

Combining Memory Management and Filesystems in an Operating Systems Course

Hans-Georg Eßer
University of Erlangen-Nuremberg
Chair for IT Security Infrastructures
Martensstr. 3, D-91058 Erlangen, Germany
h.g.esser@informatik.uni-erlangen.de

ABSTRACT

Teaching memory management aligned with filesystems in an Operating Systems course instead of treating them as separate topics can increase students' understanding and improve their grades in end-of-term examinations. In a survey they also state that they like this method.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Computer science education; D.4 [Operating Systems]: Storage Management; D.4 [Operating Systems]: File Systems Management

General Terms

Design, Experimentation

Keywords

Didactics, Memory Management

1. INTRODUCTION

Treating Memory Management (MM) and Filesystems (FS) separately in an OS course introduces a certain redundancy. For example, in simple allocation schemes, such as fixed size partitioning, where each process is given a fixed amount of memory or a file can use a fixed amount of disk space, students have to see identical concepts twice. The same is true for internal and external fragmentation which can occur in both areas. When we gave an Introduction to Operating Systems (OS) course in summer 2009, we tested the parallel treatment of the two topics and evaluated the effects on the students: We compared exam results with those of a traditional course from 2008 and also asked the students of their opinions.

The goal was to test whether this change could improve the students' understanding while repurposing redundant lecture time.

In a traditional OS course students will also note that some concepts from MM reappear in FS (or the other way round), while some concepts do not. However, the modifications we made and tested make this affinity explicit. The similarity of MM and FS in some areas becomes obvious and lets students focus on overall concepts instead of details (while not neglecting the details but letting students put them into the whole picture more easily).

This should make students more capable of transferring knowledge from one area to another.

Copyright is held by the author/owner(s).
ITiCSE'11, June 27–29, 2011, Darmstadt, Germany.
ACM 978-1-4503-0697-3/11/06 .

2. EVALUATION

We evaluated the results of our modification with two methods:

(1) Class results in the end-of-term exam were compared, for this purpose each question in the tests was classified as MM related, FS related, or other, and students' marks on each question were recorded separately. Since it is not helpful to compare students' successes from two different academic years, it makes sense to look at relative success: we compared how well students handled MM and FS questions with their overall performance by calculating quotients such as P_{FM}/P_T (where P_{FM} is the average percentage of FS and MM points gained in the exams and P_T is the average overall percentage of points). We observed an increase from 87.9 % to 97.8 % in this ratio.

(2) Students voiced their opinions about the combined treatment in a survey. Its results are positive, too, but weaker since students could not base their assessments on knowing both types of teaching OS concepts, but only the new combined approach. Also, only ten students participated in this survey. 90 % stated that the combined treatment made sense, and 80 % said that the frequent changes between FS and MM did not cause confusions. All participants said, the combination made it easy to understand that many concepts from one topic translate to the other. However, they were sceptical about combining more topics in a similar fashion (30 % approval).

3. CONCLUSIONS AND FURTHER WORK

Results from the double evaluation motivate further research in this area: Since students performed better in the exam and also valued the combined treatment, it makes sense to identify further OS topics that are typically treated separately but might also benefit from being combined. It would also be helpful to repeat this comparison with larger groups of students, ideally with a class large enough that it could be split by pretesting and forming two equally strong groups which then attend lectures that are identical except for the presentation of FS and MM topics.

More generally, it would be interesting to identify further Computer Science topics which are traditionally taught separately but share many concepts, and apply the same approach. The overall idea behind this is a shift of focus from concrete topics to general concepts.

An extended version with detailed descriptions of the modifications and the evaluations' results is available as a technical report [1].

4. REFERENCES

- [1] Eßer, H.-G., *Treating Memory Management and Filesystems as One Topic*, University of Erlangen, Dept. of Computer Science, Technical Reports, CS-2011-04, April 2011.