

Module Design Side

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Abstract

This module addresses the Conceptual and Realization Views.

Distribution

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status: draft

version: 0

logo

TBD

The conceptual view

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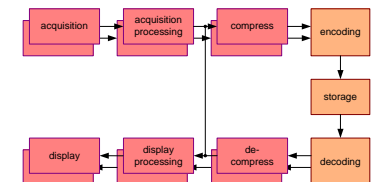
Abstract

The purpose of the conceptual view is described. A number of methods or models is given to use in this view: construction decomposition, functional decomposition, class or object decomposition, other decompositions (power, resources, recycling, maintenance, project management, cost, ...), and related models (performance, behavior, cost, ...); allocation, dependency structure; identify the infrastructure (factoring out shareable implementations), classify the technology in *core*, *key* and *base* technology; integrating concepts (start up, shutdown, safety, exception handling, persistency, resource management,...).

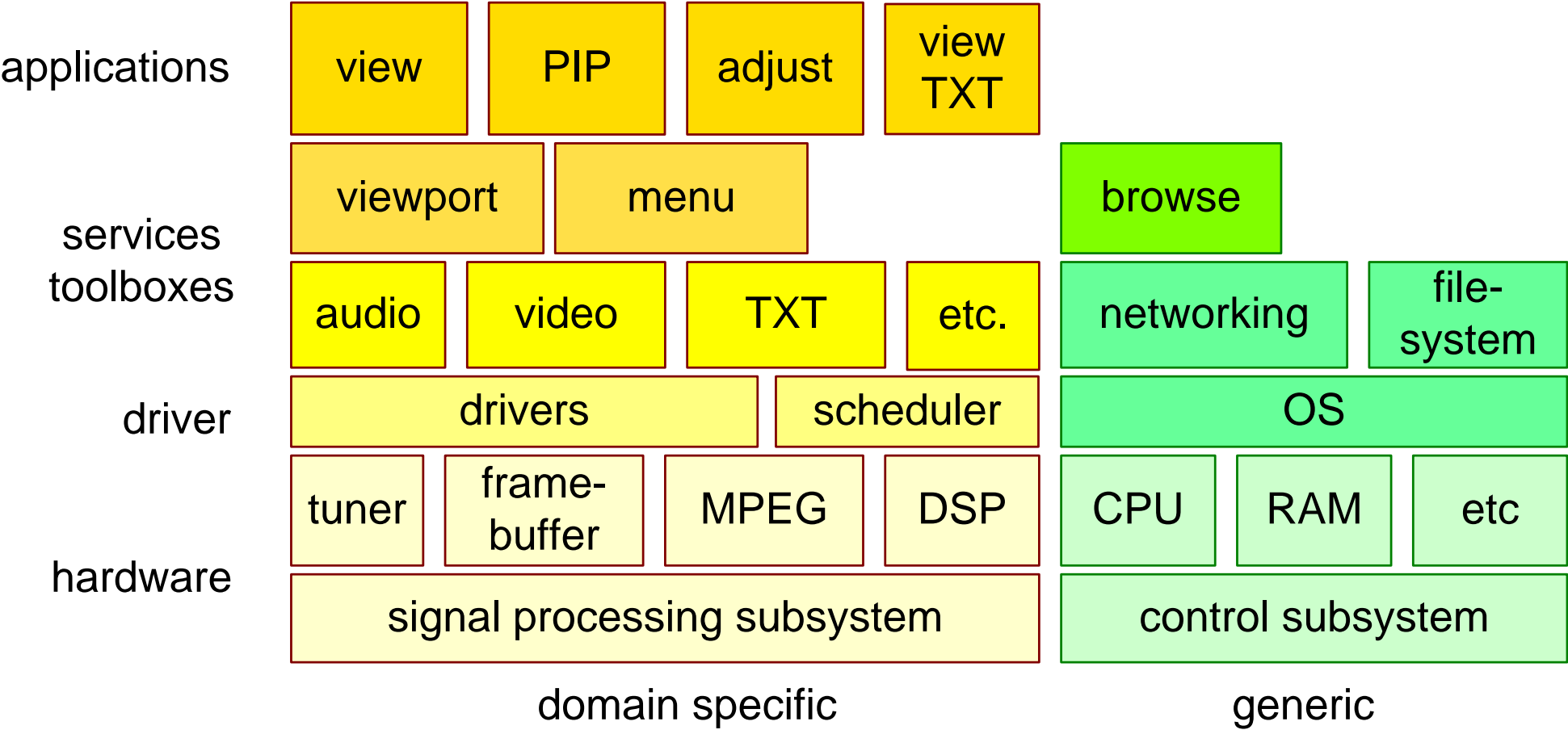
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Example construction decomposition simple TV



Characterization of the construction decomposition

management of design

SW example

HW example

unit of
creation
storage
update

file

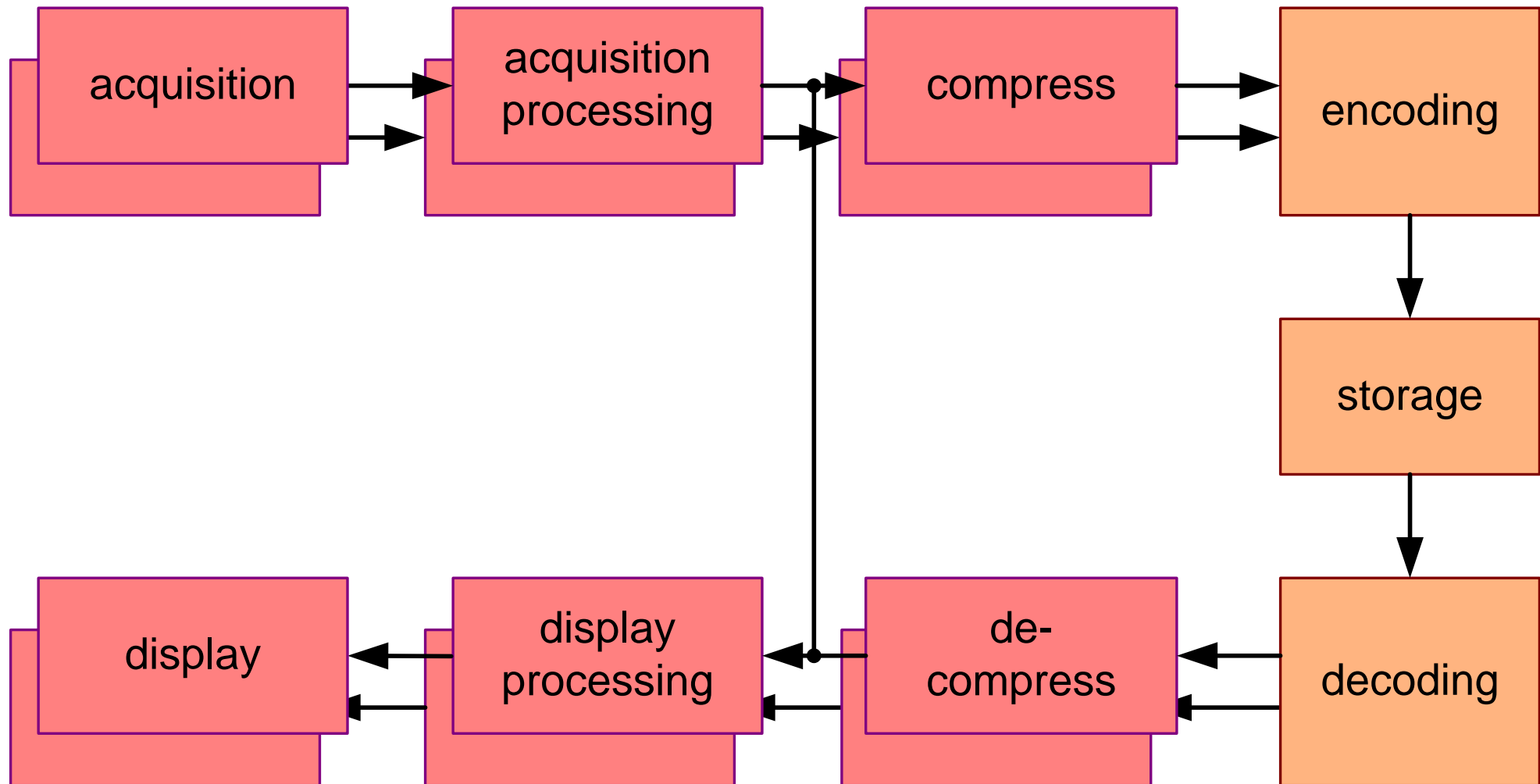
PCB
IP cells
IP core

unit of aggregation for
organisation
test
release

package
module

box
IP core
IC

Example functional decomposition camera type device



How;
what is the **flow** of internal activities
to realise **external** functionality?

some keywords:

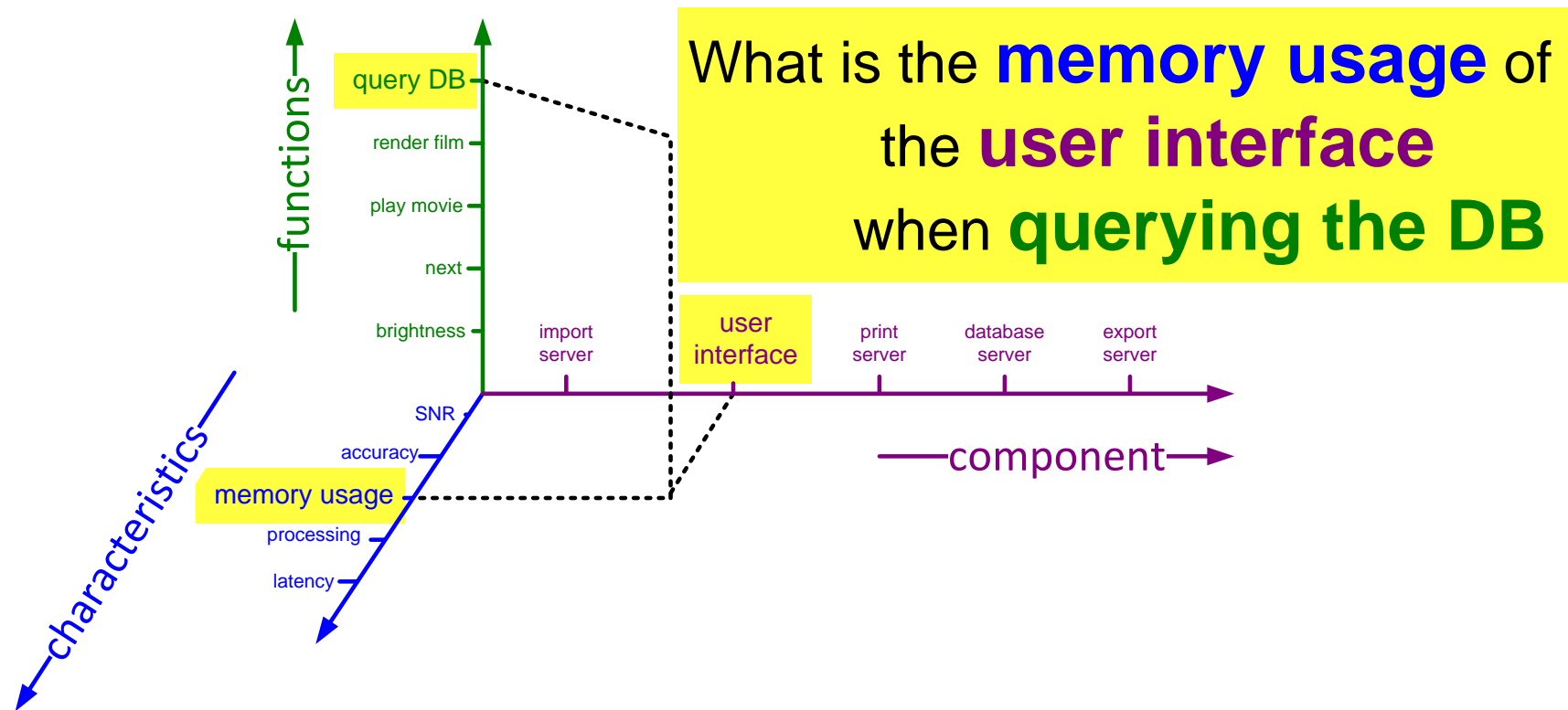
activities
transformation
input output

data flow
control flow

multiple functional decompositions
are possible and valuable!

Question generator for multiple decompositions

How about the **<characteristic>**
of the **<component>**
when performing **<function>**?



Critical for system performance

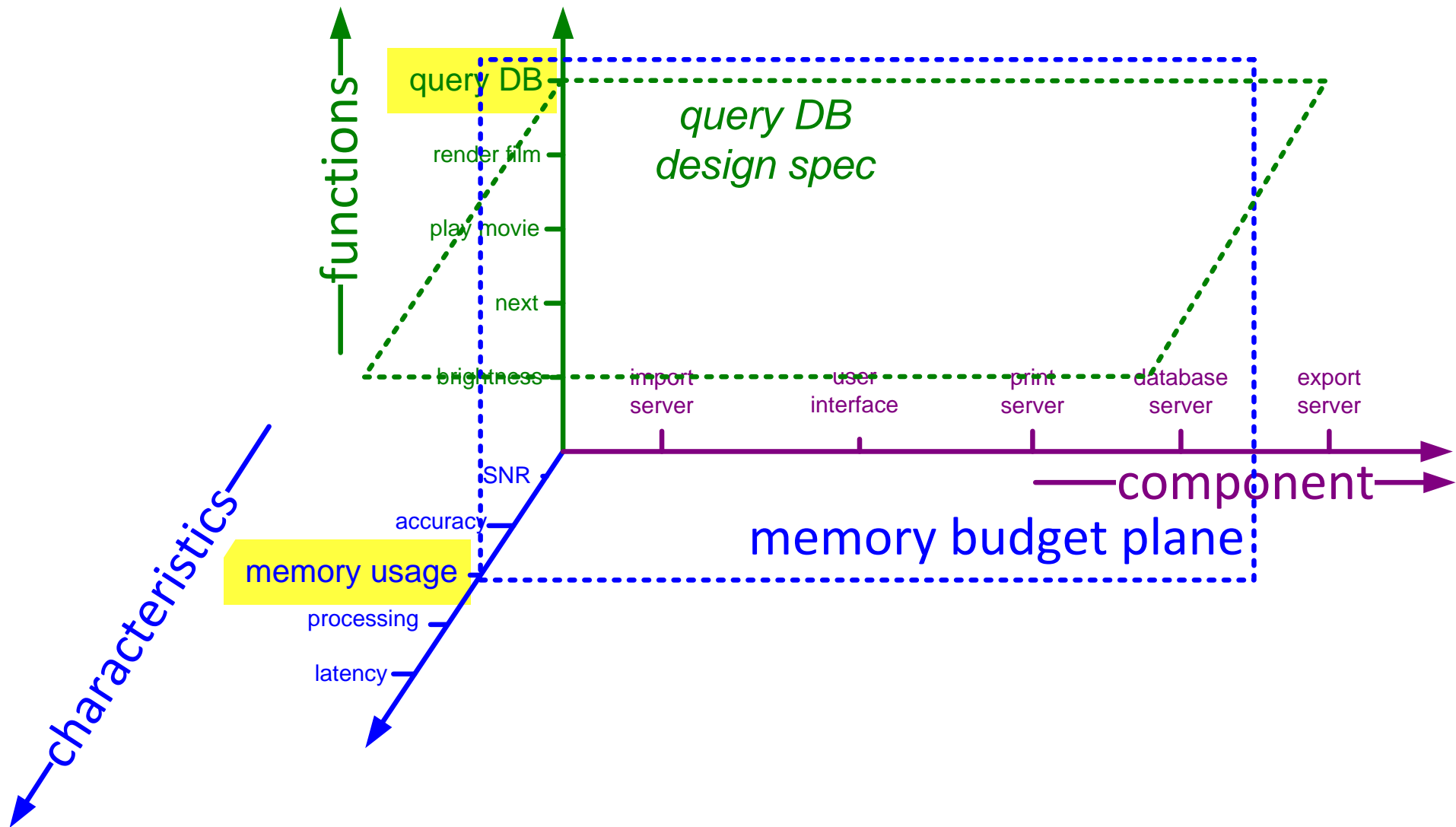
Risk planning wise

Least robust part of the design

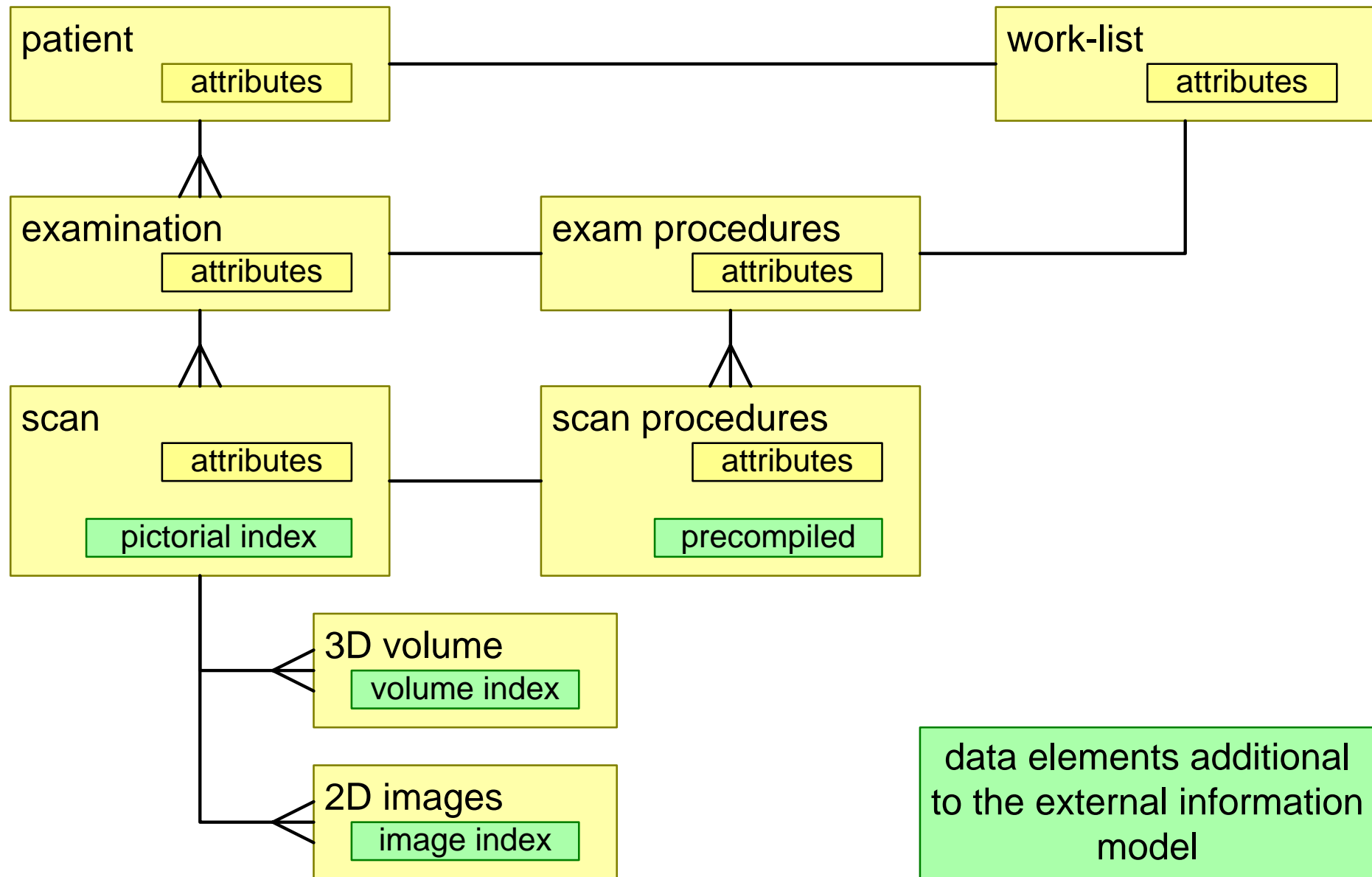
Suspect part of the design

- experience based
- person based

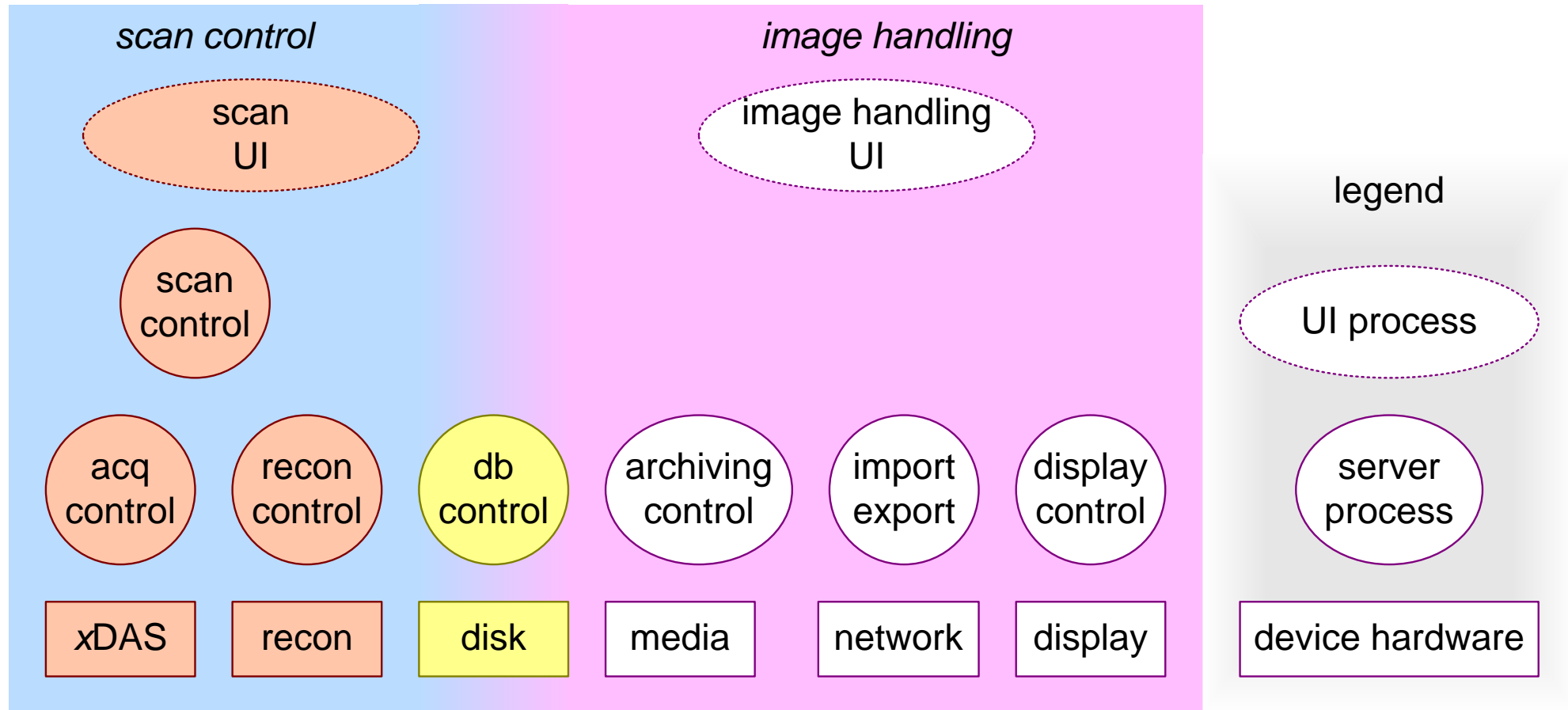
Addressing planes or lines



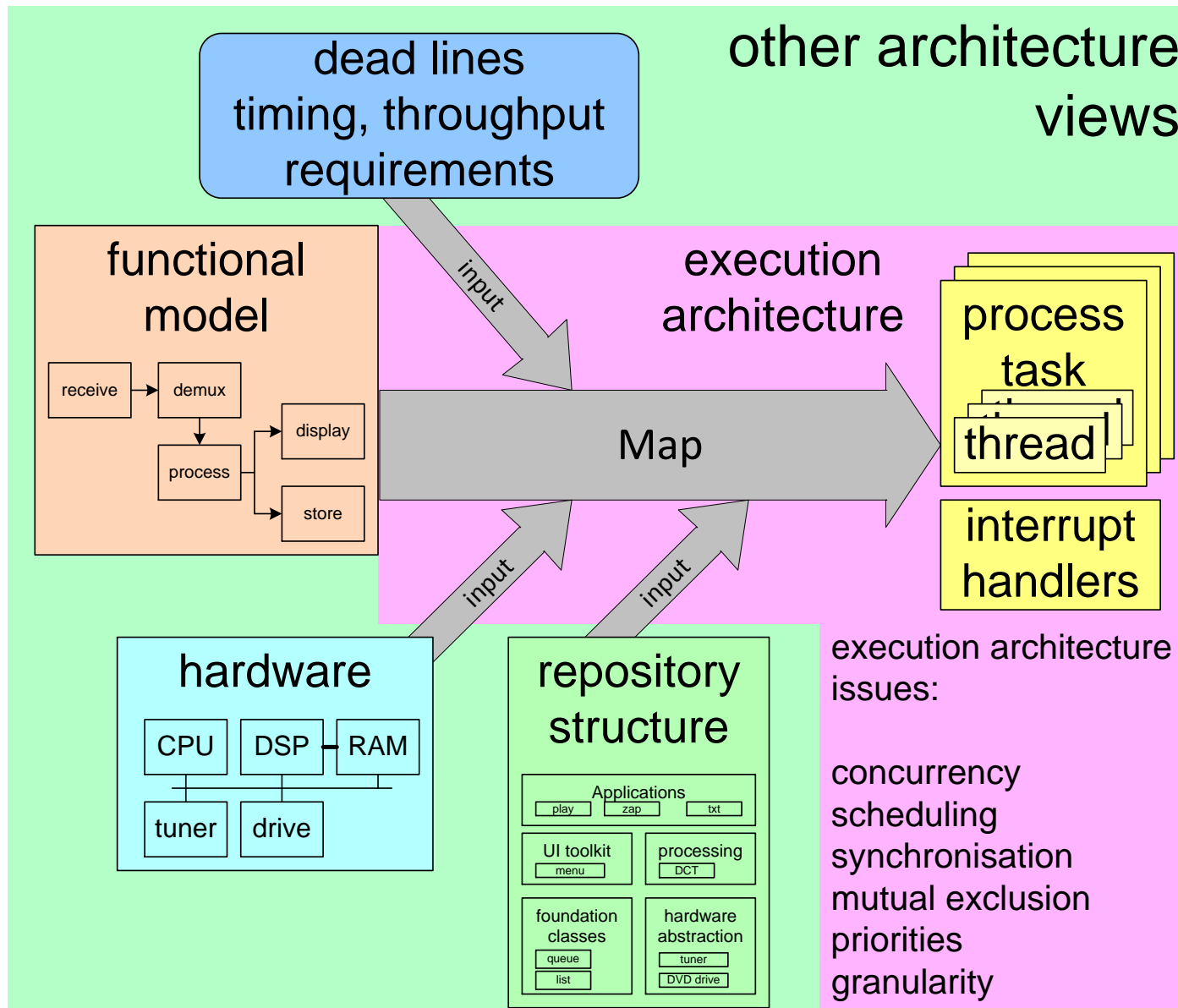
Example partial internal information model



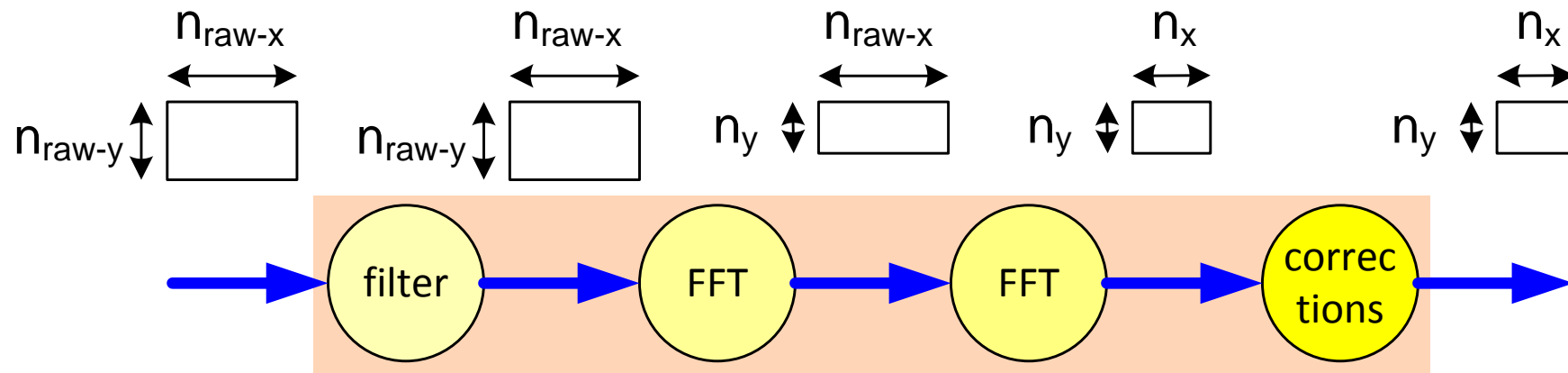
Example process decomposition



Execution architecture



Performance Model



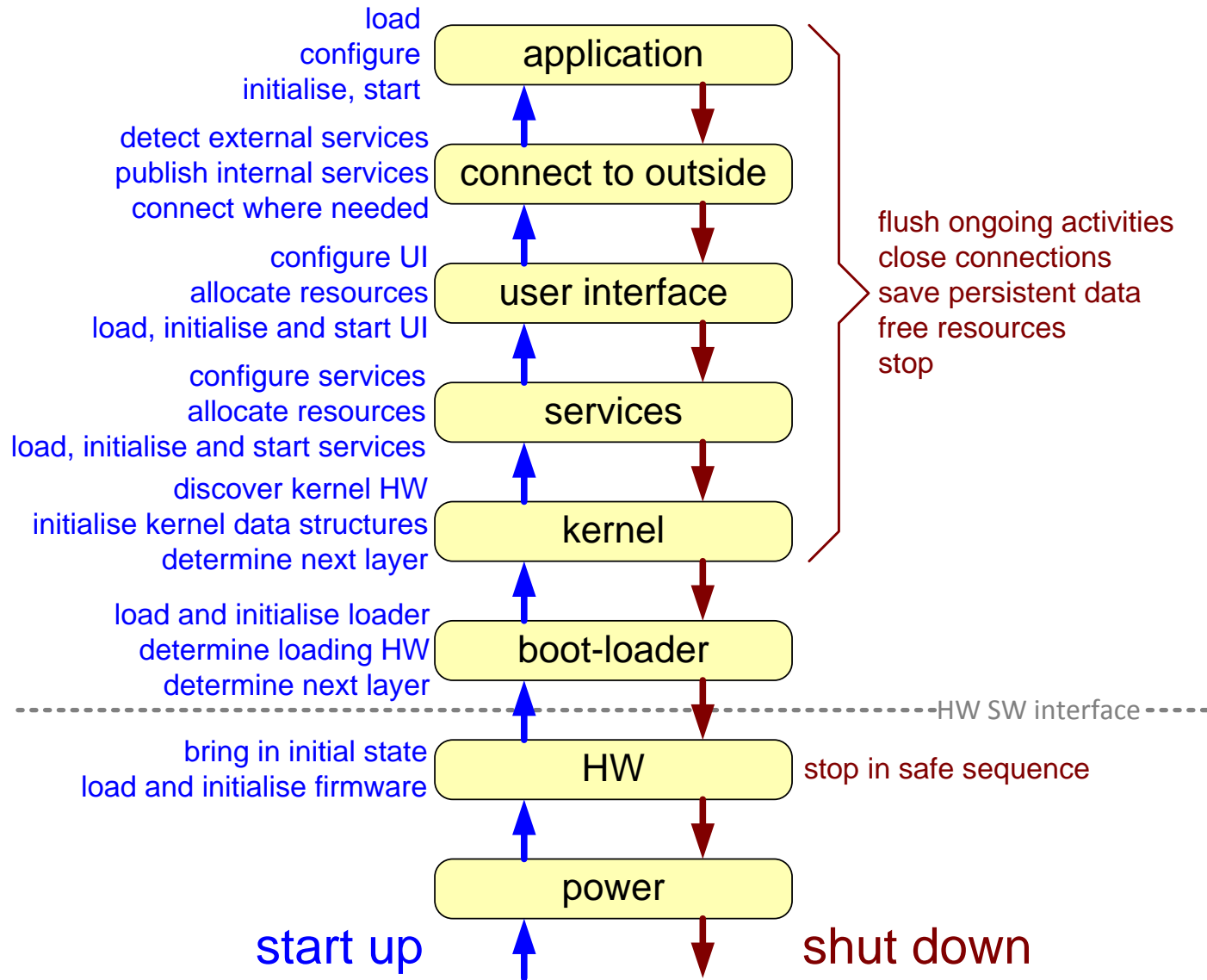
$$t_{\text{recon}} = t_{\text{filter}}(n_{\text{raw-x}}, n_{\text{raw-y}}) + n_{\text{raw-x}} * (t_{\text{fft}}(n_{\text{raw-y}}) + t_{\text{col-overhead}}) + n_y * (t_{\text{fft}}(n_{\text{raw-x}}) + t_{\text{row-overhead}}) + t_{\text{corrections}}(n_x, n_y) + t_{\text{control-overhead}}$$

$$t_{\text{fft}}(n) = c_{\text{fft}} * n * \log(n)$$

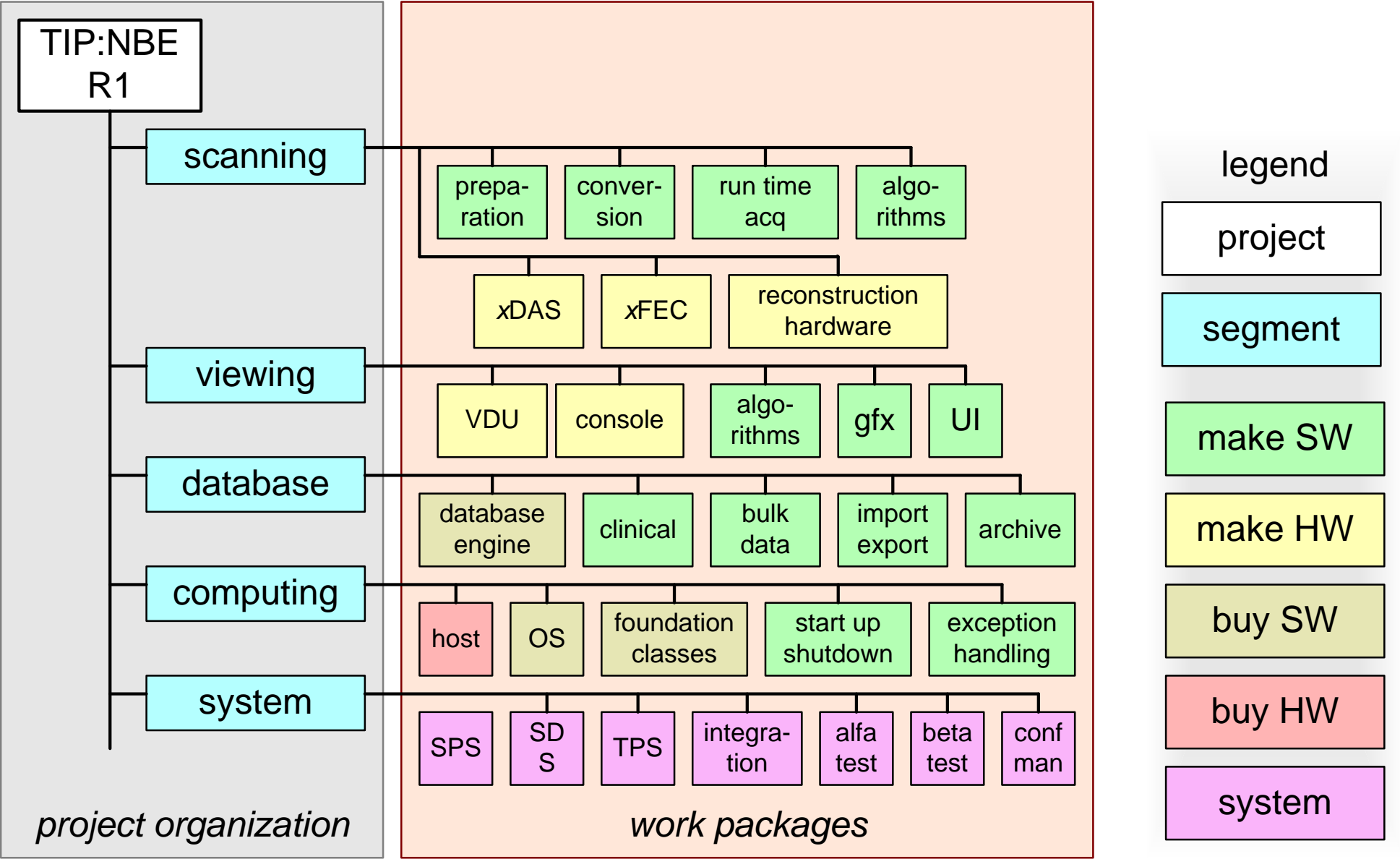
Safety, Reliability and Security concepts

- containment (limit failure consequences to well defined scope)
- graceful degradation (system parts not affected by failure continue operation)
- dead man switch (human activity required for operation)
- interlock (operation only if hardware conditions are fulfilled)
- detection and tracing of failures
- black box (log) for post mortem analysis
- redundancy

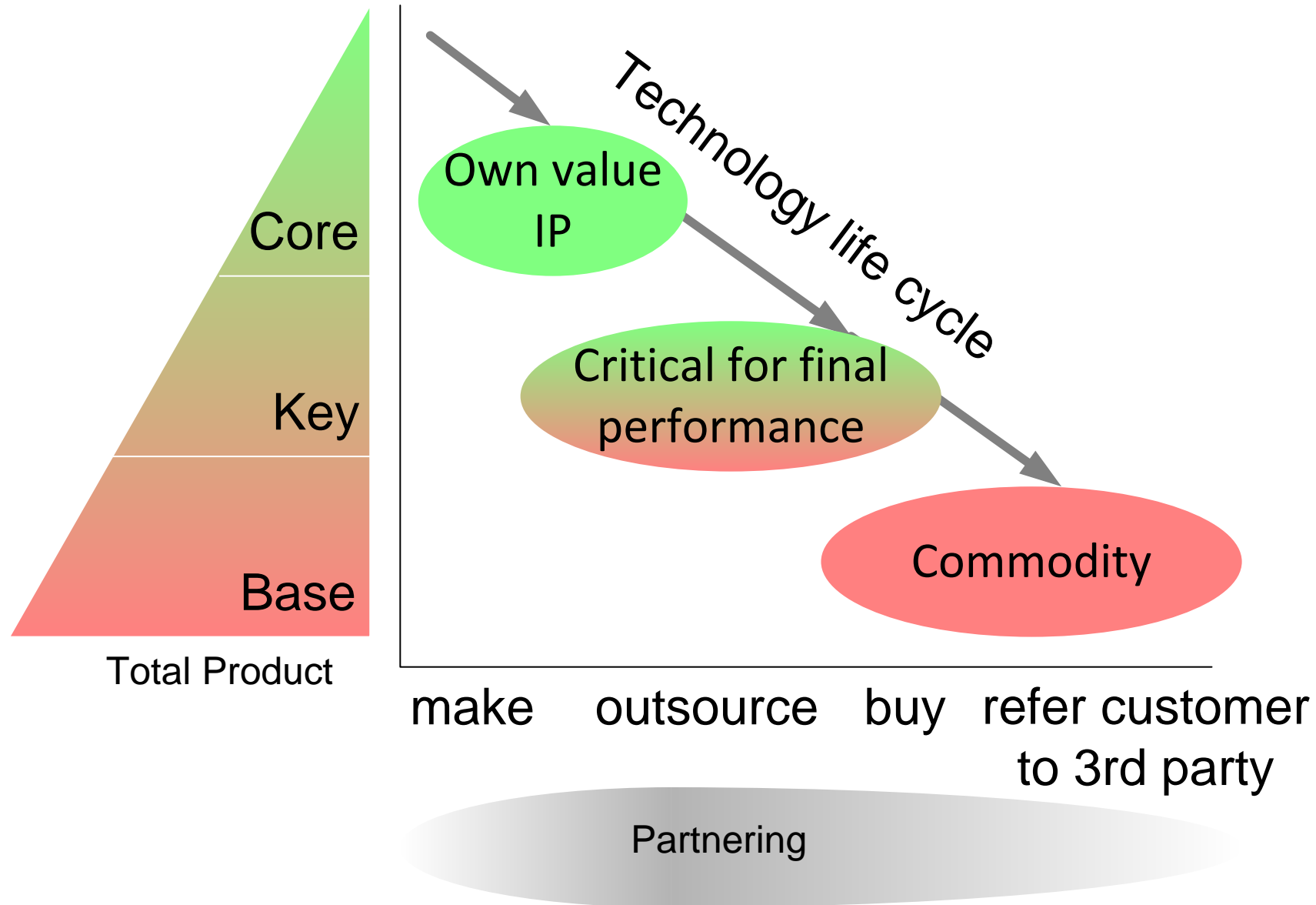
Simplified start up sequence



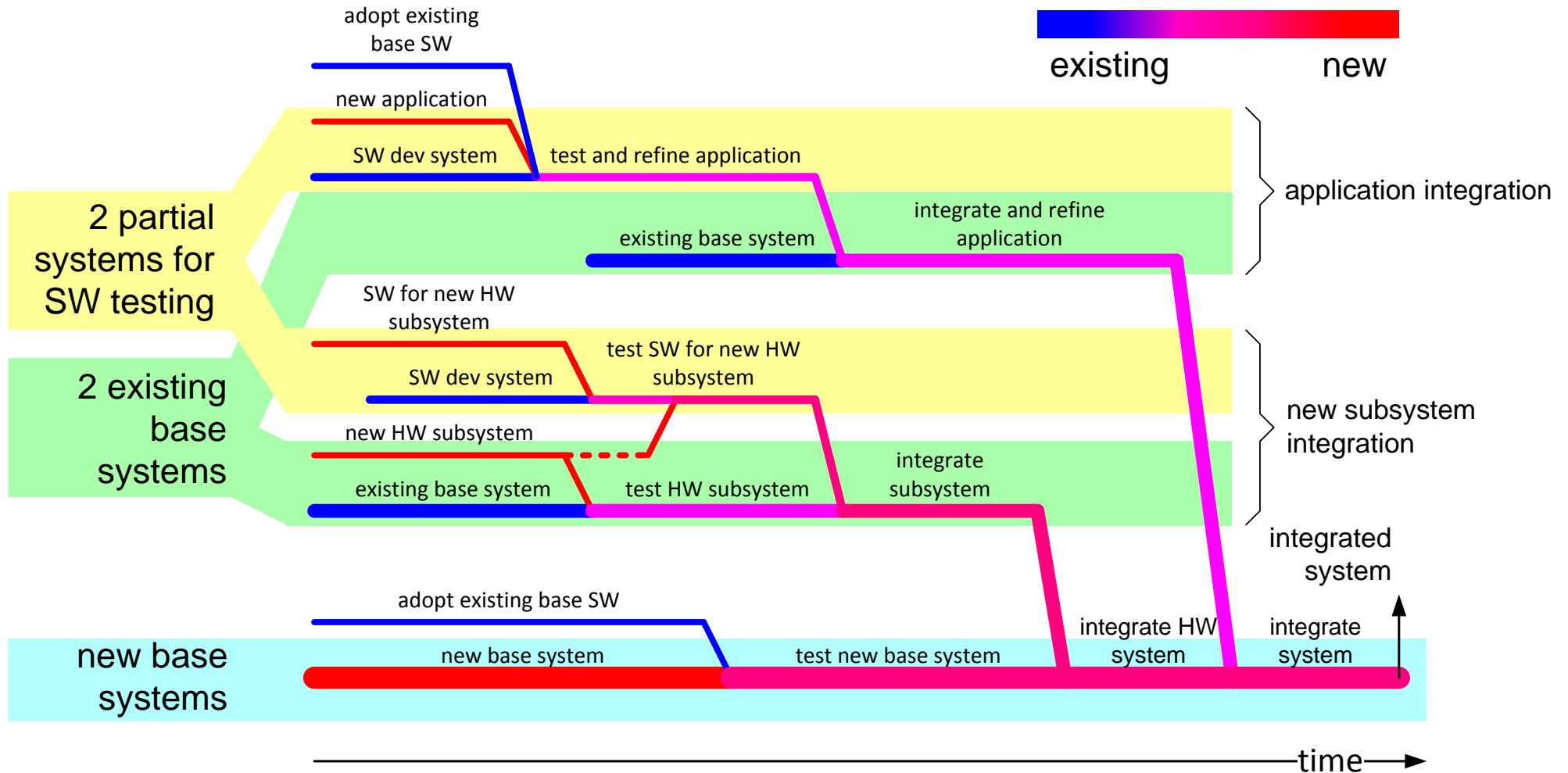
Example work breakdown



Core, Key or Base technology



Example integration plan



The realization view

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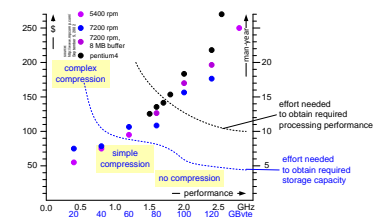
The realization view looks at the actual technologies used and the actual implementation. Methods used here are logarithmic views, micro-benchmarks and budgets.

Analysis methods with respect to safety, reliability and security provide a link back to the functional and conceptual views.

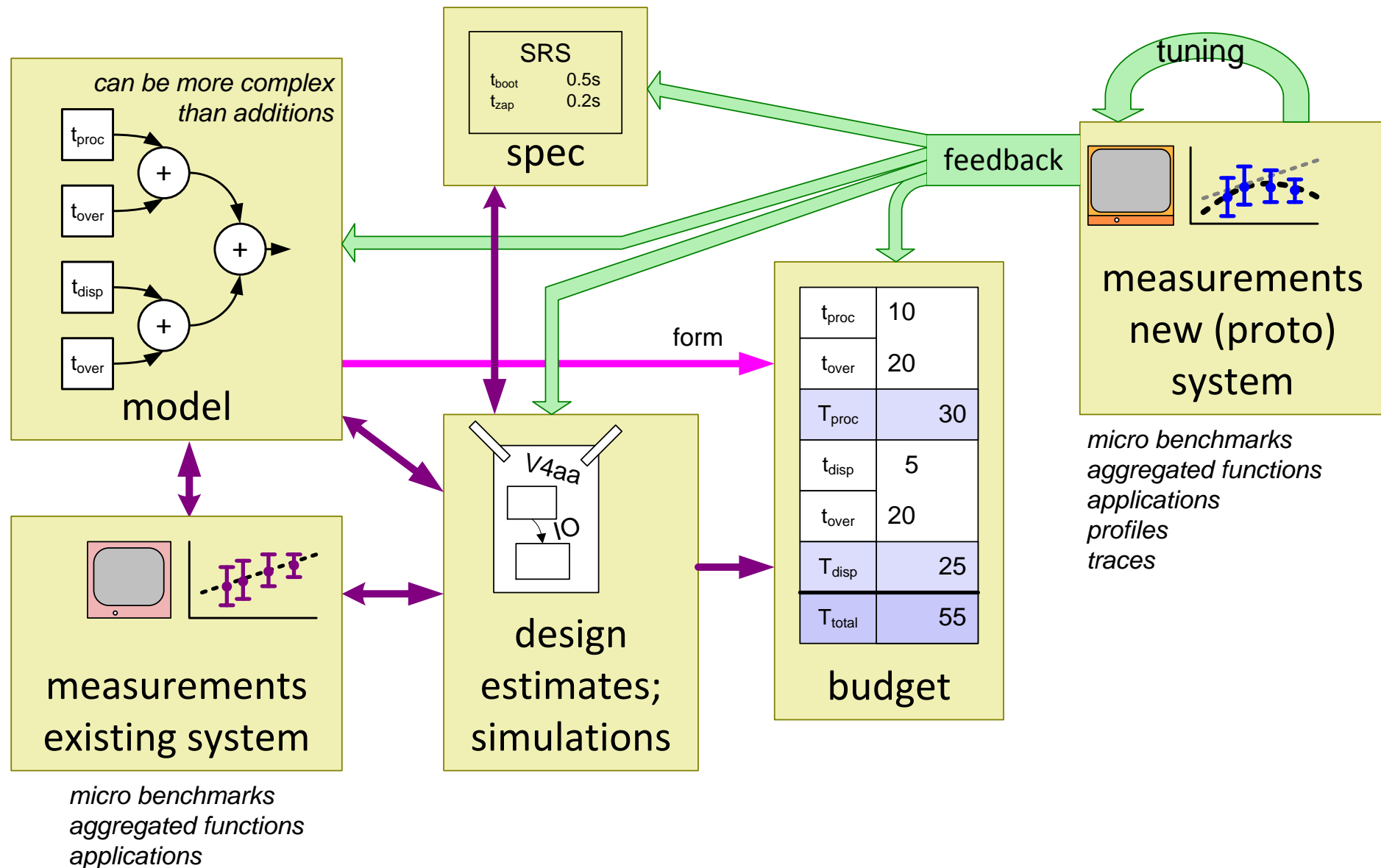
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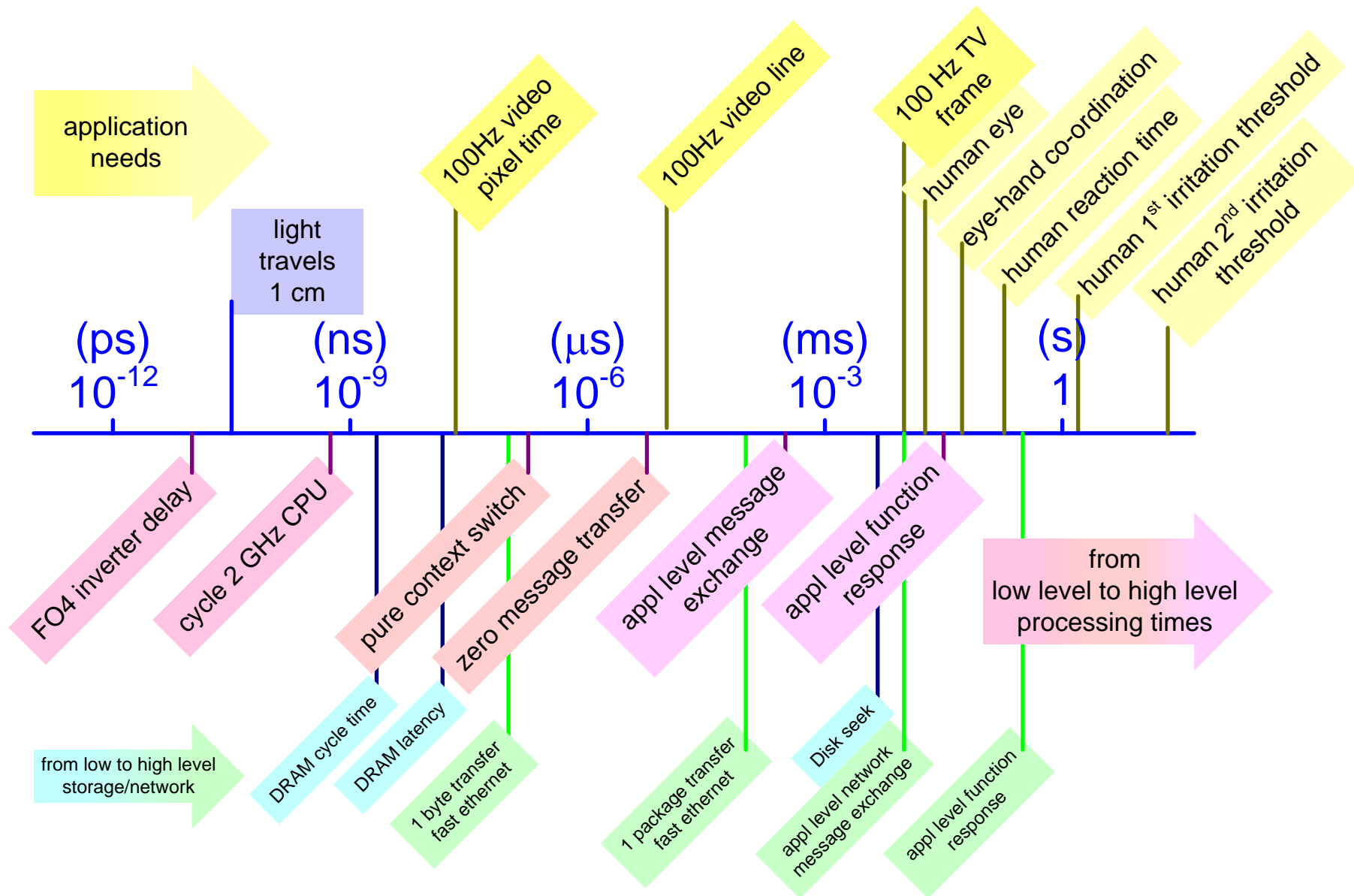
Budget based design flow



Example of a memory budget

| <i>memory budget in Mbytes</i> | code | obj data | bulk data | total |
|--------------------------------|------|----------|-----------|-------|
| shared code | 11.0 | | | 11.0 |
| User Interface process | 0.3 | 3.0 | 12.0 | 15.3 |
| database server | 0.3 | 3.2 | 3.0 | 6.5 |
| print server | 0.3 | 1.2 | 9.0 | 10.5 |
| optical storage server | 0.3 | 2.0 | 1.0 | 3.3 |
| communication server | 0.3 | 2.0 | 4.0 | 6.3 |
| UNIX commands | 0.3 | 0.2 | 0 | 0.5 |
| compute server | 0.3 | 0.5 | 6.0 | 6.8 |
| system monitor | 0.3 | 0.5 | 0 | 0.8 |
| application SW total | 13.4 | 12.6 | 35.0 | 61.0 |
| UNIX Solaris 2.x | | | | 10.0 |
| file cache | | | | 3.0 |
| total | | | | 74.0 |

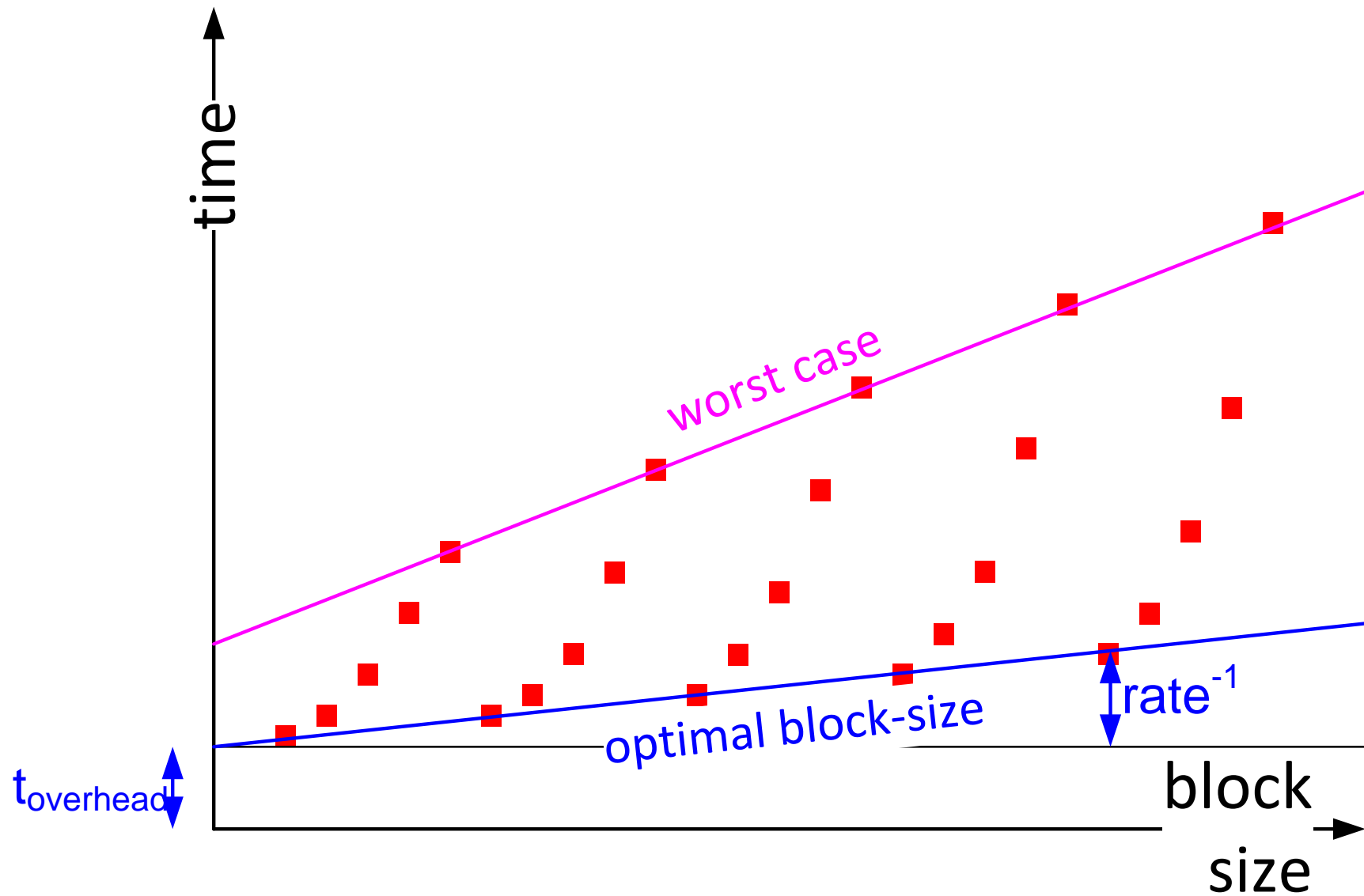
Actual timing on logarithmic scale



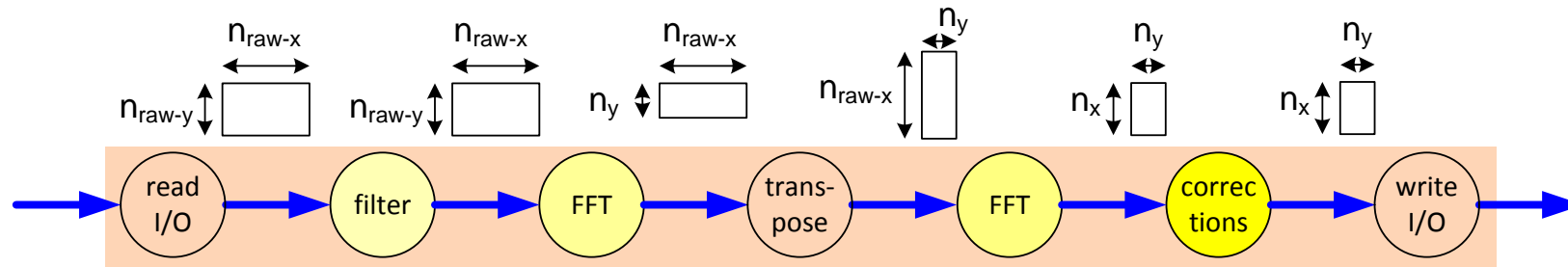
Typical micro benchmarks for timing aspects

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

The transfer time as function of blocksize



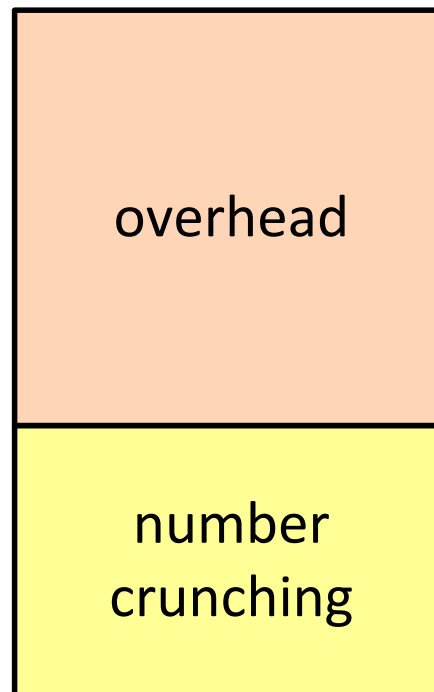
Performance evaluation



$$t_{\text{recon}} = t_{\text{filter}}(n_{\text{raw-x}}, n_{\text{raw-y}}) + n_{\text{raw-x}} * (t_{\text{fft}}(n_{\text{raw-y}}) + t_{\text{col-overhead}}) + n_y * (t_{\text{fft}}(n_{\text{raw-x}}) + t_{\text{row-overhead}}) + t_{\text{corrections}}(n_x, n_y) + t_{\text{read I/O}} + t_{\text{transpose}} + t_{\text{write I/O}} + t_{\text{control-overhead}}$$

$t_{\text{fft}}(n) = c_{\text{fft}} * n * \log(n)$

| |
|-------------------------|
| bookkeeping |
| transpose |
| malloc, free |
| write I/O |
| read I/O |
| overhead |
| correction computations |
| row overhead |
| FFT computations |
| column overhead |
| FFT computations |
| overhead |
| filter computations |



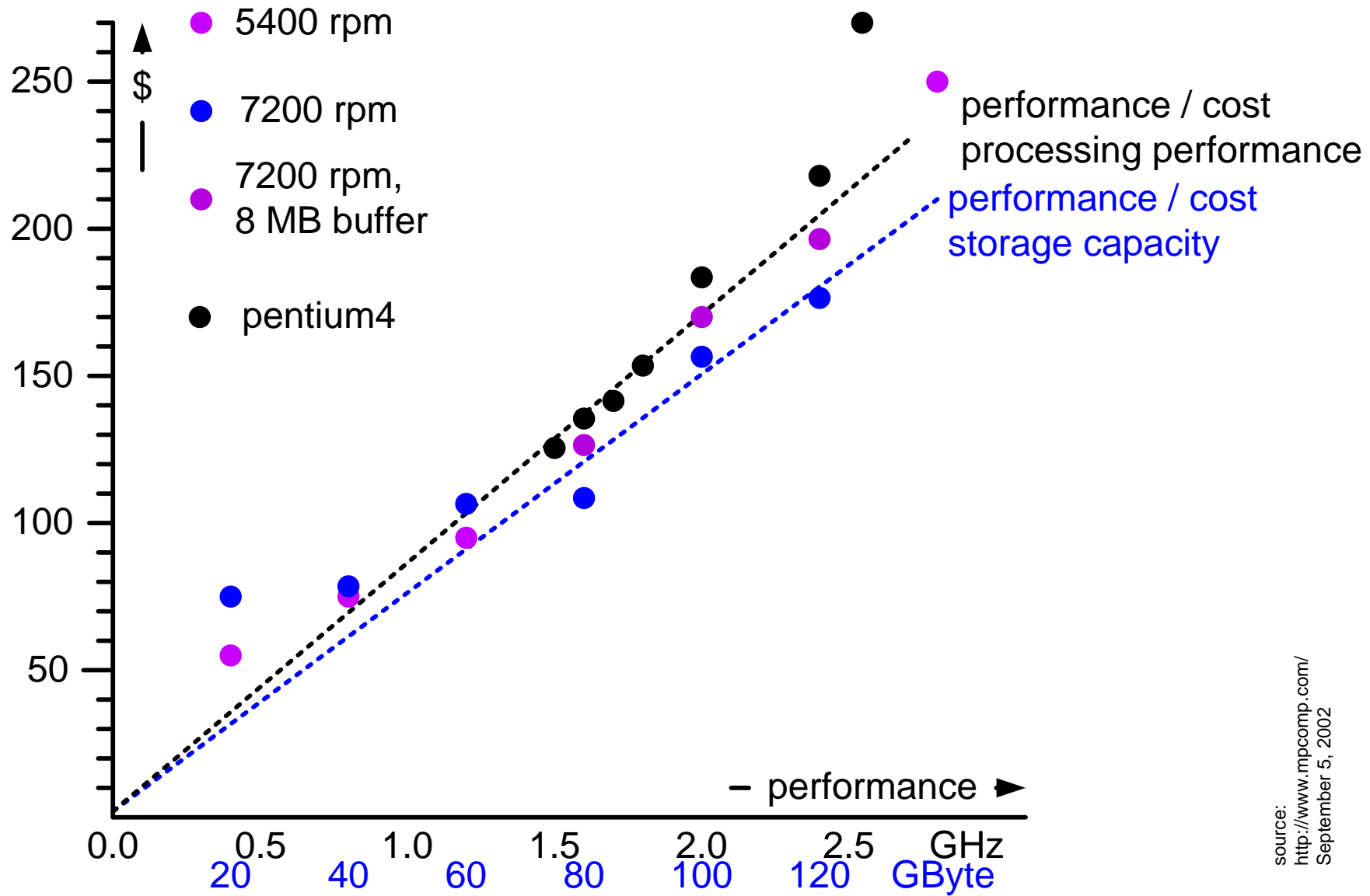
focus on overhead reduction

is more important

than faster algorithms

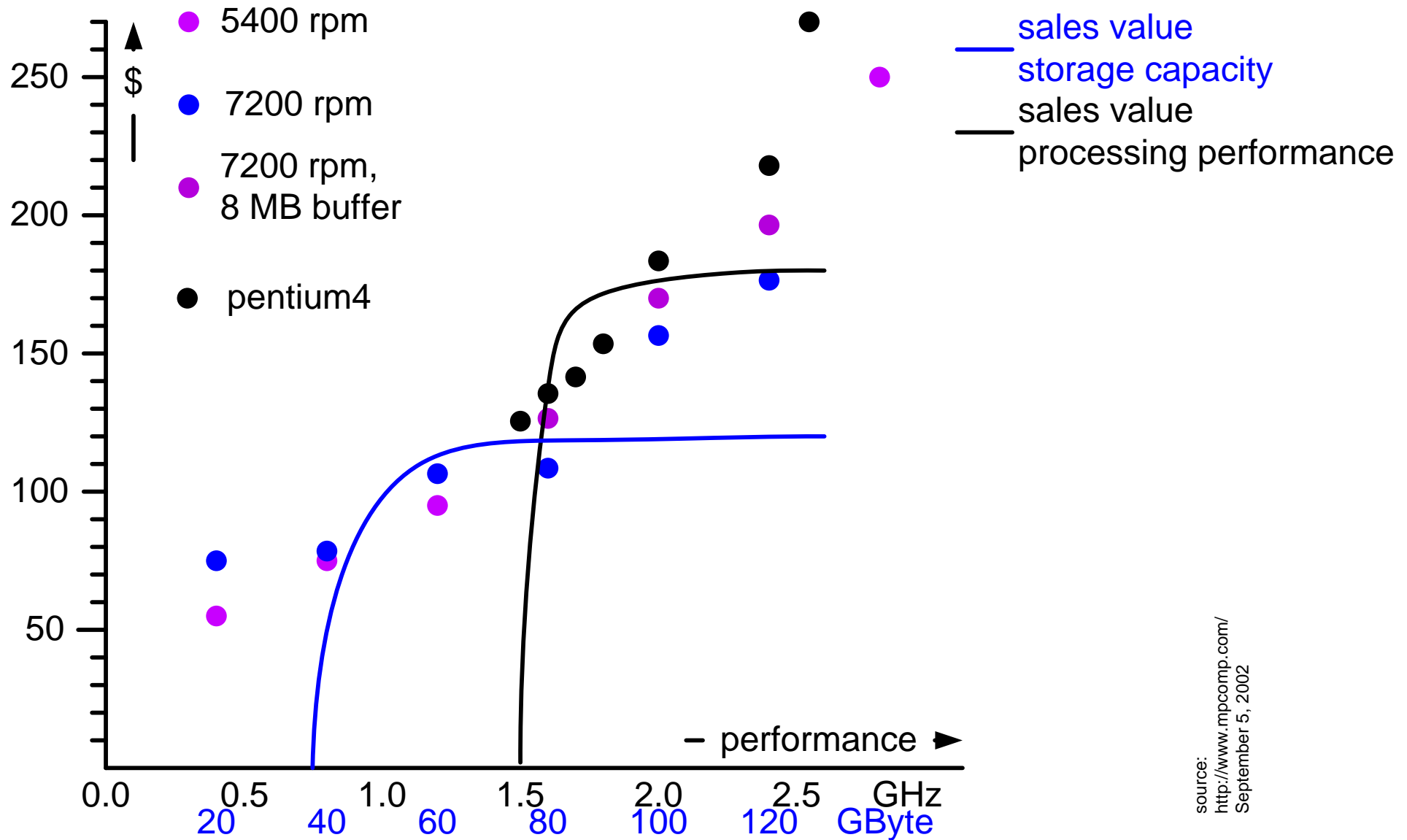
this is not an excuse for sloppy algorithms

Performance Cost, input data



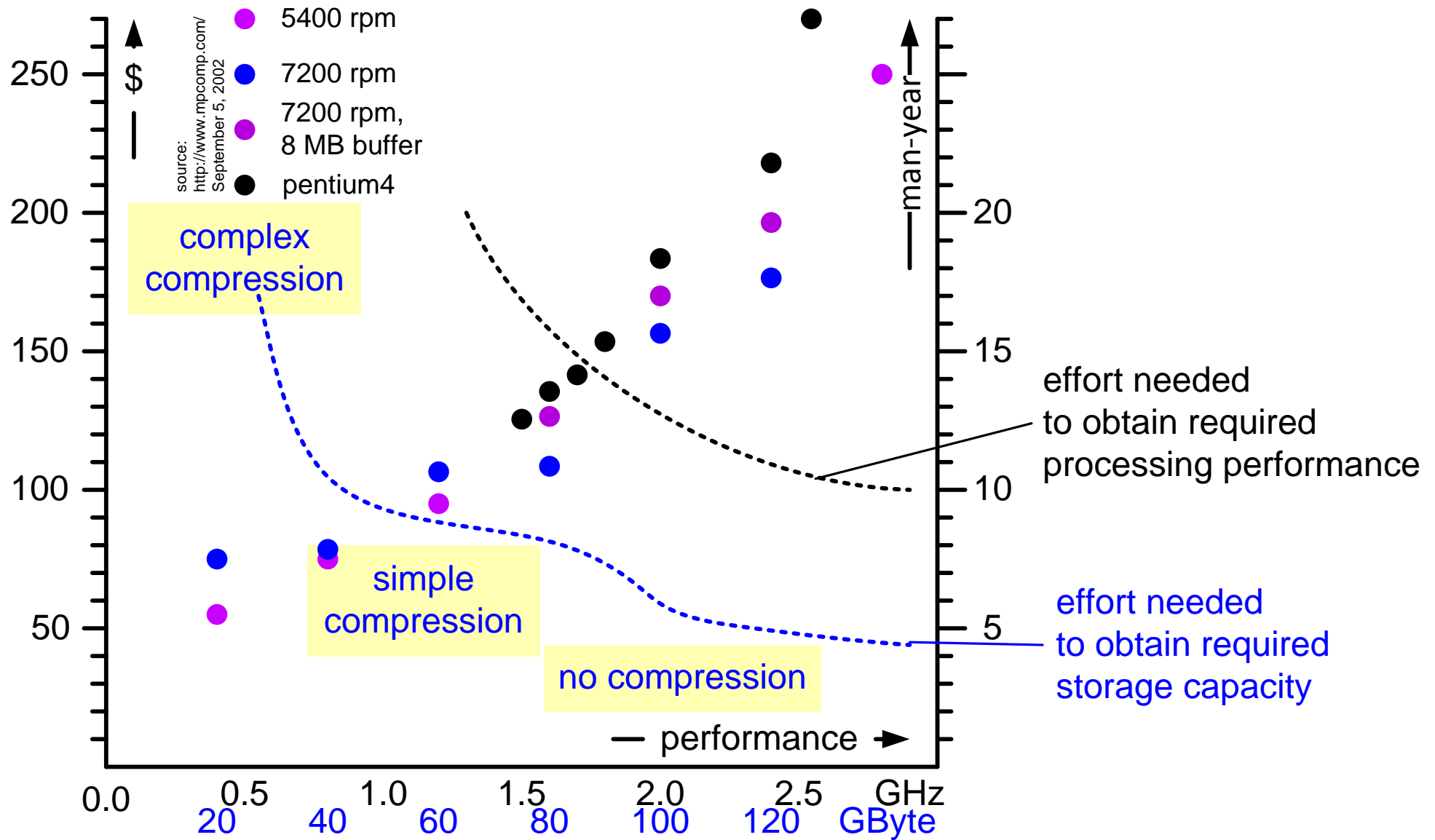
source:
<http://www.mpcomp.com/>
September 5, 2002

Performance Cost, choice based on sales value

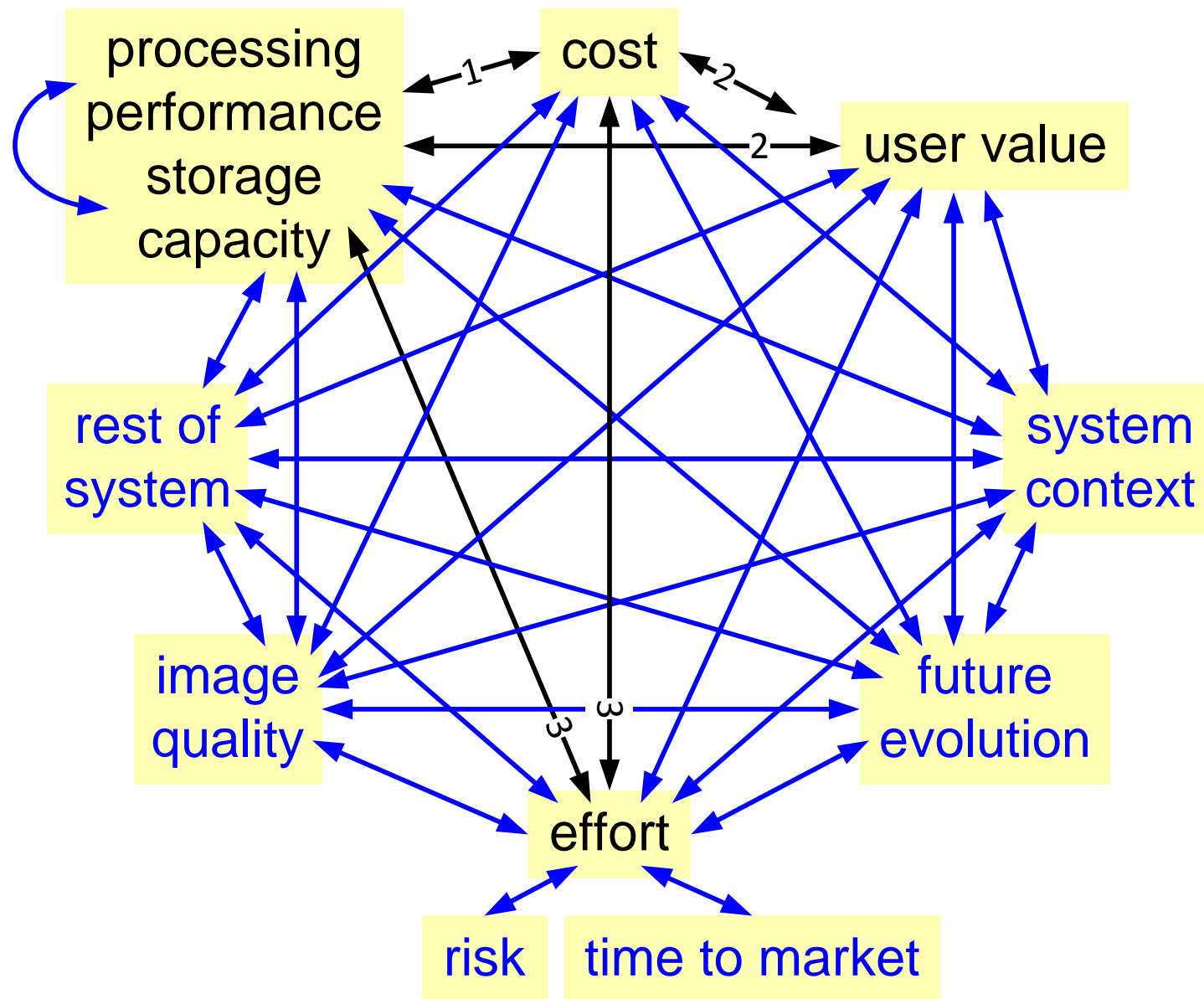


source:
<http://www.mpcomp.com/>
September 5, 2002

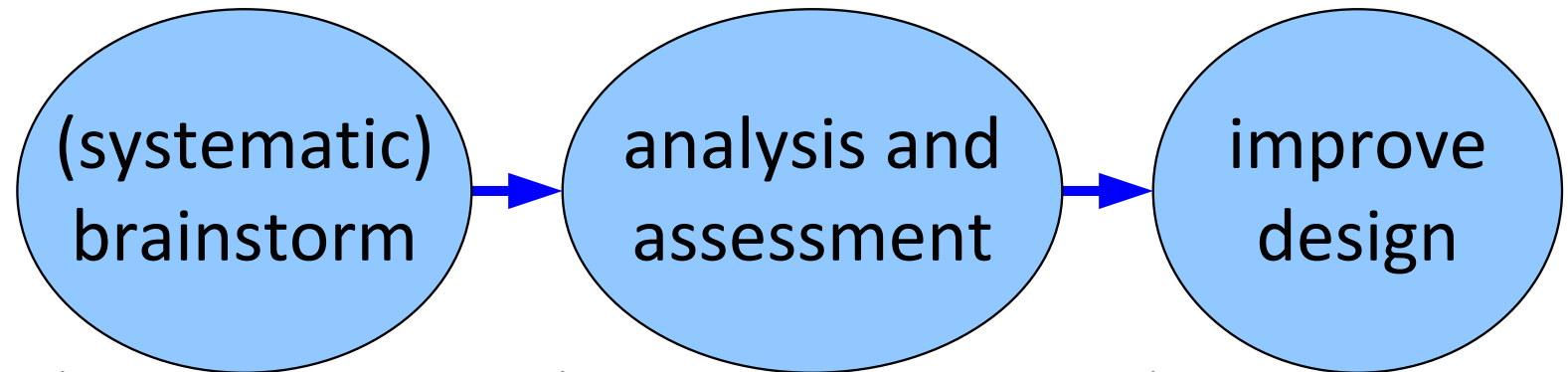
Performance Cost, effort consequences



But many many other considerations



Safety, Reliability and Security analysis methods



safety
hazard analysis

potential hazards

probability
severity

measures

reliability
FMEA

failure modes

effects

measures

security

vulnerability risks

consequences

measures

Make a first design:

- decomposition in functions
- decomposition in building blocks
- budgets for most important quality requirements

Exercise Design Side, second iteration

- Make a design:
 - that covers the most critical design aspects
 - that fulfills the most important and valuable customer needs
- Make a presentation of the design of maximal 8 sheets.