CS 4530: Fundamentals of Software Engineering Lesson 2.1 Three Scales of Design: Introduction

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Outline of this week's lessons

- Design as a way of communicating

- Three Scales of Design
  - The Architectural Level
  - The Interaction Scale ("Design Patterns")
  - The Object Scale (UML, etc.)

Learning Goals for this Lesson

- At the end of this lesson, you should be able to
  - explain why design is important
  - identify three different scales of design
  - for each of the scales:
    - be able to give examples of vocabulary words at each scale

Overall question:
How to explain some mass of code

- A Design is an Explanation
  - of what?
  - for whom?
  - what gets added to the code?
  - what gets left out?

Explain to whom?

- Software systems must be comprehensible by humans

- Which humans?
    - The other members of your team
    - The folks who will maintain and modify your system
    - Management
    - Your clients
    - and …
    - You, a week from now or 6 weeks from now

A Design is more than code

- Design is about how your code relates to the real world
- Design is about the organization of the code
- Design is about the relationships between different pieces of the code
- So: you need a different language to talk about your design

Remember Principle #2: Make Your Data Mean Something!

Communication Requires a Shared Vocabulary

- You and your teammates need to have a common understanding of the things in your program.
  - What are the "things"
  - What are their names?
  - What do they represent?
  - How do they interact?

A Design is Less Than the Code

- An explanation is always a map of the code

- Just like a map, it may have more detail or less, depending on the audience and the goal
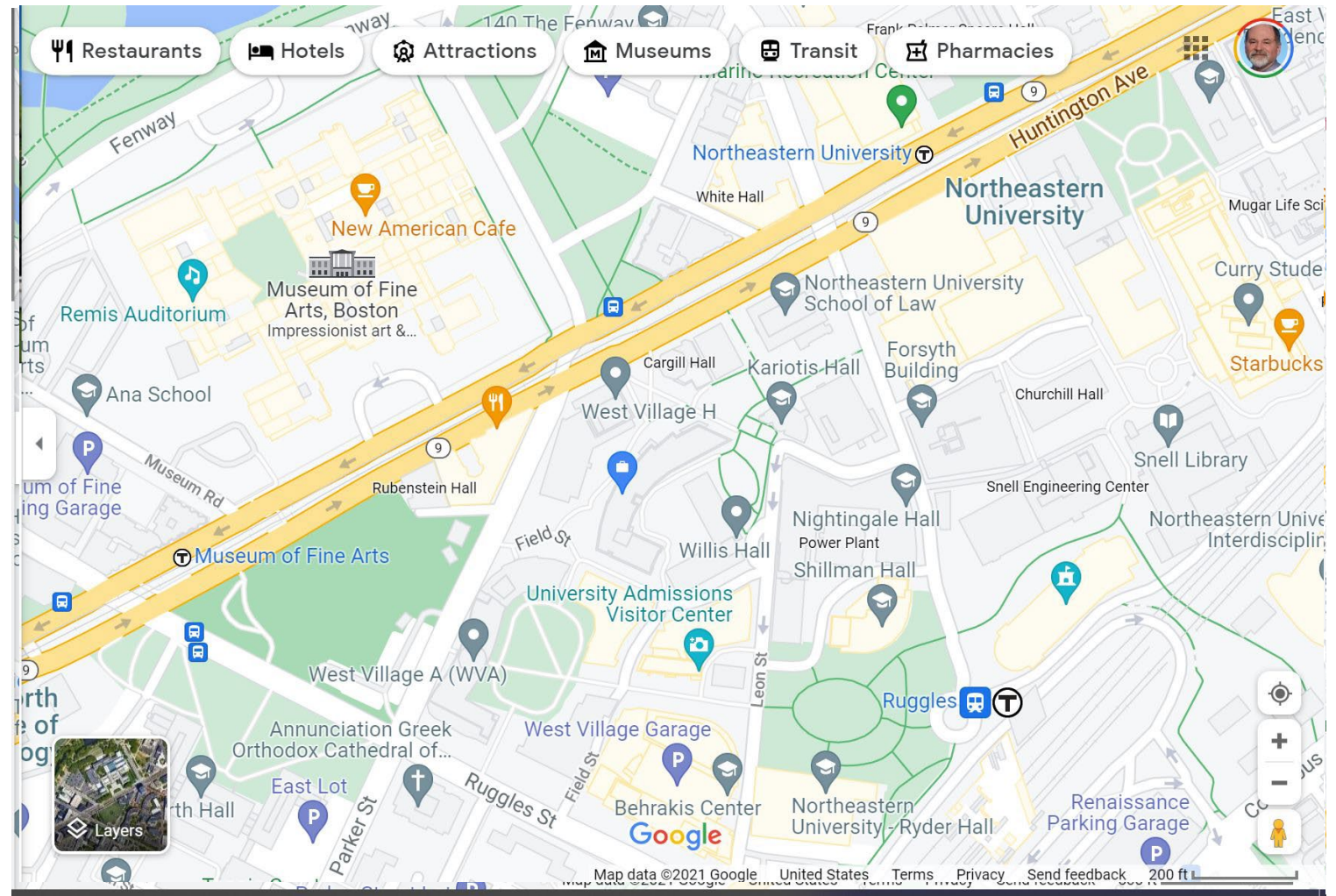
The Three Scales of Design

The Architectural Scale

- key questions: what are the pieces? how do they fit together to form a coherent whole?
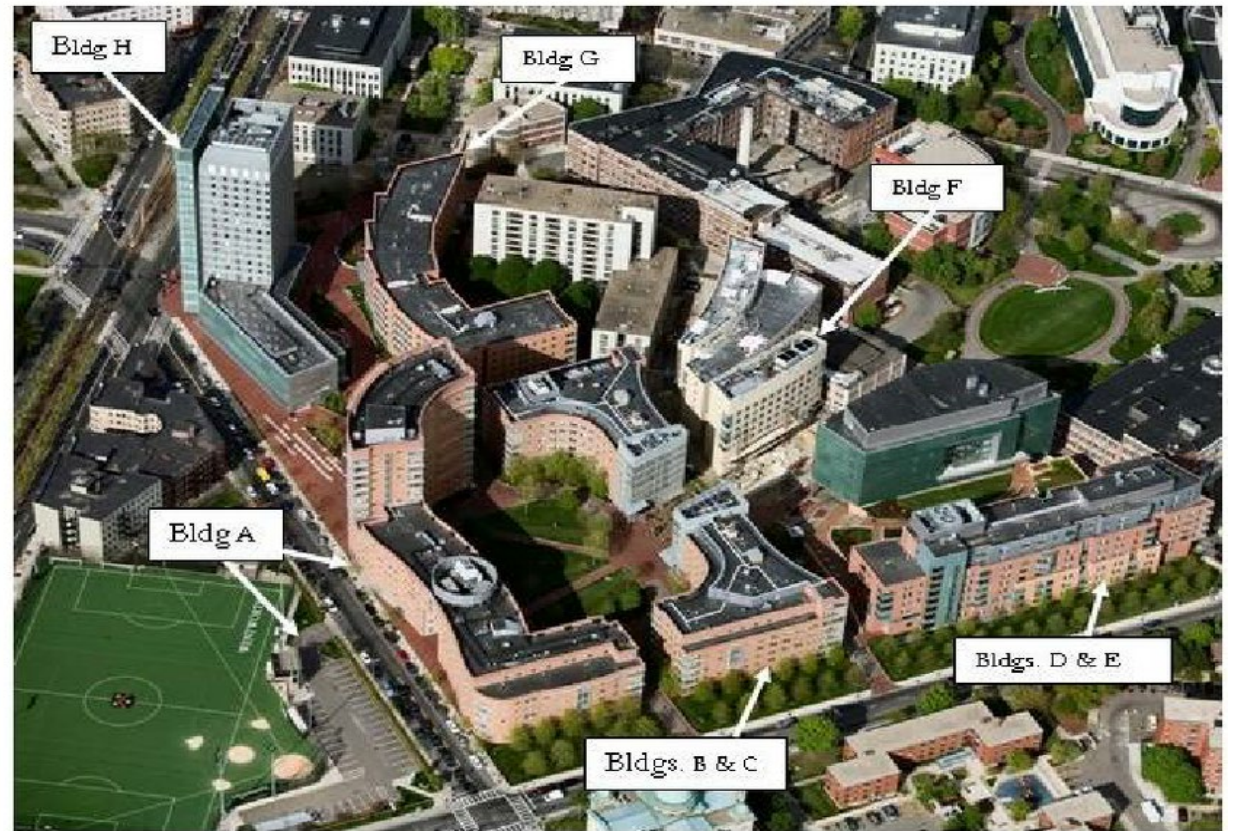
The Interaction Scale

- key questions: how do the pieces interact? how are they related?

The Object Scale

- key questions: what is in each piece? how does each piece communicate with other pieces?
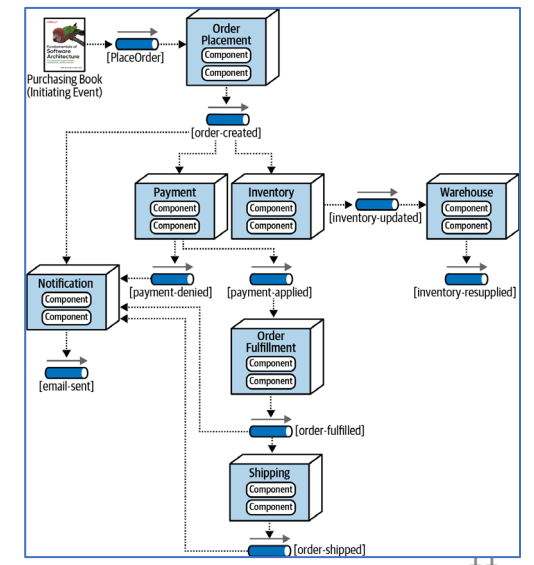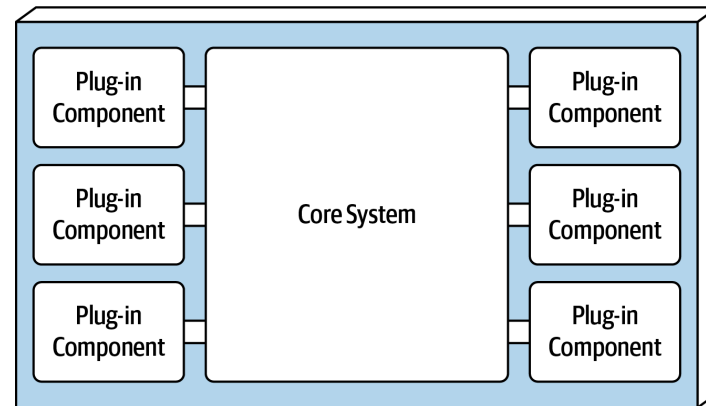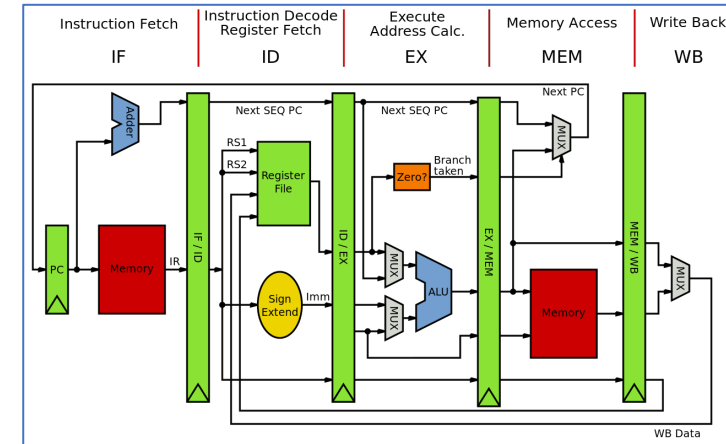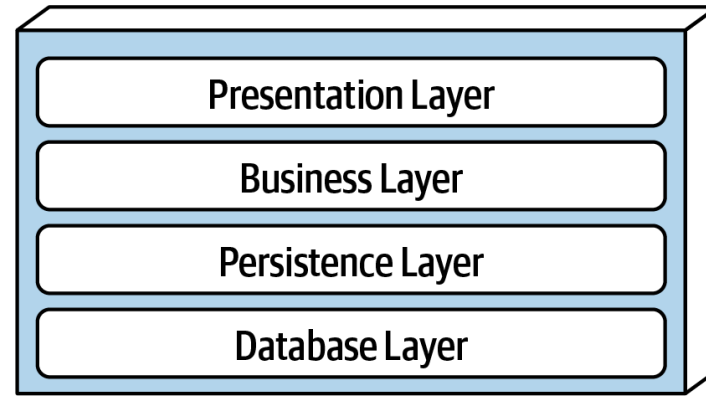
The Architectural Scale

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The Architectural Scale: Examples of Architectural Styles

- Object-oriented

- Layered

- Pipeline

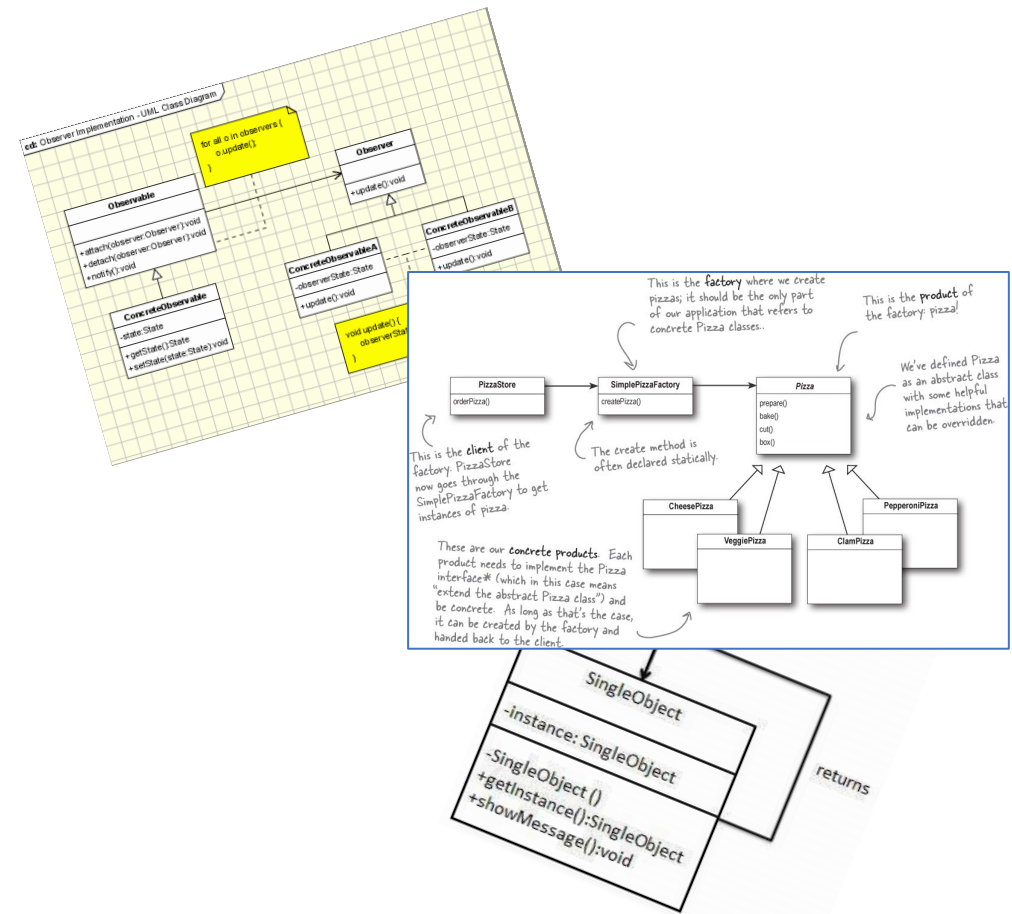- Microkernel

- Event-Driven

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The Interaction Scale

- Key question: how do the pieces interact?
- We have names for some of the possible ways.
- A few of them are canonized as "Design Patterns".
- But the others are just as valid; we'll call them by names that people are likely to recognize.

The Interaction Scale: Examples

- Observer Pattern

- Factory Pattern

- Singleton pattern

The Object Scale

- key questions: what is in each piece? What names does each piece use to communicate the with other pieces?

- An abstraction of the actual code (vs of the world)

- Choose what details to include

- Languages for recording object-scale design
  - UML diagrams
  - CRC cards
  - Javadoc, etc.

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