CSC 501 (002) Fall 2017 Operating Systems Principles

Course description:
This course will describe the principles of designing operating systems. Topics include multi-threading, synchronization, scheduling, virtual memory, and distributed systems including clusters. This course will be based on textbook & paper readings, paper discussions, projects, a midterm exam, a final exam and in-class participations. The purpose of this course is to teach computer software system structures from a design point of view. We will look at different structuring techniques, and we will examine their usage in both important historical systems and in modern systems. In addition to learning about different system structures and different operating systems, you will learn:

1. How to read a research paper in an objective manner.
2. How to articulate your understanding of and insights into a research paper.
3. How to synthesize research themes and topics across multiple papers.
4. How to apply paper ideas into real systems.

Instructor:
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Textbook:
Operating Systems: Three Easy Pieces
Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau
Arpaci-Dusseau Books
March, 2015 (Version 0.90)
(free online textbook at http://pages.cs.wisc.edu/~remzi/OSTEP/)

Grading:
20% midterm
30% final (The final will be cumulative.)
30% projects
10% class participation (We will be using clickers in the class!)
10% reading quizzes
The final grading will be based on relative ranking of students in the class instead of absolute scale of grades

Lecture schedule:

Date	Topic	Reading	Project
08/17/2017	Intro/Logistics		
08/22/2017	The Structure of Operating Systems	Arpaci-Dusseau Chapter 2, 4, 5	
08/24/2017	The Structure of Operating Systems	The Structure of the 'THE'-Multiprogramming System HYDRA: The Kernel of a Multiprocessor Operating System	

Date	Topic	Reading	Project
08/29/2017	The Structure of Operating Systems	The UNIX Time-Sharing System Mach: A New Kernel Foundation For UNIX Development	
08/31/2017	Processes & Scheduling	Arpaci-Dusseau Chapter 6, 7, 8	
09/05/2017	Processes & Scheduling	Lottery Scheduling: Flexible Proportional-Share Resource Management. Resource containers: A new facility for resource management in server systems	
09/07/2017	Virtual memory	Arpaci-Dusseau Chapter 13, 14, 15, 16, 18	
09/12/2017	Virtual memory	Arpaci-Dusseau Chapter 20, 21, 22	
09/14/2017	Virtual memory	The Multics Virtual Memory: Concepts and Design WSCLOCK-A Simple and Effective Algorithm for Virtual Memory Management	
09/19/2017	Virtual memory	Virtual Memory Management in VAX/VMS Machine-Independent Virtual Memory Management for Paged Uniprocessor and Multiprocessor Architectures	
09/21/2017	Threads	Arpaci-Dusseau Chapter 26, 27, 28, 29	Project #1 Due — Device driver/kernel module
09/26/2017	Threads	Arpaci-Dusseau Chapter 30, 31	
09/28/2017	Threads	Monitors: An Operating System Structuring Concept Experience with Processes and Monitors in Mesa	
10/03/2017	Architecture-OS interactions	TimeGraph: GPU Scheduling for Real-Time Multi-Tasking Environment The Performance of μ-Kernel-Based Systems	
10/10/2017	Midterm Review		
10/12/2017	Midterm		
10/17/2017	Architectural support for Virtual memory	Arpaci-Dusseau Chapter 19	
10/19/2017	Architectural support for Virtual memory	A Look at Several Memory Management Units, TLB-Refill Mechanisms, and Page Table Organizations Efficient Virtual Memory for Big Memory Servers	
10/24/2017	I/O	Arpaci-Dusseau Chapter 36, 37, 38 and Appendix--Flash-based SSDs	

Date	Topic	Reading	**Project**
10/26/2017	I/O	eNVy: a non-volatile, main memory storage system When Poll is Better than Interrupt	Project #2 Due — Multithreaded support in kernel module
10/31/2017	File systems	Arpaci-Dusseau Chapter 39, 40, 41	
11/02/2017	File systems	A Fast File System for Unix The Google File System	
11/07/2017	Log-structured file system	The Design and Implementation of a Log-Structured File System Don't stack your log on my log	
11/09/2017	Distributed systems	Arpaci-Dusseau Chapter 47 The Sprite Network Operating System The Distributed V Kernel and its Performance for Diskless Workstations	
11/14/2017	Networked systems	Implementing Global Memory Management in a Workstation Cluster Arpaci-Dusseau Chapter 48	
11/16/2017	Networked systems	Web Search for a Planet: The Google Cluster Architecture Windows Azure Storage: A Highly Available Cloud Storage Service with Strong Consistency	
11/21/2017	Virtual machine	Arpaci-Dusseau Appendix--Virtual machines A comparison of software and hardware techniques for x86 virtualization	Project #3 Due — File system
11/28/2017	Virtual machine	Xen and the Art of Virtualization IX: A Protected Dataplane Operating System for High Throughput and Low Latency	
11/30/2017	Final Review		
12/12/2017	Final Exam (1pm-4pm)		