CIS-4020 Outline

Last Revised: 2024-08-16

Primary Topics

The major areas covered by this course are

1. Process model. Scheduling, Threads. Some discussion of real-time, multiprocessor, and distributed systems as time allows.
2. Memory management. Segmentation vs Paging. Page replacement algorithms.
3. File systems. File system layout. Some discussion of disk scheduling.
4. Device I/O. Device drivers.

Specific Topics

1. Introduction to the Linux source. Organization, references, memory map. Show the basics of writing Linux modules.
2. Processes vs threads. Process creation and thread synchronization (spinlocks, mutexes, semaphores). Classic scheduling algorithms (FIFO, SJN). Multi-level scheduling and mulit-processor scheduling. Preemptive vs non-preemptive scheduling, priority schemes. Operation of the Linux completely fair scheduler (CFS), real time scheduling.
3. Memory management. Memory allocation in the kernel (Linux slab cache, buddy systems, etc). How paging is implemented. Page replacement algorithms, etc. Paging vs swapping vs segmentation.
4. File system layout (with emphasis on POSIX style systems).
   a) Discuss the Linux file system handling code and how to build a file system of our own design (GenericFS). This is a significant project that runs over several weeks. Some project management skills can also be explored.
   b) Go over my File system "wish list" (stored with the GenericFS documentation). Discuss various advanced features of various file systems, how they might be implemented and their implications. See “File System Features” for ideas.
   c) Install an existing, modern file system (ext3, XFS, resierfs, etc) under Linux and exercise it (which is the "best"?). This would be a good lab experience. See the references file stored with the GenericFS source code.
5. Monolithic vs microkernel designs. QNX message passing. Develop a resource manager for QNX as an example of a device driver as well as how message passing might be handled in real life.
6. Distributed operating systems. Define a distributed system by describing what features such a system should have. Talk about issues in process management (scheduling, migration), resource control (distributed mututal exclusion), etc. Talk about MPI

and/or PVM (parallel or "cluster" computing).