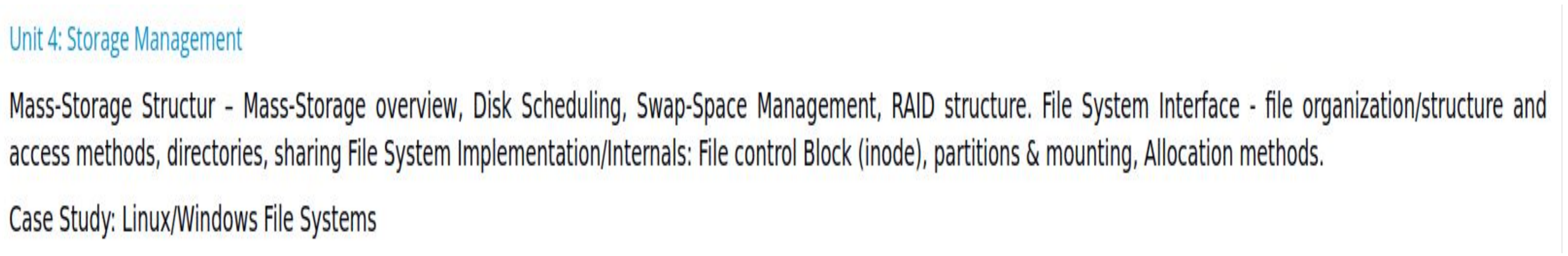
OPERATING SYSTEMS

UE18CS302_Unit 4_Revision_Class_#2

Nitin V Pujari
Faculty, Computer Science
Dean - IQAC, PES University

OPERATING SYSTEMS

Course Syllabus - Unit 4



Unit 4: Storage Management

Mass-Storage Structur - Mass-Storage overview, Disk Scheduling, Swap-Space Management, RAID structure. File System Interface - file organization/structure and access methods, directories, sharing File System Implementation/Internals: File control Block (inode), partitions & mounting, Allocation methods.

Case Study: Linux/Windows File Systems

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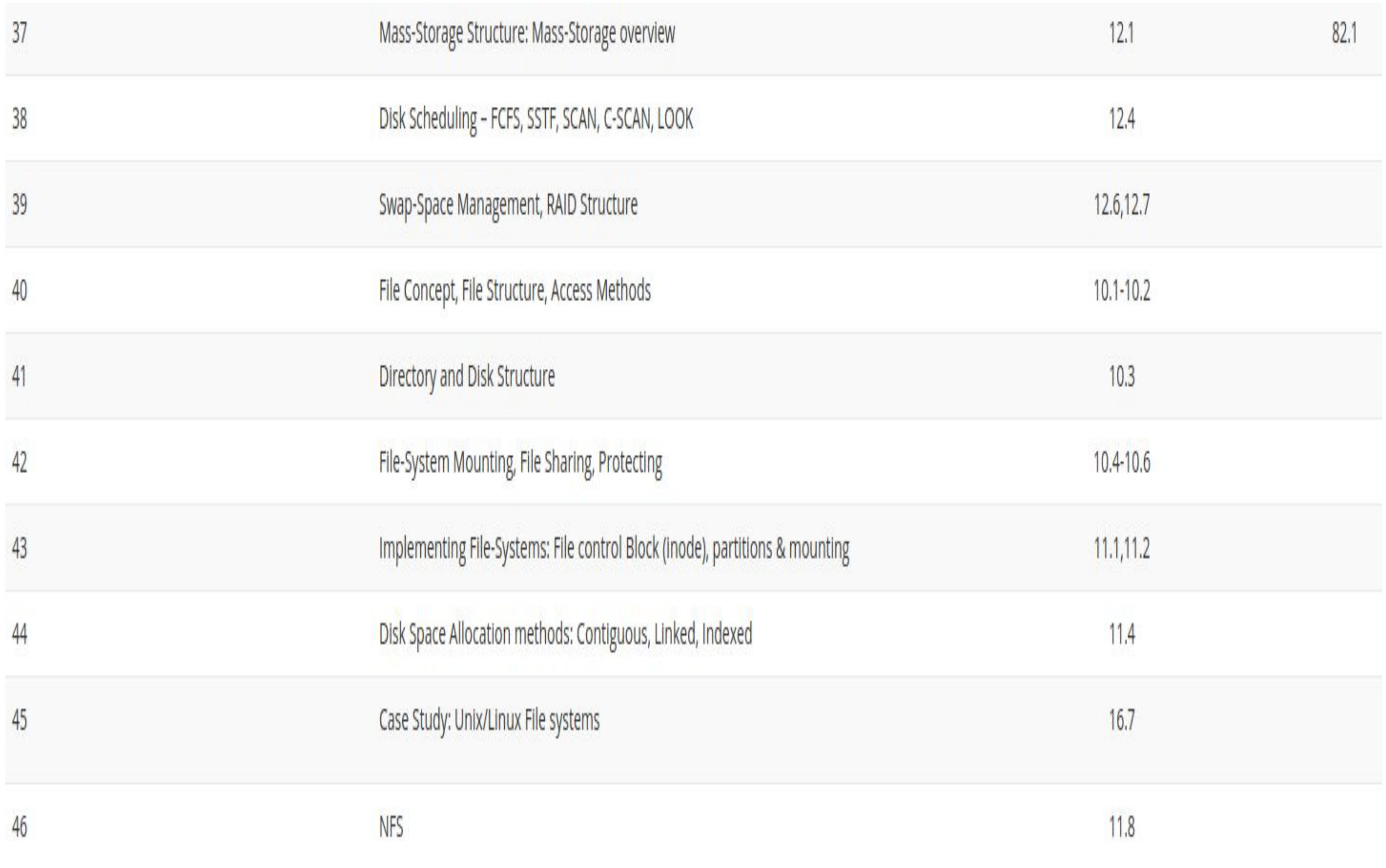
Course Outline



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40	File Concept, File Structure, Access Methods	10.1-10.2	
41	Directory and Disk Structure	10.3	
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Is disk scheduling, other than FCFS scheduling, useful in a single-user environment ? Explain your answer.

- In a single-user environment, the I/O queue usually is empty.
- Requests generally arrive from a single process for one block or for a sequence of consecutive blocks.
- FCFS is an economical method of disk scheduling.
- LOOK will perform better if multiple processes are performing concurrent I/O by the single user

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Explain why SSTF scheduling tends to favor middle cylinders over the innermost and outermost cylinders.

- The center of the disk is the location having the smallest average distance to all other tracks.
- The current location of the head divides the cylinders into two groups.
- If the head is not in the center of the disk and a new request arrives, the new request is more likely to be in the group
    - which includes the center of the disk hence, the head is more likely to move in that direction.

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Why is rotational latency usually not considered in disk scheduling ? How would you modify SSTF , SCAN , and C-SCAN to include latency optimization ?

- Even in the case of availability of rotational latency information , the time for this information to reach the scheduler would be imprecise and the time consumed by the scheduler is variable

- Logical block numbers, and the mapping between logical blocks and physical locations is usually very complex.

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Why is it important to balance file system I/O among the disks and controllers on a system in a multitasking environment ?

- A strength of any system is its weakest link
- Disks or disk controllers are frequently the weakest links in modern systems as their individual performance cannot keep up with that of the CPU and system bus.
- By balancing I/O among disks and controllers, neither an individual disk nor a controller is overwhelmed, so that bottleneck is avoided.

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What are the tradeoffs involved in rereading code pages from the file system versus using swap space to store them?

- If code pages are stored in swap space, they can be transferred more quickly to main memory because swap space allocation is tuned for faster performance than general file system allocation.
- More swap space must be allocated if it is used for both code and data pages.

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Is there any way to implement truly stable storage ? Explain your answer.

- Redundancy becomes inherent is such a case
- The fundamental technique for stable storage is to maintain multiple copies of the data, so that if one copy is destroyed, some other copy is still available for use.

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Could a RAID level 1 organization achieve better performance for read requests than a RAID level 0 organization (with nonredundant striping of data) ? If so, how ?

- Yes, a RAID Level 1 organization could achieve better performance for read requests.
- When a read operation is performed, a RAID Level 1 system can decide which of the two copies of the block should be accessed to satisfy the request.
- This choice could be based on the current location of the disk head and could therefore result in performance optimizations by choosing a disk head that is closer to the target data.

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Some systems automatically delete all user files when a user logs off or a job terminates, unless the user explicitly requests that they be kept; other systems keep all files unless the user explicitly deletes them. Discuss the relative merits of each approach.

- Deleting all files not specifically saved by the user has the advantage of minimizing the file space needed for each user by not saving unwanted or unnecessary files.

- Saving all files unless specifically deleted is more secure for the user in that it is not possible to lose files inadvertently by forgetting to save them.

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Why do some systems keep track of the type of a file, while others leave it to the user and others simply do not implement multiple file types? Which system is "better ?"

- Some systems allow different file operations based on the type of the file for instance, an ascii file can be read as a stream while a database file can be read via an index to a block.
- Other systems leave such interpretation of a file's data to the process and provide no help in accessing the data.
- The method that is "better" depends on the needs of the processes on the system, and the demands the users place on the operating system.
- If a system runs mostly database applications, it may be more efficient for the operating system to implement a database type file and provide operations, rather than making each program implement the same thing
- For general purpose systems it may be better to only implement basic file types to keep the operating system size smaller and allow maximum freedom to the processes on the system.

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Some systems support many types of structures for a file's data, while others simply support a stream of bytes. What are the advantages and disadvantages of each approach ?

- An advantage of having the system support different file structures is that the support comes from the system; individual applications are not required to provide the support.
- In addition, if the system provides the support for different file structures, it can implement the support presumably more efficiently than an application.
- The disadvantage of having the system provide support for defined file types is that it increases the size of the system.
- In addition, applications that may require different file types other than what is provided by the system may not be able to run on such systems.
- An alternative strategy is for the operating system to define no support for file structures and instead treat all files as a series of bytes.
- This is the approach taken by UNIX systems. The advantage of this approach is that it simplifies the operating system support for file systems, as the system no longer has to provide the structure for different file types.

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Explain the purpose of the open() and close() operations.

- The purpose of the open() and close() operations is
  - The open() operation informs the system that the named file is about to become active.
  - The close() operation informs the system that the named file is no longer in active use by the user who issued the close operation.

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In some systems, a subdirectory can be read and written by an authorized user, just as ordinary files can be.

a) Describe the protection problems that could arise.

b) Suggest a scheme for dealing with each of these protection problems.

a) One piece of information kept in a directory entry is file location. If a user could modify this location, then he could access other files defeating the access-protection scheme.

b) Recommendation is instead of the user to directly write onto the subdirectory, provide system operations to do so.

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Consider a system that supports 5,000 users. Suppose that you want to allow 4,990 of these users to be able to access one file.

a) How would you specify this protection scheme in UNIX ?

b) Can you suggest another protection scheme that can be used more effectively for this purpose than the scheme provided by UNIX ?

a) There are two methods for achieving this:

  i) Create an access control list with the names of all 4990 users.
  The same scheme suffers if the group is formed, if the system is not supporting group level access

b) The universal access to files applies to all users unless their name appears in the access-control list with different access permission.

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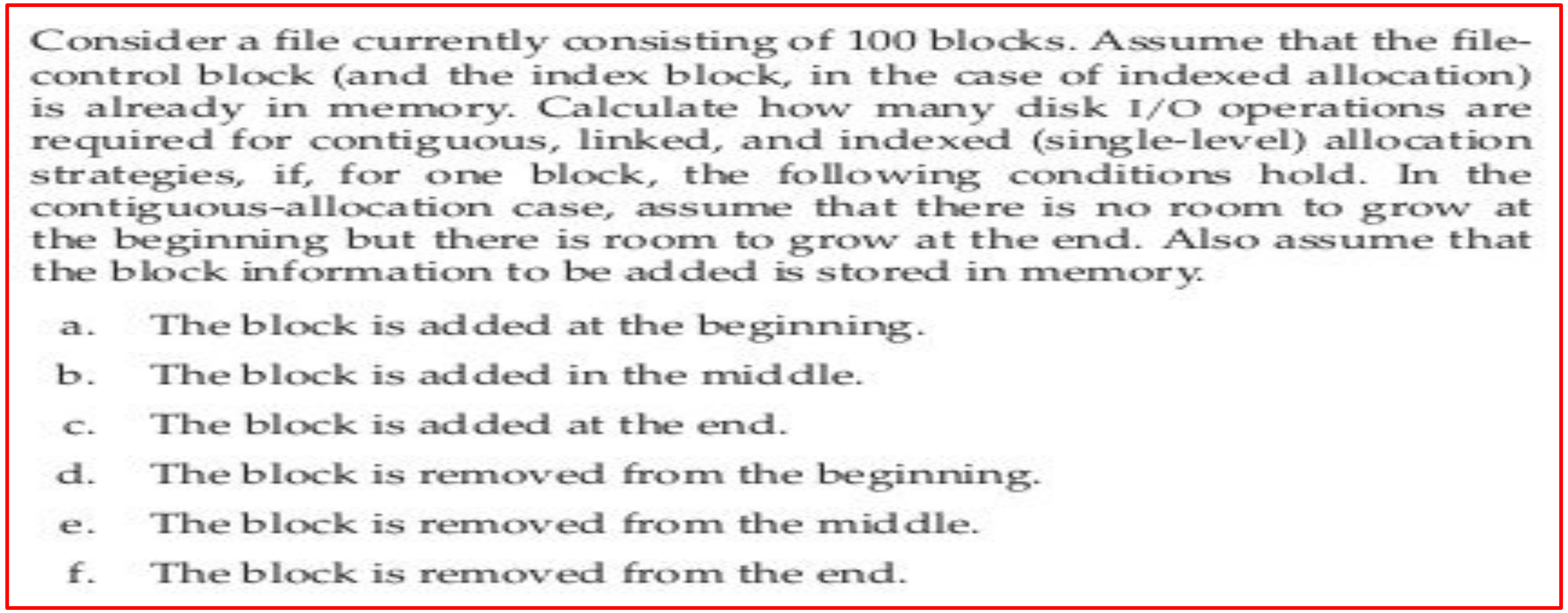

Consider a file currently consisting of 100 blocks. Assume that the file-control block (and the index block, in the case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow at the beginning but there is room to grow at the end. Also assume that the block information to be added is stored in memory.

a. The block is added at the beginning.

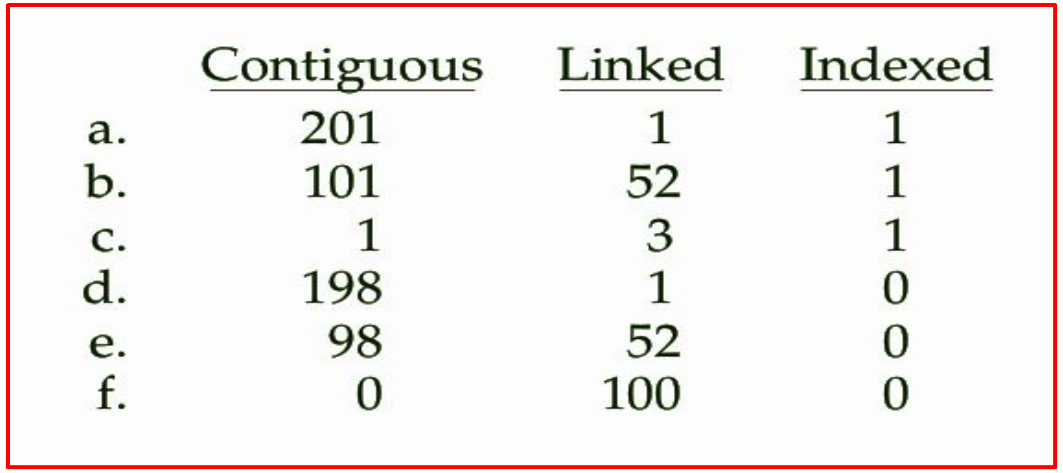
b. The block is added in the middle.

c. The block is added at the end.

d. The block is removed from the beginning.

e. The block is removed from the middle.

f. The block is removed from the end.



	Contiguous	Linked	Indexed
a.	201	1	1
b.	101	52	1
c.	1	3	1
d.	198	1	0
e.	98	52	0
f.	0	100	0

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What problems could occur if a system allowed a file system to be mounted simultaneously at more than one location ?

There would be multiple paths to the same file, which may create mistakes deleting a file with one path deletes the file in all the other paths due to the confusion in the user’s mind.

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Why must the bit map for file allocation be kept on mass storage, rather than in main memory ?

Memory failure due to system crash, as memory is volatile keeping the bit map file on a persistent storage is recommended

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Consider a system that supports the strategies of contiguous, linked, and indexed allocation. What criteria should be used in deciding which strategy is best utilized for a particular file ?

- Contiguous => For files with sequential access and relatively small
- Linked => For files with sequential access and relatively large
- Indexed => For files with random access and relatively large

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How do caches help improve performance ? Why do systems not use more or larger caches if they are so useful ?

- Caches allow components of differing speeds to communicate more efficiently by storing data from the slower device, temporarily, in a faster device (the cache).
- Cost of the device versus cost of cache

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Why is it advantageous for the user of an operating system to dynamically allocate its internal tables ? What are the penalties to the operating system for doing so ?

- Dynamic tables allow more flexibility in system use growth tables are never exceeded, avoiding artificial use limits.
- Unfortunately, kernel structures and code are more complicated, so there is more potential for bugs.
- The use of one resource can take away more system resources by growing to accommodate the requests than with static tables.

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Explain how the VFS layer allows an operating system to support multiple types of file systems easily.

- VFS introduces a layer of indirection in the file system implementation.
- In many ways, it is similar to object-oriented programming techniques.
- System calls can be made generically independent of file system type.
- Each file system type provides its function calls and data structures to the VFS layer.
- A system call is translated into the proper specific functions for the target file system at the VFS layer.
- The calling program has no file-system-specific code, and the upper levels of the system call structures likewise are file system-independent.
- The translation at the VFS layer turns these generic calls into file-system-specific operations.

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For Disk Scheduling algorithms refer the lecture handouts and relevant videos on PESU Academy

- First Come First Serve, Shortest Seek Time First - **Storage Management 3**
- SCAN, C-SCAN, LOOK, C-LOOK - **Storage Management 4**

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For all the other relevant Unit 4 concepts refer to the lecture supplements and relevant videos on PESU Academy

THANK YOU

Nitin V Pujari
Faculty, Computer Science
Dean - IQAC, PES University

nitin.pujari@pes.edu

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