Department of Computer Science
UNIVERSITY OF COLORADO BOULDER

Design and Analysis of Operating Systems CSCI 3753

Dr. David Knox
University of Colorado Boulder

These slides adapted from materials provided by the textbook authors.

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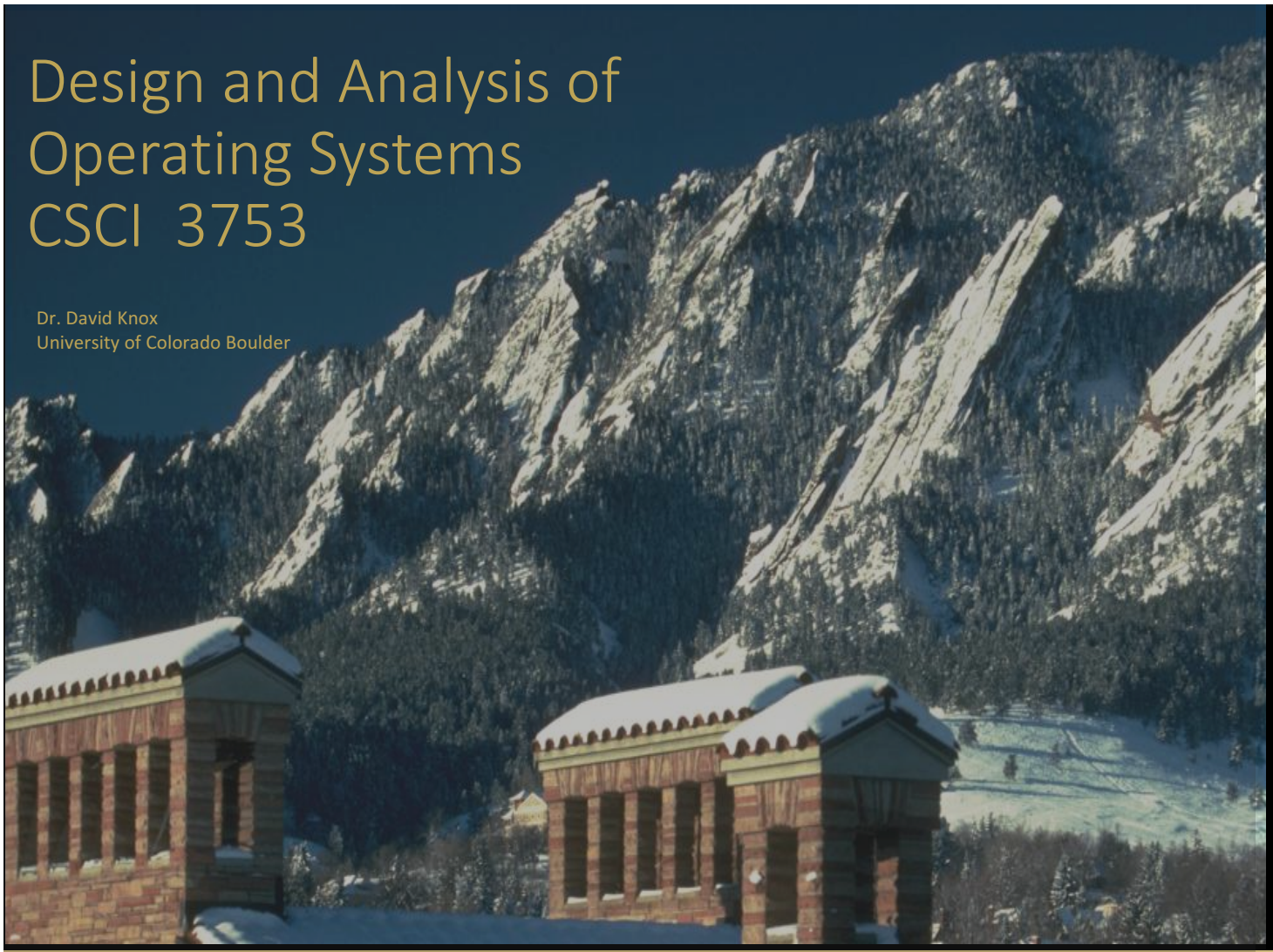

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File System

File System

What is a File?

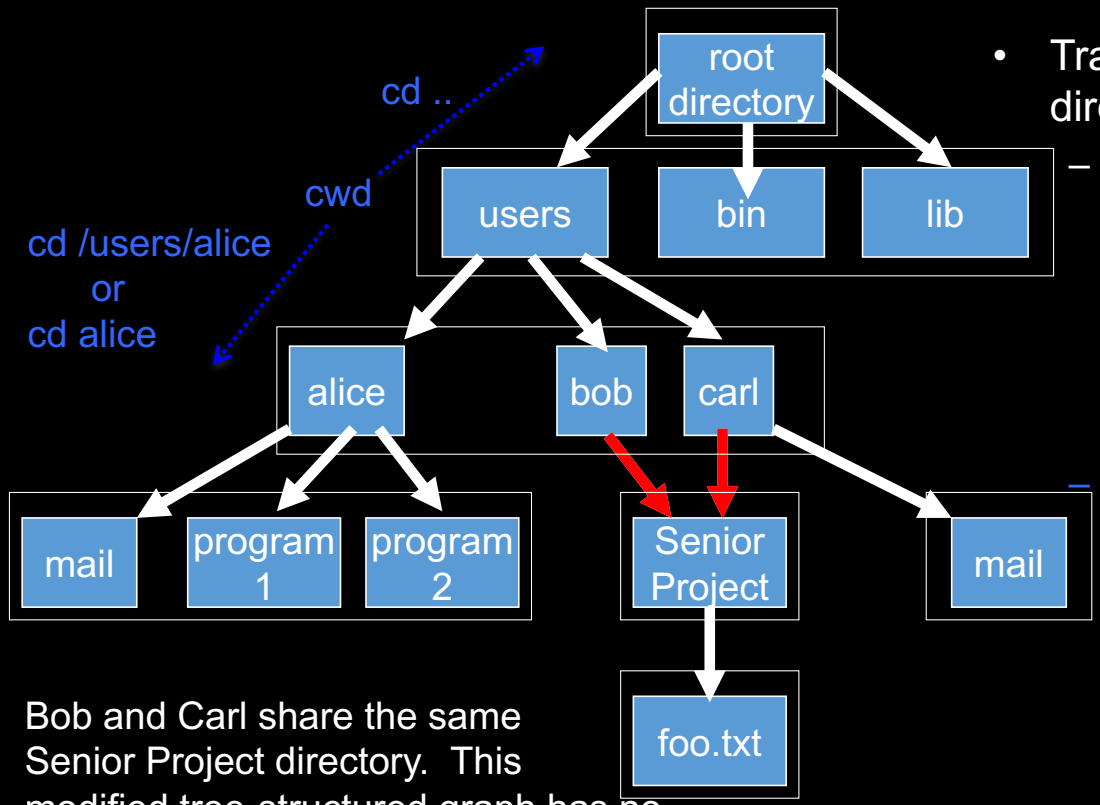
- **Logical Storage Unit**
- **Sequence of bytes mapped into storage**
- **Abstract Object with a defined API**
- **Applications must interpret the meaning of the actual data**

What is a File System?

- **Contains set of files**
- **Provides additional attributes per file**
  - **Name**
  - **Unique system id**
  - **Size**
  - **Access Rights**
  - **Timing information**
  - **Type**
  - **Creator**
  - . . .
- **Provides access to the files via API**
  - Create
  - Delete
  - Copy
  - Move
  - Rename
  - Create
  - Delete
  - Copy
  - Move
  - Rename
  - Sequential
  - Direct/Random
  - Open
  - Read
  - Write
  - Seek
  - Append
  - Truncate

Organization of Files

Tree-structured Directory



- Traversing the directory structure
  - each process keeps track of its *current working directory*
    - e.g. login shell is initialized to a user's home directory
  - change directory by specifying path name
    - absolute (full path)
    - relative
      - down: cd carl/
      - up: cd ../../

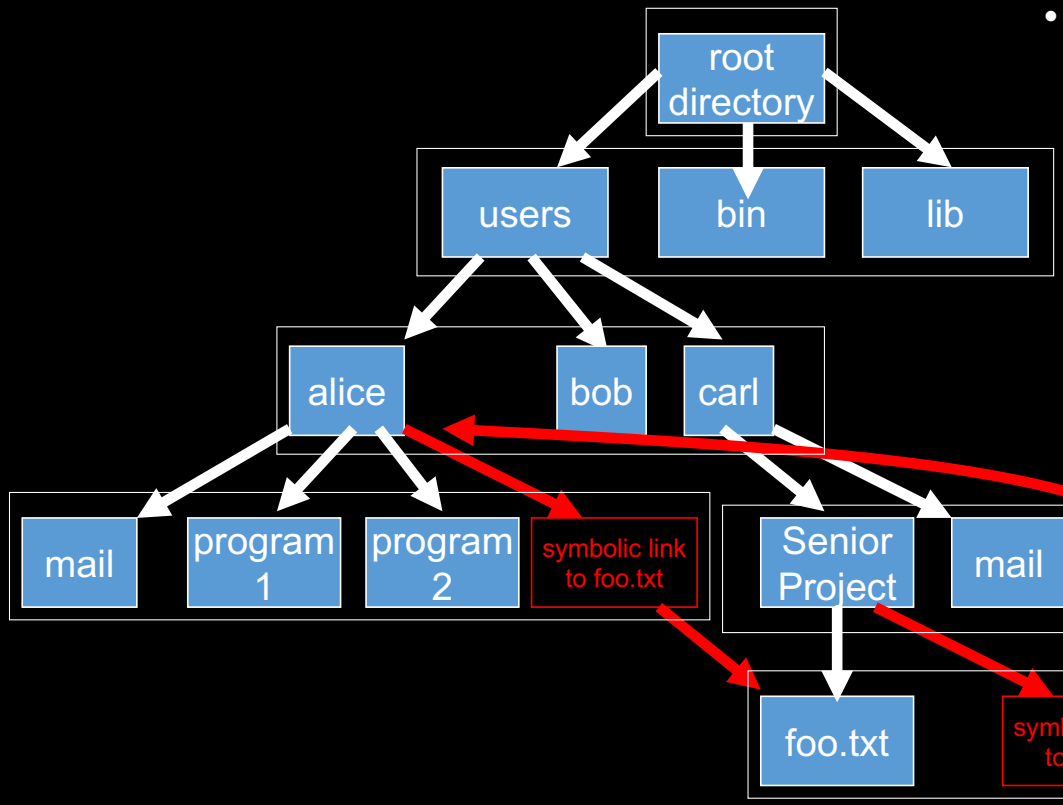
Bob and Carl share the same Senior Project directory. This modified tree-structured graph has no cycles and is termed an *acyclic graph*.

Directory Structure

- File system stores information about all files and directories in a directory structure that is also stored on disk/flash
- Directory structures:
  - Single Level (flat) Directory
  - Two Level Directory
  - Tree-structured Directories

Sharing Files

Symbolic Links



- Symbolic links
  - pointer or reference to a file
  - easy to implement
  - allow convenient sharing of files and/or directories
  - can create loops, but these can be dealt with, because symlinks are easily identifiable as distinct from files
    - by their name
    - or by a special "type" if supported by OS

Symbolic Links

- A symbolic link is not a file
  - It is a pointer to a file
  - Operations on a link behave differently than operations on a file
- When searching for a file through the directory tree, the OS needs to avoid cycles, because otherwise it will search endlessly
  - One policy is to avoid traversing any symbolic links. This policy avoid cycles
  - Or the OS could keep a record of all visited directories to avoid revisiting the same directory – expensive!
- When deleting a link, the file pointed to is not deleted
- When deleting a file
  - can leave symbolic links dangling, and leave it to the user to clean up dangling links - this is the policy of Windows, UNIX

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