

INF 551 – Spring 2018

Quiz 3: File systems (10 points), 15 minutes

1. [4 points] Consider a file system with the following parameters:

| | |
|--|------|
| Number of data blocks | 128 |
| Number of blocks storing inodes | 8 |
| Size of inode | 512B |
| Size of block | 4KB |
| Base address of inode table (i.e., the address of the first inode) | 12K |

指纯data region
不是广义上包含
Superblock, imap, dmap &
inode in data blocks.

a. #Block of 1st inode
= 12K / 4KB = 3
∴ 1 Super block & 1 imap & 1 dmap

physical size of imap

= 1 × 4KB = 4KB

physical size of dmap

= 1 × 4KB = 4KB

- a. [2 points] What are the sizes (i.e., the number of bits) of the bitmaps for inodes (i.e., imap) and data blocks (i.e., dmap)?

Size of the bitmaps for inodes

= number of inodes

= 8 × 4KB / 512 B = 64 bits (or 8 bytes)

Size of the bitmaps for data blocks

= number of data blocks

= 128 bits (or 16 bytes)

actual size of imap used

= # inodes

= # blocks × $\frac{\text{Size of block}}{\text{Size of inode}}$

= 8 × $\frac{4KB}{512B}$

= 8 × 8

= 64 bit

dmap = 128 - 8 = 120 bit

dmap = 128 bit

- b. [2 points] What is the address of inode whose inode number is 20?

12KB + 20 inodes × 512 B/inode = 22 KB

base addr. + # inode × Size of inode

= 12K + 20 × 512 B = 22KB ✓

2. [6 points] Describe the steps in executing the system call: `int fd = open("/foo/bar.txt", O_RDONLY)`. For each step indicate the type of operations (read/write), the data structure accessed (e.g., inode, imap, etc.), and the purpose of each operation. Example: "read imap to find a free inode slot". Assume that you are given the number of root directory and that "bar.txt" exists in the specified directory.

| Step | Type of operations | Data structure accessed | Purpose |
|------|--------------------|-------------------------|----------------------------------|
| 1 | Read | Inode of root | To get the position of root data |
| 2 | Read | Data of root | To get foo's inumber |
| 3 | Read | Inode of foo | To get the position of foo data |
| 4 | Read | Data of foo | To get bar.txt's inumber |
| 5 | Read | Inode of bar.txt | Permission check |

`int fd = open("/foo/bar.txt", O_RDONLY)`

| Step | Type of operation | Data Structure Accessed | Purpose |
|------|-------------------|-------------------------|--|
| 1 | read | inode of root | obtain the content of root |
| 2 | read | content of root | obtain the inumber of foo |
| 3 | read | inode of foo | obtain the content of foo |
| 4 | read | content of foo | obtain the inode of bar.txt. |
| 5 | read | inode of bar.txt | check the access perm. then assign a fd to bar.txt. update open-file table, return the fd to user |