CSE 583

Software Engineering for Data Scientists
Software Design

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Please Sit With Your Team Members

- Choose one member who has a word processor running on their computer
  - MS Word, Libre Office, Google Docs

Software Design

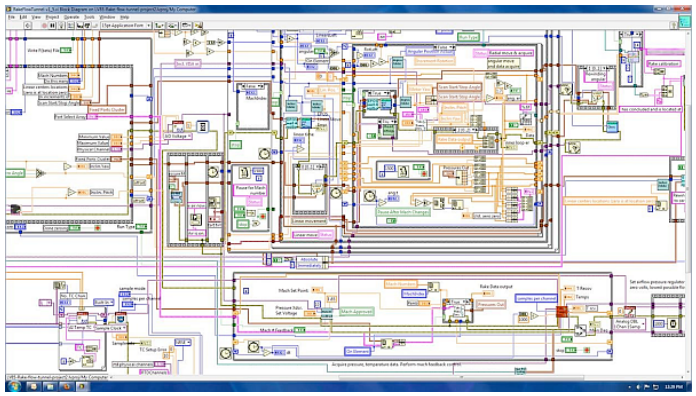
"...specification of a software artifact, intended to accomplish goals, using a set of primitive components ..." [wikipedia]

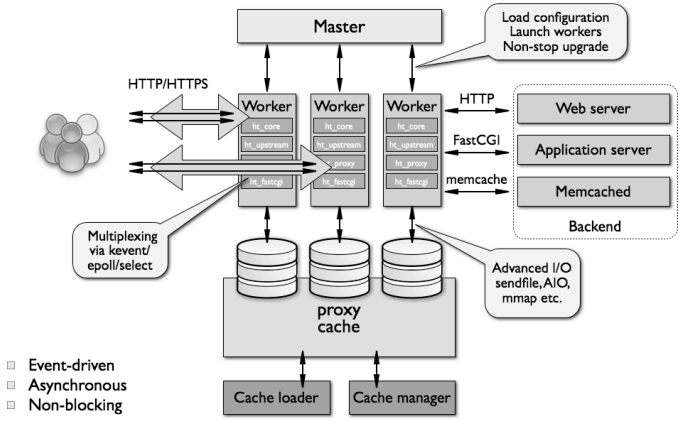
Class Timeline

- Team reports
- Lecture
  - Design: why & how
  - Use cases
  - Component specification
- Breakout - Team component specification

Design: Why & How

What Makes A Design Understandable?





- Few components with clear roles
  - Use abstraction hierarchies
- Few interactions between components
  - Carefully choose the features and interfaces
- Similarity with other designs
  - Use design patterns

Benefits of a Software Design

- Provides a systematic approach to a complex problem
- Finds bugs before you code
- Enables many people to work in parallel
- Promotes testability

Steps in Design

1. **Functional design**:
   - Describe what the system does (use cases)
2. **Component design**: Specify the components
   - Each use case has a "Top level" component.
   - Sub-components implements portions of the use case
     - Ideally want many components that are common across use cases

Iterate. Iterate. Iterate.

Functional Design

Running Example: Design of ATM

What Do We Do With ATMs?

- Get cash
- Deposit checks
- Check balances

- These are examples of ***Use Cases***.
- Implied use case – User authentication.

Describing a Use Case

- What information the user provides
  - E.g., command entered with its options
- What responses the system provides
  - E.g., prompts, plots, error messages

Authenticate User Use Case

User: Put ATM card in reader
ATM: Display 'Enter PIN'
User: Enters PIN on keyboard
ATM: [if correct] Show main menu
[if incorrect] Display 'Enter PIN'

Component Design

Specification of Components

- Describe components with sufficient detail so that someone with modest knowledge of the project can implement the code for the component.
  - Name
  - What it does
  - Inputs (with type information)
  - Outputs (with type information)
  - Interactions - how use other components

Developing Component Specifications

1. What are the components in the use cases?
2. What components are already available?
3. What are the sub-components needed to implement those components that aren't already available?

   Do 1-2 for each such component

Example Component Specification
Find Primes < N

- Name
  - `FindPrimes`
- What it does:
  - Finds the primes that are less than *N*
- Inputs (with type information)
  - *N*, an integer
- Outputs (with type information)
  - List of integers

ATM Components by Use Case

- Authenticate user
  - Database with user PIN
  - User interface that reads ATM card
  - User interface that reads user PIN
  - Control logic
- Get cash
  - Database with users cash balance
  - User interface that reads user cash requested
  - Cash drawer interface that dispenses cash
  - Control logic

Breakout

- Your charter: Design for Authenticate User
  - List of components of their interactions
    - Who calls whom for each step in the use case
  - Component(s) design using the design template
- What you'll report: Very brief
  - Summary of design
  - Issues, open questions

Breakout: Component Specification

Team Reports

- What we designed
- Issues encountered
- How operate differently