# Introduction to Software Engineering

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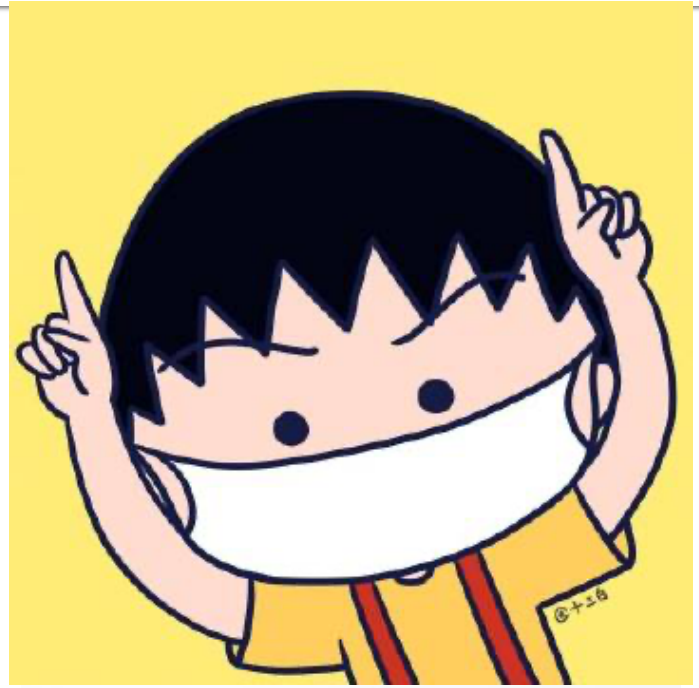
Department of Computer Science and Technology
Tsinghua University, Beijing, China

尚未进入《软件工程2021春》微信群的同学请尽快扫码入群
（两个课堂共用同一个群）

软件工程 2021春

该二维码7天内(3月1日前)有效，重新进入将更新

# 请在教室内佩戴好口罩



**所有学生必须在课堂戴口罩，这是学校疫情防控的统一要求。教室管理、教务、学生管理部门都会检查!**

# 双课堂

**裴丹**，计算机系网络所
研究方向：智能运维

清华大学东主楼9-319
E-mail: peidan@tsinghua.edu.cn
电话： 62792837（办公室）

授课地点： 六教 6A117
授课时间： 每周二第2节
（9:50-12:15）

https://zhumu.me/j/1749680080?pwd=MU1GeFZQMnUybTg3c3BGSi9YTVUrUT09
或输入瞩目会议号： 174 968 0080 会议密码：SE2020

**李丹**，计算机系网络所
研究方向：数据中心网络，网络智能，可信任互联网
清华大学 FIT楼 4-104
E-mail: tolidan@tsinghua.edu.cn
电话：62603060（办公室）

授课地点： 新水327
授课时间： 每周二第2节
（9:50-12:15）

# Grading

- In-class quizs 10%
  - 1%*8 (小测验)
  - 0.5%*4 （工业界分享、大作业展示签到）
- 4 Personal Mini-projects 25%
  - 2% （git)
  - 3% (CI/CD)
  - 8% (后端）
  - 12% （VUE/Android 二选一)
- 1 Team Project 65%

# 课程助教

首席助教：李明杰　（微信号 limjcst）

随堂助教(裴丹课堂)：陈文潇(微信号 Shiro_Shuvi)

随堂助教(李丹课堂)：魏知宇(微信号 MrArtanis)

# 大作业助教和指导教师

| | 题目名称 | 项目来源 | 教师及助教 | 例会时间(周四) |
|---|---|---|---|---|
| PRJ1A | 网络服务接入运营系统 | 华为 | 李丹,田倍闻 | 13:30-15:05 |
| PRJ1B | | | 李丹,蔚兆洋 | |
| PRJ2A | 网红分析师 | 快手 | 李丹,徐易 | 15:20-16:55 |
| PRJ2B | | | 李丹,刘光哲 | |
| PRJ3A | 在线商品交易系统 | 美团 | 李山山,孙迅 | 13:30-15:05 |
| PRJ3B | | | 李山山,成逸然 | |
| PRJ4A | 多人在线协作智能视频剪辑App | 快手 | 李山山,刘畅 | 15:20-16:55 |
| PRJ4B | | | 李山山,牛骁 | |
| PRJ5A | 计算系新系馆会议室预约系统 | 计算机系 | 裴丹,张书宁 | 13:30-15:05 |
| PRJ5B | | | 裴丹,辛杭高 | |
| PRJ6A | 企业通用权限平台 | 快手 | 裴丹,范喆恒 | 15:20-16:55 |
| PRJ6B | | | 裴丹,肖易佳 | |

- 1. 允许跨课堂组队
- 2.各个项目的基本（必做）需求难度大致相当
- 3、感兴趣以后当软工助教的同学，随时可以跟李明杰助教报名，进入候选助教队列。

# 小作业助教

| | 助教 |
|---|---|
| 软工平台SECODER | 王雨田 |
| Git、CI/CD小作业 | 王雨田 |
| VUE前端助教 | 李品农 |
| Android前端助教 | 姚振翮、牛骁、孙迅 |
| 后端小作业 | 蔚兆洋、成逸然 |

# 清华大学计算机系软件系列课程

（1秋）程序设计基础

- ✓ 立足C/C++，回归基础
- ✓ 强化测试意识、调试能力
- ✓ 尽早培养、规范编程风格
- ✓ 多设习题课，促进朋辈学习

（1春）OOP设计基础

- ✓ 培养OO思维，拓展专业视野
- ✓ “小教员+助教”立体辅导
  “自主学习”结合“帮扶带”
- ✓ 平时实践75%作为基础
  上机考试25%体现差异
- ✓ 引入报告环节
  增进课堂互动

（1夏）程序设计训练

- ✓ 课号合并，2夏留白；平行课堂，统一标准
  围绕程序设计训练，各有侧重
- ✓ 语言：QT + Python + Java
- ✓ 模块：图形、网络通讯、多线程、
  Web、RegEx、…

（2秋）数据结构

- ✓ 探索个性化培养与考核
  针对实际，落实因材施教

（2夏）JAVA程设与训练

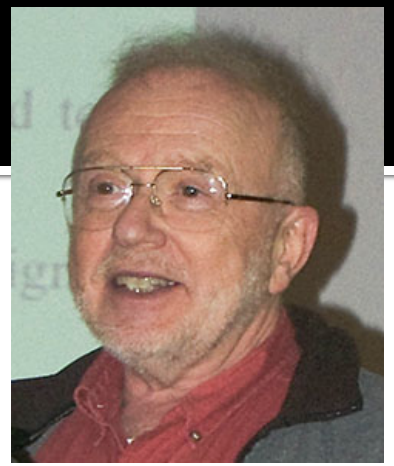
（3秋）软件工程

- ✓ 改为2春、3秋同开，
  降低3秋整体课时
- ✓ 精选内容
  重新分配学时
- ✓ 强化过程性
  训练与考核
- ✓ 调整挑战性
  提高参与度
- ✓ 增加随堂小测验
- ✓ 增加个人小作业

# What is SW engineering (vs. programming)?

"Multi-person development of multi-version programs"

"…combining separately written programs and making them suitable for use by people who had not written them…These topics usually received little or no attention in traditional programming courses"



**David Lorge Parnas**

-Fred Brooks, Jr.
(1999 Turing Award winner)

Photo credits: David Parnas: CC-BY-SA Hubert Baumeister, Wikimedia Commons ticket #2008072110008854. Fred Brooks: CC-BY-SA-3.0 ©SD&M, Wikimedia Commons



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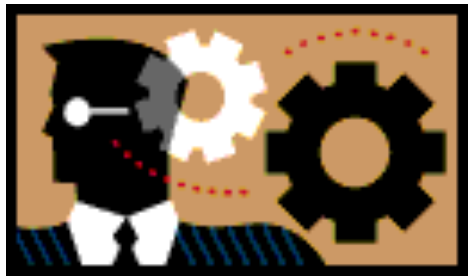
# Software Engineering

Software Engineering is the establishment & use of sound **engineering principles** in order to obtain **economically** software that is reliable & work efficiently on real machines.

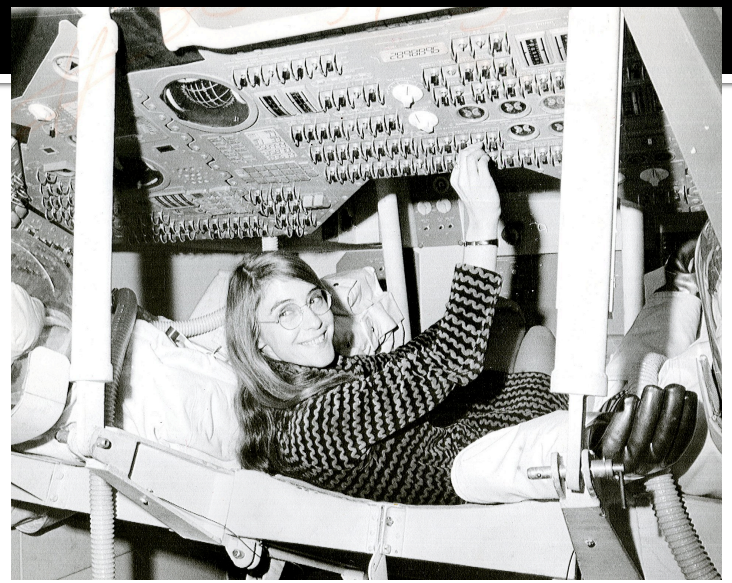
--- Fritz Bauer, 1969, NATO

"The application of a **systematic**, **disciplined**, **quantifiable** approach to the **development**, **operation**, and **maintenance** of software; that is, the application of engineering to software."



--- "IEEE Standard Glossary of Software Engineering Terminology", IEEE, Piscataway, NJ std 610.12-1990, 1990.

# Margaret Hamilton **coined term "Software Engineering"**



Apollo 8 software team at MIT, c.1965

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# What is *missing* from our student's technical skills?

1. Software development  process
2. Working with non-technical customers
3. Testing
4. Legacy code and change

# Software Process Spectrum

- Waterfall
- Incremental
- Prototyping
- Spiral

**Process Models**

**Light-weight Process**

- Agile

**Ad Hoc development**

- CMM
- SPICE

**Heavy-weight Process**

# Agile Software Development

## The Agile Manifesto

| | | |
|---|---|---|
| **Individuals and interactions** | over | Processes and Tools |
| **Working Product** | over | Comprehensive Documentation |
| **Customer Collaboration** | over | Contract Negotiation |
| **Responding to change** | over | Following a plan |

*That is, while there is value in the items on the right, we value the items on the left more.*

www.agilemanifesto.org

© Scott Adams, Inc./Dist. by UFS, Inc.

# Changing requirements

*And the users exclaimed with a laugh and a taunt: "It's just what we asked for, but not what we want." —Anonymous*

Software's strength is its evolvability—
**its ability to change and adapt**—

# Expensive Bugs

World

**Boeing engineers blame cheap Indian software for 737 Max problems**

Boeing engineers say 737 Max software outsourced from India' s HCL Technologies & Cyient. HCL denies link to troubles of 737 Max, two of which crashed.

**The Max planes were involved in two deadly crashes**

# The need for testing

产品还没测试直接投入生产时

测试的时候一切OK， 真正上线的时候...

# The need for testing

亚里亚纳火箭失事

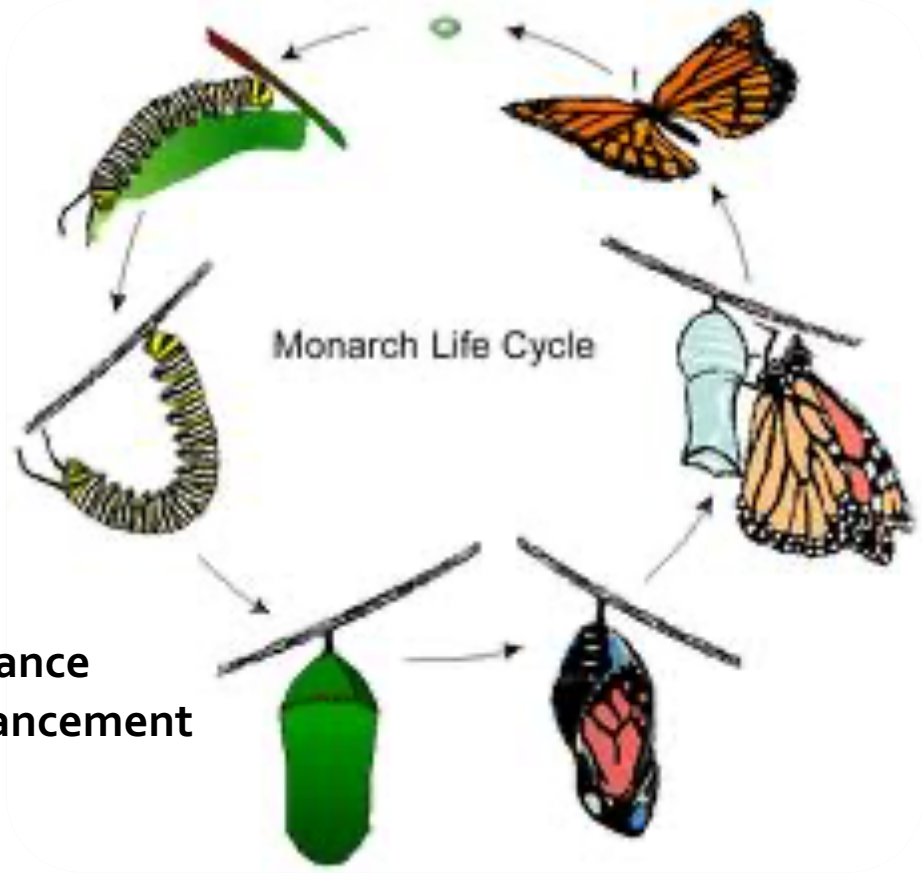
https://www.bilibili.com/video/BV127411L70b?from=search&seid=16865301561105523756

# Software Lifecycle

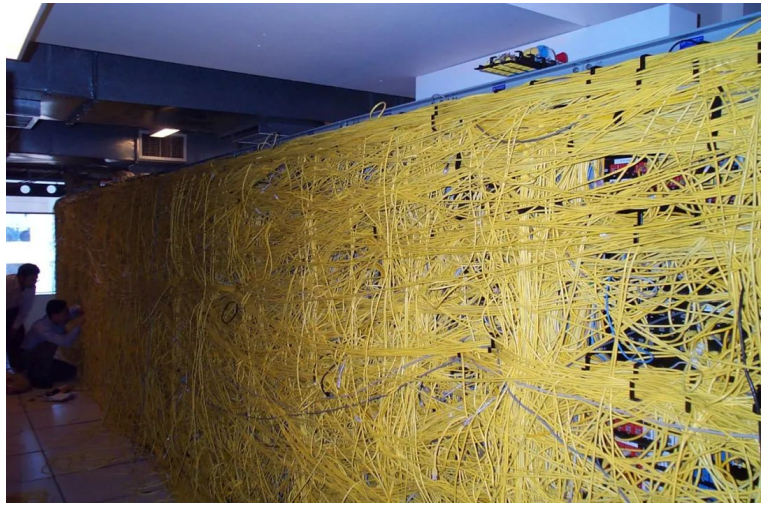
- Requirements
- Specification (Analysis)
- Design
- Implementation
- Integration
- **Maintenance**
- Retirement

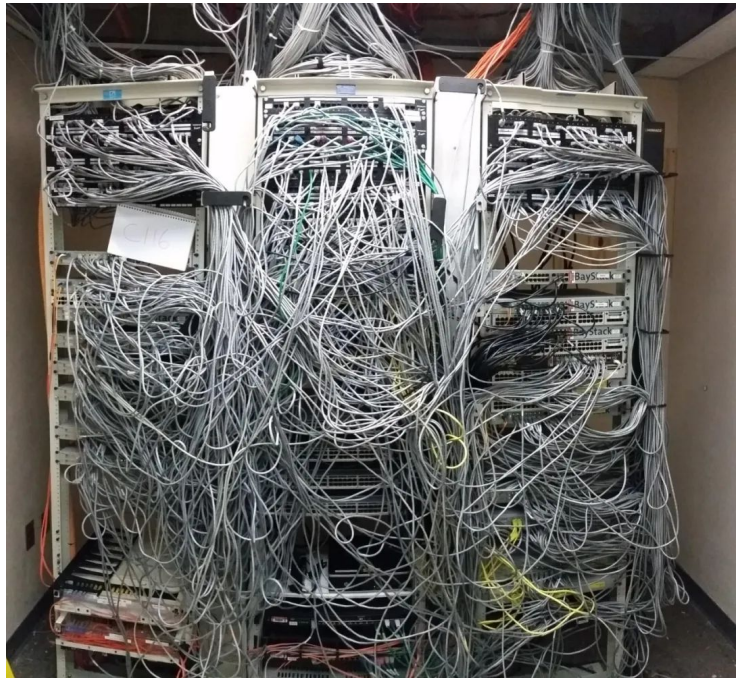
**"60/60 rule":**

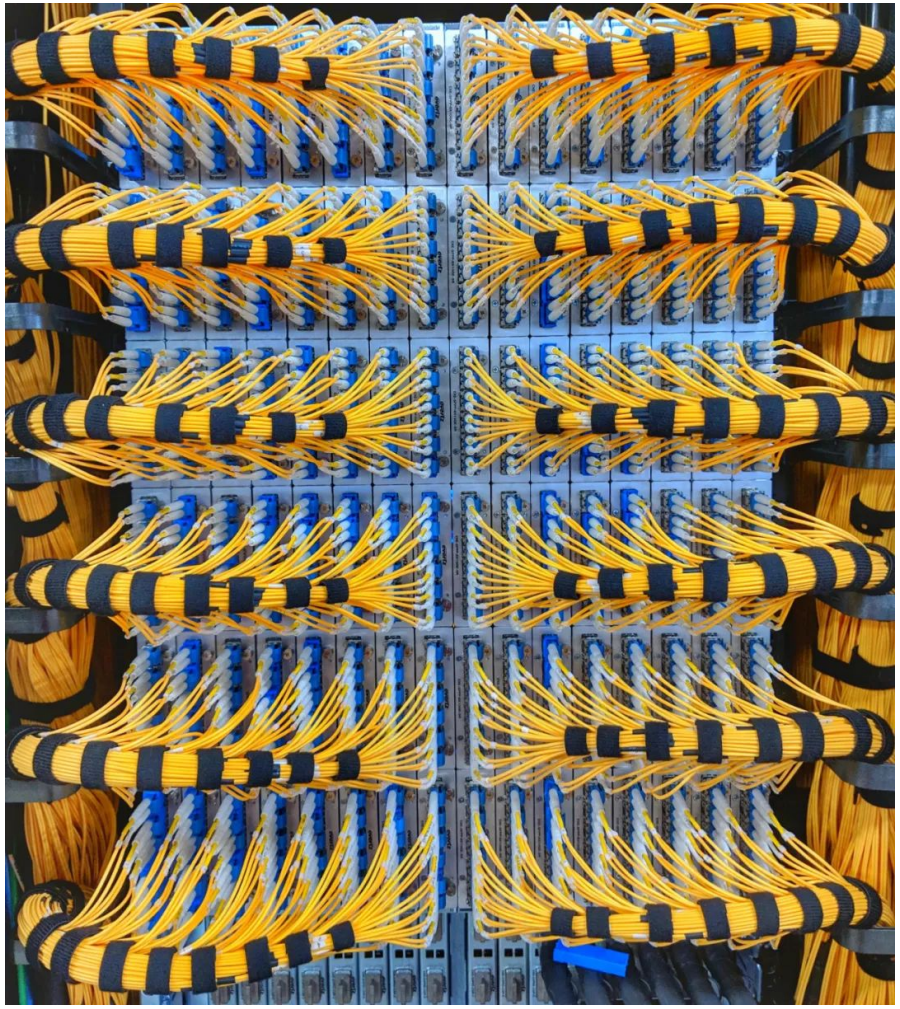
- **60% of software cost is maintenance**
- **60% of maintenance cost is enhancement**

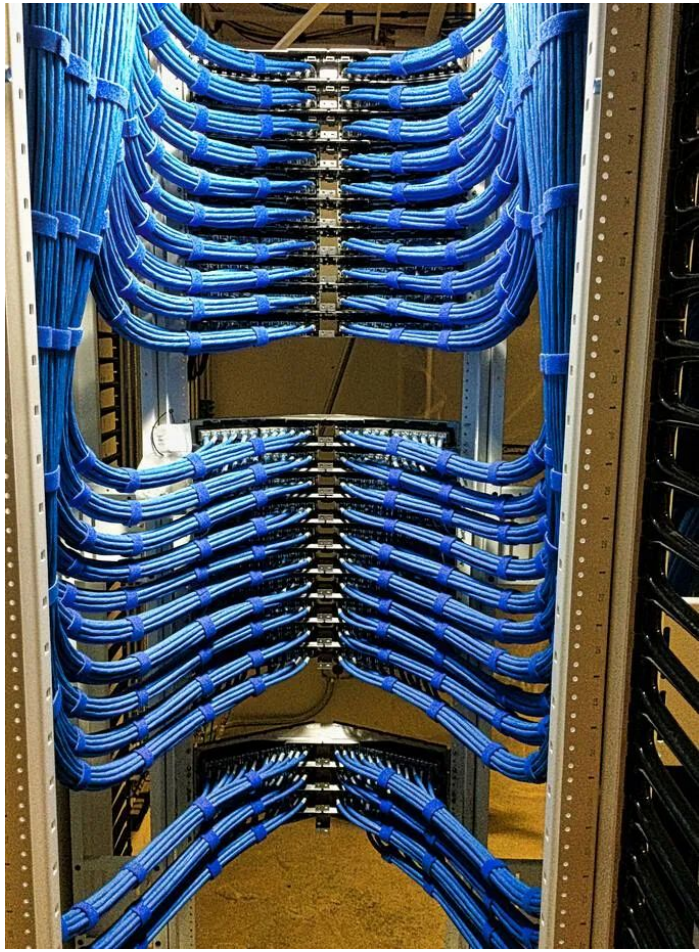


# Legacy SW vs. Beautiful SW





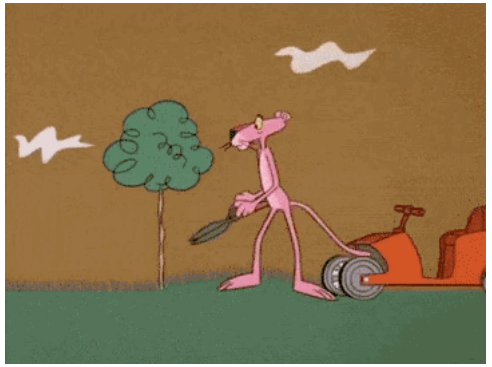




# Legacy Code

偶然间看到自己多年前写的代码

当我试图清理几行所谓的旧代码的时候



# 生产环境 修复bug

# Impact of Erroneous Software Upgrades

## 2012.10, Google

**Google Apps Incident Report**

**Gmail Partial Outage - December 10, 2012**

Prepared for Google Apps customers

The following is the ber 10, 2012. We unde apologize to

**Issu**

For a experie. The nu receiv The roo

of users gle Chrome Sync.

**Actions and Root Ca**

Background: The load balancing softwa s of users' requests to Google data centers around the world for processing and se ontent, such as search results and email.

Between 8:45 AM PT and 9:13 AM PT, a routine update to Google's load balancing software was rolled out to production. A bug in the software update caused it to incorrectly interpret a portion of Google data centers as being unavailable. The Google load balancers have a failsafe mechanism to prevent this type of failure from causing Google-wide service degradation, and they continued to route user traffic. As a result, most Google services, such as Google Search, Maps, and AdWords, were unaffected. However, some services, including Gmail, that require specific data center information to efficiently route users' requests, experienced a partial outage.

- An update to Google's load balancing software
- Poor performance to Gmail for 18 minutes

## 2014.11, Microsoft Azure

Update on Azure Storage Service Interruption

WEDNESDAY, NOVEMBER 19, 2014

JASON ZANDER
CVP, Microsoft Azure Team

Like 0

Sin Tu syste still h whet around t

nications forward.

**Wednesday, November, 19,**

As part of a performance update to Azure Storage, an issue was discovered that resulted in reduced capacity across services utilizing Azure Storage, including Virtual Machines, Visual Studio Online, Websites, Search and other Microsoft services. Prior to applying the performance update, it had been tested over several weeks in a subset of our customer-facing storage service for Azure Tables. We typically call this "flighting," as we work to identify issues before we broadly deploy any updates. The flighting test demonstrated a notable performance improvement and we proceeded to deploy the update across the storage service. During the rollout we discovered an issue that resulted in storage blob front ends going into an infinite loop, which had gone undetected during flighting. The net result was an inability for the front ends to take on further traffic, which in turn caused other services built on top to experience issues.

- A performance update to Azure Storage
- Reduced capacity across services utilizing Azure Storage

# 清华大学计算机系软件系列课程

1. Software development process
2. Working with non-technical customers
3. Testing
4. Legacy code and change

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（2夏）JAVA程设与训练

（3秋）软件工程

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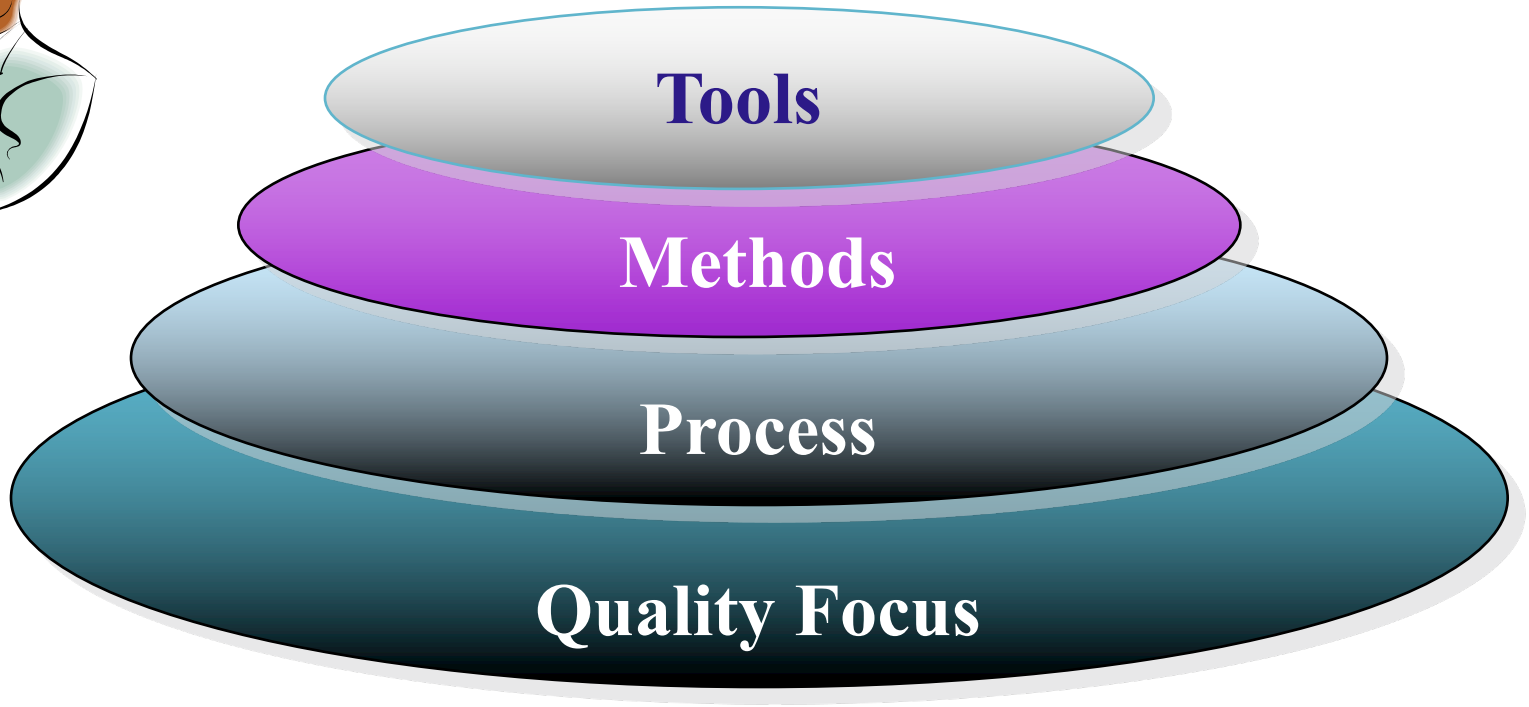
  提高参与度
- ✓ 增加随堂小测验
- ✓ 增加个人小作业

# Software Engineering: A Layered Technology



# SE Boy of Knowledge

- 15 SWEBOK key areas
  - **Software Requirements**
  - **Software Design**
  - **Software Construction**
  - **Software Testing**
  - **Software Maintenance**
  - **Software Configuration Management**
  - **Software Engineering Management**
  - **Software Engineering Process**
  - Software Engineering Models and Methods
  - Software Quality
  - Software Engineering Professional Practice
  - Software Engineering Economics
  - Computing Foundations
  - Mathematical Foundations
  - Engineering Foundations

# *What Makes a Great Software Engineer?*

*P. Li, A. Ko, J. Zhu, Microsoft & Univ. of Washington*, Proc. ICSE 2015

59 interviews with recognized SE experts at Microsoft

Always improving
Passionate
Technically open-minded
Data-driven

**Personal Characteristics**

Helps others understand by tailoring explanations to them
Creates shared success possibly via personal compromises
Creates "safe haven" where others can learn from mistakes
Gives honest feedback

**Team Skills**

**Decision Making**

Knows people & organization
Updates mental models when learn new skills/facts/context
Consider situation at multiple levels when making judgments
Can reason about complex & intertwining ideas

**Technical Skills**

Elegant solutions
Creative thinking when faced with limitations of current solutions
Anticipates technical needs based on prior experience

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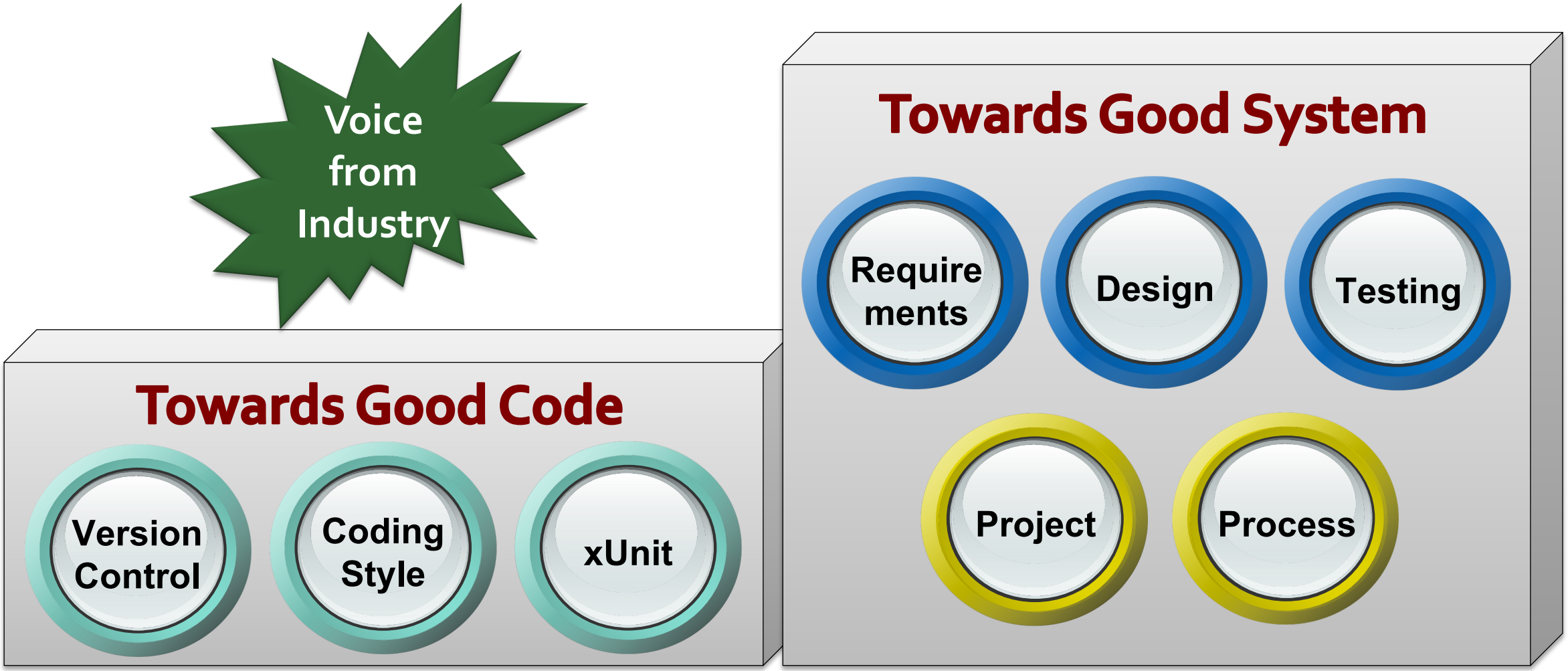
Our goal is for you to learn
*disciplined*,
*customer-focused*,
*agile* software engineering

prepare you to function as member of professional software engineering community

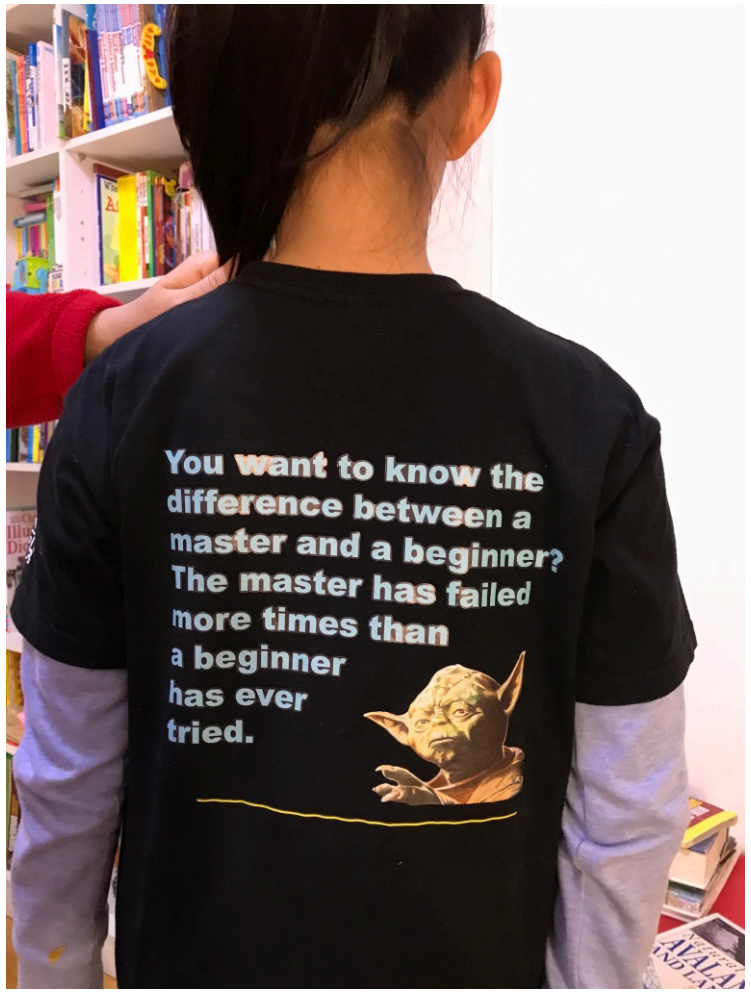

© 2013 -2017 Armando Fox & David Patterson, all rights reserved Berkeley CS 169 Slides

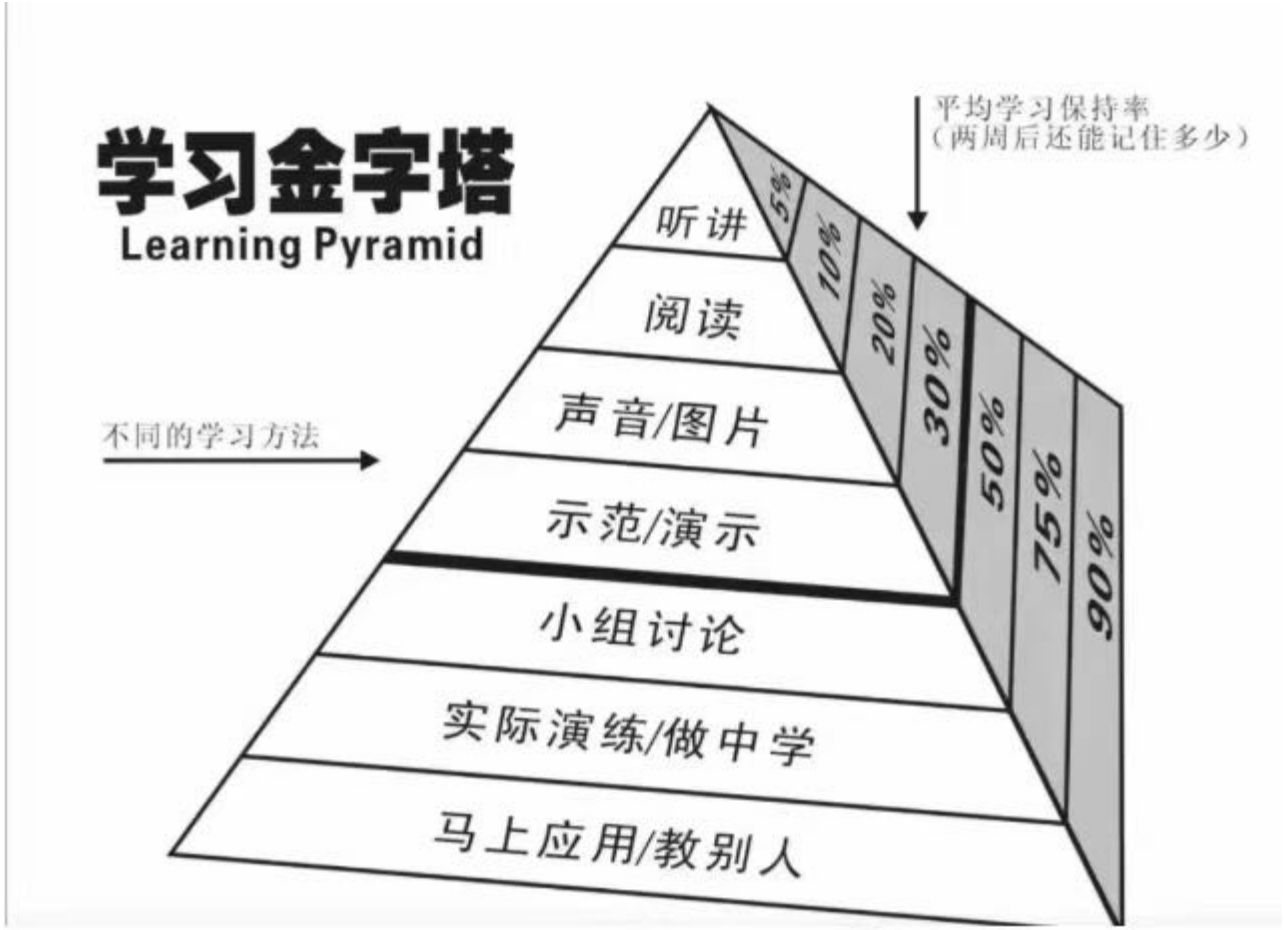
# Course Outline

Project
Practice, Practice, Practice



# Software Engineering: Practice, Practice and Practice!

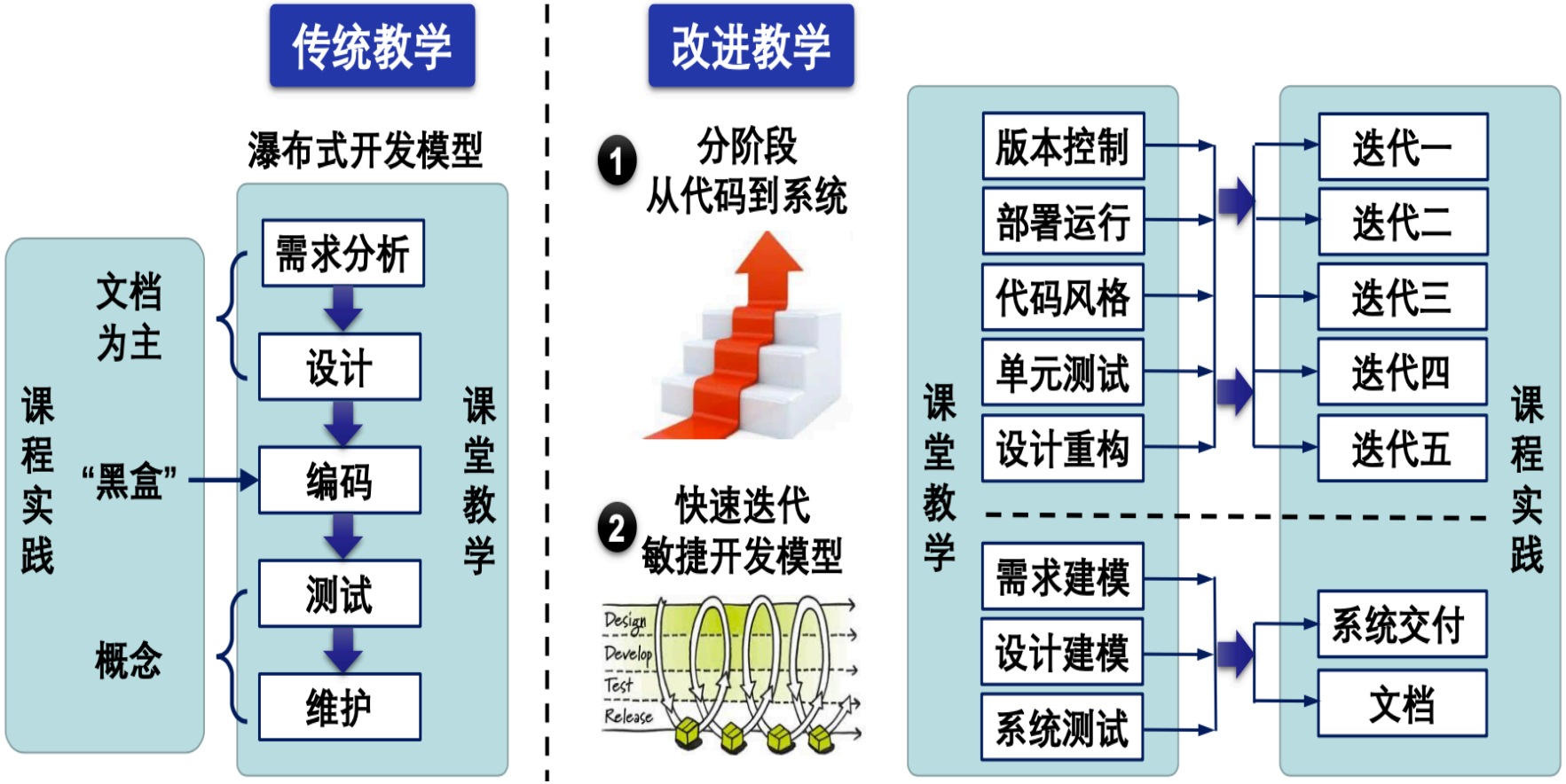


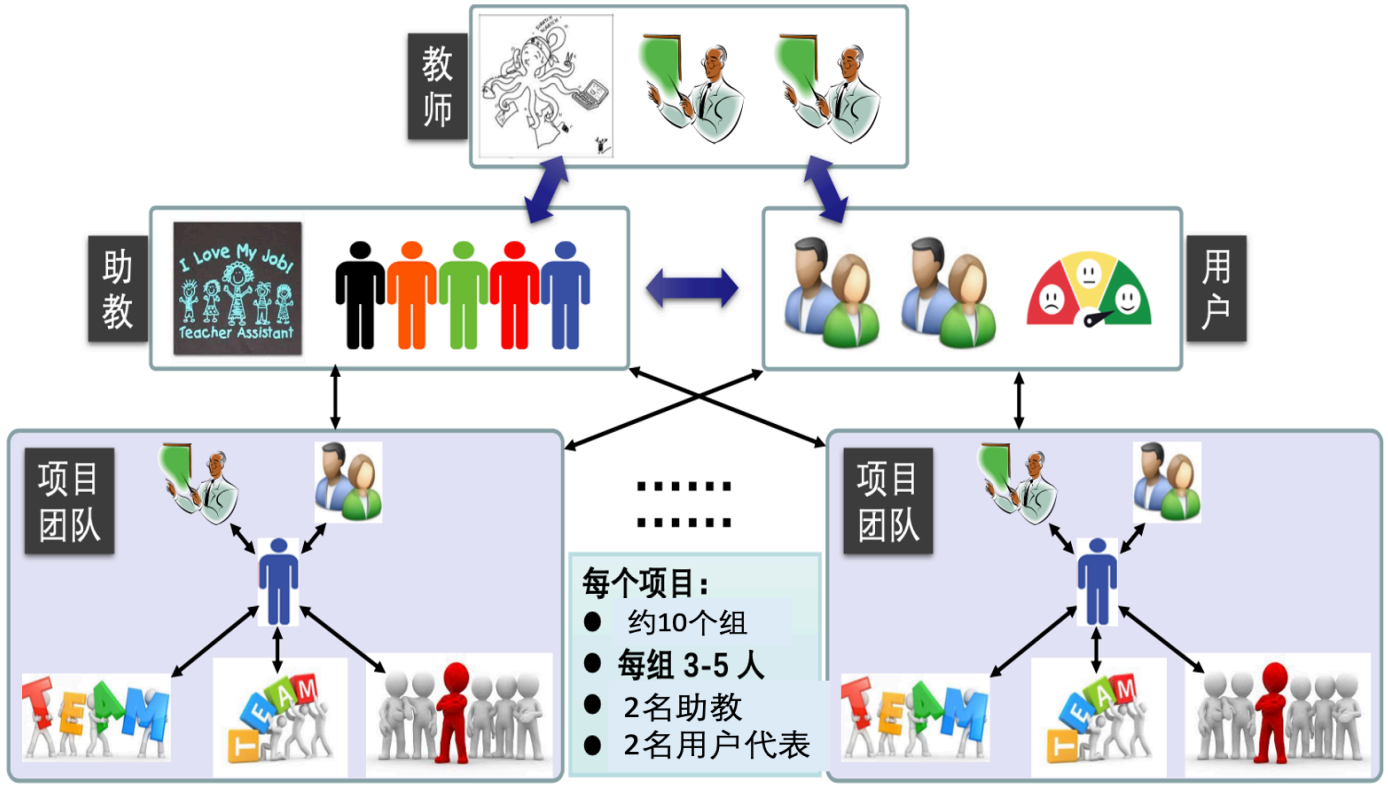
# Team Project

If you want to be incrementally better: Be competitive.
If you want to be exponentially better: Be cooperative.

# 大作业设计


传统教学
瀑布式开发模型
课程实践
文档为主
“黑盒”
概念
需求分析
设计
编码
测试
维护
课堂教学
改进教学
1
分阶段
从代码到系统
2
快速迭代
敏捷开发模型
Design
Develop
Test
Release
课堂教学
版本控制
部署运行
代码风格
单元测试
设计重构
需求建模
设计建模
系统测试
迭代一
迭代二
迭代三
迭代四
迭代五
系统交付
文档
课程实践

# Team work!


教师
助教
I Love My Job!
Teacher Assistant
用户
项目团队
项目团队
.....
.....
每个项目：
● 约10个组
● 每组 3-5 人
● 2名助教
● 2名用户代表

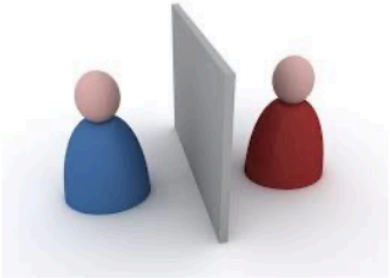
# 开放实践

课堂教学

企业实训

授课

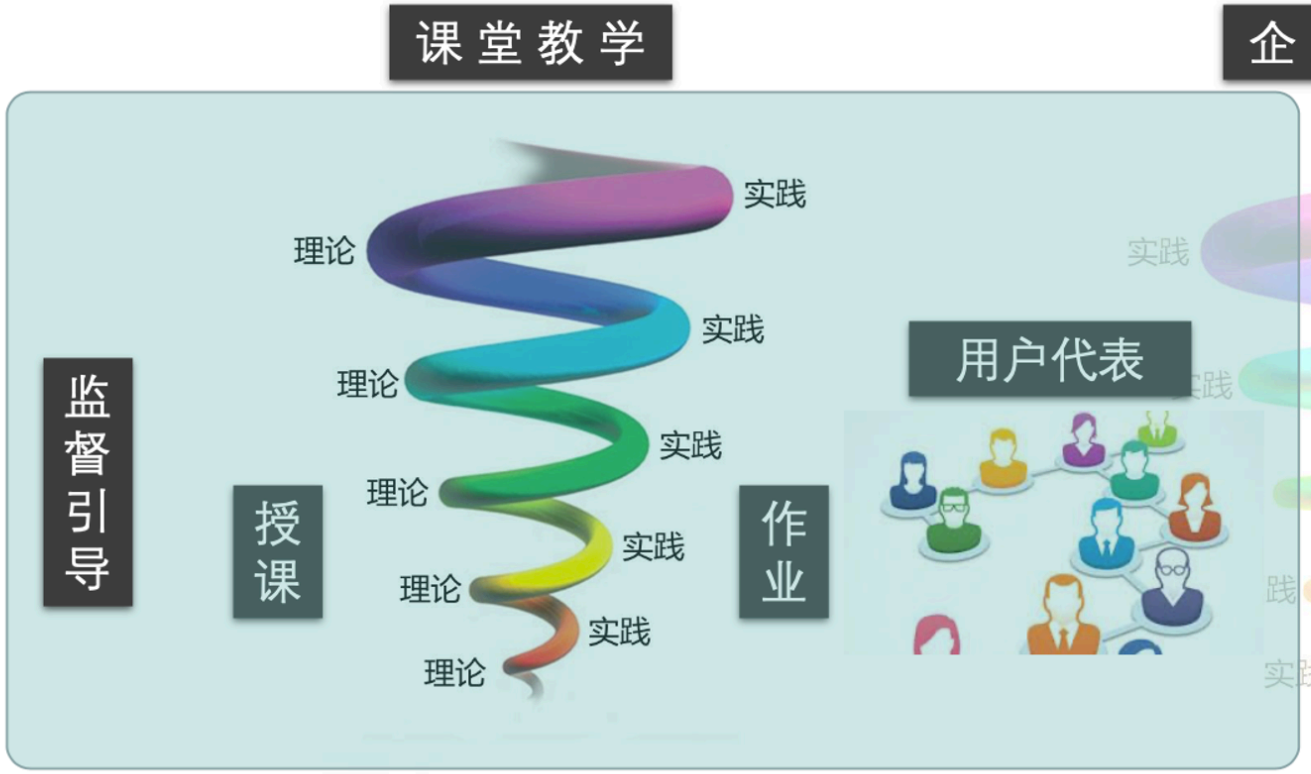
作业



实习

培训

# 优势




企业实训

- 实践强度
- “真实性”
- 不确定性
- 技术先进性

13

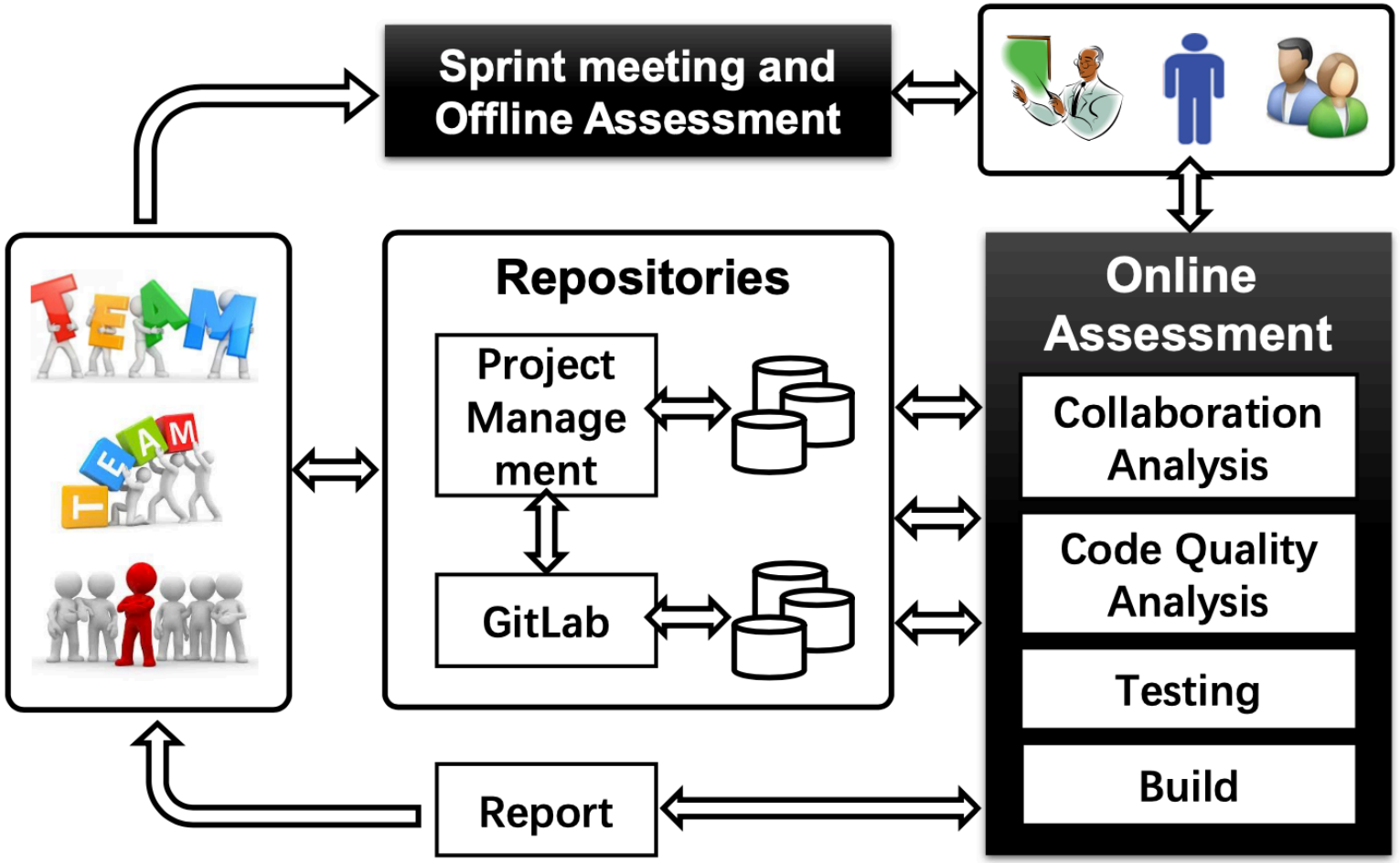
# Grading

| 类别 | 比例 | 考察点 | |
|---|---|---|---|
| [R1]<br>过程管理 | 40% | [R1-1] 周例会参与讨论，周计划制定与执行 | 25% |
| | | [R1-2] 版本管理，Git 协同 | 25% |
| | | [R1-3] 单元测试 | 25% |
| | | [R1-4] 代码质量 | 25% |
| [R2]<br>系统实现 | 40% | [R2-1] 基本功能实现完整，满足用户要求 | 70% |
| | | [R2-2] 满足用户的非功能要求 | 30% |
| | | [R2-3] 扩展功能实现 | ++ |
| [R3]<br>文档 | 10% | [R3-1] 需求分析完整，层次清晰，结构合理，有必要的模型表述 | 40% |
| | | [R3-2] 模块及其接口设计合理，报告详实 | 30% |
| | | [R3-3] 数据库设计合理，报告详实 | 30% |
| [R4]<br>用户评价 | 10% | [R4-1] 用户对系统的满意程度 | 40% |
| | | [R4-2] 用户对过程的满意程度 | 40% |
| | | [R4-3] 与用户的交流与沟通能力 | 20% |

1) 在基本功能完善的基础上，实现扩展功能，酌情加分。
2) 第12周确定R1、R2成绩。如后期完善改进较多，R2成绩可在后期浮动调整，浮动不超过20%。
3) 第14周，所有大作业交付截至，确定R3、R4及总成绩。
4) 过程评价中，根据每个同学的实际贡献，个人成绩在小组成绩基础上可上下浮动。

# R1 评价

## 线上+线下；团队+个人




- Combined Assessment
  - Online automatic evaluation based on the DevOps platform
  - Offline manual evaluation based on regular Sprint meetings and in person discussion
- Continuous assessment
  - Timely feedback to continuous deliveries
- Personalized assessment
  - For each team and individual students.

**持续监控、反馈与评价**

# 大作业助教和指导教师

| | 题目名称 | 项目来源 | 教师及助教 | 例会时间(周四) |
|---|---|---|---|---|
| PRJ1A | 网络服务接入运营系统 | 华为 | 李丹,田倍闻 | 13:30-15:05 |
| PRJ1B | | | 李丹,蔚兆洋 | |
| PRJ2A | 网红分析师 | 快手 | 李丹,徐易 | 15:20-16:55 |
| PRJ2B | | | 李丹,刘光哲 | |
| PRJ3A | 在线商品交易系统 | 美团 | 李山山,孙迅 | 13:30-15:05 |
| PRJ3B | | | 李山山,成逸然 | |
| PRJ4A | 多人在线协作智能视频剪辑App | 快手 | 李山山,刘畅 | 15:20-16:55 |
| PRJ4B | | | 李山山,牛骁 | |
| PRJ5A | 计算系新系馆会议室预约系统 | 计算机系 | 裴丹,张书宁 | 13:30-15:05 |
| PRJ5B | | | 裴丹,辛杭高 | |
| PRJ6A | 企业通用权限平台 | 快手 | 裴丹,范喆恒 | 15:20-16:55 |
| PRJ6B | | | 裴丹,肖易佳 | |

- 1. 允许跨课堂组队
- 2.各个项目的基本（必做）需求难度大致相当
- 3、感兴趣以后当软工助教的同学，随时可以跟李明杰助教报名，进入候选助教队列。

# 教学日历

## 教 学 日 历

## （ 2021 年 2 月 22 日 更 新 ）

| 周、日期 | 授课内容 | 个人小作业 | 团队大作业 |
|---|---|---|---|
| 1. 02.23 | 课程简介<br>1. 课程要求和大纲<br>2. 软件工程基本概念<br>3. 软工平台 SECODER 简介<br>4. GIT 简介、布置小作业 1<br>5. CI/CD 简介、布置小作业 2 | 小作业 1： Git 使用<br>小作业 2： CI/CD | |
| 2. 03.02 | 1. 大作业内容介绍<br>2. 后端开发框架 Django，布置小作业 3<br>3. 敏捷软件开发 | 小作业 3： 后端开发 | 03.06 日提交分组选题，0.3.08 公布分组选题<br>确定选题分组名单，设置分组帐号，配置分组项目，开始熟悉开发环境 |
| 3. 03.09 | 1. 软件测试 1<br>2. 前端开发框架 VUE 介绍<br>3. Android 开发介绍<br>4. 小作业 4: VUE/Android 二选一 | 小作业 4:<br>VUE/Android 开发二选一 | 03. 11 日下午，助教、用户和各选题小组例会（1）：启动 Sprint1<br>明确需求，熟悉开发环境，选择开发语言和工具 |
| 4. 03.16 | 软件测试 2 | | 03.18 日下午，助教和各小组例会（1） |
| 5. 03.23 | 软件测试 3 | | 03.25 日下午，助教、用户和各小组例会（2）：启动 Sprint2<br>熟悉单测框架。结合 SonarQube，强调代码质量。 |
| 6. 03.30 | 代码风格及重构 | | 04.01 日下午，助教和各小组例会（2） |
| 7. 04.06 | 软件架构 1 | | 04.08 日下午，助教、用户和各小组例会（3）：启动 Sprint3 |
| 8. 04.13 | 软件架构 2 | | 04.15 日下午，助教和各小组例会（3） |

# 教学日历

| | | | |
|---|---|---|---|
| 9. 04.20 | 软件架构 3 | | 04.22 日下午，助教、用户和各小组例会（4）：启动 Sprint4 |
| 10. 04.27 | 需求管理 | | 04.29 日下午，助教和各小组例会（4） |
| 11. 05.04 | 五一假期 (04.30-05.05) | | 05.06 日下午，助教、用户、各小组例会（5）。要求 05.06 日中午完成大作业。下午给用户代表演示大作业（demo）。用户代表现场打分。 之后到 05.13 前可以选择继续修 bug |
| 12. 05.11 | 软件运营维护 | | 05.10 学生提交演示视频及演示脚本给助教。<br>05.13 日下午及晚上：全体教师、助教，集中检查系统实现并确定评分 |
| 13. 05.18 | 大作业课堂展示 (两个课堂一起上课) | | 05.20 提交文档 |
| 14. 05.25 | 工业界特邀报告 1 (两个课堂一起上课) | | 05.27 助教提交大作业最终打分 |
| 15. 06.01 | 工业界特邀报告 2 (两个课堂一起上课) | | |
| 16. 06.08 | 工业界特邀报告 3 (两个课堂一起上课) | | |

# 工业界分享

TiDB 大家不知道的那些事
现在大概是第n（n>10）个迭代版本，具体是哪个版本已经记不住，代码迭代速度非常快
TiDB 在全球都有用户
Square （美国）
Paypay (日本)
SEA Group （新加坡）
Bookmyshow （印度）
Zomato (印度)
中国 30 亿美金以上的公司，80% 用上了 TiDB
PingCAP

为什么要开发物联网大数据平台？
陶建辉
涛思数据创始人
TAOS DATA

NO SIGNAL

# 工业界分享

重新定义可视化开发
当可视化开发落实到工程时，用最短的时间做出令人满意的效果，永远是工程师追求的极致
刘冰晶

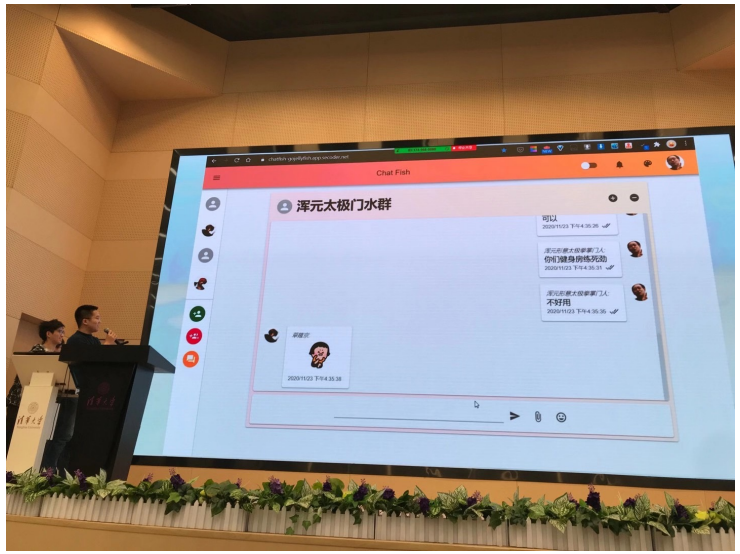
美团外卖介绍
李滔 美团到家事业群外卖技术部
美团XX事业部
CODE A BETTER LIFE

知识图谱的基础介绍与策略实践
胡懋地 美团到家事业群外卖技术部
美团XX事业部
CODE A BETTER LIFE

# 大作业展示

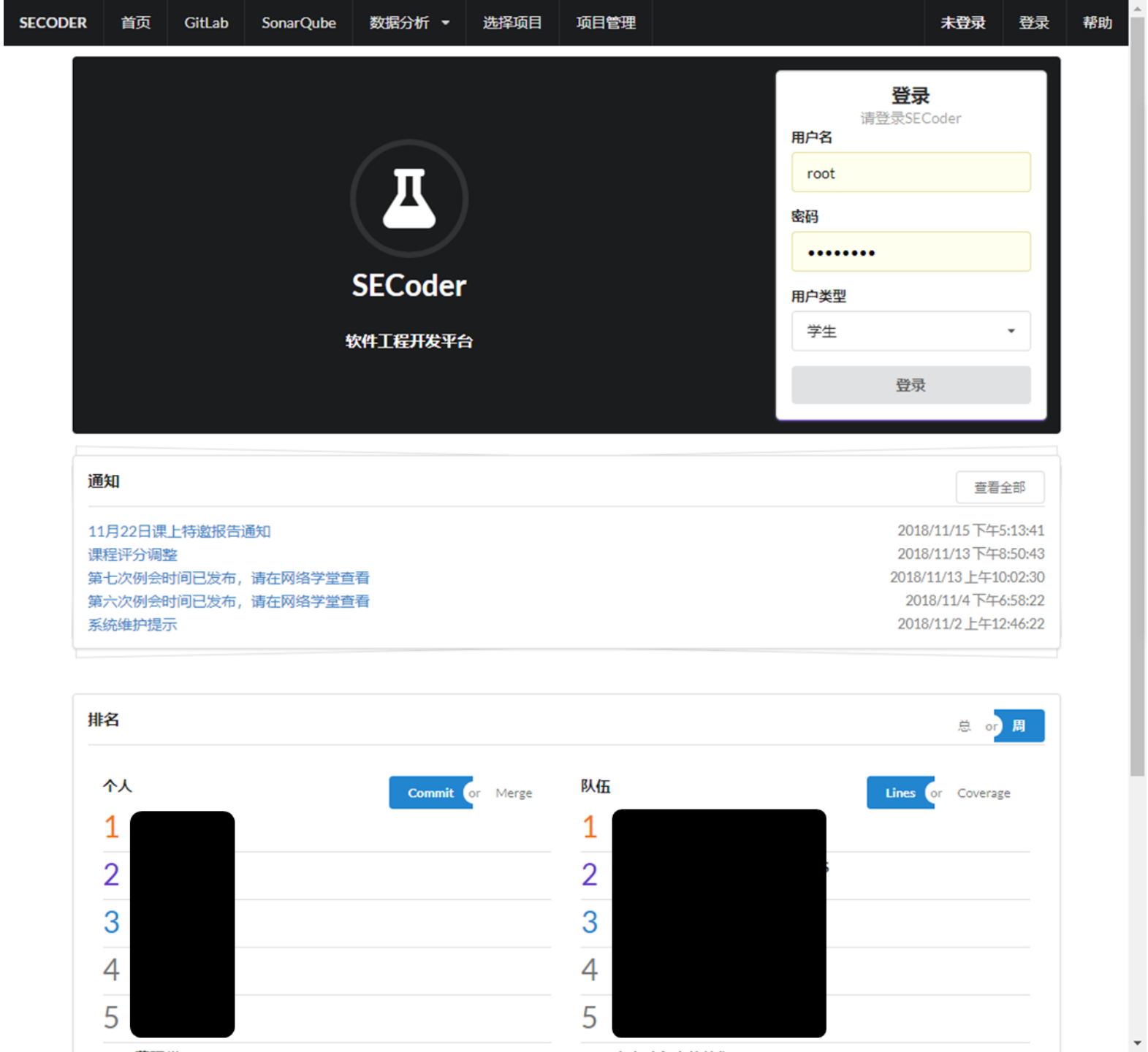
一个好的舆情分析系统应该有 ...
舆情榜单
舆情搜索
关键词预警
权限管理
舆情展示
核心在于后台分析！

整体架构
elastic
REST API
django
REST API
RPC
前端框架: Vue.
负责人: 潘传宇, 邹恬园
后端框架: Django
数据库:
Sqlite3/MySQL
负责人: 刘畅
后端部署在软工平台Docker上
数据库部署在腾讯云服务器上
索引: Elastic Search
负责人: 任一
部署在腾讯云服务器上
美团
阅读理解模型
负责人: 戴傲初
部署在腾讯云服务器上
2020/12/24


Chat Fish
浑元太极门水群

Dubbing Master
声纹匹配小游戏
73
返回首页

# LET'S GO!


SECODER
首页
GitLab
SonarQube
数据分析
选择项目
项目管理
未登录
登录
帮助
SECoder
软件工程开发平台
登录
请登录SECoder
用户名
root
密码
用户类型
学生
登录
通知
查看全部
11月22日课上特邀报告通知 2018/11/15 下午5:13:41
课程评分调整 2018/11/13 下午8:50:43
第七次例会时间已发布，请在网络学堂查看 2018/11/13 上午10:02:30
第六次例会时间已发布，请在网络学堂查看 2018/11/4 下午6:58:22
系统维护提示 2018/11/2 上午12:46:22
排名
总 or 周
个人
Commit or Merge
1
2
3
4
5
队伍
Lines or Coverage
1
2
3
4
5

# Thank you!