CS314 - Operating Systems Homework 6 (Fall '18)

1 Administrivia

LaTeX version of this file is here: `/home/cs314/hw6.tex`

2 Assignment

1. (10 points) Using the `stat` utility on the os server, what can you say about how renaming a file differs from copying a file and deleting the old one, and how copying a file to a different directory differs from moving the file there?

2. (10 points) What is the difference between symbolic and hard links to files? On the os server, What happens when you try to create a symbolic link in `/tmp` to a file that is in your home directory? How about a hard link? Explain what happens and why.

3. (10 points) How many disk operations are maximally needed to fetch the i-node for the file `/dir1/dir2/dir3/myfile`? Assume that the i-node for the root directory is in memory, but nothing else along the path is in memory. Also assume that each i-node or directory fits into exactly one disk block.

4. (10 points) DDR3 SDRAM can read or write a word of memory with a latency of about 10 nanoseconds. Suppose that when an interrupt occurs, the program counter, PSW, and an additional 30 CPU registers are pushed onto the stack. What is the maximum number of interrupts per second that this machine can process (assume that each interrupt is handled, but does no actual work)?

5. (10 points) Assume that on some computer the overhead of trapping to the kernel for clock ticks is about 2 microsecond, with the handler requiring another 9 microseconds. Clock ticks typically occur at a frequency of 500Hz. What percentage of the CPU's time is devoted to the clock?

6. (10 points) If a programmable clock uses a 3000 MHz crystal, what should be the value of the holding register to achieve a clock resolution of a millisecond? How about 100 microseconds?

7. (40 points) Answer the following with the assumption that you have a RAID array:

   (a) (10 points) Compare RAID levels 0 through 5 with respect to read performance, write performance, storage overhead, and reliability.

   (b) (15 points) Including the human involved in the process, generally describe the steps between the time of failure and restoration of normal I/O activity in a RAID-5 array.

   (c) (15 points) What RAID arrangement could allow for normal I/O activity to continue uninterrupted, regardless of the failure and the slow human? Explain.