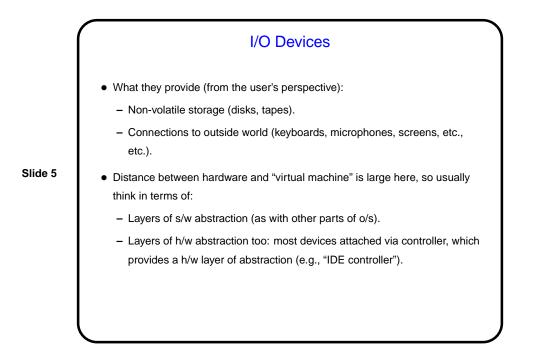
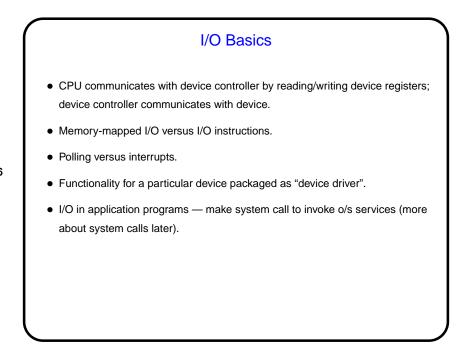
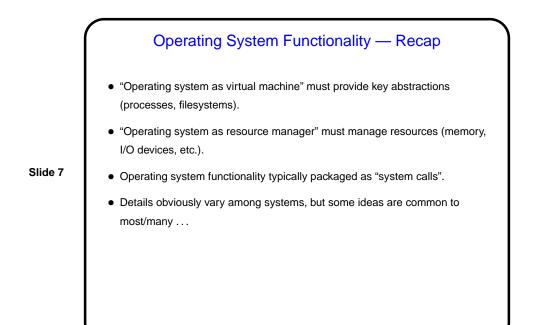
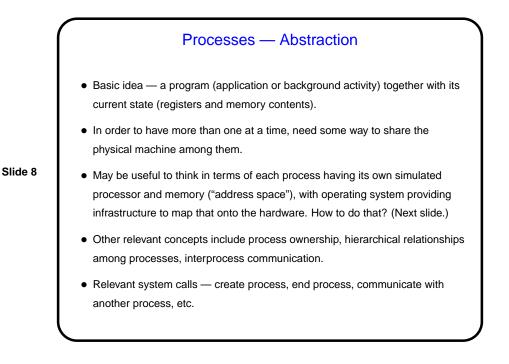


Memory Hierarchy — Recap
Registers included with processor; explicitly managed by software.
Caches can be part of processor or separate; mostly/entirely managed by hardware. If more than one processor, caches can be shared — which can get interesting (more later?).
Slide 4
Main memory (RAM) also explicitly managed by software. Interface between processors and memory often involves an MMU that can provide memory protection as well as relocation (more later). (Review minute essay from last time.)
Disks and tapes can be considered lower levels in the hierarchy.









Processes — Implementation

 Managing the "simulated processor" aspect requires some way to timeshare physical processor(s). Typically do that by defining a per-process data structure that can save information about process. Collection of these is a "process table", and each one is a "process table entry".

Slide 9

 Managing the "address space" aspect requires some way to partition physical memory among processes. To get a system that can defend itself (and keep applications from stepping on each other), memory protection is needed probably via hardware assist. Some notion of address translation may also be useful, as may a mechanism for using RAM as a cache for the most active parts of address space, with other parts kept on disk.

	Filesystems
Slide 10	 Most common systems are hierarchical, with notions of "files" and "folders"/"directories" forming a tree. "Links"/"shortcuts" give the potential for a more general (non-tree) graph.
	 Connecting application programs with files — notions of "opening" a file (yielding a data structure programs can use, usually by way of library functions).
	 Many, many associated concepts — ownership, permissions, access methods (simple sequence of bytes, or something more complex?), whether/how to include direct access to I/O devices in the scheme.
	• Relevant system calls — create file, create directory, remove file, open, close, etc., etc.
	 See text for some UNIXisms — single hierarchy, regular versus special files, pipes, etc.

