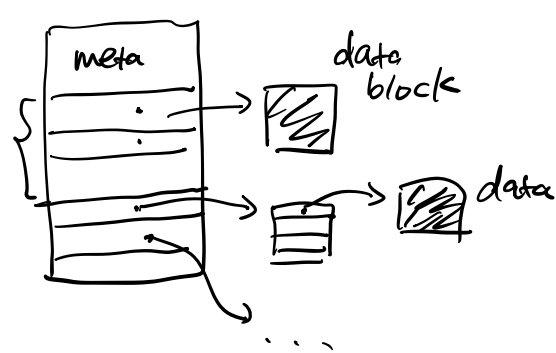


1. Last time ←
 2. fs5600 interface ←
 3. Crash recovery
 - intro
 - ad-hoc
 - copy on write
 - journaling
-

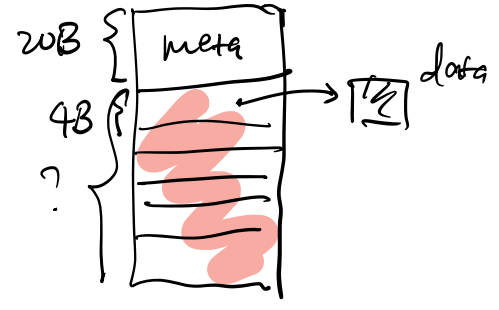
• files.

(file, offset) $\xrightarrow{\text{inode}}$ disk addr

Unix inode



fs5600 inode
(4KB)



$$\frac{4KB - 20B}{4B} \times 4KB \approx 4MB$$

Q: how large can fs5600 file be?

A: $4KB - 20B - 4B \leftarrow$

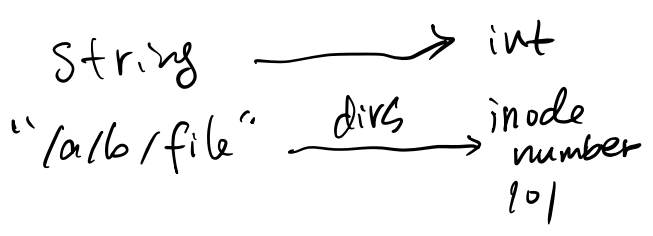
B: $4KB \times (A) \leftarrow$

C: $(4KB - 20B) - 4KB \leftarrow$

D: $\frac{C}{4B}$

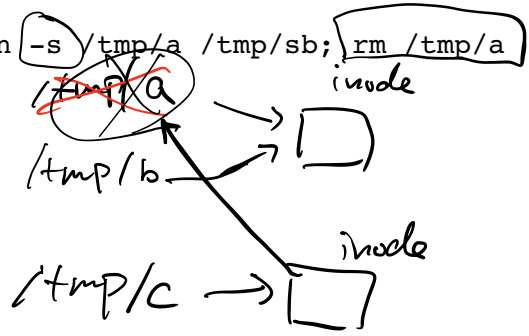
• directories

↓
16MB

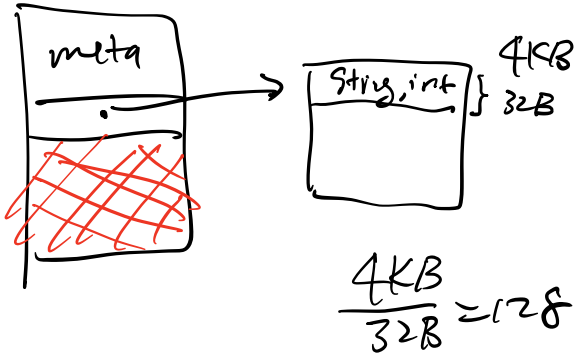


Question: if I run
`$ touch /tmp/a; ln /tmp/a /tmp/b; ln -s /tmp/a /tmp/sb; rm /tmp/a`

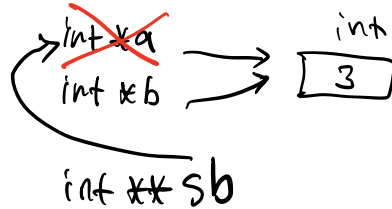
What is the output of this cmd?
`$ cat /tmp/b` → okay
 What is the output of this cmd?
`$ cat /tmp/sb` → error
 and why?



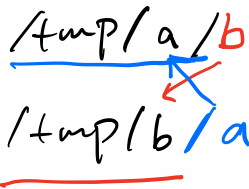
`dir inode (fs5600)`



• link
 hard/soft link
 ⇕
 pointers in C



• cycles.

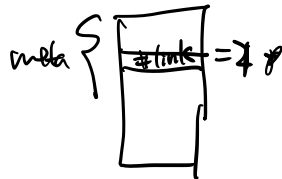


⇒ /tmp/a/b/a/b/a/b...

Linux prevents. hardlink cycles. WHY?



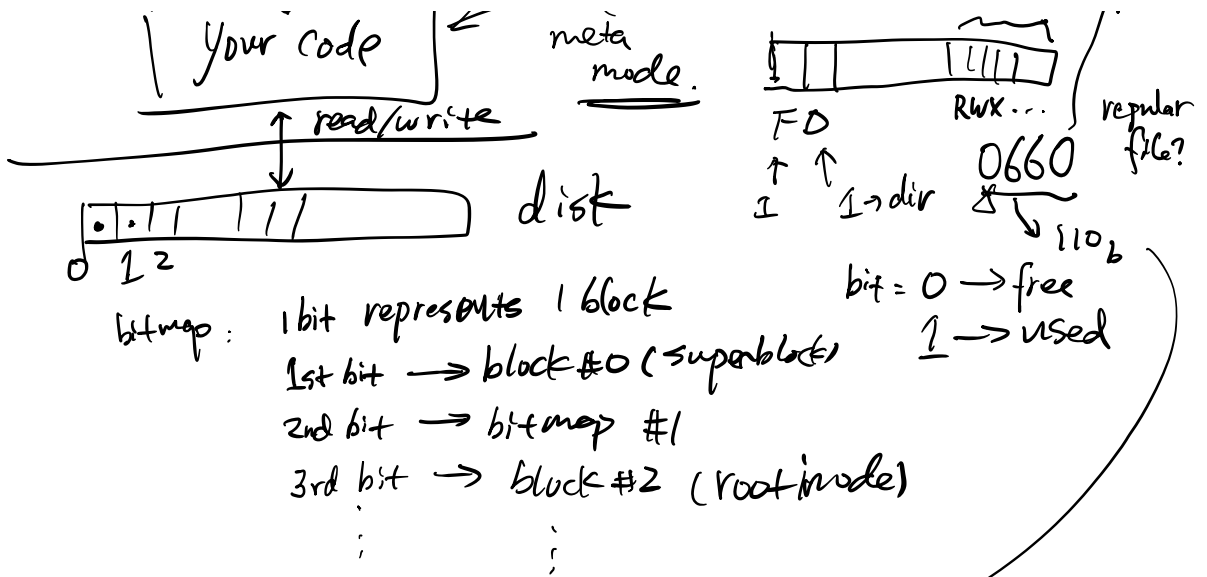
`$ rm -r /tmp/a.`



• fs5600



[0.7]
 9bit 1



• dir

R: read contents of dir (ls)

w: write contents of dir (create/rm)

x: cd.

0760

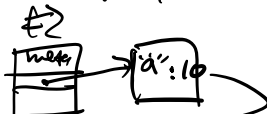
• interface.

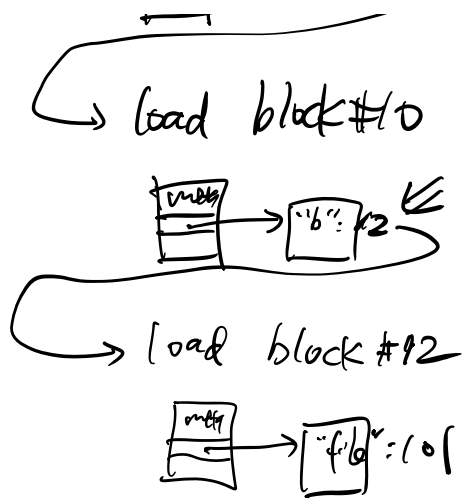
• path walk.

int inum = path2inum(char * path)

lo ← "a/b/file"

find root inode (#2)



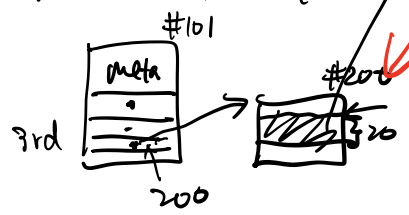
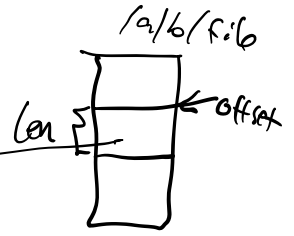


• fs_read. / write.

```

read("/a/b/file", buf, len, offset)
write(
int
101 ← path2inum(
↳ read block #101

```



• fs_create

```

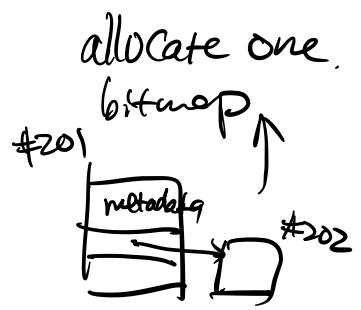
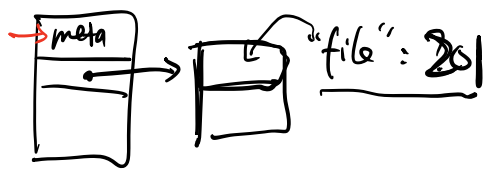
create("/a/b/file", 0660)

```

```

12 ← path2inum(

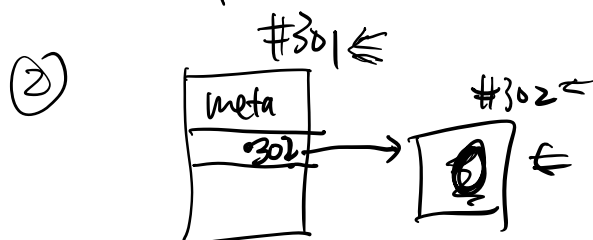
```



★ Casting ^{ctime} mtime ⇒ millisec. ^{int} U32

`mkdir("/dir1/", 0644)`

① bitmap → allocate blocks ← #301, #302



③ root inode, add "dir1" → #301

Q: How many block_write?

3. 4. 5

① block #1: bit map

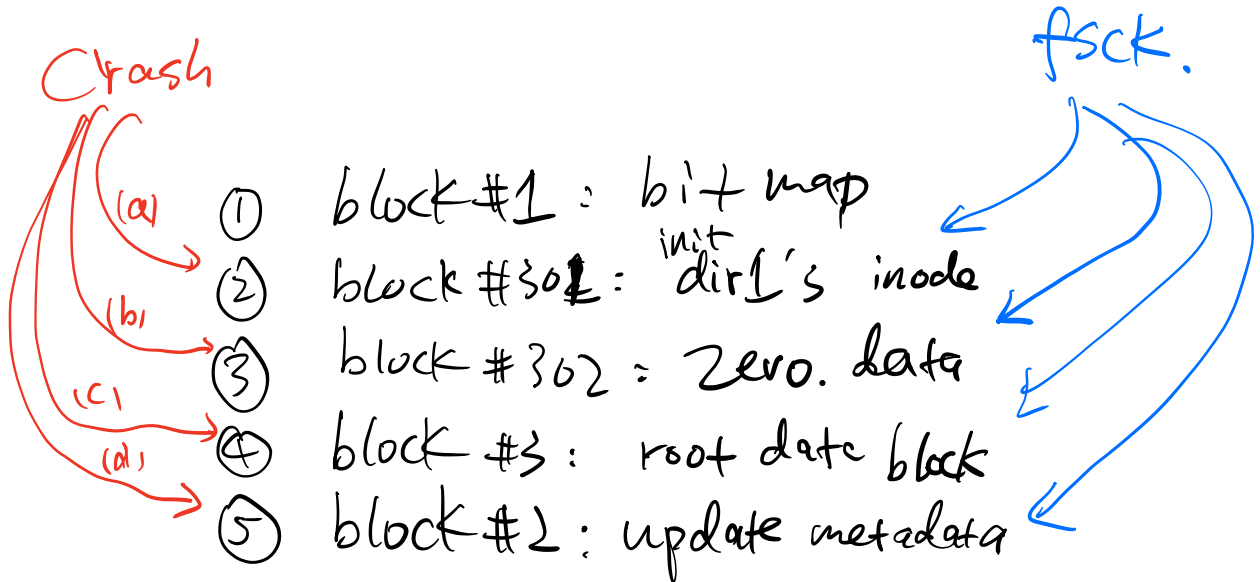
② block #~~301~~: dir1's inode

③ block #302: zero. data

④ block #3: root data block

⑤ block #2: update metadata

• Crash recovery.



(a) : block lost . → scan bit map

(b) : ^{lost}dir1 inode , garbage contents → found an inode

(c) : ^{lost}dir1 inode → "lost+found"

(d) : inconsistent metadata. → ?

Atomicity

⌋ A. ad-hoc (fsck)

⌋ B. Cow fs.

C. Journaling

A = goal : metadata consistency

