File System (Practice)

ICS332
Operating Systems

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(q1) Basic Questions

- If I create a hard link to a file, have I added a new inode to the system?

- What is a problem with storing the data blocks of a file as a linked list? (instead of, say, using an inode-like approach)

- Why do we have this concept of "opening a file before doing reads/writes to it"?

(q1) Answers

- If I create a hard link to a file, have I added a new inode to the system?
  - No

- What is a problem with storing the data blocks of a file as a linked list? (instead of, say, using an inode-like approach)
  - Random access super slow (also fragility)

- Why do we have this concept of "opening a file before doing reads/writes to it"?
  - So that we don't have to do the same path translation over and over

(q2) inode

- Say we have a micro-inode data structure with just:
  - 4 direct pointers
  - 1 single-indirect pointer
- The block size is 8KiB
- The block pointer size is 2 bytes
- What is the maximum file size in KiB?
- What is the **total** number of on-disk blocks required to store that file on disk?

(q2) Answer

- Say we have a micro-inode data structure with just:
  - 4 indirect pointers
  - 1 single-indirect pointer
- The block size is 4KiB
- The block pointer size is 2 bytes
- What is the maximum file size in KiB?
  - 4 * 8KiB + ($2^{13}/2$) * 8KiB = 32 + 4096*8 KiB = 32800 KiB
- What is the **total** number of on-disk blocks required to store that file on disk?
  - 4 + ($2^{13}/2$) + 1 (inode is stored in a block) + 1 (single-indirect block of pointers) = 4102 blocks

(q3) inode

- **Say we have a small inode data structure with just:**
  - 4 direct pointers
  - 1 single-indirect pointer
  - 1 double-indirect pointer
- The block size is 4KiB
- The block pointer size is 16 bytes
- What is the maximum file size in KiB?

(q3) Answer

- Say we have a small inode data structure with just:
  - 4 indirect pointers
  - 1 single-indirect pointer
  - 1 double-indirect pointer
- The block size is 4KiB
- The block pointer size is 16 bytes
- What is the maximum file size in KiB?
  - $4 * 4 + (2^{12} / 2^4) * 4 + (2^{12} / 2^4)^2 * 4 = 2^4 + 2^{10} + 2^{18} = 263184$