CS331
Advanced Operating Systems
1:30—2:50 Tu/Th
Instructor: Shan Lu (257A, shanlu@...
Outline

• An overview of 331
  • Who am I
  • What this class will be about

• Introduce yourself

• A brief history of OS

• Administrative stuff
Who am I

• Shan
  – Research
    • Software reliability, concurrency, etc.
  – Teaching
    • I enjoy discussion
    • We will use chalk board a lot
    • Thanks in advance for your feedback
What this class is about?

• What does operating system do?
What this class is about?

- What does operating system do?

Diagram:

- Software
  - OS
  - Management
  - Protection
  - Communication
  - Interface
  - A software of software

- Hardware
  - CPU
  - Memory
  - Devices
This class is about ...

• Knowledge about OS

• OS research approaches

• Recent system research topics

No textbook; paper reading
OS Knowledge

• Similar w/ CS230, except that ...

• More emphasis on `research’
  – How did things come out and evolve?
    • What was the driving force
    • How was the problems addressed
  – What are/were the alternative solutions?

Hopefully you are interested in history
OS research ideas/approaches

• Common themes
  • Performance
  • Complexity
  • Illusion & Usability
  • Protection and security

• Common tricks
  • Caching
  • Indirection
  • Modularity/abstraction
  • Mechanism vs. policy
  • Hardware support
  • Balance/trade-off

• ...

...
What do you need to do?

• Paper reading
  • Get knowledge; writing tips; **taste**
  • Answer questions before class, ask questions in class

• Come to class

• Do a project
  – Proposal
  – Implementation
  – Write-up and presentation
Introduce yourself!

• Name

• Something interesting about yourself

• What do you want to learn from this class?

• What research topic (inside and outside OS) are you interested in?
A brief history of OS (i)

- 1\textsuperscript{st} period (1940’s—1950’s)
  - Machine is very expensive
    - Most things are manual
  - Software
    - No high-level language

Q: was there OS? Why …?
A brief history of OS (i)

- 1st period (1940’s—1950’s)
  - Machine is very expensive
    - Most things are manual
  - Software
    - Library, I/O device, compiler
    - No OS
    - Long software setup time
A brief history of OS (ii)

• 2\textsuperscript{nd} period (1950’s)
  – Batching system
    • A deck of card/paper-tape at a time
  Q: what does OS do?
    • OS is a loader
      – Handles interrupt, no scheduling
  – Magnetic tape (replaces paper tape)
    • Use separate machine to turn paper-tape to magnetic tape
  – Disk replaces magnetic tape
    • Reading to disk can go together with calculation (spooling)
UNIVAC
A brief history of OS (iii)

- **1960---1970’ s**
  - `advanced batch OS`
    - Virtual memory
      - Ease programming
      - Atlas [1961] a batch OS with spooling
    - Multi-programming
      - Improve CPU utility
      - THE [1968] 5-job at a time, s/w VM
      - DOS/360 [1966 IBM] 3-job at a time, no VM
  - Time-sharing OS
    - Human interaction becomes more important
      - CTSS [1962], Multics [1965~], Unix [1969]
A brief history of OS (iv)

• 1980’s
  – PC OS
    • Back to single-user and single address-space
    • Pilot [1980 Xerox]
    • PC-DOS, MS-DOS (single task)

• 1990’s--
  – PC OS goes back to old mainframe style
    • Multi-user, multi-task, protection, virtualization
Current OS research

• Complexity
• Reliability & Security
  – Singularity, SELinux, ...
• Scalability
  – Multicore, cloud computing
  – Cellphone, sensor
• Opportunities/challenges from new hardware
  – SSD
  – Sensors
  – Heterogeneity
Administration
A brief overview of our schedule

- 3 lec  
  OS (kernel) organization
- 3 lec  
  Concurrency/Synchronization
- 1 lec  
  Resource management
- 1 lec  
  Virtualization
- Midterm
- 4 lec  
  FS, Disk
- 3 lec  
  Reliability, security, manageability
- 1 lec  
  Project Presentation
- 2 lec  
  Guest lectures by graduate students
Things you will do (i)

- Paper reading
  - Form a reading group (2~4 people)
    - Let me know if you cannot find partners
  - Read the paper(s) BEFORE every class
  - Submit one review BEFORE every class
    Send to me (shanlu@)
    - At least one question about the paper(s)
    - Answer one or two questions posted on-line
Things you will do (ii)

- Come to class
  - Ask questions
  - Answer questions

- Class website
  http://people.cs.uchicago.edu/~shanlu/teaching/33100_fa15/index.html
Things you will do (iii)

• A course project
  – Who  1~3 people group
  – When  now
  – What
    • Decide topic & write project proposal (10/21)
    • Do the work & meet w/ me at least once (Nov.)
    • Final report (12/9) & group presentation (12/2)
Things you will do (iv)

- Mid-term
  - Nov. 4\textsuperscript{th}
- Final
  - December ??
Grading

• 20% reading and class participation
• 20% mid-term
• 20% Final
• 40% course project
Summary

• Things to do
  – Form a reading group
  – Write a review for THE/Nucleus
  – Start thinking about project proposal

• Things to remember
  – This class is research oriented
  – System research is fun
  – Interact with your instructor 😊!