Lecture 1:
Introduction to Software Engineering

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Instructor

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Software Engineering
Engineering Computer Science 160
University of California, Davis

Course Information

Staff

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Online Information

https://canvas.ucdavis.edu/courses/318233

https://piazza.com/ucdavis/winter2018/ecs160 (Signup)

Times and Locations

6:10 – 7:30P TR, 6 Olson
4:10 – 5:00P M, 100 Hunt

Texts

Readings/Slides will be posted on Canvas

Prerequisites

Courses

- ECS 140A Programming Languages (or equivalent)
  - ECS 36C Data Structures Programming (or equivalent)
  - ECS 36B Software Development and Object-Oriented Programming (or equivalent)

MUST HAVE PASSED140A CANNOT TAKE CONCURRENTLY!

Grading Breakdown

Problem Sets (5%)
- Approximately one per lecture

Midterm (15%)
- Covering the first half of quarter

Final (30%)
- Cumulative with emphasis on second half.

Team Project (50%)
- One major project
- Many weekly deadlines
- Teammates will evaluate each other
- Instructor has final authority of point allocations

General Overview

- Software Process/Practices
- Software Patterns (and Anti-Patterns)
- Software Lifecycle Models
- Language Updates

What really can go wrong?

- I'm a computer scientist, so my program crashes.
- Maybe a customer is unhappy.
- So the program needs to be restarted.
- We can always patch it in the field.
- Sometimes failures are terrible!

Terrible Failures

- San Francisco 911
- Mars Pathfinder
- Mars Climate Orbiter
- Year-2010-Problem
- BadUSB
- Northeast Blackout of 2003
- THERAC-25
- China Airlines Flight 140
- Oko False Alarm of 1983

San Francisco 911

- San Francisco tried for three years to upgrade 911 system
- October 12, 1995 crashed 30 minutes
- November 4, 1995 collapsed for hour
- Missed between 100 – 200 calls per day.

Source: Phillip Matier and Andrew Ross, San Francisco Chronicle, October 18, 1995, p.A1; SEN 21, 2, 19.

Mars Pathfinder

- Used Wind River VxWorks RTOS
- Pathfinder had "information bus" considered shared resource
- Classic priority inversion
  - Communication (Med) blocked
    Meteorological (Low) blocked
    Information bus (High)
- Total mission cost $265 million

Source: http://research.microsoft.com/en-us/um/people/mbj/mars_pathfinder/mars_pathfinder.html

Mars Climate Orbiter

- Launched to study Martian climate
- September 23, 1999 communication lost
- Miscommunication of units
  - Ground based software sent lb·s
  - Orbiter software assumed N·s
- Obiter burned up in atmosphere (170km lower)
- Total mission cost $193.1 million

Source: ftp://ftp.hq.nasa.gov/pub/pao/reports/1999/MCO_report.pdf

Year-2010-Problem

- Dates encoded as Binary Coded Decimal (BCD)
- Systems could not distinguish change of year
- Short Message Service (SMS) uses BCD for date
- 30 million German bank cards failed due to Europay International Mastercard and Visa (EMV)
- Estimated cost €300 million

Source: http://www.theguardian.com/world/2010/jan/06/2010-bug-millions-germans

BadUSB

- USB design has security bug
- Bad device can rewrite firmware
- Host OS unable to detect compromise
- Infected USB host can
  - Imitate keyboards or other devices
  - Intercept all input devices
- Currently unknown financial/privacy impact
- USBHarpoon is an implementation that hides in a USB charging cable

Source: http://www.wired.com/2014/07/usb-security/
https://www.bleepingcomputer.com/news/security/usbharpoon-is-a-badusb-attack-with-a-twist/

Northeast Blackout of 2003

- Race condition existed in GE Energy's Unix XA/21 Energy Management System
- FirstEnergy's control room failed to detect alarm
- Overloaded power lines sag and make contact with trees
- August 14, 2003, 85% of Northeast was in blackout for up to 16 hours
- Up to 10 fatalities attributed to blackout

Source: https://en.wikipedia.org/wiki/Northeast_blackout_of_2003

THERAC-25

- Radiation therapy machine manufactured by Atomic Energy of Canada Limited
- Hardware interlock replaced by software
- Concurrent programming errors
  - Gave radiation doses thousands greater than normal
- 6 incidents between 1985 & 1987

Source: Nancy Leveson, “Medical Devices: The Therac-25”

China Airlines Flight 140

- Airbus A300B4-622R
- Previous A300-600R had “out-of-trim” incidents
- September 1993 a software update to fix issue was available
- April 26, 1994 Flight 140 crashed
- 264 people died in crash

Source: http://sunnyday.mit.edu/accidents/nag-4-7.html

Oko False Alarm of 1983

- September 1, 1983 USSR accidentally shoots down Korean Air Lines Flight 007
  - Of Flight 007 269 fatalities are 62 Americans including a U.S. Representative from Georgia
- Cold War tensions are extremely high
- Oko is Soviet Union's early warning system
- September 26, 1983 Oko falsely detects a nuclear missile launch from U.S.
  - Caused by software bug and rare alignment of sunlight on high altitude clouds and satellite orbits
- Lt. Col. Stanislav Petrov ignored warning likely preventing all out nuclear war

Source: https://en.wikipedia.org/wiki/Korean_Air_Lines_Flight_007
https://en.wikipedia.org/wiki/1983_Soviet_nuclear_false_alarm_incident

What this class is not!

- Not algorithms class
- Not languages class
- Not an Android or iOS development class
- Not a business/finance class

What this class is about.

- Developing software faster
- Developing better/cheaper software
- Developing software in teams
- It is about process, models, and tools
- Hopefully you will learn through doing

Team Project

- Entire class project
- Broken up into large teams
- Every week we will assess teams progress
- Team members will evaluate each others points allocation
- Instructor has final say on points allocation

What is the project?

- Design/Porting/Support/Maintenance of a Computer Game
- Clone of RTS game, either Warcraft II[1] or StarCraft[2]
- Provided C++ source code for mostly complete Linux version

[1] https://en.wikipedia.org/wiki/Warcraft_II:_Tides_of_Darkness
[2] https://en.wikipedia.org/wiki/StarCraft_(video_game)

Game Demo

- Show current game status.

Development Teams

- Linux/Lead Development
- Windows Porting
- OS-X Porting
- Android Porting
- iOS Porting
- Development Tools
- Artificial Intelligence/Scripting
- Multiplayer Development
- Web Server
- Others?