

Chapter 5: File Systems.

2075 Bhadra:

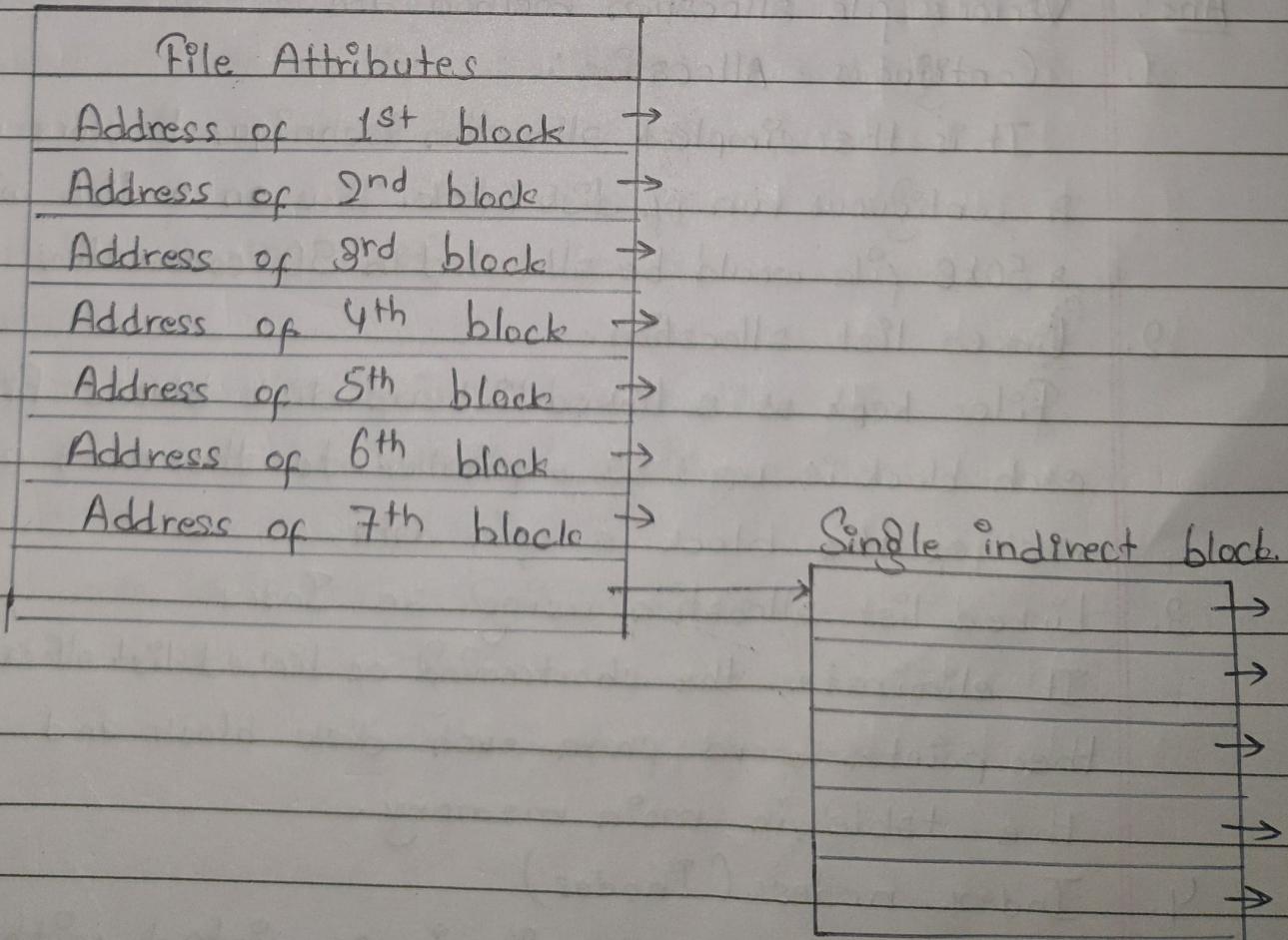
Explain inode approach of file system implementation with its advantages and disadvantages.

Ans:

Inode approach is an allocation method in which each file is associated with data structures known as i-node (index node). I-node of specific files contains around 40 separate pieces of information.

Some of them are:

- Uid (User-Id) and Gid (Group Id) of file.
- File type
- File creation, access and modification time.
- Inode modification time
- No. of links to the file
- Size of file.
- Disk address, specifying or leading to the actual disk location for disk blocks that make up file.



Advantages:

- At any instant, only i-nodes of opened files need to be in main memory, thereby occupying much smaller space in main memory.
- Larger files can be accessed efficiently.

Disadvantages:

- As inode information is kept separately from data, access of data often requires a long seek when file is initially accessed.
- Inodes of files in a common directory if not kept together leads to low performance when searching directories.

2074 Bhadra:

- Q. Discuss various file allocation and access method. Compare their advantages and disadvantages.

Ans: Various file allocation method are:

1. Contiguous Allocation:

It is the simplest allocation technique to store each file as a contiguous run of disk blocks. Thus on a disk with 1kB blocks, a 50kB file would be allocated in 50 consecutive blocks.

2. Linked List allocation:

Files kept as a linked list of disk blocks. First word of each block is used as a pointer to the next one. The rest of the block is for data.

3. Linked list allocation using an Index

It eliminates the shortcoming of linked list allocation by taking the pointer word from each disk block and putting it in the table in main memory.

4. Index nodes (Inodes)

In this method, each file is associated with data structure

known as inode or index node.

Advantages & disadvantages:

i) Contiguous allocation

Advantage:

- Sequential and direct access are supported.
- Simple to implement.

Disadvantage:

- Suffers internal as well as external fragmentation.
- Inefficient memory utilization.
- Difficult to increase the file size.

ii) Linked list allocation:

Advantage:

- Flexible in terms of file size.
- No problem regarding the contiguous chunks of memory.

Disadvantage:

- Random access is slow.
- Comparatively slower than contiguous allocation.
- Random or direct access is not supported.

iii) Linked list allocation using an index

Advantage:

- Random access is easier.
- Large file can be accessed easily.

Disadvantage:

- Entire memory table must be in memory all the time to make it work.

iv) Index nodes (Inodes)

Advantages:

- o The scheme supports random access of the file.
- o The scheme supports fast access to the file blocks.
- o The scheme is free from the problem of external fragmentation.

Disadvantages:

- o The pointer head is relatively greater than the linked allocation of file.
- o Index allocation suffers from the wasted space.

File access methods are:

1. Sequential Access.

When the information in the file is accessed in the sequential order i.e. one record after another, it is called sequential access.

Advantages:

- o Easiest file access method.

Disadvantages:

- I. Lengthy & Slow process.

2. Direct Access.

In direct access, bytes or records can be accessed in any order. Access is based on a key than a position.

Advantage:

- J. Faster than sequential access.

Qno. 6(a)

In what ways is file system management similar to virtual memory management? When which file organization technique is most appropriate for tape storage?

Ans:

File systems and virtual memory perform similar functions in different spheres. Virtual memory creates apparent contiguous memory regions from the combination of physical memory frames, backing mass storage and translation pages. Thus, user perceived memory can both grow without affecting other processes on the same system, and within reason grow beyond the capacity of physical memory.

A file system translates discontinuous collections of mass storage space into virtually contiguous files. A significant simplification. File system thus allows multiple files residing on the same storage device to grow without requiring data migration. From user perspective there does not appear to be any segmentation.

The best file organization technique for tape storage is sequential access because

- o Data is accessed one record after another in an order.
- o Read command cause a pointer to be ahead of by one.

Qno. 6(b)

List the file system performance indicators with brief explanation

Ans: The file system performance indicators are

- 1. Block cache or buffer cache:

Cache is a collection of blocks that logically belongs

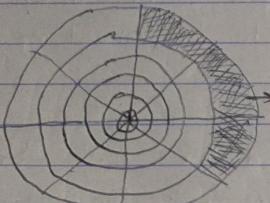
a block on disk but are kept in memory for performance reason. First check whether the required block is in cache or not. If it is, then request can be satisfied without disk access. If a block is not in the cache, it is free read into a cache, then copied to whenever it is needed.

2. Block Read Ahead

- Get block into cache before they are needed to increase hit rate.
- A file system ask to produce block k of a file, it does that, but when it is finished, it makes a sneaky check in the cache to see if block $k+1$ is there or not. If it is not there, it brings block $k+1$ to memory in the hope that when it is needed, it will already have present in memory.

3. Reduce Disk Arm Motion

- Keep the block that are likely to be accessed in a sequence close to each other, preferably in same cylinder.
- Another performance bottleneck is system that use i-nodes requires reading over a short file requires two disk access.
 - a) One for inode
 - b) One for block



Inodes are located near the starting edge of disk.

In the figure, it is shown that all the inodes are near the beginning of disk, so average distance between an inode and its block will be about half the no. of cylinders, requiring less seek.

Q. Write short notes on:

UNIX File System

UNIX file system is a file system supported by UNIX and UNIX-like OS. It is a distant descendant of the original file system used by version 7 UNIX.

A UNIX file system volume is composed of the following parts:

- A few blocks at the beginning of the partition reserved for boot blocks
- A superblock, containing a magic number identifying this as a UFS file system, and some other vital number describing filesystem geometry, statistics etc.
- A collection of cylinder groups.

2073 Magh.

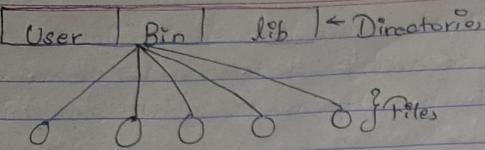
What is File Attribute? What is the difference between single level directory system and Hierarchical directory system. Explain how OS manages free block of secondary storage?

Ans:

File attributes are secondary storage settings associated with computer files that grant or deny certain rights to how a user or the OS can access the file.

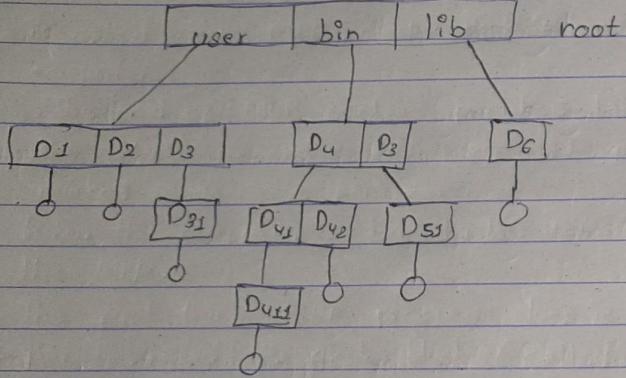
Single level directory system

It is simplest directory structure. There is only one directory that holds all the files. Sometimes it is also called root directory.



Hierarchical directory system

Also known as tree of directory or tree-structured directory. It allows user to have sub directories under their directories, thus making the file system more logical and organised for user.

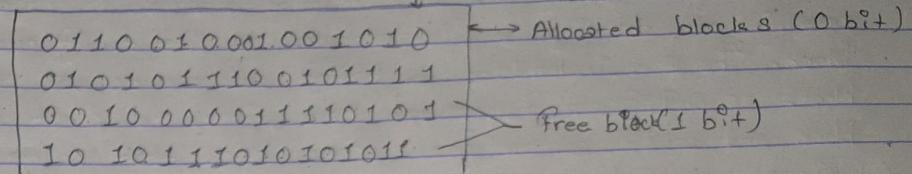


OS manages free blocks of secondary storage by allowing methods:

Bit vector

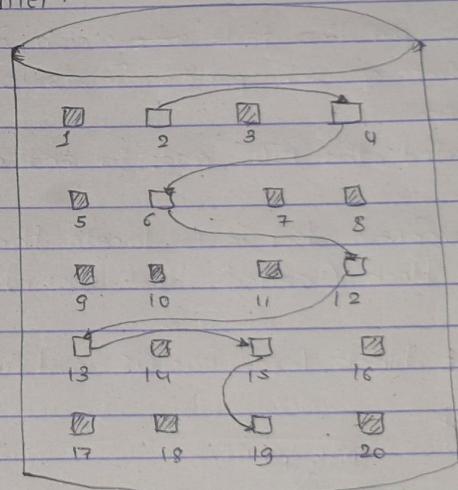
Bit vector known as bit map is widely used to keep tracks of free blocks on a disk. To track all the free and used blocks on a disk with total n blocks, bit map having n bits is required. Each bit is bit map represented disk block, where a '0' in a bit represents an allocated block and a '1' in a

bit represent a free block.



2. Linked list:

Linked list entry of free space management create a link list of all free blocks on the disk. A pointer to the first free block is kept in a special location on the disk and is cached in memory. The first free block contains the pointer.



3. Grouping

Grouping is a modification to the free-list approach in the sense instead of having a pointer in each free block to the next free block,

4. Counting

When a contiguous or clustering approach is used, creating or deleting a file allocates multiple contiguous blocks. Therefore instead of having address of all free blocks as in grouping, we can have pointer to first free block and count of contiguous free block that follows the first free block.

2071 Ashwin,

A. What is file system layout?

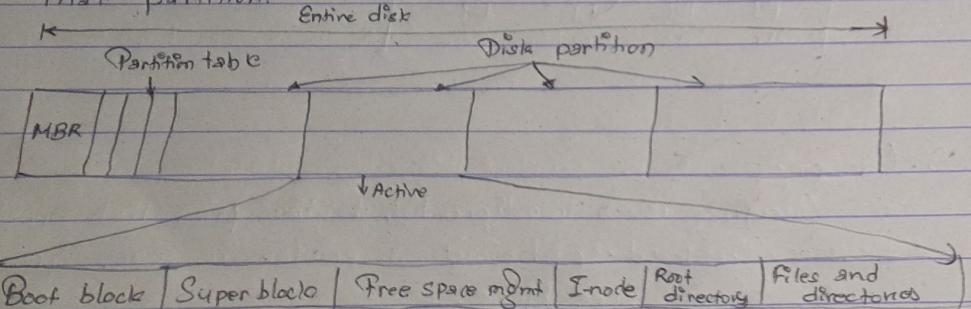
Ans. Files are stored on a disk. Sector 0 of the disk is called the MBR (Master Boot Record) and is to boot the computer.

The end of MBR contains partition table which gives the starting & ending address of each partition in table is marked as an active partition.

When the computer is booted, the BIOS reads in and executes the MBR.

The first thing MBR program does is to locate the active partition, reads its first block (called boot sector) and executes it.

The program in the boot block loads the OS contained in that partition.



2071 Math,

Q. What is file?

Ans. File is a collection of related information defined by its creator. The abstraction used by the kernel to represent and organize the system non-volatile storage resources including hard disks, floppy disks, CD-ROM and optical disks.

2070 Bhadra,

A. Explain the system layout in detail. What are the major differences between file system interfaces and file system implementation?

Ans: File system implementation deals with:

- o How files and directories are stored?
- o How disk space is managed?
- o How to make everything work, efficiently and reliably?

The main objective of file system implementation:
> To describe the details of implementing local file system & directory structures.

> To describe the implementation of remote file systems
> To describe discuss block allocation & free-block algorithm & trade-offs

Some of the allocation methods in file system implementation are

1. Contiguous allocation.
2. Linked allocation.
3. Indexed allocation.

File system interface provide application with various system calls and commands such as open, write, read, seek, etc. Since main memory is usually too small, the computer system must provide secondary storage to back up main memory. The file system provides the

mechanism for storage of and access to both data and programs residing on the disks. Under this, we describe following topics:

- o Access method
- o Directory structure
- o File system mounting
- o File sharing
- o Protection.