

# High Level Modeling to Support Software Design

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## Abstract

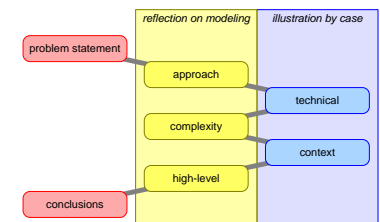
High level models are simple models with the primary goal to support understanding, analysis, communication and decision making. The models have different complementary representations and formats, e.g. visual diagrams, mathematical formulas, and quantitative information and graphs.

The models are made at different levels to guide software design choices: enterprise level, specification level, and design.

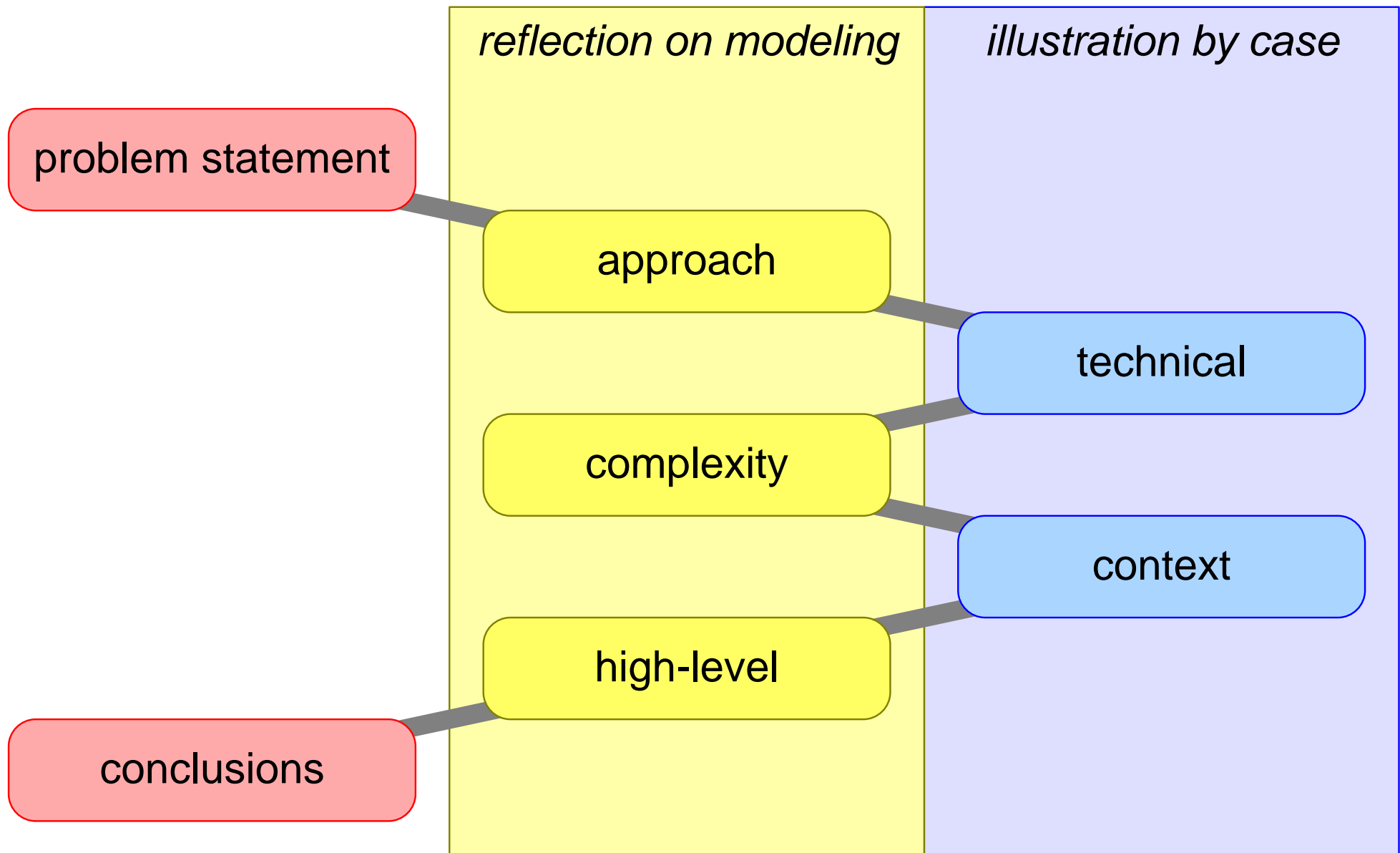
## Distribution

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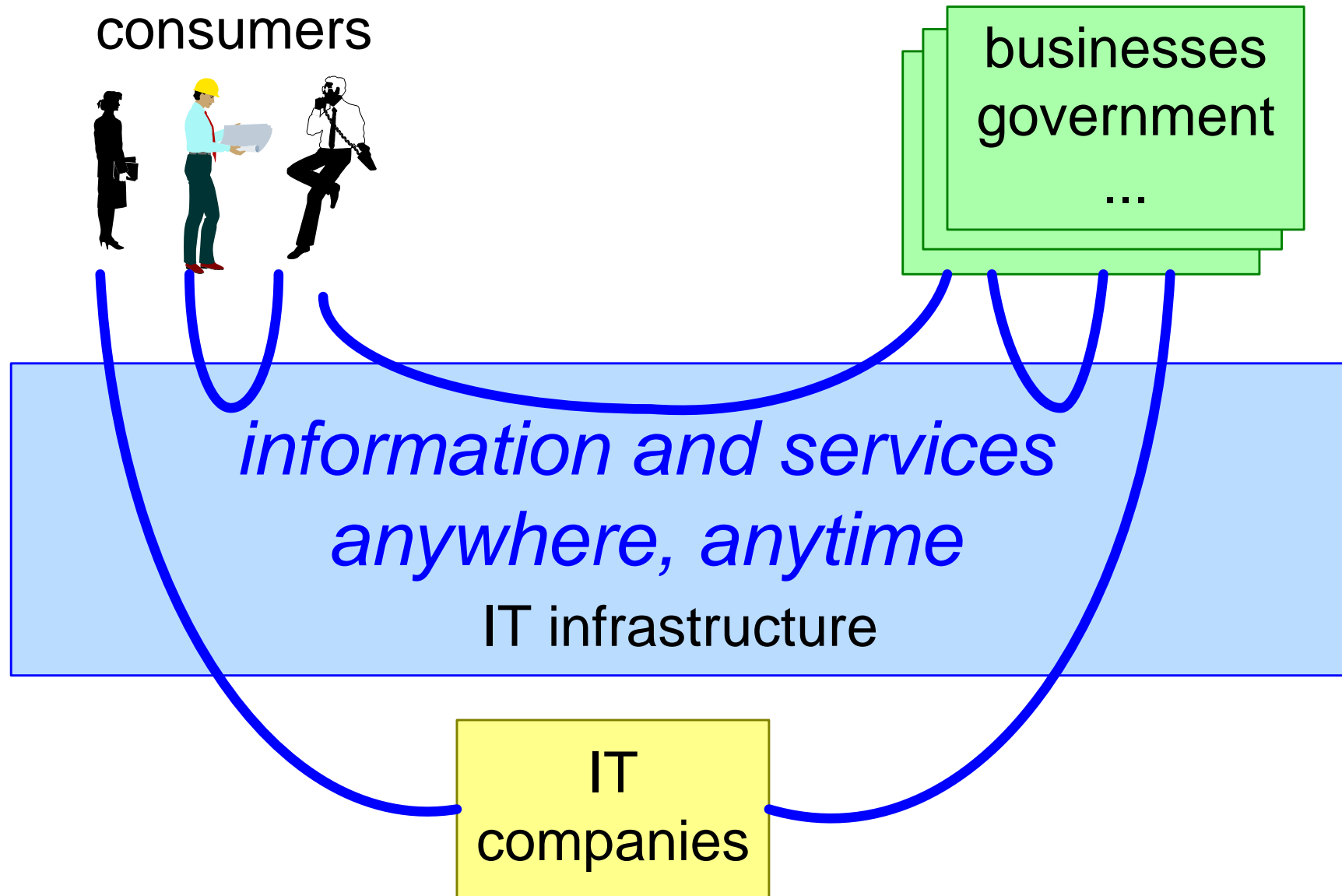
August 16, 2025  
status: preliminary  
draft  
version: 0



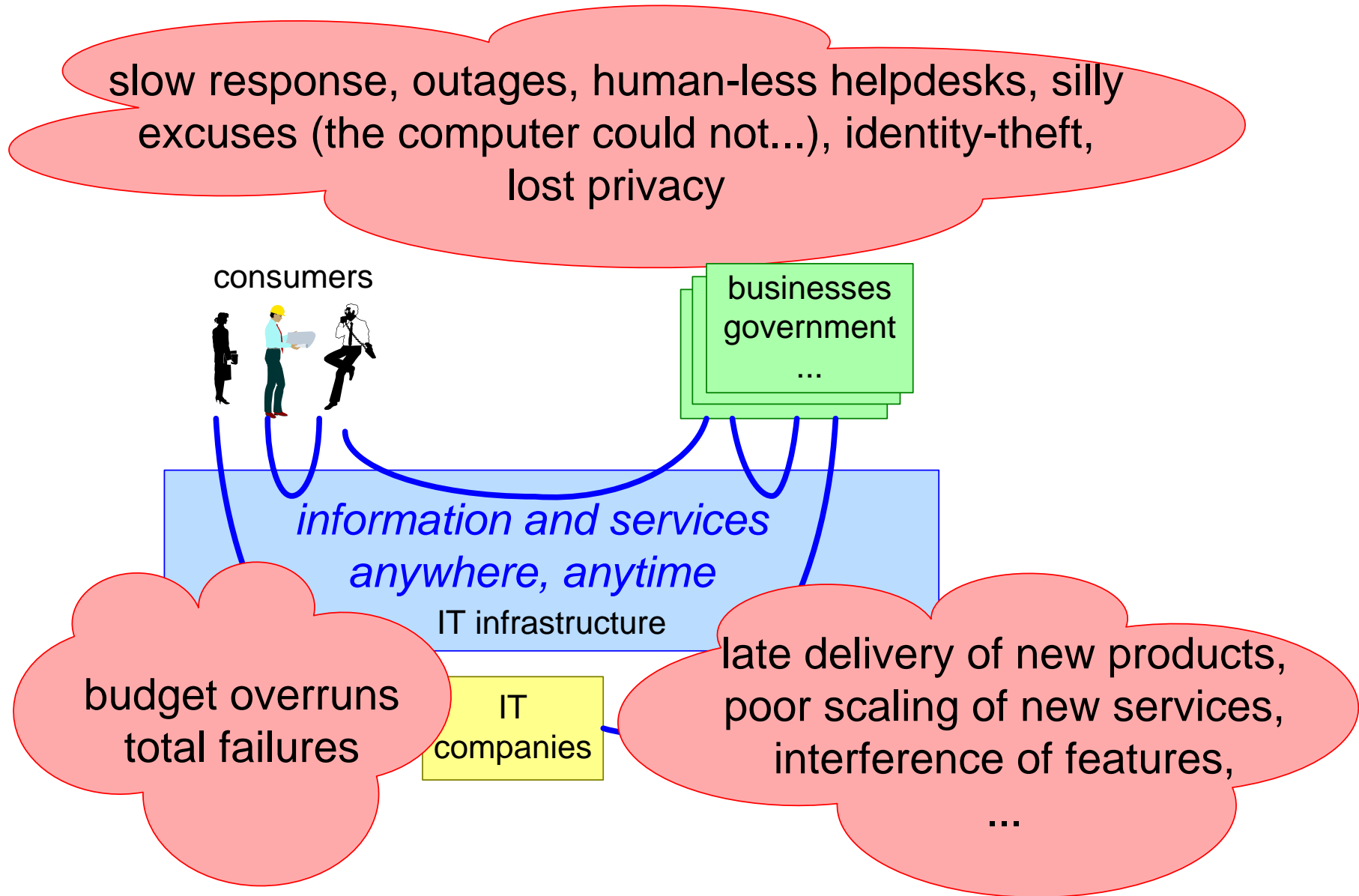
# Figure Of Contents™



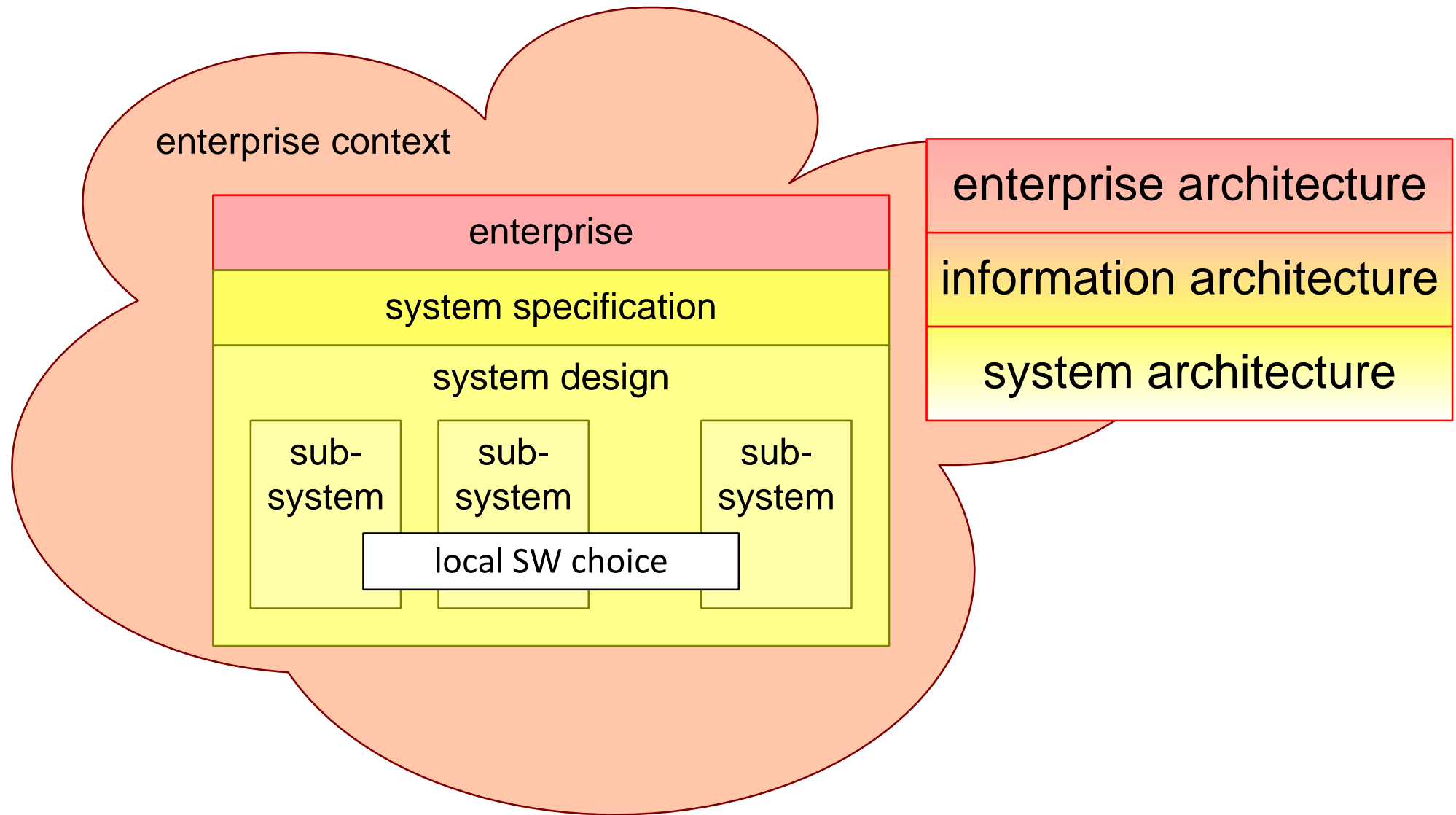
# Ubiquitous Information and Services

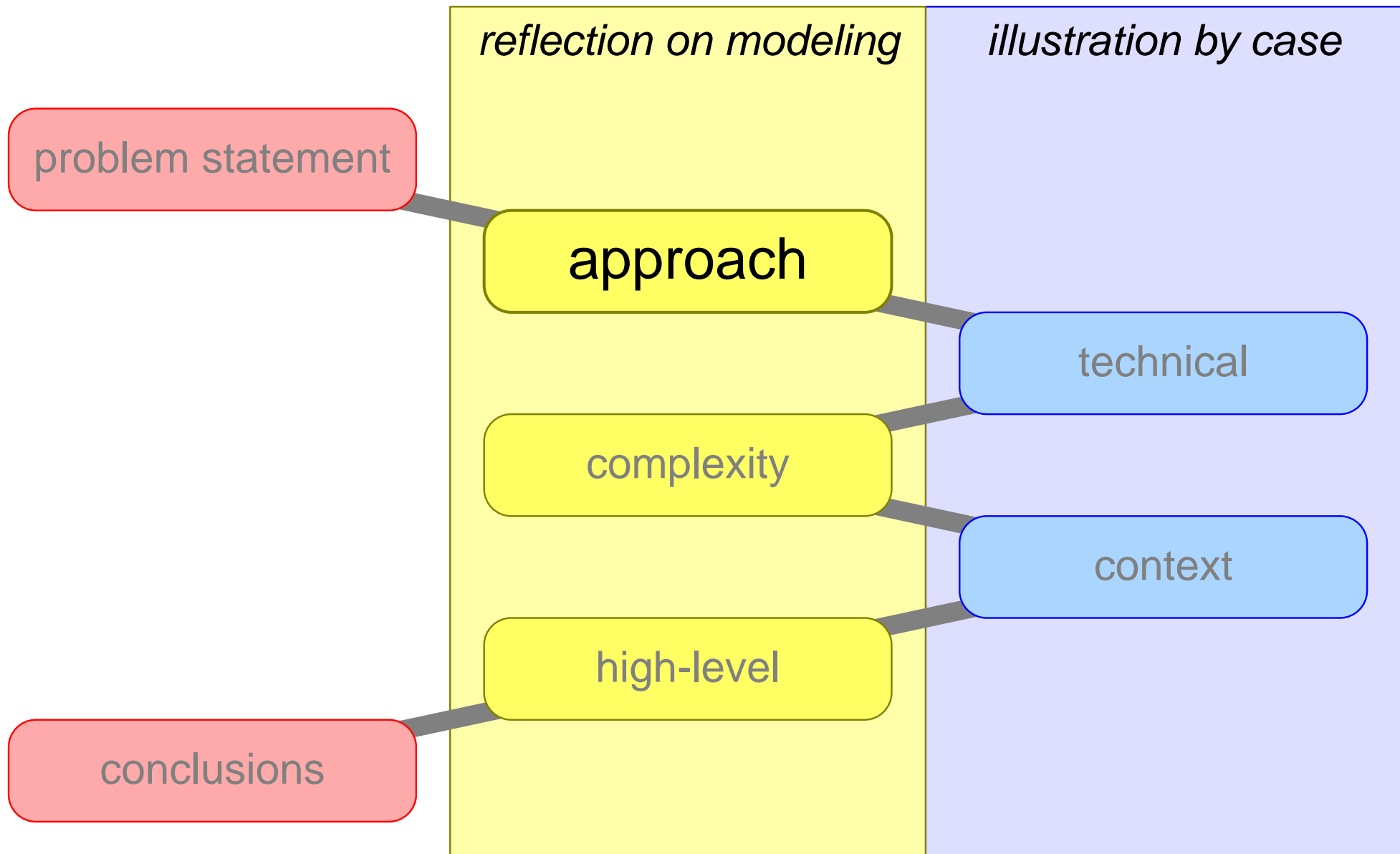


# But, Horrendous Failure Rate

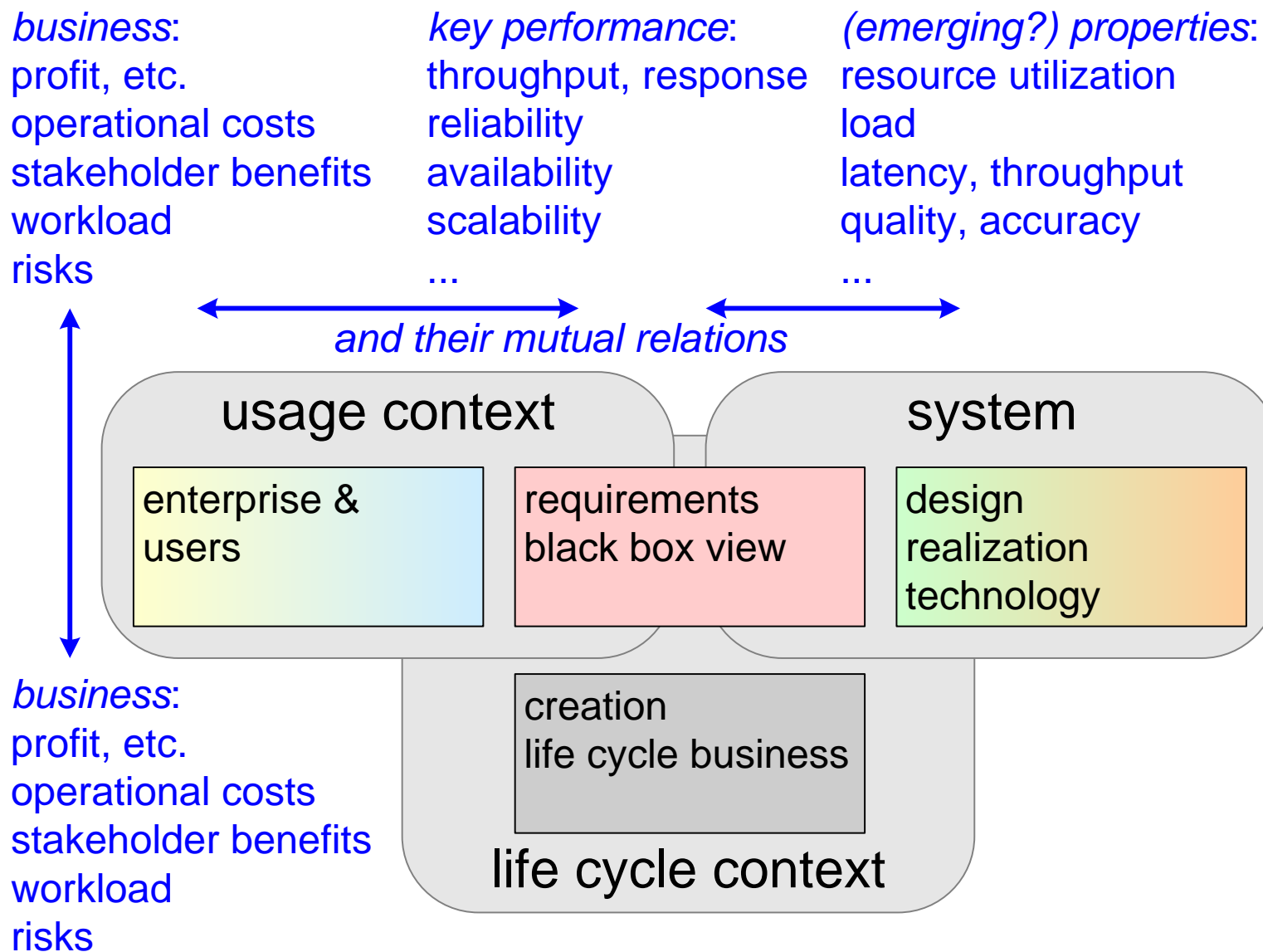


# Typical Architecture Levels in IT

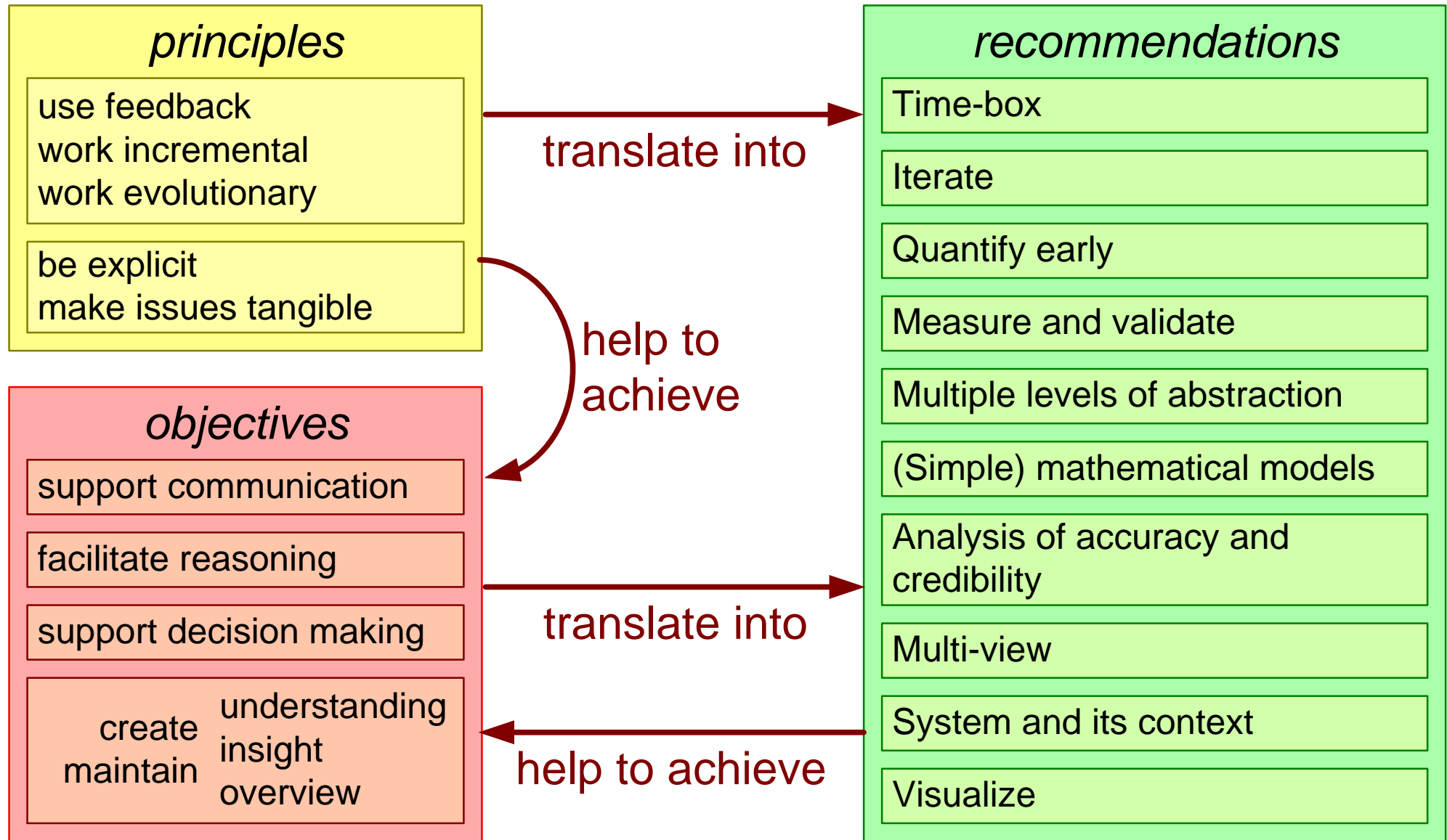


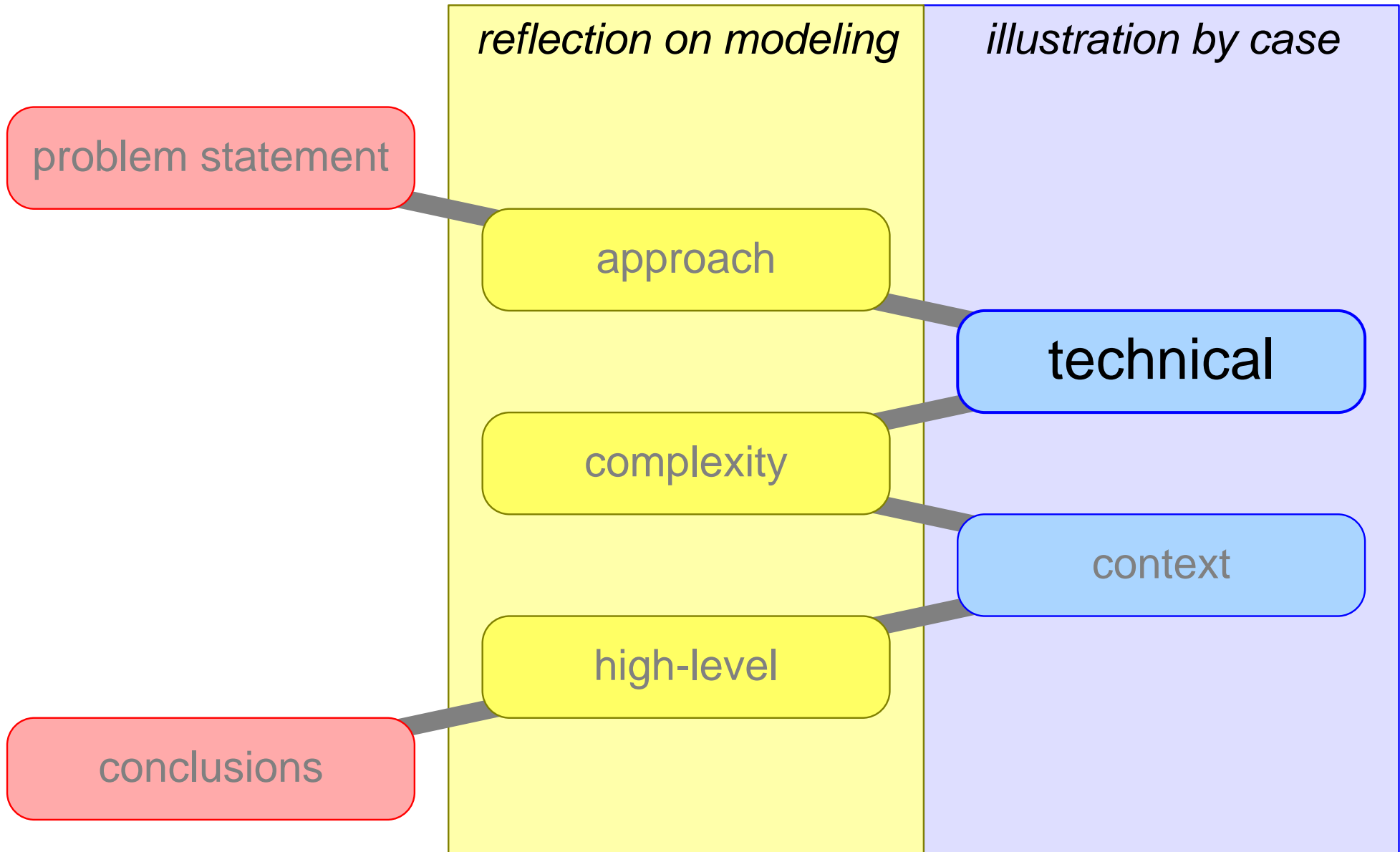


# Simplified Framework for Modeling

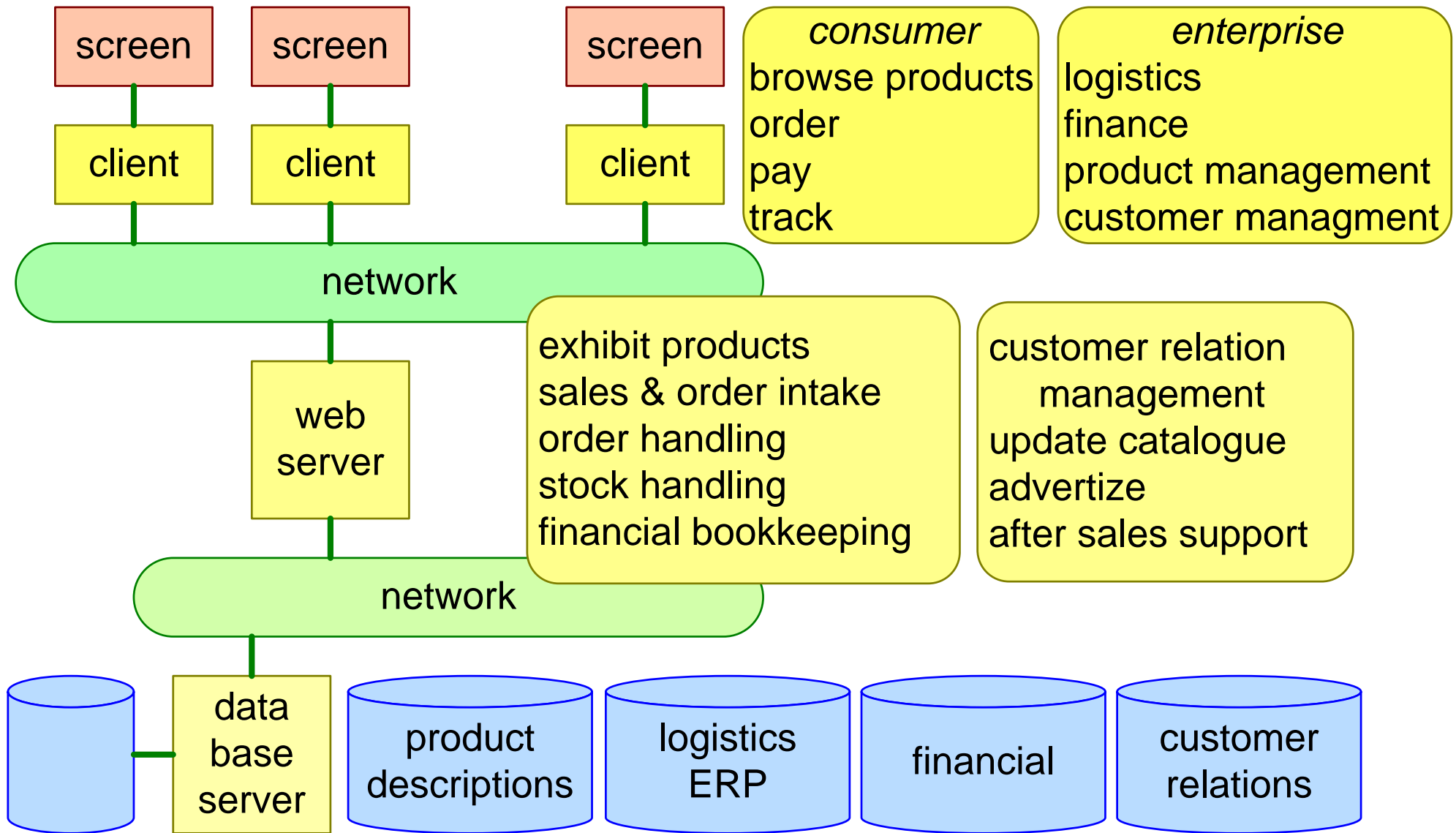


# Recommendations for Modeling





# Example Web Shop



# Web Shop: NFR's, Properties and Critical Technologies

1

2

system

3

*NFR's:*

performance browsing  
initial cost  
running costs  
reliability/availability  
scalability order rate  
maintainability  
effort product changes  
effort staff changes  
security

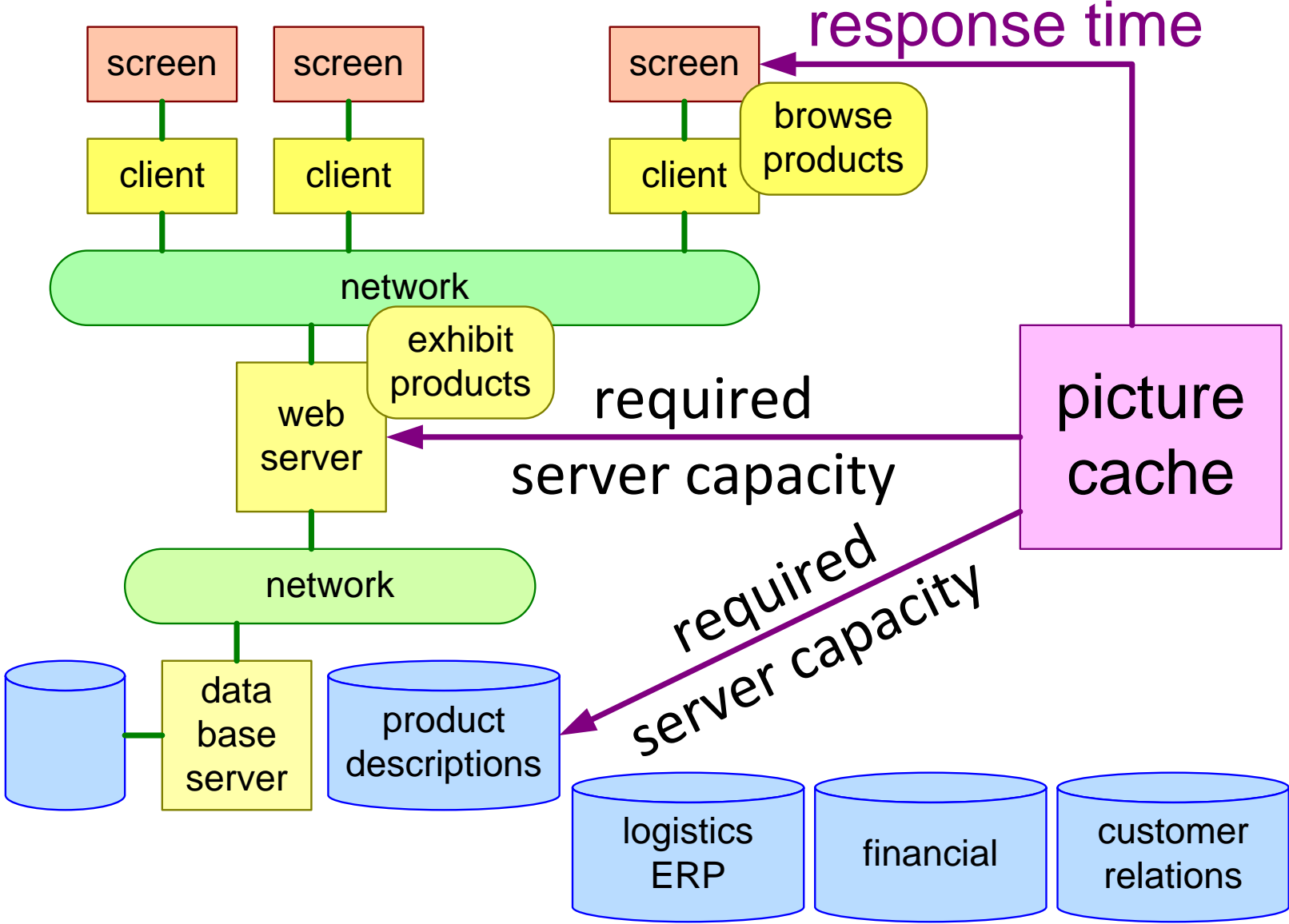
*(emerging?) properties:*

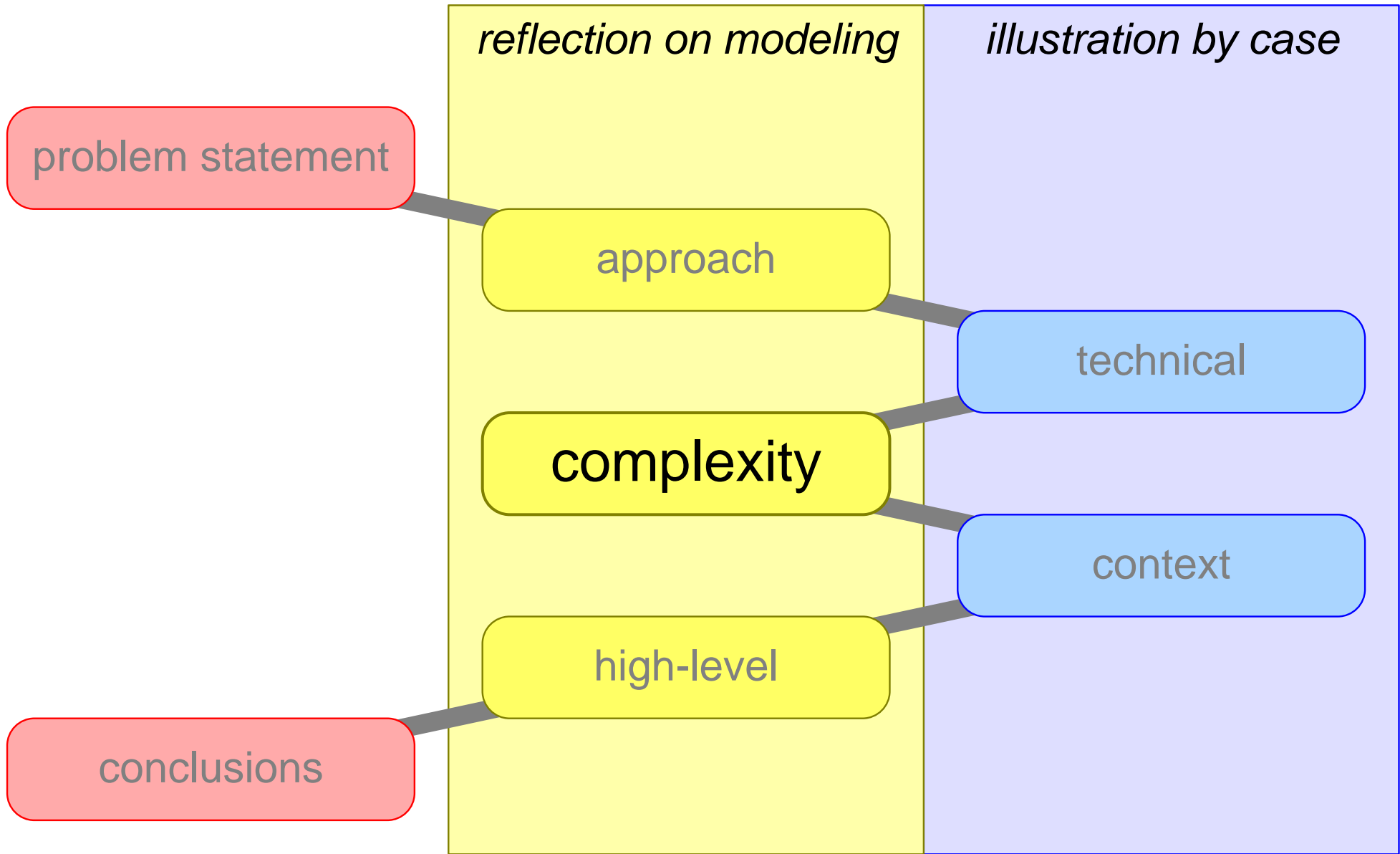
resource utilization  
server load, capacity  
memory load, capacity  
response latency  
redundancy  
order throughput  
product data quality  
product definition flow  
staff definition flow  
security design  
compartmentalization  
authentication  
encryption

*critical technologies*

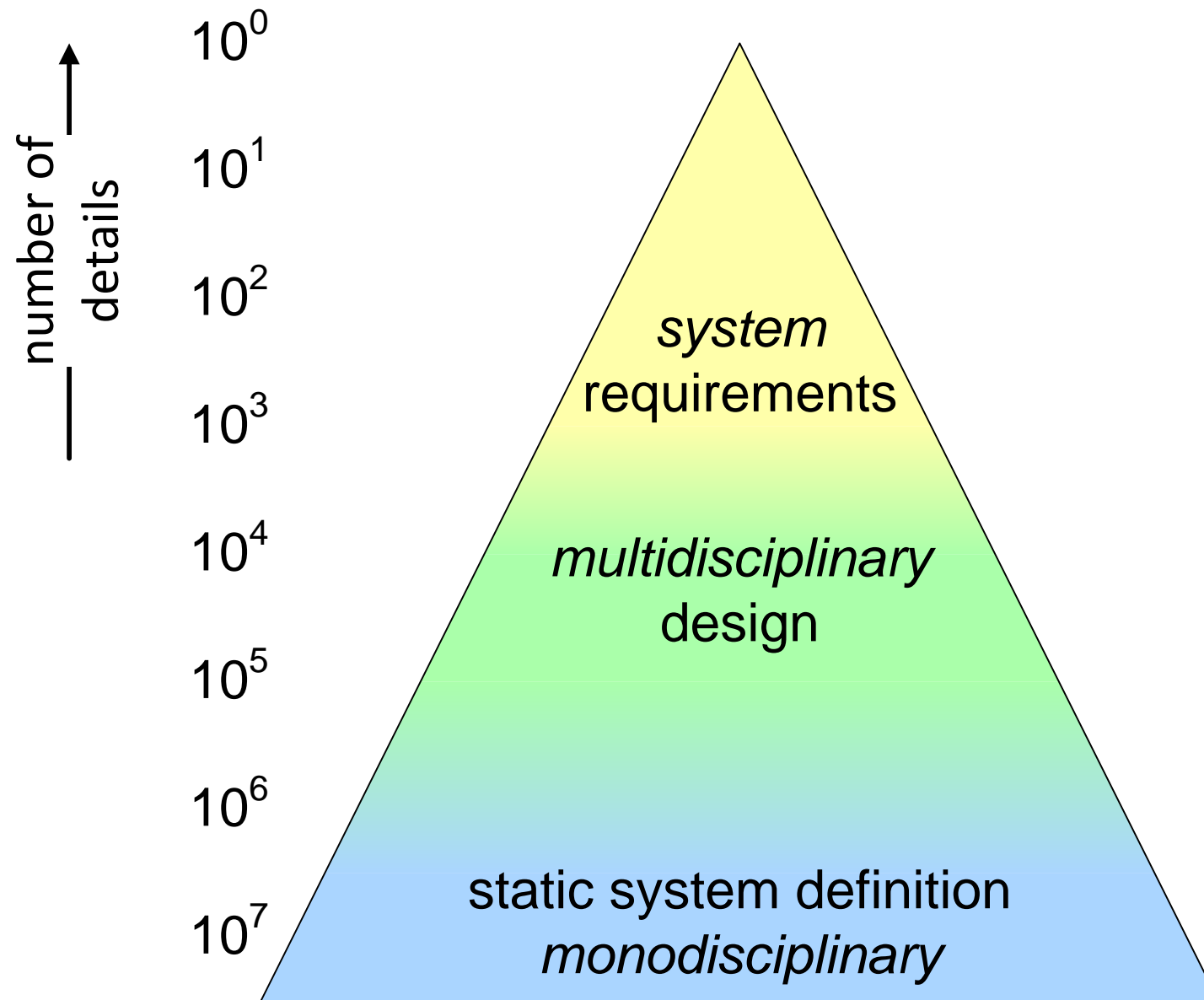
caching  
load balancing  
pipelining  
virtual memory  
memory management  
data base transactions  
XML for customization  
and configuration  
firewalls  
virtual networks  
...

# Purpose of Picture Cache Model in Web Shop Context

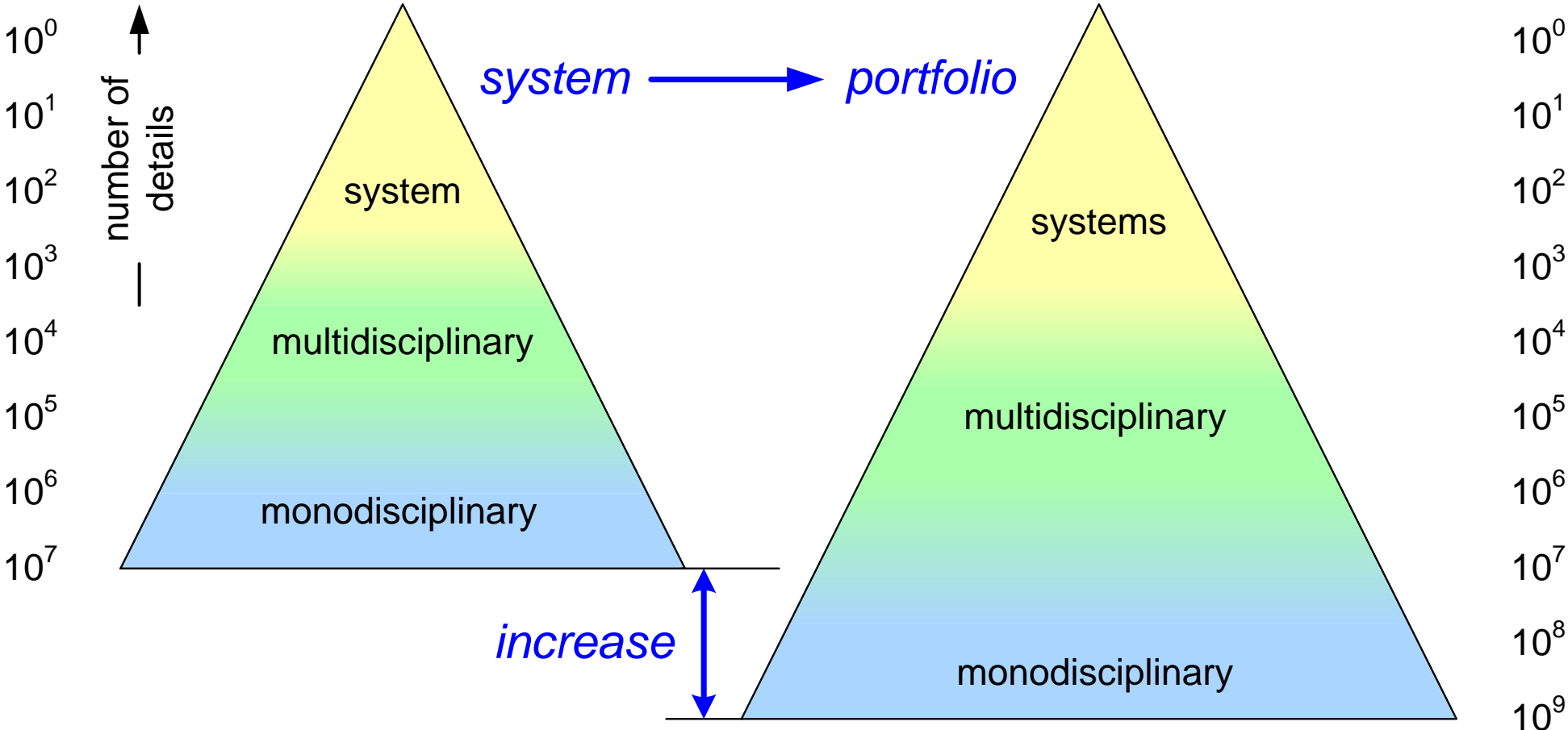




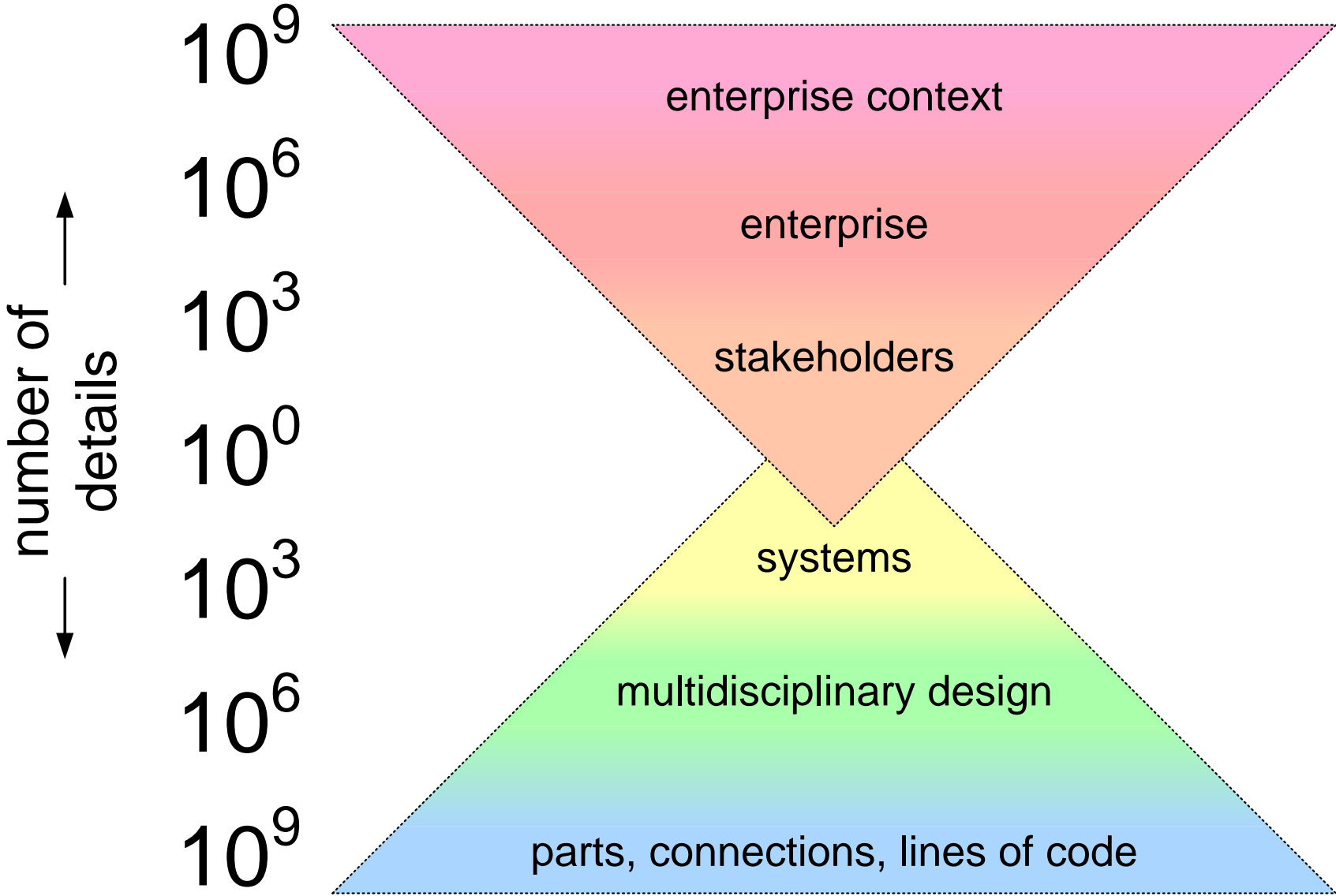
# Level of Abstraction Single System



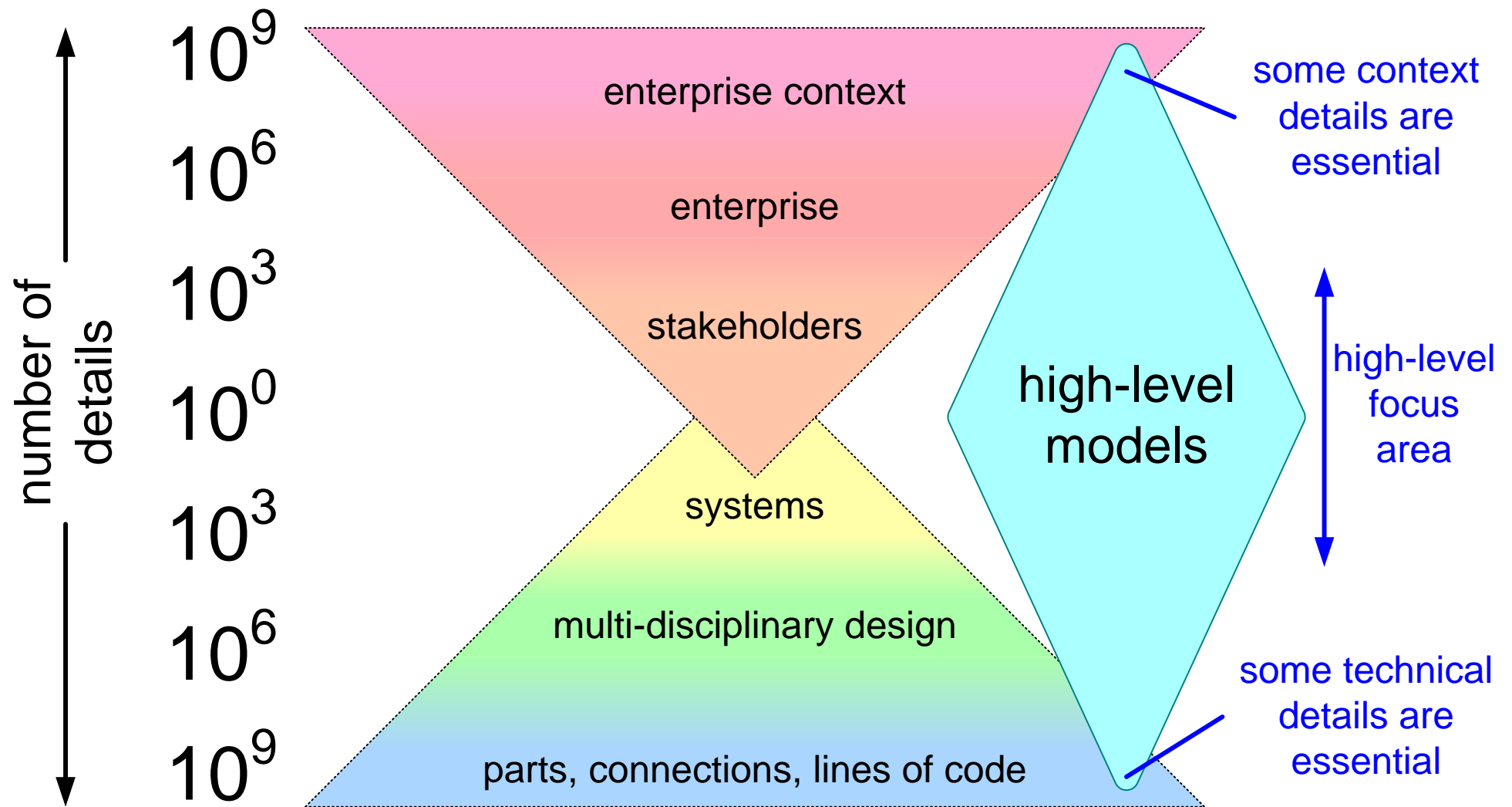
# From system to Product Family or Portfolio

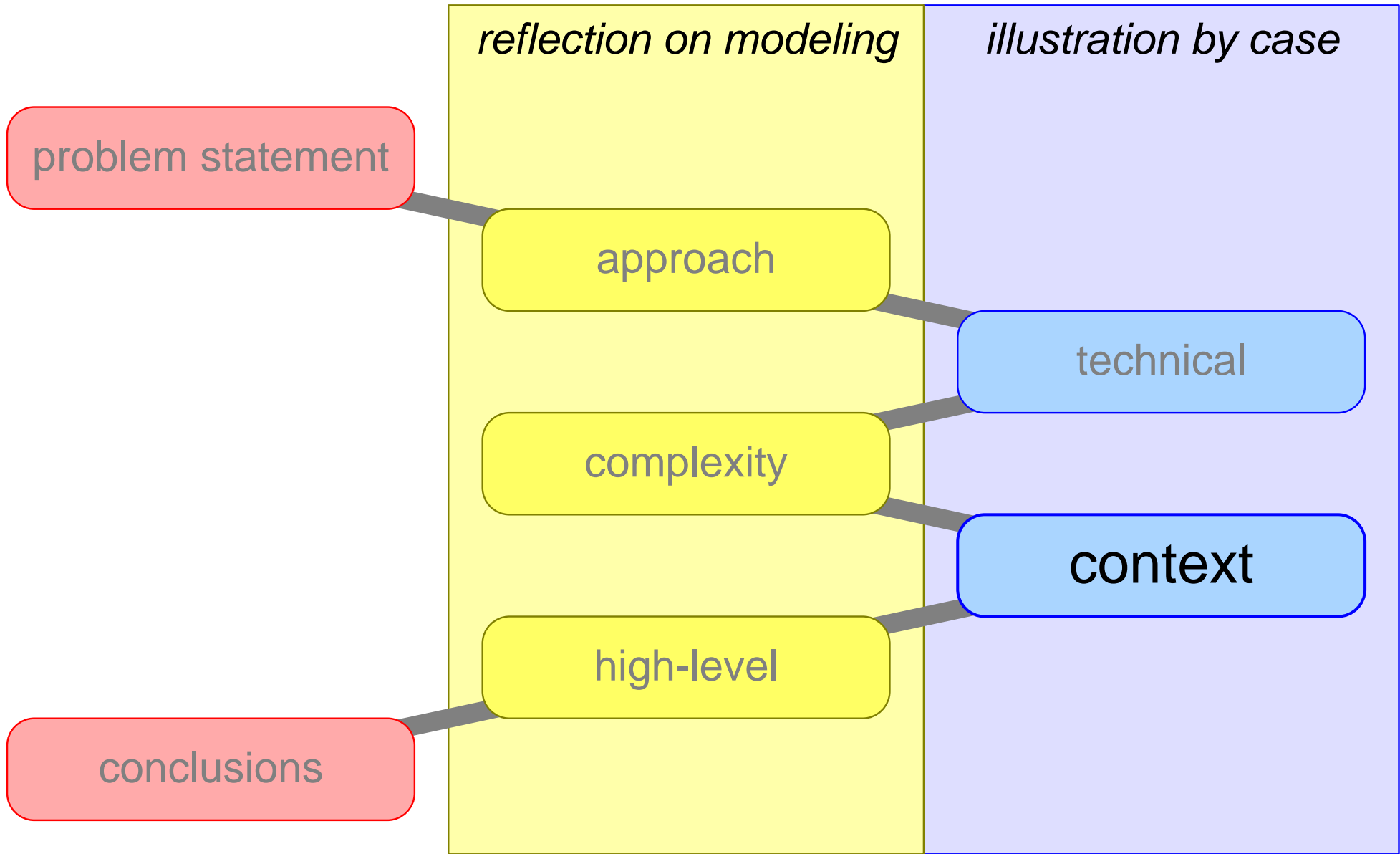


# Product Family in Context

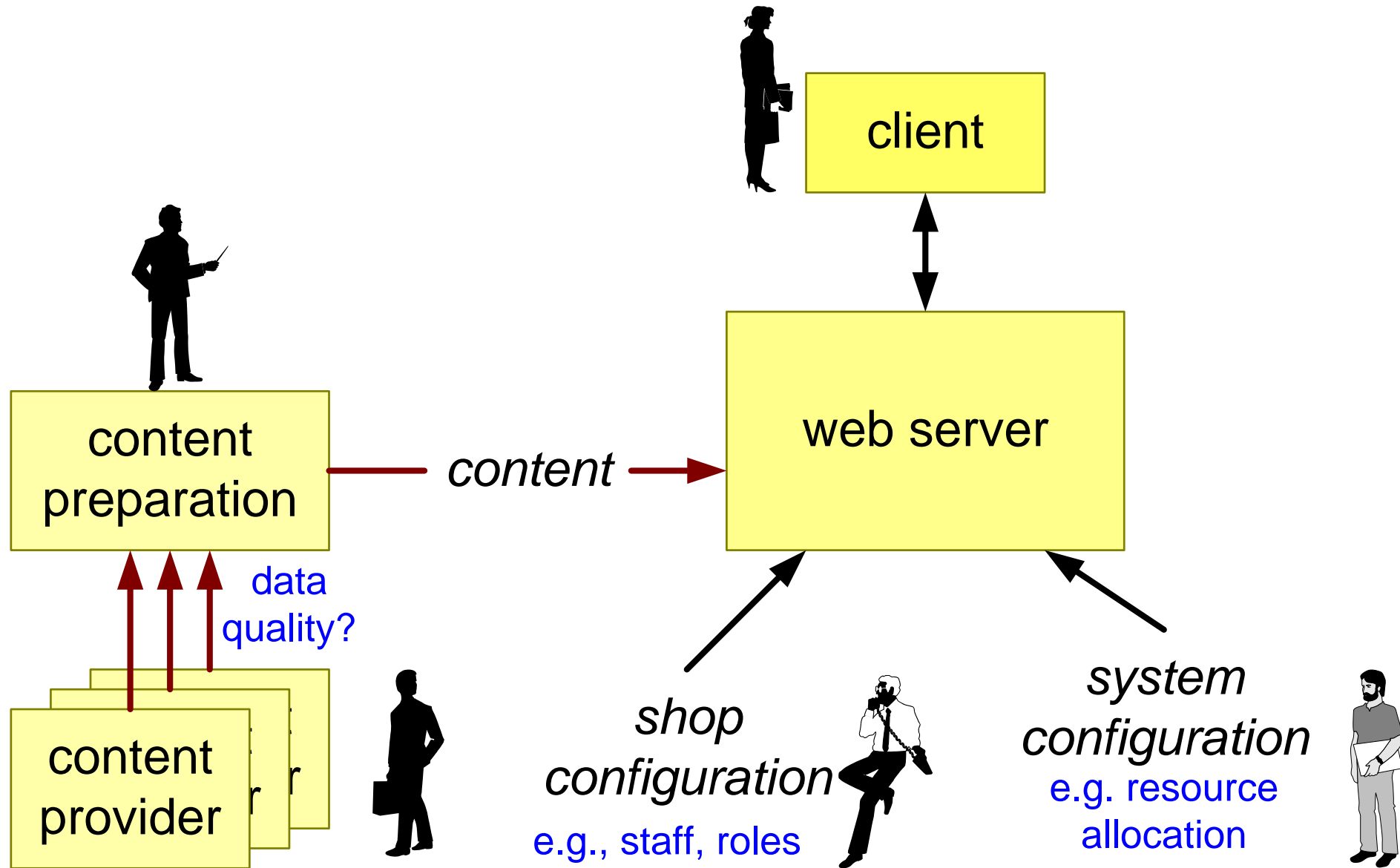


# RA: Capturing the Essence

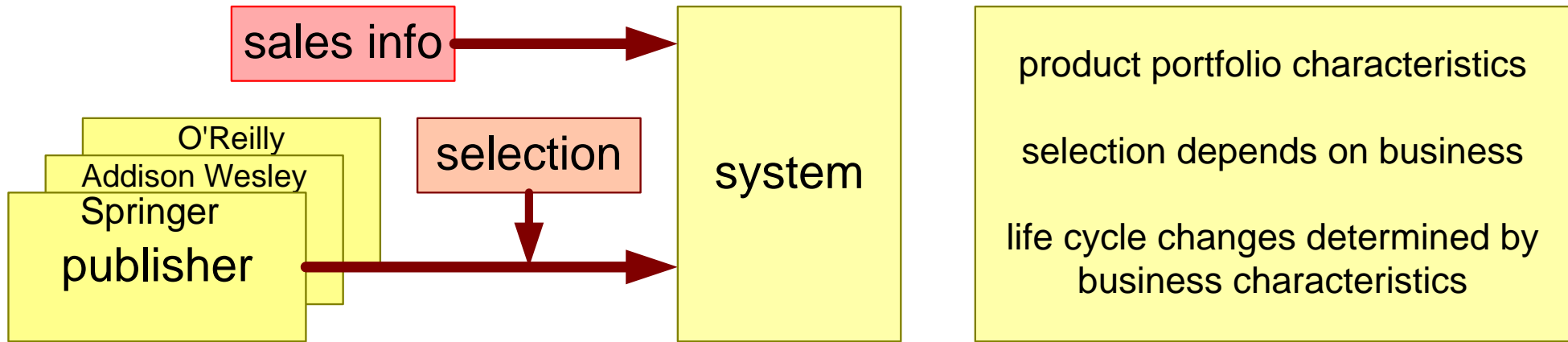




# Data Sources of Web Server



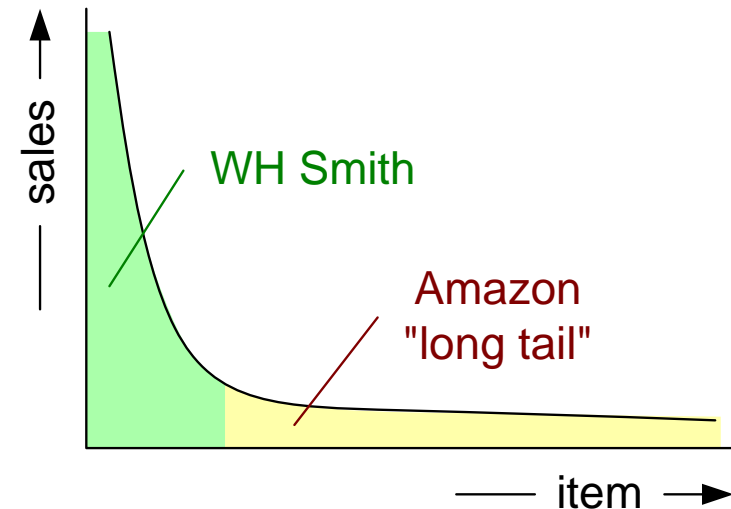
# Example Product Portfolio Change Books



## new books per year

|           |             |             |
|-----------|-------------|-------------|
| UK (1)    | 206k (2005) | 107k (1996) |
| USA(2)    | 172k (2005) | 68k (1996)  |
| China(3)  |             | 101k (1994) |
| India(21) |             | 12k (1996)  |

source: [http://en.wikipedia.org/wiki/Long\\_tail](http://en.wikipedia.org/wiki/Long_tail)



source: [http://en.wikipedia.org/wiki/Books\\_published\\_per\\_country\\_per\\_year](http://en.wikipedia.org/wiki/Books_published_per_country_per_year)

# Example Customer Change

## *internet: broadband penetration*

|                    | Q1 '04 | Q2 '04 | growth in<br>Q2 '04 |
|--------------------|--------|--------|---------------------|
| Asia Pacific total | 48M    | 54M    | 12.8%               |
| China              | 15M    | 19M    | 26.1%               |
| India              | 87k    | 189k   | 116.8%              |

[http://www.apira.org/download/world\\_broadband\\_statistics\\_q2\\_2004.pdf](http://www.apira.org/download/world_broadband_statistics_q2_2004.pdf)

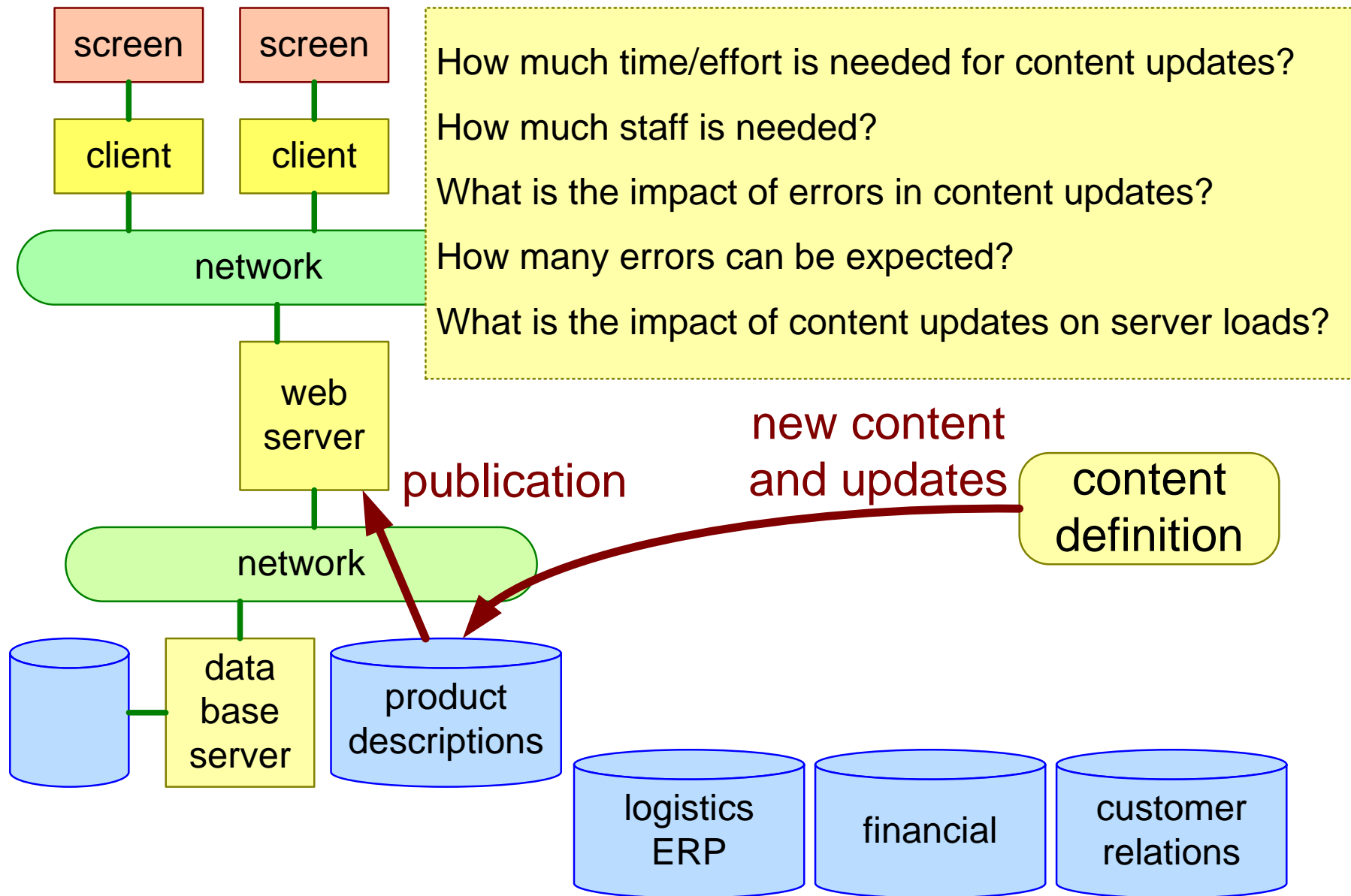
What is the expected growth of # customers?

What is the impact on system and infrastructure?

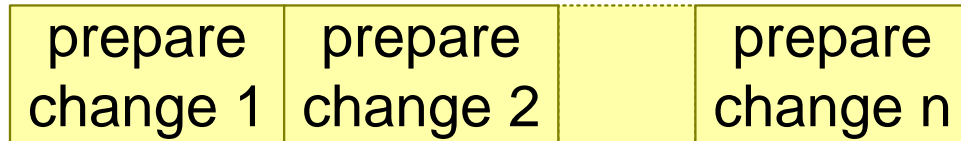
What is the impact on CRM (Customer Relation Management)?

What is the impact on customer, sales support staff?

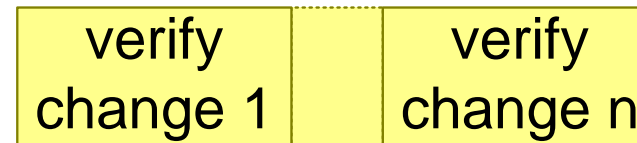
# Web Shop Content Update



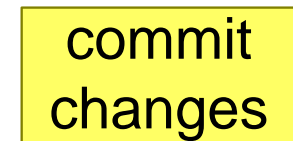
# Web Shop Content Change Effort



review input  
select info  
layout&cosmetics  
check-in



inspect source  
inspect result



$$\text{effort}_{\text{changes}} = n_{\text{changes}} * (t_{\text{prepare}} + t_{\text{verify}}) + t_{\text{commit}}$$

$$\#fte = \text{effort}_{\text{changes}} / \text{hours per day}$$

with  $t_{\text{prepare}} = 4 \text{ min}$

$t_{\text{verify}} = 2 \text{ min}$

$t_{\text{commit}} = 1 \text{ min}$

hours per day = 8 hours

|                                  |       |        |         |
|----------------------------------|-------|--------|---------|
| $n_{\text{changes}}$ per day     | 10    | 100    | 1000    |
| $\text{effort}_{\text{changes}}$ | 1 uur | 10 uur | 100 uur |
| #fte                             | 0.1   | 1      | 12      |

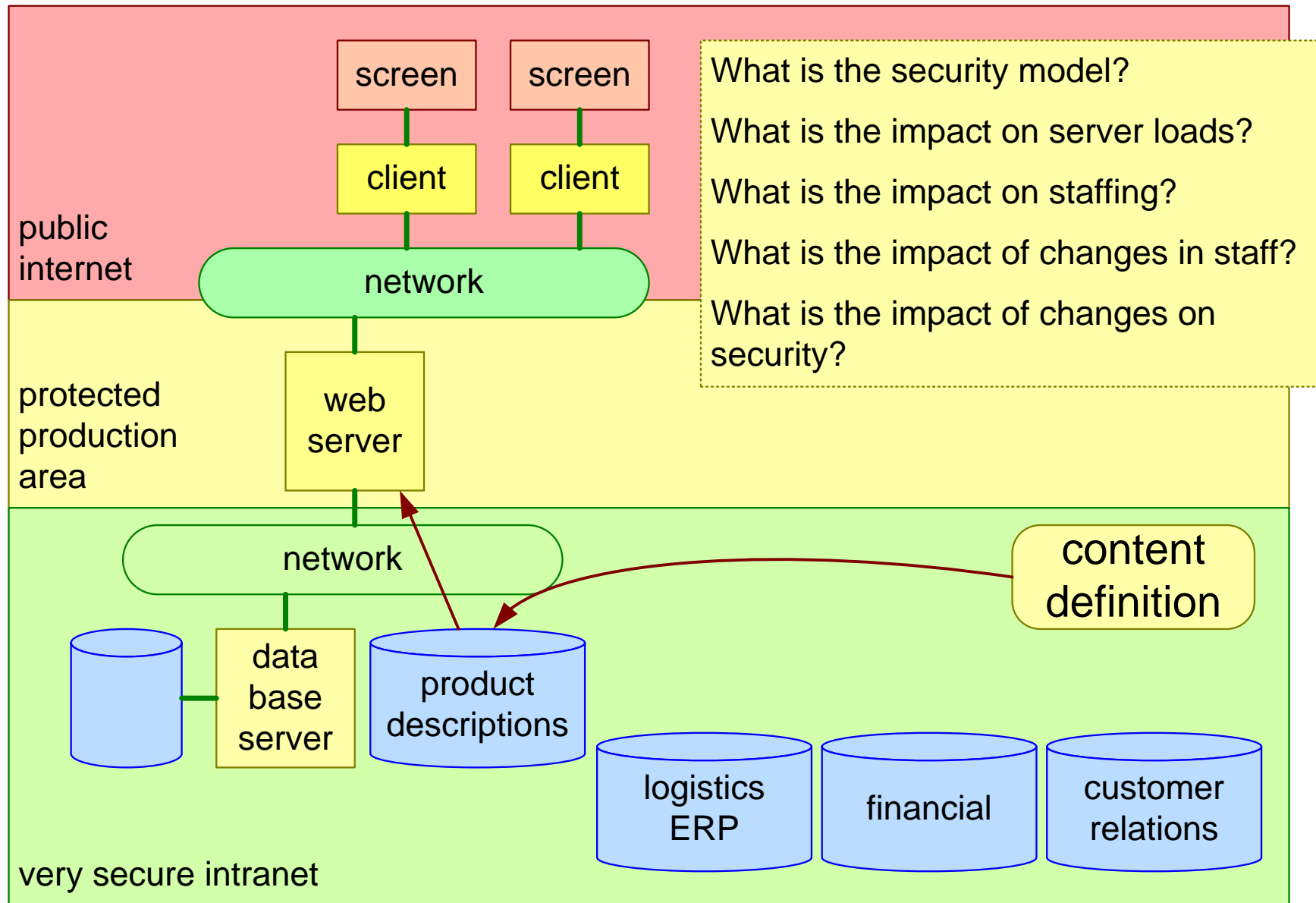
# Example of Client Level Changes

The image shows a screenshot of the Amazon.com website in a Mozilla Firefox browser window. The browser's address bar shows 'http://www.amazon.com/'. The page content includes a search bar, a navigation menu on the left, and several promotional banners. The following callout boxes are overlaid on the image:

- main access through search**: A yellow box pointing to the search bar.
- personalization**: A yellow box pointing to the 'Hello, sign in to get personalized recommendations...' text.
- catalogue entries**: A vertical yellow box on the left side, pointing to the 'Browse' navigation menu.
- Up-to-date information: Bestsellers**: A yellow box pointing to the 'Books Bestsellers' section.
- What Other Customers Are Looking At Right Now**: A yellow box pointing to the 'What Other Customers Are Looking At Right Now' section.
- other advertisements**: A vertical yellow box on the right side, pointing to the 'Extreme Savings on...' and 'Free Stand with Bow...' promotional banners.
- styling: frequently updated, fashion!**: A yellow box on the right side, pointing to the overall layout and promotional banners.
- standard boilerplate**: A yellow box at the bottom, pointing to the footer area containing links like 'Directory of All Stores', 'Investor Relations', and 'Privacy Notice'.

snapshot of  
www.amazon.com

# Web Shop Security and Changes

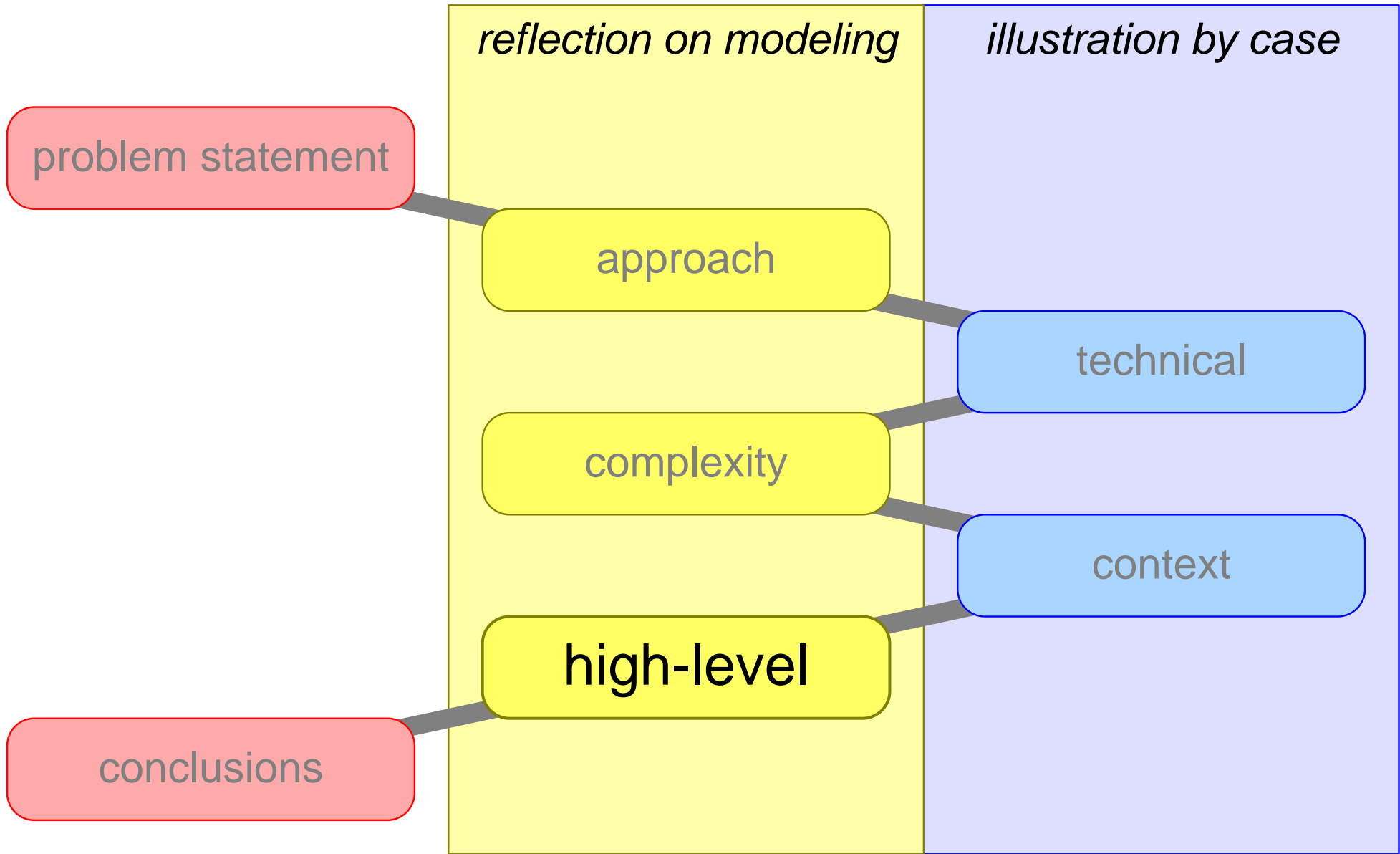


# Web Shop Reliability and Changes

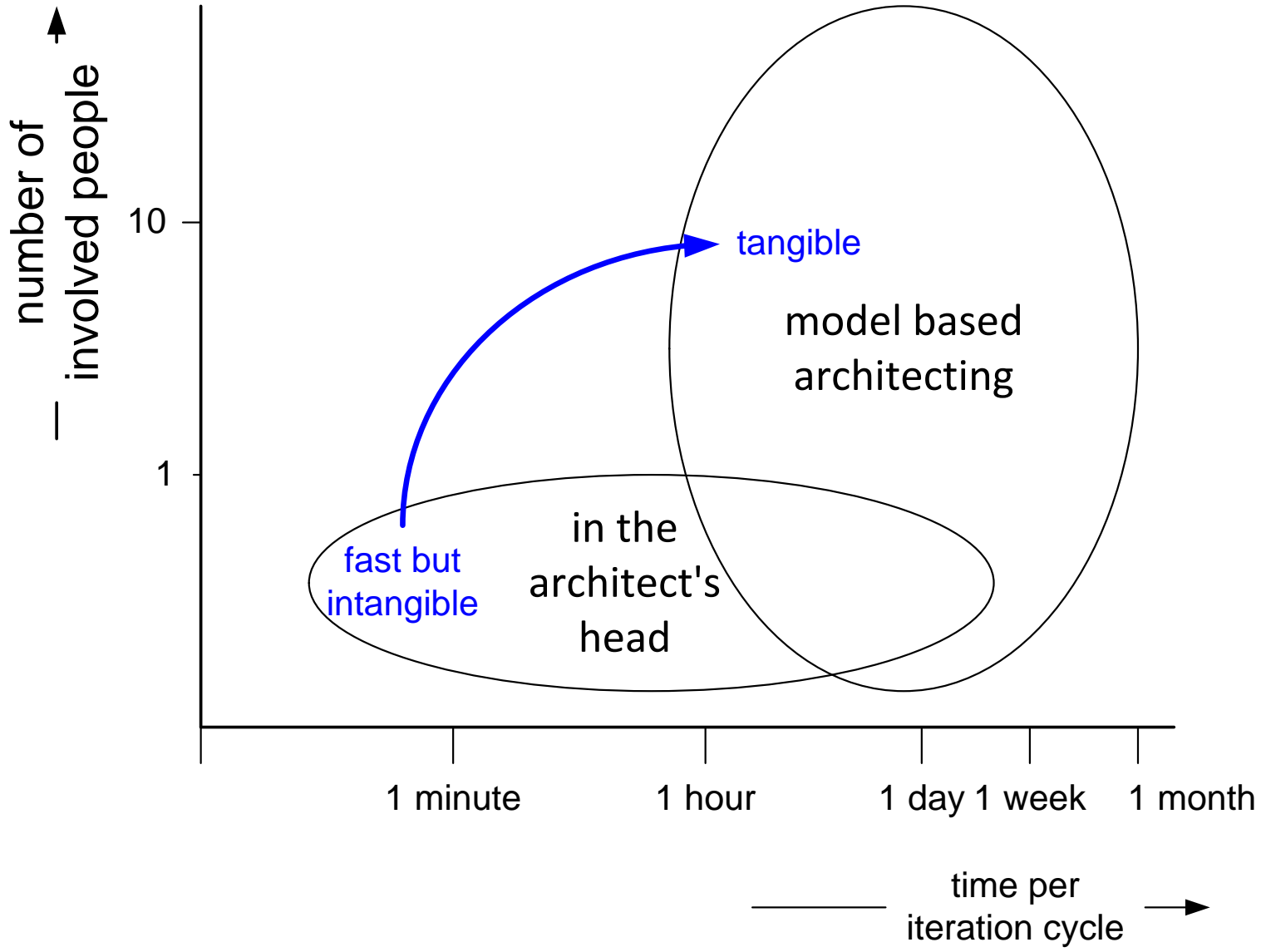
new faults = average fault density \* #changes

$$\#errors = \sum_{\text{faults}} f(\text{severity, hit probability, detection probability})$$

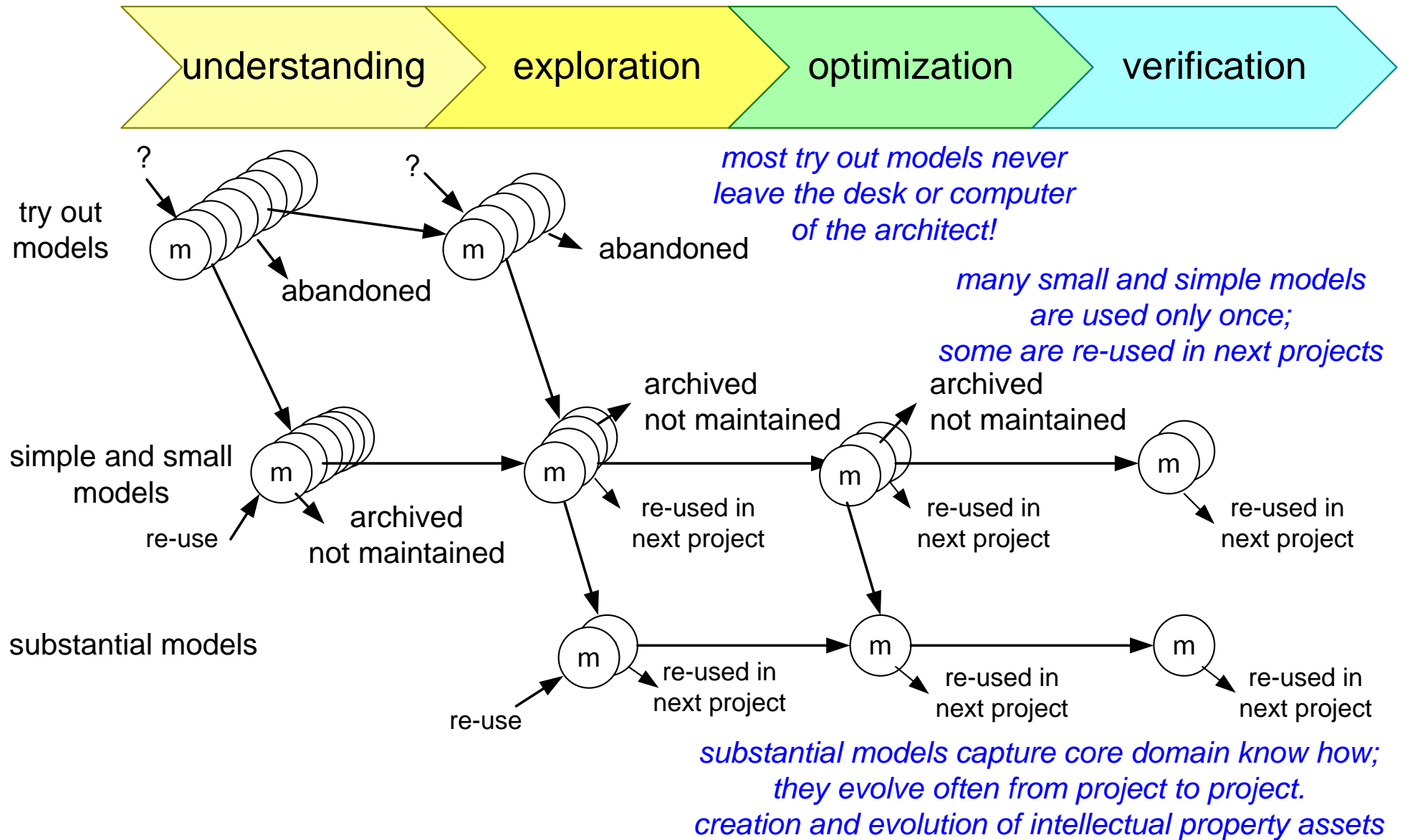
|                                    | severity | hit probability | detection probability |
|------------------------------------|----------|-----------------|-----------------------|
| <i>Jansen iso<br/>Janssen</i>      | low      | high            | low                   |
| <i>operator iso<br/>sales repr</i> | high     | high            | medium                |



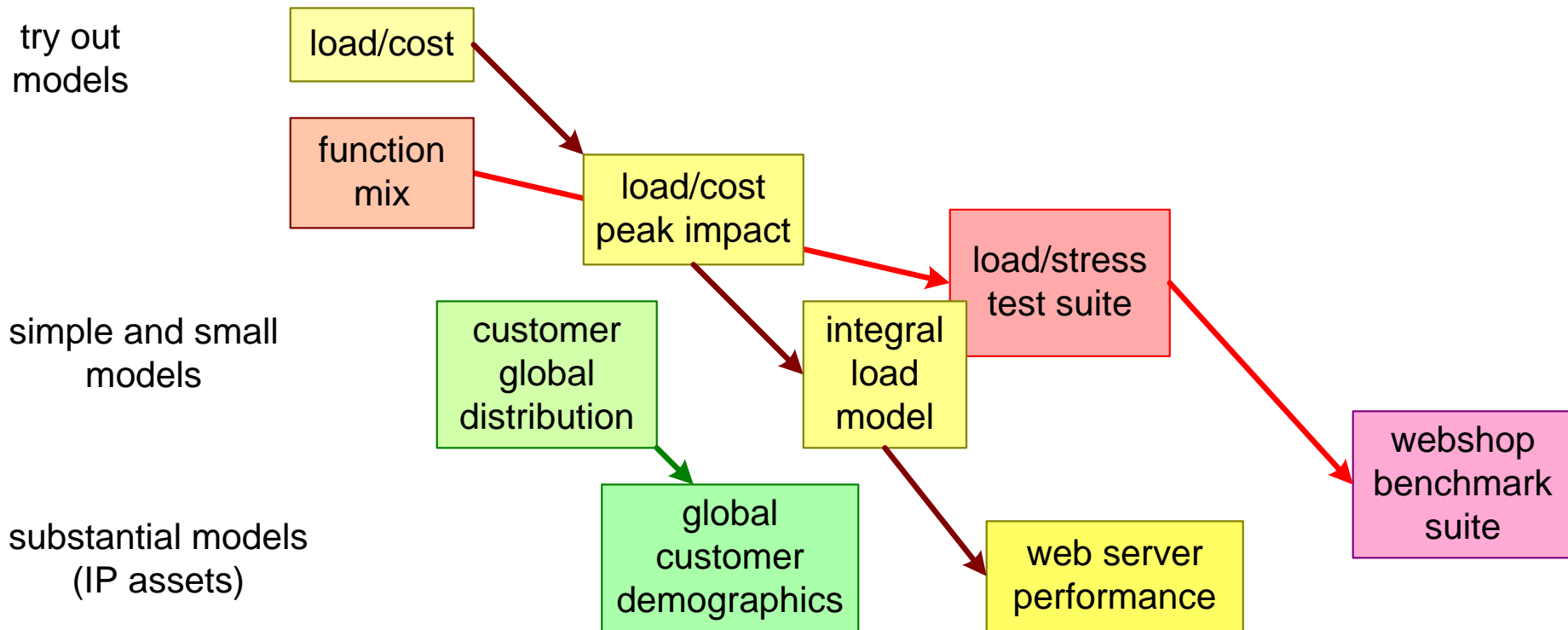
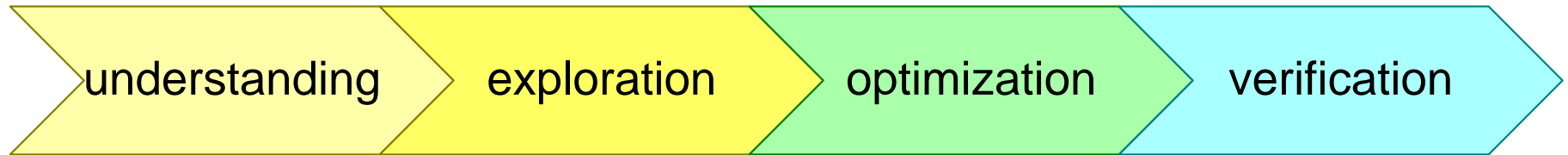
# High Level Models Support Communication

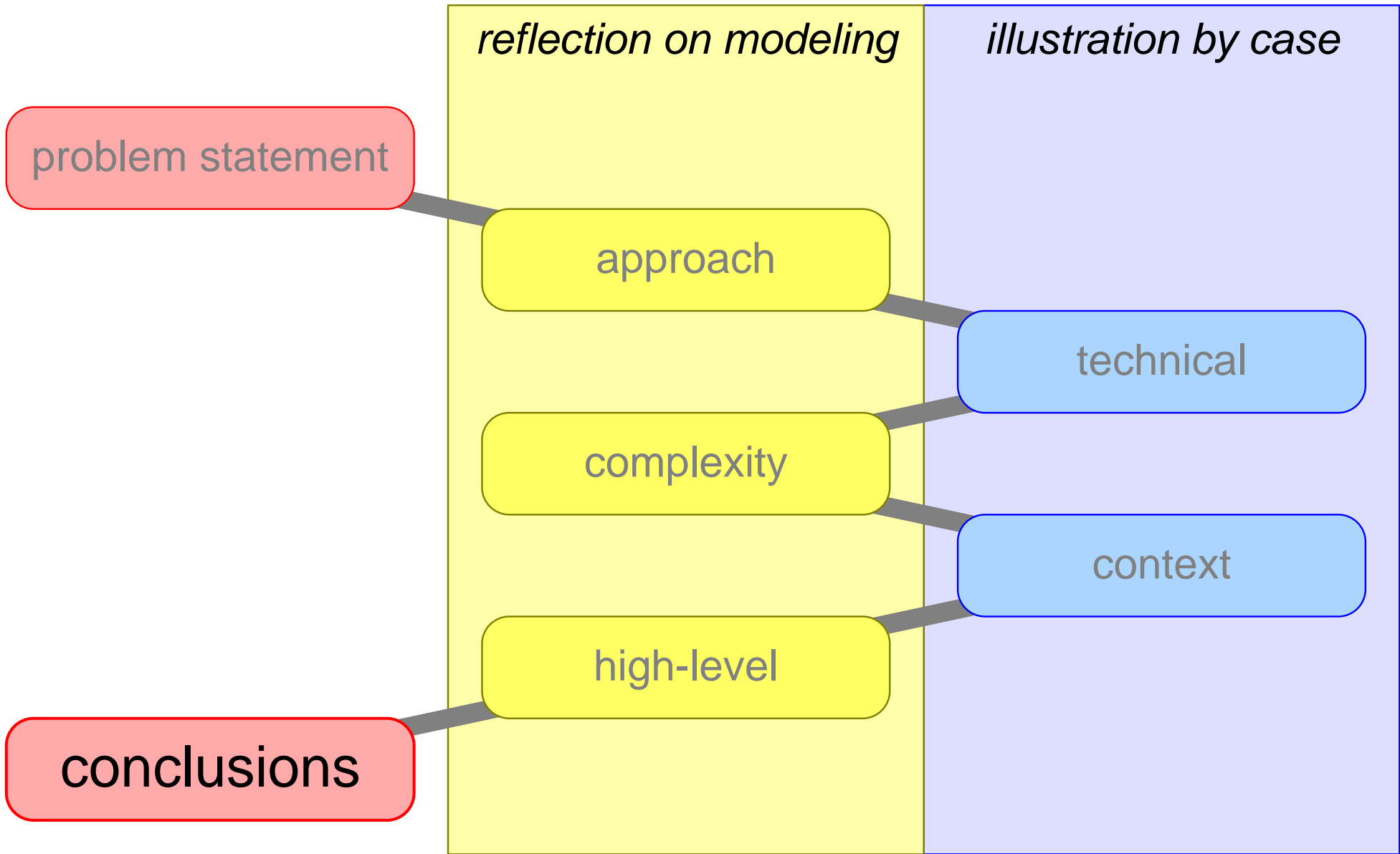


# Model Life Cycle



# Example Model Life Cycle





lack of integral understanding  
of software in human and business context  
causes horrendous failure rate of IT projects and systems

simple high-level models  
create understanding across specialties  
and stimulate fact based decision making