CS 320

Introduction to Software Engineering
Spring 2017

January 25, 2017

Recap

What is Software Engineering?

- The complete process of specifying, designing, developing, analyzing, and maintaining a software system.

Why is it important?

- Decomposes a complex engineering problem.
- Organizes processes and effort.
- Improves software reliability.
- Improves developer productivity.

Recap

Software development process: ad-hoc or systematic?

Pros: Ad-hoc

- No formal process, no overhead. *"Brain to keyboard"*
- Easy, quick, and flexible.

Cons: Ad-hoc

- Might lack important tasks such as design or testing.
- Doesn't scale to multiple developers.
- Impossible to measure effort and progress.

Today

- What are the activities and steps in a systematic software development process?
- What are the definitions of all these terms and what are intuitive examples?

Today

- What are the activities and steps in a systematic software development process?
- What are the definitions of all these terms and what are intuitive examples?

Software development process

Activities and steps

Suppose you picked a class project…now what?

Software development process

Activities and steps

- Requirements engineering
- Design and architecture
- Implementation
- Verification and Validation
- Deployment and Maintenance

Example project: smart fridge

Scenario

- Dinner/party time
- On the way home
- Is the fridge stocked?

Example project: smart fridge

Scenario

- Dinner/party time
- On the way home
- Is the fridge stocked?

Solution

- DIY smart fridge
- Realtime data
- Mobile app

Software development process

Activities and steps

- Requirements engineering
- Design and architecture
- Implementation
- Verification and Validation
- Deployment and Maintenance

Software development process

Activities and steps

- **Requirements engineering**

Group discussion

- How to gather requirements?
- What are potential requirements for our smart fridge example?

Requirements engineering

The process of eliciting, analyzing, documenting, and maintaining requirements.

Types of requirements

- Functional requirements
  - E.g., input-output behavior
- Non-functional requirements
  - E.g., security, privacy, scalability
- Additional constraints
  - E.g., programming language, frameworks, testing infrastructure

Requirements engineering

The process of eliciting, analyzing, documenting, and maintaining requirements.

Common mistakes and challenges

- Implementation/design details instead of requirements
- Unclear scope and unclear requirements
- Changing/evolving requirements

Requirements engineering

The process of eliciting, analyzing, documenting, and maintaining requirements.

Possible strategies for eliciting requirements

- Interviews
- Observations
- Use cases
- User stories
- Prototyping

Software development process

Activities and steps

- Requirements engineering
- **Design and architecture**

Group discussion

- Given our requirements on the whiteboard, how would you design the system?
- What is the difference between design and architecture?

Software architecture vs. design

Architecture (what is developed?)

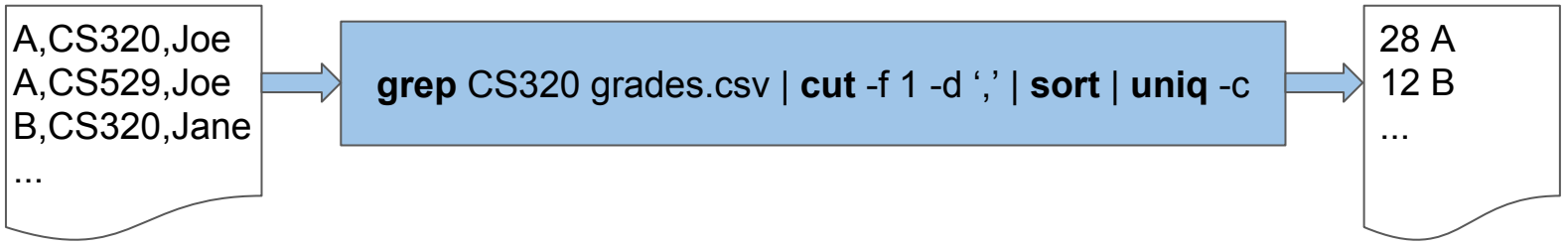
- High-level view of the overall system:
  - What components do exist?
  - What type of storage etc.?

Design (how are the components developed?)

- Considers individual components:
  - Data representation
  - Interfaces, Class hierarchy
  - …

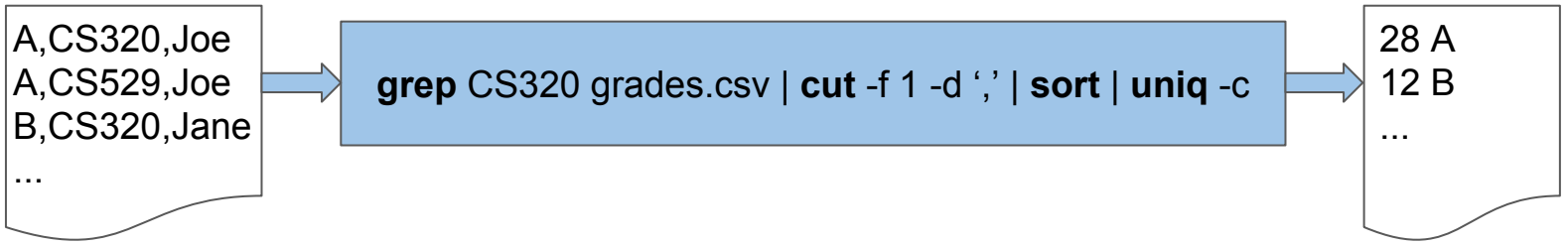
Software architecture: examples

Pipe and Filter



Software architecture: examples

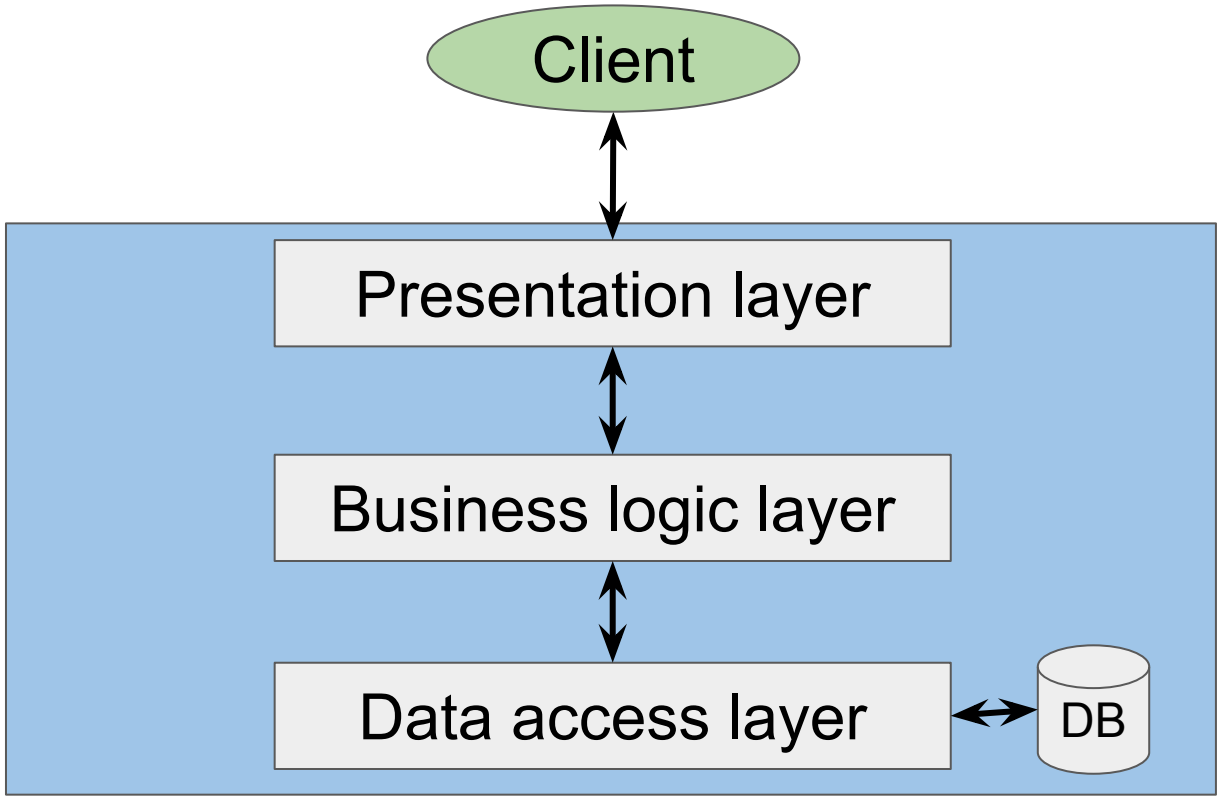
Pipe and Filter



The architecture doesn’t specify the design or implementation details of the individual components (filters)!

Software architecture: examples

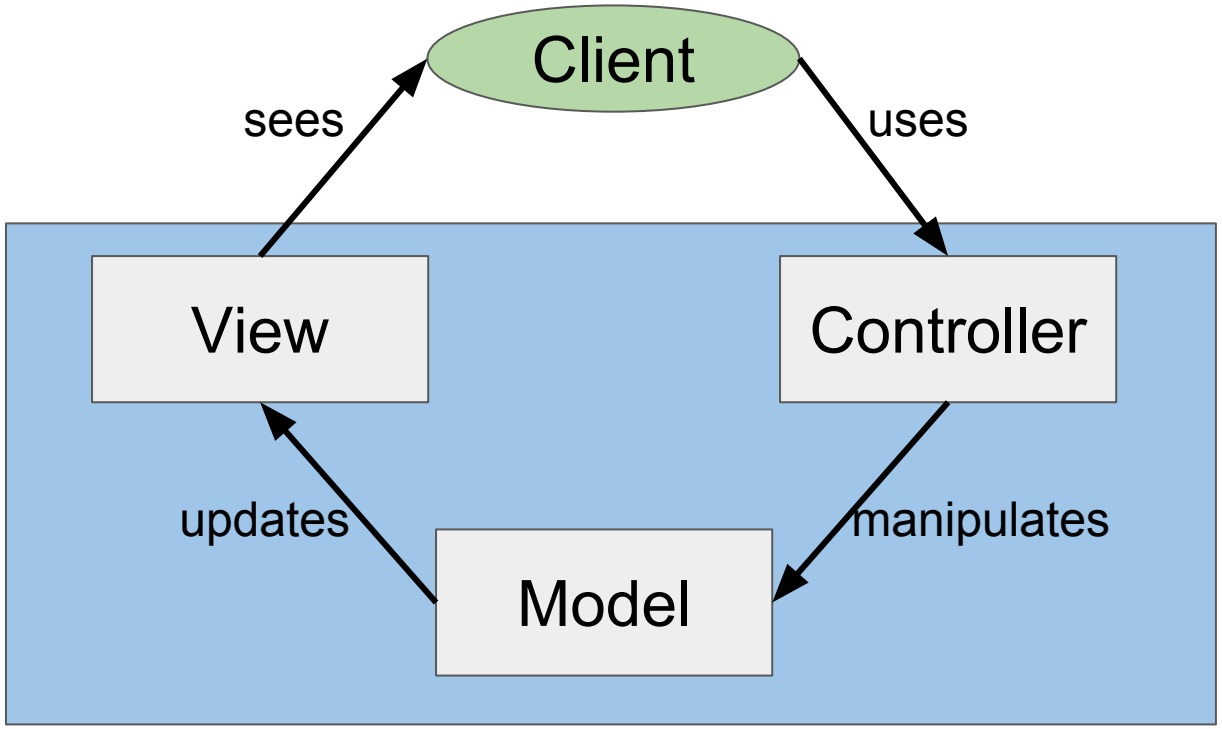
Client-server / n-tier



Simplifies reusability, exchangeability, and distribution.

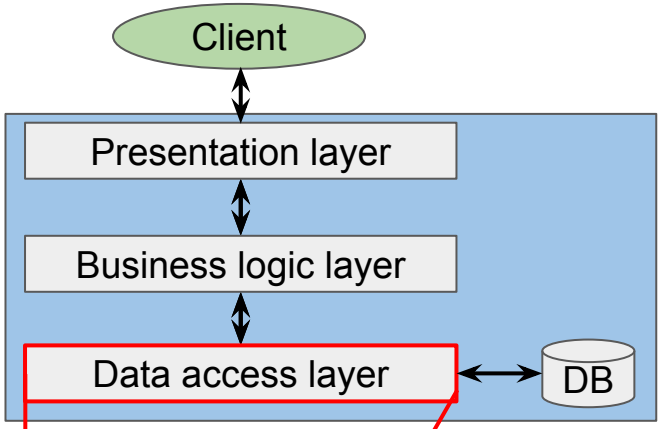
Software architecture: examples

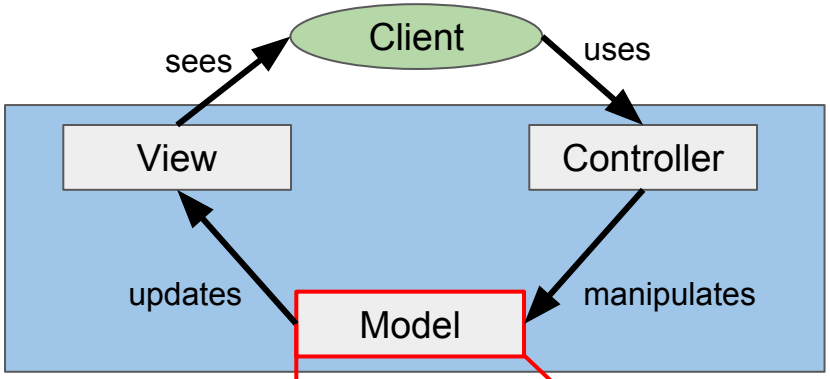
Model View Controler (MVC)

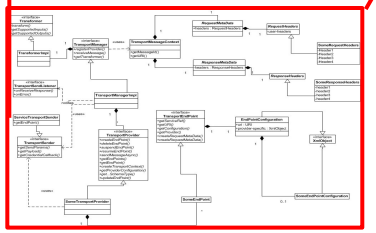


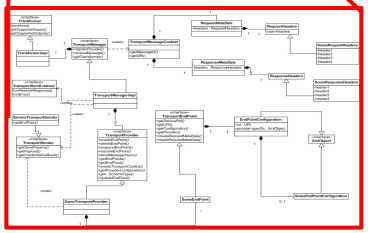
Separates data representation (Model), visualization (View), and client interaction (Controller)

Software architecture vs. design: summary









Architecture and design

- Lowers complexity: separation of concerns, well defined interfaces
- Simplifies communication
- Allows effort estimation and progress monitoring

What's next?

Activities and steps

- Requirements engineering
- Design and architecture
- Implementation
- Verification and Validation
- Deployment and Maintenance

More on these activities and steps.

How to organize these steps in traditional and agile software development processes?