Software Reuse; Caught between strategic importance and practical feasibility

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Abstract

Worldwide the belief is shared that software reuse is needed to cope with the ever increasing amount of software. Software reuse is one part of addressing the amount of software, which is often overhyped and underestimated. Reuse of software is discussed via 8 statements, addressing: the need for reuse, the technical and organizational challenges, integration issues, evolution, reuse of know how, focus on the bussiness and customer and validation.

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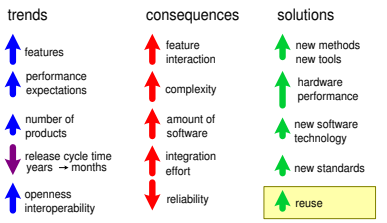


Why reuse: many valid objectives

+ reduced time to market
+ reduced cost per function
+ improved quality
+ improved reliability
+ easier diversity management
+ employees only have to understand one base system
+ improved predictability
+ larger purchasing power
+ means to consolidate knowledge
+ increase added value
+ enables parallel developments of multiple products
+ free feature propagation

Experiences with reuse, from counterproductive to effective

bad	good
longer time to market	reduced time to market
high investments	reduced investment
lots of maintenance	reduced (shared) maintenance cost
poor quality	improved quality
poor reliability	improved reliability
diversity is opposed	easier diversity management
lot of know how required	understanding of one base system
predictable too late	improved predictability
dependability	larger purchasing power
knowledge dilution	means to consolidate knowledge
lack of market focus	increase added value
interference	enables parallel developments
but integration required	free feature propagation

Succesful examples of reuse

homogeneous domain	cath lab MRI television waferstepper
hardware dominated	car airplane shaver television
limited scope	audio codec compression library streaming library

Limits of successful reuse

struggle with integration/convergence with other domains

TV: digital networks and media
cath lab: US imaging, MRI

poor/slow response on paradigm shifts

TV: LCD screens
cath lab: image based acquisition control

software maintenance, configurations, integration, release

MRI: integration and test
wafersteppers: number of configurations

how to innovate?

Reuse statements

1 Reuse of software modules is needed

customer diversity
market dynamics → product diversity → reuse shared
proven functionality

2 The technical and 3 organizational challenge are underestimated

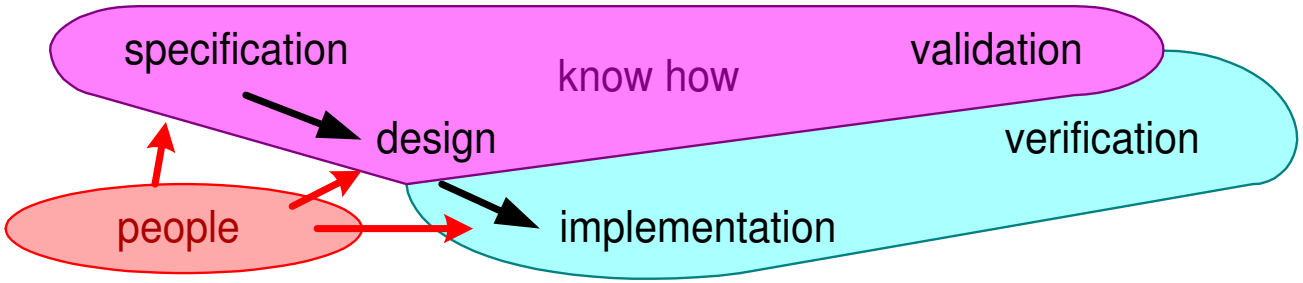
reuse
sharing
↓
overdesign or
under performance ← conflicting
interests → complicated
supplier customer
relationships

4 Components are the easy part, integration is difficult

integrating concepts: performance, resource management, exception handling, etcetera

Reuse statements continued

5 Reuse of know how or people instead of implementation is more effective



6 The platform must evolve continuously

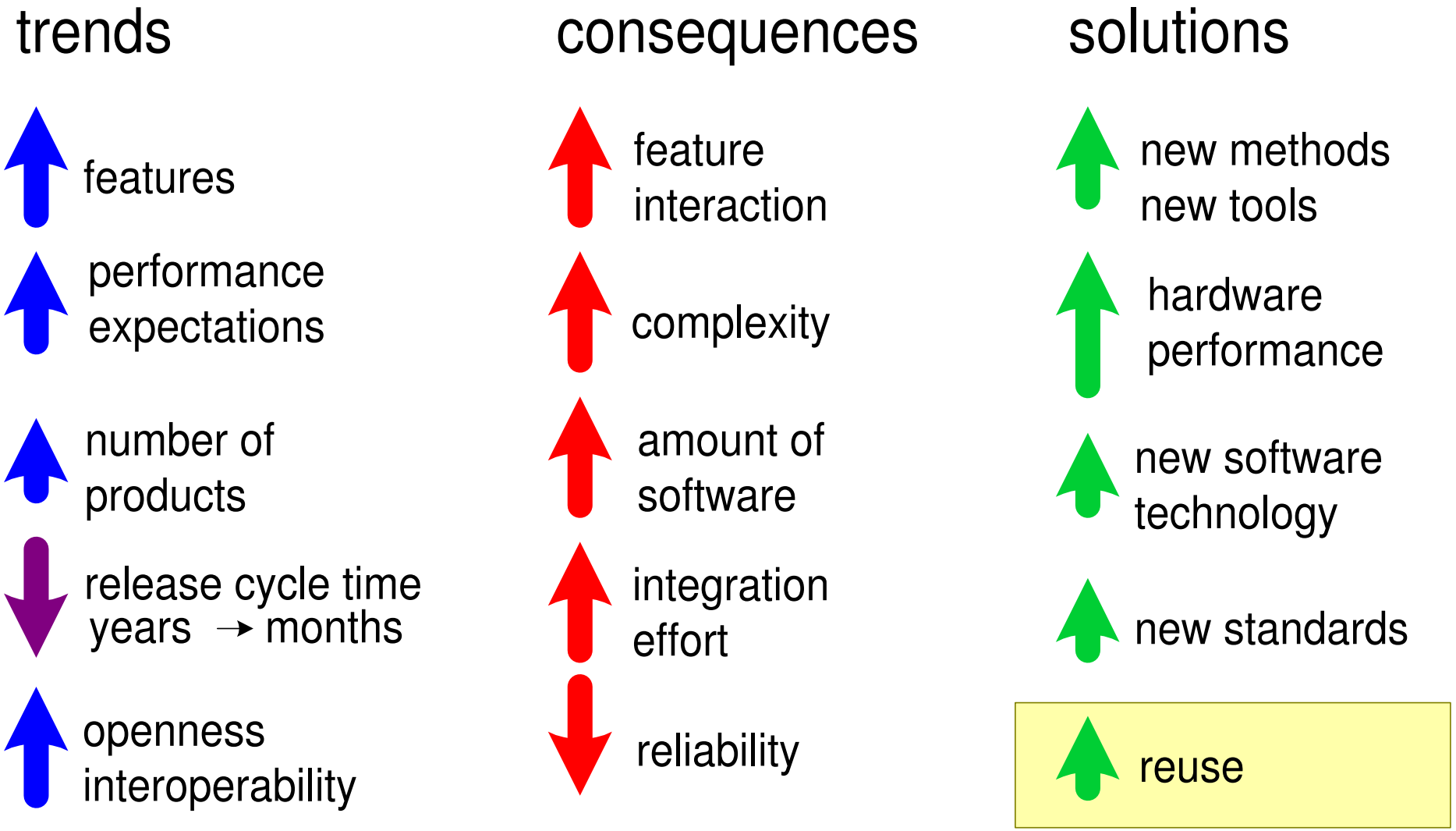
dynamic market **changing** applications ← served by — **up to date** products ← based on — **evolving** platform ← using — **rapid changing** technology (Moore!)

7 Focus on business bottomline and customer not on reuse

8. Use *before* reuse

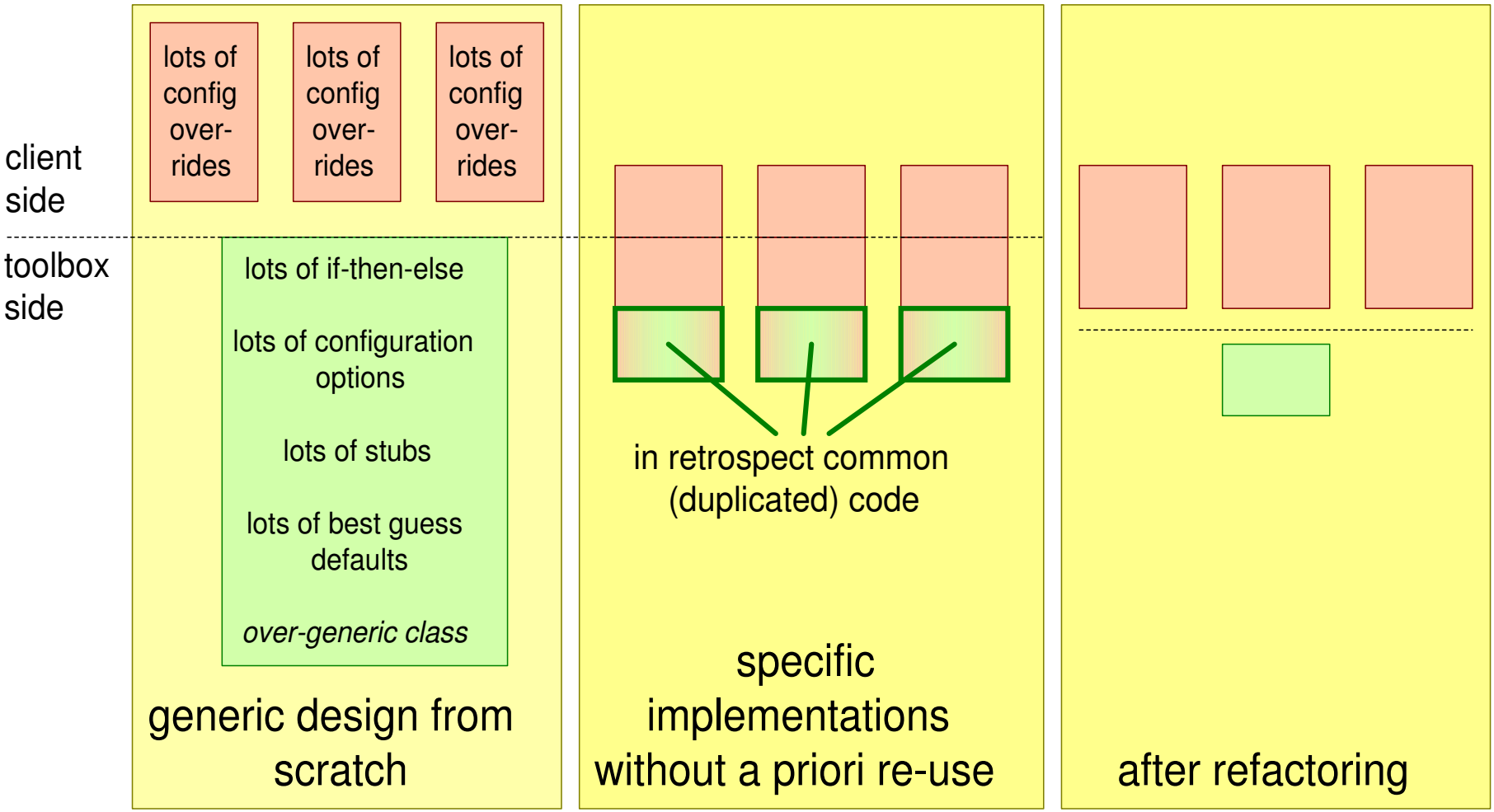
1. Reuse is needed

Reuse is needed ... as part of the solution



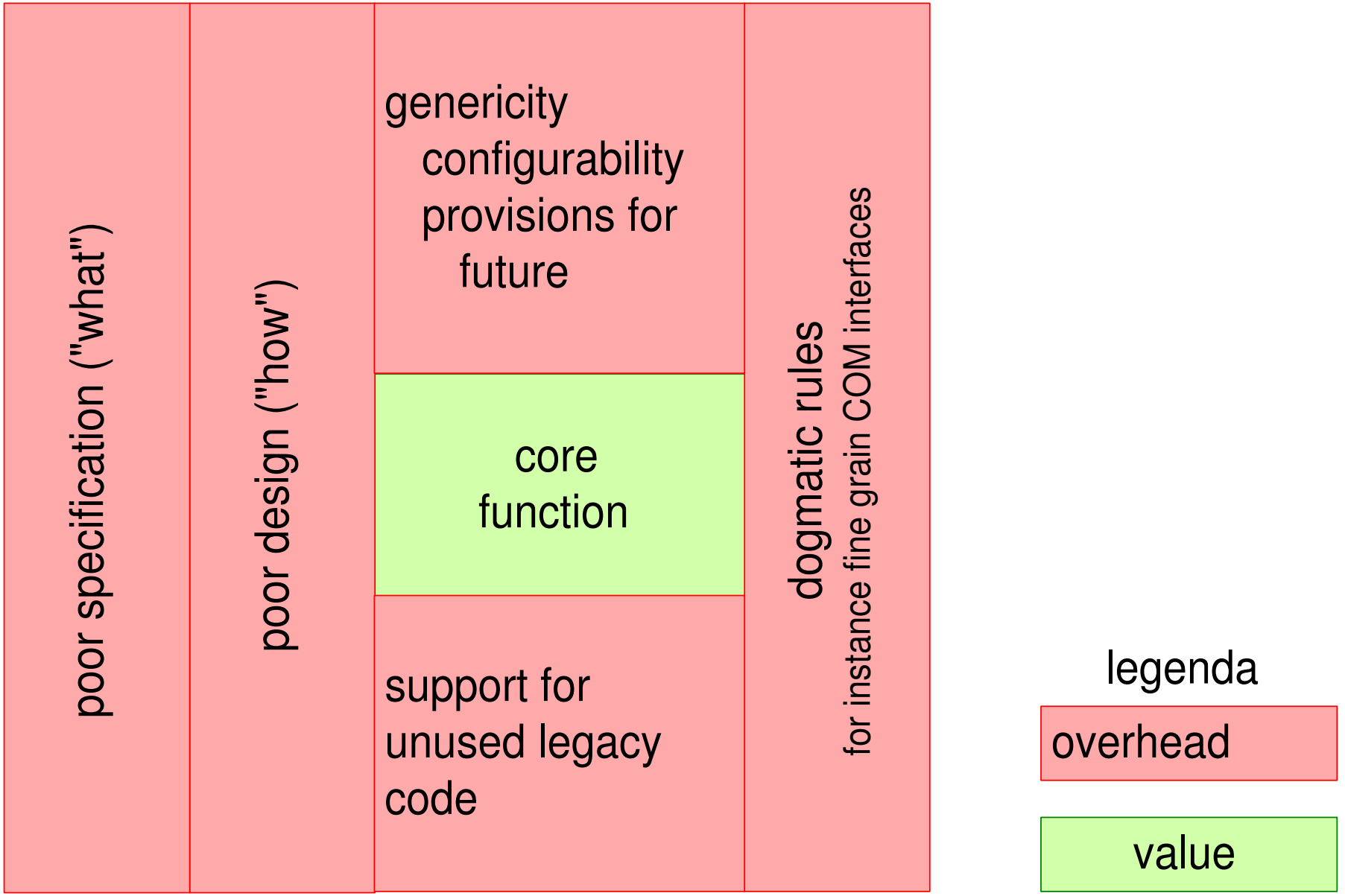
2. Technical challenge

The danger of being generic: bloating

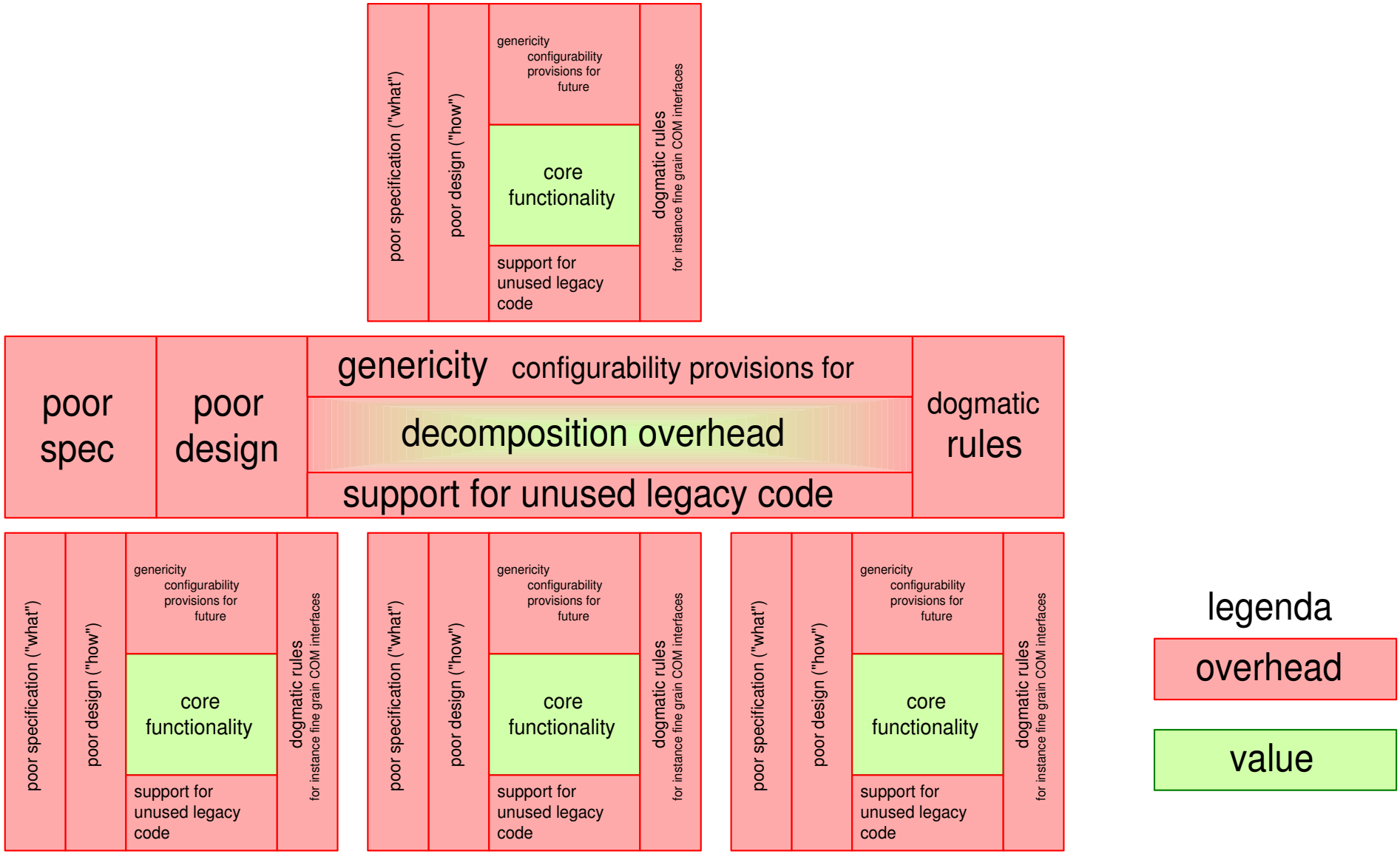


"Real-life" example: redesigned *Tool* super-class and descendants, ca 1994

Exploring bloating

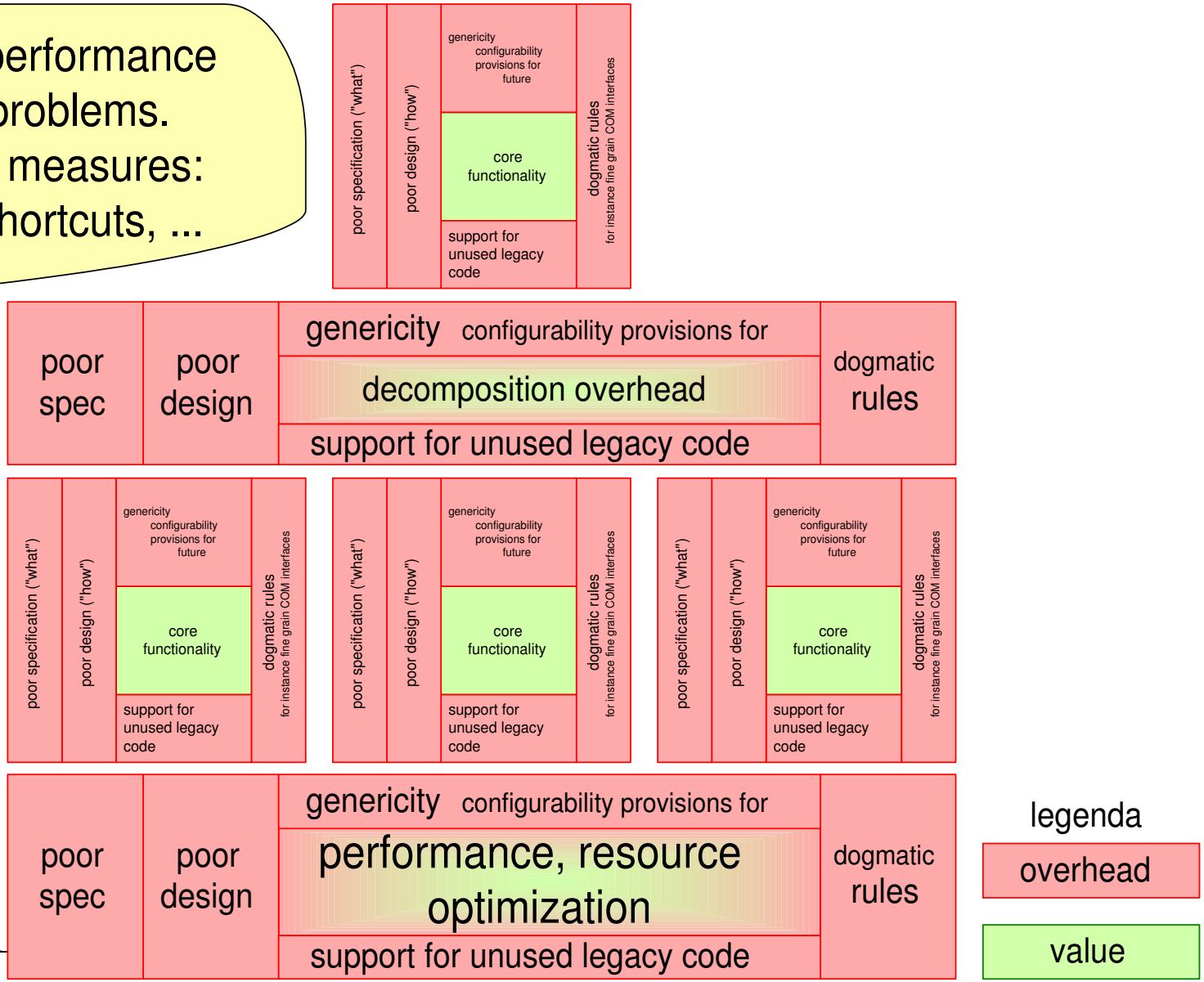


Bloating causes more bloating



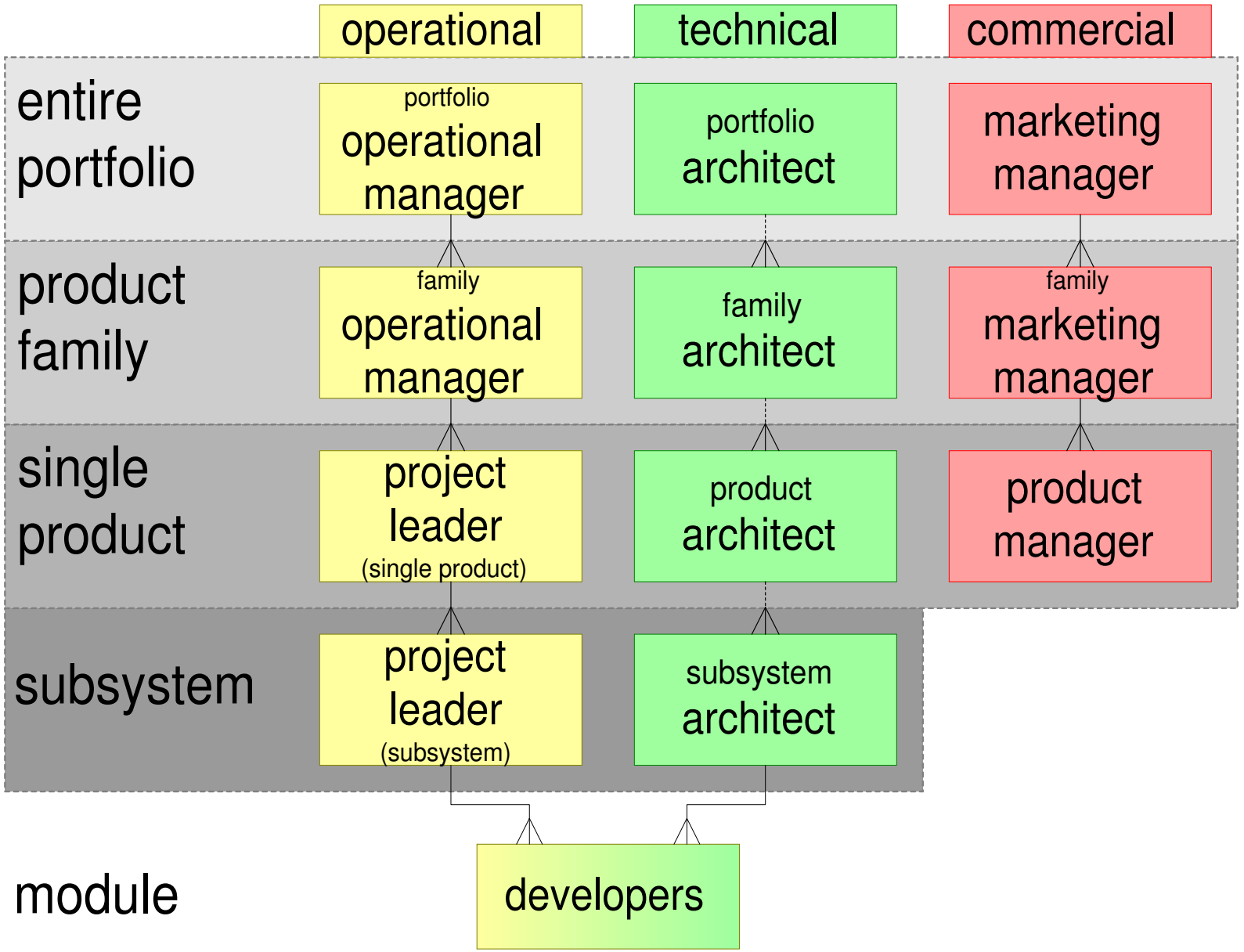
causes even more bloating...

Bloating causes performance and resource problems.
Solution: special measures: memory pools, shortcuts, ...

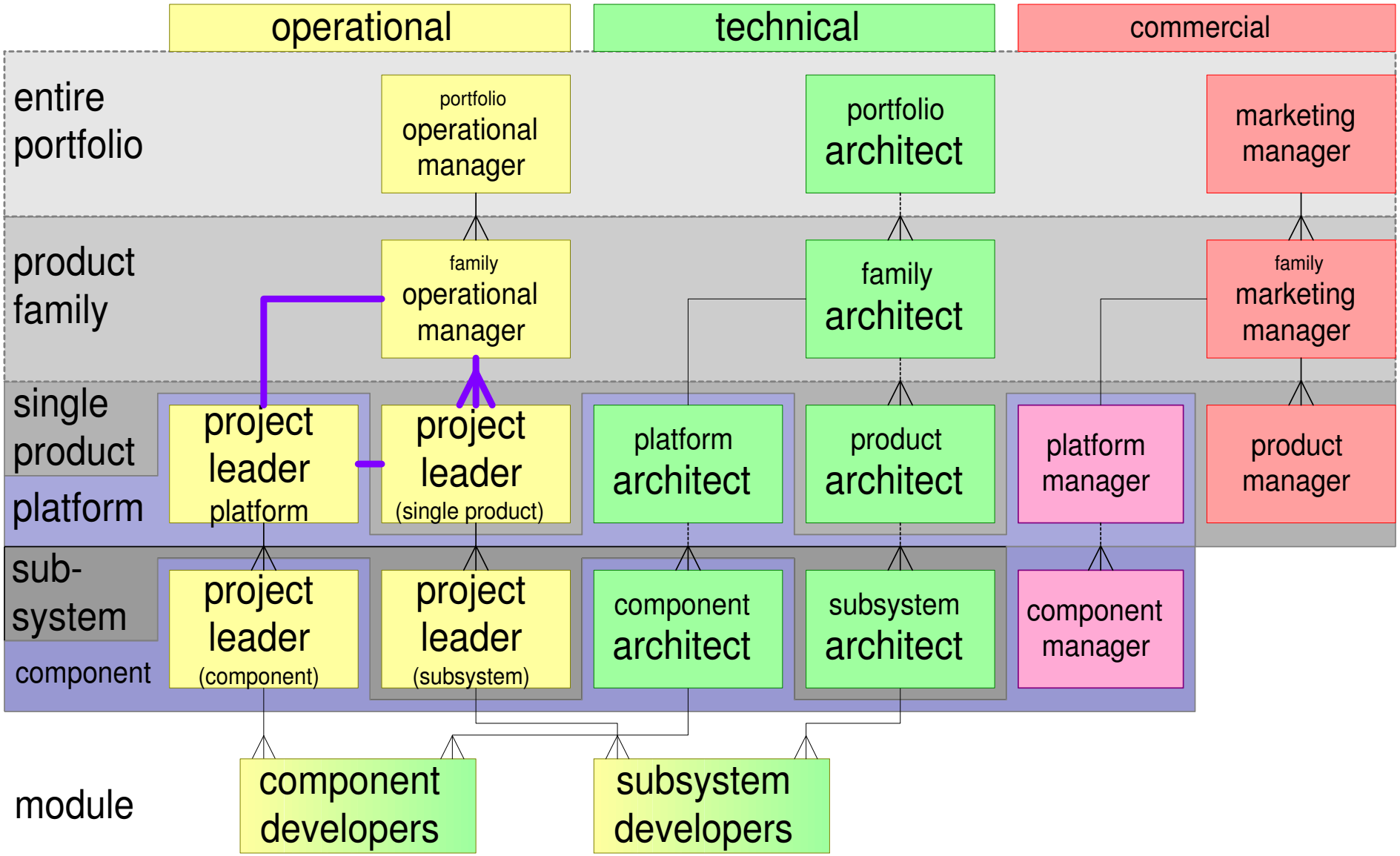


3. Organizational challenge

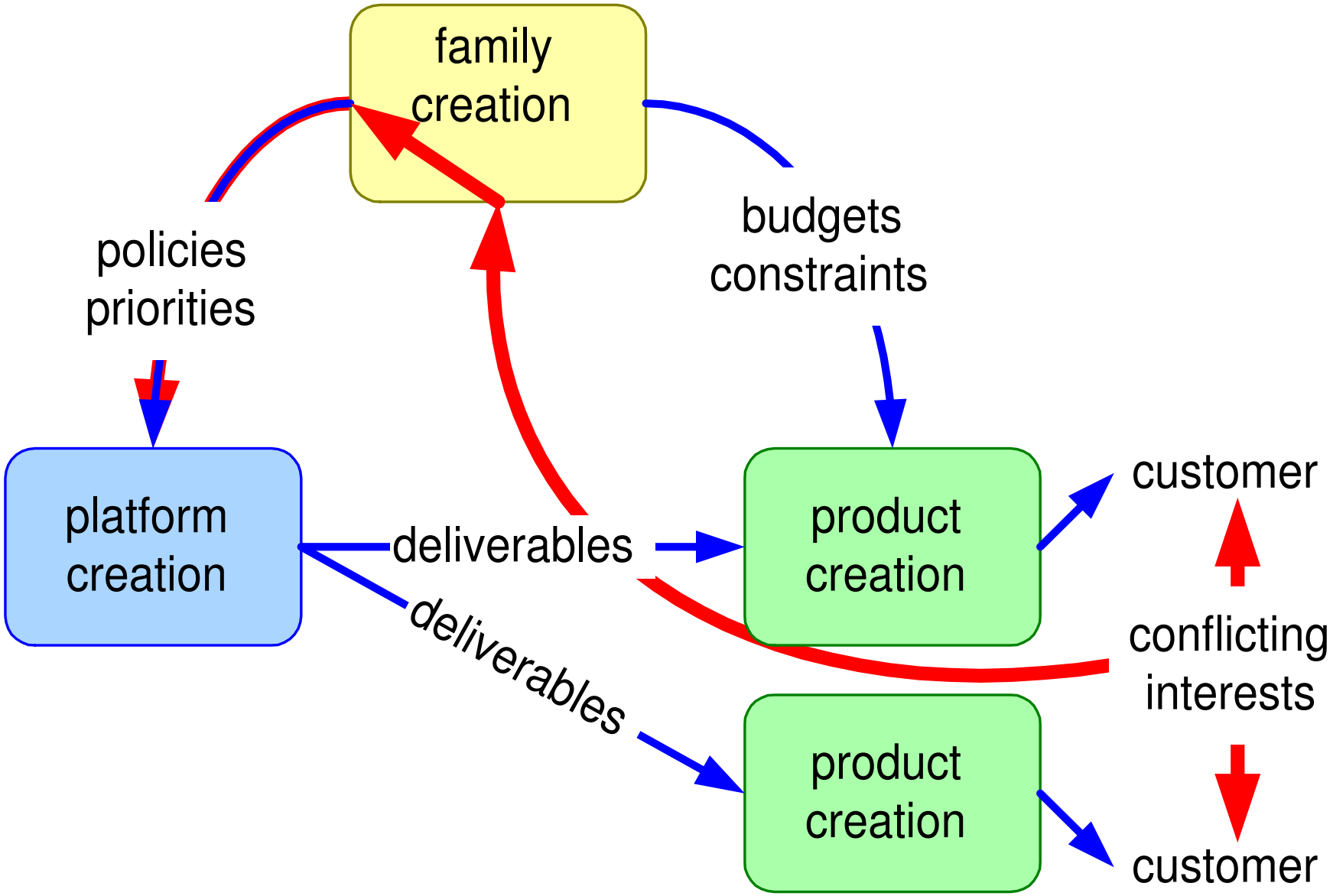
Conventional operational organization



Modified operational organization

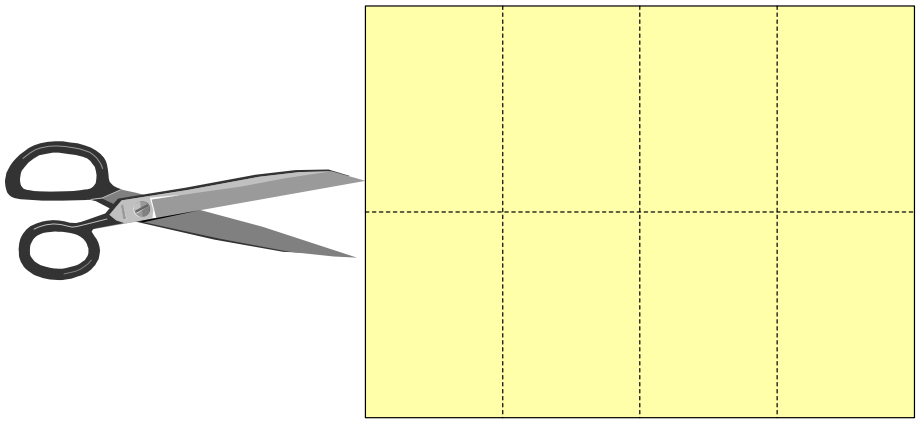


Reuse causes coupling

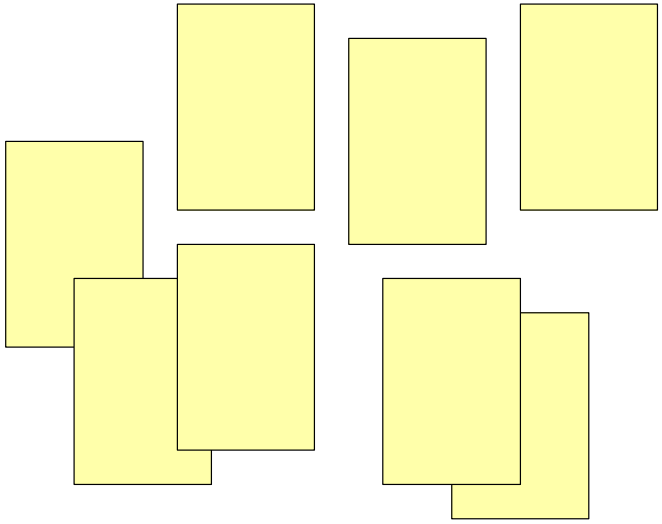


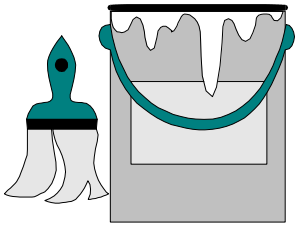
4. Integration

Decomposition is easy, integration is difficult

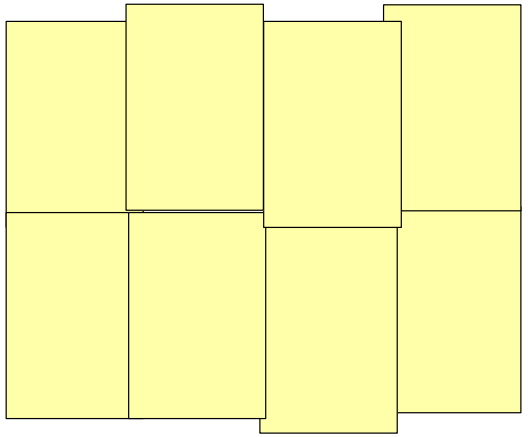


Decomposition is "easy"

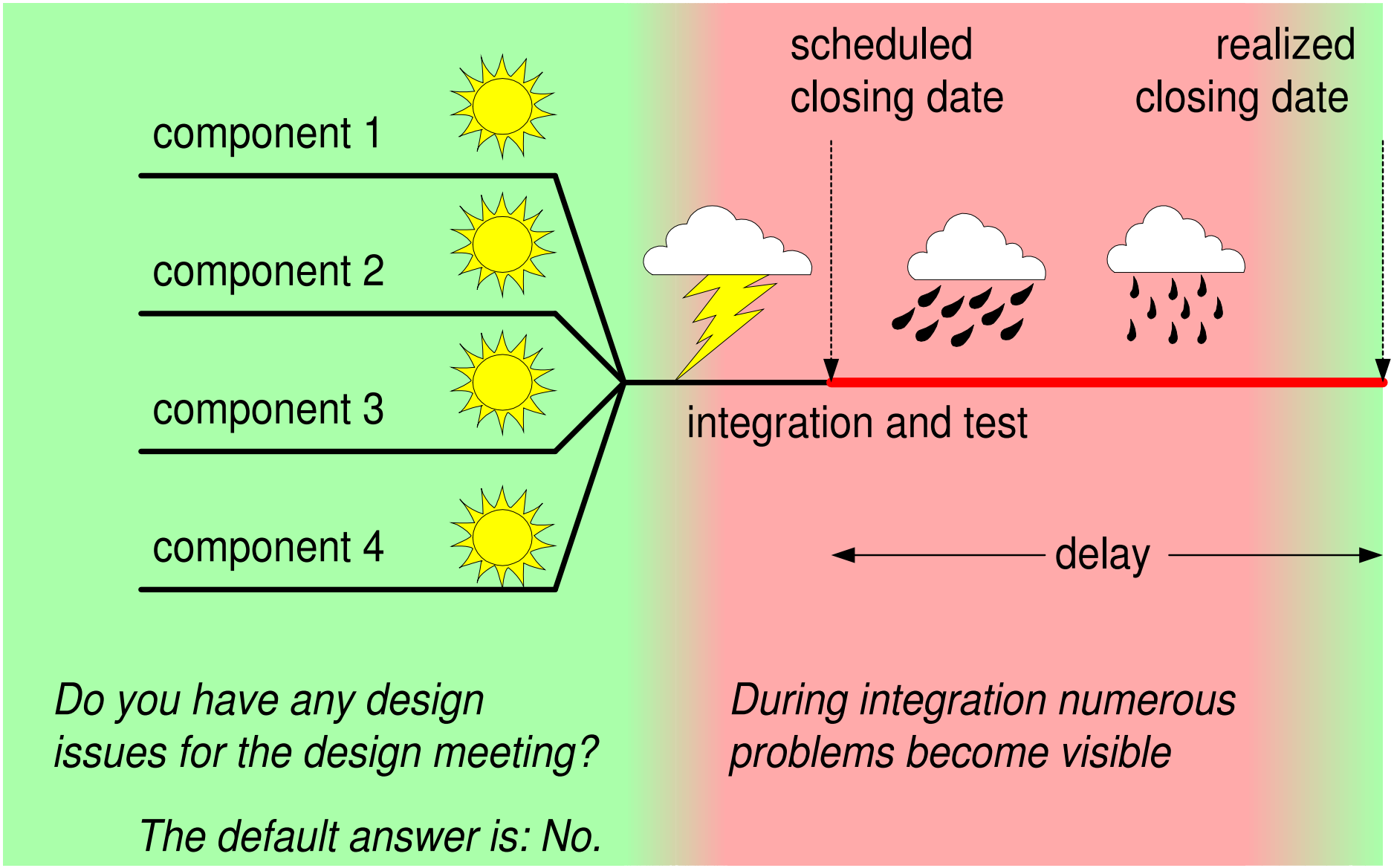




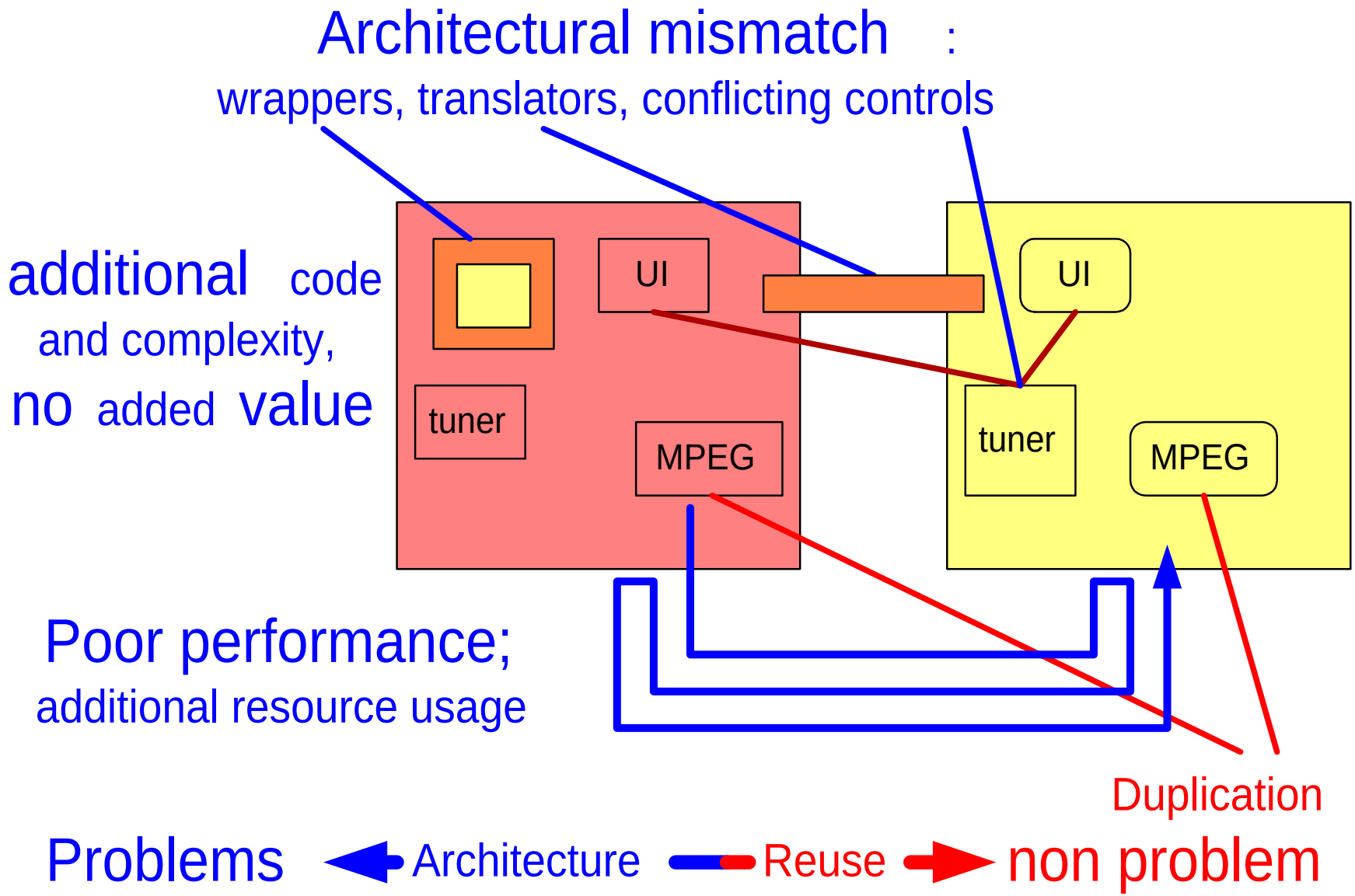
Integration is difficult



Nasty surprises show up during integration

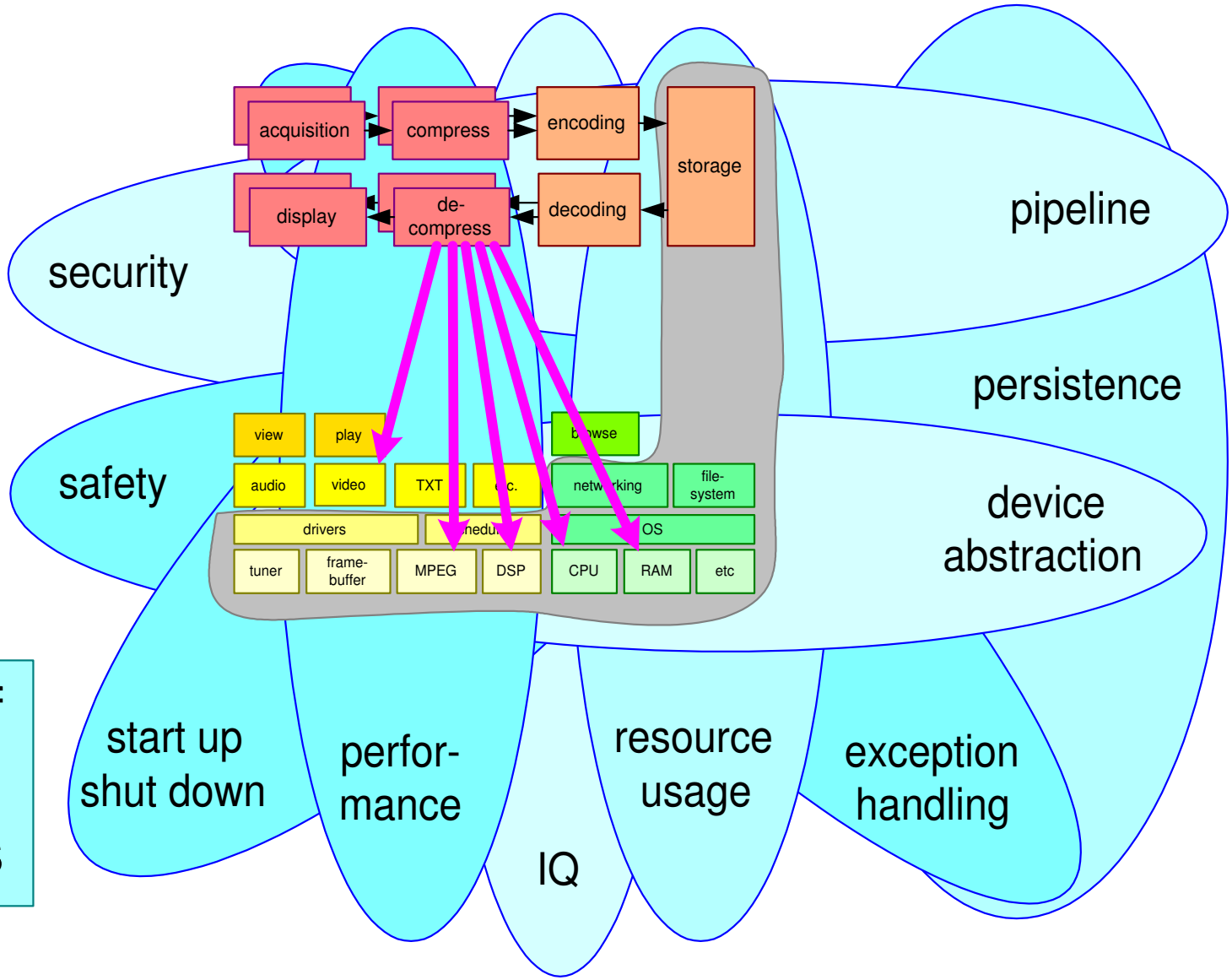


Architectural mismatch

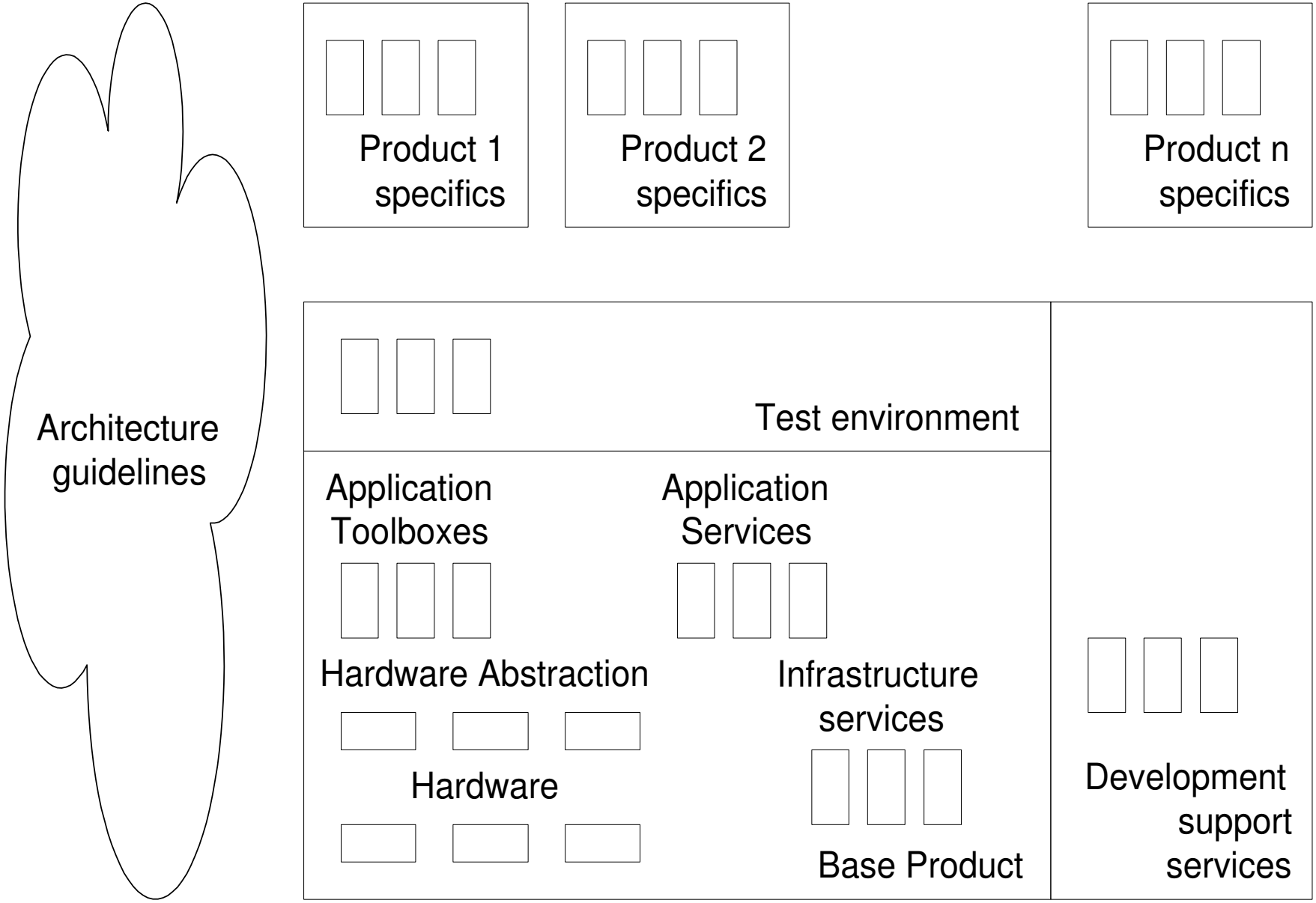


Integrating concepts

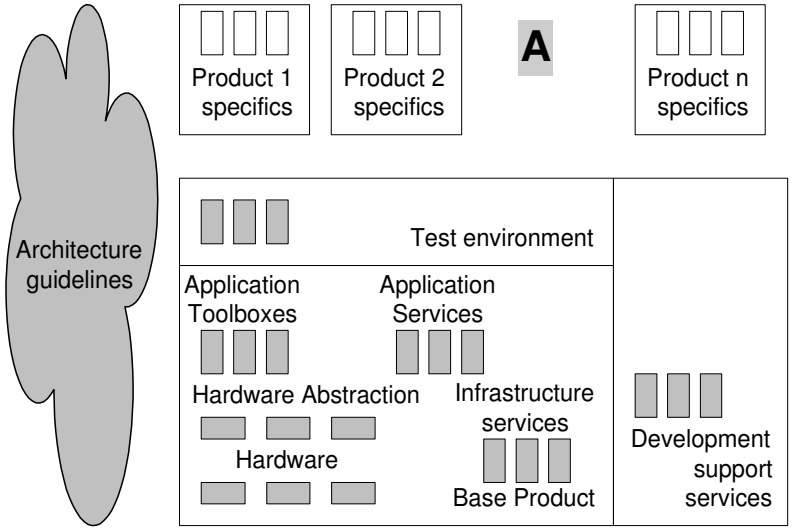
1. functional decomposition
2. construction decomposition
3. allocation
4. infrastructure
5. choice of integrating concepts

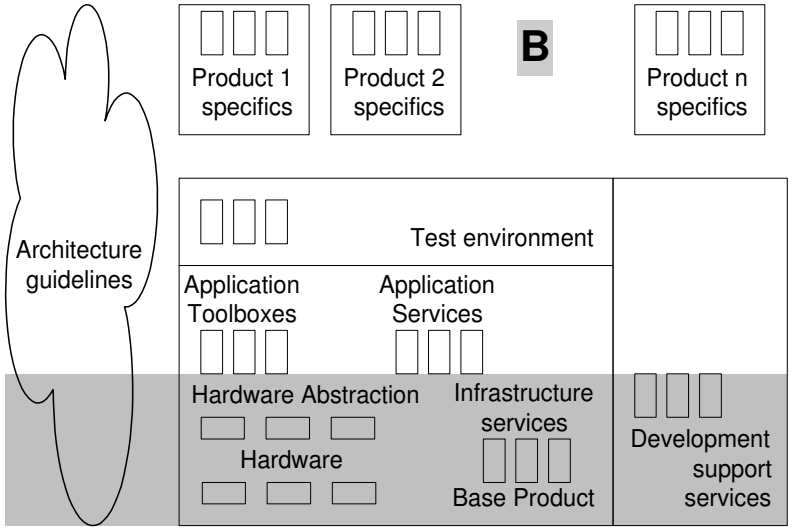


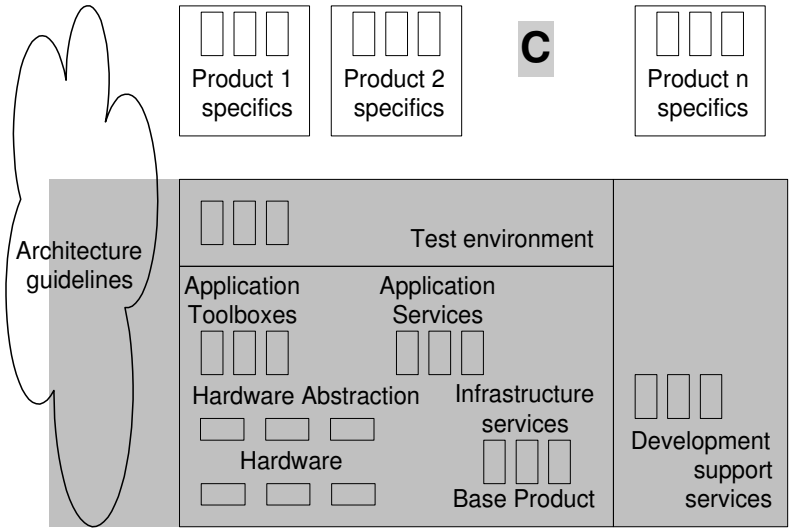
Platform block diagram

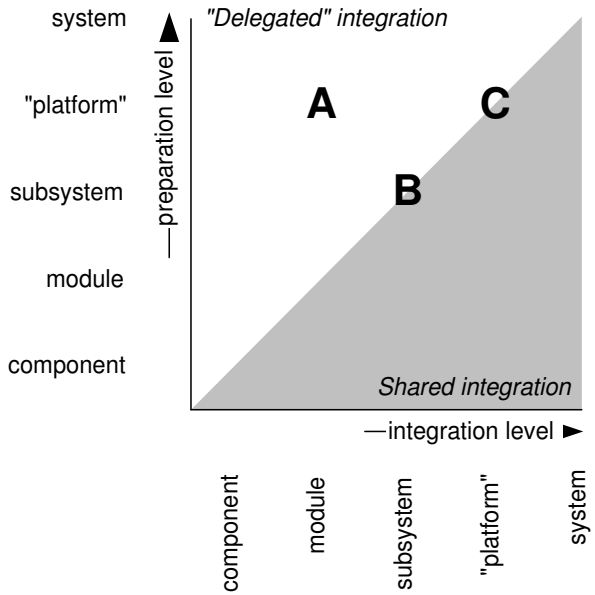


Platform types



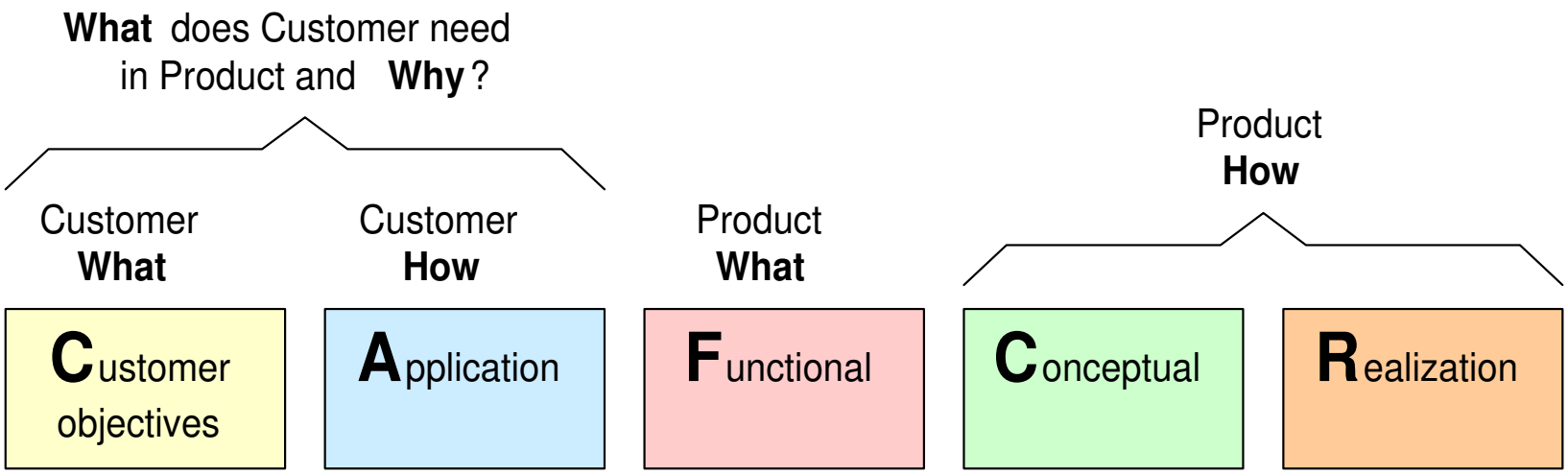


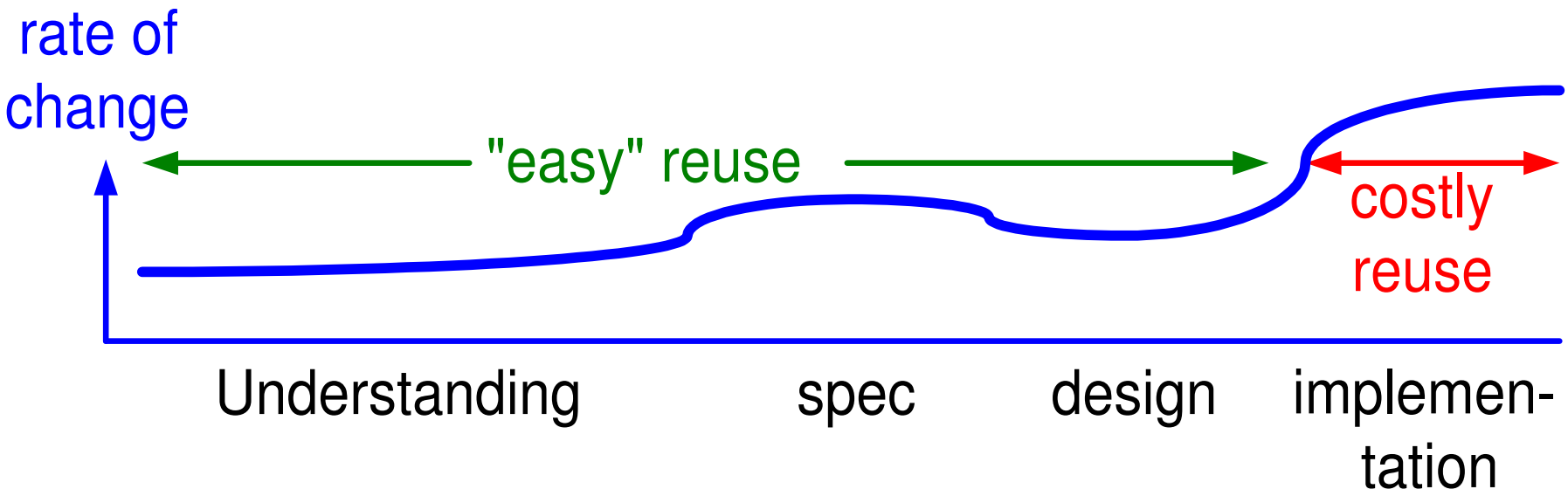




5. Reuse of know how and people

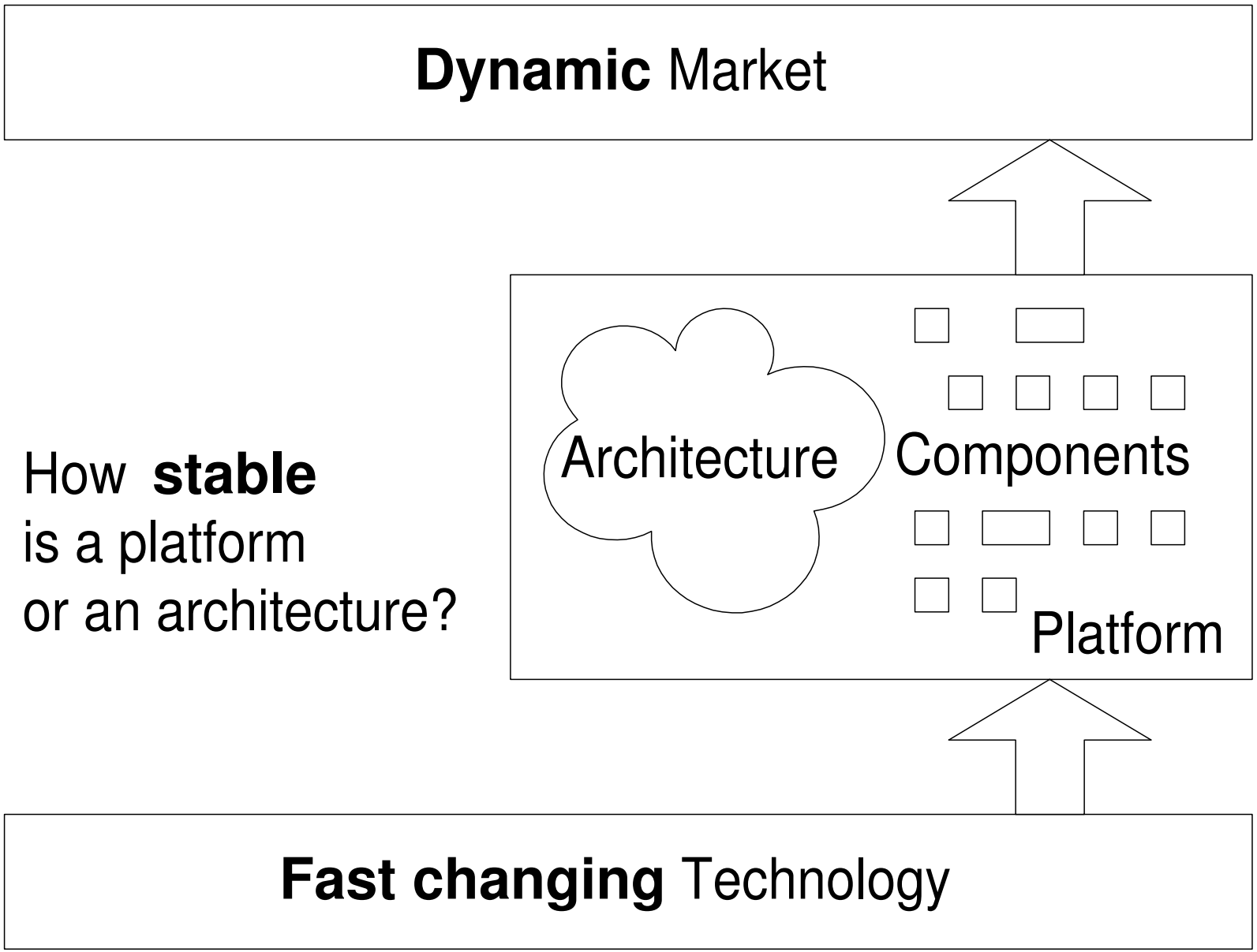
Reuse in CAFCR perspective



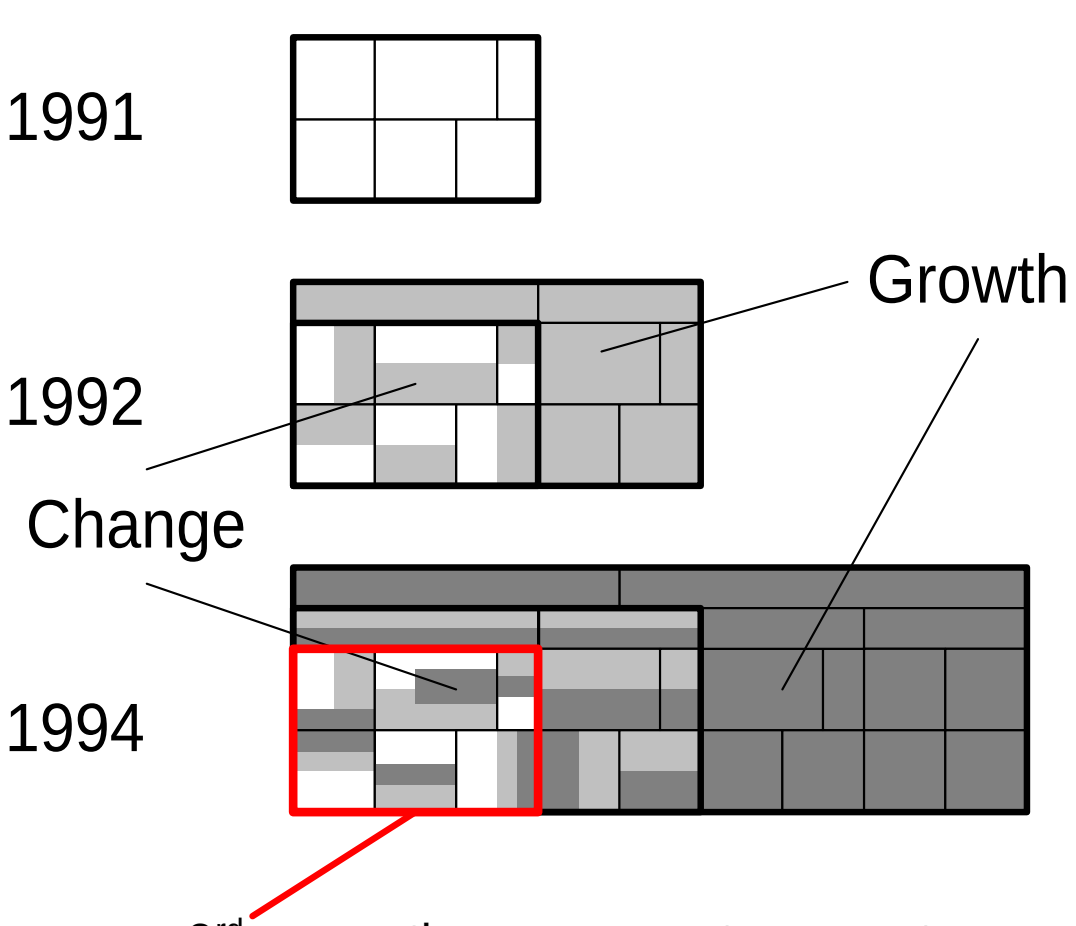


6. Evolution

The platform in a dynamic world



Platform evolution (Easyvision 1991-1996)



Last changed in:

1991

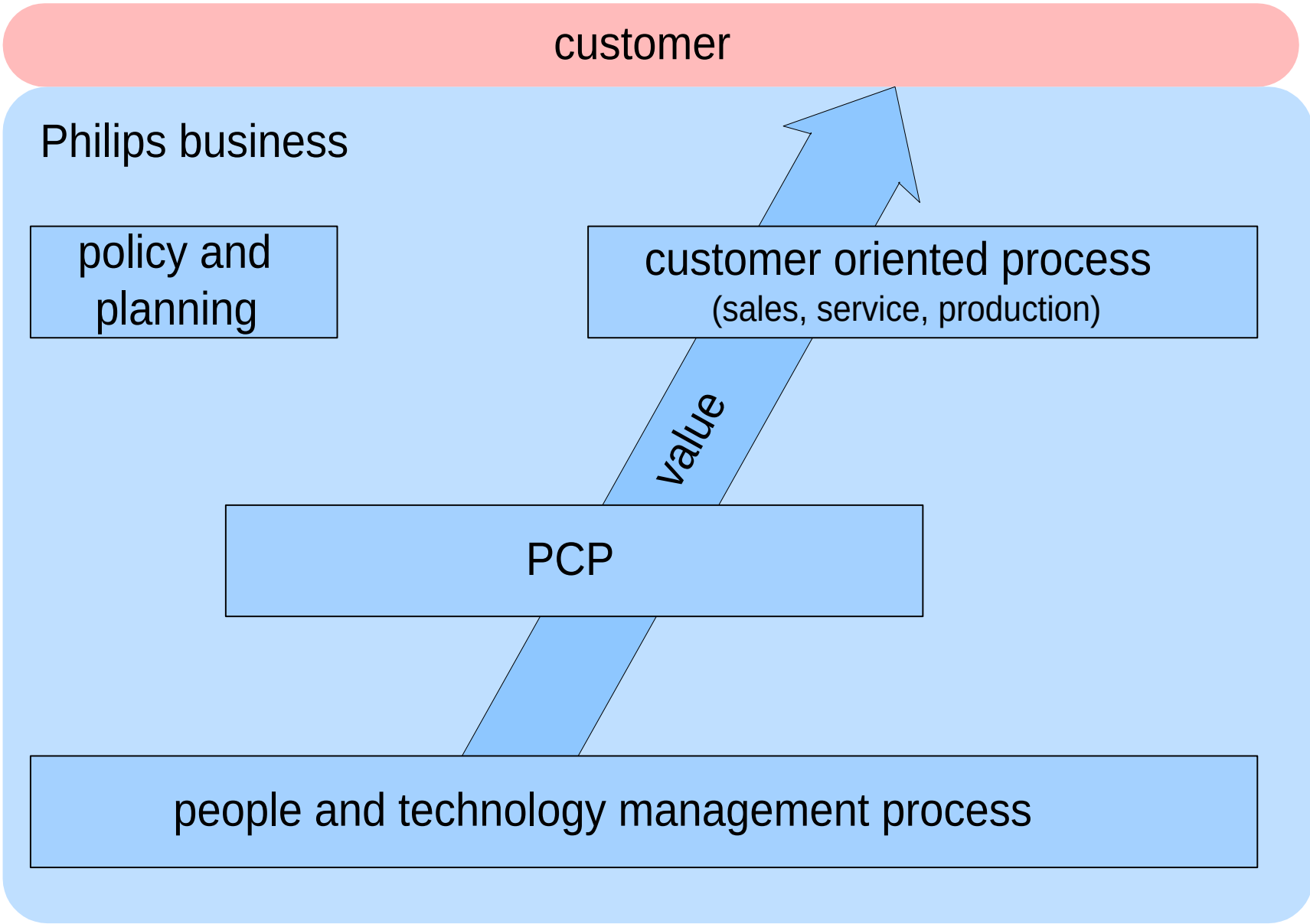
1992

1994

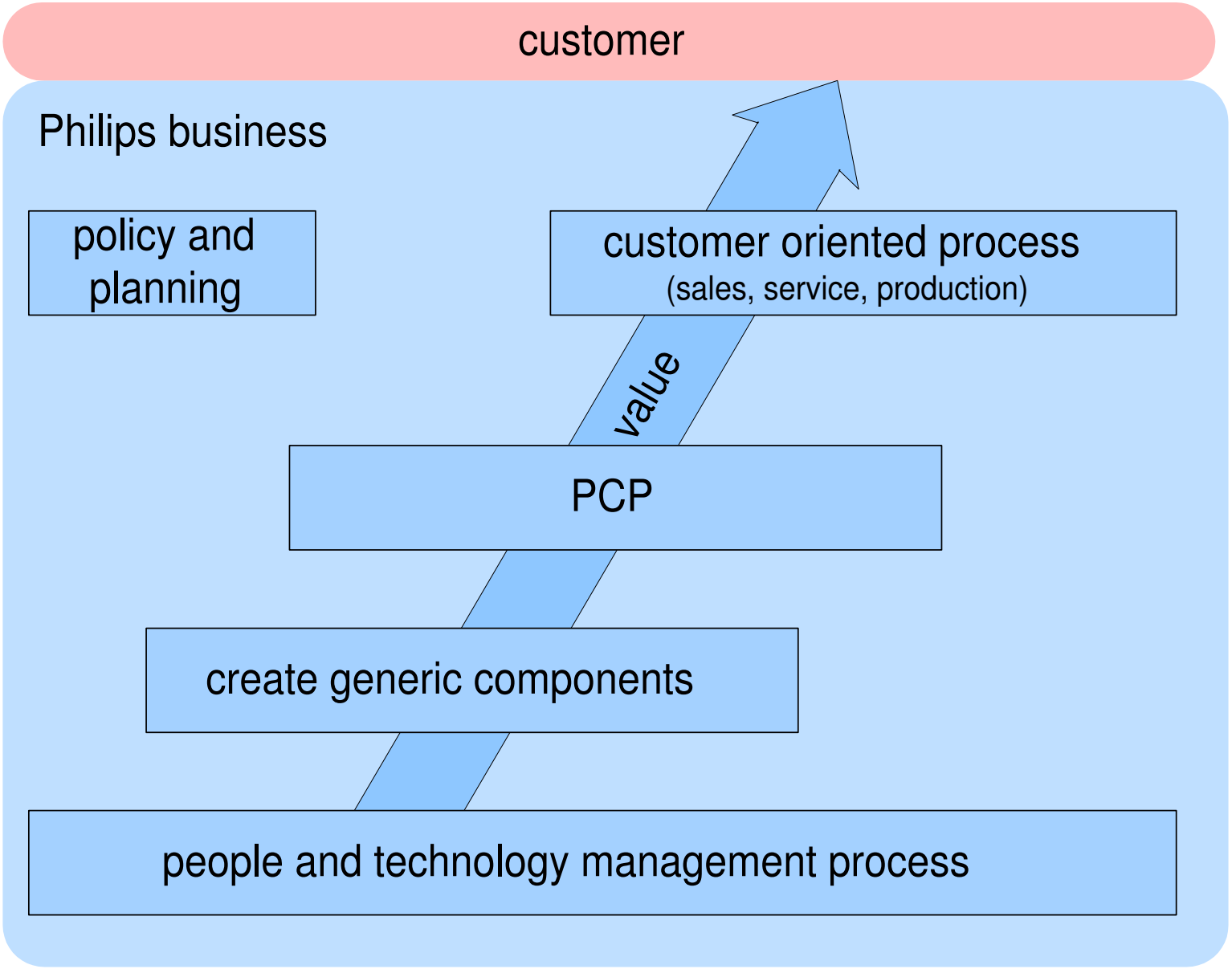
3rd generation components are mature, active maintenance needed.
Growth and change continues, some "old" components become obsolete

7. Focus on business bottomline and customer

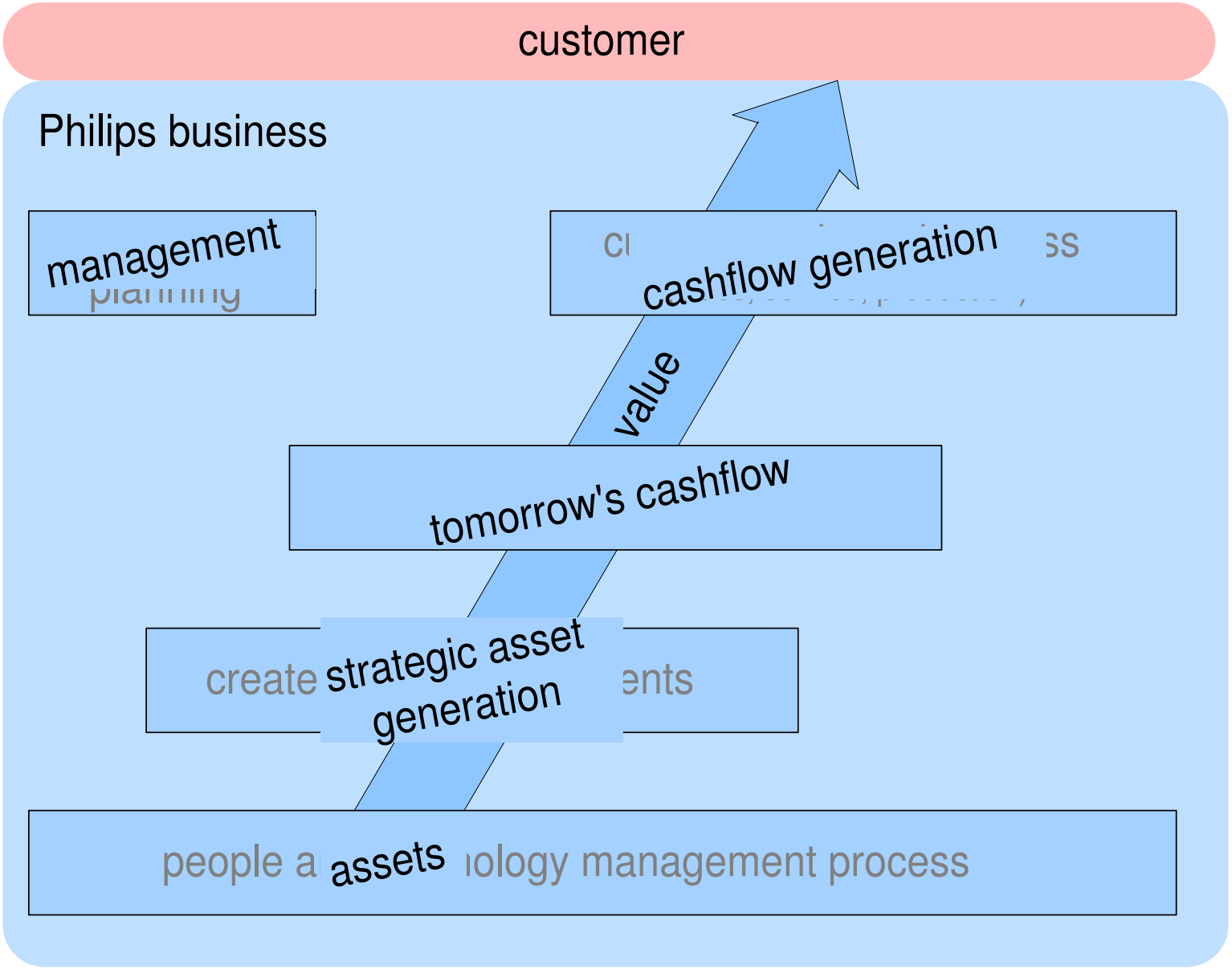
Simplified process view



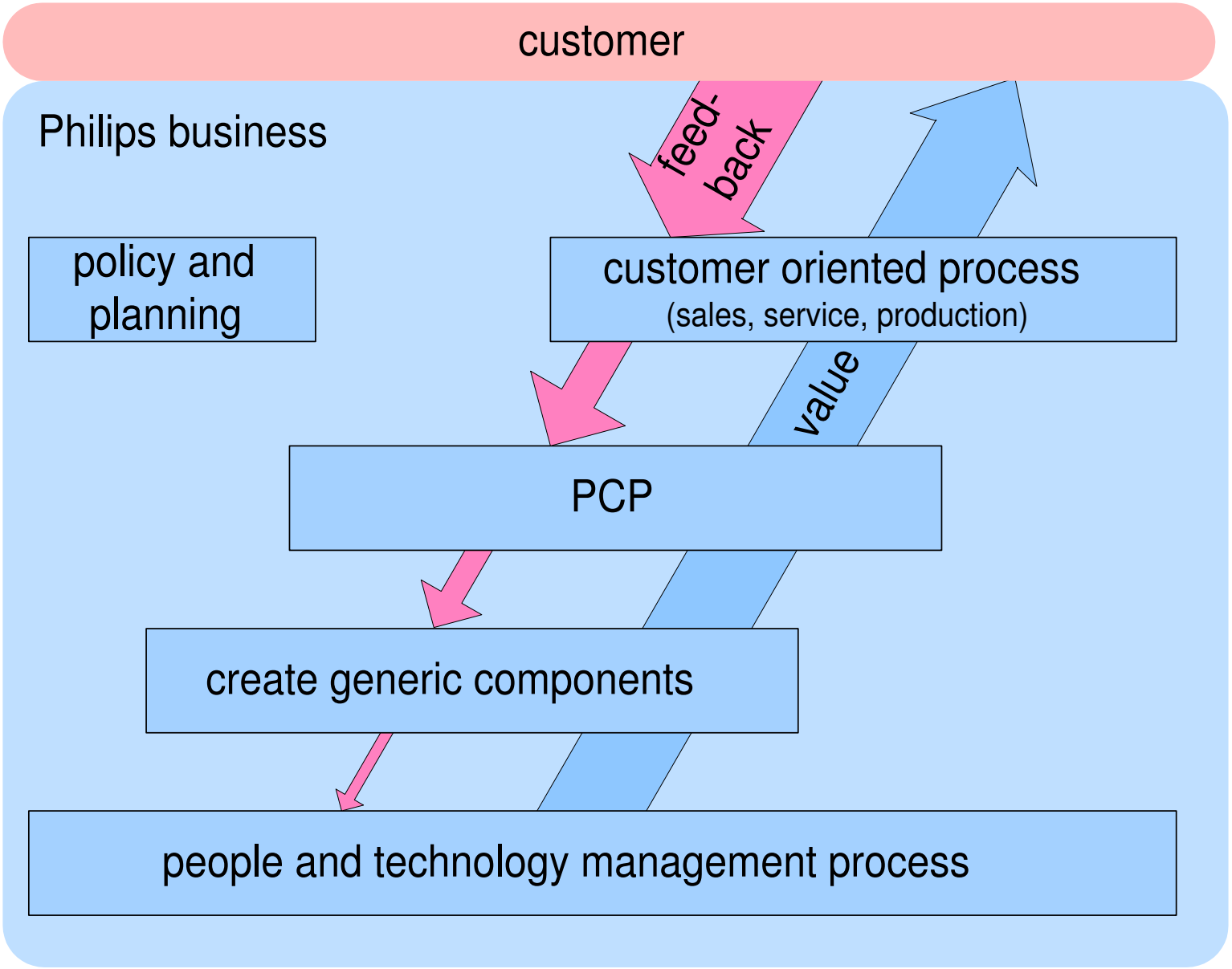
Modified Process Decomposition



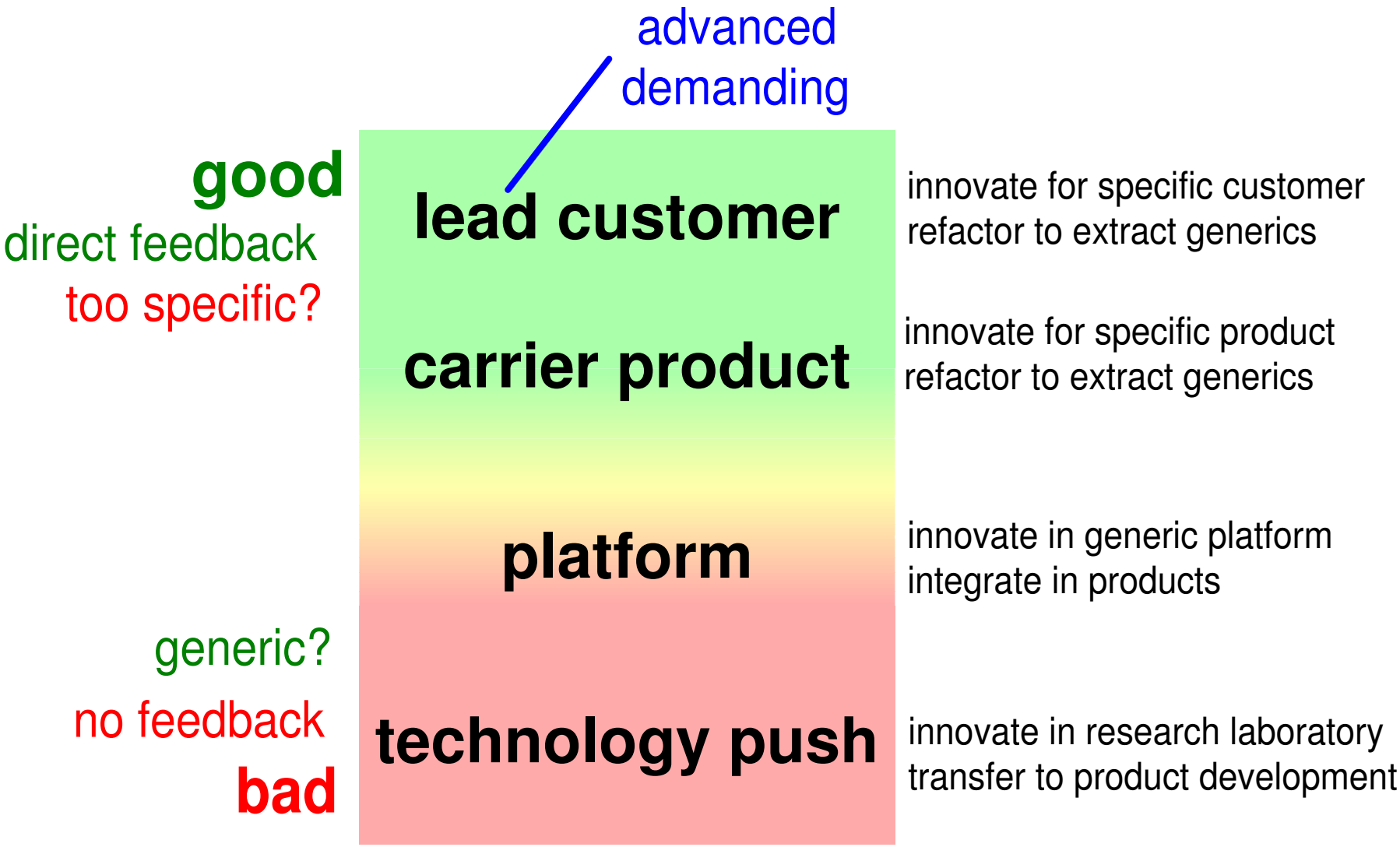
Financial Viewpoint on Process Decomposition



Feedback flow: loss of customer understanding!



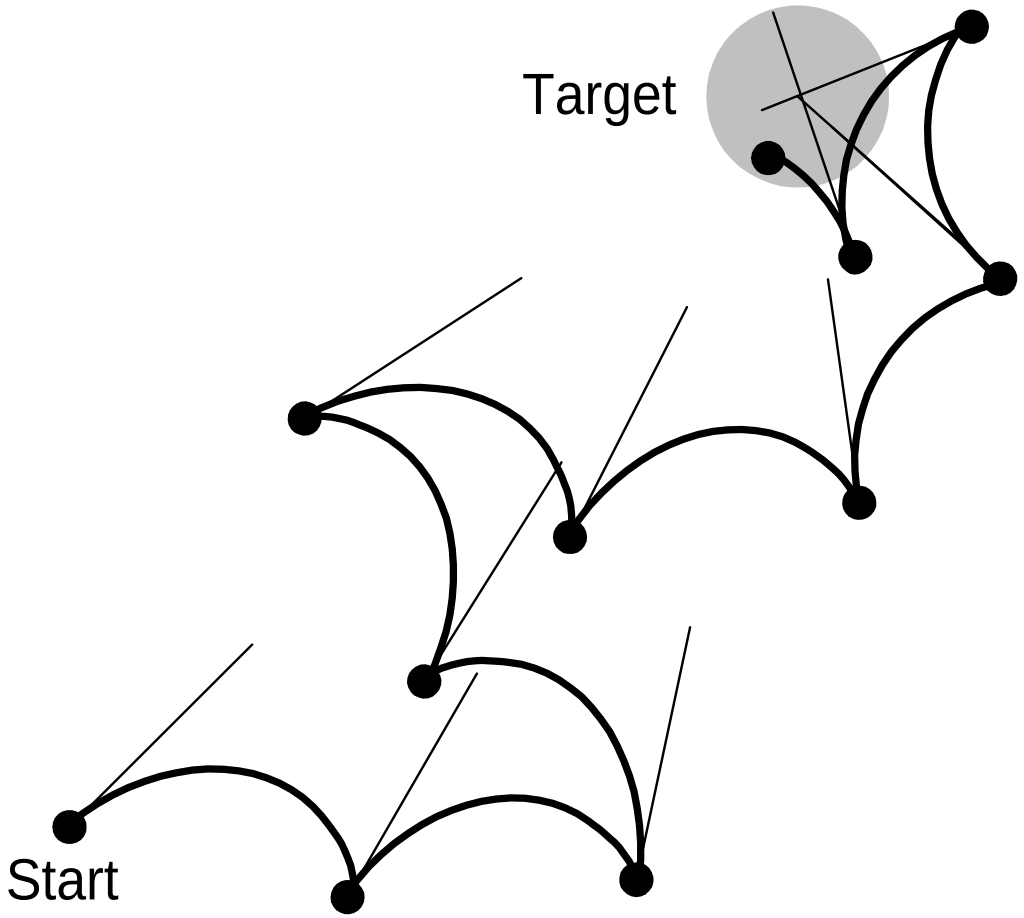
Models for reuse



8. Use before reuse

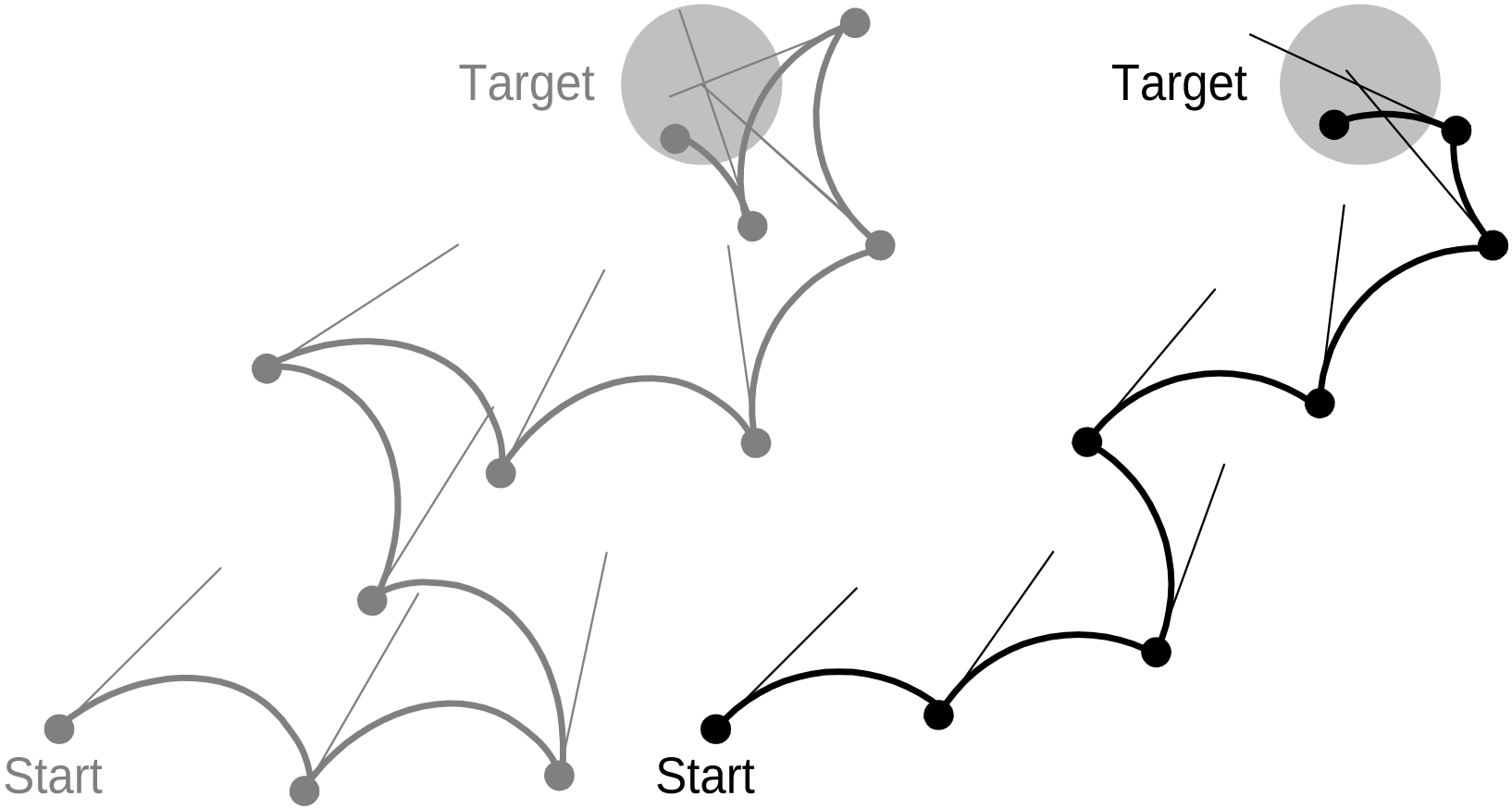
Feedback

stepsize: 3 months
elapsed time: 25 months

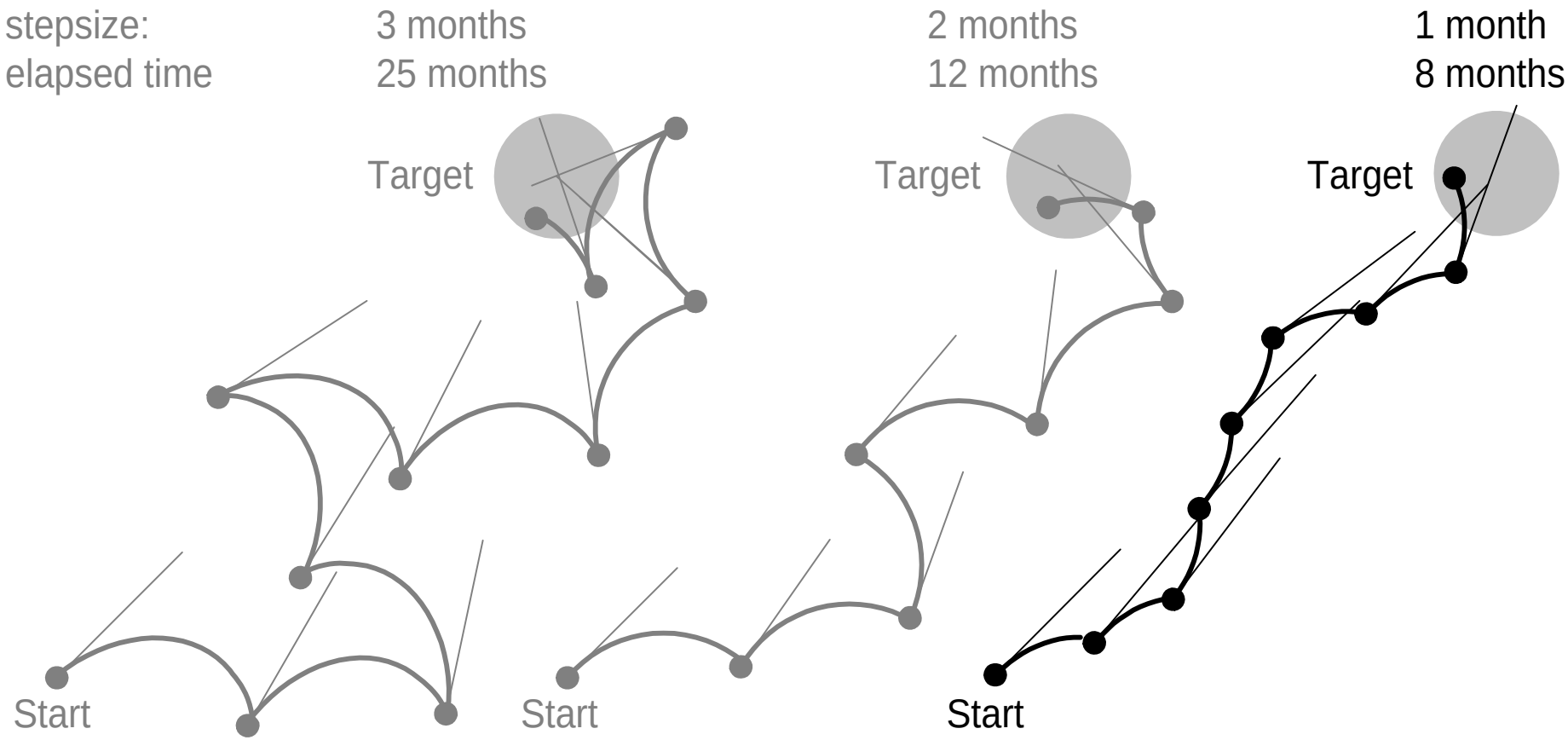


Feedback (2)

stepsize: 3 months 2 months
elapsed time 25 months 12 months



Feedback (3)



Small feedback cycles result in Faster Time to Market

Use = Validate before Reuse

Does it satisfy the needs?

performance
functionality
user interface

Does it fit in the constraints?

cost price
effort

Does it fit in the design?

architectural match
no bloating

Is the quality sufficient?

multiplication of problems
or multiplication of benefits