LAB 6 – TASK 11
System Calls

John Dempsey
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California State University, Channel Islands
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Task 11. System Calls

System calls provide the interface to the Unix kernel. For this task, we will write a program using the system calls listed below.

Remember if you need help with a system call, like mkdir, you can use the man pages. Since mkdir is a command and a system call, to view the man page for a system call you can type: man mkdir.2 or man -s2 mkdir. To display the entire man page at once, you can type:

```
%man stat.2 | cat
```

You can copy the example code found in man stat.2 for step 12 below.

To complete LAB 6, write a program called **syscalls.c** which:

1. Prints “System Calls”.

2. Display your user name using getpwuid(getuid()).
   (getpwuid isn’t actually a system call.)

3. Display your user id by using getuid().

4. Display your group id by using getgid().

5. Display the host you are on using gethostname().

6. Display the domain name of your host using getdomainname().

7. Display your current working directory using getcwd().

8. Check to see if the /etc/passwd file exists using access(). Print "/etc/passwd exists".

9. Check to see if you can read /etc/passwd file exists using access().

10. Check to see if you can write /etc/passwd file using access().

11. Using the system() call, run: "id; hostname; domainname; pwd; cat /etc/passwd | grep <your_user_id>" commands and compare the returned values with the above system calls. Replace <your user id> with your actual user id on the system.

12. Print out the current date/time. You can use the system call **time(&t);** where t is defined as a long. Then use **tp = localtime(&t);** , where tp is defined as **struct tm *tp;** to print out the following output:

    Date from running time() system call is:

Seconds:	12	
Minutes:	14	
Hour:	15	Hours 0 to 23.
Day:	17	Day 0 to 31.
Month:	4	Months 0 to 11.
Year:	2025	Year + 1900.
Weekday:	2	Weekday Sunday=0.
Julian Day:	90	
Daylight Savings:	0	Daylight savings flag.

13. Let's check the file status of /etc/passwd using stat(). Run **man stat.2** to view example code which you can **copy/paste** into your program. Print the following for the /etc/passwd file:

    File status for /etc/passwd follows:

File type:	regular file
File I-node number:	99999
File Mode (octal):	644
File owner:	99
File group id:	99

File size in bytes: 9999
Blocks allocated: 99
Last file status change: <date format>
Last file access: <date format>
Last file modification: <date format>

14. Using the system() call, run “ls -l /etc/passwd” and check above values returned.

15. Check to see if the demo.dir directory exists. If it exists, print “demo.dir exists.” If demo.dir does not exist, create directory demo.dir using mkdir command and set mode to 0x755.

16. Change into demo.dir using chdir().

17. Print working directory using getcwd().

18. Print your program’s process id using getpid().

19. Print your program’s parent process id using getppid().

20. Using the system() call, run “ps -ef > processes.txt; cat processes.txt”. Locate your program’s process id and parent’s process id in list. (You don’t have to document this step, just check.)

21. Let’s check your system out using sysinfo(). Display how long your system has been up in seconds, minutes, hours, and days; display the load averages for 1, 5, and 15 minutes; display the amount of free RAM and total RAM; and finally, display the number of processes running on your system.

22. Let’s fork a process using fork(). The parent process will create the child.

23. For the child process:

24. Print “Child Process”.

25. Print “Child process id = “ using getpid().

26. Print “Child’s parent process id = “ using getppid().

27. Print "----------"

28. Print output from running "ps -ef" using system().

29. Print "----------"

30. For the parent process:

31. Print "Parent Process".

32. Print "Parent process id = " using getpid().

33. Print "Parent's parent process id = " using getppid().

34. Using signal(), call killprocess() when a SIGALRM is seen. (To do this, you can add the following line of code **signal(SIGALRM, killprocess);** which can be the first line in your program.)

35. killprocess() is a function which displays the running processes then kills the current process. The killprocess() function is provided for you below (after Step 40).

36. Next, if you are in the parent process, issue the SIGALRM signal in 5 seconds. If you are in the child process, issue the SIGALRM signal in 10 seconds.

37. Now for both the child and parent processes go to sleep for 60 seconds using sleep().

38. Print "All Done!"

39. Check the exit status of program using "echo $?". Do you see 0, 10, or another number?

40. Now, display all system calls used called by your syscalls program by running:
    % **strace syscalls**

    strace can be used to help locate where your code might be crashing.

41. Review the strace output. Look for the write statement for printing line “All Done!” performed in step 37.

Here is the killprocess() function:

```
void killprocess()
{
      int     pid;

      system("ps");
      pid = getpid();
      printf("-----------------------------------------------------------------\n");
      printf("killprocess() was called.  Kill pid = %d\n", pid);
      printf("-----------------------------------------------------------------\n");
      fflush(stdout);
      kill(pid, SIGKILL);
      exit(10);
}
```

Expected output as an example:

john@oho:~$ **syscalls**

```
----------------------------------------------------------------
System Calls
----------------------------------------------------------------
Your login name is john
Your uid is 1000
Your group id is 1000
/etc/passwd file entry: john:x:1000:1000:,,,:/home/john:/bin/bash
The host name is oho
The domain name is localdomain
----------------------------------------------------------------
Status for /etc/passwd
----------------------------------------------------------------
File status for /etc/passwd follows:
        File type:              regular file
        File I-node number:     9570149208451419
        File Mode (octal):      644
        File owner:             0
        File group id:          0
        File size in bytes:     1769
        Blocks allocated:       8
        Last file status change:Tue Jan  4 20:27:17 2022
        Last file access:       Wed Jan  5 11:32:51 2022
        Last file modification: Tue Jan  4 20:27:17 2022
-rw-r--r-- 1 root root 1769 Jan  4 20:27 /etc/passwd
----------------------------------------------------------------
cd demo.dir
----------------------------------------------------------------
demo.dir exists
CWD = /home/john/demo.dir
----------------------------------------------------------------
System Information
----------------------------------------------------------------
        System load:            33984 37856 38400 (1, 5, 15 minutes)
        Uptime in seconds:      10115 seconds
        Uptime in minutes:      168 minutes
        Uptime in hours:        02 hours
        Uptime in days:         00 days
        Free memory:            7 GBs
        Total memory:           15 GBs
        #processes running:     7 processes
----------------------------------------------------------------
Processes
----------------------------------------------------------------
Process id is 1119
Parent process id is 8
root         1     0  0 08:44 ?        00:00:00 /init
```

```
root         7     1  0 08:44 tty1     00:00:00 /init
john         8     7  0 08:44 tty1     00:00:00 -bash
john      1119     8  0 11:32 tty1     00:00:00 a.out
john      1124  1119  0 11:32 tty1     00:00:00 sh -c ps -ef|grep 8
john      1126  1124  0 11:32 tty1     00:00:00 grep 8
------------------------------------------------------------------
Call fork()
------------------------------------------------------------------
Parent process
Child process
Parent process id = 1119
Child process id = 1127
Parent's parent process id = 8
Child's parent process id = 1119
In 5 seconds, the SIGALRM signal will go off in parent process.
-----------------------------------------------
Sleep for 60 seconds.
UID        PID  PPID  C STIME TTY          TIME CMD
root         1     0  0 08:44 ?        00:00:00 /init
root         7     1  0 08:44 tty1     00:00:00 /init
john         8     7  0 08:44 tty1     00:00:00 -bash
root       152     1  0 09:41 tty2     00:00:00 /init
john       153   152  0 09:41 tty2     00:00:00 -bash
john      1119     8  0 11:32 tty1     00:00:00 a.out
john      1127  1119  0 11:32 tty1     00:00:00 a.out
john      1128  1127  0 11:32 tty1     00:00:00 sh -c ps -ef
john      1129  1128  0 11:32 tty1     00:00:00 ps -ef
-----------------------------------------------
In 10 seconds, the SIGALRM signal will go off in child process.
Sleep for 60 seconds.
  PID TTY          TIME CMD
    8 tty1     00:00:00 bash
 1119 tty1     00:00:00 a.out
 1127 tty1     00:00:00 a.out
 1130 tty1     00:00:00 sh
 1131 tty1     00:00:00 ps
------------------------------------------------------------------
Killprocess was called.  Kill pid = 1119
------------------------------------------------------------------
Killed
john@oho:~$   PID TTY          TIME CMD
    8 tty1     00:00:00 bash
 1127 tty1     00:00:00 a.out
 1132 tty1     00:00:00 sh
 1133 tty1     00:00:00 ps
------------------------------------------------------------------
Killprocess was called.  Kill pid = 1127
------------------------------------------------------------------
```