

Hands-on 1

Recall the naming layer of Unix version 6 file system you have learned in the class and answer the following questions.

1. Block layer is a mapping from block number to block data, how to

know the size of a block, and how to know which block is free?

Modern unix le systems often use a bitmap for keeping track of free blocks. Bit i in the bitmap records whether block i is free or allocated. The bitmap itself is stored at a well-known location on the disk (e.g., right after the super block).

2. What will happen if the block size is too small? What if it is too big?

If block size is too big, disk blocks are wasted by small files.

provided many files are smaller than 4 kilobytes, a 16-kilobyte block size wastes space.

On the other hand, a very small block size may incur large data structures to keep track of free and allocated blocks.

3. Suppose the size of a block pointer is 4-byte, the size of one block is

128-byte, an inode contains 1 triple indirect block, 3 double indirect

- block pointer(index) 4-byte(32-bits) Single
- 1 triple indirect block blocks, and 28 indirect blocks. How many data blocks can an inode
- 3 double indirect blocks
- 28 single indirect blocks

hold? What if the block size is 256-byte? (You can answer this

question in the form of $(512 * 512 * 128) / (4 * 1024)$)

Provided one block
(block size)
128-byte
Total : ~ 64MB

128 / 4 = 32 blocks
single 32 * 128 = 4096-byte (4KB)
double 32 * 128 * 128 = 512KB
triple 32 * 128 * 128 * 128 = 64MB

Provided one block
(block size)
256-byte
Total : ~ 1GB

256 / 4 = 64 blocks
single 64 * 256 = 16KB
double 64 * 256 * 256 = 4MB
triple 64 * 256 * 256 * 256 = 1GB

4. Suppose your file system contains a large number of small files, and

the block size is 512-byte and the block size is unchangeable, please

redesign the file system to well support this case.

- block size 512-byte
- block pointer 4-byte
- 12 direct blocks
- 1 single blocks
- 1 double blocks
- 1 triple blocks

512 / 4 = 128 blocks
single 128 * 512 = 64KB
double 128 * 512 * 512 = 32MB
triple 128 * 512 * 512 * 512 = 16GB

Total: ~16GB

5. How to avoid cycle for link? Can you think of one of more methods

other than the method mentioned in class?

Don't allow links to directories,
which rules out the possibility of cycles.
Or, it is possible to detect this situation,
for example by using garbage collection.

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