CSC 501 (002) Fall 2018 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:
Hung-Wei Tseng
Office hours: TBD @ EB2 3254
E-mail: hungwei_tseng+CSC501@ncsu.edu

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 (tentative):

Date	Topic	Reading	Project
08/23/2018	Intro/Logistics		
08/28/2018	The Structure of Operating Systems and the Abstraction of Processes	Arpaci-Dusseau Chapter 2, 4, 6	

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08/30/2018	The Structure of Operating Systems	The Structure of the 'THE'-Multiprogramming System HYDRA: The Kernel of a Multiprocessor Operating System	
09/04/2018	The Structure of Operating Systems	The UNIX Time-Sharing System Mach: A New Kernel Foundation For UNIX Development	
09/06/2018	Processes & Threads	Arpaci-Dusseau Chapter 5, 26, 27	
09/11/2018	Processes & Threads	Arpaci-Dusseau Chapter 28, 29, 30, 31	
09/13/2018	Processes/Threads Scheduling	Arpaci-Dusseau Chapter 7 An experimental time-sharing system	
09/18/2018	Processes/Threads Scheduling	Lottery Scheduling: Flexible Proportional-Share Resource Management. Scheduler Activations: Effective Kernel Support for the User-level Management of Parallelism	
09/20/2018	Virtual memory	Arpaci-Dusseau Chapter 13, 15, 16, 18	
09/25/2018	Virtual memory	Arpaci-Dusseau Chapter 20, 21, 22	
09/27/2018	Virtual memory	Virtual Memory Management in VAX/VMS Machine-Independent Virtual Memory Management for Paged Uniprocessor and Multiprocessor Architectures	Project #1 Due — Process/ Thread Scheduling in resource containers
10/02/2018	Virtual memory	Converting a Swap-Based System to do Paging in an Architecture Lacking Page-Reference Bits WSCLOCK-A Simple and Effective Algorithm for Virtual Memory Management	
10/09/2018	Architectural support for Virtual memory	Arpaci-Dusseau Chapter 19	
10/11/2018	Architectural support for Virtual memory	Translation Caching: Skip, Don't Walk (the Page Table) Efficient Virtual Memory for Big Memory Servers	
10/16/2018	Midterm Review		
10/18/2018	Midterm		
10/23/2018	I/O and conventional storage devices	Arpaci-Dusseau Chapter 36, 37 When Poll is Better than Interrupt	

Date	Topic	Reading	Project
10/25/2018	File systems	Arpaci-Dusseau Chapter 39, 40, 41	Project #2 Due — Memory management in resource containers
10/30/2018	File systems	A Fast File System for Unix The Design and Implementation of a Log-Structured File System	
11/01/2018	Fast, non-volatile memory-based storage devices	Arpaci-Dusseau Appendix--Flash-based SSDs eNVy: a non-volatile, main memory storage system Don't stack your log on my log	
11/06/2018	Networked & cloud storage	Arpaci-Dusseau Chapter 49	
11/08/2018	Networked & cloud storage	The Google File System MapReduce: Simplified Data Processing on Large Clusters	
11/13/2018	Networked & cloud storage	Windows Azure Storage: A Highly Available Cloud Storage Service with Strong Consistency f4: Facebook's Warm BLOB Storage System	
11/15/2018	Distributed systems	The Sprite Network Operating System The Distributed V Kernel and its Performance for Diskless Workstations	
11/20/2018	Distributed systems	Web Search for a Planet: The Google Cluster Architecture Implementing Global Memory Management in a Workstation Cluster	Project #3 Due — A file system for resource containers
11/27/2018	Virtual machine	Arpaci-Dusseau Appendix--Virtual machines A comparison of software and hardware techniques for x86 virtualization	
11/29/2018	Virtual machine	Xen and the Art of Virtualization IX: A Protected Dataplane Operating System for High Throughput and Low Latency (2014)	
12/04/2018	Wrapup	Hints for computer system design	
12/06/2018	Final Review		
12/11/2018	Final Exam (8am-11am)		