

CSE 221: Graduate Operating Systems
Fall Quarter, 2003
In-Class Exam

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One Operating System to rule them all,
One Operating System to find them
One Operating System to bring them all...
and in the Machine bind them.
Three Systems for the Laptops under the sky,
Seven for the Personal Computers in their halls of stone
Nine for PDAs doomed to obsolescence,
One for the Super Computer on his throne
In the Land of Computing where Resources lay,
One Operating System to rule them all, One Operating Sys-
tem to find them
One Operating System to bring them all and in the Machine
bind them.
In the Land of Computing where Resources lay.

Name _____

1	/20
2	/20
3	/20
4	/20
5	/20
Total	/100

Attention: You have eighty minutes to complete the questions. As with any exam, you should read through the questions first and start with those that you are most comfortable with. If you believe that you cannot answer a question without making some assumptions, state those assumptions in your answer.

1. (20 pts) In 1999, Wang et al. proposed a disk drive architecture supporting a service called “eager write”. Rather than update a block in place, as with normal disks, an eager writing disk simply writes to the next free block near the disk head (the disk internally keeps track of this mapping by maintaining a table mapping “logical” disk blocks to physical disk blocks). Argue whether using such a disk would improve the performance of a Log-Structured File System, hurt its performance, or make little difference.

2. (20 pts) Across the operating systems we have studied, we have seen two general approaches to file data access: memory mapped files, and streaming I/O.

(a) Briefly describe these approaches.

(b) For each approach, give two examples of operating systems that support it

(c) For each approach, give two advantages and disadvantages

(d) Can each be implemented in terms of the other? If so, briefly describe how. If not, why not?

(e) Even though commercial operating systems support both approaches, why do you think most programs today use streaming I/O?

3. (20 pts) Many of the papers we have read can be placed into one of two categories: papers that attempt to virtualize a resource to provide transparency to the underlying implementation, and papers that attempt to expose a resource to allow applications to improve their performance. For the following systems, describe which resource is virtualized or exposed and what they hoped to accomplish by doing this:

(a) Scheduler Activations

(b) GMS

(c) IO-Lite

(d) Sprite

4. (20 pts) A fundamental aspect of protection in operating systems is rights amplification. Rights amplification enables a more privileged protection domain to perform an operation on behalf of a less privileged protection domain.

For each of the following operating systems, describe (1) the protection domains that they support, (2) the mechanism for crossing protection domains, (3) how rights are represented, (4) how rights are amplified crossing domains, and (5) how the OS determines whether to allow the domain crossing.

(a) Unix

(b) Hydra

(c) Multics

(d) Pilot

5. (20 pts) According to D. D. Clark, “The Structuring of Systems using Upcalls”, what are the benefits of using an upcall structure, and what are the potential drawbacks?