CS421
Introduction to Operating Systems
Fall 2000

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Course Objective

An Operating System is a complex software package that manages a the resources of a computer system, and provides the base upon which applications can be written. In this course we will study the basic components of an operating system, their functions, policies and techniques used in their implementation and several examples from popular operating systems. The components which will be discussed are:

1. Process management: process description and control, concurrency, mutual exclusion, synchronization, inter-process communication, deadlock and scheduling;
2. Programming with threads: creation, multi-threaded programs, synchronization, scheduling, Solaris implementation of threads;
3. Storage management: virtual memory, I/O management and file systems;
4. Networking and distributed systems: network protocols, two-tier and three-tier client/server application development; Issues in building a distributed systems; New paradigms in distributed system technology: Remote object access in CORBA and network-centric Jini technology.
5. Protection and security: protecting resources, security threats, public key encryption, access control, network security;
6. Examples from Unix-based and Windows-NT based systems.

Concepts discussed during the lecture will be supported by hands on practical projects. Students will also work on a term paper dealing with a topic of current interest.

Class Meetings

CSE421 B: M,W,F 12.00 - 12.50pm, 228 NSM
CSE421 A: M,W,F 1.00 - 1.50pm, 228 NSM

Required Textbooks

1. *Operating Systems, Internals and Design Principles*, by William Stallings, Third Edition, Prentice Hall Inc, 1998.

2. *Design of the Unix Operating System*, by Prentice-Hall Inc., Latest Edition.

Recommended optional supplements

1. *Distributed Operating Systems*, by A.S. Tannenbaum, Prentice-Hall Inc., 1995. (Overview of various distributed systems.)
2. *Distributed Computing: Implementation and Management*, by R. Khanna, Prentice-Hall Inc., 1994. (An excellent book on how distributed computing is addressed by various vendors.)
3. *Core Jini*, by Keith Edwards, Sun Micro Systems Press, Java Series, Prentice-Hall Inc., 1999. (Distributed Systems design issues and Jini technology.)
4. C++ for Java Programmers, by Timothy Budd, Addison-Wesley Longman, Inc., 1999.
5. C++ : How to Program, by Deitel and Deitel, Prentice-Hall Inc., 1998.
6. Java : How to Program, by Deitel and Deitel, Prentice-Hall Inc., 2000.

These texts support the two topics that will be emphasized throughout this course: threads and distributed systems. These books may not be available in the bookstore but they are available in most of the local bookstores, or they may be directly ordered from the publisher or the online shops. You may want to buy one or more of these books depending on how your interest develops as the semester progresses.

Prerequisites

1. CS341: Computer Architecture or equivalent. You should have a good knowledge of computer architecture concepts: interrupts, common bus systems, direct-memory access, instruction cycle, instruction set, processor operation, call frame and support for subroutine implementation.
2. Working knowledge of C++ and Java programming languages.

Grading

Midterm Exam	100 points
Final Exam	150 points
Projects (3 - 50,100,100 points each)	250 points
Quizzes (5 out of 7)	100 points
Attendance (1 for each lecture)	40 points
Paper	50 points

Final letter grades will be based on the (combined) overall percentage of all the items listed above. A (95 –), A- (90 – 94), B+ (85 – 89), B (80 – 84), B- (75 – 79), C+ (70 – 74), C (65 – 69), C- (60 – 64), D+ (55 – 59), D (50 – 54), F (less than 50). This policy is subject to change. If needed, the individual components and the overall grades will be appropriately curved.

Exams

The midterm exam will be held before the last date to **R**esign from the course. Final exam will be held during the regularly scheduled final exam week. Midterm exam will cover approximately 25% of the material and the final exam will be comprehensive. No make up exam will be given unless otherwise there is an extraordinary reason.

Quizzes

There will be 7 unannounced quizzes. I plan to give a quiz once in every two weeks. The best 5 grades out of the 7 will be taken for quiz-grade. So you can afford to miss 2 quizzes and still come up with full grade for the quiz component. The questions will be from the material covered in the immediately preceding lectures and recitations.

Homework will be assigned but will not be collected. The answers to the homework problems will be discussed during the recitation. It is important that you work on the homework assigned to prepare yourself for the quizzes and the exams.

Paper

In this assignment you are required to learn about a topic that is of current interest. The topic for this semester is Sun Micro Systems' answers to distributed system infrastructure: The Jini Technology. The Core Jini book listed above gives all the material needed for this paper. You are required to study the material and write a paper in the form answers to few questions that will be given to you.

Projects

The due date for each project will be announced when it is assigned. All the source code, documentation, makefile, data files, and README files are to be submitted on-line. The details of how to submit given along with your first project. You will have to follow the rules for the other projects too.

I reserve the right to change the project specifications at any point before the due date to answer the problems that may arise during the course of the project. If your design is modular the changes will not be difficult to implement. A detailed grading guideline will be given to you along with the project specification. Use this as a guide for your design and implementation. It is absolutely necessary to keep up with the programming projects in the class. There will be a 10 point deduction for each day the project is late after the due date.

Academic Dishonesty

There is no group work assigned in this course. You are required to work on your own. Students who collaborate on homework, projects and/or the exams will be penalized with an 'F' for that component of the course. Repeat offenders will be given an 'F' for the course. CSE department is working on a strict policy on Academic Dishonesty. This will be strictly followed once it is made available to the students.

Attendance and Participation

It is very important that you attend all the lectures and the recitation. A point for every lecture you attend is to encourage you not miss many lectures. You are strongly encouraged to participate in the lecture by asking relevant questions and taking part in useful discussion. This helps break the monotony of the lecture format. But if I find a discussion digressing from the topic of the lecture I may defer the discussion to after the regular lecture period or to the newsgroup meant for this class. Understand that the newsgroup is a public forum and try to be civil.

Important dates

Item	Due date
Project 1	2/20
Project 2	3/28
Project 3	4/30
Exam 1	2/25
Final exam	Final exam week

Tentative Lecture Schedule

WEEK OF	TOPICS	MATERIAL
1/19	Computer Systems Overview; Operating system basics: interrupts, mememory hierarchy and communication	Ch.1,2
2/24	Process description and control; Examples from UNIX SVR5	Ch.3 notes
1/31,2/7	Processes and threads; symmetric multiprocessing; microkernels; examples from Solaris and Windows NT	Ch.4
2/14	Concurrency and mutual exclusion; Synchronization at various levels : semaphores, monitors, messages, and locks; Classical problems: reader/writer and producer/consumer	Ch.5
2/21	Resource management and deadlocks; deadlock prevention, detecion, avoidance, and resolution	Ch.6
2/28	Memory management: locality principles, paging and segmentation, address translation; traslation buffers	Ch.7,8
3/13	Scheduling: uniprocessor. multiprocessors, and real-time scheduling; priority queues; queuing theory; scheduling threads	Ch.9, 10, Appdx.
3/20	IO management : Devices, buffering, DISK IO; RAID	Ch.11, notes
3/27	File Systems: File organizations; directory structure; sharing and access rights; secondary storage management	Ch.12
4/3	Distributed Systems: Issues in design, implementation and use; Network protocols	Ch.13
4/10	Client-server technology (Ex: CORBA), network centric computing : Jini technology	Notes, Jini txt.
4/17	Naming, directory services: CORBA and DCOM examples	Notes
4/24	Security and protection issues : access control; private and public key encryption; network security; Review for final exam	Ch.15
5/1	Review for Final Exam	Notes