CSCI 315 Operating Systems Design
Activity 23

---

1) Describe the difference between *hard links* and *soft links.*

2) Why are *soft links* also called *symbolic links*? How are they implemented in a directory?

3) How are hard links implemented in a directory?

4) Using a shell to a linuxremote server, experiment with the following sequence of operations:
    a) Create a file called *junk.txt* with any content you like
    b) Create a symbolic link to *junk.txt* called *junk_soft*
    c) Remove junk.txt
    d) List the directory with ***ls -lsa*** and notice what you see for junk_soft. Explain what happened to the this link.

5) Using a shell to a linuxremote server, experiment with the following sequence of operations:
    a) Create a file called *junk2.txt* with any content you like
    b) Create a symbolic link to *junk2.txt* called *junk_soft_a*
    c) Create a symbolic link to *junk2.txt* called *junk_soft_b*
    d) Remove *junk_soft_a*
    e) List the directory with ***ls -lsa*** and notice what you see for ***junk2****. Is there anything wrong with what remains? Did anything happen to the file *junk2.txt* at the end of the symbolic links? Explain why things went the way they did.

6) Using a shell to a linuxremote server, experiment with the following sequence of operations:
    a) Create a file called *junk3.txt* with any content you like
    b) Create a **hard link** to *junk3.txt* called *junk_hard_a*
    c) Create a **hard link** to *junk3.txt* called *junk_hard_b*
    d) Remove *junk_hard_a*
    e) List the directory with ***ls -lsa*** and notice what you see for ***junk3****. Is there anything wrong with what remains? Did anything happen to the file *junk3.txt* at the end of the symbolic links? Explain why things went the way they did.
    f) Remove *junk_hard_b*
    g) List the directory and notice what you see for junk3*. Is there anything wrong with what remains? Did anything happen to the file *junk3.txt* at the end of the symbolic links? Explain why things went the way they did.

7) The OS uses *process control blocks* to aggregate information on processes. By the same token, we can imagine that the information on each individual files is aggregated on a *file control block* (FCB). Sketch out what an FCB should contain.

8) The concept of FCB in Linux is called ***inode***. Using a shell to a linuxremote server:
   a) Create a file called *junk4.txt* with any content you like
   b) Read the online man page for the ***ls(1)*** command and discover how you can use it to determine the *inode* for file *junk4.txt*.
   c) Read the online man page for the ***stat(1)*** command to learn what it does. Run this command on your file *junk4.txt* and compare the output of ***stat junk4.txt*** you get with that of item (b).
   d) Do a bit of research online to discover the structure of an *inode*. Report here what you find.

9) Skim the online manual pages to discover what what the following functions do for you:
   a) **opendir**(3)
   b) **readdir**(3)
   c) **closedir**(3)