CSE531 Distributed and Multiprocessor Operating Systems – Syllabus

Catalog Data:
Distributed systems architecture, remote file access, message-based systems, object-based systems, client/server paradigms, distributed algorithms, replication and consistency, and multiprocessor operating systems.

Textbook:
None

Course Objectives
A graduate level course, that covers advanced topics in Operating Systems. The course covers the concepts, policies and mechanisms used in the construction of operating systems that handle multiple processors, from closely coupled system (multiprocessors) to loosely coupled systems (distributed systems). In depth coverage of concurrency, architectures, distributed programming, distributed algorithms and operating system kernel structures.

Course Outcomes:
After the course the student will be able to:

1. Understand the structure of OS kernels for multiple-core architectures
2. Understand the methods used for handling concurrency and parallelism at the OS level.
3. Understand the methods used for handling concurrency and parallelism at the application programming level.
4. Understand the system models of distributed operating systems
5. Understand programming methodologies of cooperation in a distributed system
6. Understand the theoretical concepts of distributed computing

Evaluation:
Students are assessed on grades received in projects, homeworks, exams. The grades are "curved" for determining grade cutoff points on an A, B, C scale. The weight distribution is Assignments: 30%; Mid-Term Exam: 30%; Final Exam: 40%. There will be **no makeup**, such as extra credit work, extra credit exams and/or other methods beyond what all students are expected to do. Extra credit warps class rankings.

Important Things:

1. MCS "portfolio": Yes, the class projects are eligible for MCS portfolio.
2. Academic Dishonesty: You are responsible for understanding what consists academic dishonesty. ASU and Fulton policies for academic dishonesty applied. No tolerance policy will be in effect and a grade of F or XE will be awarded and a report will be filed with Fulton School. Please refer to https://provost.asu.edu/files/AcademicIntegrityPolicyPDF.pdf for details -- also please note item N on Page 2.

Topics:

Multiprocessor Architecture

- MIMD, SIMD Systems
- UMA, NUMA and NORMA systems
- Caches and coherency and scalability

Operating Systems Kernels

- Kernel and interrupt structure
- System calls and reentrancy
- Race conditions and kernel locks

Concurrency and Parallelism

- Locks, semaphores and Synchronization
- Coroutines
- P-thread programming
- Classical process coordination problems and solutions
- Implementing schedulers (user level threads)
- Programming using Open-MP, MPI, Linda

Multiprocessor Scheduling

- Coscheduling, affinity scheduling, hand-off scheduling and others

Distributed Operating Systems

- Vision, goals and current state of the art

System Models and Cooperation Architectures

- Workstation model
- Server model
- Client Server architectures
- Web model

Distributed File Systems

- Unix File System
- NFS and other remote file systems
- Theory and practice in DFS implementations

Message Passing

- Basic Message models
- Ports, naming and programming

Client Server Programming

- Client Server programming
- Nesting, recursion and multithreading
- Nameservice

- Implementing Distributed Messaging systems
- Locking is distributed systems

RPC and DSM
- RPC Systems
- DSM Systems – coherency models and release consistency

Distributed Systems Theory
- Distributed Knowledge (Muddy Children)
- Time and event ordering
- Distributed Mutual Exclusion
- Distributed Snapshots
- Replication Management

Further Information: Will be provided on the class web-site.

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As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish discuss any concerns confidentially and privately.