Introduction to CS580

CS580 Advanced Software Engineering
http://cs580.yusun.io
September 29, 2014

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CAL POLY POMONA

About Myself

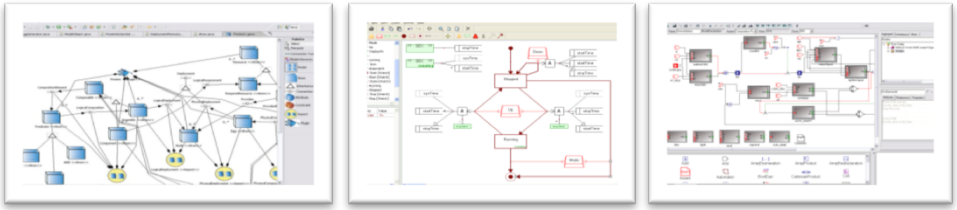
PhD in Software Engineering

- Ph.D. Research in Software Engineering & Software Modeling
- University of Alabama at Birmingham

Problem Domains

Represent the System

Domain-Specific Modeling Languages

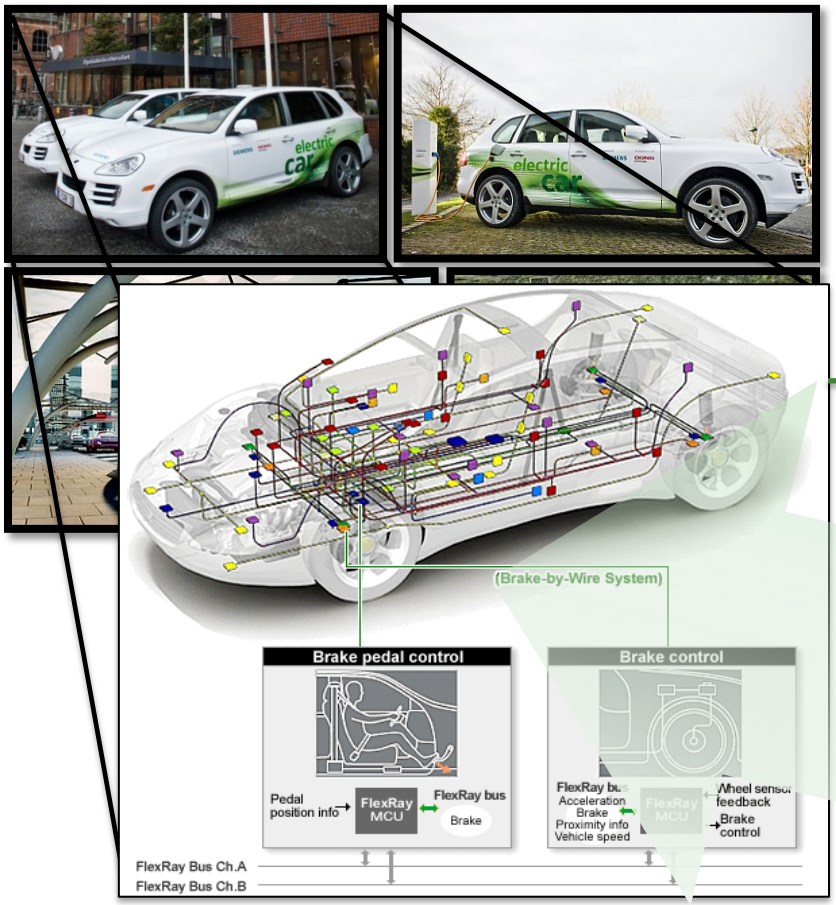


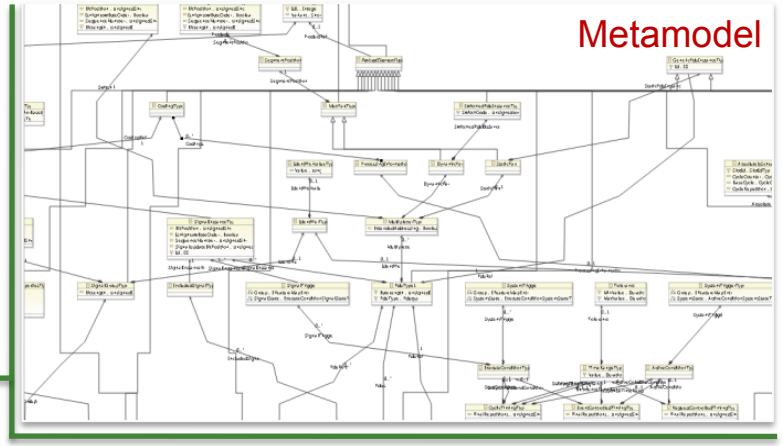
Generate the Code

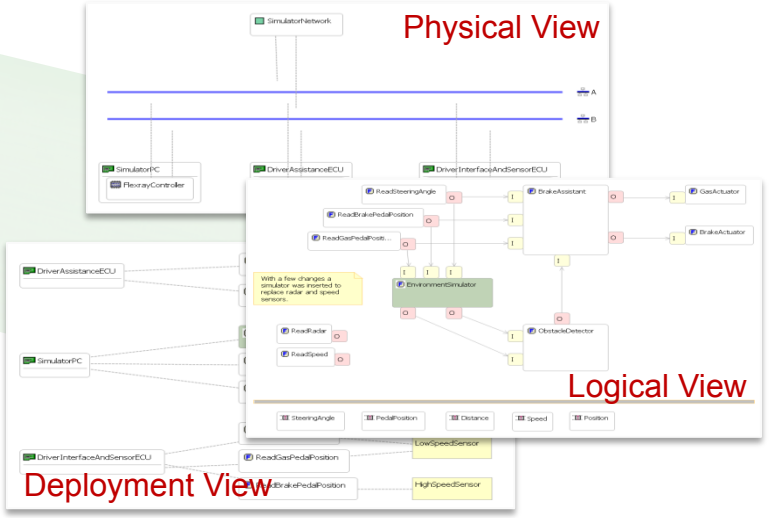
Low-Level Software Artifacts

Embedded Software Systems

SIEMENS

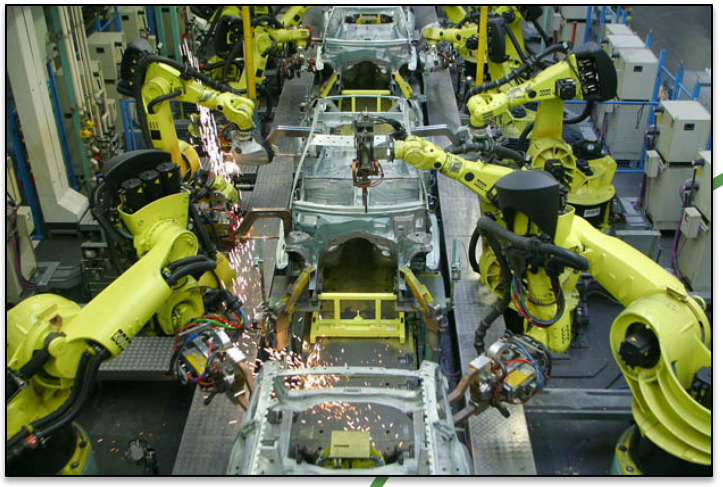




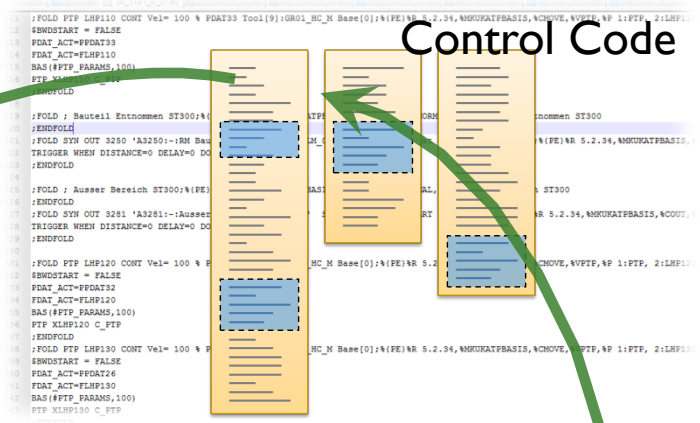


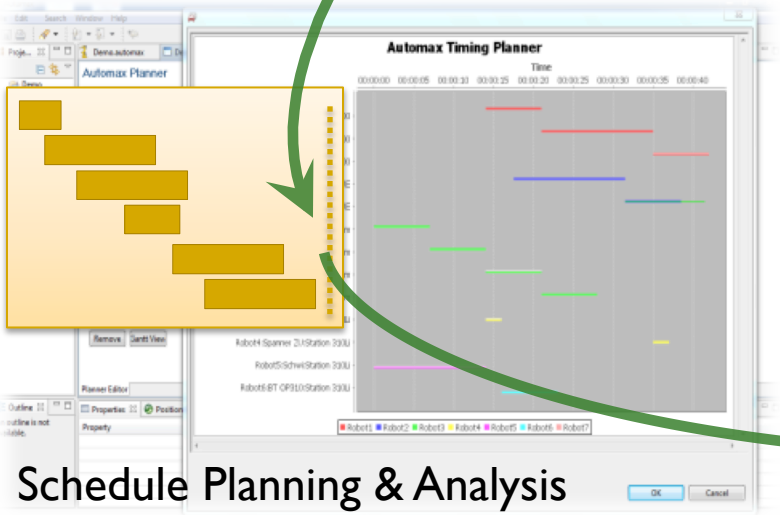
Embedded Software Systems

Mercedes-Benz

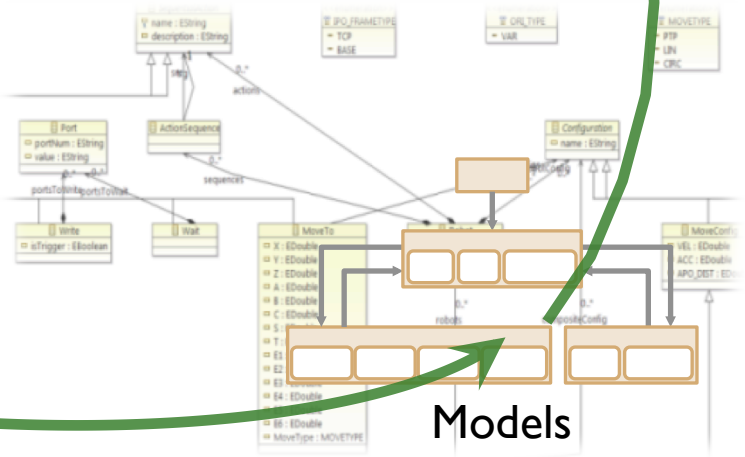


Control Code





Schedule Planning & Analysis



Models

Software Engineer in Amazon

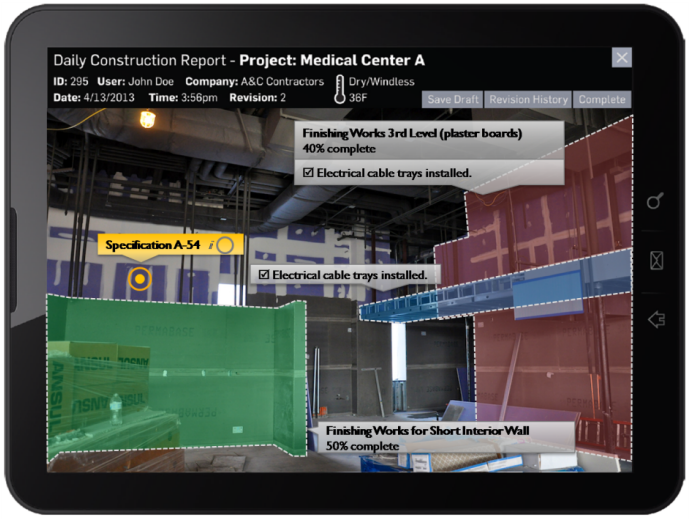
- Amazon Silk
- Cloud-Based Web Browser for Amazon Kindle Devices

Cloud-based Mobile Software Systems

amazon web services™

Director of Engineering in Startup

PAR works
An Allied Minds Company

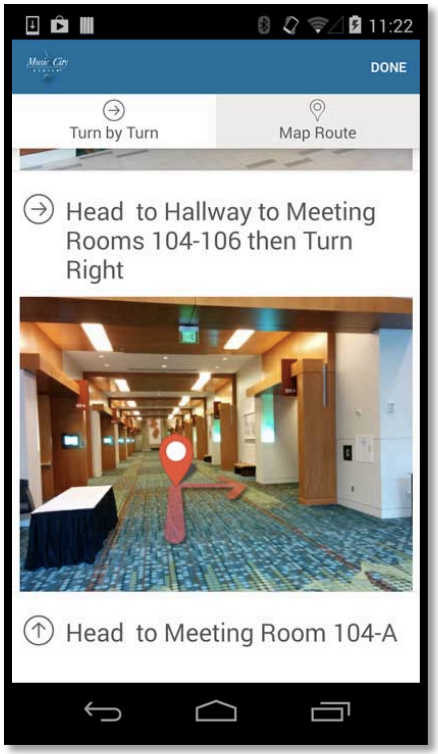


Mobile Augmented Reality

- For more info and demos: http://www.cloudpoint.io/

Post-doc in “ISIS”

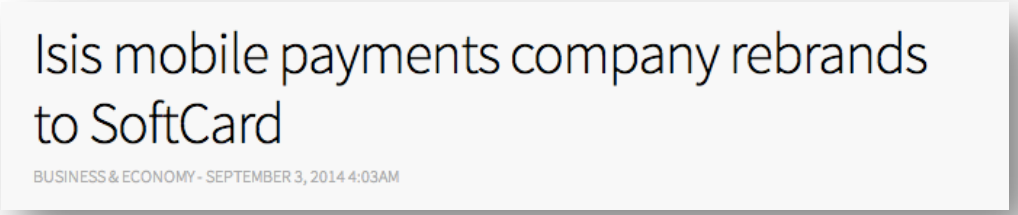
- **Institute for Software Integrated Systems (ISIS)**
- **Vanderbilt University**



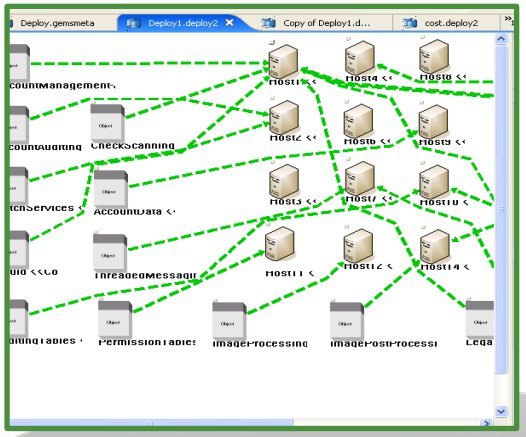
- Indoor Navigation System
- http://zii.io

Post-doc in “ISIS”

- Software Integrated Systems Institute (SISI)
- IS^2
- The Institute for Software Integrated Systems (Thesis)
- Institute of Software (IS)



Summary of My Research Area



Software Engineering -
Model-Driven Engineering/
End-User Programming

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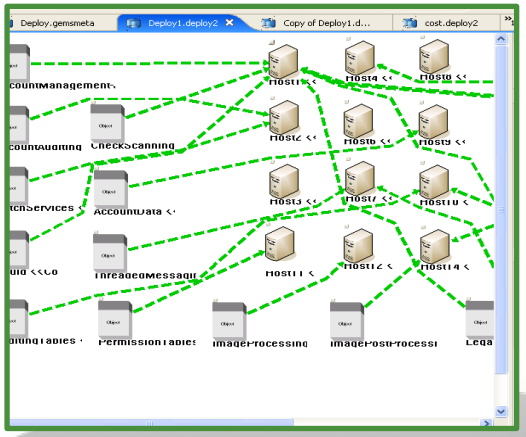

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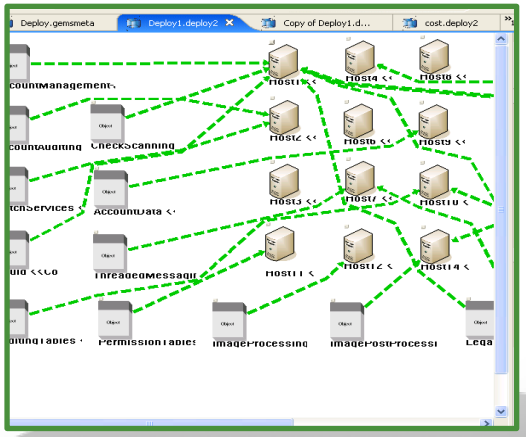
Optimization/Application

Summary of My Research Area



Software Engineering -
Model-Driven Engineering/
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Cloud Computing –
Optimization/Application

Mobile Computing –
Augmented Reality/
Any Cool Applications

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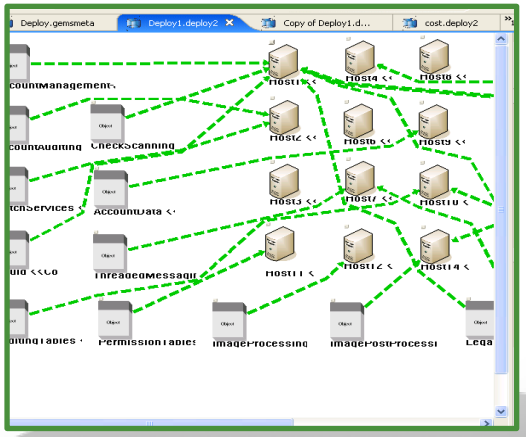


Cloud Computing –
Optimization/Application

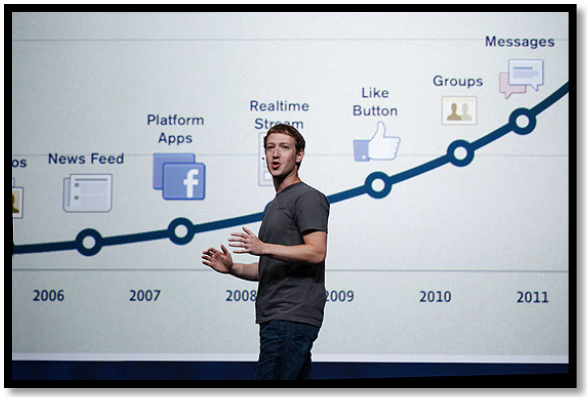
Software Engineering -
Model-Driven Engineering/
End-User Programming

Mobile Computing –
Augmented Reality/
Any Cool Applications

My work focuses on using **modeling**, **optimization**, **automation & cloud services** to deal with the complexity of domain-specific problems.

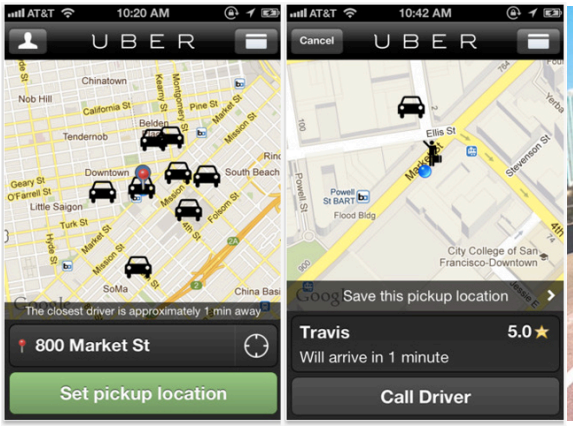
Fast Growing Software Industry

Fast Growing Software Industry



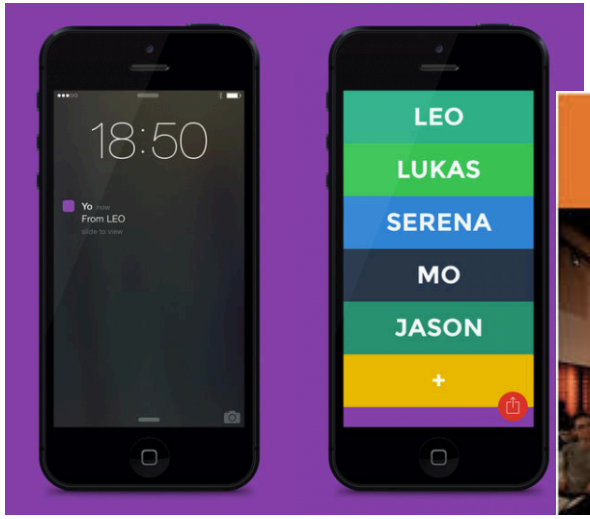
- NASDAQ Composite

Fast Growing Software Industry - Startups



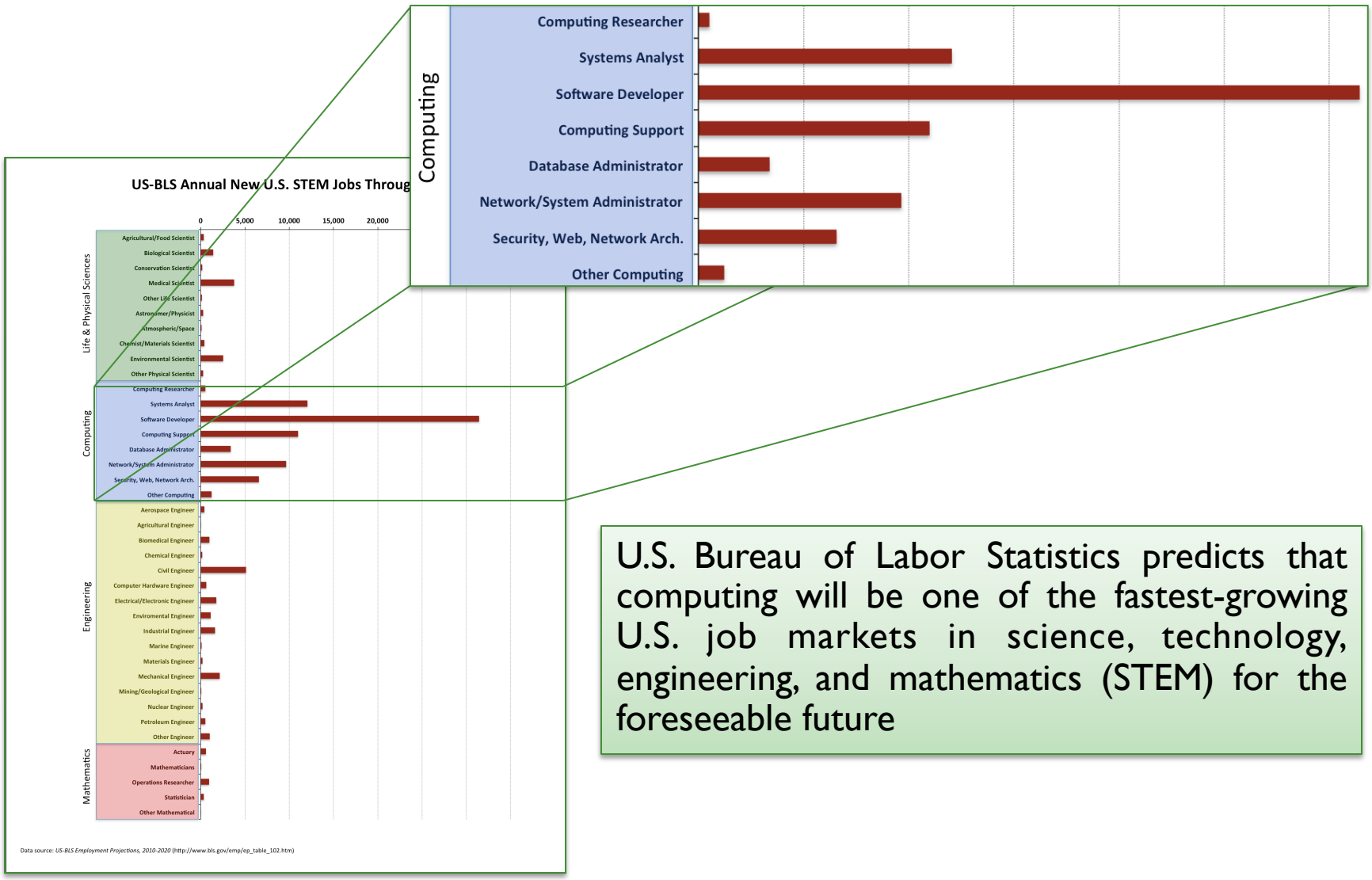
Dropbox

$19 BILLION



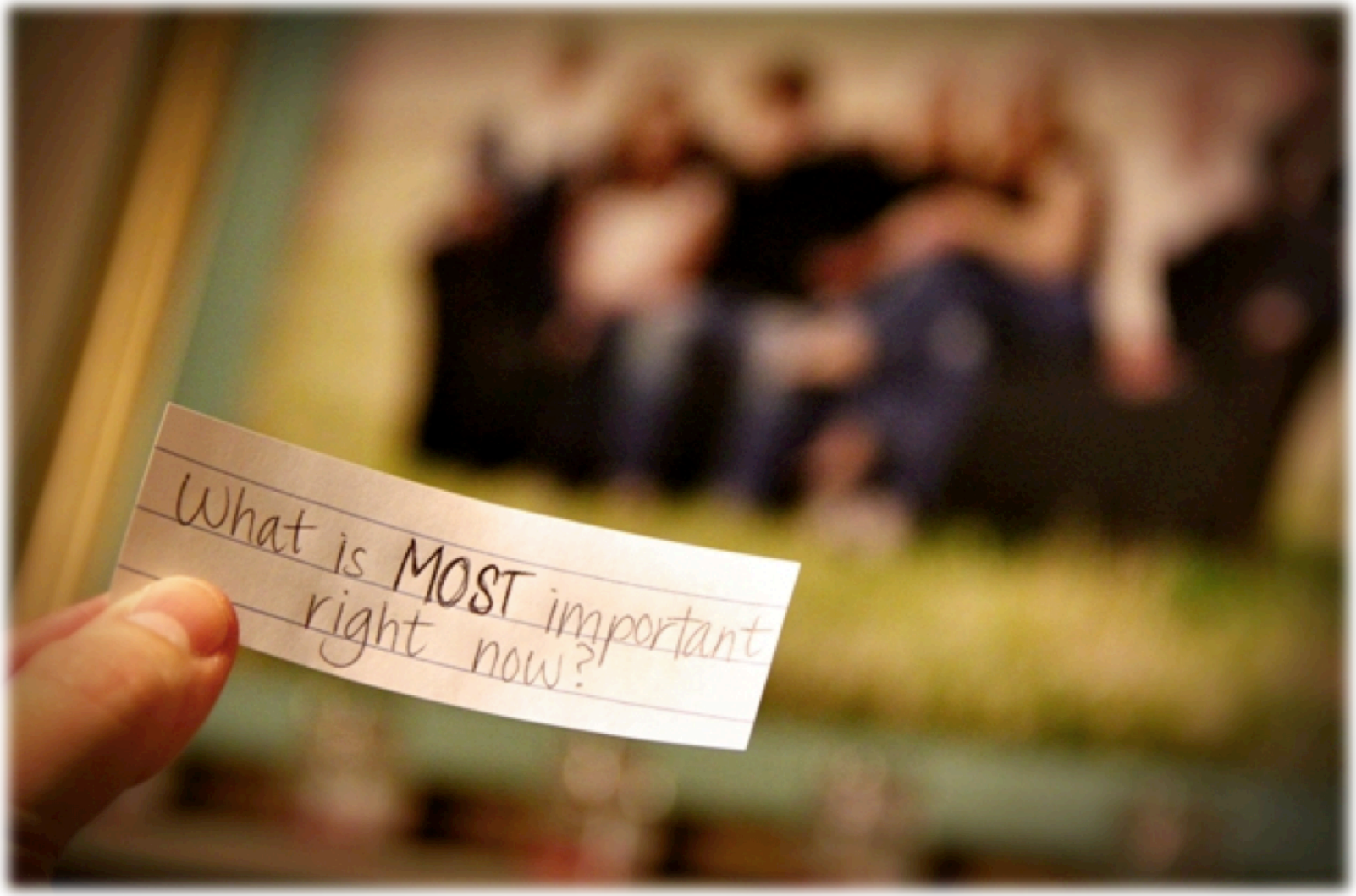
Y Combinator

Software Job Market

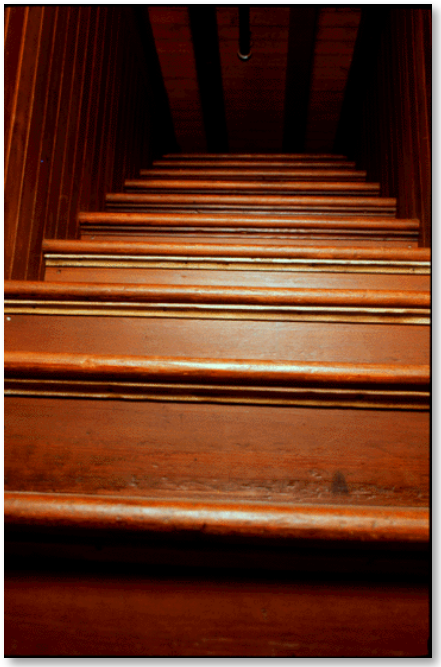


U.S. Bureau of Labor Statistics predicts that computing will be one of the fastest-growing U.S. job markets in science, technology, engineering, and mathematics (STEM) for the foreseeable future

Why is SE so important?

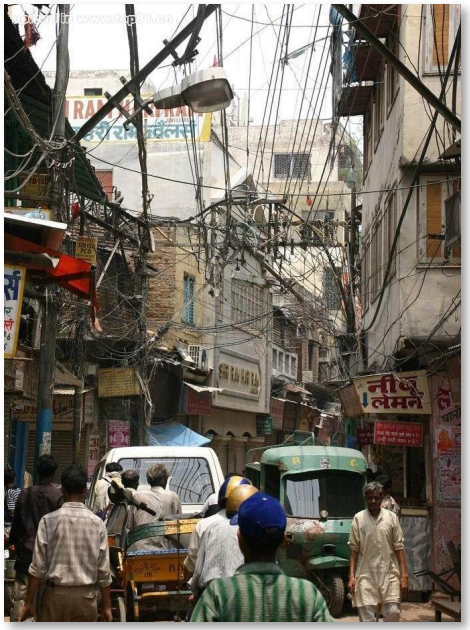


Poor Engineering Leads to Ad-hoc Structures



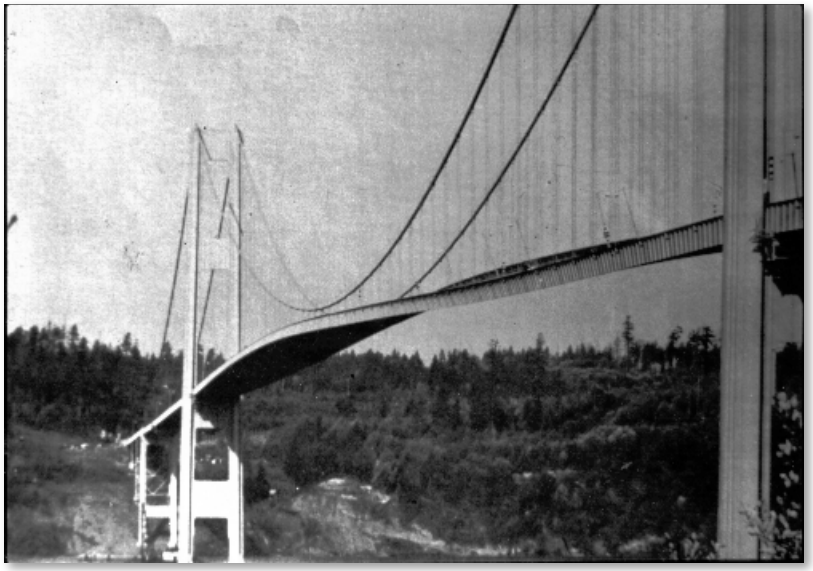
- Winchester Mystery House
  - The result of continuous building without any thought toward design
- Result:
  - Stairs leading to ceiling
  - Windows in the middle of room
  - Doors opening to wall
  - Non-intuitive floor plan

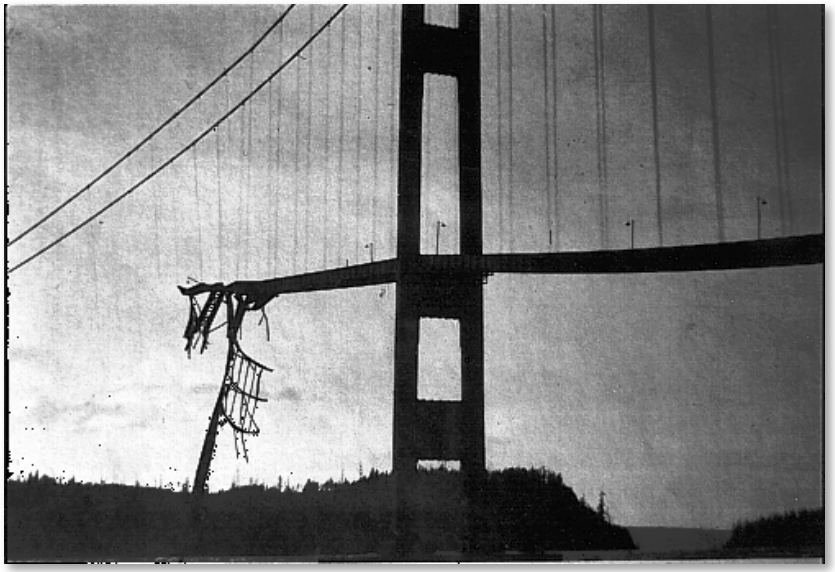
Poor Engineering Leads to Ad-hoc Structures



- The result of continuous building without any thought toward design
- Problems:
  - How would you maintain this if something went wrong?
  - How would you extend this to add more connections or features?

Poor Engineering Has Disastrous Consequences



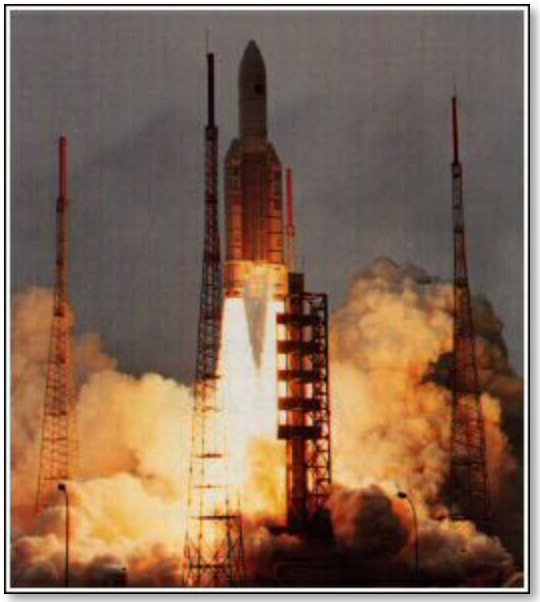


Tacoma Narrows Bridge (July 1, 1940)

Aerodynamic phenomena in suspension bridges were not adequately understood in the profession nor had they been addressed in this design. New research was necessary to understand and predict these forces.

The remains, located on the bottom of the Sound, are a permanent record of man's capacity to build structures without fully understanding the implications of the design.

Poor Engineering Has Disastrous Consequences

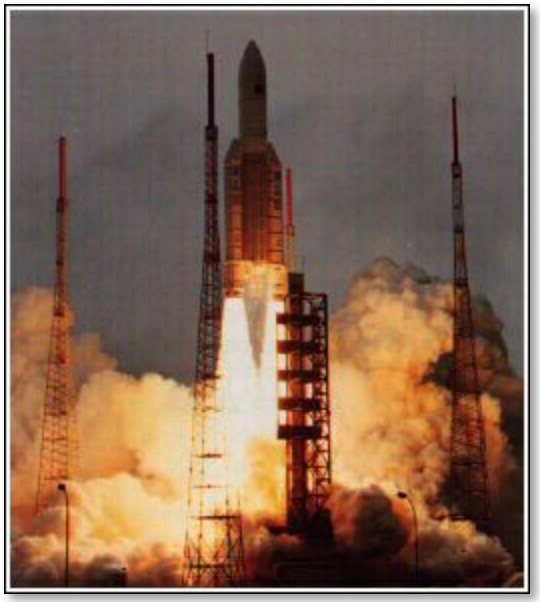


$7 Billion Fire Works – One Bug, One Crash

On 4 June 1996, the maiden flight of the Ariane 5 launcher ended in a failure. Only about 40 seconds after initiation of the flight sequence, at an altitude of about 3700 m, the launcher veered off its flight path, broke up and exploded.

The failure of the Ariane 501 was caused by the complete loss of guidance and attitude information 37 seconds after start of the main engine ignition sequence (30 seconds after lift-off). This loss of information was due to specification and design errors in the software of the inertial reference system.

Poor Engineering Has Disastrous Consequences



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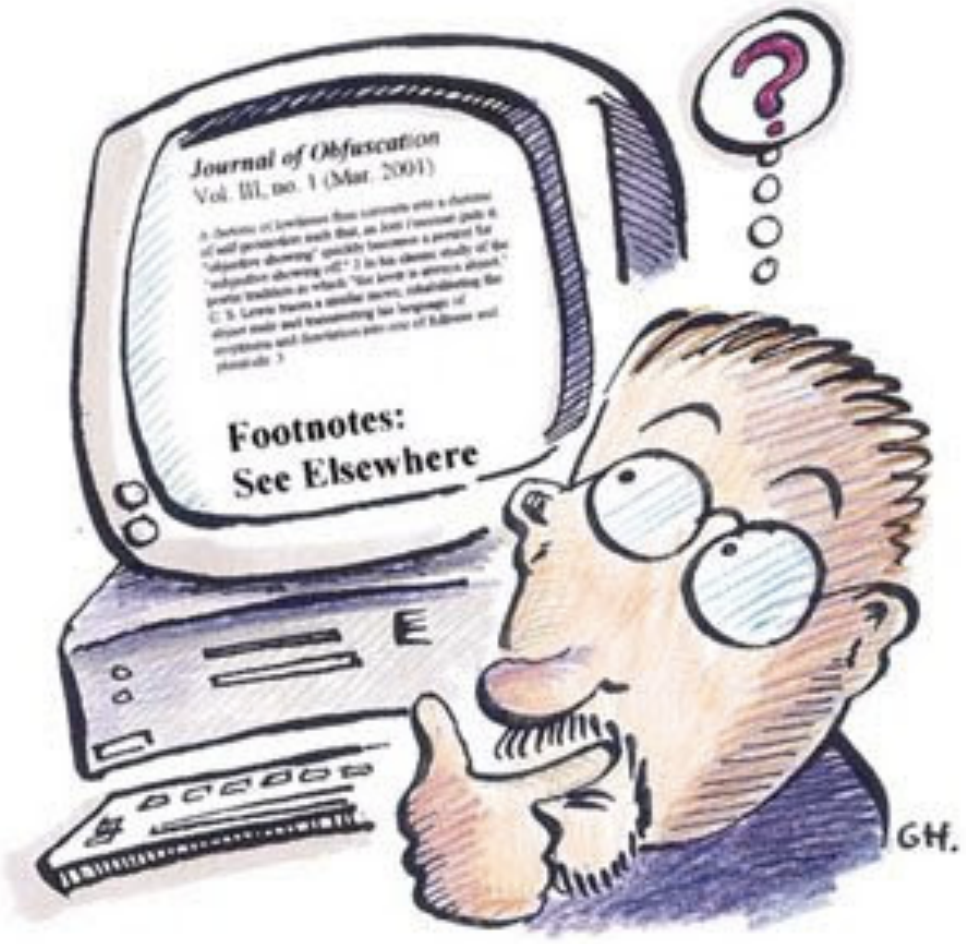
"The internal SRI software exception was caused during execution of a data conversion from 64-bit floating point to 16-bit signed integer value. The floating point number which was converted had a value greater than what could be represented by a 16-bit signed integer. This resulted in an Operand Error. The data conversion instructions (in Ada code) were not protected from causing an Operand Error, although other conversions of comparable variables in the same place in the code were protected."

What is SE?


Journal of Obfuscation
Vol. III, no. 1 (Mar. 2001)
Footnotes:
See Elsewhere
GH.

1968: Birth of Software Engineering

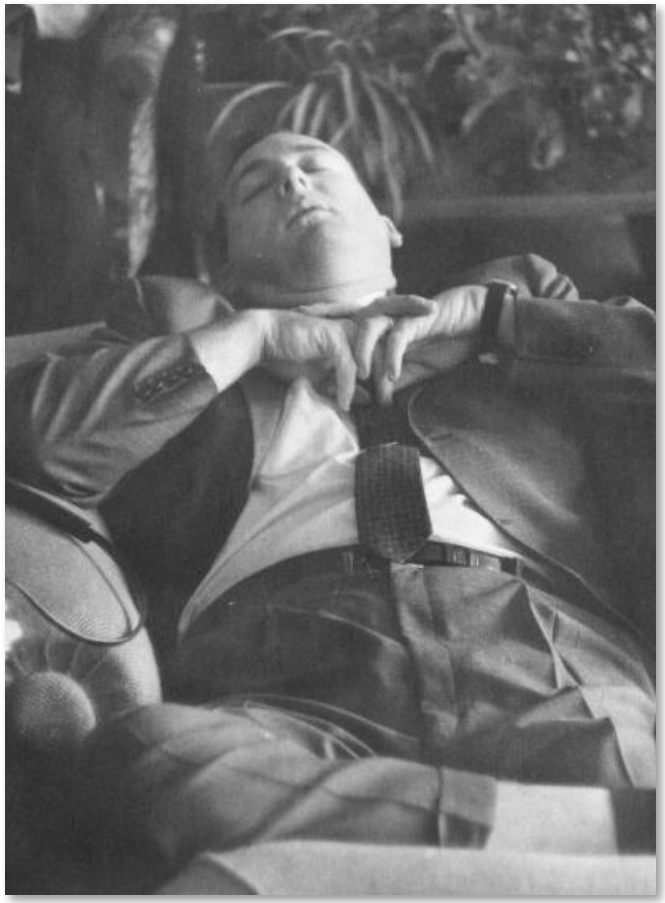
- NATO Software Engineering Conference 1968
- "The phrase 'software engineering' was deliberately chosen as being provocative, in implying the need for software manufacture to be based on the types of theoretical founda
  traditional in the
  [Naur and Randell
- Purpose:
  - Shed light on
    engineering
  - Discuss possible
    which might lead

First Software Reuse Paper

- "Software components (routines), to be widely applicable to different machines and users, should be available in families arranged according to precision, robustness, generality and time-space performance." – [McIllroy, 1968

Tiring Conference

- The conference must have been tiring…



Basic Definitions of SE

- "Software engineering is a discipline whose aim is the production of fault-free software, delivered on time and within budget, which satisfies the users needs." – [Schach]

- "(1) The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software. (2) The study of approaches as in (1)." [IEEE Computer Society]

What's SE in Practice?

A Typical Software Development Cycle

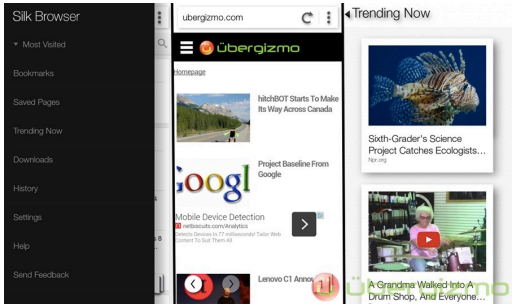
2011/9 Kindle Fire

2012/9 Kindle Fire HD

2014/6 Fire Phone

Silk Browser 1.0

Silk Browser 2.0



Silk Browser 3.0

Collect the Requirements

- Make it faster
- Private browsing mode
- Reading mode
- Trending web pages
- Easy to share/save pages
- Cooler UI
- … …

Prioritize and Finalize the Features

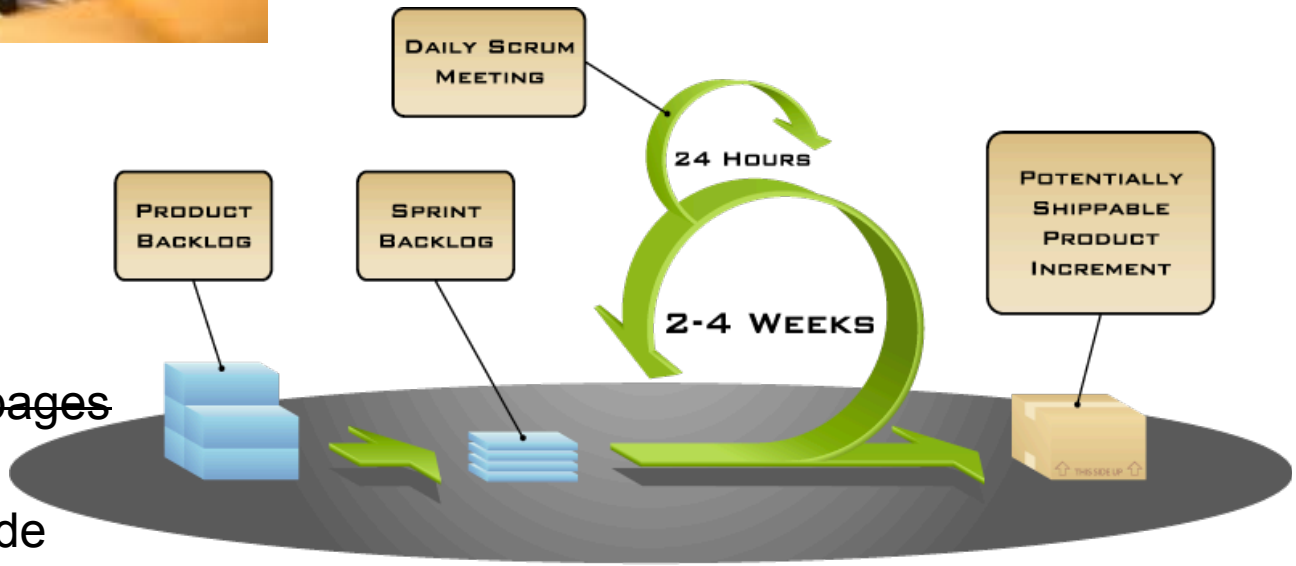
Team Meeting (Business)

- Make it faster
- Reading mode
- Trending web pages
- ~~Easy to share/save pages~~
- Cooler UI
- Private browsing mode
- … …

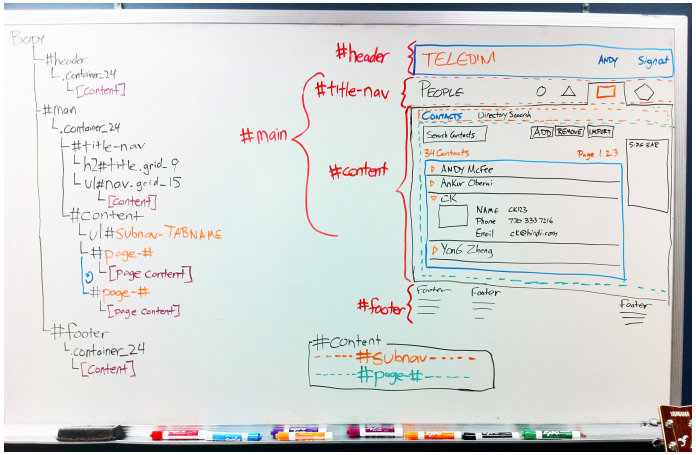
Dev Planning Meeting

Agile Development

- Make it faster
- Reading mode
- Trending web pages
- ~~Easy to share/save pages~~
- Cooler UI
- Private browsing mode
- … …

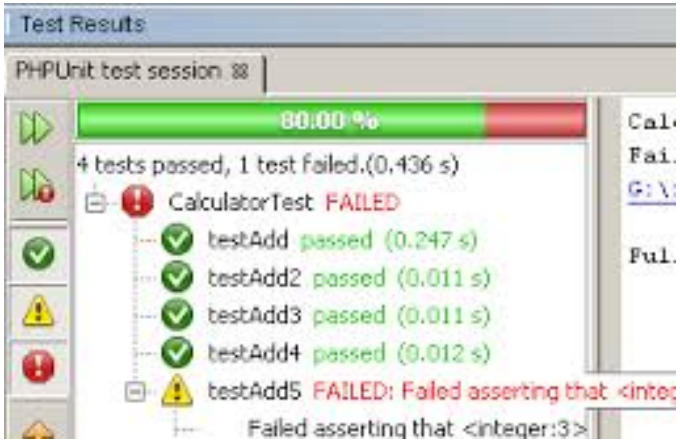


Make the Code Change

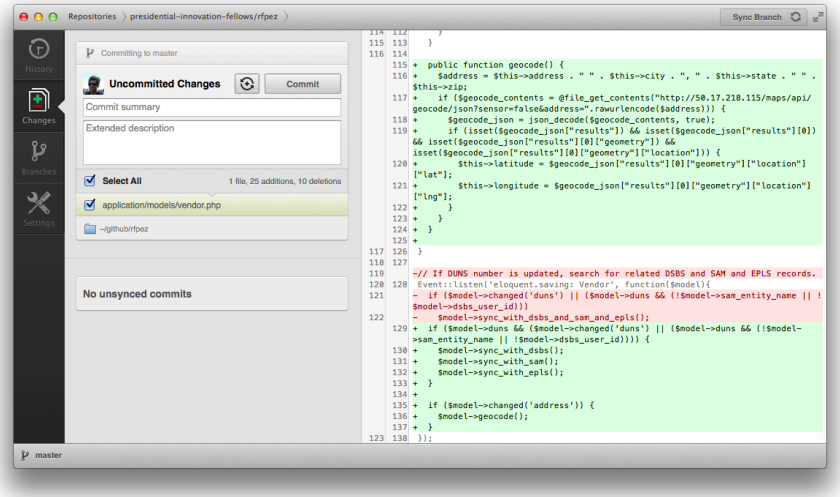


- Design

- Implementation

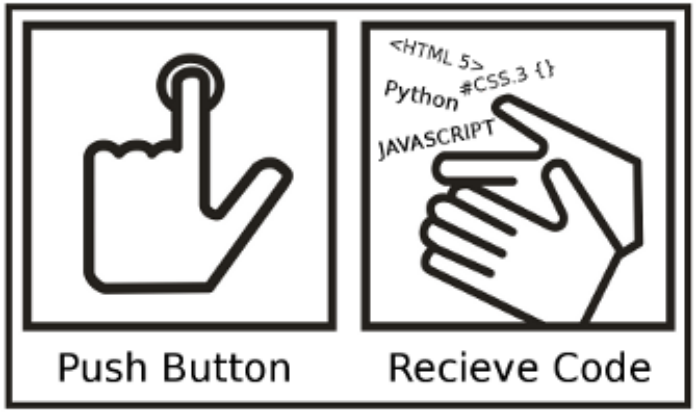


- Testing



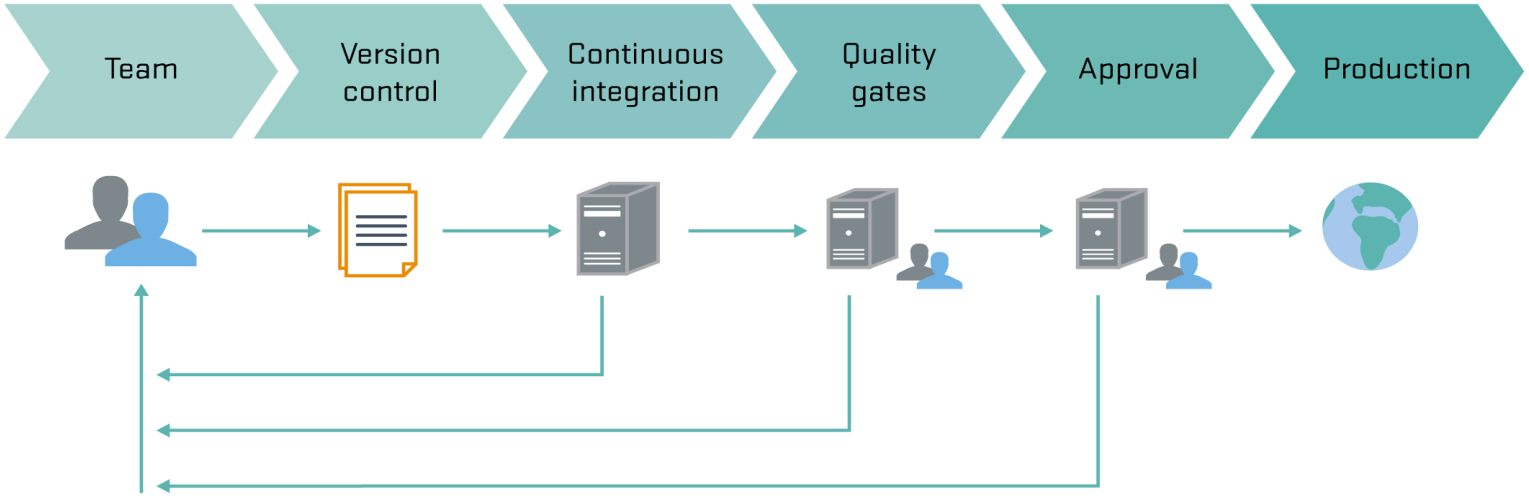
- Code Review

Make the Change Available to Customers

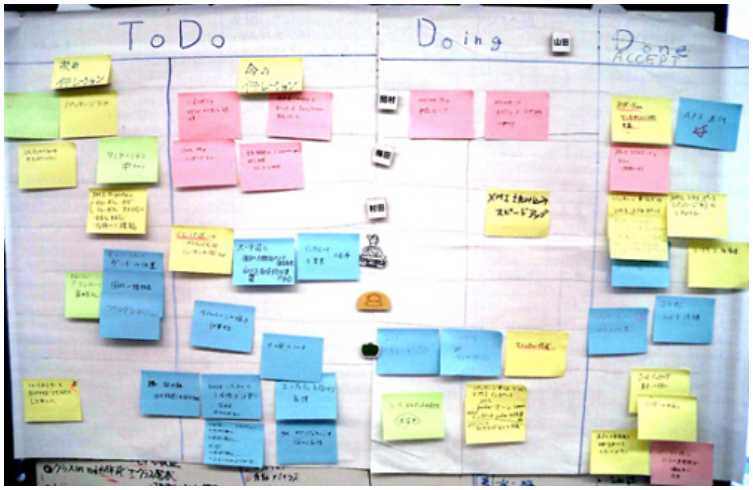


- Push the Change

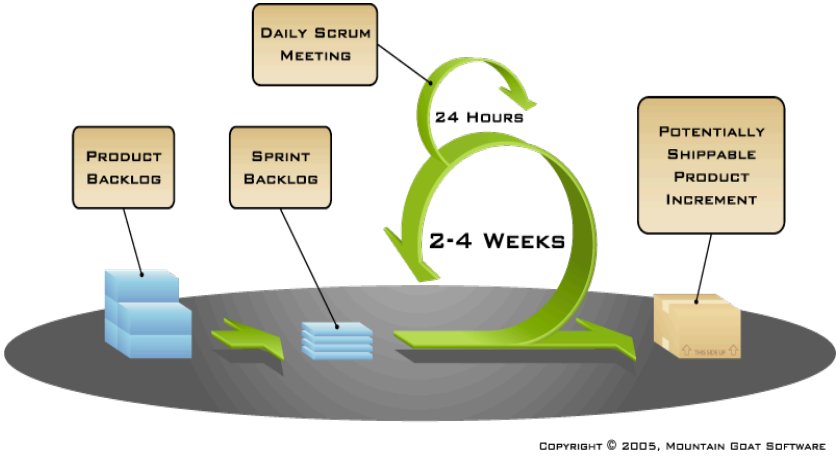
- Build & Deploy



Track the Development Progress

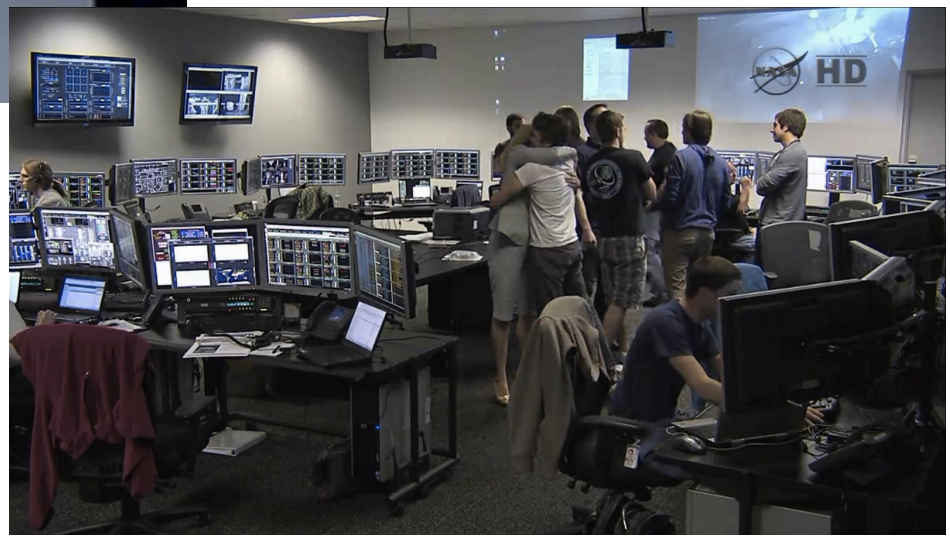


- Daily Scrum



- Sprint Meeting

Product Release

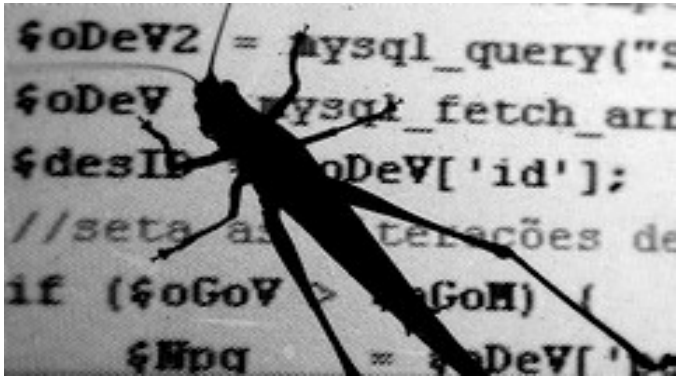


No Ending – A Lot More To Do

- Monitoring

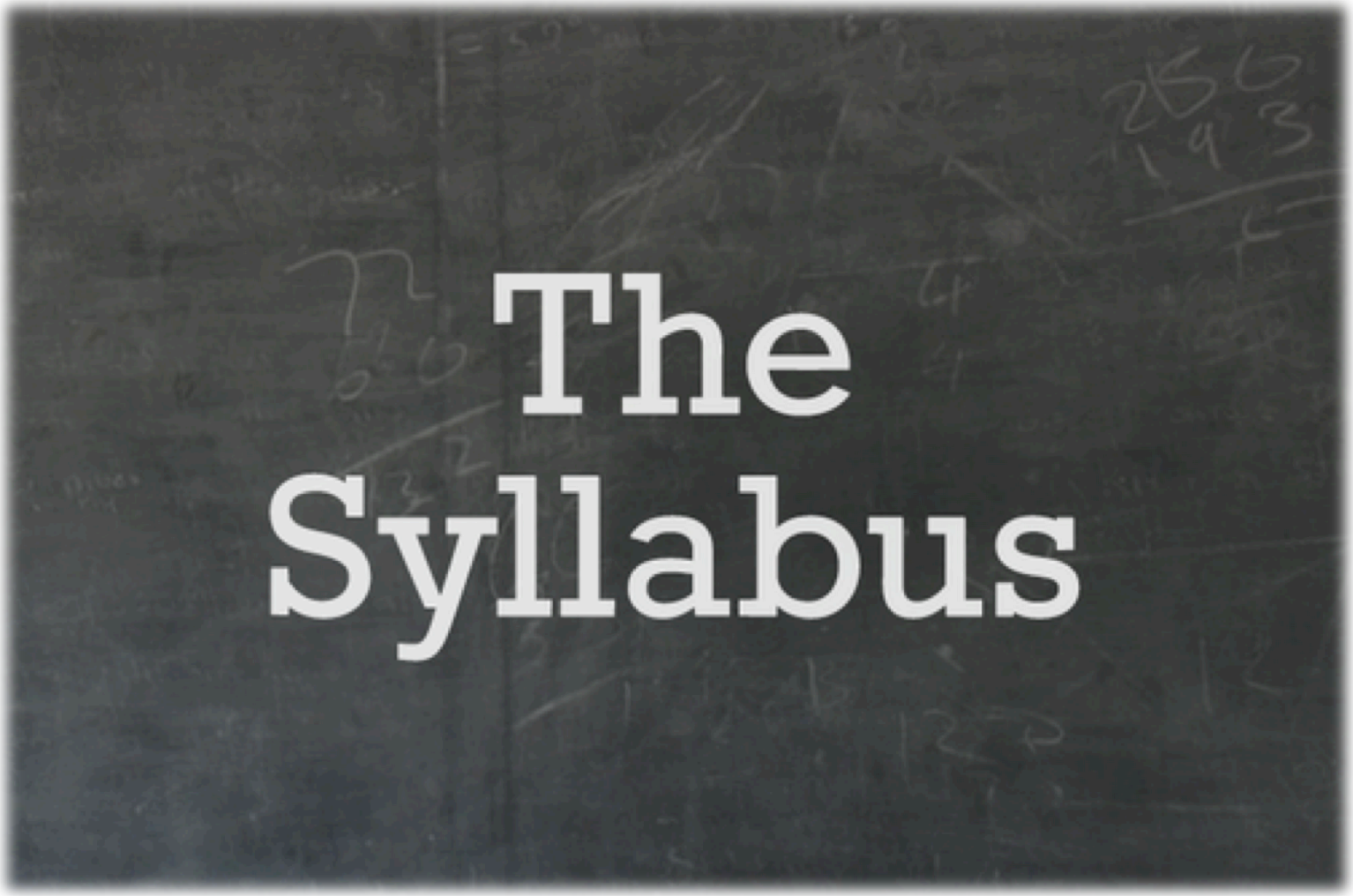
- Maintenance

- Bug Fixes



- Next Release

About CS580



Goals

- Be ready for a Software Engineer
  - Learn the right skills
  - Gain practical experiences
  - Help you get the job
- Be ready for a SE Researcher
  - Learn the key SE research areas
  - Develop your research interests
  - Help you apply PhD or research positions

Topics to Cover in CS580

SE Practice	SE Special Topics
Requirements Analysis	SE Overview
Design	No Silver Bullet
Coding	Modularization
Version Control	Transparency
Code Review	Frameworks
Build	Refactoring
Deployment	SE & Cloud Computing
Maintenance	SE Job Interviews

Course Project – Overview

- iPhotoWeb
- Photo Management / Processing / Following
- Individual Project (10 Assignments)

Course Project – Hands-on Experience

SE Practice	SE Special Topics
Requirements Analysis	SE Overview
Design	No Silver Bullet
Coding	Modularization
Version Control	Transparency
Code Review	Frameworks
Build	Refactoring
Deployment	SE & Cloud Computing
Maintenance	SE Job Interviews

Course Project – Things to Know

- Java (Required)
- Web Services (Helpful to know)
  - HTTP
  - Java Servlet
  - Spring Framework
    - http://spring.io/
  - Spring Boot
    - http://projects.spring.io/spring-boot/
  - MOOC Course
    - Programming Cloud Services for Android Handheld Systems
    - https://class.coursera.org/mobilecloud-001

Course Project – Points & Rewards

- Total score (10 assignment): 100
- Each assignment: 5 – 25

- Project Rewards:
  - Extensible design (10)
  - Clean code (10)
  - Top tester (10)
  - Best performance (10)
  - Move fast (10)
  - ……

TODO

- Reading Assignment
  - [Brooks86] Fred P. Brooks. (1986). "No Silver Bullet — Essence and Accident in Software Engineering". Proceedings of the IFIP Tenth World Computing Conference: 1069-1076.
- Assignment 1
  - http://cs580.yusun.io/assignments/Assignment1.pdf
- Bring laptop to class?