CSE 451: Operating Systems
Spring 2010

Module 13
Secondary Storage Overview

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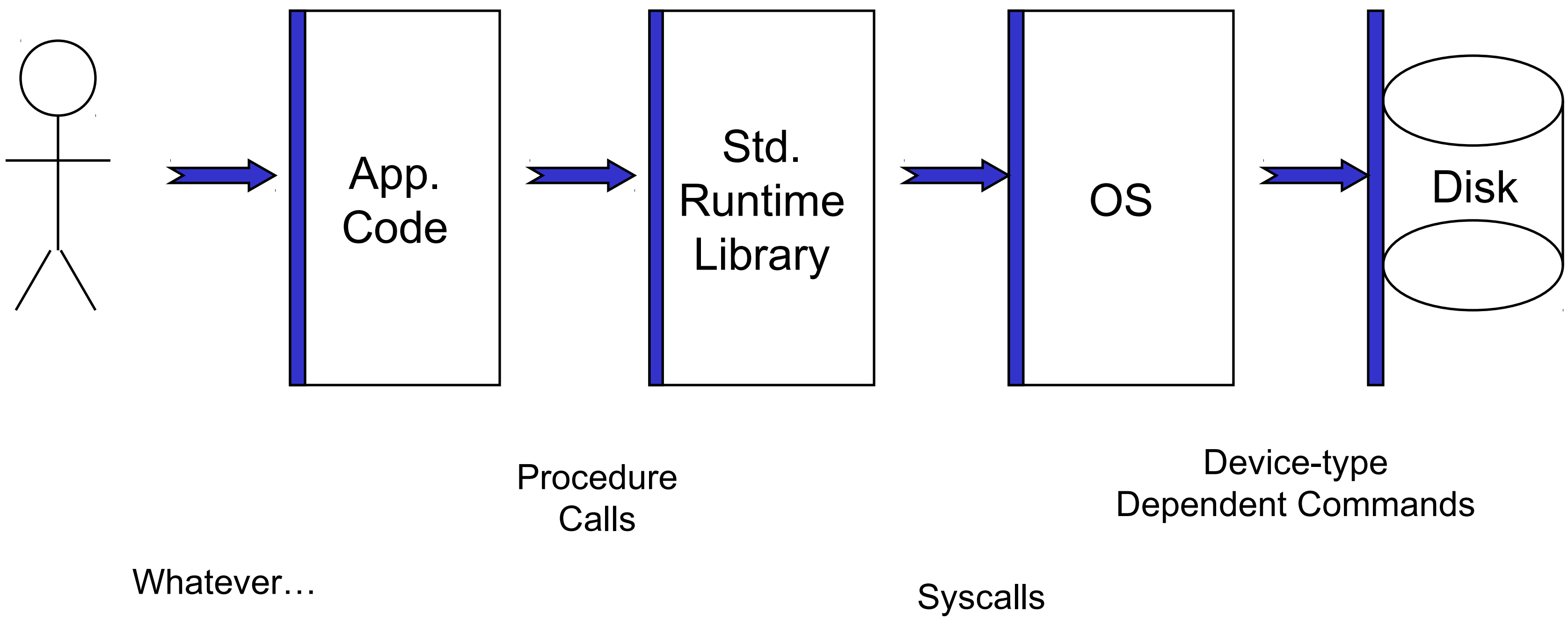
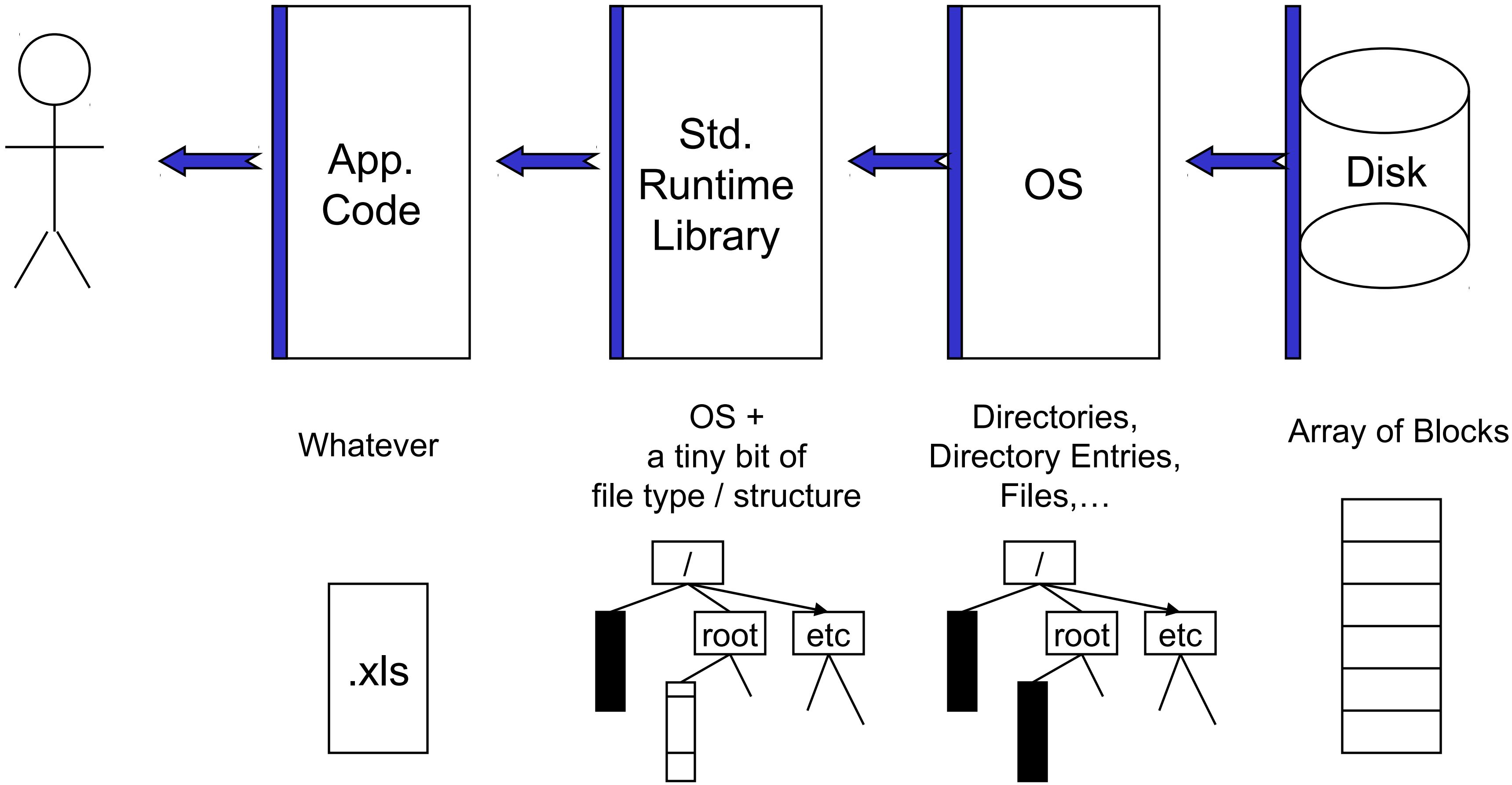
Interface Layers

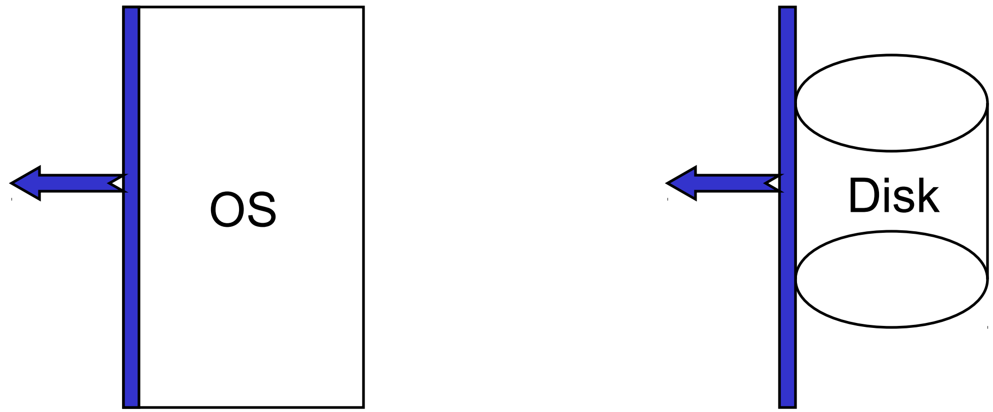


Exported Abstractions



Primary Roles of the OS (file system)

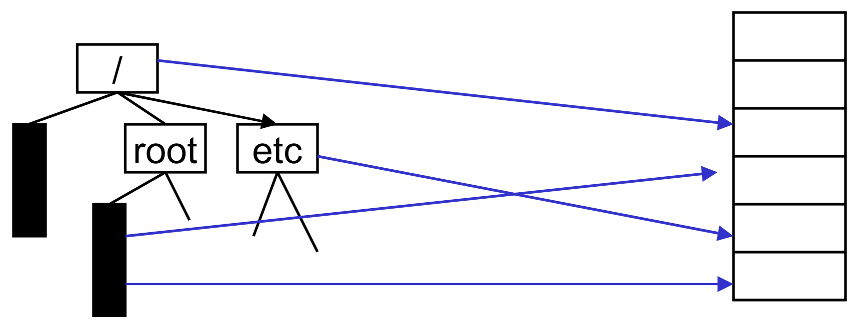
1. Hide hardware specific interface
2. Allocate disk blocks
3. Check permissions
4. Understand directory file structure
5. Maintain *metadata*
6. Performance
7. Flexibility



Why does the OS define directories?

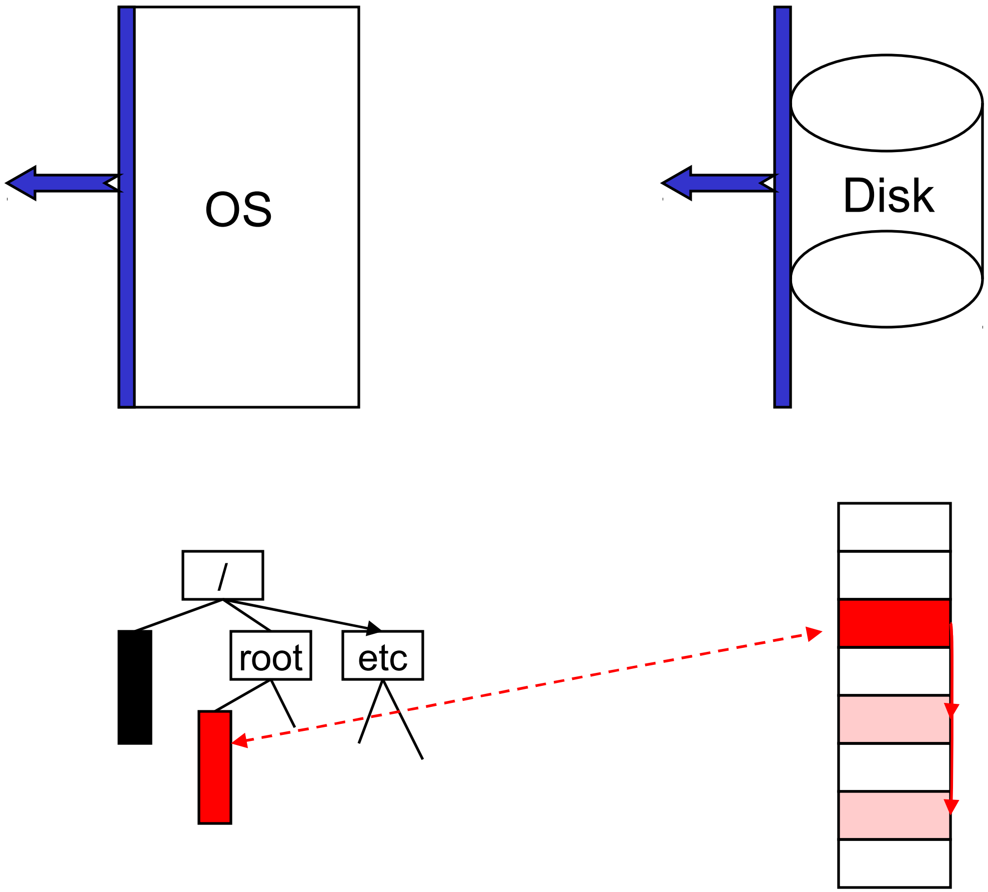
Why not leave that to the library/application layer?

(Why would you want to leave it to the app/library?)

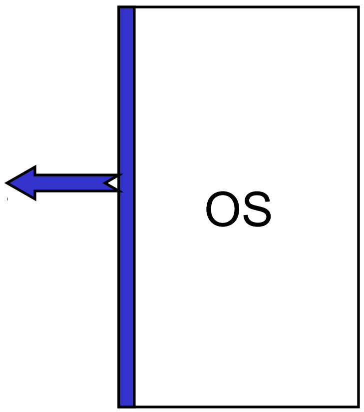


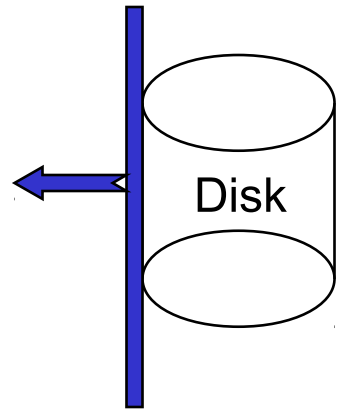
What Is A File?

- At this level, what we think of as a file is an “inode”
- An inode keeps track of where the data blocks are
- It also keeps track of metadata (e.g., permissions, last modification time, etc.)

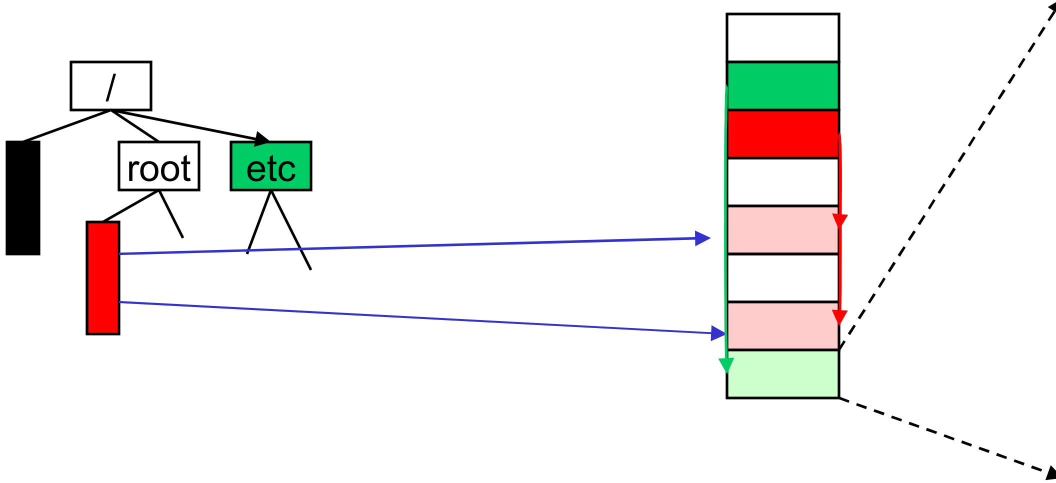


What Is A Directory?



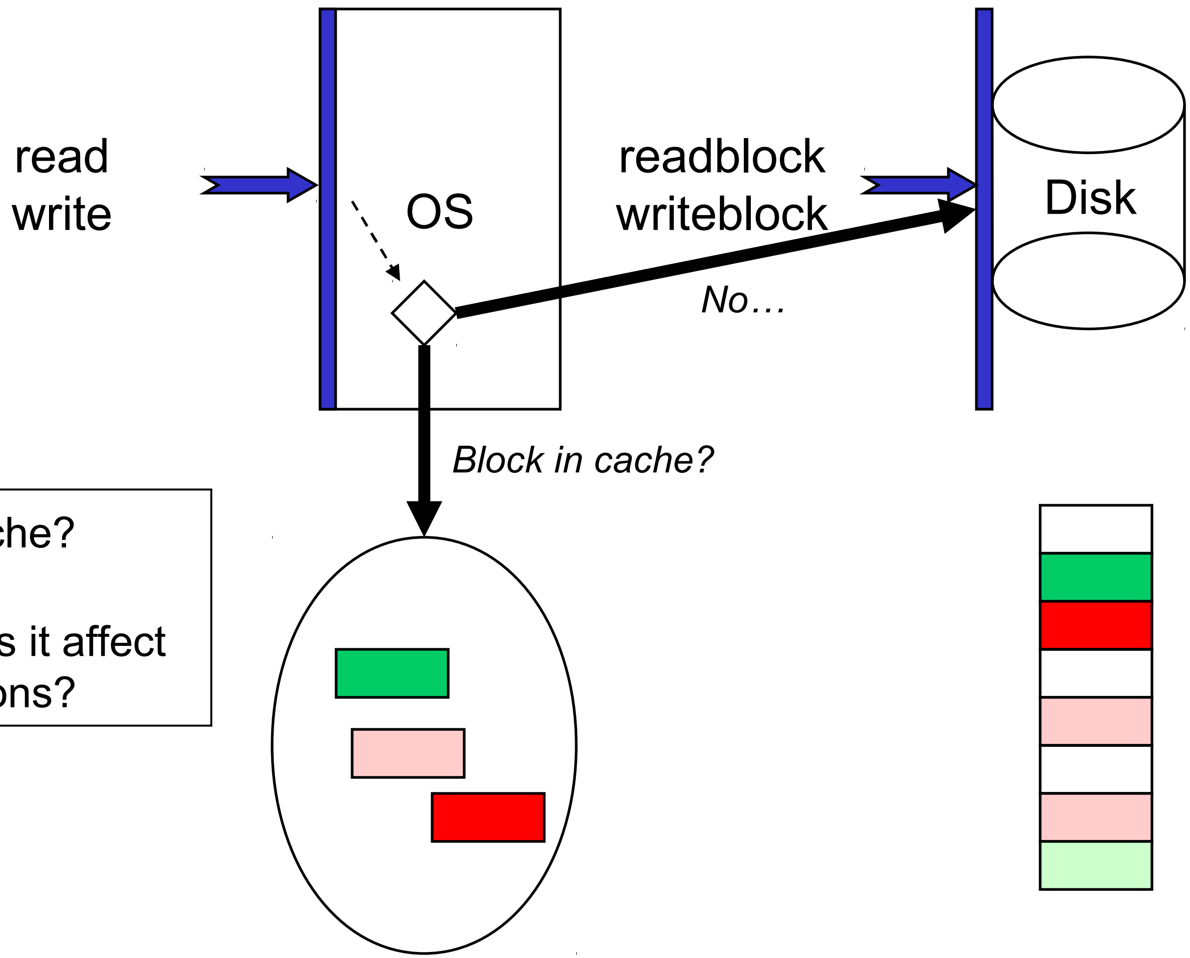


Ok, so what is a "hard link"?



17	.
2	..
21812	passwd
45709	hosts

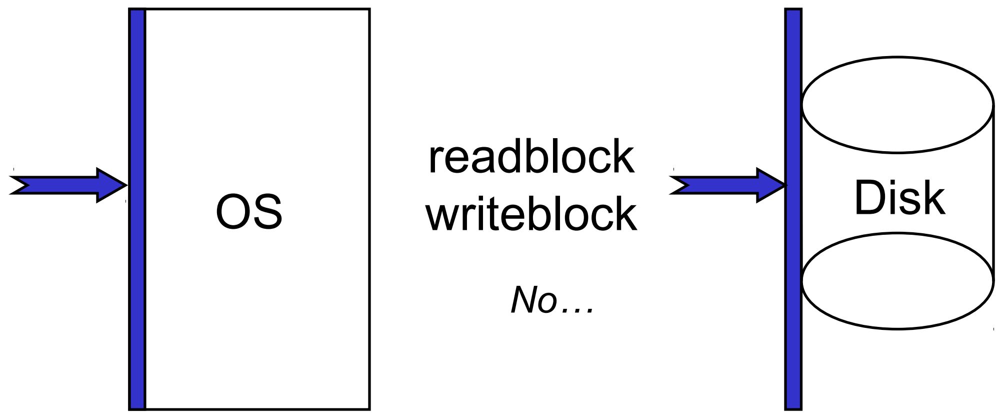
Obtaining Performance: Caching



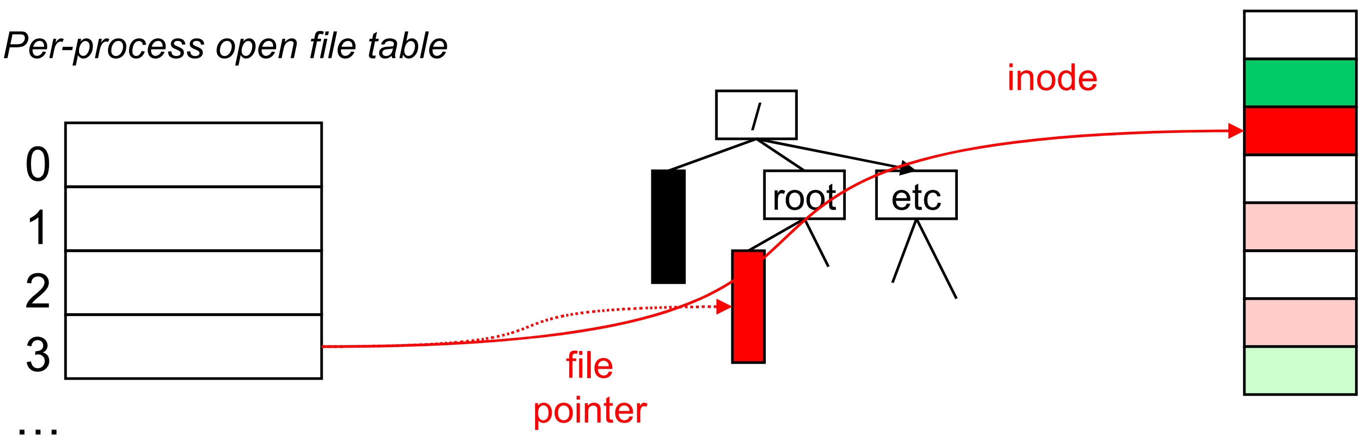
- Why cache?
- How does it affect applications?

Obtaining Performance: `open`

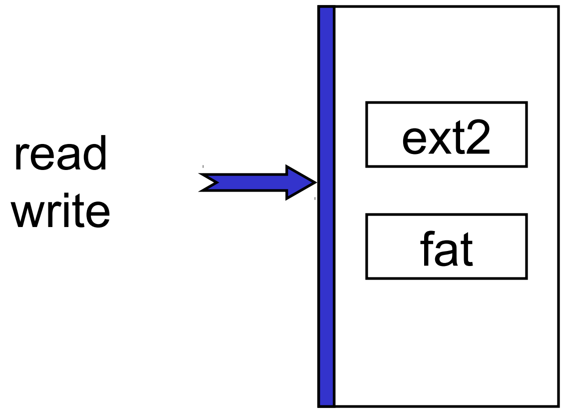
int fd = open("/root/xxx", O_RDONLY)
[read(fd,…)
write(fd,…)]

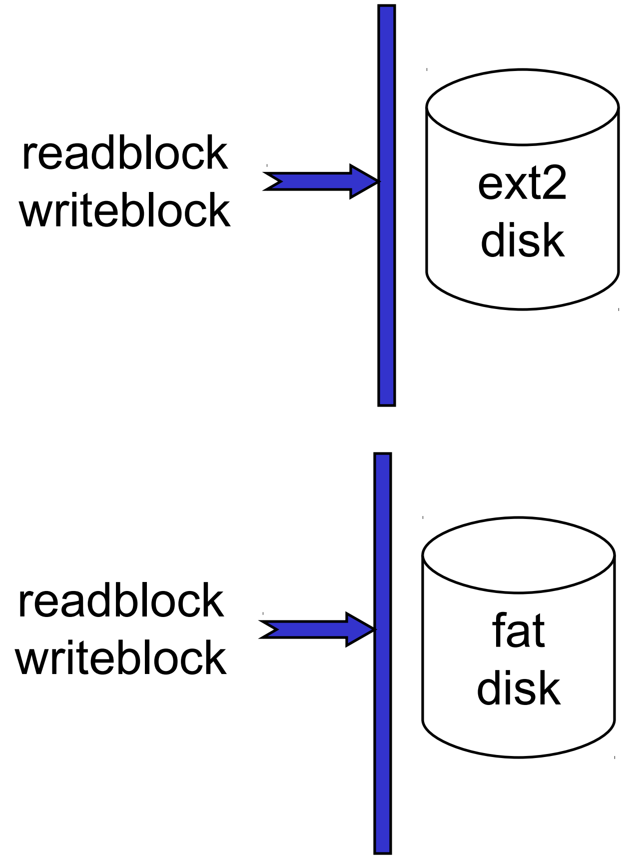


Per-process open file table



Multiple File Systems



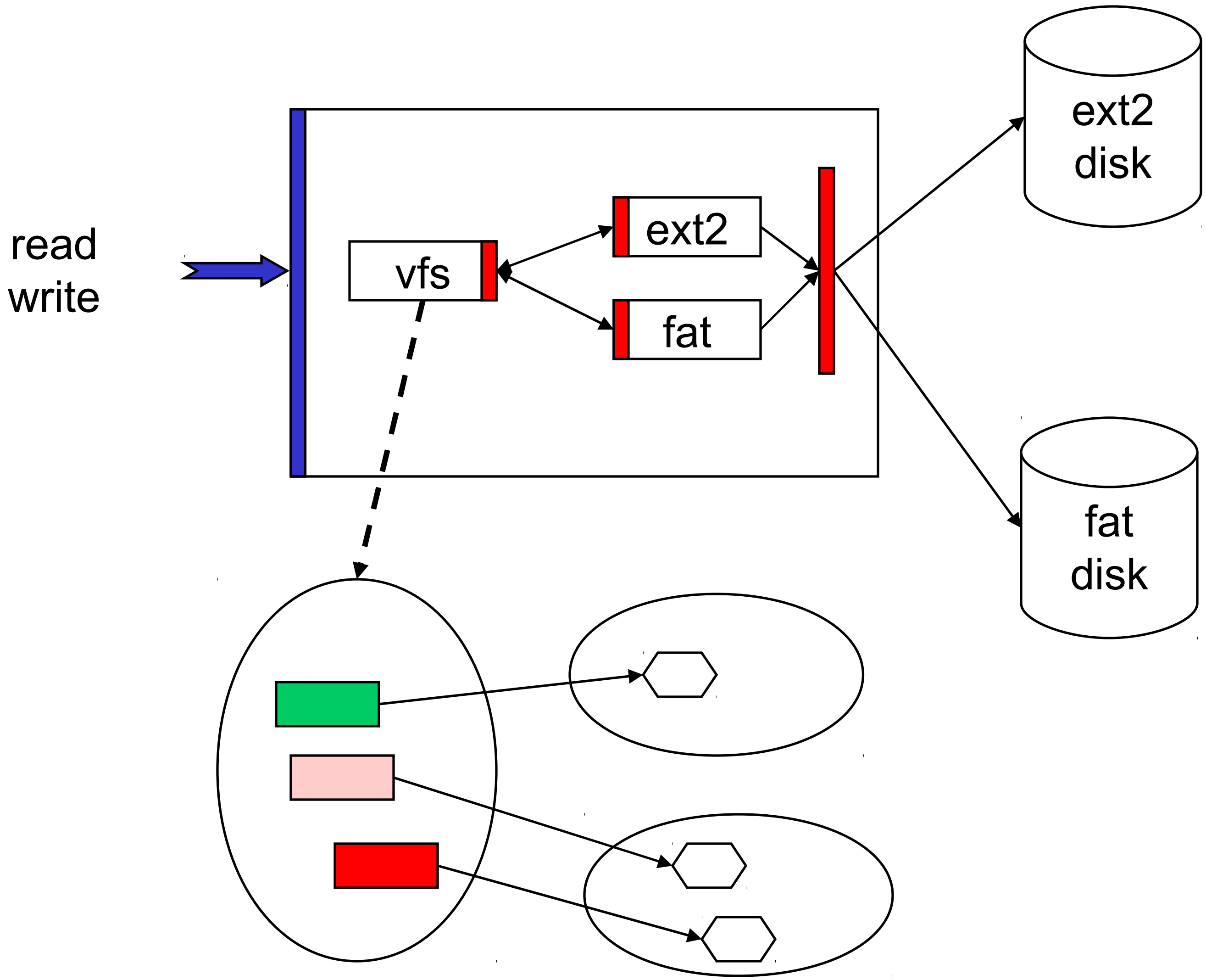


Each filesystem:

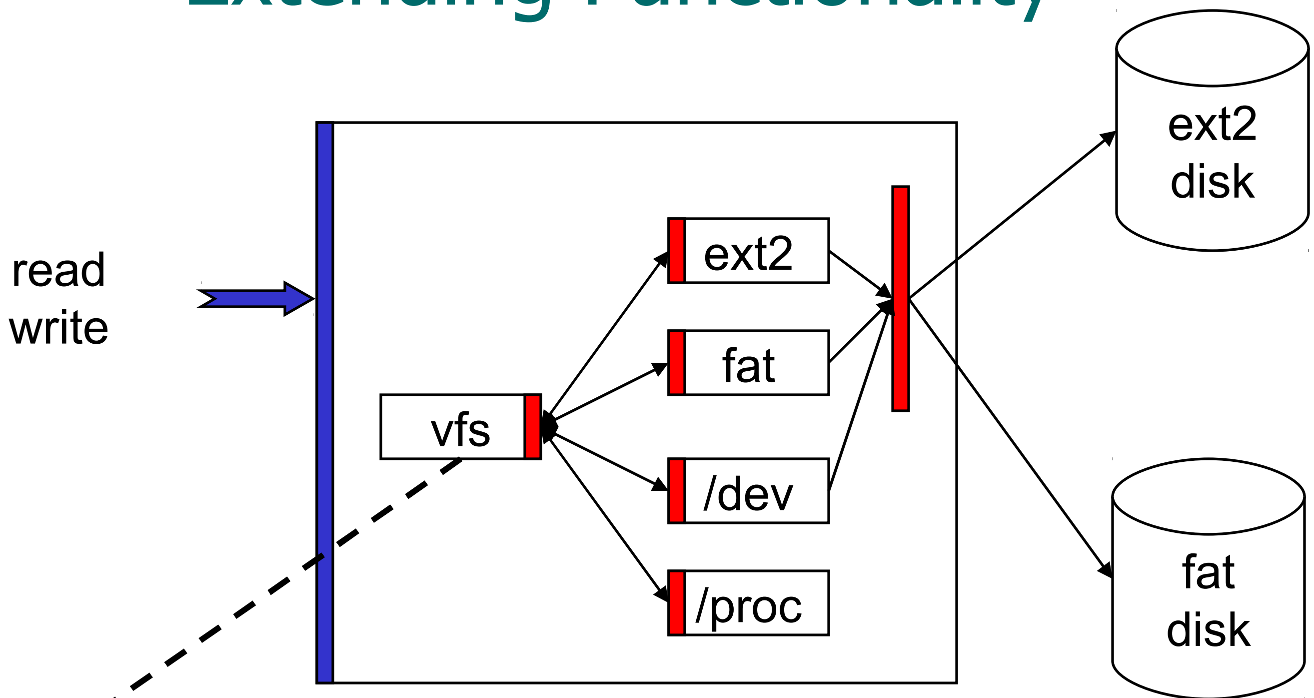
- Decides which blocks to allocate for what (inodes, directories, file data)
- Decides what the format of a directory is

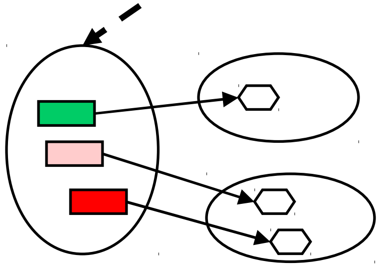
Not really disks, but partitions.
We'll get to that later…

Supporting Multiple File Systems: vfs



Extending Functionality





- /dev: direct access to hardware blocks
- /proc: “virtual files” (computed, not stored, results)
  - /proc is to the file system what cgi’s are to a web server (sort of)

Are Directories Fundamental?

What is the logical role of the directories?

What practical role(s) do they have?

Are there alternatives?