15-213

System-Level I/O
November 12, 2007

Topics

- Unix I/O
- Robust reading and writing
- Reading file metadata
- Sharing files
- I/O redirection
- Standard I/O

Unix I/O Key Characteristics

Classic Unix/Linux I/O:

I/O operates on linear streams of Bytes

- Can reposition insertion point and extend file at end

I/O tends to be synchronous

- Read or write operation block until data has been transferred

Fine grained I/O

- One key-stroke at a time
- Each I/O event is handled by the kernel and an appropriate process

Mainframe I/O:

I/O operates on structured records

- Functions to locate, insert, remove, update records

I/O tends to be asynchronous

- Overlap I/O and computation within a process

Coarse grained I/O

- Process writes "channel programs" to be executed by the I/O hardware
- Many I/O operations are performed autonomously with one interrupt at completion

Unix Files

A Unix *file* is a sequence of *m* bytes:

- $B_0, B_1, \ldots, B_k, \ldots, B_{m-1}$

All I/O devices are represented as files:

- `/dev/sda2` (`/usr` disk partition)
- `/dev/tty2` (terminal)

Even the kernel is represented as a file:

- `/dev/kmem` (kernel memory image)
- `/proc` (kernel data structures)