COMP314:

Design

Readings:

Chapter 4+5 Code Complete

Where have we got to?

Problem definition

Requirements

Use cases

Architecture Design

Modeling Analysis

Code

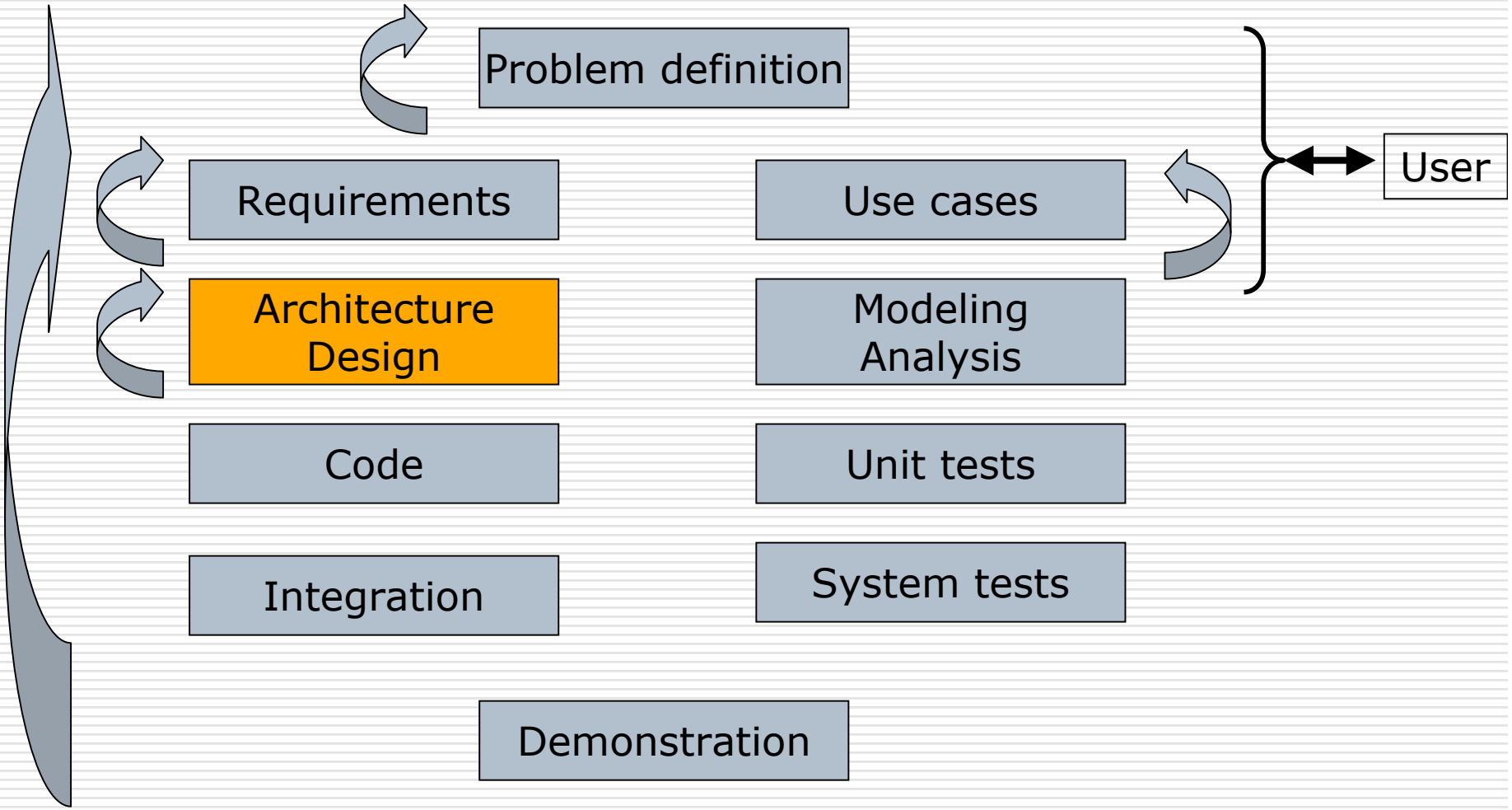
Unit tests

Integration

System tests

Demonstration

Where is the feedback?



Choice of Programming Language

- Sapir-Whorf hypothesis: “can only think thoughts expressible in words” [e.g. division using roman numerals]
- Programming language choice:
  - productivity (C-1, C++/Java 2.5, Python 6)
  - code quality
  - language expert 3x more productive

Major decisions

- Coding
  - Amount of upfront design
  - Coding conventions
- Pair programming
- Quality:
  - Units tests, integration tests before checkin
  - Review/inspect each other's code?
- Tools:
  - Revision control tool (svn, cvs, …)
  - Language / Compiler / OS version
  - Other: IDE (Eclipse), other libraries

Art and Science of Design

Design is a “wicked” problem -

can only be defined by solving it

Art and Science of Design

Tradeoffs and priorities

Restrictions

Non-deterministic

Heuristic Process

Emergent

Art and Science of Design

Art of creating a design

The science of what a good design should be

Complexity - the great enemy

- Many other domains can hide essential complexity behind a wall of accidental complexity

- In computer science (often) the accidental complexity is removed exposing naked essential complexity

Complexity - the great enemy

"Everything should be as simple as possible and no simpler" - Einstein (maybe).

Complexity - how things go wrong

- complex solution to a simple problem
- simple, but wrong solution for a complex problem
- a complex, but wrong solution for a complex problem

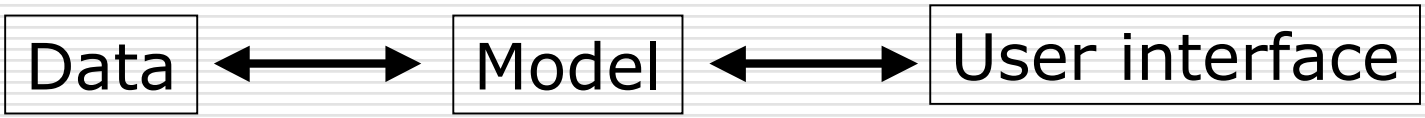
Complexity - how to discover it isn't there and to manage it

- Divide into parts
- Hide information
- Iterate
- Testability
- Identify potential changes
- Use appropriate language to describe problem
- Avoid accidental complexity

Decomposition into parts

- Loose coupling
- High fan-in
- Low-to-medium fan-out
- Stratification
- Testability
- What does each part have to know about?
- Hide things

Decomposition into parts

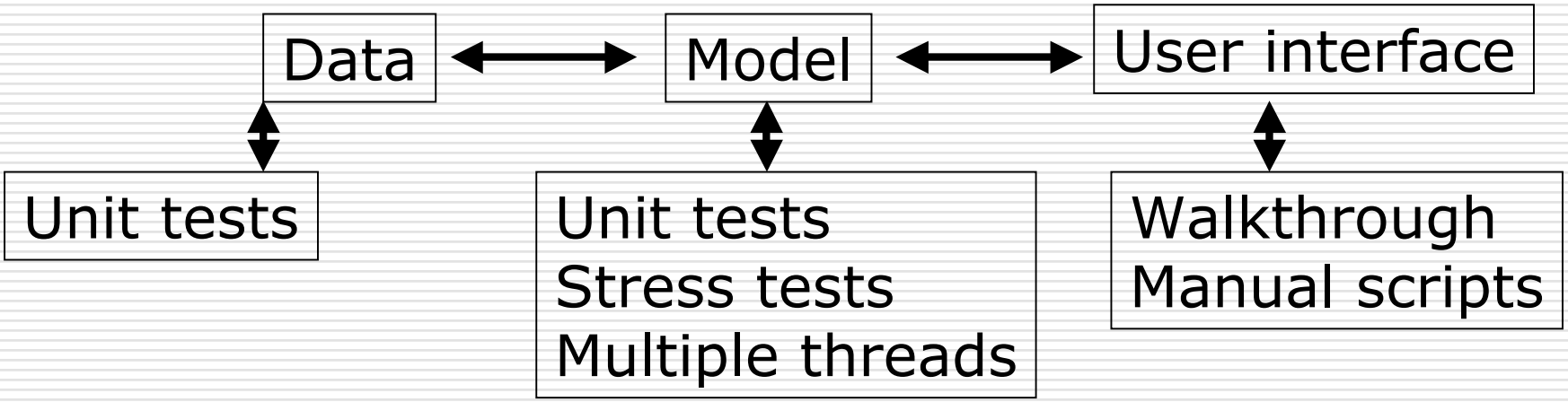


Operations
on data
-update loans db
-write to log

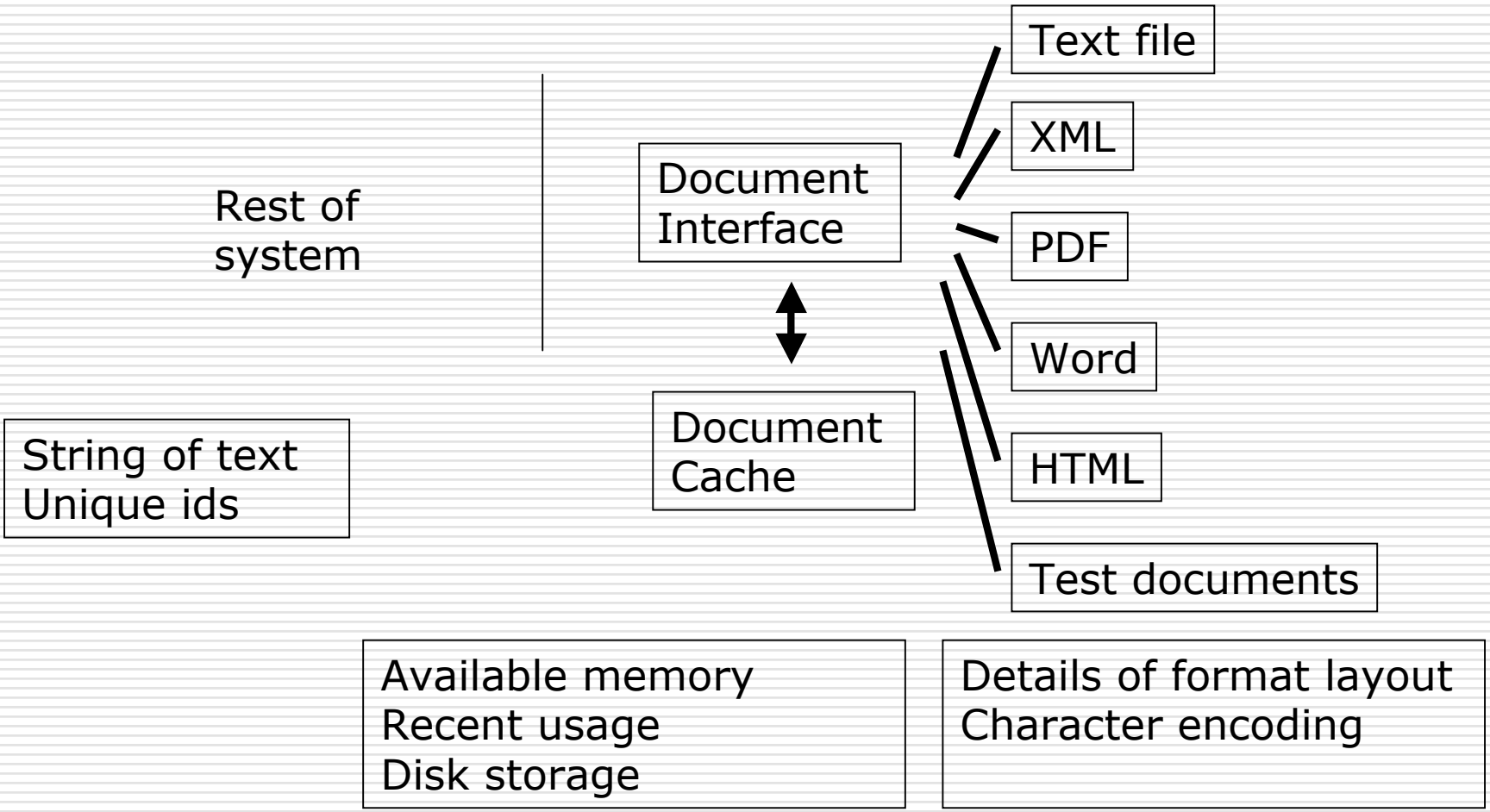
Major Operations
-borrow a book
-return a book
-Transactions
-Multiple threads

Mouse clicks
Input values
Colors
Appearance
Layout

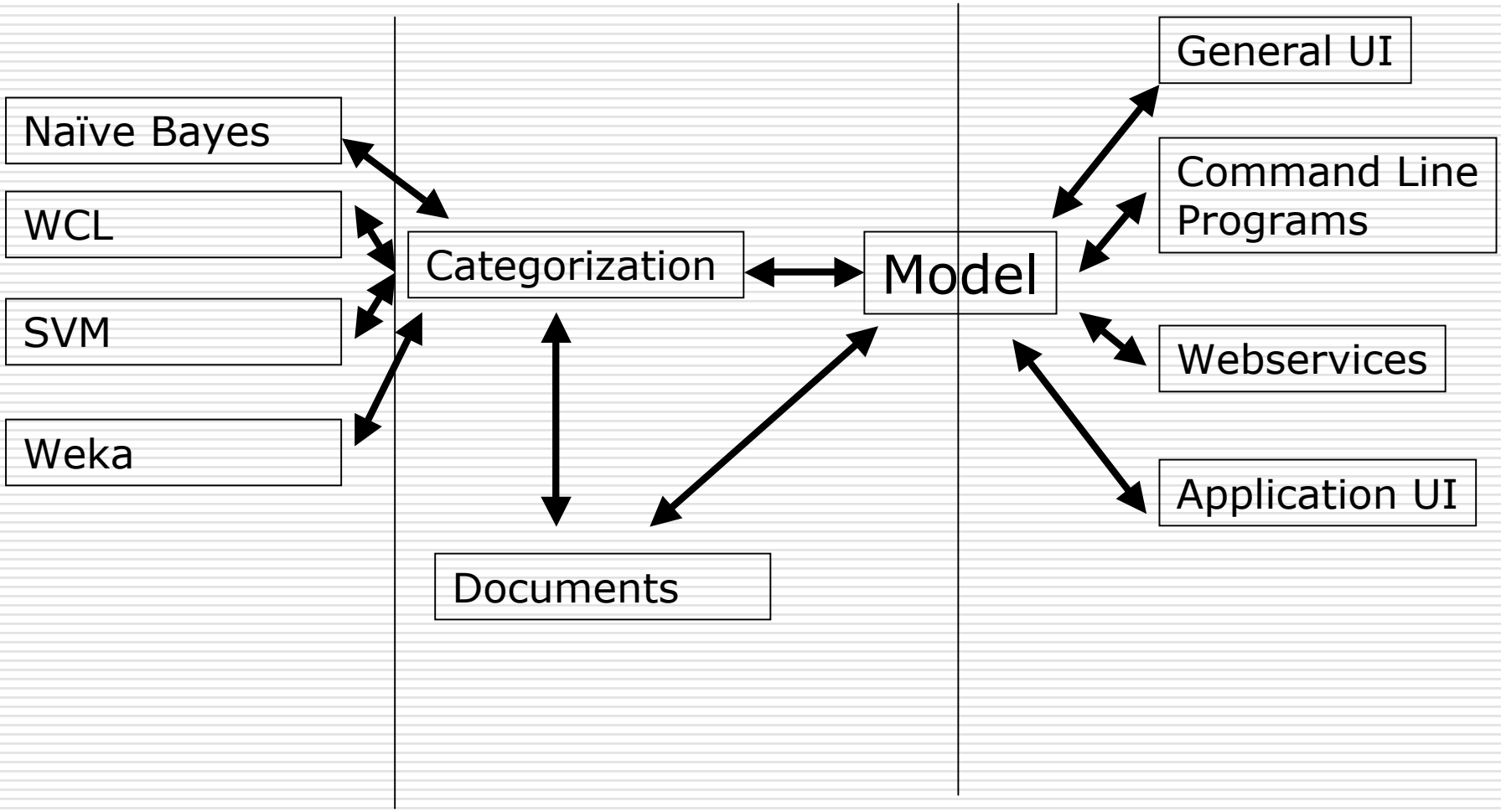
Decomposition into parts - testing



Example from ReelTwo - handling millions of documents



Example from ReelTwo



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Why hide information?

- Size of human brain
- Reason (informally) about correctness
- Ease of testing
- Ease of maintenance
- Proven in practice

Barriers to hiding

- Global data
  everyone can see it
  everyone can modify it
  hard to know when it will be changed
  hard to test
- Constants
  6 ?? MAX_LOANS

Barriers to hiding

- Excessive worry about performance
- when you can measure it and it is too slow

  then do a more complicated and faster thing

Ways to document design

- Java Interfaces
- UML diagrams
- English
- Wiki
- Comments

Checklist: design practices - p122 Code Complete

- Iteration - best of several possibilities
- Split system in different ways
- Top down and bottom-up
- Prototype
- Design review
- Implementation obvious?
- Captured design?

Checklist: design goals - p122 Code Complete

- Reflect architecture and requirements
- Stratified
- Good decomposition
  subsystems, packages, classes, routines
- Minimal interaction
- Is everything necessary?
- Standard techniques
- Minimize complexity

Design

- Much room for art and creativity have been given ideas for how to do it

- Strict guidelines for what constitutes a good design - keep it simple.