Architectural Reasoning Illustrated by an ATM Example

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Abstract

A short general introduction to Architecting, CAFCR framework and Architectural Reasoning is given We explore the creation of an ATM case with the CAFCR framework. We start with existing requirements and then we explore customer and future needs.

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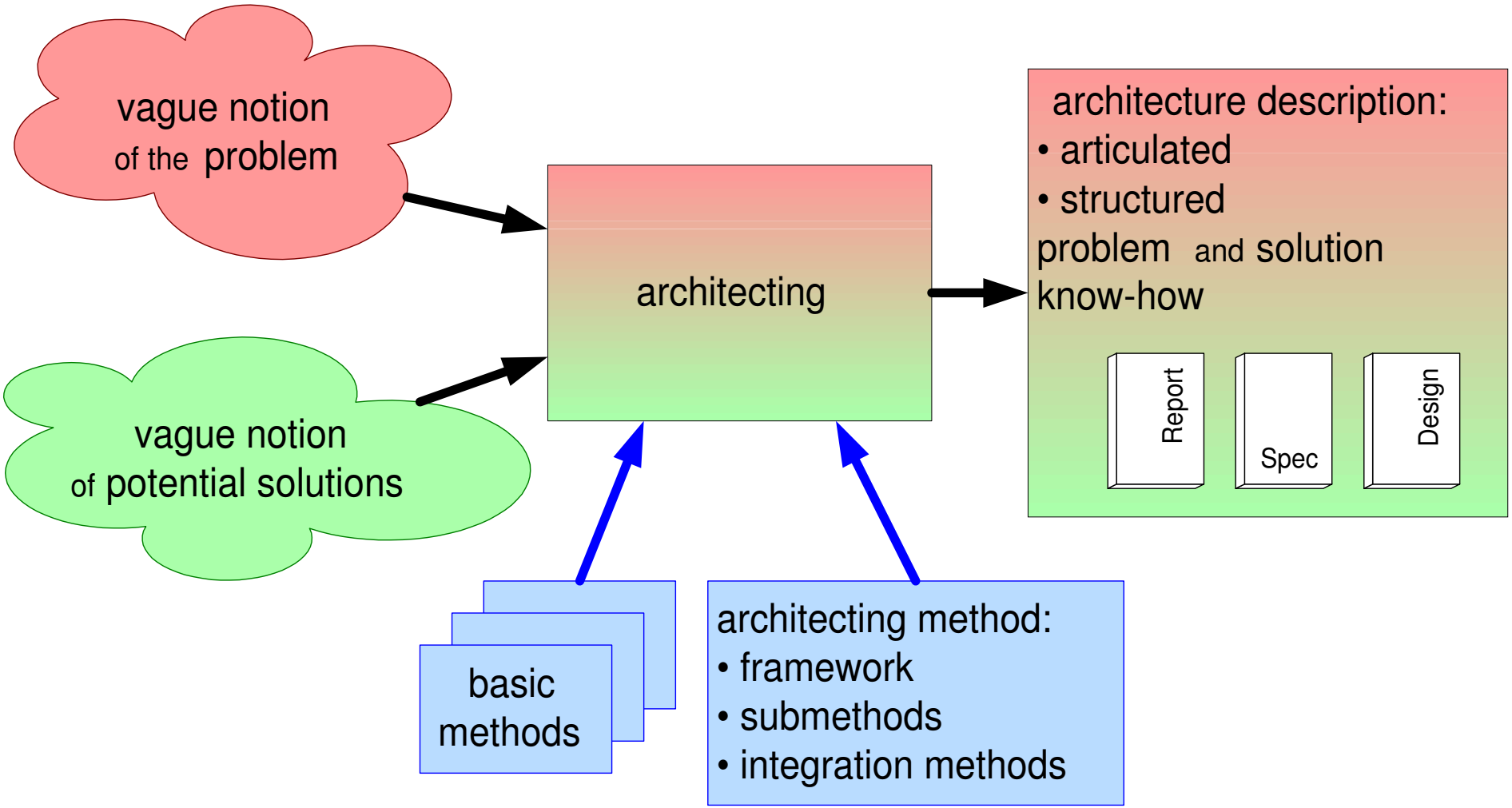
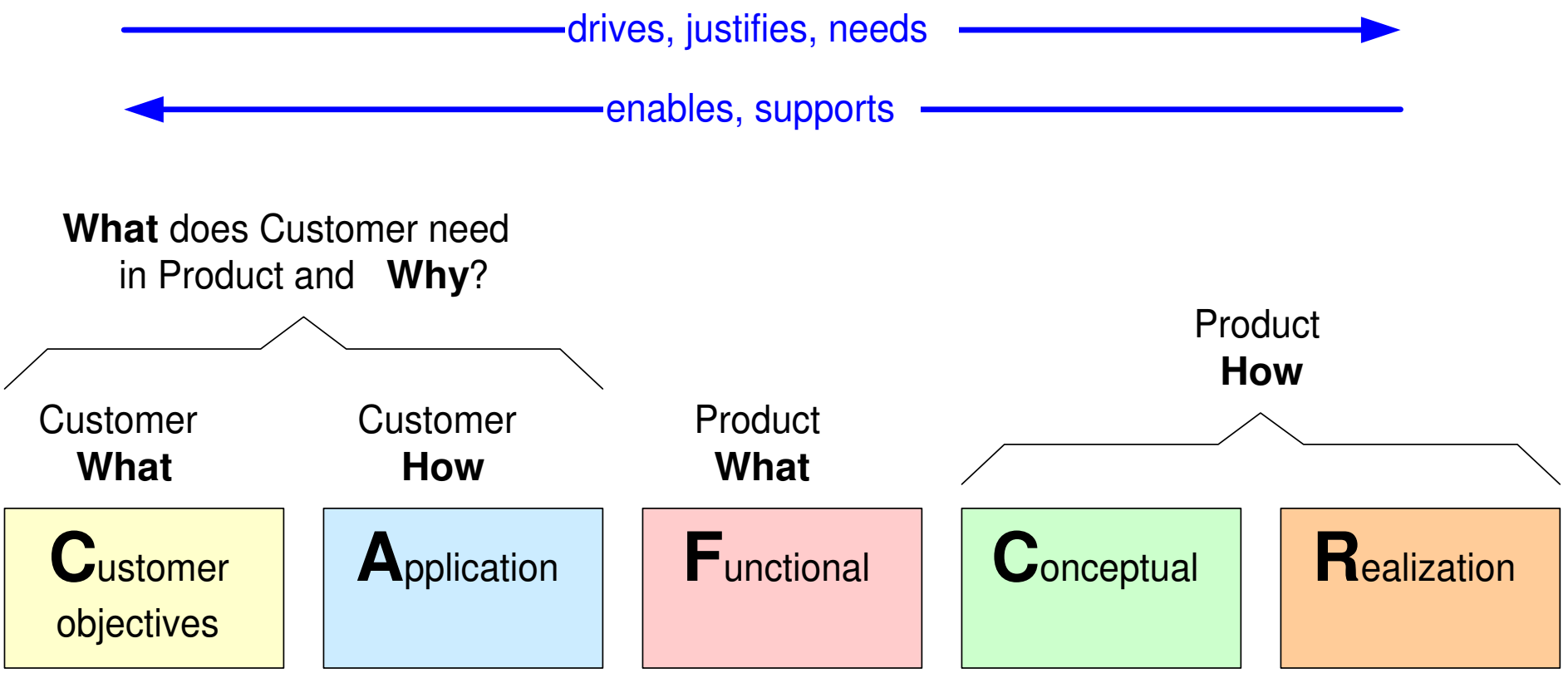
logo
TBD

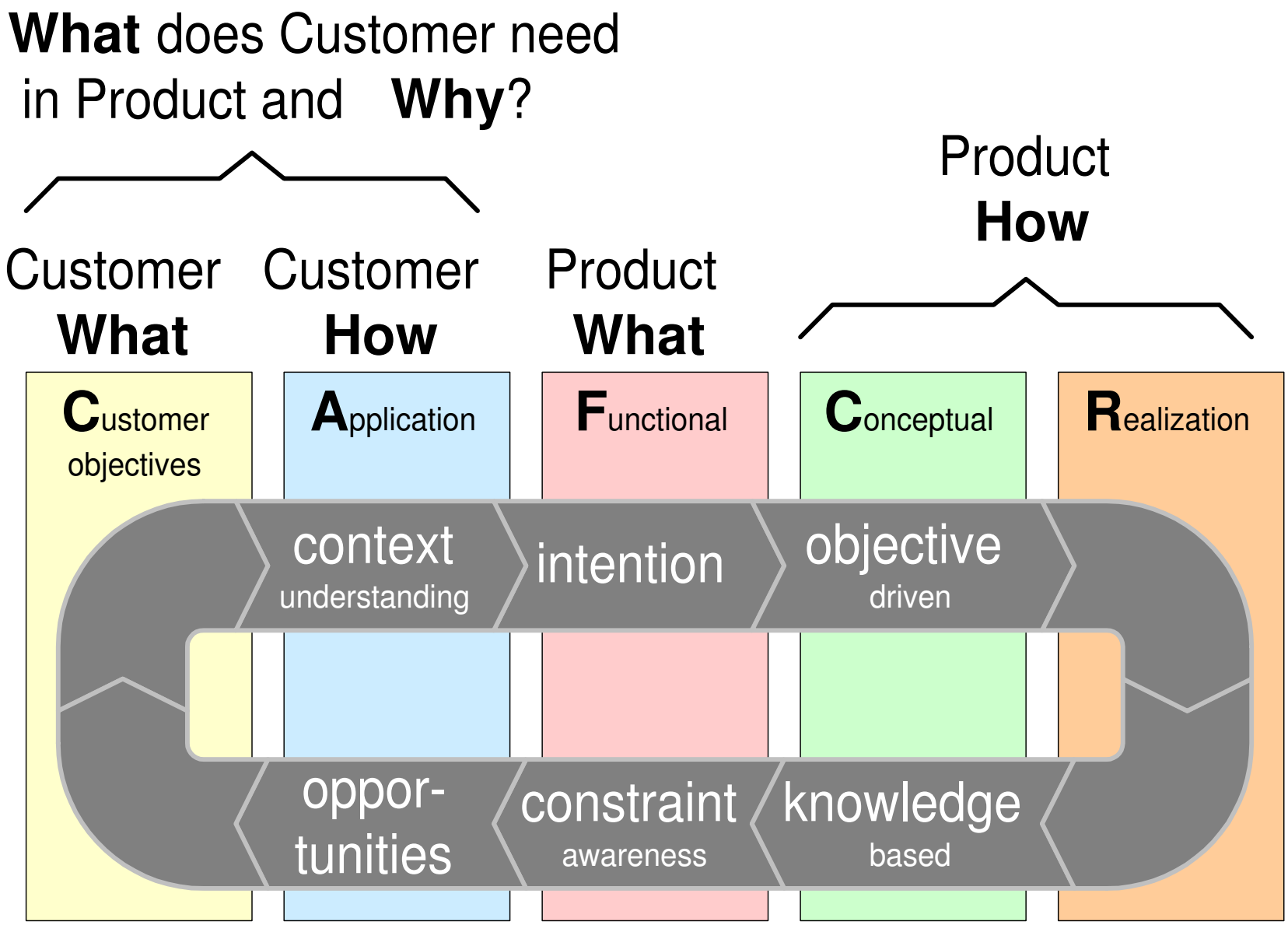
What is Architecting?



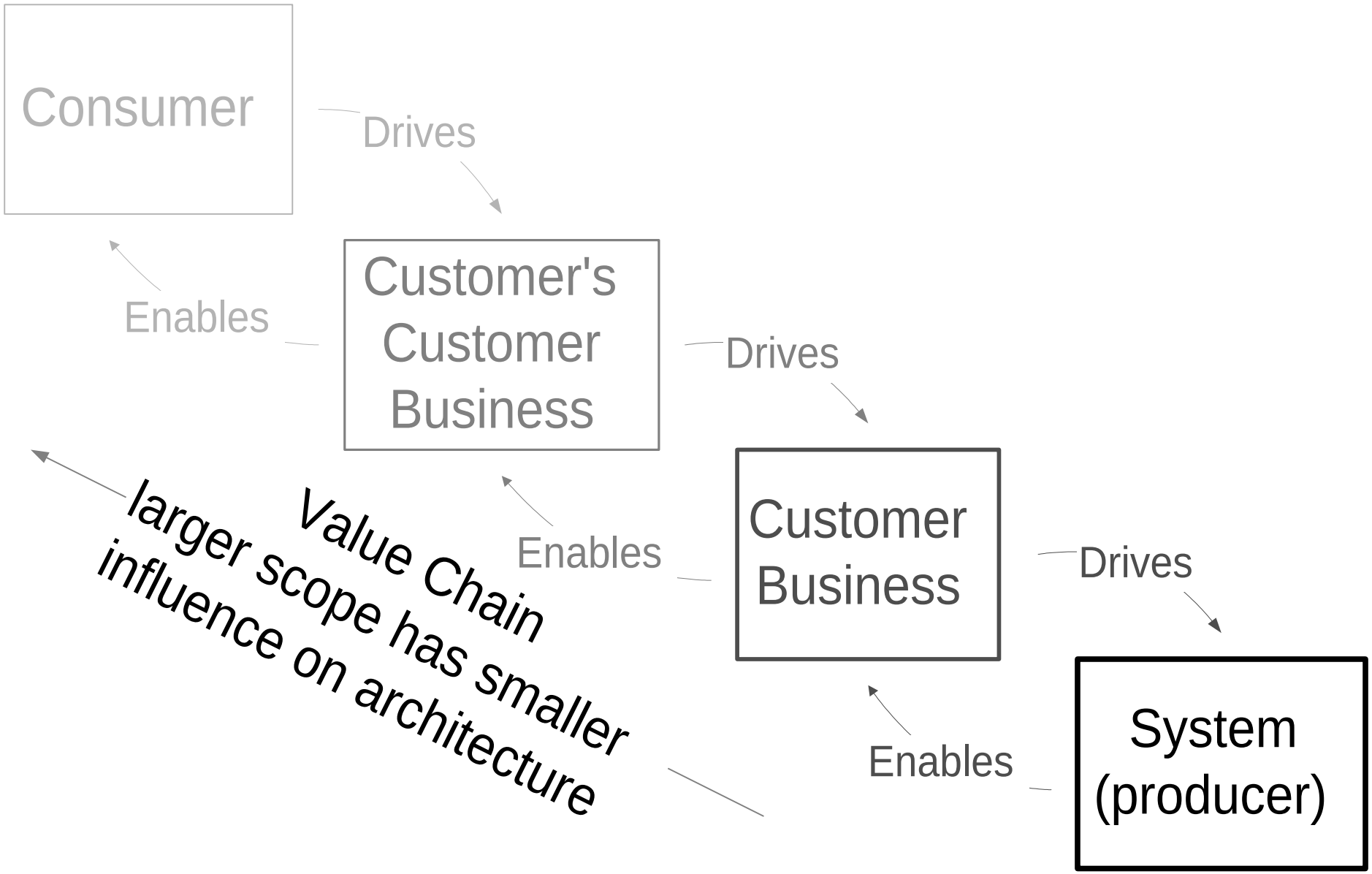
The “CAFCR” model



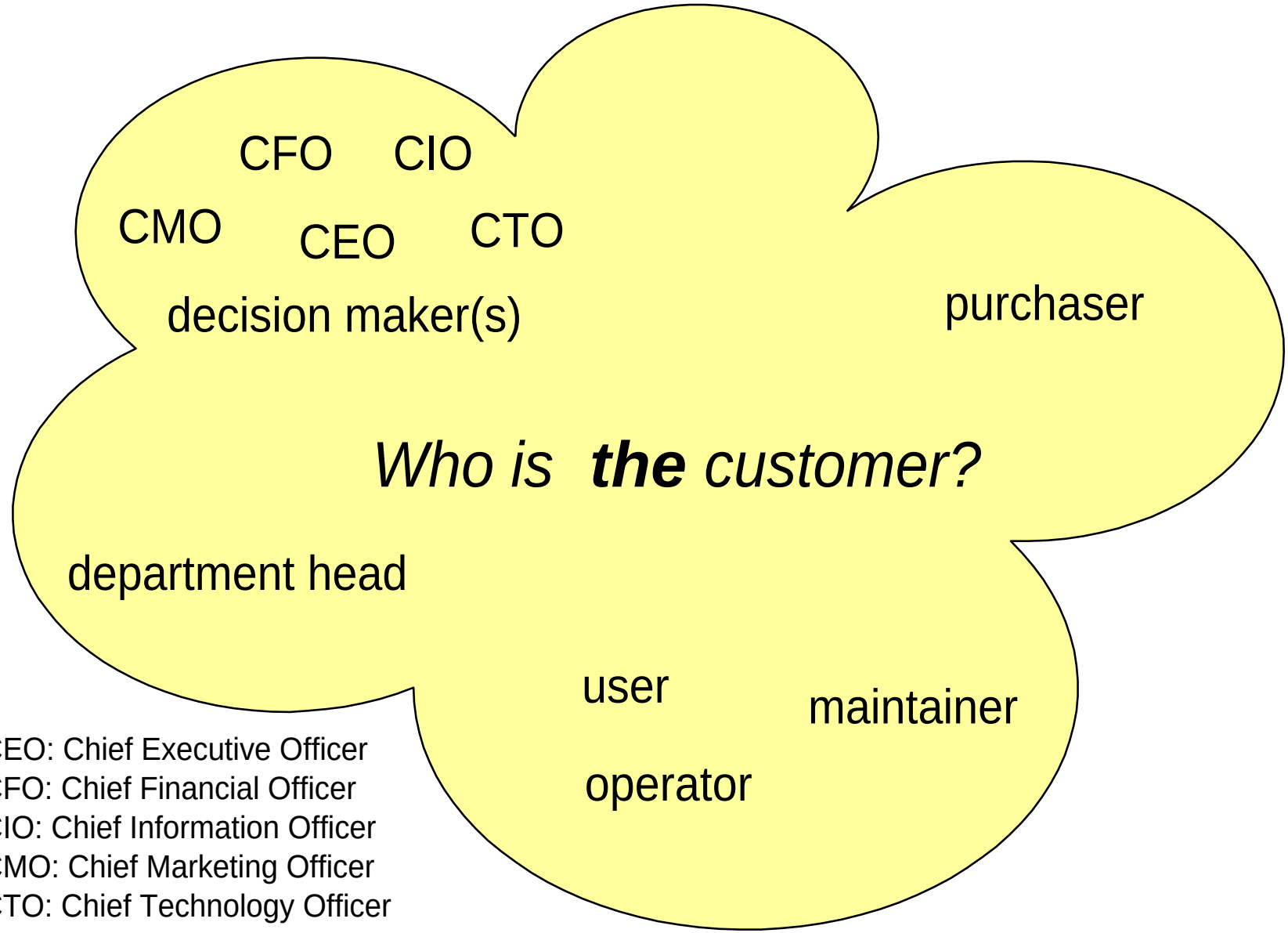
Integrating CAFCR



CAFCR can be applied recursively

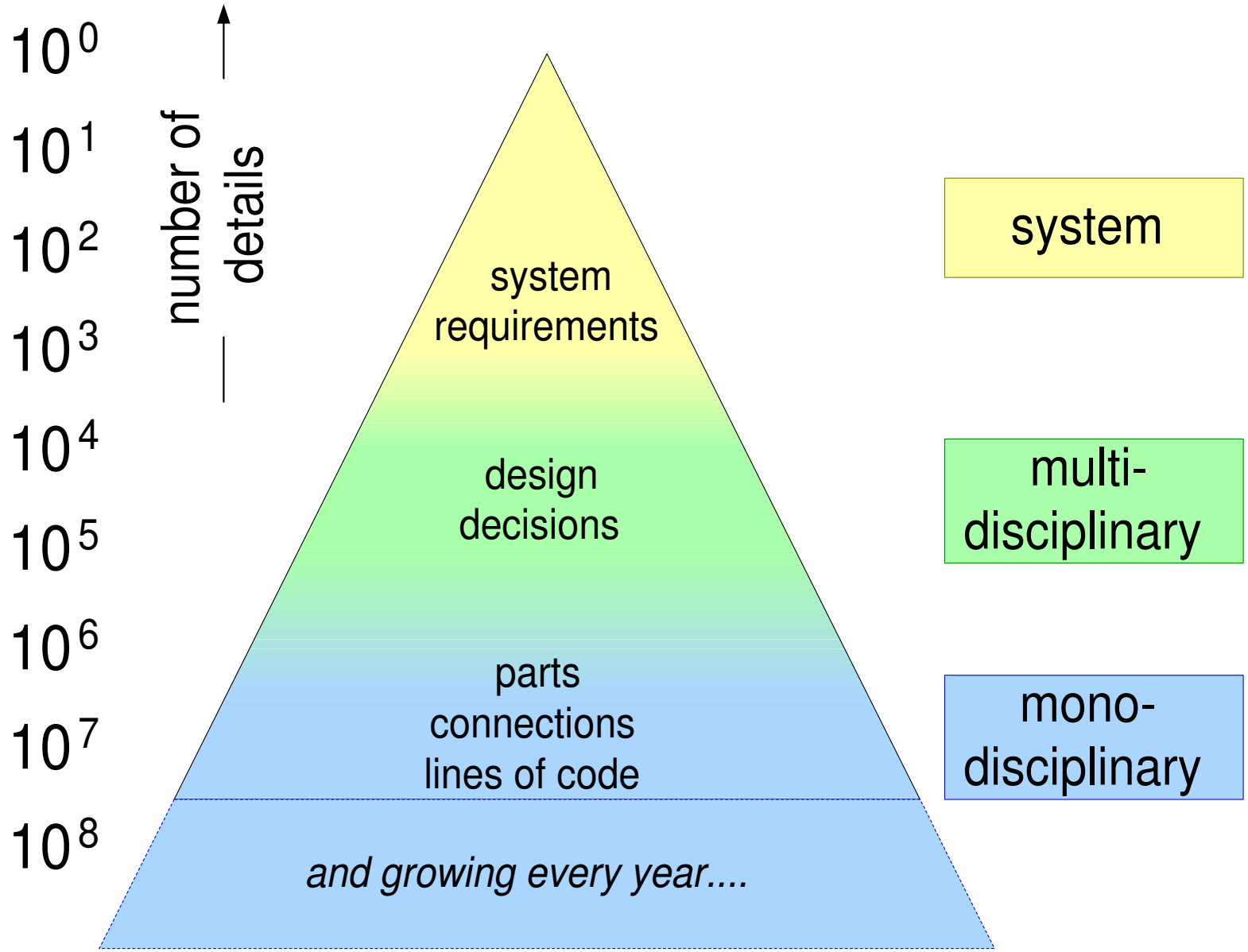


Example of a small buying organization

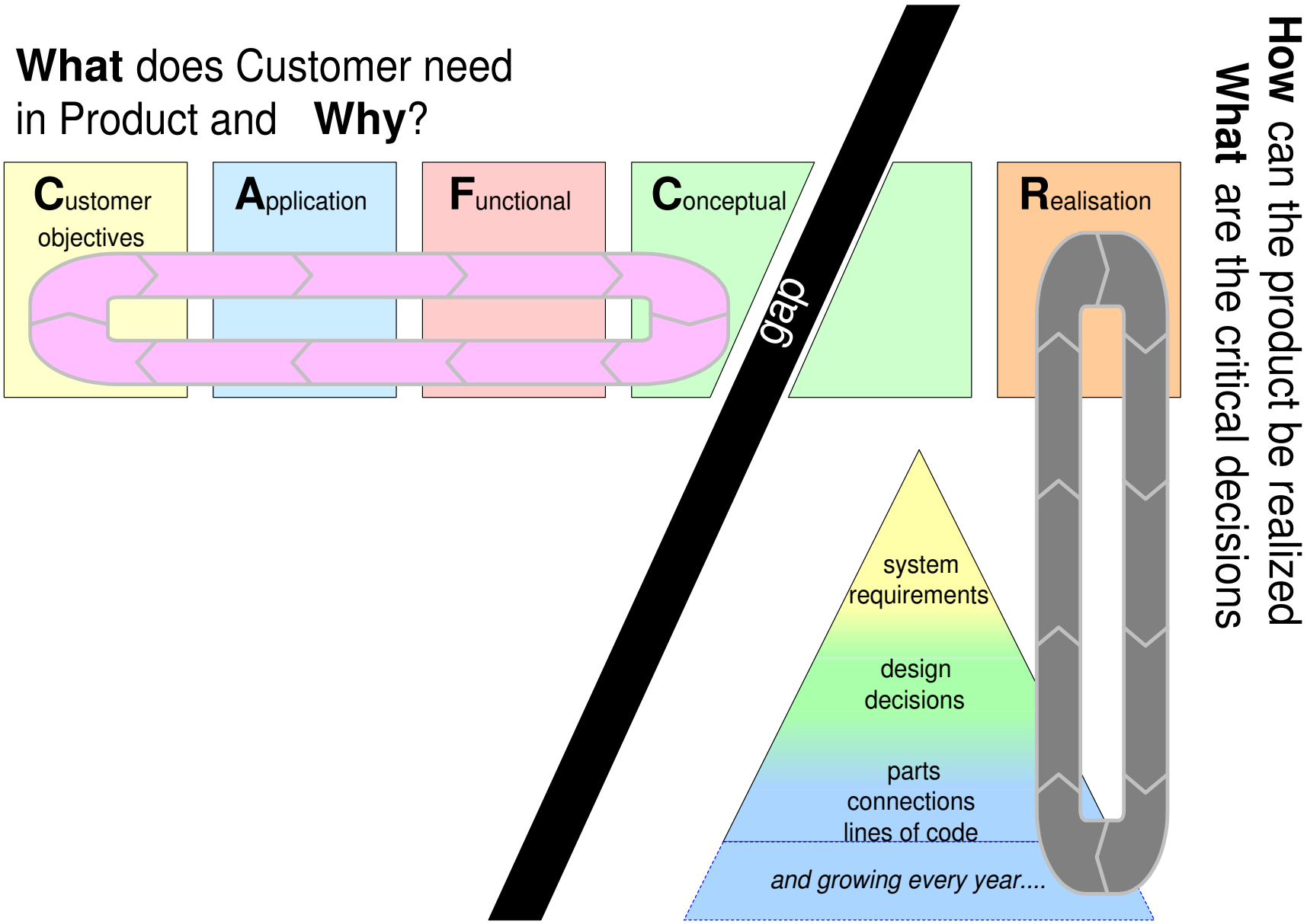


CEO: Chief Executive Officer
CFO: Chief Financial Officer
CIO: Chief Information Officer
CMO: Chief Marketing Officer
CTO: Chief Technology Officer

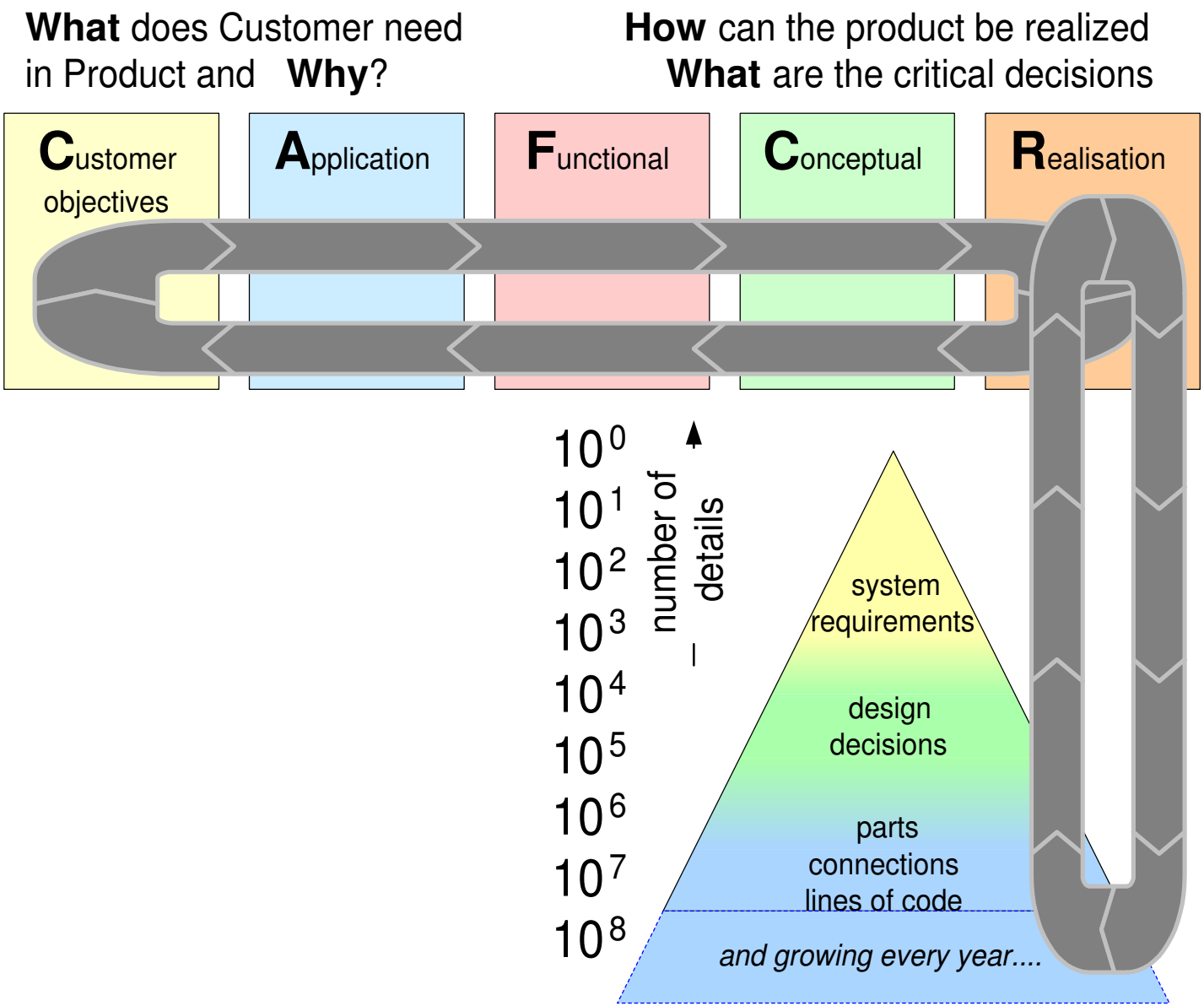
Connecting System Design to Detailed Design



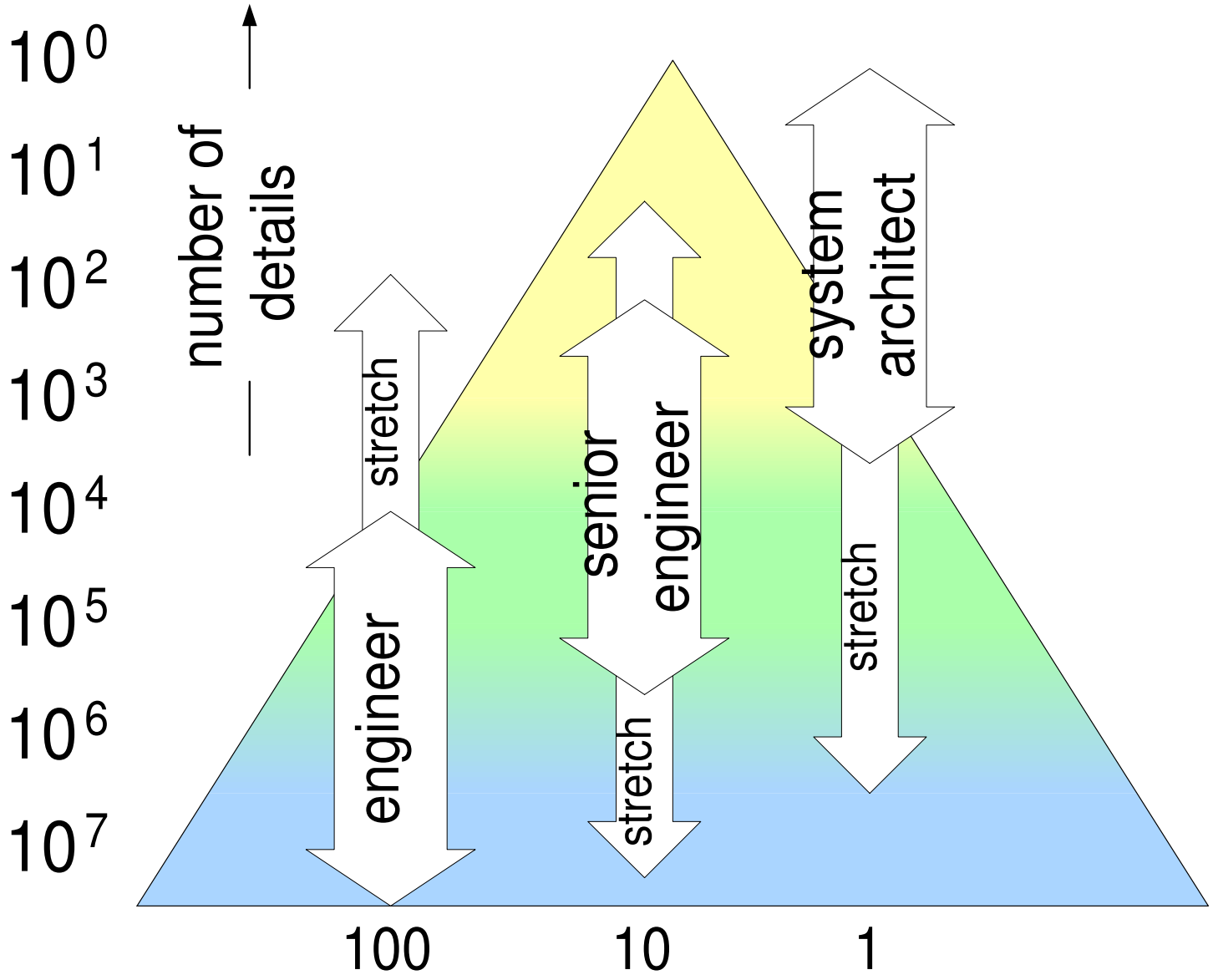
Organizational Problem: Disconnect



Architect: Connecting Problem and Technical Solution



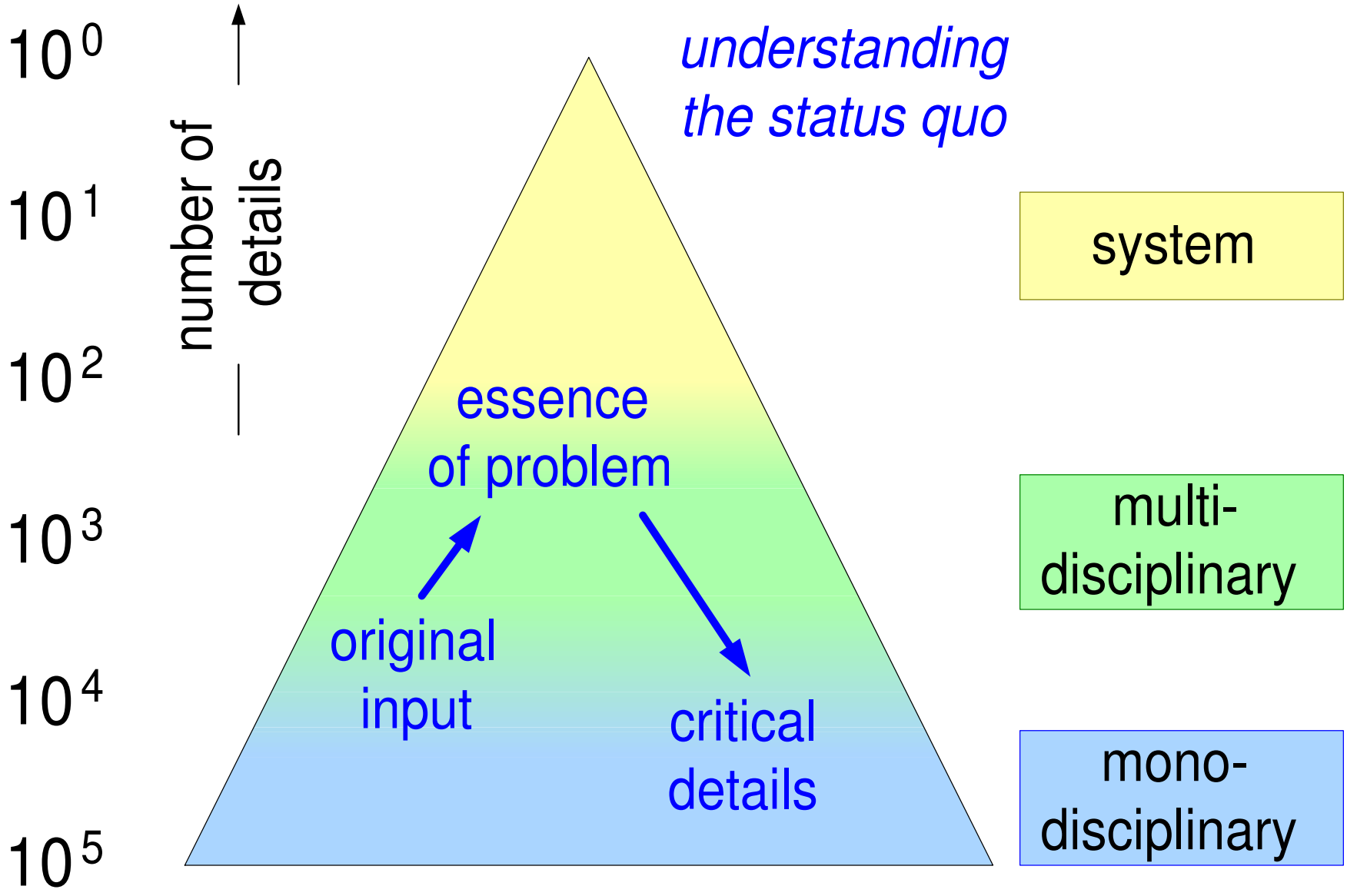
Major Bottleneck: Mental Dynamic Range



ATM Illustration

1. ATM Specification and Design Status Quo
Exercise: Identify Critical Design Decisions
Exercise: What is the Minimal Cost of the Controller
2. Customer and Life Cycle Perspective
Exercise: What are Important Future Customer Concerns
3. The Big (Complicated) Picture
4. Thread of Reasoning
Exercise: What did You Learn?

Step 1, Status Quo



ATM Original Input SDOE 650 Exercise

5.0 Operational Phase Requirements *(partial)*

5.1 Input/Output Requirements

5.1.1 Input Requirements

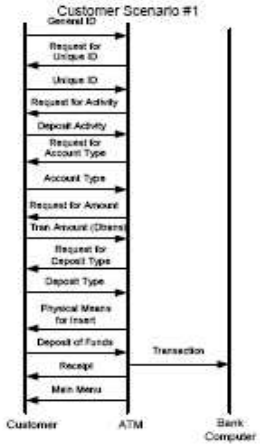
5.1.1.1 The ATM system shall accept a general ID from the customer.
5.1.1.2 The ATM system shall accept a unique ID from the customer.
5.1.1.3 The ATM system shall accept customer requests, including requests for deposits and requests for withdrawals.
5.1.1.4 The ATM system shall accept customer input, including account type (i.e. savings, checking, and bank credit), amount of deposit, deposit type (cash vs. check), and amount of withdrawal (Creq).
5.1.1.5 The ATM system shall accept a cash/check deposit from the customer.
5.1.1.6 The ATM system shall accept the amount of available funds from the bank computer. (Fmax).
5.1.1.7 The ATM system shall accept an employee code from a bank employee.
5.1.1.8 The ATM System shall accept a request to open from the bank employee.
5.1.1.9 The ATM System shall accept cash from the bank employee.
5.1.1.10 The ATM system shall accept blank receipts from a bank employee.
5.1.1.11 The ATM System shall accept a request to close from the bank employee.
5.1.1.12 The ATM system shall accept an initialization instruction from a bank employee.

5.1.2 Output Requirements:

5.1.2.1 The ATM system shall provide a request for unique ID to the customer.
5.1.2.2 The ATM system shall provide requests for customer input, including activity type, account type, deposit amount, and type of deposit (cash vs. check).
5.1.2.3 The ATM system shall provide a means for the customer to physically insert a deposit (cash/check).
5.1.2.4 The ATM shall provide a record of a transaction to the bank computer.
5.1.2.5 The ATM system shall provide a request for the amount of available funds to the bank computer (Fmax).
5.1.2.6 If Fmax ≥ Creq, and Clim ≥ Creq, the ATM shall provide the cash withdrawal to the customer. (Clim = the maximum withdrawal allowed for the particular ATM.) .
5.1.2.7 The ATM system shall provide a receipt for a transaction to the customer.
5.1.2.8 The ATM system shall provide the main menu to the customer.
5.1.2.9 The ATM system shall provide employee access to a valid bank employee.
5.1.2.10 The ATM system shall provide physical access to a valid bank employee.
5.1.2.11 The ATM system shall provide customer deposits and payments to a bank employee.
5.1.2.12 The ATM System shall provide confirmation that it has been locked to the bank employee.

2.0 ATM System Operational Phase Scenarios

1) **Customer makes deposits.**
   - Customer provides valid general identification information.
   - ATM requests unique identification information.
   - Customer enters unique identification information.
   - ATM requests activity selection.
   - Customer selects deposit.
   - ATM requests account type.
   - Customer identifies account type (i.e., savings, checking, and bank credit card).
   - ATM requests amount of deposit.
   - Customer identifies amount of deposit (Dtrns).
   - ATM requests type of deposit (cash vs. check).
   - Customer identifies type of deposit-cash/check.
   - ATM provides a means to physically insert cash/check into ATM.
   - Customer enters deposit.
   - ATM transmits the transaction to the main bank computer, gives customer receipt, and returns to main menu.



excerpts from SYS 650 System Architecture and Design
ATM Case Study
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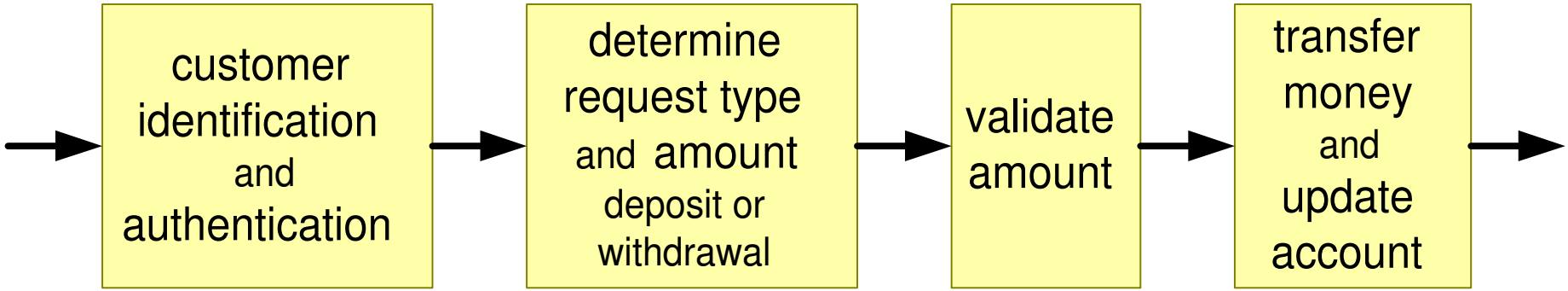
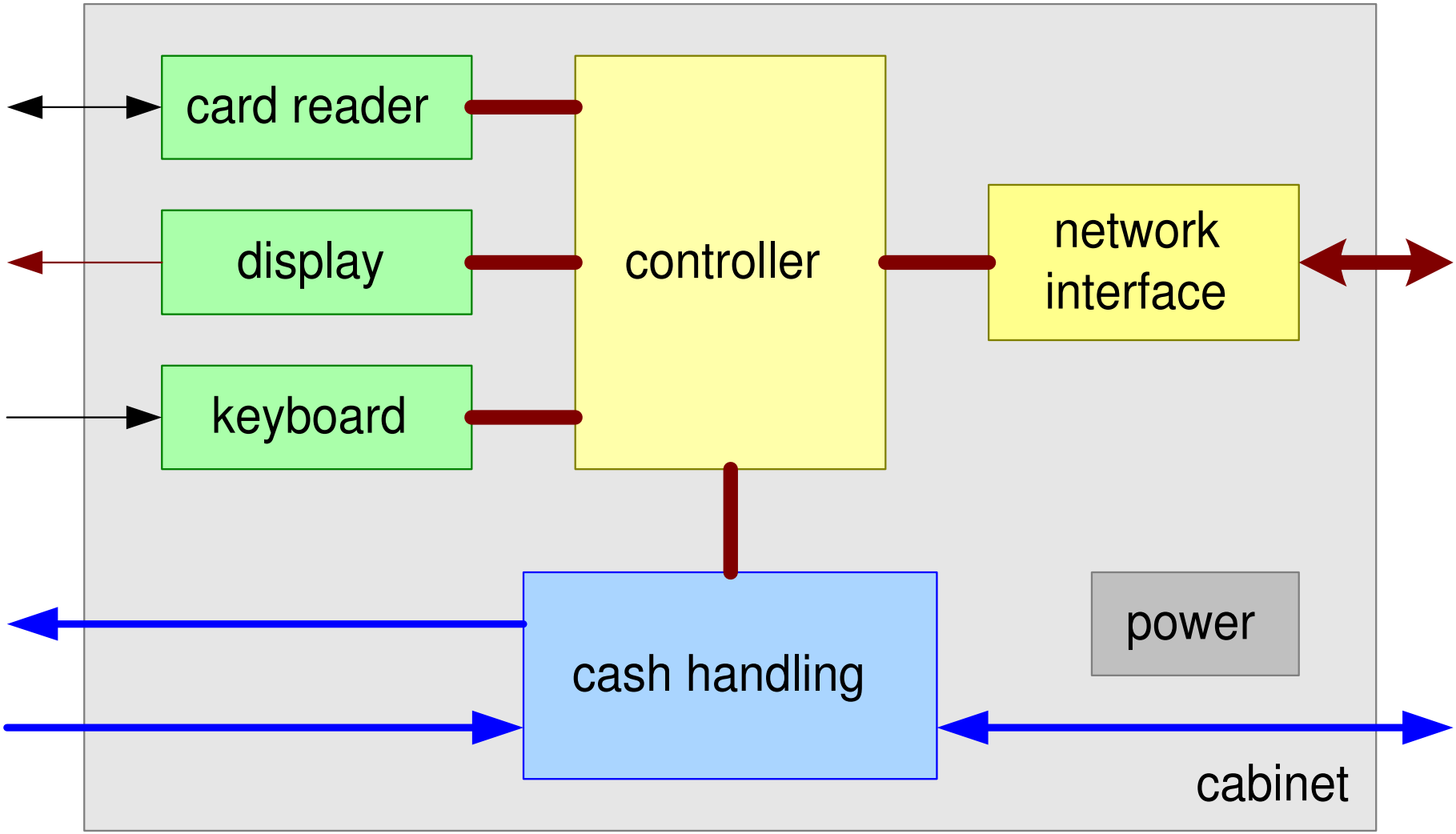
Adapted from a case study by Dennis Buede, Ph.D.

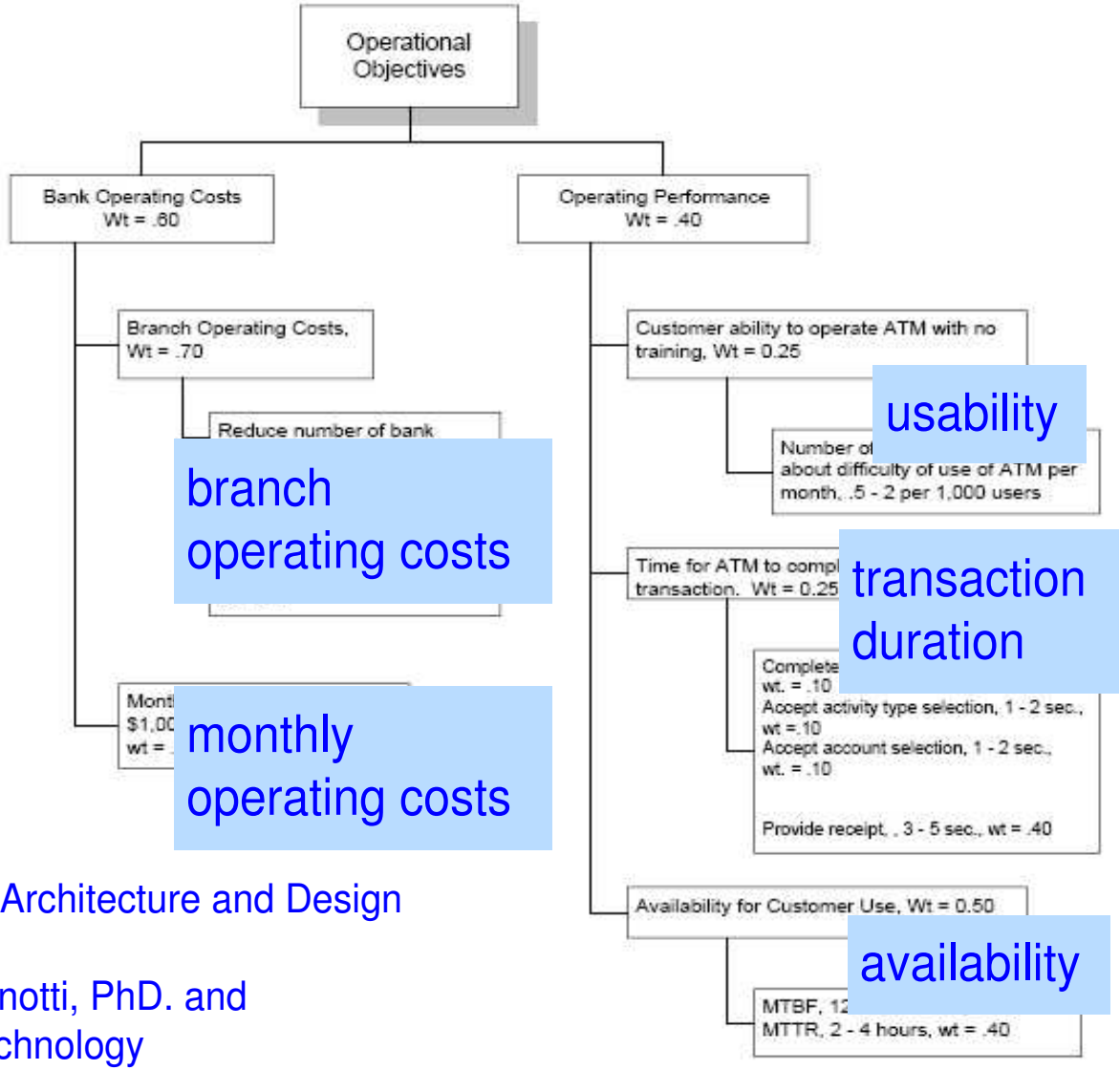
ATM Typical Function Flow



ATM Hardware Diagram



Objectives



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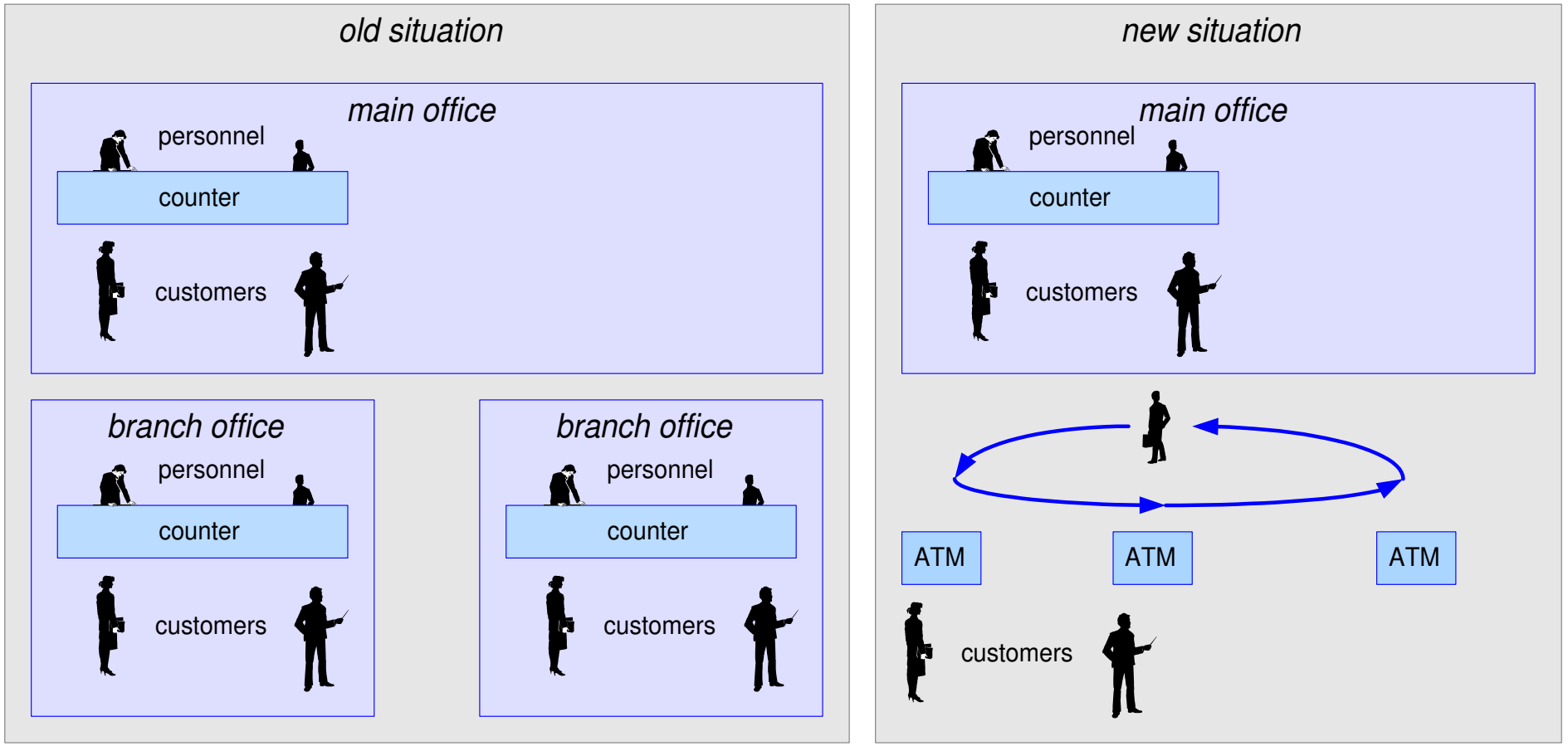
Impact of ATM introduction



Exercise: Identify Critical Design Decisions

Identify critical design decisions

Critical: high riks, sensitive or vulnerable, high impact on objectives

What decisions are critical?

Why are these decisions critical?

How do you decrease the risk?

Exercise: What is the Minimal Cost of the Controller

Determine Minimal Cost Controller

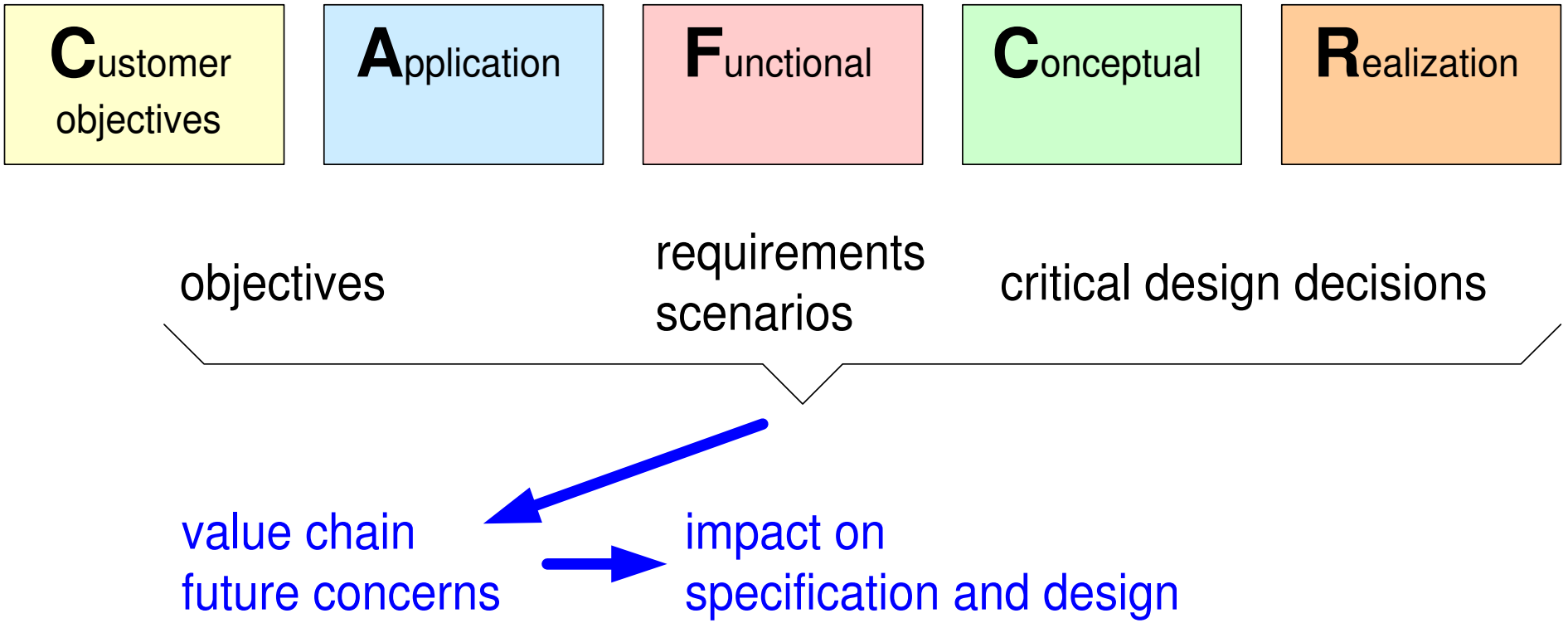
Identify multiple controller alternatives.

Estimate cost per alternative.

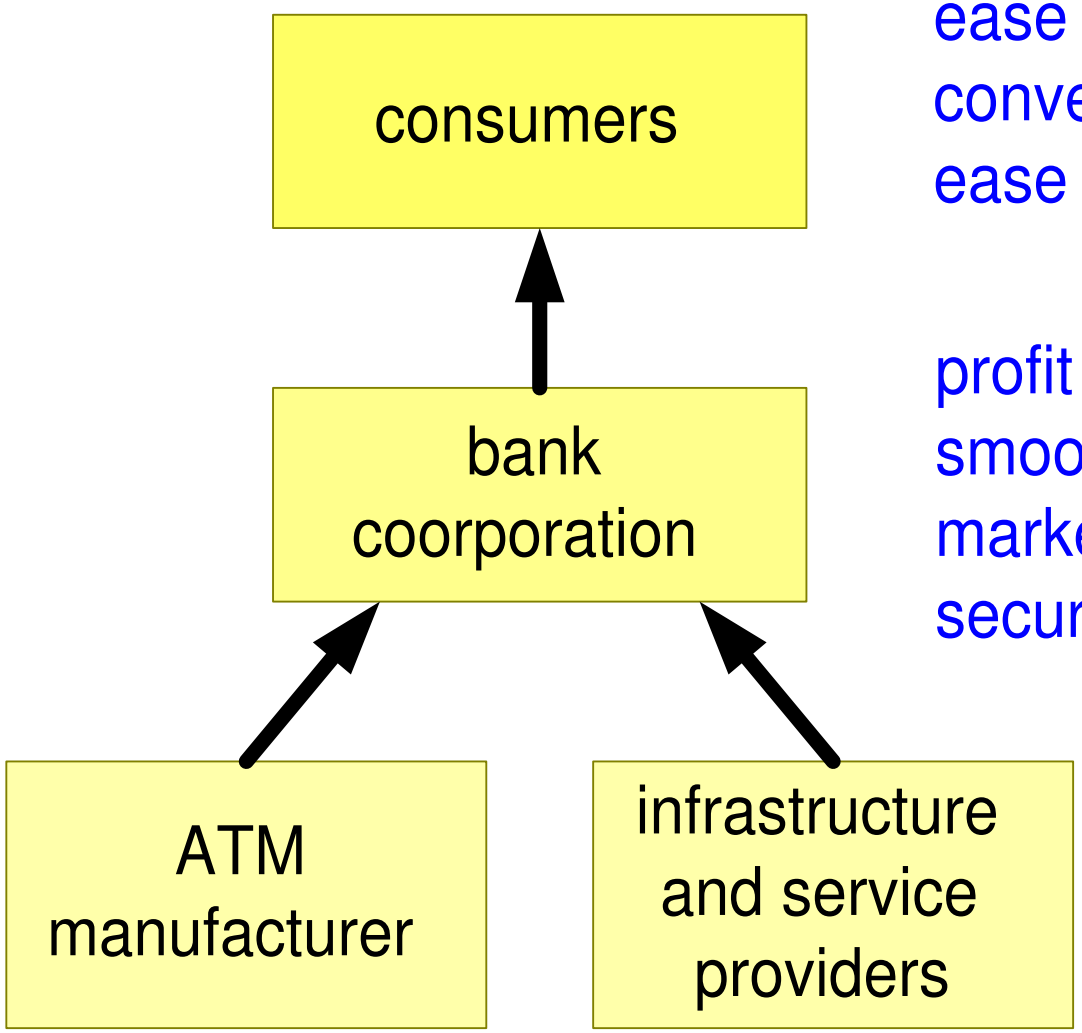
What is the impact on other design aspects?

What is the impact on the objectives?

Step 2, Customer and Life Cycle Perspective



Value Chain and Customer Concerns



concerns

ease of use
convenience
ease of mind

profit / cost of operation
smooth operation / availability
market share / customer base
security

Exercise: What are Important Future Customer Concerns

What are Important Future Customer Concerns?

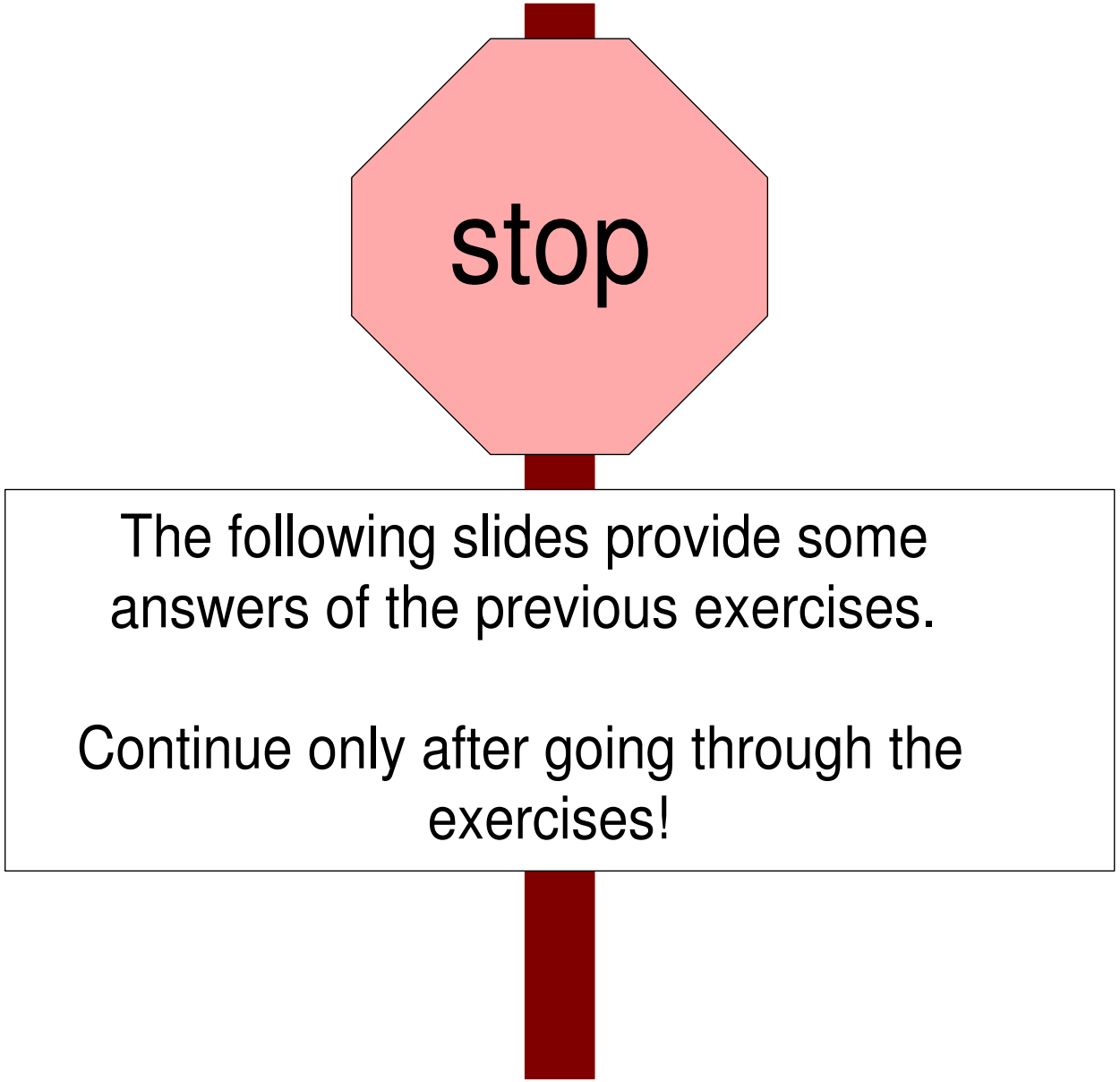
Describe or visualize these concerns very specific.

What are the consequences of replacing offices with machines?

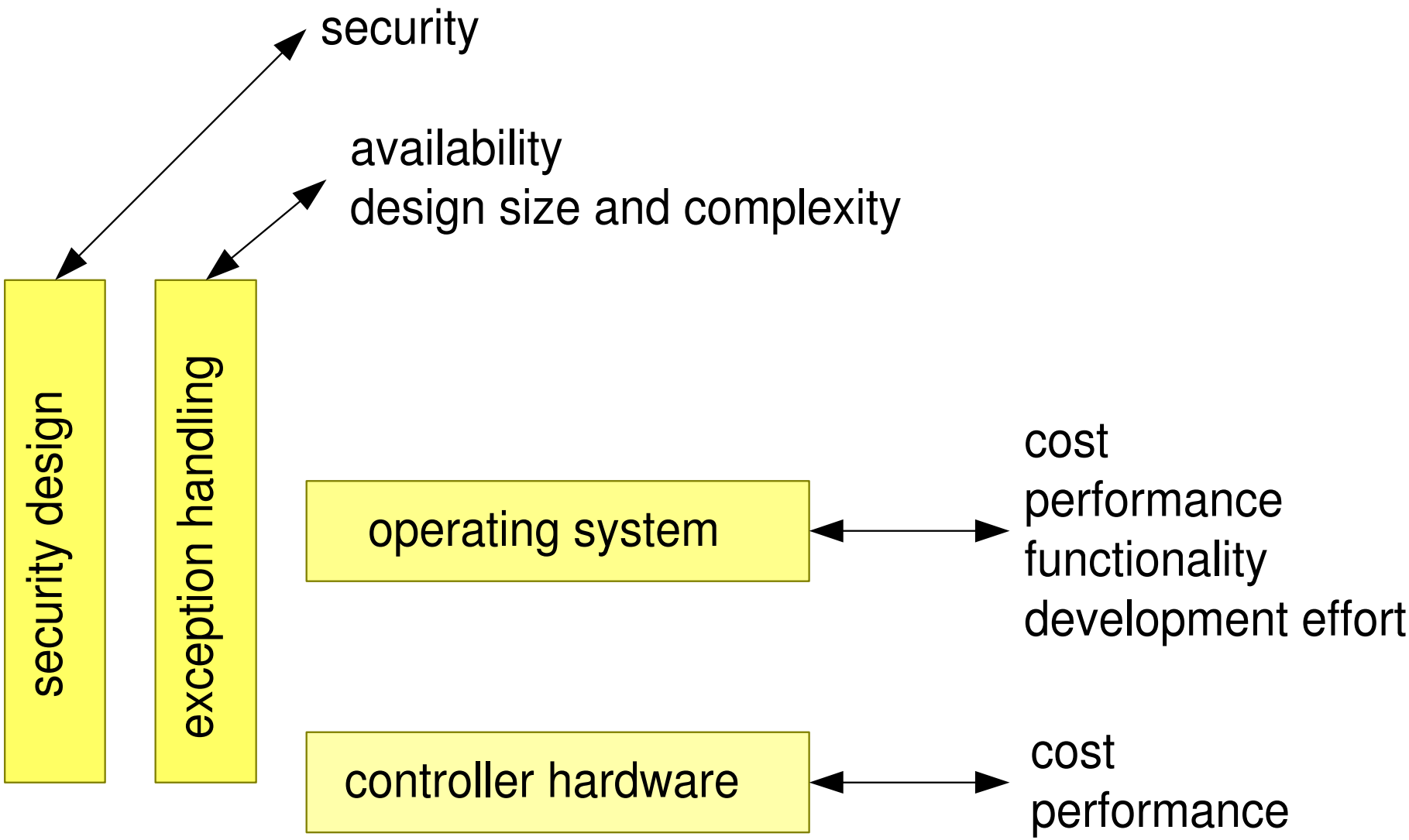
What is the biggest nightmare of the management and the consumers?

How is the current system prepared for these future concerns?

Warning: Following Slides provide Answers!



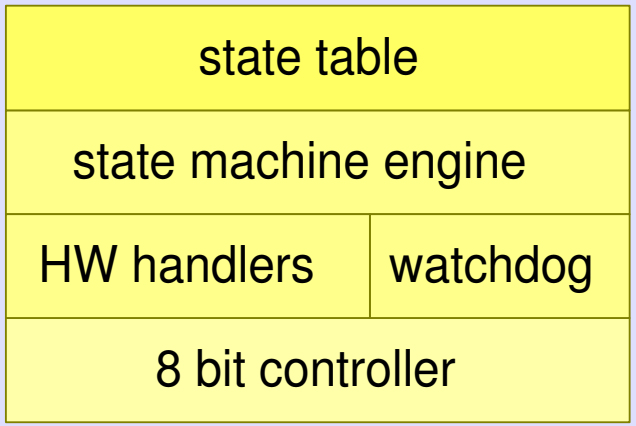
Examples of Critical Design Issues



Examples Controller Alternatives

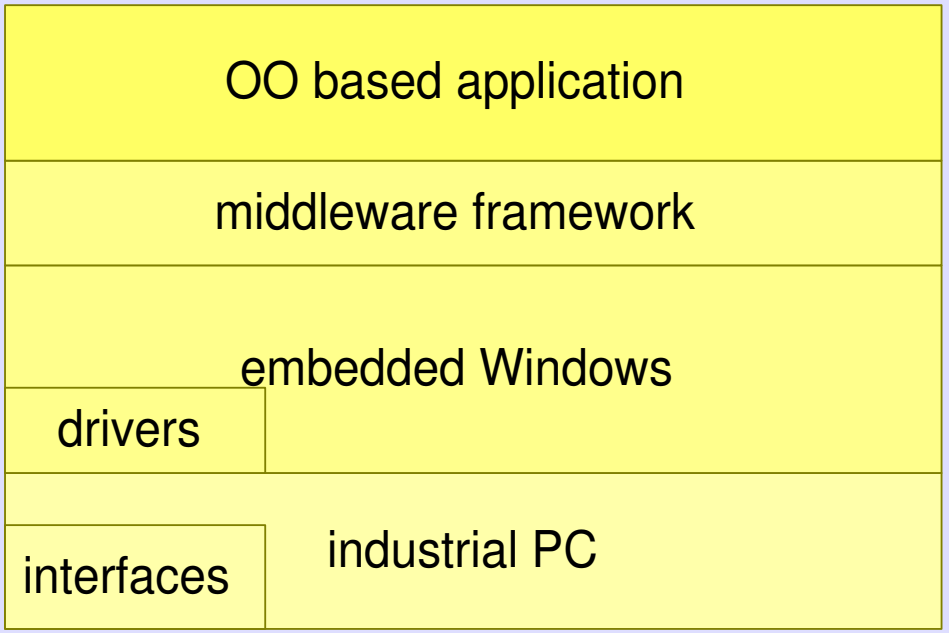
minimal cost design

HW material cost: 100$
SW license cost: 0$
SW size: 20kloc
performance: HW/network constrained

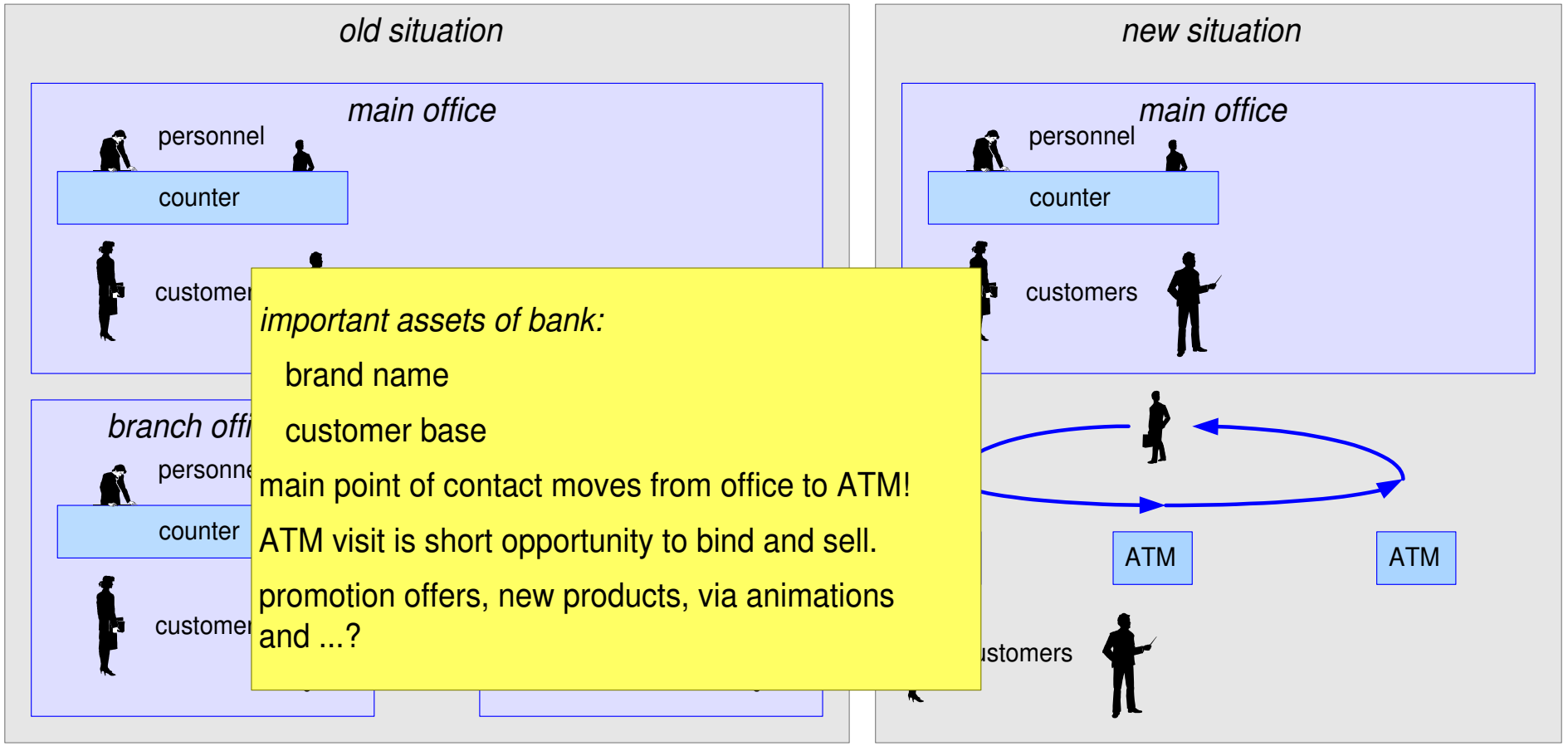


PC oriented design

HW material cost: 500$
SW license cost: 40$
SW size: 120kloc
performance: HW/network constrained



Example of Customer Contact Concern



Security Nightmare

Phantom withdrawals, see <http://www.phantomwithdrawals.com/>

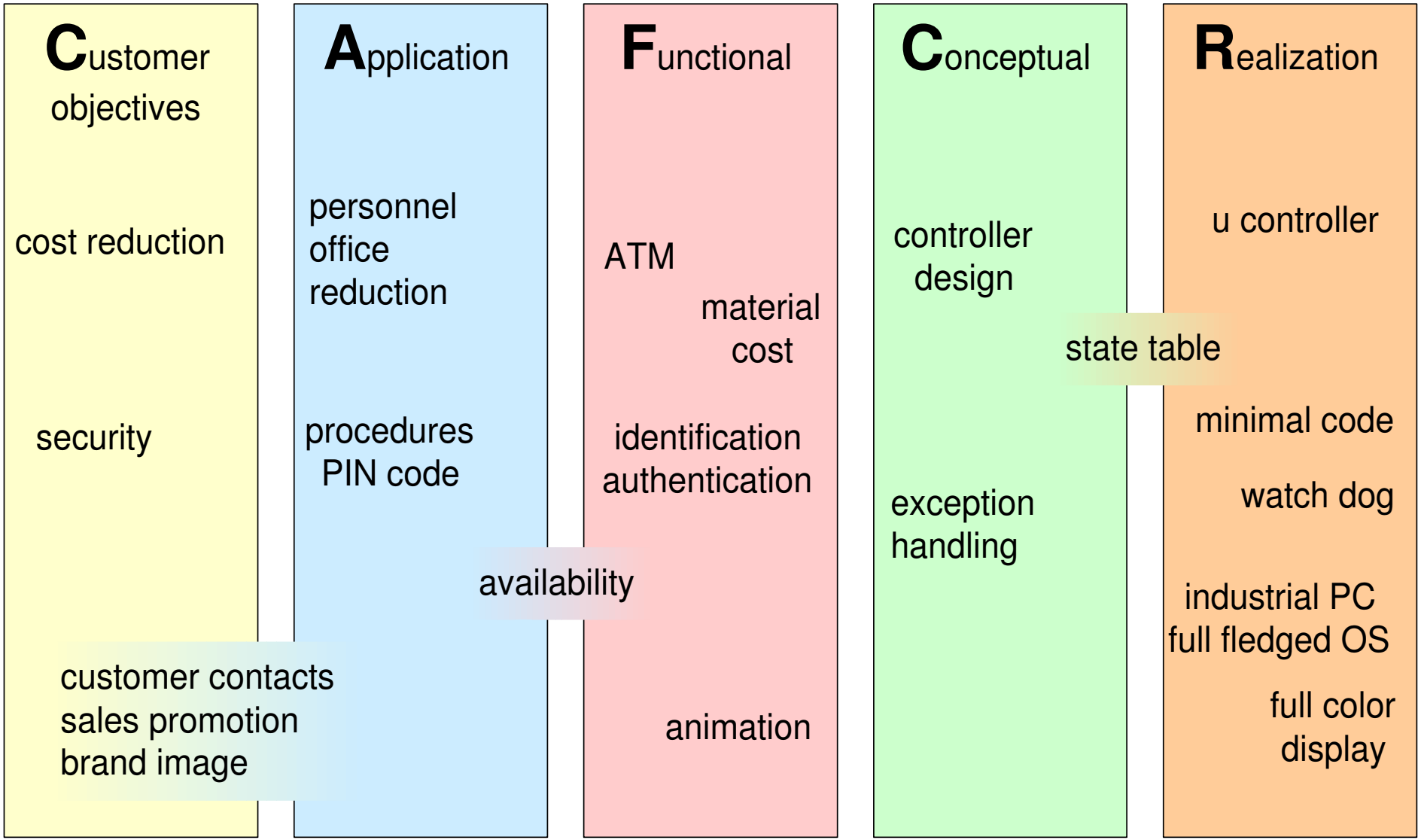
De belangrijkste feiten:
– PIN gaat over op EMV
– Geen hoge kosten door geleidelijke invoering
– Volledige invoering verwacht rond 2013
– Magneetstrip werkt nog lange tijd

from: http://www.currence.nl/site/site/website/data/00149/Currence%20Nieuws%202005%2002%20def.pdf

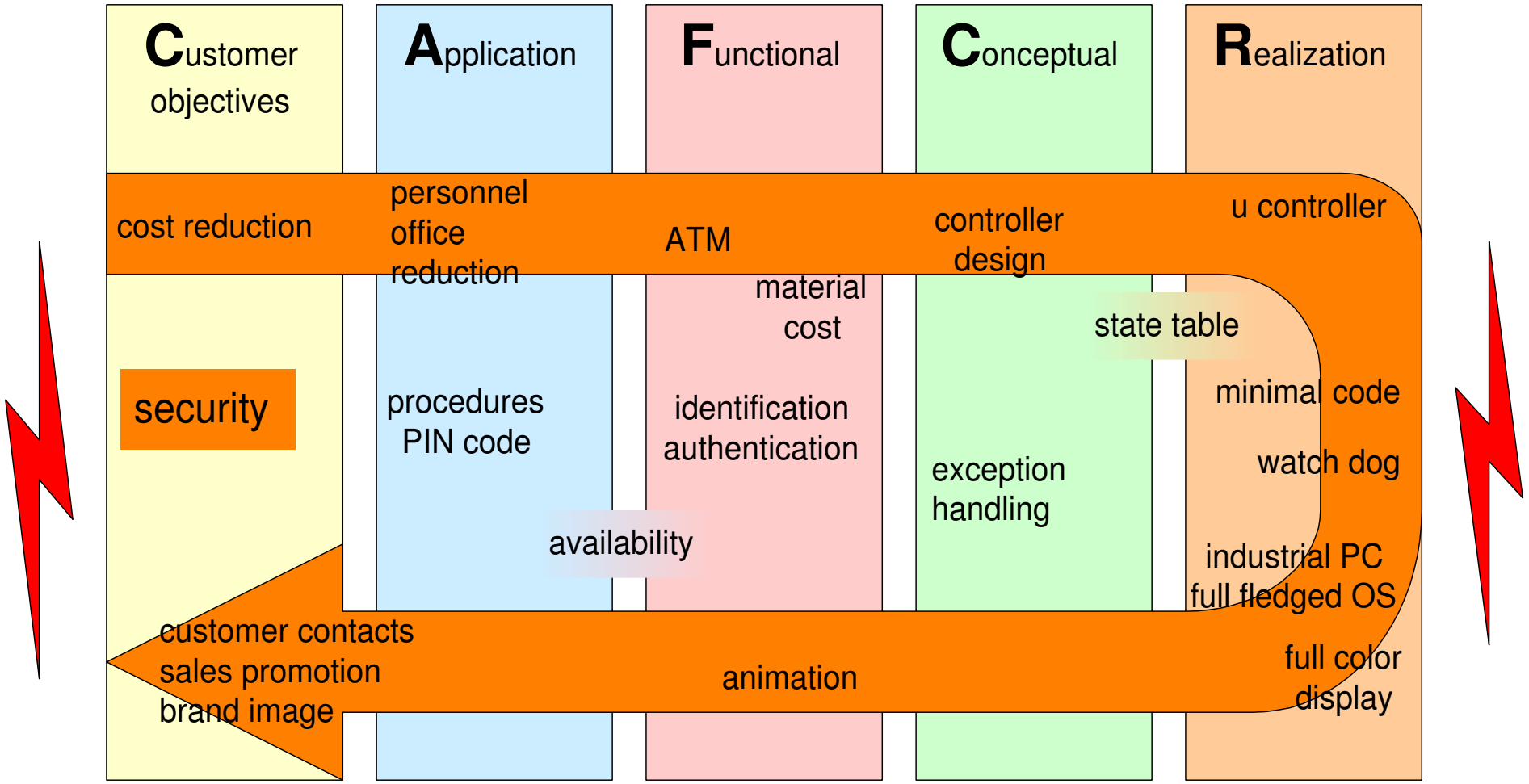
translation:
+ PIN changes into EMV standard
  magnet strip replaced by chip
- introduction complete ca 2013

Security relates to all system aspects
from bank management, personnel and processes
down to network medium and hardware drivers.
The bad guys also make lots of progress.

Step 3, The Big (Complicated) Picture



Step 4, Thread of Reasoning



Exercise: What did You Learn?

What did You Learn?

Where did we start?

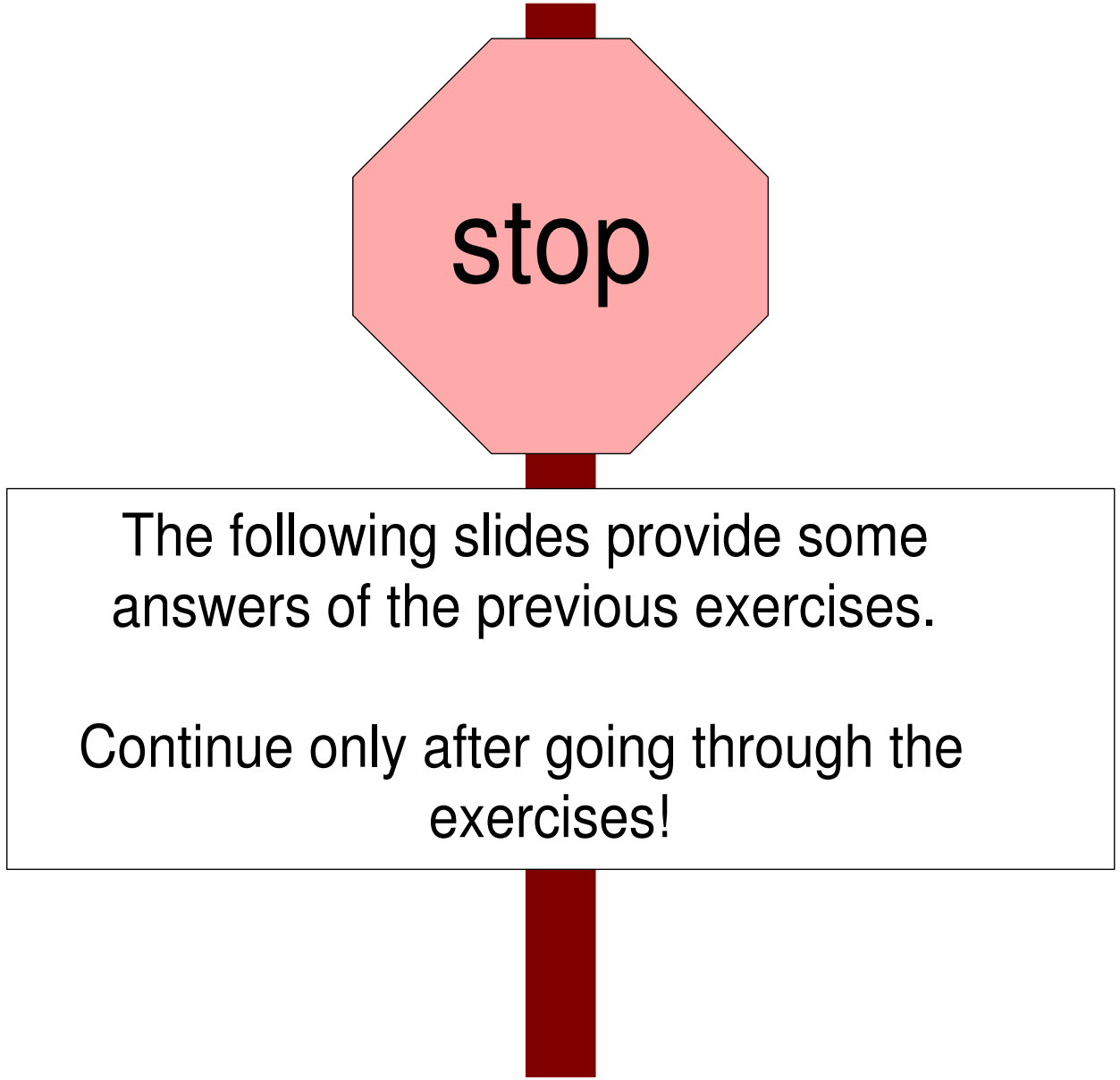
What are the iterative steps that we took?

What are the new insights?

How SMART is the result?

What do we still have to do?

Warning: Following Slides provide Answers!



Reflection

What is next?

We made a very fast iteration over many view points.

Most reasoning has been qualitative.

Fact finding and quantification needed to determine relevant and significant issues.

Keep on iterating and sharpening!