

Last section!

- n Project 4 + EC due tomorrow
- n Today:
 - n Project 4 questions
 - n Some practice for the exam
 - n "Big picture" review tomorrow
 - n Evaluations
 - n Project 3 + all old stuff back
 - n Project 3 average: 52/55
 - n Great job
 - n You will get project 4 grades by email

1

Project 4 questions

- n Filename length?
- n File size?
- n General?

2

Review: file systems

- n Two improvements BSD Fast File System implemented?
- n Name the type of system and workload that LFS was based on
- n Calculate max UNIX file size for 1K blocks
- n The sequence of actions that occurs when a user executes the following, in terms of inodes and directory entries:
`touch file && ln file file2 && rm file && rm file2`

3

Review: file systems

- n Two improvements BSD Fast File System implemented?
 - n Cylinder groups, blocksize 1->4K, disk params
- n Name the type of system and workload that LFS was based on
 - n Frequent writes with lots of small files
- n Max UNIX file size for 1K blocks?
 - n $(12+256+256^2+256^3)*1K = \text{around } 16 \text{ GB}$
- n The sequence of actions that occurs when a user executes the following, in terms of inodes and directory entries: `touch file && ln file file2 && rm file && rm file2`
 - n ...

4

Review: virtual memory


- n Segmentation doesn't have this problem of wasted space.
- n How does copy-on-write work? What is it used for?
- n What is Belady's anomaly?
- n What is Belady's algorithm?
- n Give the number of memory references the first load will produce on x86 on powerup.

5

Review: virtual memory

- n Segmentation doesn't have this problem of wasted space.
 - n Internal fragmentation
- n How does copy-on-write work? What is it used for?
 - n ...
- n What is Belady's anomaly?
 - n Bad property of FIFO - fault rate can increase with more allocated frames
- n What is Belady's (OPT) algorithm?
 - n Optimal page replacement - evict page the won't be needed longest into the future
- n Number of references the first load will produce on x86 on powerup.
 - n Two-level PT: 3 (assuming paging enabled)


6



n People do not program the Belady's page replacement algorithm today because:

- it is too expensive to build the hardware support
- it is impossible to do so
- page replacement costs are not sufficiently high for optimality to be a significant concern
- there exist better-performing page replacement algorithms
- This policy are only applicable in computers that support page reference bits within the PTE. Not all processors do so.

7




synchronization

n The best reason to use semaphores rather than busy-waiting in a user-level program is:

- decreases the chance of deadlock
- decreases the chance of livelock
- allows more different types of synchronization to be coded
- avoids wasted processor cycles
- avoids expensive context switches

8




n True/false: good style dictates that a thread performing a P on a semaphore should always be the thread performing the corresponding V on that semaphore

n When monitors are used for synchronization and access to shared data:

- True/False: deadlock becomes impossible
- True/False: race conditions on access to that data become impossible


9



n Consider a modern desktop computer on which the hard disk is spinning. The more significant delay in reading from a 4K byte file that has not been accessed in a long time is:

- context switch to enter the operating system
- time spent in the OS to determine what disk blocks to fetch
- latency awaiting disk arm movement
- latency awaiting disk rotation
- transfer time


10



n Four out of the five of these instantiate a single basic principle. But the fifth one is essentially unrelated. Which is the unrelated one?

- processor (L2) cache
- disk buffer pool
- page table
- translation lookaside buffer
- DNS cache


11



n Which of the following are not typically saved when a process issues a system call that blocks, causing a context switch to some other process:

- contents of registers
- program counter value
- interrupt vector table
- name of the process that was executing
- elapsed time since process last started executing

12



Which of the following abstractions are implemented entirely in the kernel of an OS like Linux:

- a) remote object invocation and remote procedure call
- b) the process abstraction
- c) dynamically linked libraries (DLLs)
- d) the window manager
- e) public key encryption/decryption

13



T / F A *microkernel* is a category of operating systems designed for sensors or other forms of micro-processors.

T / F A *priority inversion* is said to occur if a higher priority task is waiting for a lower-priority task to perform some action.

How can you detect someone stole your password?

Why does Windows require ctrl+alt+del before you type your username/password?

14



Last slide

- Good luck on the exam!
- Congratulations on making it through a tough class ☺

15