SOFTWARE MAINTENANCE AND EVOLUTION

CS563
TUE/THU @2PM,

Danny Dig
Today’s goals

• Discovery: learning about each other (Family Occupation Recreation Motivation)

• Examples of Research in Software Maintenance and Evolution, theme on IoT

• How can I be successful in CS563?
Family
Change is the heart of software development

Programming is program transformation

Q1: Analyze what software changes occur in practice?
Q2: How can we automate them?
Q3: Can we represent programs as transformations? Archive, retrieve, and visualize them?
Q4: Can we infer higher-level transformations?

Automated changes in (i) upgrading library APIs, (ii) convert sequential to parallel code, (iii) improve responsiveness in mobile
Recreation
On Aug 5, 2015 …

A life of significance: intentionally add value to others
Quiz #1: About YOU

- Write down your name
- FORM (family, occupation, recreation, motivation)

- Grad Program (e.g., EECS PhD, EECS MS, MEng), year of study, who is your grad advisor

- Your background (e.g., undergrad SE classes that you took, industry SE experience, other CS background – such as strong ML, PL, etc.)

- What is the ONE Thing that you expect to take out of CS563?
- What are your plans post graduation?
What are your expectations from CS563?

A. ...
B. ...
C. ...
D. ....
E. ...
F. ....
Topics in Software Maintenance and Evolution

• Reverse engineering and re-engineering
• Software refactoring and restructuring
• Software migration and renovation
• Software and system comprehension
• Software repository analysis and mining
• Code cloning and provenance
• Concept and feature location
• Change and defect management
• Evolution of non-code artefacts
• Software testing
• Maintenance and evolution processes
• Software quality assessment

Run-time evolution and dynamic configuration
Human aspects of software evolution
Theme: Mobile & IoT revolution: digitization & connection of everything

In 15 years, smart Infrastructure estimated to become $59T market

Q: What do you envision as some Killer Feature for IoT?
Q: What are the Killer Features for IoT?

K1: smart decisions without exposing privacy and security
K2: standards for devices to communicate
K3: digital identity
K4: personalization of sw services
K5: raising the level of abstraction for programming IoT devices
K6: new ways for humans to control devices
K7: virtual assistant to automate repeated tasks
Q: What are the Killer Features for IoT?

Smart home:
- managing the home (monitoring energy and resources), scheduling family activities, housekeeping (auto-replenish consumables, cleaning, pet feeding), health monitoring (assistive care)

Smart City:
- transportation (find parking), environmental monitoring of pollution, manage resources (control street lighting), enhances perception of city activities

Smart Manufacturing:
- virtual chief foreman assisting managers
From IoT 1.0 to 2.0

V 1.0: sensors and actuators to collect data

V 2.0: augmenting our intelligence with knowledge to expedite decision-making, everyday activities, and processes
Pervasive Personalized Intelligence (PPI)

From Reactive to Predictive Analytics:
- Ag: predict diseases, harvest
- Industry 4.0: auto-diagnosis
- City: resource utilization

Pervasive to the Edge

Personalized
Research Thrusts for IoT 2.0

- Smart Office
- Smart Manufacturing
- Smart Health & Fitness
- Smart Home
- Smart City
- Shipping & Logistics
- Smart Retail

- Precision Ag
- Smart Food
- Data Science
- Edge Computing
- Programmability
- Security & Privacy
- Human Users
- Dev Maintain
Course Administration

Check webpage:
http://web.engr.oregonstate.edu/~digd/courses/cs563_Sp19/

Work items due today:
- Familiarize with class webpage
- sign up on Piazza (all communications through Piazza, no email)
- Read one paper about how to read Soft Eng papers

Prereqs are enforced: 361 & 362 --> 561 --> 562 → 563
- took at least two classes of undergrad coursework in Software Engineering (e.g., equivalent CS361 & 362 @ OSU)
CS563 is Different!!!

Research-based course:
- at times it would feel it is not ”organized”
- there are lots of choices, you need to select
- structure is fixed, but content is dynamic

Complete a research or industrial-novel project of your choice (teams of 2-3 students)
- follow the steps of open-ended/risky research (proposal, fit in SE literature, evaluate empirically)
- at the end of the term you would have produced a research paper that you can submit to conference

- WHY: equips you to conduct novel R&D
CS563 is Different!!!

Participate in class discussion and activities.

Read 1-2 research papers for every class meeting (11 pages each, double column => total of 500 research pages)
  - later on, you choose papers that match your project
  - 1 book chapter /week (Put Your Dream to the Test)

Paper Critiques: for each class meeting, for each research paper, submit before class (by 5pm previous day)
  - WHY: equips you with critical thinking

Research presentation: you prepare and deliver for the selected research papers
  - WHY: equips you to communicate your ideas
Projects Focus on SE + Mobile & IoT

Technological shifts/opportunities for IoT:
- constraints on memory/CPU/bandwidth/battery usage
- connectivity with the cloud
- rapid evolution of the platform

Encouraging good (old) software engineering practices

Industrial-innovation: availability of rich data from sensors (e.g., dataset from City of Portland)

Research projects (not implementing an app)
- teams of 2-3 people
Example Transformations for Mobile & IoT

What are the new transformations we need to automate?
- inspiration from explorative studies
- empirical studies to find performance or energy anti-patterns

Examples of transformations:
- candidate programs with trade-offs between performance & power consumption
- adaptation to different display technologies
- split functionality between the device and cloud
1-hour Group Discussion

Soft Skills: leadership, creating a vision and plan for accomplishing

WHY: Soft Skills make a greater Difference in life than “Hard Skills”

WHAT: Take your dream through 10-step process to see, own, reach it

HOW: learning environment in a roundtable format
Testimonials

“This course was exceptionally difficult and carried a massive time requirement. I only took two courses this quarter and even then I'm not sure I was able to give either of the classes the amount they deserved because of the time requirement for this class.”  [student from previous year]

“… But that doesn't mean that I'm not satisfied, have students who previously took the course convey this”

Announcements for next class:
- Read the posted 2 papers and write critiques

Office hours: right after the class