

Information Management

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Introduction :- The information model of operating system is concerned with storage & retrieval of information from the system. In such a manner that the information should be kept ready for access at the highest speed as similar to the library of the book.

The information management has mainly 4 functions to be performed.

1. It keeps the track of all information to be stored or accessed.
2. It decides the policy for determining where & how the information is stored & who can access this information.
3. Allocation :- It allocates the information to diff. users according to the policy.
4. Deallocation :- When the information is no longer needed they are released from the resource.

The information management are collectively refers to file system. The information is one of the most important resource of an O.S.

* File :- A file is a smallest storage unit of a system. It is a logical organisation of an information. It deals with the collection of uninterrupted information at O.S. level. Thus each separately identified collection of information is called a file.

A file with collection of related information unit is called record.

EX-1 In database system one row contains the information regarding a single entity, which is a record. So the database file is collection of such records.

* A simple file structure :-

A simple file system contains information regarding the file is the data regarding the file. A data is kept in a database, called as file database directory.

These file database directory contains the information that one necessary to find if access the file. The logical organisation or in programming view the logical file contains records.

A file may contain the records.

The physical location of the file on a storage device can be determined by the means of string block for the logical records are kept in these storage block. Thus we can

distinguish between physical & logical structure of a file. A file is in a form of records is present in

dissequencial manner i.e. what records present in a file are sequentially stored on storage device, where this is a physical view of a file. But most of physical require the records

are stored in a sequential manner. They need not to be in a sequential manner.

The mapping of logical & physical block

has to be maintained. To achieve this directory of data regarding a file is maintained which contains mainly 6 entries. They are entry no, name, logical size of record, no. of records, address of first physical block where record is saved. & protection & access control fields.

EX:-

Entry No.	Name	Logical size of record	No. of Records	address of 1st rec.	Access control
1	student	50	10	2	R/W Access to all

In above example which contains students as its name which has got 10 records at each record contains 50 as its record size. This file is placed in memory from second on secondary storage device & this can be accessed by any user. when we want to access the file from the storage device the control is brought to 1st physical block & according to the logical size diff. records can be fetched into the memory.

Q. General model of file system

(A) 17

General model of file system

...

...

...

★ Hierarchical structure of a file:

General model of file system.

Request Regarding information

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virtual computer

Symbolic file system [SFS]

management

Basic structure of file system [BFS]

Access control verification [ACV]

Logical structure of file

physical structure of file

device management

Allocation strategy model

Device strategy model

Initiate I/O program

Device handler

0000 1000 2000 3000 4000

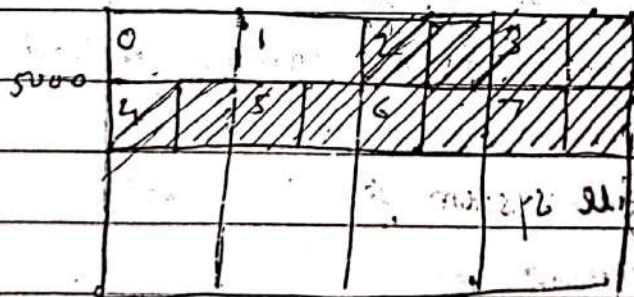


Fig (A)

physical structure of file.

In general model of a file system, the file system are shown with hierarchical model [tree structure]. when we want to read a student file which contains no. of records, each

record has 500 bits of logical size & there file is present on the physical device. This physical device contains the block of 1000 bytes. If we want to read the file into the memory the following steps are performed, the junction can be called as

Read (file (student), 8, memory)

where we have to read the 8th record of the

file into the memory. The steps are,
1. First the file directory is searched to find the entry for file name student which is present in symbolic file system model. In symbolic file system model every file has given the unique identification number. Thus, in symbolic file directory, 'master table' have to one corresponding with a actual file name & a file ID.

Unique ID list: The unique ID no. is used by the

Name	File ID	entire basic file system as its
Student	881	identification.
lect	5	

The information about the student file is retrieved with ID no. & basic file structure model.

From which we get the information i.e. logical record size, no. of records, address of 1st physical block, protection of access control & information etc.

3] Based on protection information & access control, the decision is made whether to allow the request

to be proceed or not i.e. whether allow read student file or not.

4] In this step, the logical address specification is done with the help of information provided in basic file structure [step 2]. This logical byte address is calculated according to the no. of records in a file which is to be read.

In above example, we want to read the 8th record. The formula to calculate logical record

(Record no. - 1) * Logical size of record

Record byte address for the 8th record will be

$(8 - 1) * 500 = 7 * 500 = 3500$

These calculations are performed if logical address is given for the record in logical file system model.

The logical byte address is transferred into physical byte address, i.e. logical address byte is added with the first bit of a file from where it is stored. This information is specified in basic

file structure. So physical address of a 8th record in our example will be

$2000 + 3500 = 5500$

the address for the 8th record on a physical level will be 5500.

5. The physical address from 5500 to 6000 is brought into the memory, i.e. the physical address calculated to the end of record

i.e. physical address + logical address size

5500 + 500 = 6000

Thus, particular record is brought into memory

* Logical file system :- The logical file system is concerned with mapping of logical records into the linear byte string i.e. it gives the logical address for that record i.e. present on the physical file system. It convert the request for the record into a request for a byte string. A logical file system provides various facilities or methods to access the record. mainly gives the sequential access & direct access for the record.

1] Sequential Access :- When the record is searched sequentially i.e. starting from first record of the file & the next till we get the specified or required record.

2] Direct access :- with some mathematical calculation we can directly searched the record present in the file.

The different access methods are

1] sequentially structured fixed length record :-

2] sequentially structured variable length record :-

3] sequentially structured keyed records

4] multiple keyed records

5] change structured record

6] Relational or triple structure records.

① Robots are able to work at design time

* CLBA - current logical byte address.

* sequentially structured fixed length record :-

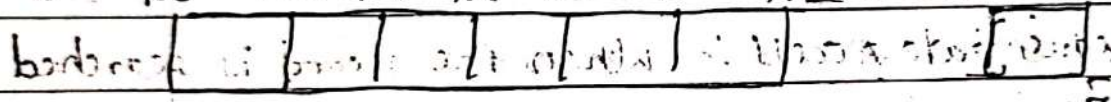
For this type of record organisation which contains the fixed length for a record in an active file table or in file.

eg. when we declare an array of integer i.e.

int A[20]; at that time the record size will be 20. Thus we get a continuous memory

block of 40 bytes with the initial address of this array. as shown in fig.

100 102 104 106 108 110 112



int A[20];

when we want to read file which contains the fixed length record we can use two access methods

1) sequential access :- In this which the records are searched sequentially. Thus we want the address of next record then the logical file system must

maintain the current logical byte address [CLBA]

in active file table [AFT] for the file entry.

When this file is initially opened the CLBA is set to be 0. & after processing each request

CLBA is updated as follows:

$$CLBA = CLBA + R_L$$

where R_L is length of record. This calculated

CLBA is added to initial address present in AFT
 If we get the address of next record...

EX

In our above example to find the next record, from initial 100 address, we add 2: the record length of a file

2] Direct Access :- In direct access we can directly find out the address of an expected record with the help of simple formula.

$$CLBA = (RN - 1) * RL$$

Where RN = desired record number.

As in our example, if we want to know the address of 6th record, we can use the formula.

$$(6 - 1) * 2 = 5 * 2 = 10$$

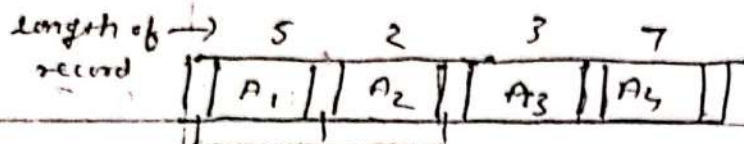
Where 6 is RN & 2 is RL .

When we add 10 to initial starting address i.e. 100 we get 110 which is the address of 6th record.

Sequential structured variable length record :-

In this type of record organisation the records are stored in a file with variable length i.e. the size of each record may be different. So that they will use a less memory space or storage space than fixed length record. To manipulate these records for every record 2 bytes are added which contains the information regarding the record i.e. the length of record. So the record

can be like this



additional bits size.

where there are 4 files A₁, A₂, A₃ & A₄ with variable length records i.e. 5, 2, 3 & 7.

Sequential access can be performed by the following formula.

$$CLBA = CLBA + 2 + N$$

Where N - is the length of a record in current position.

* Direct access: In direct access it is somehow difficult to have the particular record. In this access we have to calculate length of each record & add 2 bytes to each record so that we get our expected record.

Ex:- If we require to find third record then the formula is

$$CLBA = l_1 + 2 + l_2 + 2$$

where l₁ & l₂ are the lengths of first & second record respectively.

2] space is less but complexity is more

3] space is more but complexity is less

* Sequentially keyed records

The records in a file is stored sequentially on the basis of one key value or key field. when we want to search the record in such file, we can directly search a record.

Ex:- A student file which contains roll no., name & address of student. The records are stored in

file in sequential manner according to key field i.e.

* Multiple keyed record :- The record which may not be accessed with the help of single key. So with the help of more than one field, we identify the record of record. This key is called composite key, with the help of this key the records are saved & accessed in a file.

e.g. :- The phone number consist of 11 digits contains first two digits for the country code next 4 digits for the city code & last code is for a local no. Thus it is a multiple keyed record.

* Chain structured Record :- In this type of record the records are saved as a linked list.

The linked list can form the tree structure which contain the address of next record. In this way a particular branch of is searched & records can be identified.



* Relational or triple structured Record :-

In this type of file structure the records are stored in diff. tables & with the help of

common key they are related with one another.

Thus the relation is set bet two tables of that can be accessed with sophisticated procedure language like SQL.

* Physical file system: - physical file system allows us to get physical block no. of the address of record in this physical block. It is called as physical offset block. The physical file system used, the physical block from where the file starts. It also use the active file table, which contains the logical byte address. on the basis of logical byte, physical block size of the 1st physical block for the file, the physical block no. is calculated. with the help of this number the device strategy model is called an appropriate function like reading, writing or appending next place, the physical block no. is calculated as

$$\text{Physical block no.} = \frac{\text{logical byte address}}{\text{physical block size}} + \text{1st physical block no. of the file.}$$

eg. If we have the logical byte address 3500 as discussed before.

The physical block size is 1000 then

$$\text{Physical block no.} = \frac{3500}{1000} + 2 = \frac{7}{2} + 2 = \frac{11}{2}$$

$$\frac{7}{2} \cdot 3.5 + 2 = 5.50 \text{ [5]}$$

where 2 is the 1st physical block of the file

Fig. (A)

Now, the physical offset block is calculated which contains the address of particular record in the physical block, which is calculated as

Security & Protection

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Security:- A security term is defined by various computer literature by for instance the trusted comp. system evaluation criteria [TCSEC] defines the security as follows:-

A secure system will control through the use of specific security features access to information that to only properly authorized individual who can have an access to read, write, create or delete the information. In

In generally a security is connected with the ability of O.S. to enforce control over the storage & transport of data between the objects that the operating system support. Specially in multiuser environment, the concept of security & protection are very important. The user program should not interfere with other program, this can be achieved by proper memory & other device management. The lack of security mechanism can lead to the various problems.

In operating system interconnection, different elements of security are defined. They are:

1. Confidentiality :-
2. Integrity :-
3. Availability :-
1. Confidentiality :-

It ensures that information is not accessed in an unauthorized manner.

This is done by protecting read operation.

2. Integrity :- It ensures that the information is not amended or deleted in an unauthorized manner, where the right protection is apply. i.e., one should not able to append or change the content of information.

3. Availability :- It ensures that the information is available to authorized users at right time. It is possible only by essentially controlling read & delete operations & ensuring the other errors.

* Security problems :-

As the cost of hardware is falling at rapid rate millions of ordinary users & programmers - are have a small or large computer equipments. with a trained towards a networking the users or programmers have access to data & programs at different remote locations. This increase the problem of security in computer environment, specially in operating system.

Sharing & protection are requirement of modern computing but these are contradictionally goal i.e. in previous o.s. like DOS which were single user there was no need of protection at operating system level. But, at network operating systems such as Novel network or other networks which is the modern networks we have the need of protection. The major threat or problem to