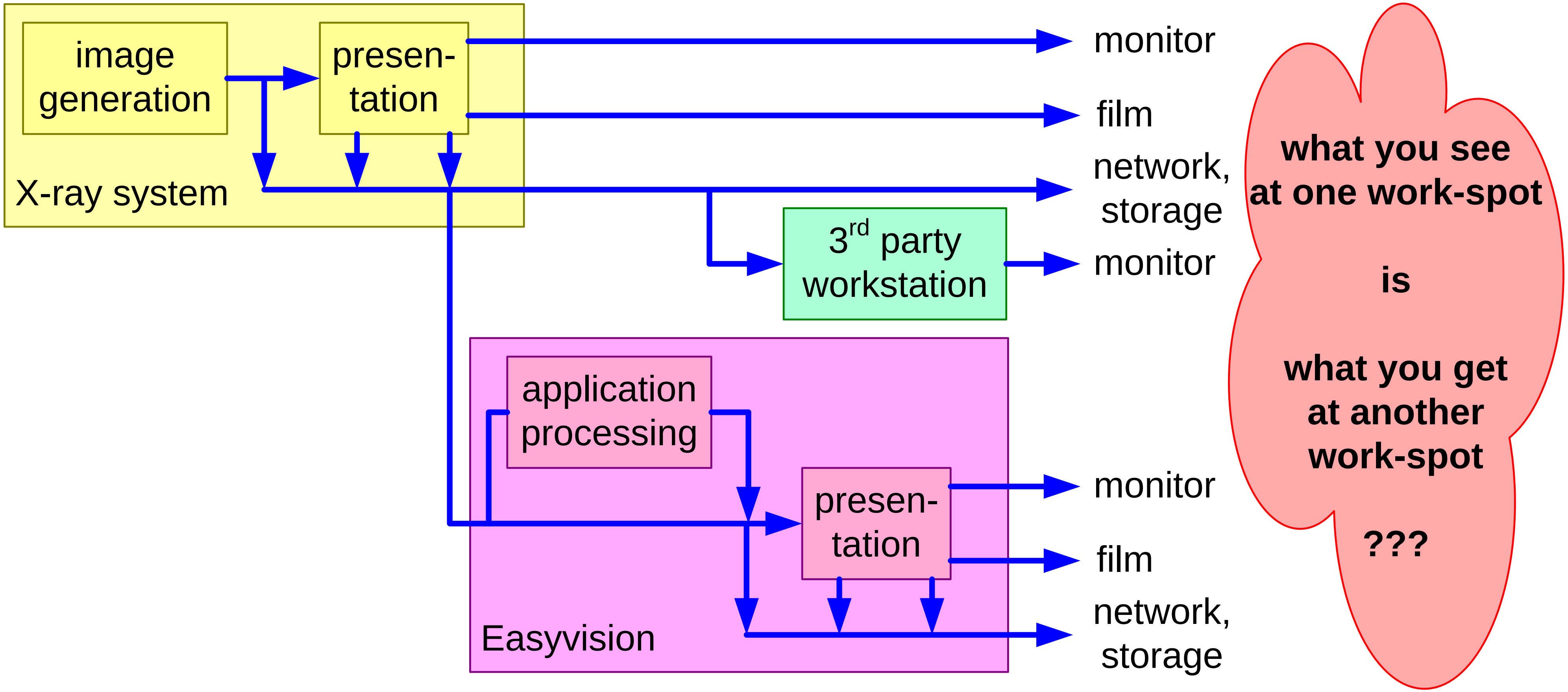
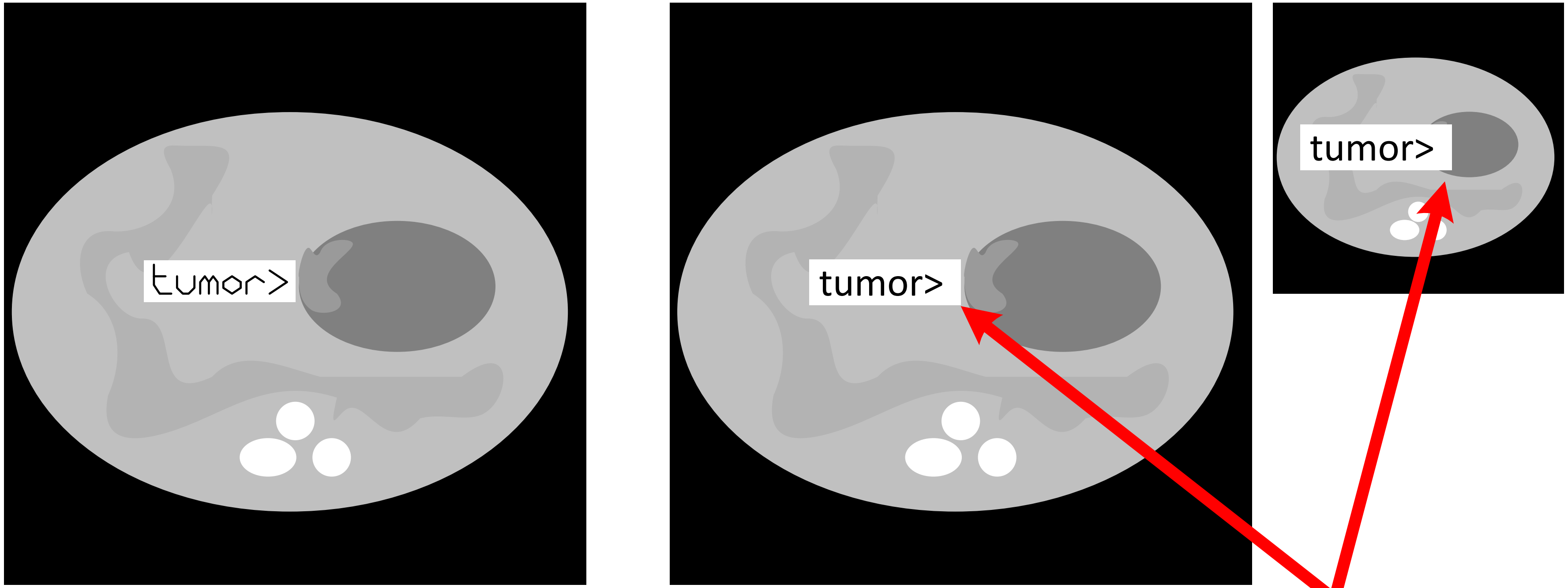


Image Quality expectation WYSIWYG



Safety problem



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

URF monitor output:
fixed size letters at fixed grid

EV output: scaleable fonts in graphics overlay

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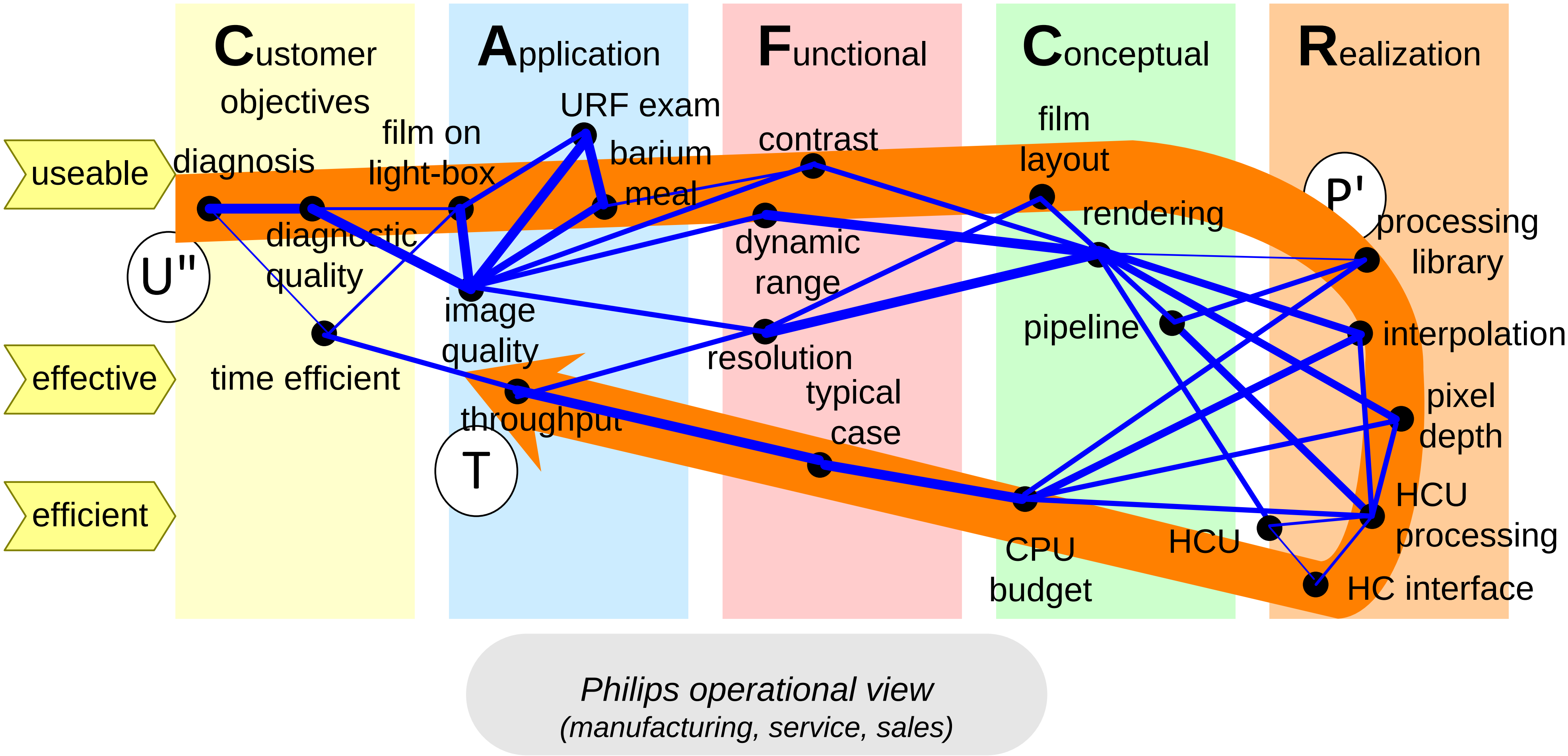
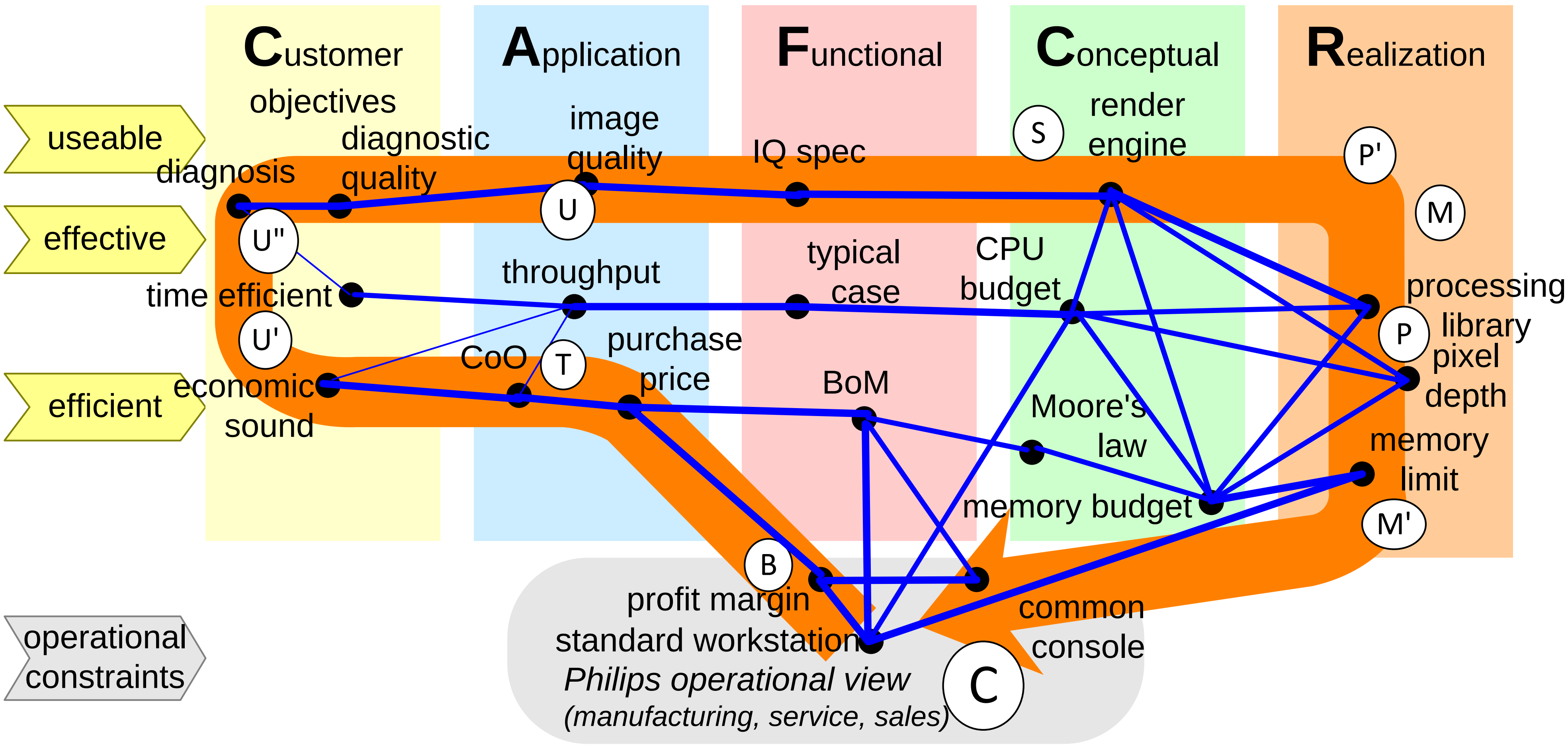
MITORfontScaling

Thread of reasoning; phase 4



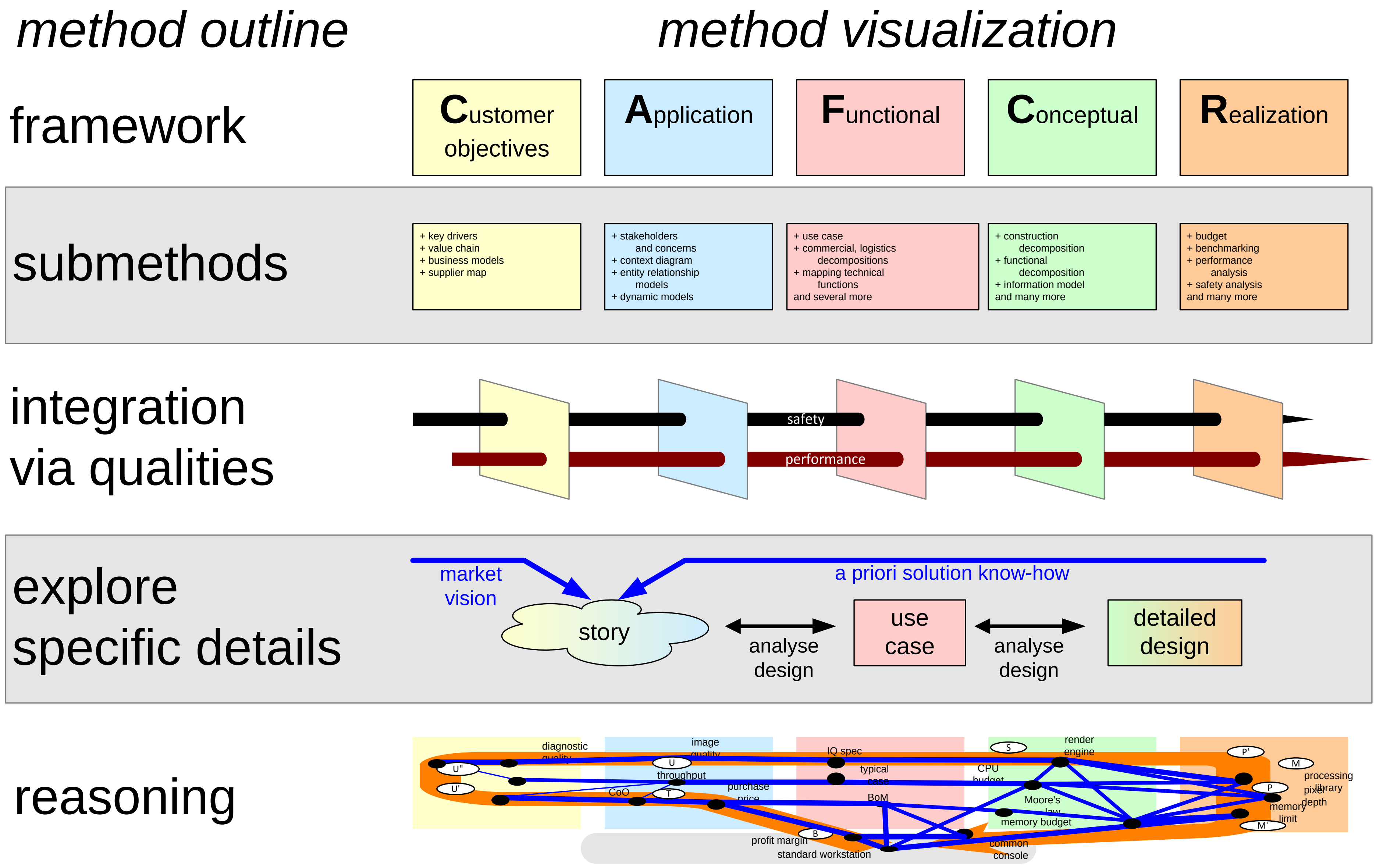
from extrovert diagnostic quality, via image quality, algorithms and load, to extrovert throughput

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



Exercise

- Make a key driver graph

  Use the key driver approach

  Take the recommendations into account

Reflection on Exercise

+ Key drivers put requirements in broader perspective
+ Discussion creates shared understanding

~ The graph needs external feedback

- Are the key drivers really from the customer?
- Are the key drivers *sharp* enough?

Summary Threads of Reasoning

Conclusions

Key Driver graph connects customer objectives to system requirements

Threads of Reasoning connects Customer and Operational Objectives to design and technology choices

The overview is maintained by focusing on valuable, important, critical or sensitive aspect; Look for tensions!

Techniques, Models, Heuristics of this module

Key driver graph

Thread of reasoning

Why, What and How

Tensions

Colophon

The Boderc project contributed to Key drivers and Threads of Reasoning. Especially the work of

Lou Somers, Peter van den Bosch, Zhaouri Yuan (Océ),

Berry van der Wijst (Philips),

Adriaan van den Brand (Centric TSolve),

Heico Sandee and *Maurice Heemels* (TU/e, ESI)

has been valuable.