Performance Method Fundamentals

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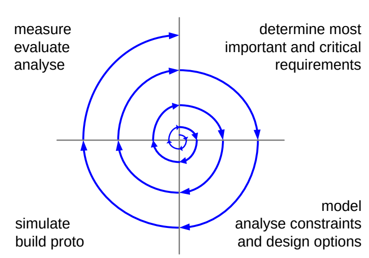
Abstract

The Performance Design Methods described in this article are based on a multi-view approach. The needs are covered by a requirements view. The system design consists of a HW block diagram, a SW decomposition, a functional design and other models dependent on the type of system. The system design is used to create a performance model. Measurements provide a way to get a quantified characterization of the system. Different measurement methods and levels are required to obtain a usable characterized system. The performance model and the characterizations are used for the performance design. The system design decisions with great performance impact are: granularity, synchronization, prior-ization, allocation and resource management. Performance and resource budgets are used as tool.



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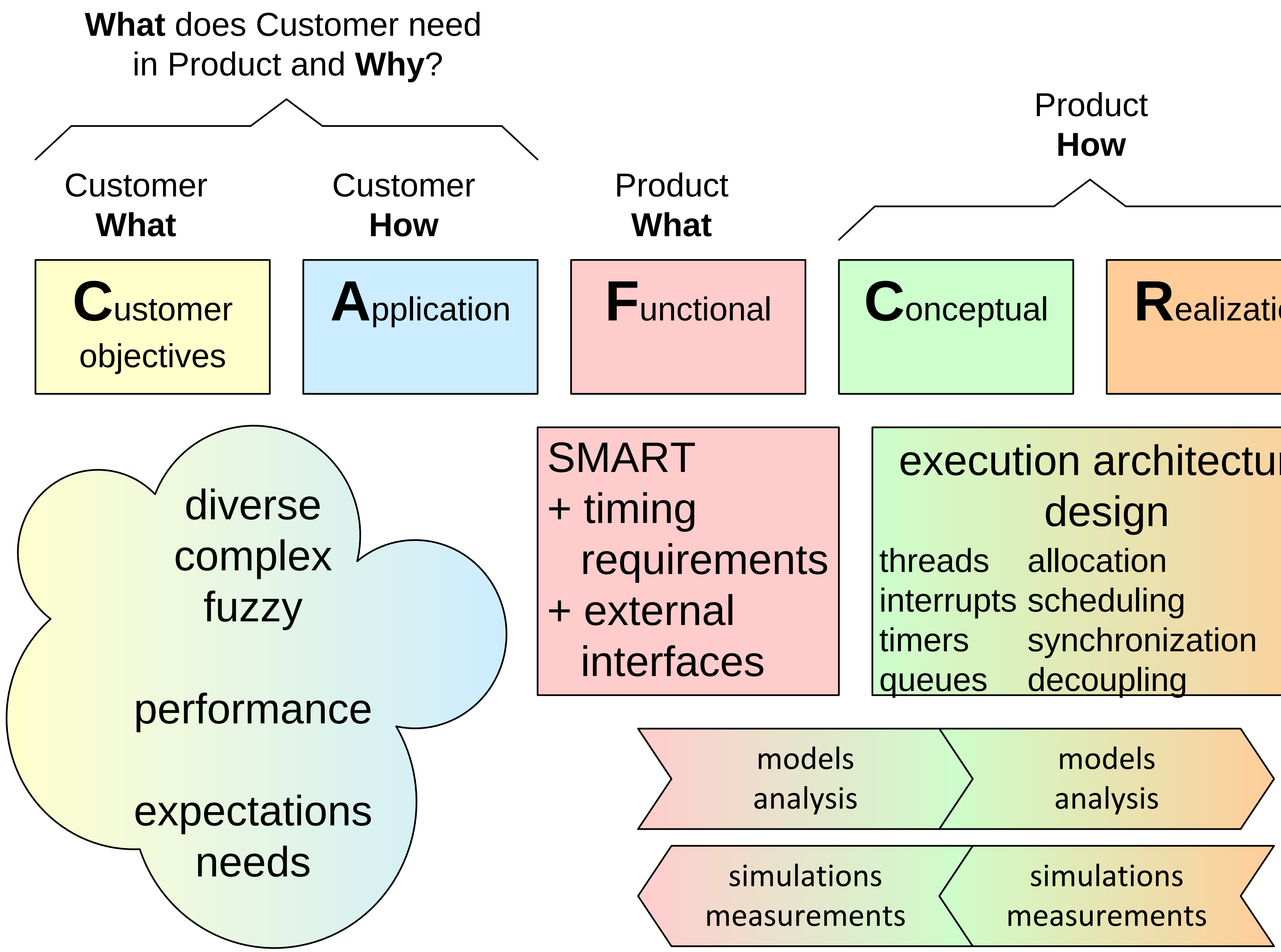
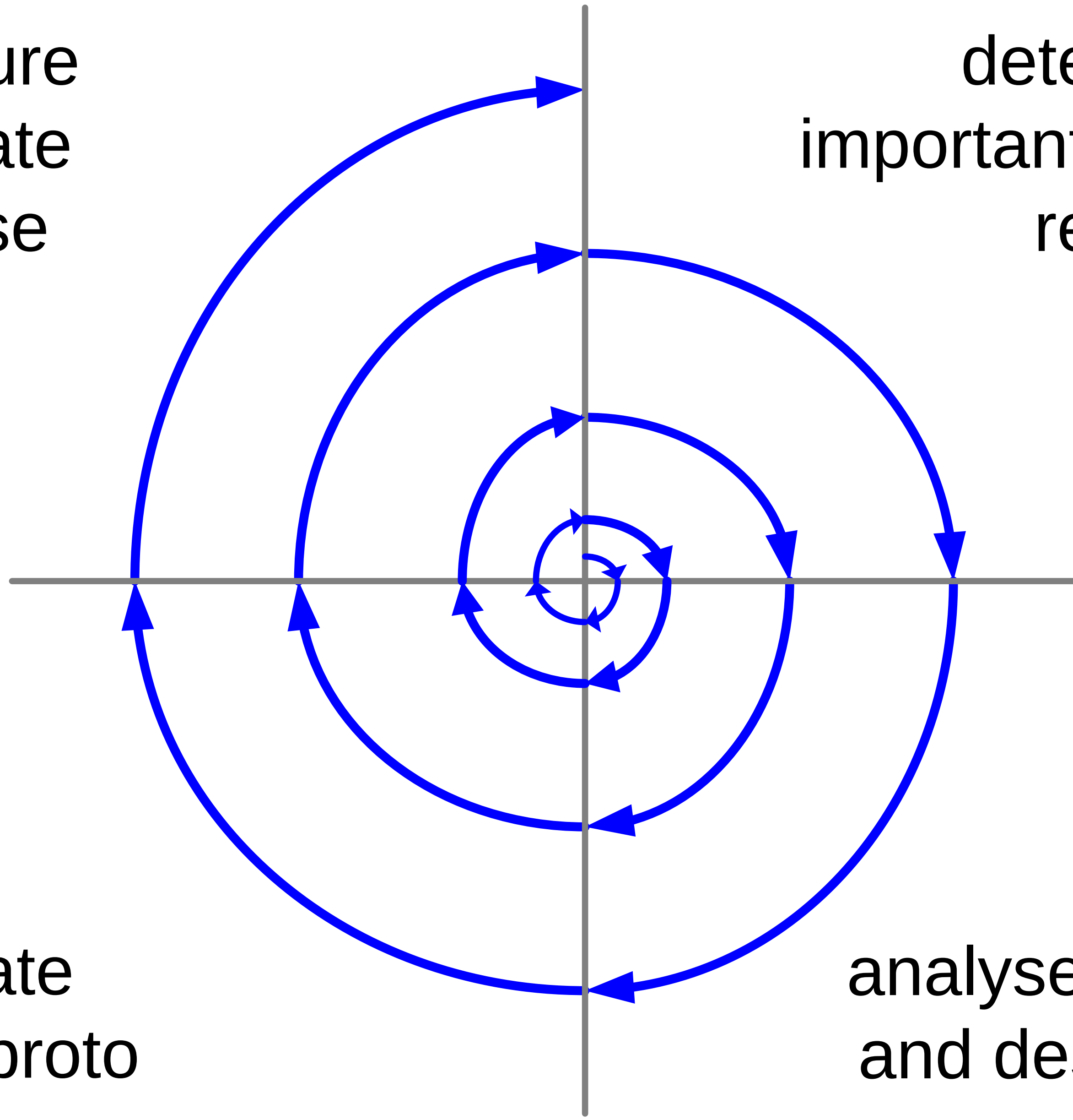
Positioning in CAFCR



Toplevel Performance Design Method

1A Collect most critical performance and timing requirements	
1B Find system level diagrams	HW block diagram, SW diagram, functional model(s) concurrency model, resource model, time-line
2A Measure performance at 3 levels	application, functions and micro benchmarks
2B Create Performance Model	
3 Evaluate performance, identify potential problems	
4 Performance analysis and design	granularity, synchronization, priorization, allocation, resource management
Re-iterate all steps	are the right requirements addressed, refine diagrams, measurements, models, and improve design

Incremental Approach



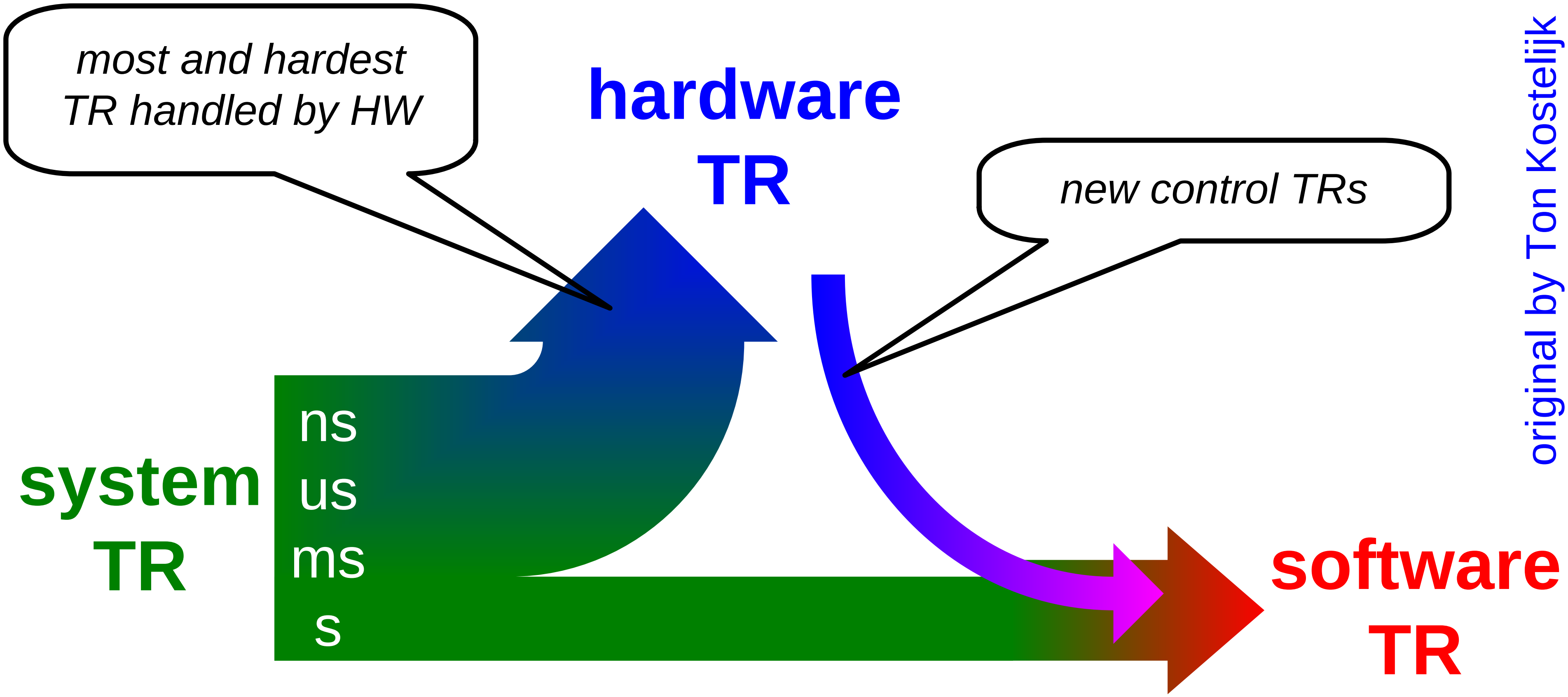
measure
evaluate
analyse

determine most
important and critical
requirements

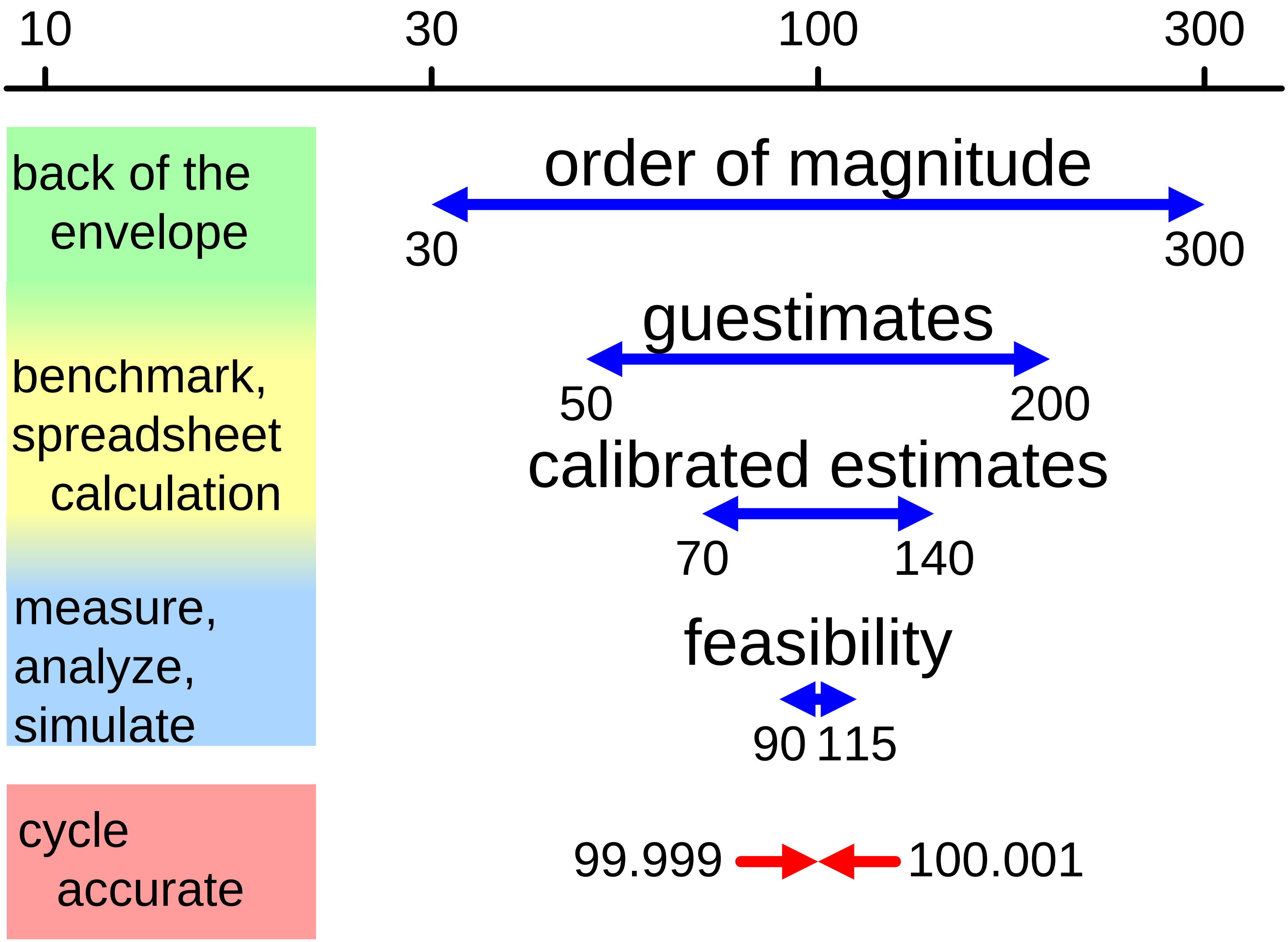
simulate
build proto

model
analyse constraints
and design options

Decomposition of System TR in HW and SW



Quantification Steps



Iteration

zoom in on detail

aggregate to end-to-end performance

from coarse guestimate to reliable prediction

from typical case to boundaries of requirement space

from static understanding to dynamic understanding

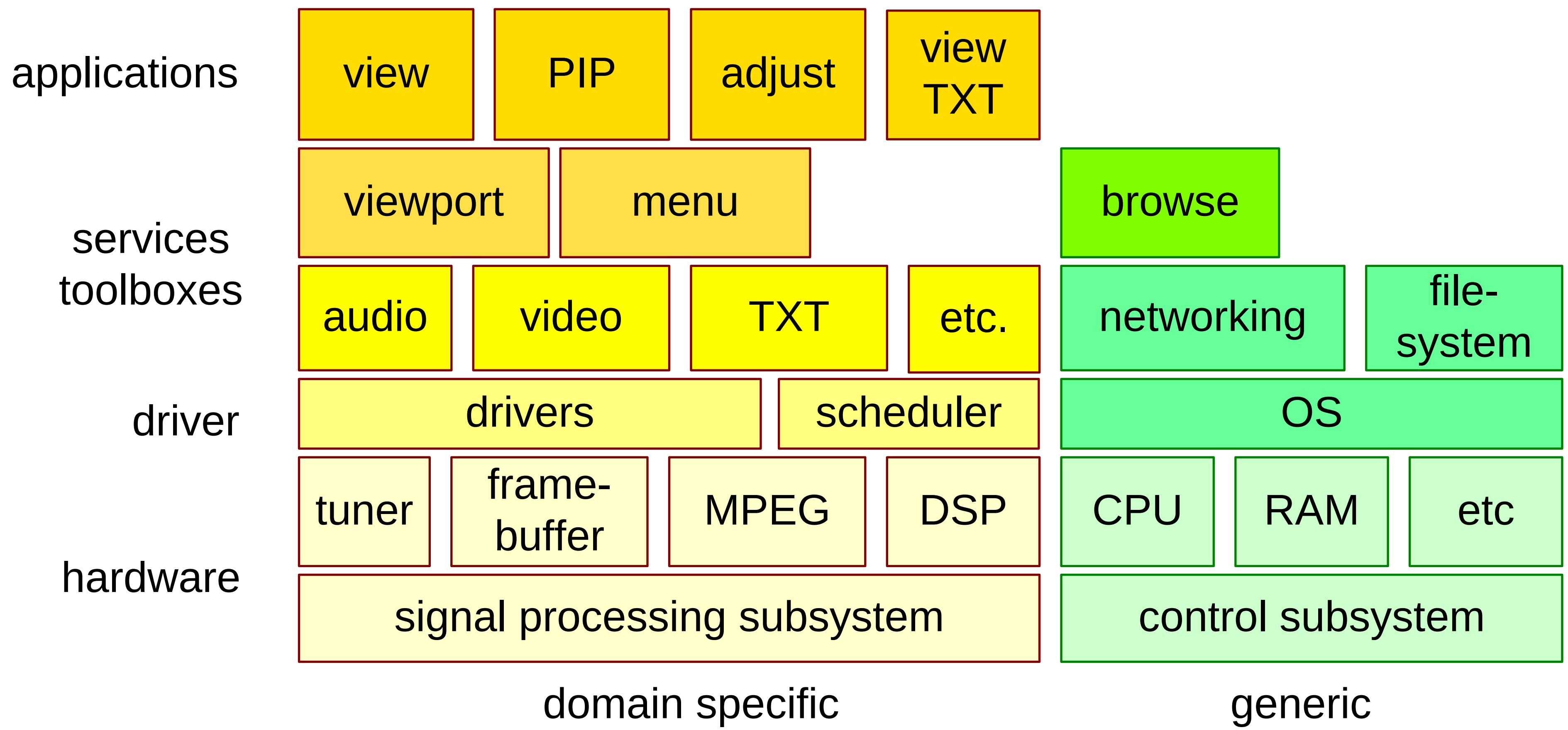
from steady state to initialization, state change and shut down

discover unforeseen critical requirements

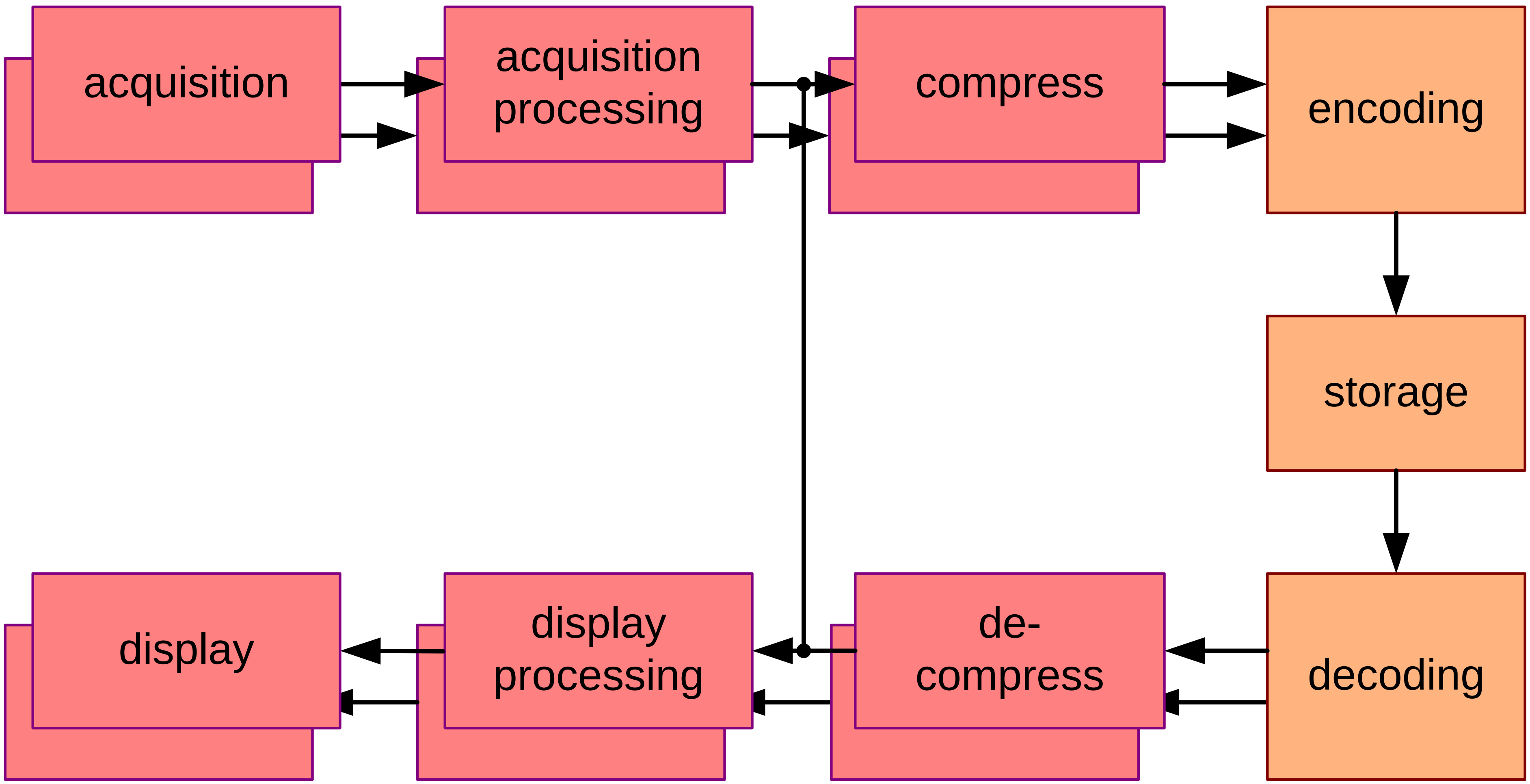
improve diagrams and designs

from old system to prototype to actual implementation

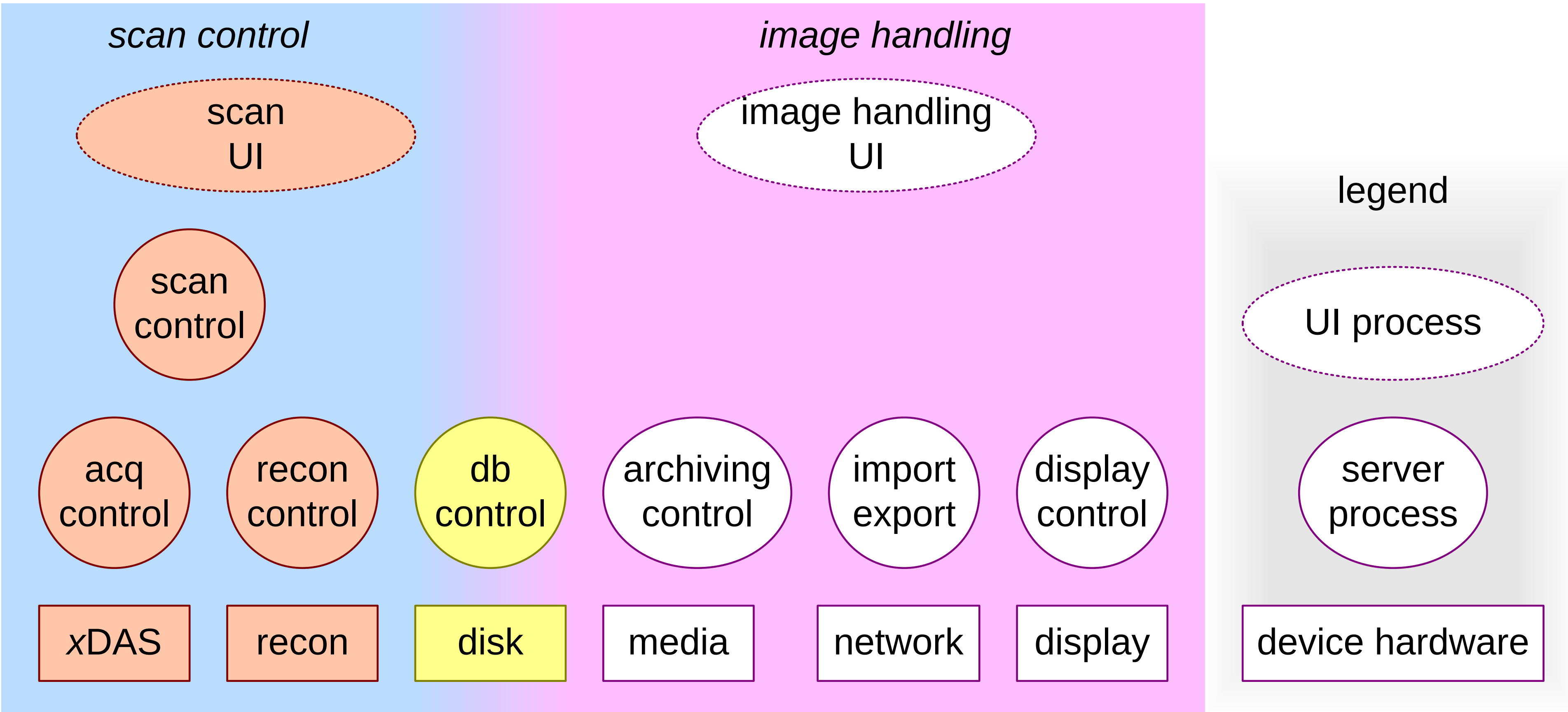
Construction Decomposition



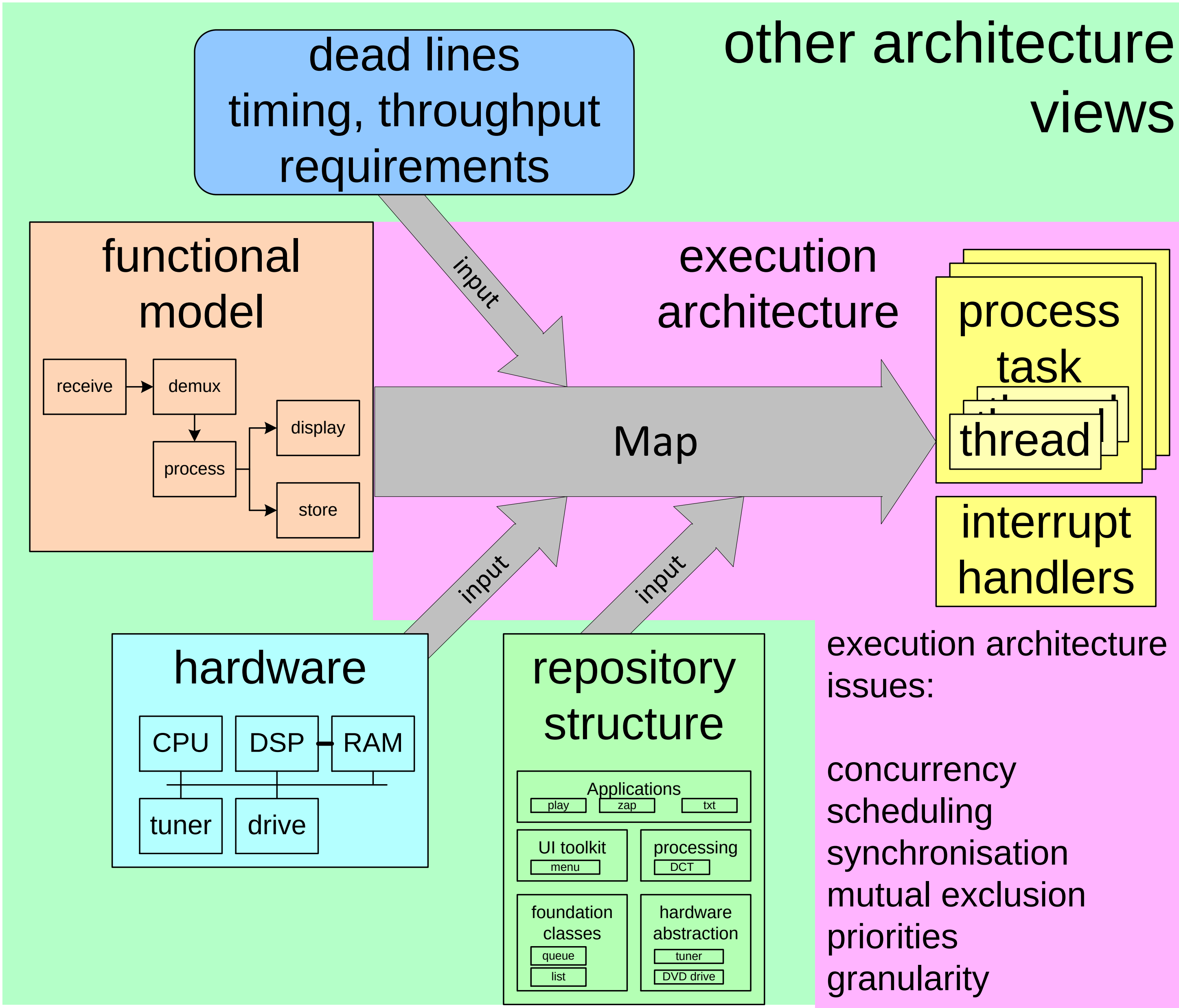
Functional Decomposition



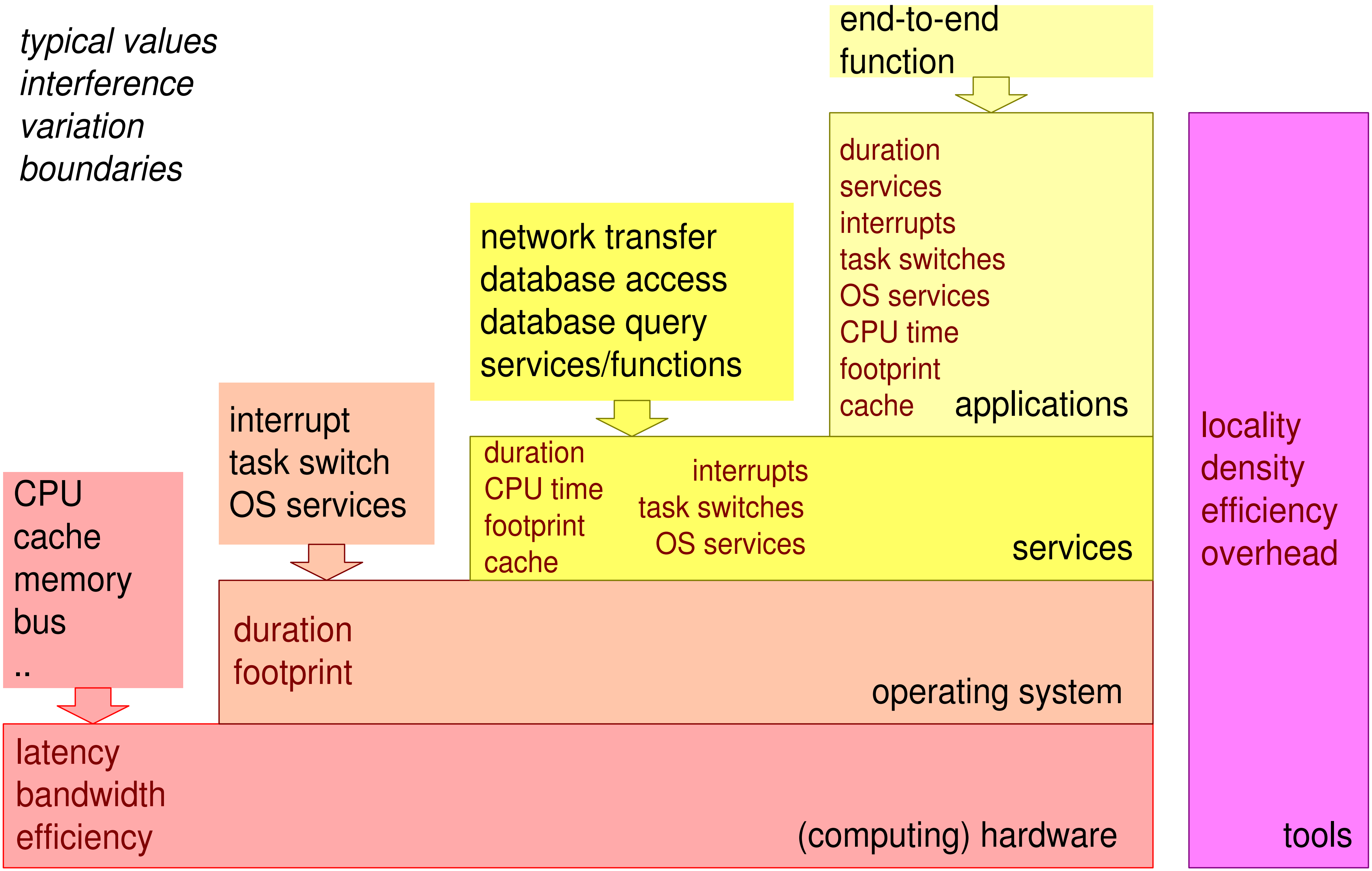
An example of a process decomposition of a MRI scanner.



Combine views in Execution Architecture



Layered Benchmarking Approach



Micro Benchmarks

	infrequent operations, often time-intensive	*often repeated operations*
database	start session finish session	perform transaction query
network, I/O	open connection close connection	transfer data
high level construction	component creation component destruction	method invocation same scope other context
low level construction	object creation object destruction	method invocation
basic programming	memory allocation memory free	function call loop overhead basic operations (add, mul, load, store)
OS	task, thread creation	task switch interrupt response
HW	power up, power down boot	cache flush low level data transfer

Colofon

The ASP ™ course is partially derived from the EXARCH course developed at *Philips CTT* by *Ton Kostelijk* and *Gerrit Muller* .

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