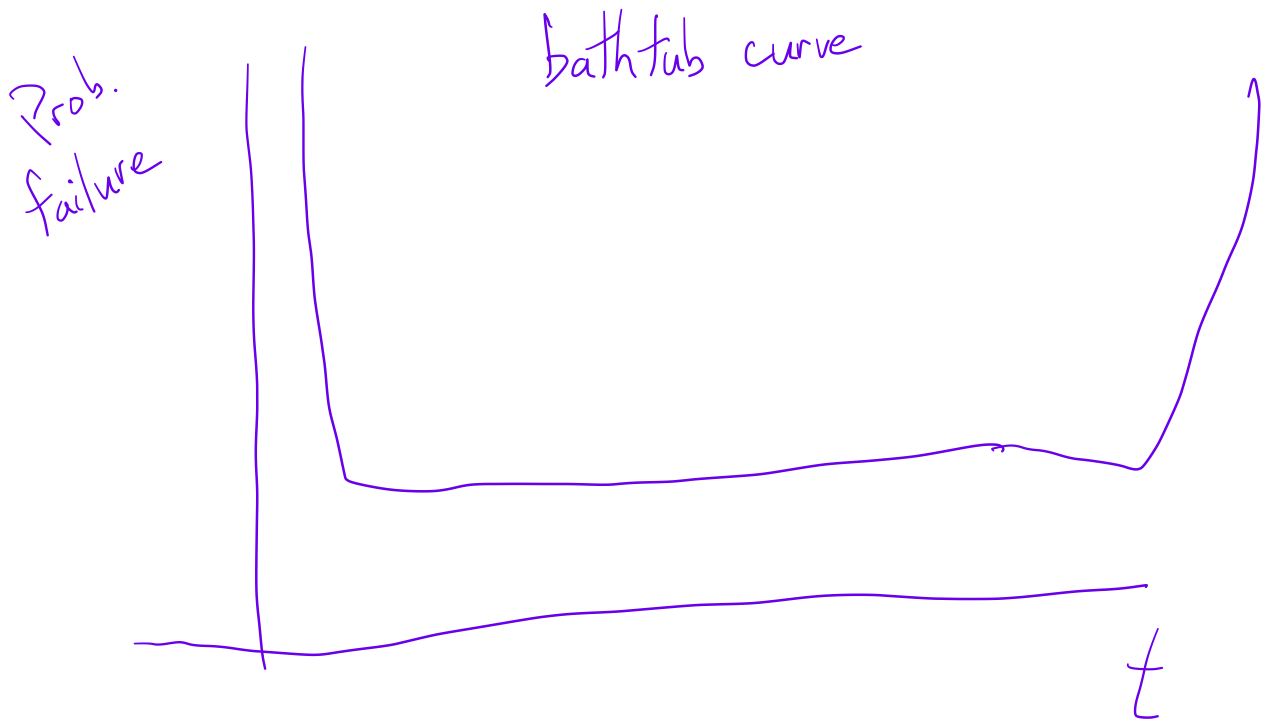


- 1. Last time
 - 2. Intro to file systems
 - 3. Files
 - 4. Implementing files
 - 5. Directories
 - 6. Performance
- } next time
-



2.

Intro to file systems

What does a FS do?

- provide persistence

- create a way to name data on the disk

FS: can be implemented in lots of places

- We focus on the disk, generalize later

Note: disk is the 1st thing we've seen that is both modifiable and persistent.

3.

Files

What is a file?

From user's view: a named, contiguous run of bytes

From FS's view: collection of disk blocks

Job of a FS:

map {file, offset in file} $\xrightarrow{\text{FS}}$ disk address

operations:

create(file), delete(file), read(), write()

Goal: operations have as few disk accesses as possible
and minimal space overhead

4. Implementing files

A. Contiguous

B. Linked files

C. Indexed files

Assume for now that a given file's metadata is known to the system.

Access patterns to support:

- Sequential
- Random access

Ideal is good sequential + good random access performance

Candidate designs:

A. Contiguous allocation

user pre-specifies length

[<free¹> a1 a2 a3 <5 free> b1 b2 <free¹>]

+ fast access, both seq. and R.A.

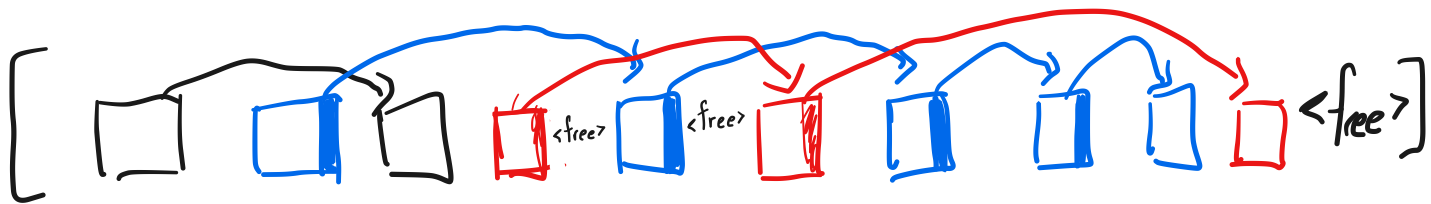
+ simple

- fragmentation

-

B. Linked files

metadata is pointer (disk address) to file's first block



+ seq. access easy + probably fast
+ R.A. easy

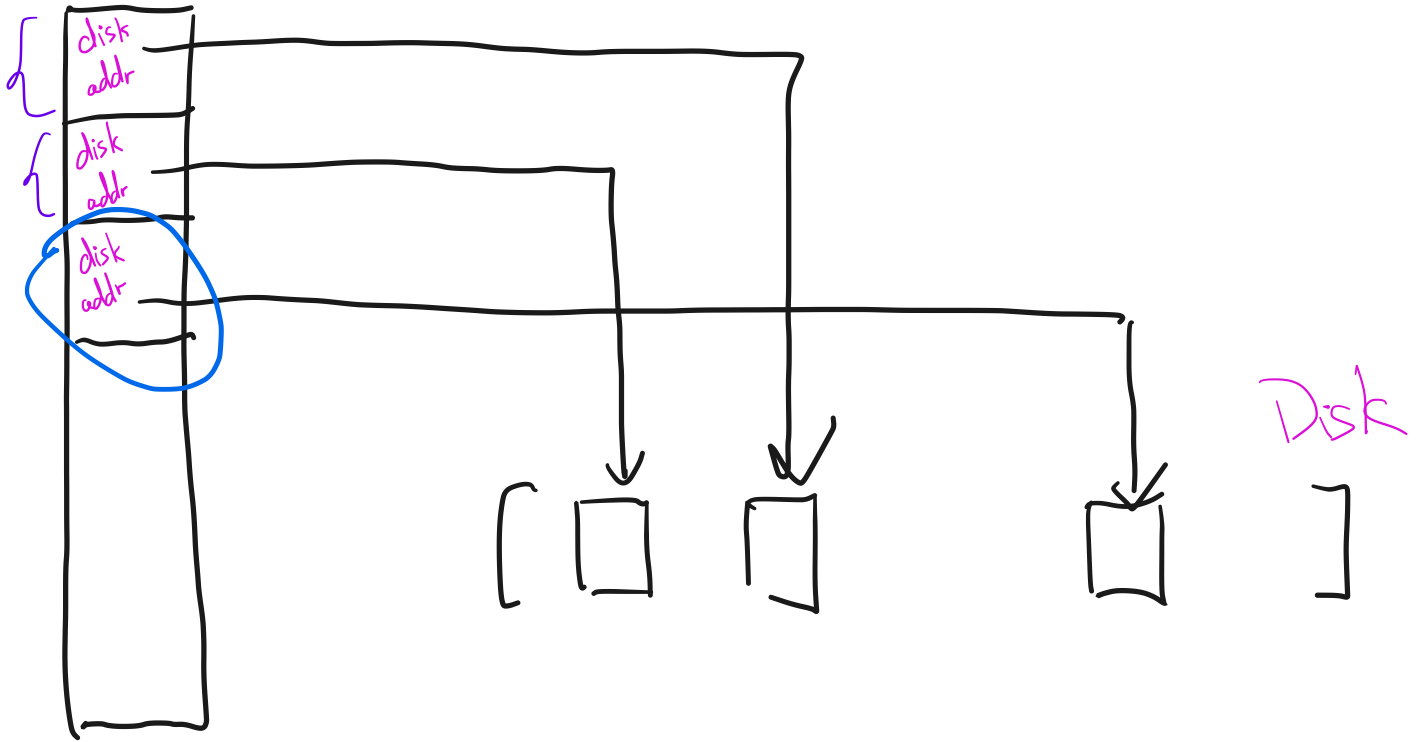
- R.A. is a disaster

- alignment of data can get messed up

C. Indexed files

attempt 1

metadata attempt

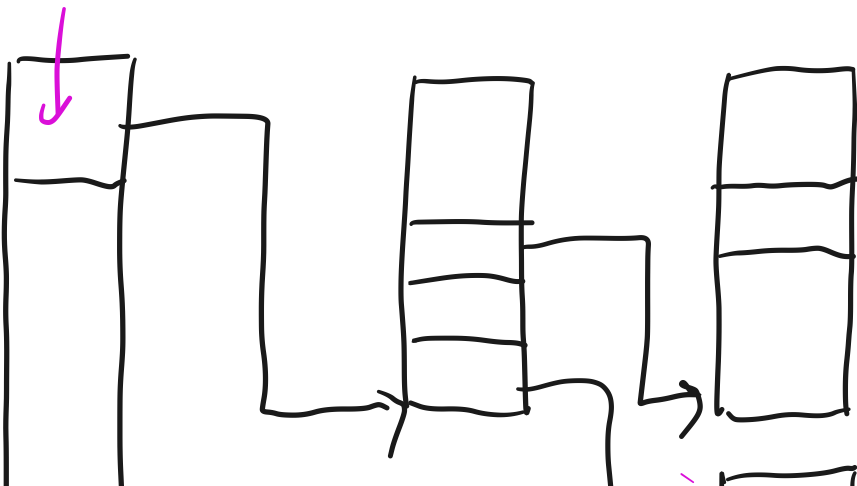
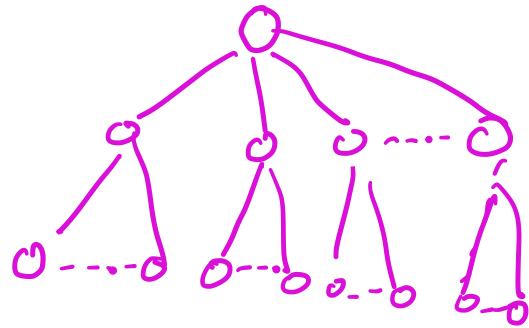


+ seq, R.A. easy
+

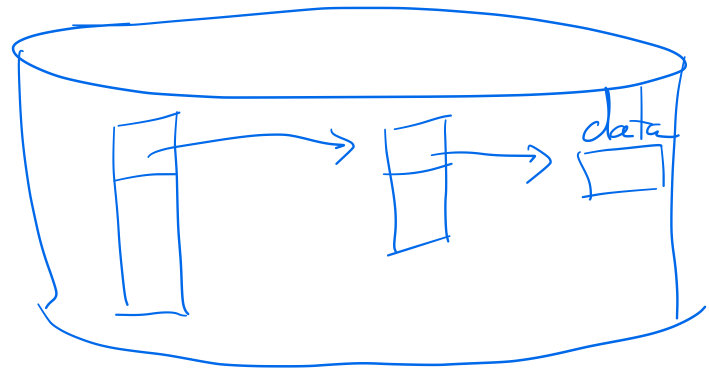
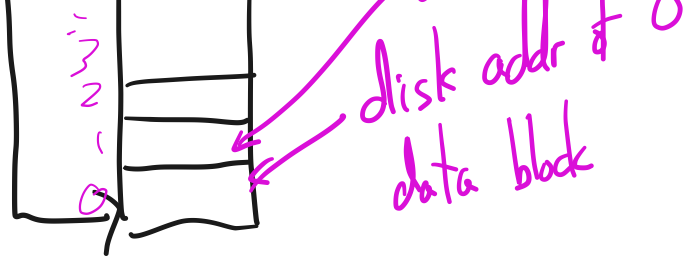
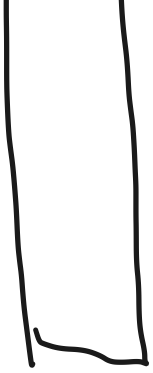
- storing this array is impractical

disk addr of metadata

attempt 2



disk addr of 1st data block

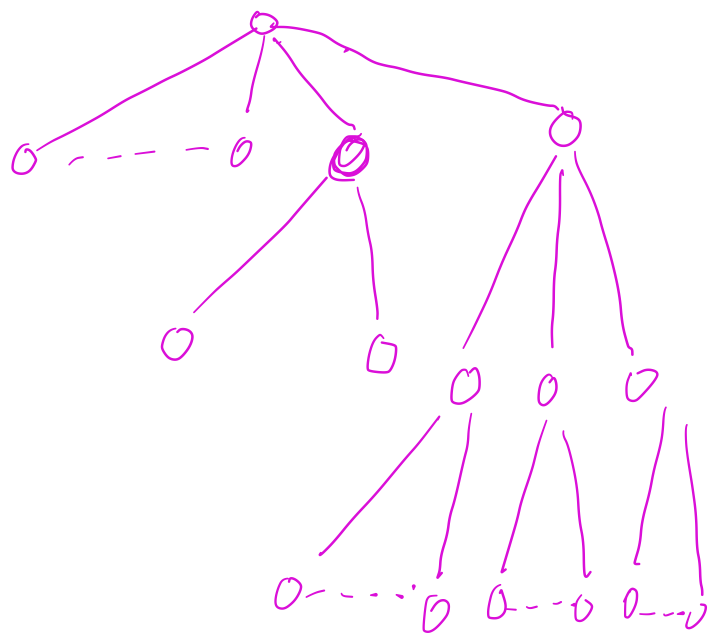


+

-

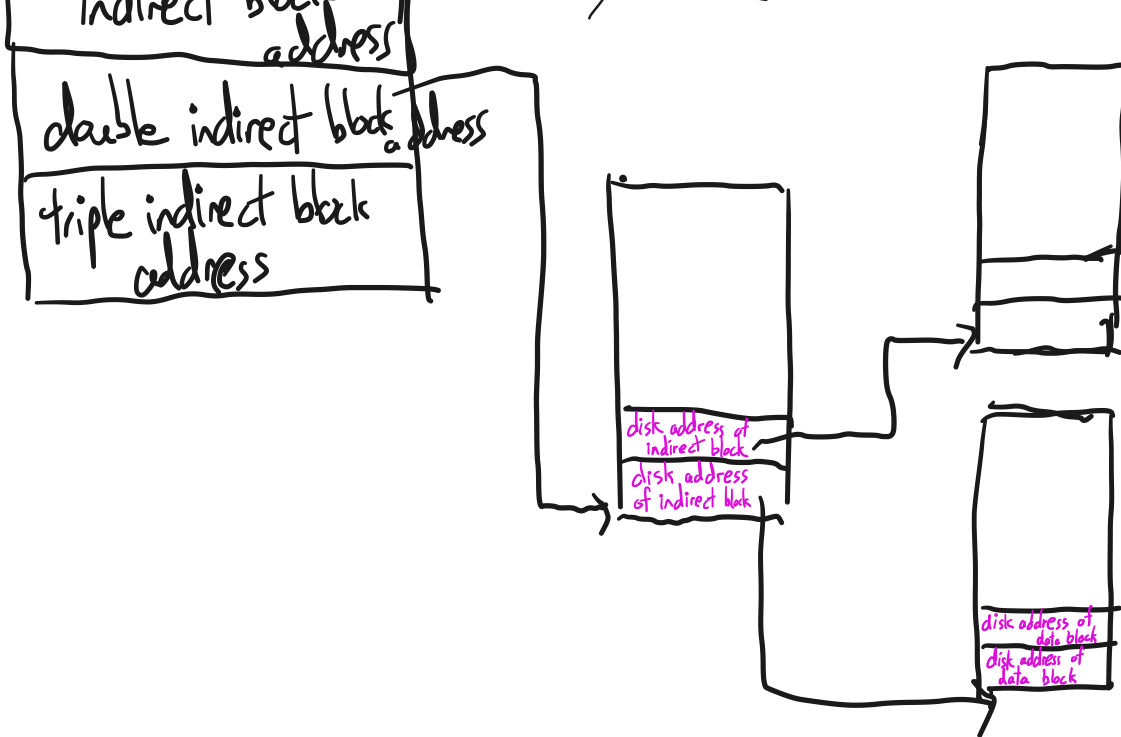
attempt 3

Metadata: inode



perms
mtime
ctime
link count
disk address
⋮
disk address
indirect block

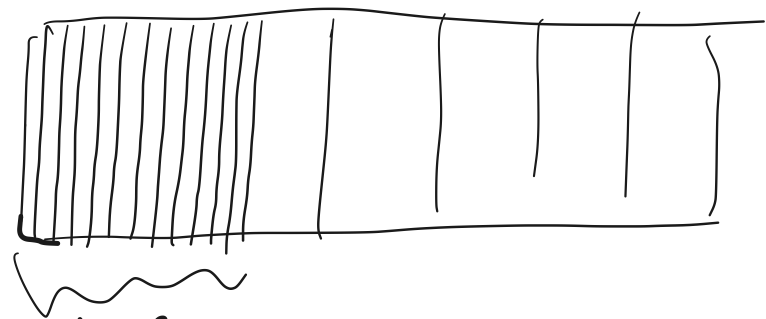




- + fast access to small files
- + Max length can be enormous
- + Simple, easy to build
- worst case # of accesses: pretty bad
- " " " " " "
- " " " " " " " " space ovhd.
- locality issues

inodes: stored in a fixed-size array, known location

vocab: "inumber"



stat (&sb);

slots for
inodes

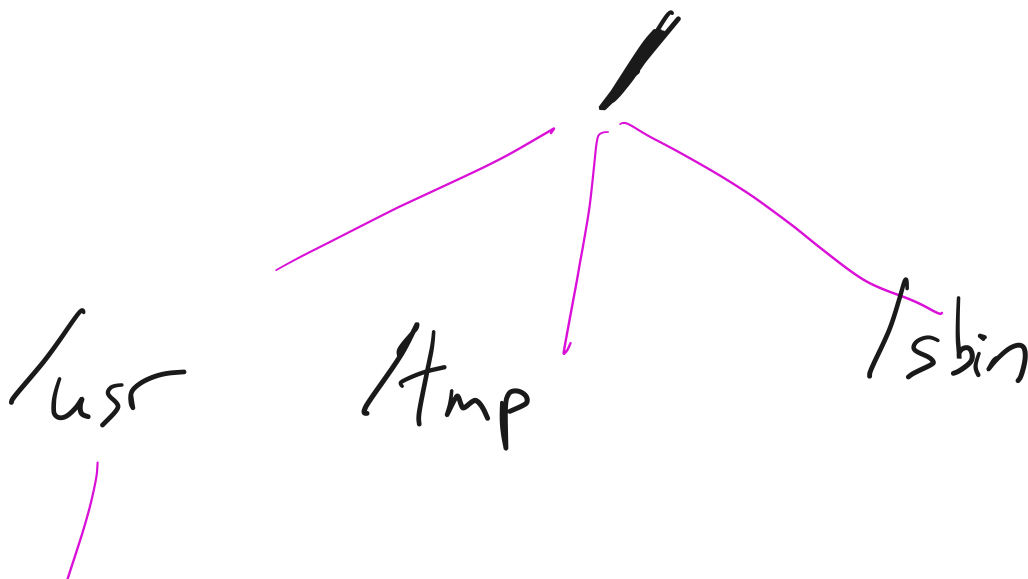
5. Directories (next time)

/bin/

/sbin

/usr

/tmp



/usr/mw



/lab4



kernel.c . . .