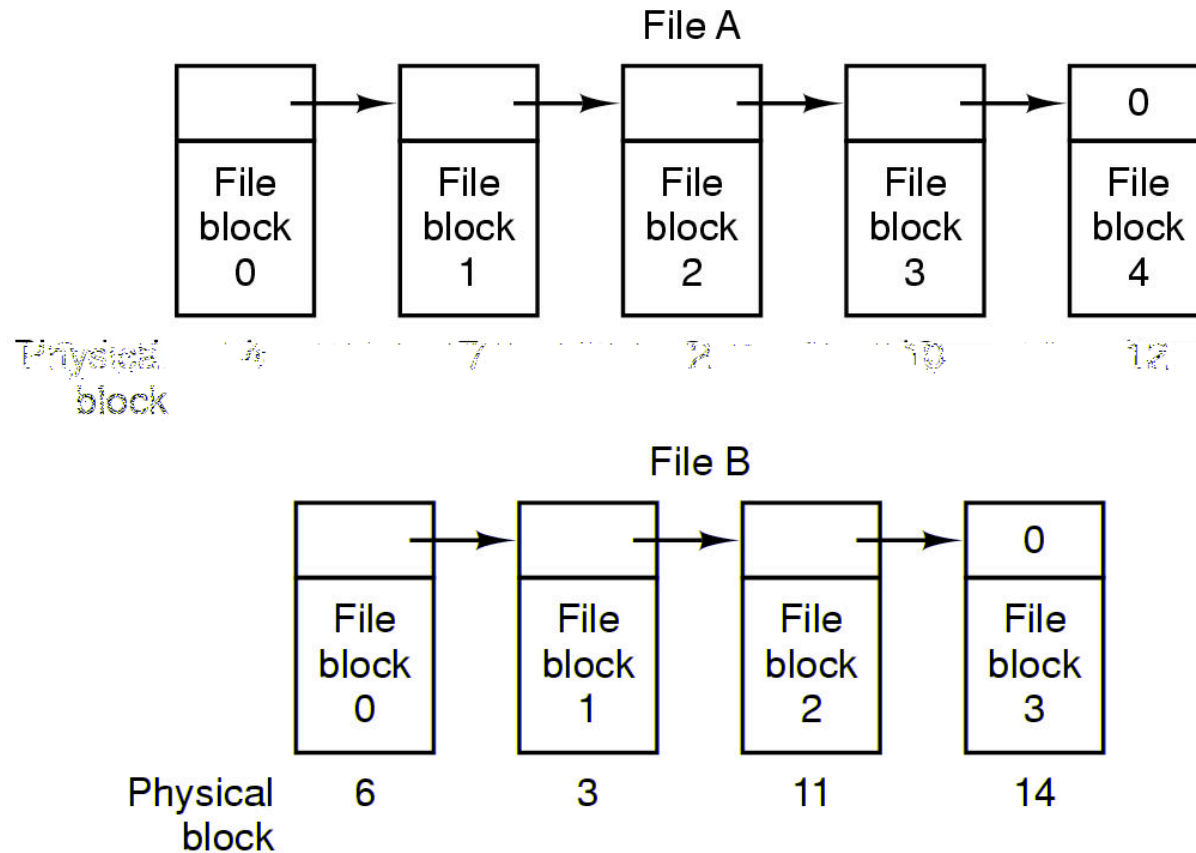


Implementing Files

Linked List Allocation



Storing a file as a linked list of disk blocks

Link List Allocation

Advantages

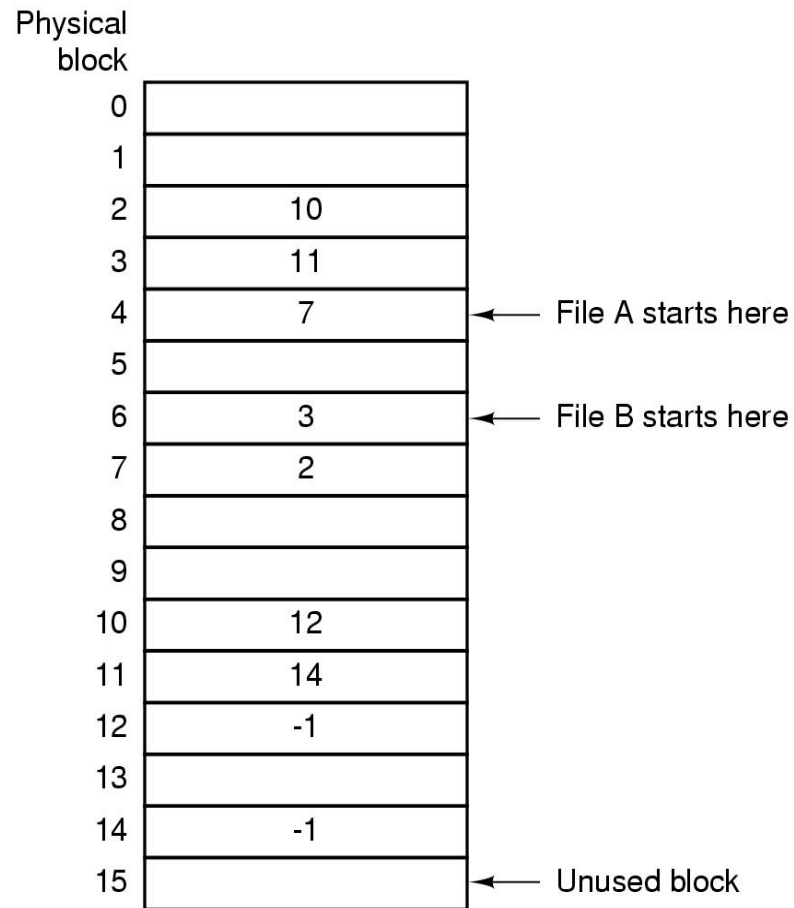
- No space is lost to fragmentation
 - All disk blocks can be used
- Relatively simple to implement
 - Need the address of the first block
- Sequential reads are fast
 - Blocks are read in sequence

Linked List Allocation

Disadvantages

- Random access is very slow
 - To read block n , one has to read all the blocks from 1 to $n-1$
- A similar technique without this disadvantage is the file allocation table (FAT).

Implementing Files FAT



Linked list allocation using a file allocation table in RAM

FAT Advantages

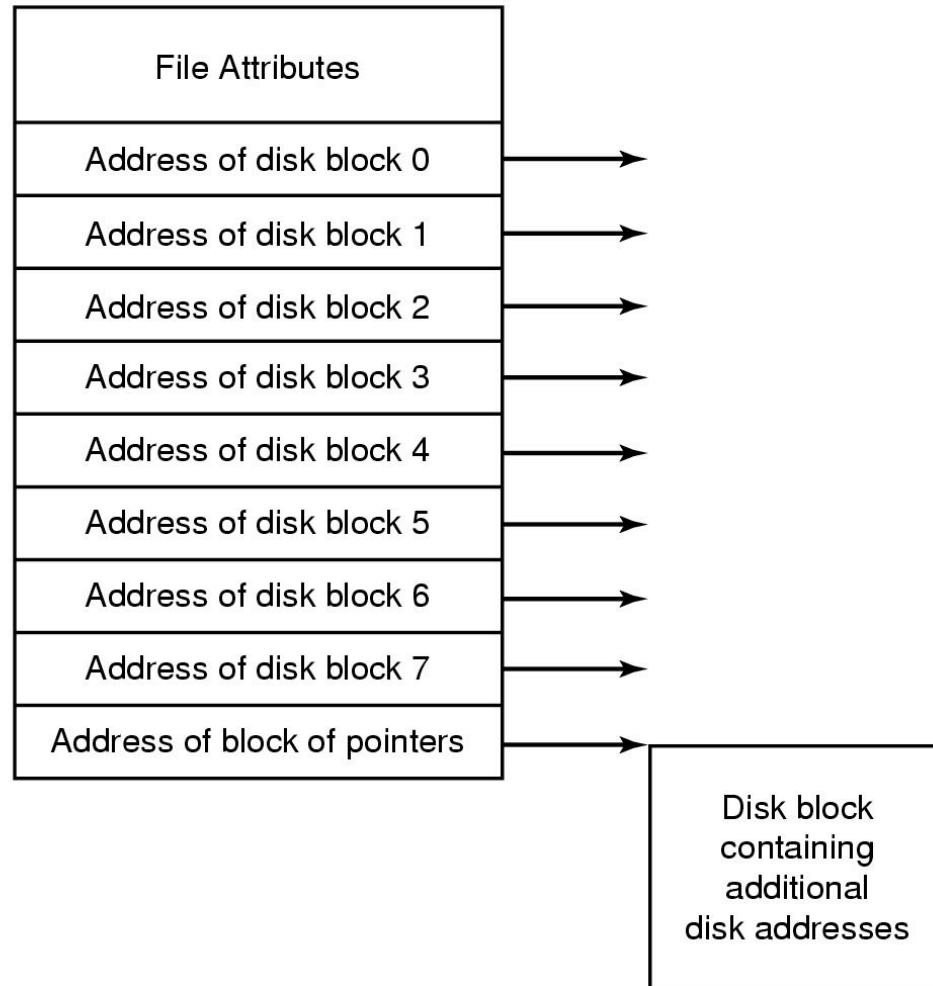
- Random access is feasible
 - the FAT for a file can be read in a single operation and stored in memory
- Simplicity
 - Need to keep track of the first block of the file

FAT Disadvantages

- The FAT has to be kept in memory
 - With a 20GB disk and 1KB blocks we need about 60MB of RAM to store the table
- Newer versions of FAT use the notion of clusters
 - A contiguous sequence of sectors are grouped into clusters
 - This minimizes memory requirements

Implementing Files

I-Nodes

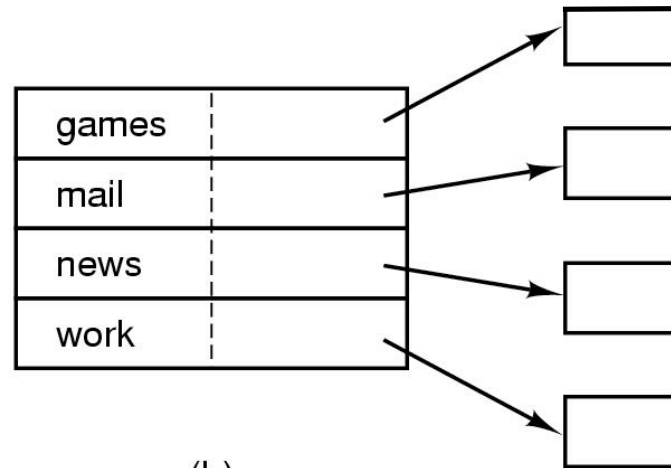


An example i-node

Implementing Directories (1)

games	attributes
mail	attributes
news	attributes
work	attributes

(a)



(b)

Data structure
containing the
attributes

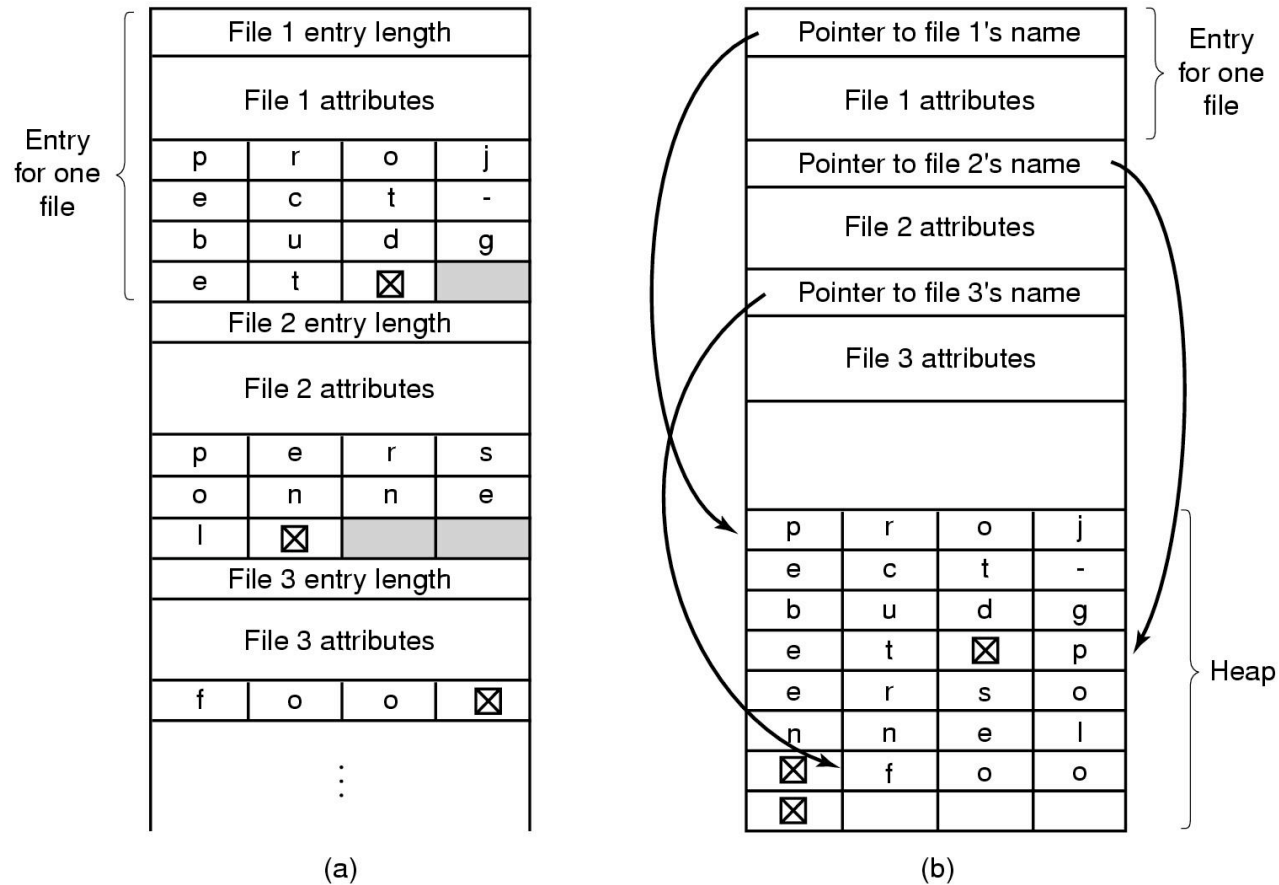
(a) A simple directory

fixed size entries

disk addresses and attributes in directory entry

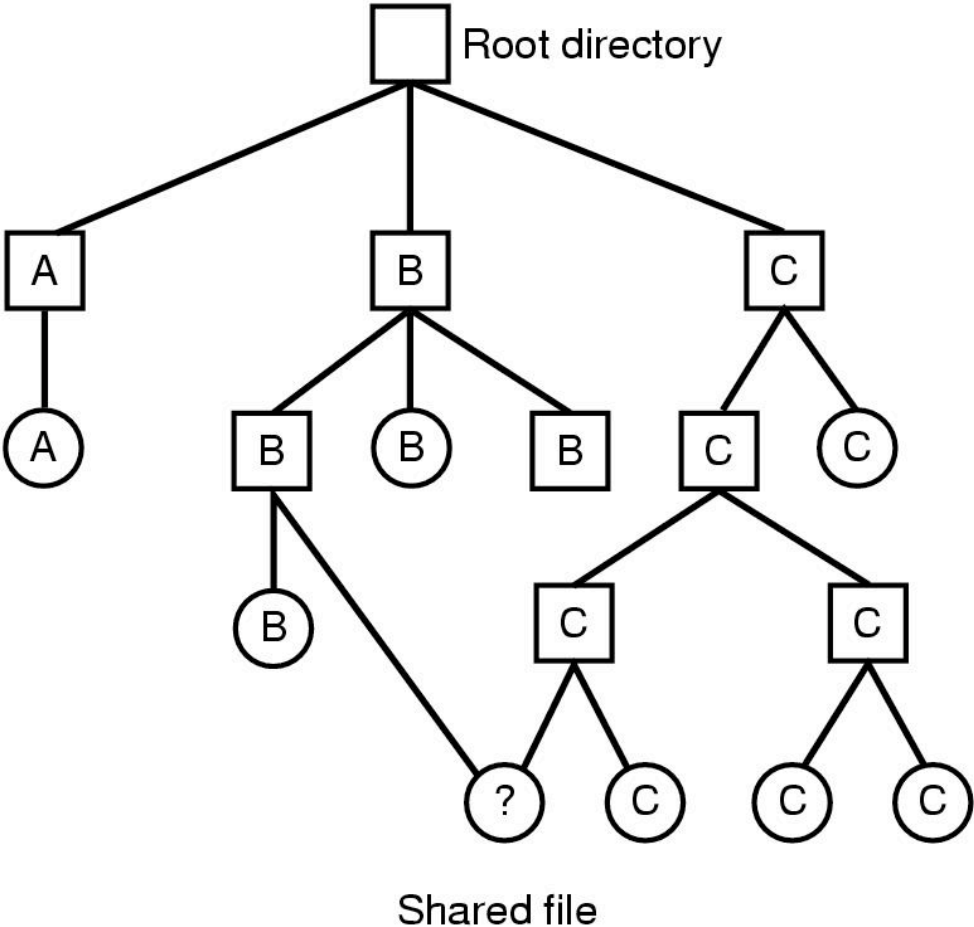
(b) Directory in which each entry just refers to an i-node

Implementing Directories (2)



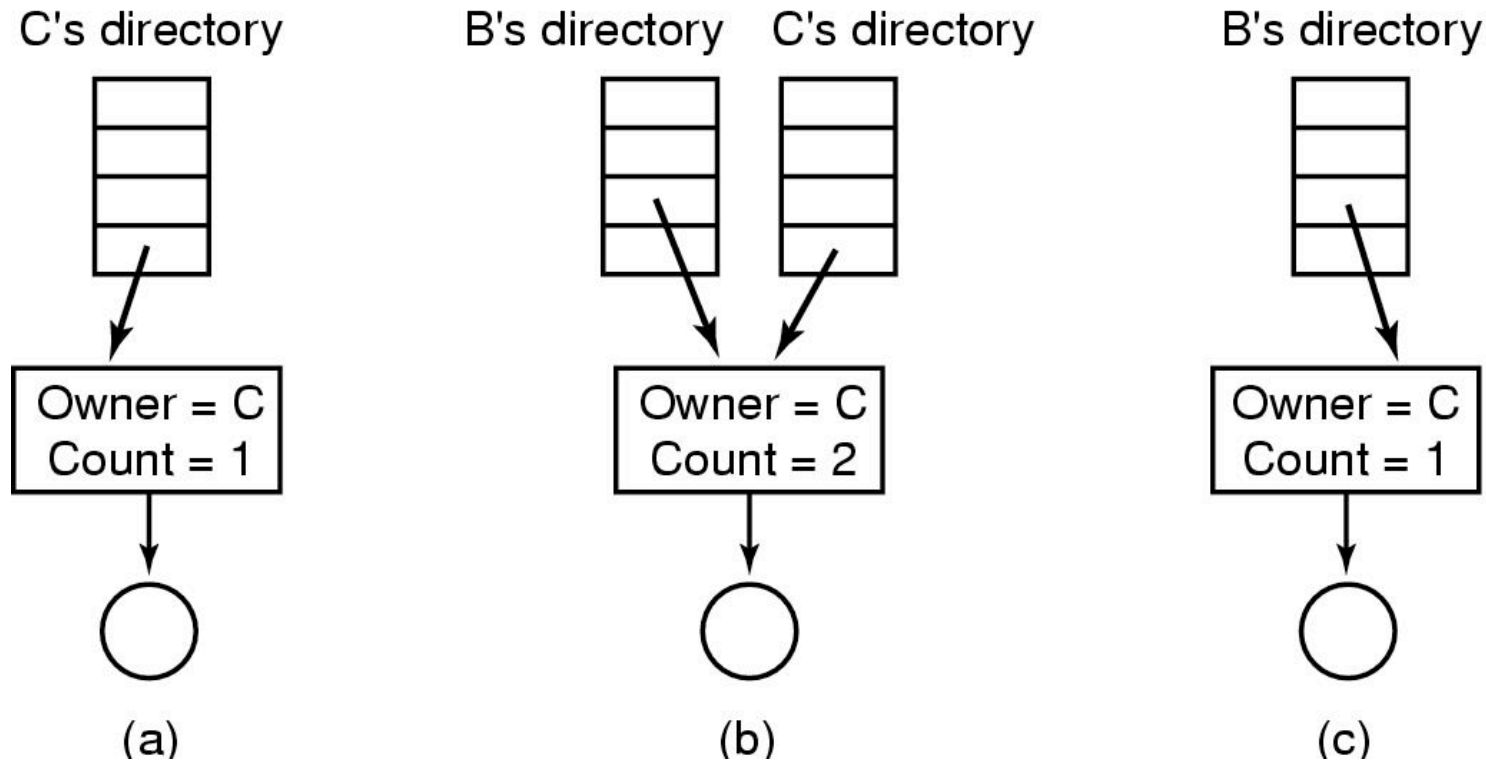
- Two ways of handling long file names in directory
 - (a) In-line
 - (b) In a heap

Shared Files (1)



File system containing a shared file

Shared Files (2)



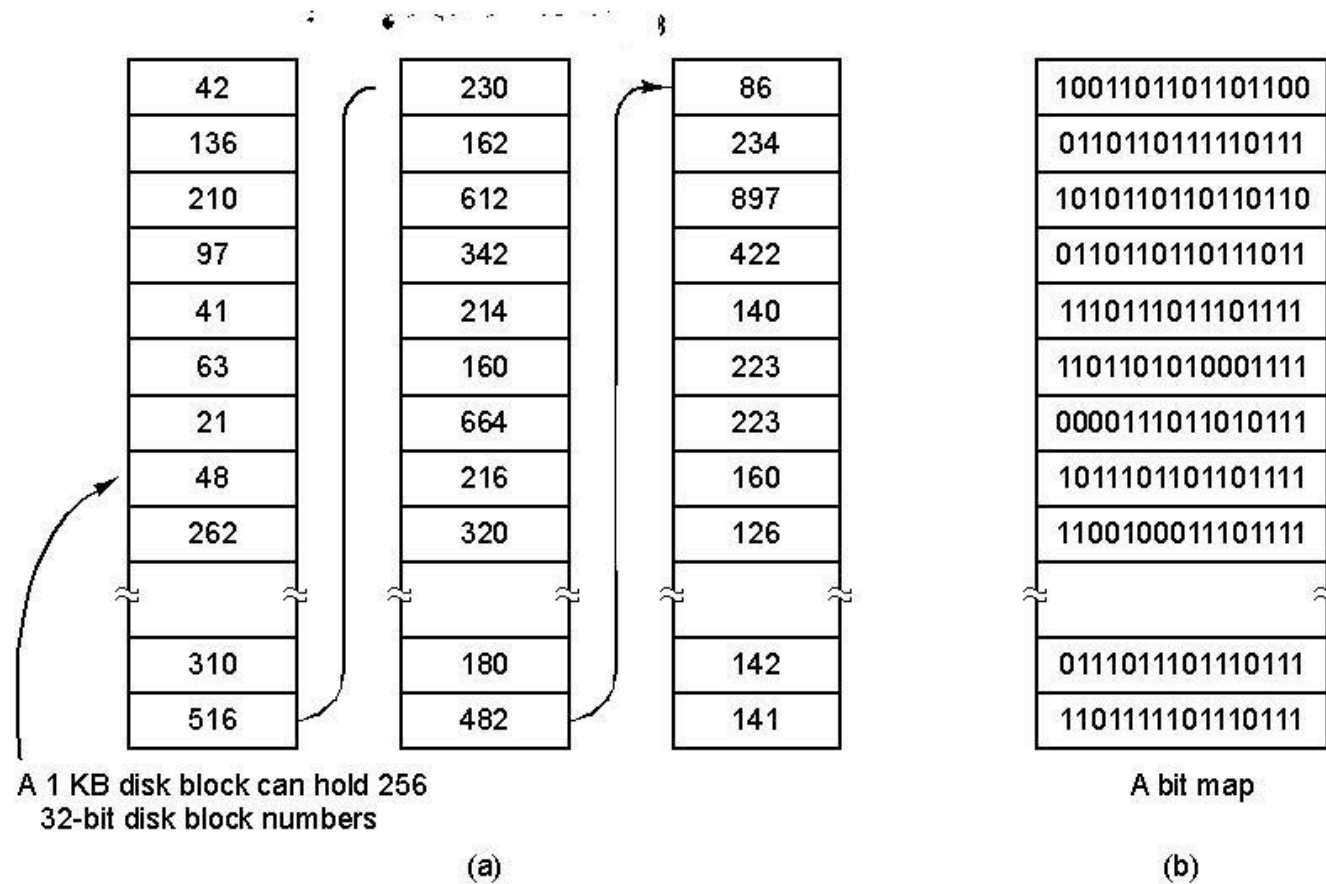
(a) Situation prior to linking

(b) After the link is created

(c) After the original owner removes the file

Disk Space Management

Free Blocks Management

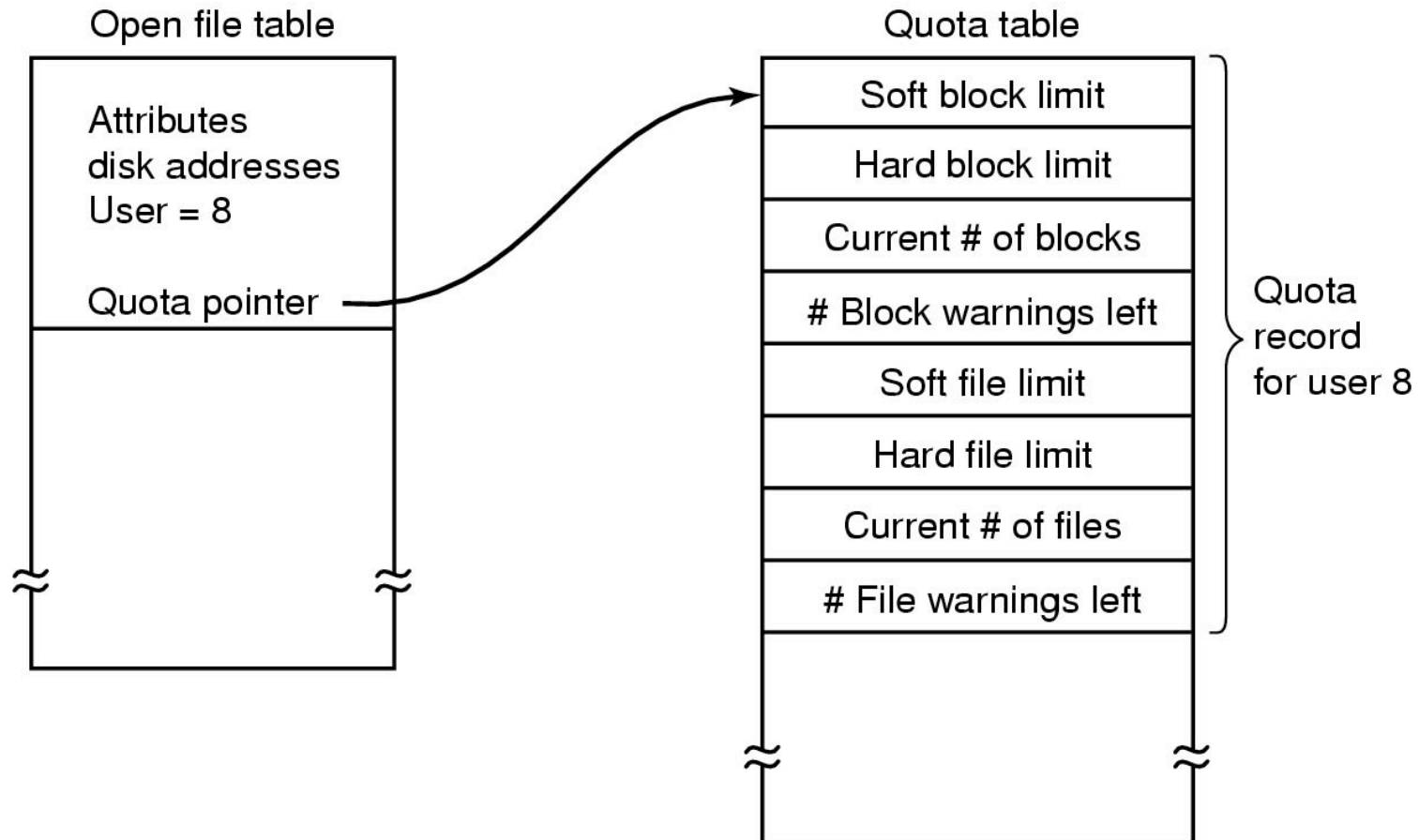


(a) Storing the free list on a linked list

(b) A bit map

Disk Space Management

Disk Quotas



Quotas for keeping track of each user's disk use