Multiple Choice Questions (MCQs)

What is a major drawback of using a linked list to manage free space in a filesystem?

Answer: a) It is difficult to traverse.

Why do spinning disks only support reading/writing in sectors?

Answer: c) To reduce fragmentation

What is the main purpose of the block cache in a filesystem?

Answer: a) To store deleted files

Which of the following is NOT a challenge in crash recovery?

Answer: b) File fragmentation

What is the purpose of the fsck utility?

Answer: d) To increase I/O performance

Which of the following is a drawback of using fsck?

Answer: c) It permanently deletes all inconsistent files

In ordered writes, which operation should be performed first to prevent corruption?

Answer: c) Writing data first, then updating the inode

Short Answer Questions

Explain why delayed writes improve performance but can lead to data loss in case of a crash.

Answer:

Delayed writes mean that data is stored in memory for some time before being written to disk, which helps make writes faster. However, if the system crashes before the write happens, the data is lost, and the file could be incomplete or corrupted. This is why systems sometimes use a delay timer to reduce the chances of data loss.

Describe a situation where an inconsistent filesystem state might occur due to a crash. How can fsck help resolve this issue?

Answer:

If a file is being written and a crash happens before the free list is updated, the file might still be marked as available even though it has data. fsck can scan the filesystem and detect blocks that are referenced by multiple files or not referenced at all, then attempt to repair the state by moving files to a lost+found directory or reclaiming the space.

What is the tradeoff between synchronous writes and delayed writes in terms of crash recovery and performance?

Answer:

Synchronous writes ensure that data is saved immediately, making the system more reliable, but they are slower because every write operation has to wait for the disk. Delayed writes improve performance by grouping multiple writes together before writing to disk, but they increase the risk of data loss if the system crashes before the write completes.

Conceptual Questions

What is the primary goal of crash recovery in filesystems? Discuss how different techniques (fsck, ordered writes) address this goal.

Answer:

The goal of crash recovery is to make sure that files are not lost or corrupted if the system crashes unexpectedly. fsck helps by scanning the disk and fixing any inconsistencies, like missing inodes or incorrect free lists. Ordered writes ensure that critical updates happen in a specific order, reducing the chances of corruption. Both methods try to make the filesystem more reliable after a crash.

If a filesystem crashes before an update to a file’s inode is completed, what are the possible risks? Suggest a way to mitigate such risks.

Answer:

If the inode update is incomplete, the file might be missing data or could end up being unreadable. There is also a risk that a block is allocated to two different files, leading to corruption. One way to prevent this is using journaling, where the system first logs changes before applying them, ensuring that incomplete updates can be recovered after a crash.