Homework: File System

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The purpose of this assignment is to apply the techniques of experimental design we have learned this semester to one more operating system feature, the file system.

Explore the file system

Conduct experiments to learn as much as you can about the implementation of the file system. Some of the things you might want to investigate are:

- How long does it take to open a file? Write one byte? Close a file? How much of that time is user time, and how much is system time?

- Compare the performance of local files and files that are mounted by NFS from puma.

- Is there a file cache? If so, how can you tell whether a given file is in it or not? Are NFS-mounted files cached?

- How does random access work? Try out `fseek` and characterize its performance.

- How does file locking work? What happens if two processes try to write a file at the same time? What about two readers? What if one is reading while another is writing?

- Are file operations CPU bound or I/O bound? What about different kinds of access, like sequential versus random access.

- Can you find evidence of UNIX's multi-level file index system? Can you measure the number of pointers at each level?

- How big is a disk block? How big is the unit of transfer between memory and the disk?

Obviously, some of these are more difficult than others. I don't expect you to answer all of them. I would like to see two or three well-designed, well-explained experiments that address a few of these questions (or other questions about the file system that you are curious about).

I strongly recommend that you explore the behavior of the file cache as one of your first experiments, because the existence of the cache affects almost every file system operation.

As a general guideline, you should explore at least two axes (a range of file sizes or a range in the number of files or a range in the number of times you traverse a file, etc.).

Have fun!