Operating Systems
COMS W4118
Lecture 21

Alexander Roth

2015 – 04 – 14

1 Disk Interface

- For the file system, the disk is just a one dimensional array of logical sectors.
- Modern drives export logical block addresses and do the mapping ot the cylinder/head/sector internally.
- If you try to read sequentially through a block, the head will read through the platter and move inwards towards the center of the disk.
- The disk is optimized for sequential access and sequential access is fast.
- It is a good idea to arrange information sequentially.

2 File Systems

- There are two modes of access:
  1. Sequential Access
  2. Random Access
     - Randomly address any block, difficult to make fast.
- We want to minimize unnecessary slow down by modeling the data system cleverly.

2.1 Disk Management

- We need to keep track of where the file is and which file takes up which block.
- Need to track where the file is on disk.

- Need to have some metadata on disk that maintains the information of the disk, which is handled by the file system.

2.2 Allocation Strategies

- There are various approaches to allocating information on a disk.

2.2.1 Contiguous Allocation

- We will allocate a contiguous number of blocks to a file and break it up accordingly.
- You need to keep track of where a file is and how big it goes.
- Most of the block is used for itself.
- easy to implement, there is a low storage overhead.
- The issue is that it is almost impossible to grow the file.
- There can be overlaps in the file, so we may need to relocate the file accordingly.
- If files increase in size and need to be relocated, there will be holes within the disk, where information cannot sit. Thus, there is *external fragmentation*.
- *Internal fragmentation* is the issue of not all memory being written within a block.
- These systems are typically used for write-once read-often systems. Such as DVD's, tape drives.

2.2.2 Extent-based Allocation

- Instead of one contiguous chunk per file, there are multiple chunks per file.
- Similar to contiguous allocation, but with multiple chunks.
- The metadata has to keep track of more information: start of the chunk and length of the chunks.

2.2.3 Linked Allocation

- Treat the disk drive as a linked list.
- There is a chunk of data within the block, and the last segment of the data is a pointer to the next block in the chain.

2.2.4 FAT Table

- There is a file allocation table that contains pointers to the addresses of all the files on the disk.
- The files on the disk have pointers to the other chunks of the same file.
- All the file table knows is that there is a file at a given address.
- Fast random access. Only search through the cached FAT.
- There is a large storage overhead for FAT table.
- Possibly slow sequential access.

2.2.5 Indexed Allocation

- You store in a file metadata all the blocks that a file has.
- The first block holds all the indexes to the other chunks.
- Unix systems use an inode