CHAPTER 4

FILE MANAGEMENT

Introduction

- Files are an abstraction mechanism
- A file consists of data on disk. Can regard this data as a sequence of bytes.
- A filename is an alias for this data. We can access the data by using the lename. So, we don't worry about:

  → Where the data is on the disk (what cylinder, sector, etc)

  → How the data is read in from disk to main memory
- The file system handles these details for us.

File System

- **File system** is a method for storing and organizing computer files and the data they contain to make it easy to find and access them.
- File systems may use a data storage device such as a hard disk or CD-ROM.
- Involve maintaining the physical location of the files.
- Provide access to data on a file server by acting as clients for a network protocol.
- It is distinguished from a directory service and registry.

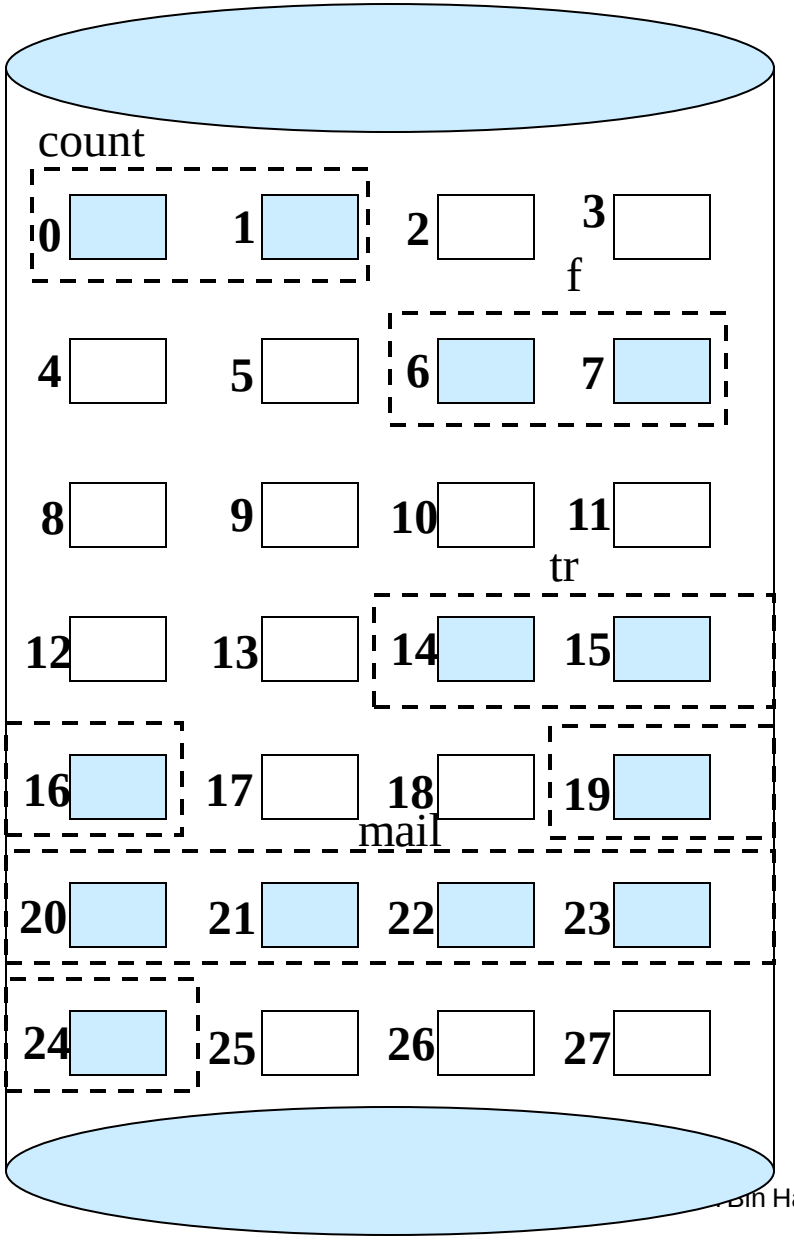
ALLOCATION METHODS

- The main idea behind allocation is effective utilization of file space and fast access of the files.
- There are three types of allocation -
  1.contiguous allocation
  2.linked allocation
  3.indexed allocation

- To keep track of the free space the file system maintains a free space list which tracks all the disk blocks which are free.
- To create a file required space is reserved for the file and the corresponding space is removed from the free list.

Contiguous File Allocation

- Each file occupies a set of consecutive addresses on disk
- Each directory entry contains:
  - **file name**
  - **starting address of the first block**
  - **block address = sector id (e.g., block = 4K)**
  - **length in blocks**
- Usual dynamic storage allocation problem
  - **use first fit, best fit, or worst fit algorithms to manage storage**
- If the file can increase in size, either
  - **leave no extra space, and copy the file elsewhere if it expands**
  - **leave extra space**
- Contiguous allocation of a file is defined by the disk address of the first block and its length



DIRECTORY

File	Start	Length
count	0	2
tr	14	3
mail	19	6
f	6	2

Figure 1 : Contiguous allocation on disk space

Linked File Allocation

- each data block contains the block address of the next block in the file
- each directory entry contains:
  - file name
  - **block address**: pointer to the first block
  - sometimes, also have a pointer to the last block (adding to the end of the file is much faster using this pointer)

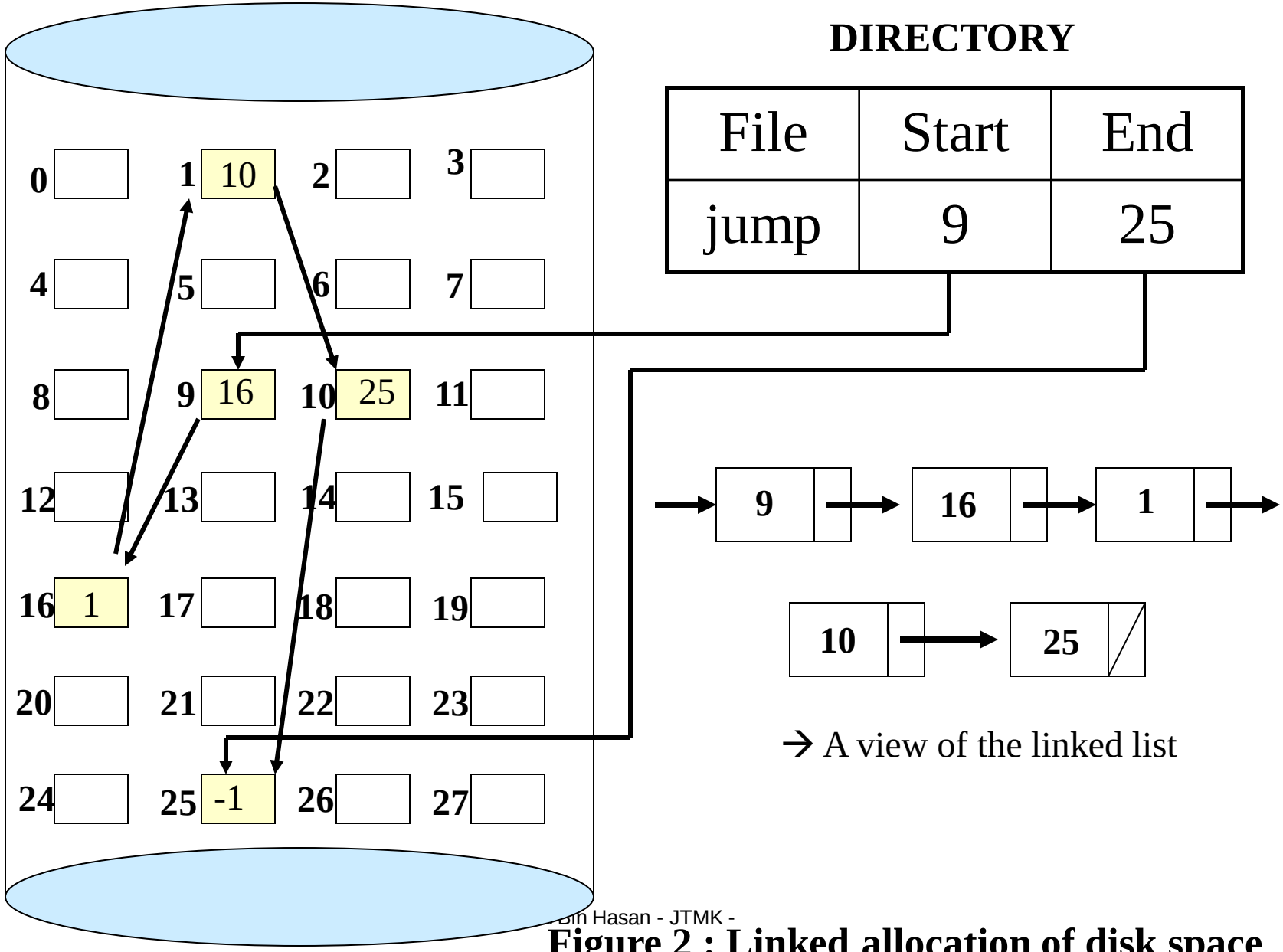


Figure 2 : Linked allocation of disk space

Indexed File Allocation

- ***Indexed allocation*** uses an index to directly track the file block locations.
- A user declares the maximum file size, and the file system allocates a file header with an array of pointers big enough to point to all file blocks.
- Although indexed allocation provides fast disk location lookups for random accesses, file blocks may be scattered all over the disk.

- A file system needs to provide additional mechanisms to ensure that disk blocks are grouped together for good performance (e.g., disk defragmentor).
- Also, as a file increases in size, the file system needs to reallocate the index array and copy old entries. Ideally, the index can grow incrementally.

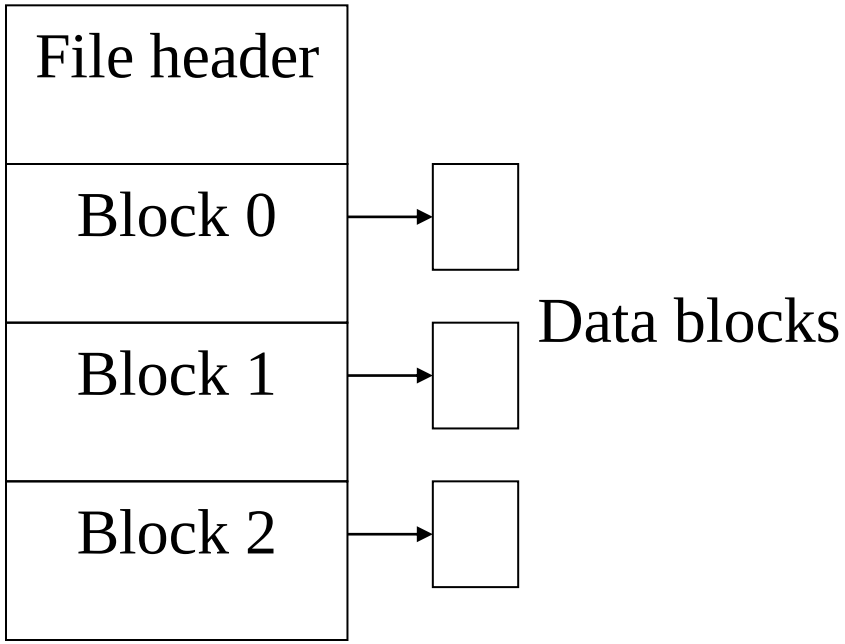


Figure 3 : Indexed File Allocation of Disk Space

- How it looks on the disk:

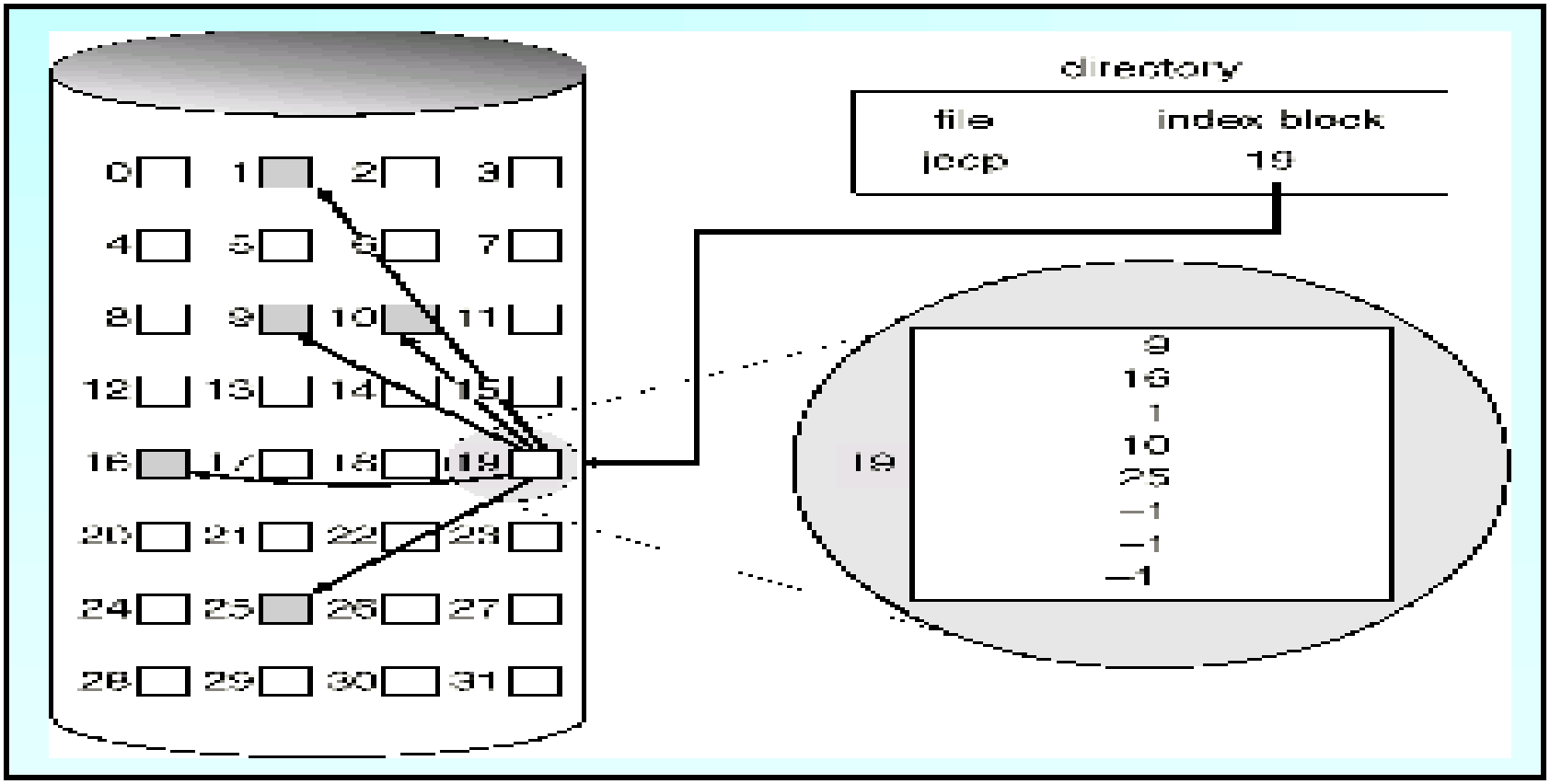


Figure 4 : Indexed Allocation In Disk Space