

CS 6410: Advanced Systems

Fall 2010

Instructor: Hakim Weatherspoon

TA: Ki Suh Lee

Who am I?

- Prof. Hakim Weatherspoon
 - (Hakim means Doctor, wise, or prof. in Arabic)
 - Background in Education
 - Undergraduate University of Washington
 - Played Varsity Football
 - » Some teammates collectively make \$100's of millions
 - » I teach!!!
 - Graduate University of California, Berkeley
 - Some class mates collectively make \$100's of millions
 - I teach!!!
 - Background in Operating Systems
 - Peer-to-Peer Storage
 - Antiquity project - Secure wide-area distributed system
 - OceanStore project – Store your data for 1000 years
 - Network overlays
 - Bamboo and Tapestry – Find your data around globe
 - Tiny OS
 - Early adopter in 1999, but ultimately chose P2P direction

Goals for Today

- Be brief!
- Why take this course?
- How does this class operate?
- Class details

Why take this course

- Learn about systems abstractions, principles, and artifacts that have had lasting value,
- Understand attributes of systems research that is likely to have impact,
- Become comfortable navigating the literature in this field,
- Gain experience in thinking critically and analytically about systems research, and
- Acquire the background needed to work on research problems currently under study at Cornell and elsewhere.

Why take this course

- Satisfy systems breadth requirement

		Research Styles		
		Theoretical	Systems	Applied
Areas	Algorithms/Theory	68xx		
	AI	676x		67xx except 676x
	Systems		632x, 64xx	
	PL	6110		
	Sci. Comp. and Apps			62xx, 65xx, 66xx

How class operates and class detail

How this class operates

- Instructor: Hakim Weatherspoon
 - hweather@cs.cornell.edu
 - Office Location: 4105C Upson
- TA: Ki Suh Lee
 - kslee@cs.cornell.edu
- Lectures:
 - CS 6410: Tu, Th: 10:10 – 11:25 PM, Philip 213

Course Help

- Course staff, office hours, etc:
 - <http://www.cs.cornell.edu/courses/cs6410/2010fa>
- Research projects
 - <http://fireless.cs.cornell.edu>

CS 6410: Overview

- Prerequisite:
 - Mastery of CS 4410 material
 - Fundamentals of OS design
 - How parts of the OS are structured
 - What algorithms are commonly used
 - What are the mechanisms and policies used
- Class Structure
 - Papers Readings (whole semester)
 - Paper Presentations (whole semester)
 - Labs (first 1/8)
 - Research Project (second 7/8)

CS 6410: Topics

- Operating Systems
 - Concurrency, file systems, VM, I/O, etc.
- Distribution/Networking
 - RPC, clusters, pub/sub, mobility, etc.
- Fault Tolerance
 - Replication, consensus, transactions, etc.

CS 6410: Paper Readings

- Required reading is always *two* papers
 - Different approach, competition, criticism,...
 - Papers pulled from, best journals and conferences
 - TOCS, SOSP, OSDI, ...
 - 27 lectures, 54 (required) papers!
- Read papers before each class and bring notes
 - takes ~3 to 4 hrs per paper, write notes and questions
- Write a review and turn in *at least one hour* before beginning of class
 - Turn on online via Course Management System (CMS)
 - ***No late reviews will be accepted***

CS 6410: Writing Reviews

- Each student is *required* to prepare notes on each paper before class and to bring them to class for use in discussion.
- Your notes should list assumptions, innovative contributions and criticisms. Every paper in the reading list has at least one major weakness.
- Turn paper reviews in online before class via CMS
 - Be succinct—One paragraph per paper
 - Short summary of paper (two or three sentences)
 - Two to three strengths/contributions
 - and at least one weaknesses
 - One paragraph to compare/contrast papers
 - In all, turn in two to three paragraphs

CS 6410: Paper Presentations

- Each person will present a paper one or two times, depending on class size
 - Read and understand both required and suggested papers
- Two and a half weeks ahead of time
 - Meet with professor to agree on ideas to focus on
- One and a half weeks ahead of time
 - Have presentation prepared and show slides or “chalk talk” to professor
- One week ahead of time
 - Final review / do a number of dry-runs

CS 6410: Class Format

- 45 minutes presentation,
30 minutes discussion/brainstorming.
 - In that order, or mixed.
- All students are required to participate!
- Counts in final grading.

CS 6410: Labs

- Labs (first 1/8 of semester)
 - 2 labs
 - Using Amazons EC2/S3 infrastructure
 - Building a proxy using events (instead of threads)

CS 6410: Research Project

- One major project per person
 - Or two persons for a very major project
- Initial proposal of project topic – due mid-September
- Survey of area (related works)—due begin of October

- Midterm draft paper – due begin of November
- Peer reviews—due a week later

- Final demo/presentation—due begin of December
- Final project report – due a week later

CS 6410: Project Suggestions

- <http://fireless.cs.cornell.edu/projects>
- Networks
 - Software Routers and Packet Processors
 - Netslice, FwP, Fmeter
- Network Measurements
 - Software Defined Network Adapter (SDNA)
 - Cornell NLR Rings Testbed
- Cloud Storage
 - Federated (cloud) storage and other services
 - Redundant Array of Cloud Storage (RACS)
- File Systems
 - Local and wide-area file systems enhancements
 - Reliability, consistency, performance

CS 6410: Project Suggestions

- Global-scale datacenters
 - Utilization, Low-energy file systems, Virtual machines, etc
 - High bandwidth-delay product networks enhancements
 - Cluster of servers, Netslice, RouteBricks, FWP, Maelstrom, etc
 - Exploit parallelism in multicore processors
 - Thread vs events, operating system, network process architectures
- P2P
 - Cloud storage @ home, etc
- I have more ideas, but you can also talk to other faculty for more ideas:
Professors Birman, Sizer, Schneider, Van Renesse, or Gehrke

CS 6410: Project Infrastructure

- Amazon's Cloud Infrastructure EC2/S3
- Cornell NLR Rings testbed
- Emulab
- PlanetLab
- Cornell's Center for Advanced Computing (CAC)
- ...

Important Project Deadlines

9/16	Submit your topic of interest proposal
9/30	Submit 2-3 pages survey on topic
10/5	Discuss project topic with me
11/4	Midterm draft paper of project
12/2	Final demo/presentation of project
12/9	Final paper on project

CS 6410: Grading

- Class Participation ~ 40%
 - lead presentation, reading papers, write reviews, participation in class discussion
- Project ~ 50%
 - Proposal, survey, draft, peer review, final demo/paper
- Labs ~ 5%
- Subjective ~ 5%
- This is a rough guide

Academic Integrity

- Submitted work should be your own
- Acceptable collaboration:
 - Clarify problem, C syntax doubts, debugging strategy
 - You may use any idea from any other person or group in the class or out, provided you **clearly state what you have borrowed and from whom.**
 - If you do not provide a citation (i.e. you turn other people's work in as your own) that is *cheating*.
- Dishonesty has no place in any community
 - May NOT be in possession of someone else's homework/project
 - May NOT copy code from another group
 - May NOT copy, collaborate or share homework/assignments
 - University Academic Integrity rules are the general guidelines
- Penalty can be as severe as an 'F' in CS 6410

Stress, Health and Wellness

- Need to pace yourself to manage stress
 - Need regular sleep, eating, and exercising
- Do ***not*** come to class sick (with the flu)!
 - Email me ***ahead*** of time that you are not feeling well
 - People not usually sick more than once in a semester

Next time

- Read *two* papers below and write review
 - *End-to-end arguments in system design*, J.H. Saltzer, D.P. Reed, D.D. Clark. *ACM Transactions on Computer Systems* Volume 2, Issue 4 (November 1984), pages 277--288.
<http://portal.acm.org/citation.cfm?id=357402>
 - *Hints for computer system design*, B. Lampson. *Proceedings of the Ninth ACM Symposium on Operating Systems Principles* (Bretton Woods, New Hampshire, United States) 1983, pages 33--48.
<http://portal.acm.org/citation.cfm?id=806614>
- Lab 0
 - Using Amazon's EC2/S3 infrastructure
- Check website for updated schedule