# W4118 Operating Systems

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# Why study OS?

- OS examples
- OS = one of the most fundamental software systems
  - We do almost everything with computers through OS
- By studying OS, you will
  - Gain a good understanding of OS
  - Learn some portable tricks
  - Gain a good understanding of the big picture
    - How do hardware, programming language, compiler, algorithms, OS work together?

Possibly

- Get a job at Google/Microsoft/VMware/…
- Get started in OS research
- Apply OS concepts to your area
- …

# What will we learn?

- OS concepts
  - What does an OS do?
    - Abstract hardware: processes, threads, files
    - Manage resources: CPU scheduling, memory management, file systems
- OS implementations
  - How does an OS do these?
    - We will learn how to implement the concepts at a general level
  - How does Linux, a real OS, do these?
    - Detailed implementations

# What will we learn? (cont.)

- Hands on experiences hacking Linux
  - Best way to learn is through practice
  - We will have six programming assignments, five of which are Linux kernel programming assignments
    - Probably your first time dealing with large software
  - Practical system hacking skills
    - How to understand large body of code
    - How to modify
    - How to debug
    - How to work with others
    - …

# My background

- Research area: systems
  - Publish in systems conferences
    - e.g., OSDI, SOSP, NSDI
- Practical kind of guy; believe in only stuff that works and is useful
- System reliability research for 8 years
  - Systems research shifted from pure performance to reliability starting around 2000
  - I was fortunate to be at the cutting edge of this shift
  - Hacked Linux and Windows, found some of the worst bugs
- Cool projects available for interested students

# Some of my previous results

- Built several effective bug-finding tools
- Found 100+ serious bugs
  - Security holes: write arbitrary memory
  - Data loss errors: lose entire file system data
  - Errors in commercial data center systems: stuck w/o progress
- Serious enough that developers immediately worked on fixes
  - google "lkml junfeng"
- Reported at news website (e.g. lwn.net)

# Basic Course Info

- Course website: http://www.cs.columbia.edu/~junfeng/os/

- Next: tour of course website

# Homework 1

- Written part: basic OS concepts
- Programming part: simple shell
  - Warm up: user-space programming
  - Subsequent programming assignments will be more difficult
- Apply CS account
- Look for teammates