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DT141G Operating Systems

Theory assignment: Storage

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Contents

1 Aim

The aim of the assignment is, first, to aid your understanding of the treated content by providing questions and problems which inspire reflection. Second, it is to examinate the following:

- That you understand the problems having to be solved by a file system, and how these compare to those of main memory.
- That you can analyze the overhead required by different file systems.
- That you can analyze a situation and apply your knowledge about file systems, their performance and security, to solve the problems.
- That you understand that the algorithms employed by the operating system are hardware dependent.

2 Prerequisites

This assignment covers part four of the book [1; 2], i.e. storage management. Before attempting this assignment you should have read chapters 10–11, "File System", "Implementing File-Systems". Some of the tasks also delve into chapter 12, "Mass-Storage Structure". See the study guide for a complete list of reading instructions.

3 Tasks

1. In the context of computer file-systems, define the term *file*.
2. Define the terms
   (a) *directory*,
   (b) *path*, and
   (c) *search path*.
3. When a file system is mounted onto a mount point which is a directory already containing files, those files will no longer be visible until the file system is unmounted again [1, p. 479]. Why is that?
4. You have a system which uses disk blocks of size 4 KiB. You are given the following two file systems.

   First, a file system using linked allocation. It uses 32-bit numbers as disk addresses (i.e. pointers) for the disk blocks.

   Second, an inode-based file system. An inode contains 16 pointers, each of which is 32 bits in size. The first 13 point directly to disk blocks. The next points to a single indirect block, i.e. a block of direct pointers. The next-to-last points to a double indirect block and the last points to a triple indirect block.

   (a) Find the maximum size of a single file in each file system.
   (b) How much space is wasted on meta data in each file system (the overhead)?

   Remember to get the units right.
5. Given a solid-state disk (SSD), which disk-scheduling algorithm would you like your operating system to use for I/O-scheduling? The available algorithms in your operating system is FCFS, SSTF, SCAN, C-SCAN, LOOK, and C-LOOK. Motivate your choice well.
6. You are tasked to set up the server storing the home folders for all users in the company. Each user's home folder will then be mounted using a DFS, perhaps NFS. The characteristics for the users vary from editing film material (huge files!) to simple text-file editing and web-browser caching. There are at the moment approximately 200 users, but the company is continously expanding. At your disposal you have 20 disks of 2 TB each and accompanying host-bus adapters. A backup is performed each night,

but if a user has to wait for a restore from backup you will be hung by your feet in the foyer of the company building – these backups are only for saving the users from their own mistakes. Furthermore, if the system is too slow, the users will be frustrated and also hang you by your feet. How do you make use of the disks?

4 Examination

Your answers should be handed in using the course platform in a PDF-format. All questions and subquestions must be fully answered. The answers should be well written using correct references including page or section numbers. Use the IEEE Citation Reference[1] and the IEEE format for your references.

References

[1] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013. International Student Version.

[2] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013.

[3] Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 8 edition, 2009. International Student Version.

[1] The IEEE Citation Reference is available at: http://apachepersonal.miun.se/~jimahl/DT141G/ieeecitationref.pdf