

Homework 6 - Chapters 11 and 12

Misha Ward

File-System Interface: Chapter 11

Q11.10: The open-file table is used to maintain information about files that are currently open. Should the operating system maintain a separate table for each other or maintain just one table that contains references to files that are currently being accessed by all users? If the same file is being accessed by two different programs or users, should there be separate entries in the open-file table? Explain?

Using a open-file table allows the OS to perform operations that normally wouldn't work. If a file is accessed via more than one process and that file is deleted, then it should not be removed until the rest of the processes are completed (similar to readers-writers problem). This example can only work if there is a centralized administration which keeps track of the number of processes accessing the file. When there are changes to the file, the OS then needs to keep and update separate files for the two processes.

Q11.14: If the operating system knew that a certain application was going to access file data in a sequential manner, how could it exploit this information to improve performance?

While the OS accesses the initial file, subsequent files could be prefetched of future blocks of data which would reduce the waiting time for the future requests thus improving performance.

Q11.17 Some systems provide file sharing by maintaining a single copy of a file. Other systems maintain several copies , one for each of the users sharing the file. Discuss the relative merits of each approach.

When you have a single copy of a file, synchronization might cause errors in that file as many changes could occur at the same time resulting in incorrect information. Multiple copies could waste storage and the copies might not be consistent with each other.

File-System Implementation: Chapter 12

Q12.12: Consider a system where free space is kept in a free-space list.

- a) To rebuild the free list, the computer needs to utilize garbage collection which would need to search the entire directory file structure to find out which pages are allocated to jobs. Any files or pages that are still unallocated could be added to the free-space list.
- b) The contents of the small local file (a, b, c) involves four different disk operations. The first one, reading in the disk block which also contains the root directory, second and third, reading in the disk block which also contains the directories for b and c, and then finally reading the disk block containing the file c.

Homework 6 - Chapters 11 and 12

Misha Ward

- c) The pointer for the free-space can be stored on the disk in a lot of places.

Q12.13: Some file systems allow disk storage to be allocated at different levels of granularity. For instance, a file system could allocate 4 KB of disk as a single 4-KB block or as eight 512

By using this type of system, internal fragmentation would be decreased because when a file that is larger than 4KB, it could be allocated a 4KB block with two 512 byte blocks for sharing data. Additionally, utilizing an extra state for which sub blocks are being used inside a block would help allocate subblocks to get the larger block when the other sub blocks become available.

Q12.16 Consider a file system that uses inodes to represent files. Disk blocks are 8 KB in size, and a pointer to a disk block requires 4 bytes. This file system has 12 direct disk blocks, as well as single, double, and triple indirect disk blocks. What is the maximum size of a file that can be stored in this file system?

The max size of the file would be 64TB (see calculation below).

Calculation: $(12 * 8KB) + (2048 * 8KB) + (2048 * 2048 * 8KB) + (2048 * 2048 * 2048 * 8KB) = 64 \text{ terabytes}$