

# CS 137: File Systems

## Class Overview

# Today's Topics

- ▶ Purpose of class
- ▶ How class will be run
- ▶ Project
- ▶ Sources of filesystem papers
- ▶ Early reading
- ▶ Introduction to disk technology

# Class Purpose

- ▶ Understand how filesystems work
- ▶ Review current research in filesystems
- ▶ Go away with graduate-level understanding

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- ▶ Get me to read good FS papers!

# Class Mechanics

- ▶ Begin with general information on disk drives, SSDs, file systems
- ▶ Rest of term will be reading & discussing papers
- ▶ Early papers will be assigned by me
  - ▶ Give you background
  - ▶ Discuss in class
- ▶ See class calendar on Web site:  
`http://www.cs.hmc.edu/~geoff/cs137`
- ▶ Later papers chosen by you
  - ▶ Goal is to have fun, learn lots
  - ▶ You will take turns leading discussion

# Filesystem Homework

- ▶ 20% of grade
- ▶ We will use FUSE as a development framework
  - ▶ Frees you from kernel development
  - ▶ Otherwise quite similar to “real thing”
- ▶ First assignment: “Hello, world” filesystem
- ▶ Assignments 2 & 3: FAT filesystem

# Class Project

- ▶ Written/oral report on some aspect of filesystems research
  - ▶ E.g. survey paper on RAID technology
- ▶ Filesystem development project
- ▶ Filesystem measurement project
- ▶ But I'm open to other ideas & suggestions
- ▶ 70% of grade
  - ▶ Other components: homework (20%), general participation during term (10%)

# Where to Find FS Papers

- ▶ Specialized FS conferences
  - ▶ File and Storage Technology (FAST)
  - ▶ IEEE Mass Storage Conference (MassStor)
  - ▶ SIGOPS International Systems and Storage Conference (SYSTOR)
  - ▶ ACM/Usenix HotStorage
- ▶ Supercomputing conferences
  - ▶ IEEE High Performance Distributed Computing
  - ▶ Supercomputing



## Where to Find Papers (cont'd)

- ▶ Filesystems are part of operating systems
  - ▶ So big OS conferences have FS papers
  - ▶ Symposium on Operating Systems Principles (SOSP)
  - ▶ Operating Systems Design & Implementation (OSDI)
  - ▶ Usenix Annual Technical Conference
  - ▶ Eurosys
- ▶ Important journals (current & older stuff)
  - ▶ ACM Transactions on Storage
  - ▶ ACM Transactions on Computer Systems
  - ▶ Communications of the ACM
  - ▶ IEEE Computer

## Where to Find Papers (cont'd)

- ▶ Database conferences
  - ▶ ACM SIGMOD
  - ▶ Very Large Databases (VLDB)
- ▶ Cloud conferences (e.g., HotCloud)
- ▶ Architectural Support for Programming Languages and Operating Systems (ASPLOS)
- ▶ Sometimes architecture, networking, applications conferences
- ▶ Random other places—list is constantly changing

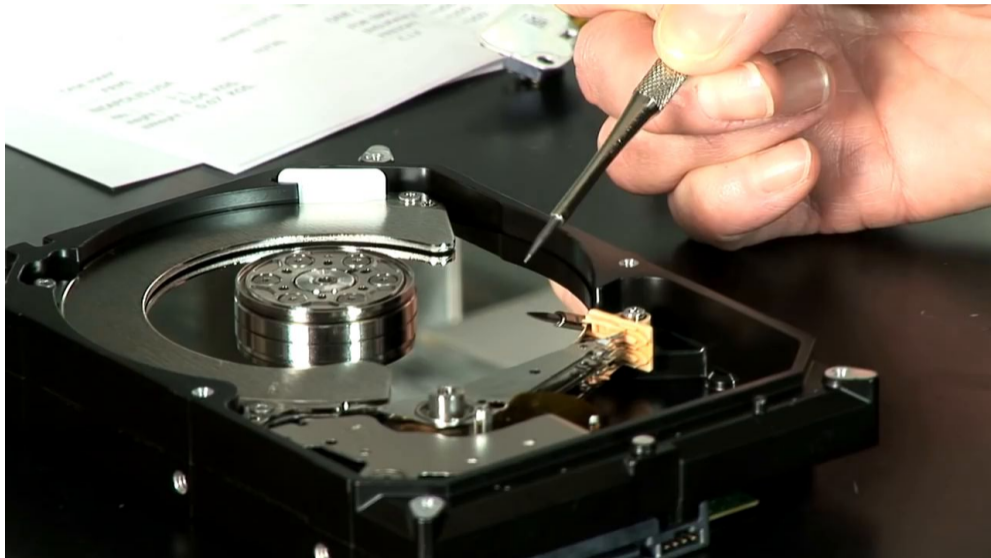
# First Papers We'll Read

- ▶ How nasty disks really are (Ruemmler & Wilkes; Anderson; Patterson et al)
- ▶ Original Unix file system (for elegance)
- ▶ BSD Fast Filesystem (for speed)
- ▶ FAT32 (for ugliness) and NTFS (for breadth)
- ▶ NFS and Coda (for networking)
- ▶ LFS and WAFL (for influence)

# Disks In 2 Minutes



# Disks In 7 More Minutes



# A Running Disk



## Slowing That Down

**THIS IS A 500GB HARD DRIVE.**

# Disks From the Beginning

(To be done on the board)

- ▶ Head/platter arrangements
- ▶ Motion technology
- ▶ Winchester drives
- ▶ Sectors and gaps
- ▶ Sector alignment and timing
- ▶ Encodings and ECC
- ▶ General block layout
- ▶ Modern complexities
- ▶ Shingling



# Shouting in the Datacenter

