CS342301: Operating System
MP1: System Call
Deadline: 2019/10/20 23:59

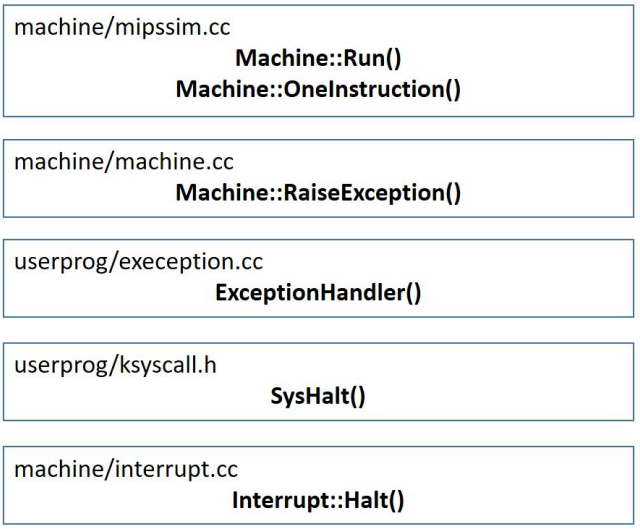
I. Goal

1. Understand how to work in Linux environment.
2. Understand how system calls are implemented by OS.
3. Understand the difference between user mode and kernel mode.

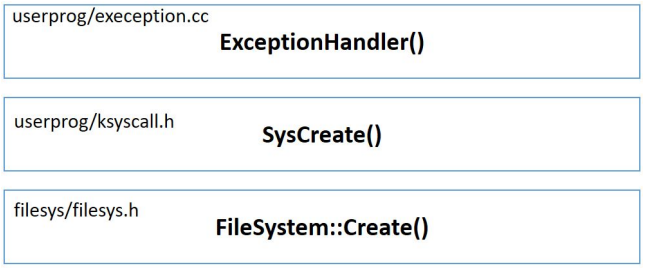
II. Assignment

1. Trace code
   - Working items:

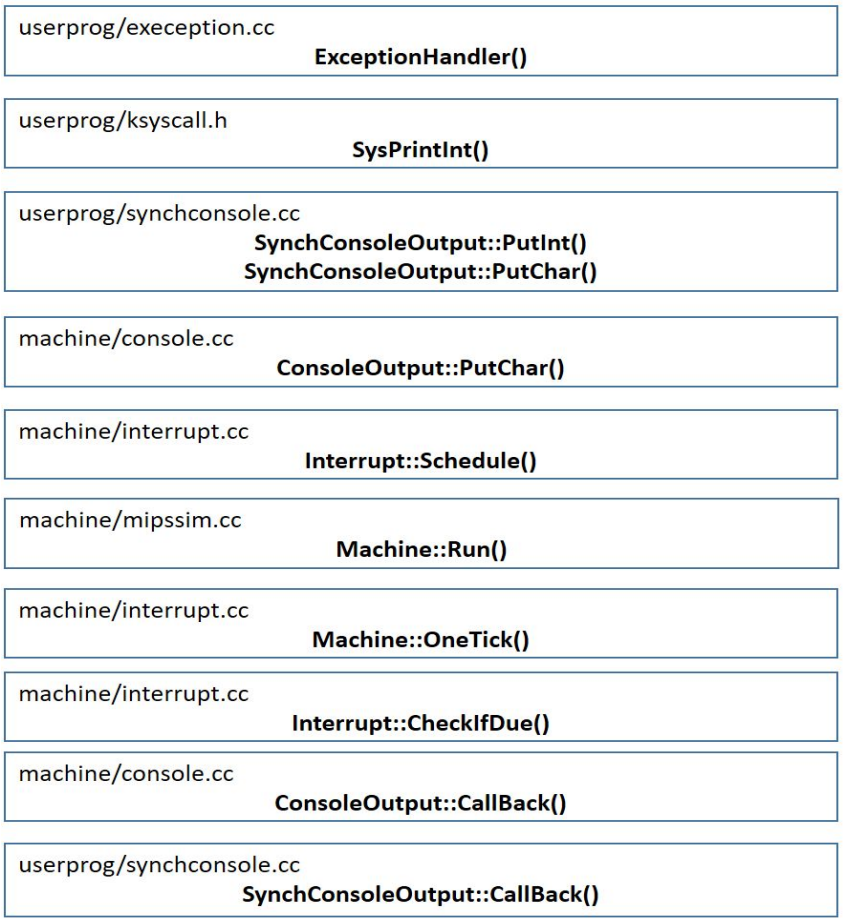
   (a). Trace the **SC_Halt** system call to understand the implementation of a system call. (Sample code: halt.c)



   (b). Trace the **SC_Create** system call to understand the basic operations and data structure in a file system. (Sample code: createFile.c)



(c). Trace the **SC_PrintInt** system call to understand how NachOS implements asynchronized I/O using CallBack functions and register schedule events. (Sample code: add.c)



- Requirements:

Include the following answers in your writing report:

(a). Explain the purposes and details of each function call listed in the code path above.

(b). Explain how the arguments of system calls are passed from user program to kernel in each of the above use cases.

2. Implement four I/O system calls in NachOS
   - Working items

   (a). `OpenFileId Open(char *name);`

   Open a file with the name, and returns its corresponding OpenFileId.
   Return -1 if fail to open the file.

   (b). `int Write(char *buffer, int size, OpenFileId id);`

   Write "size" characters from the buffer into the file, and return the number of characters actually written to the file.
   Return -1, if fail to write the file.

   (c). `int Read(char *buffer, int size, OpenFileId id);`

   Read "size" characters from the file to the buffer, and return the number of characters actually read from the file.
   Return -1, if fail to read the file.

   (d). `int Close(OpenFileId id);`

   Close the file with id.
   Return 1 if successfully close the file. Otherwise, return -1.

   - Requirements:

(a). Must use the table entry number of fileDescriptorTable as the FileId.
(b). Must handle invalid file open requests, including the non-existent file, exceeding opened file limit (i.e., 20), etc.
(c). All valid file open requests must be accepted if the opened file limit (i.e., 20) is not reached.
(d). DO NOT use any IO functions from standard libraries (e.g. printf(), cout, fopen(), fwrite(), write(), etc.).
(e). DO NOT change any code under "machine/" folder
(f). DO NOT modify the content of fileDescriptorTable outside "filesystem/" folder

   - Hint & Reminder:

(a). You can use the file operations defined in **lib/sysdep.cc**
(b). We use the stub file system for this homework, so DO NOT change or remove **the flag -DFILESYS_STUB in the Makefile under build.linux/**.

   - Verification:

First use the command "../build.linux/nachos -e fileIO_test1" to write a file.
Then use the command "../build.linux/nachos -e fileIO_test2" to read the file

```
[test@lsalab test]$ ../build.linux/nachos -e fileIO_test2
fileIO_test2
Passed! ^_^
Machine halting!

This is halt
Ticks: total 777, idle 0, system 110, user 667
Disk I/O: reads 0, writes 0
Console I/O: reads 0, writes 0
Paging: faults 0
Network I/O: packets received 0, sent 0
```

3. Report
   - Working items
     (a). Cover page, including team member list, team member contributions
     (b). Explain how system calls work in NachOS as requested in Part II-1.
     (c). Explain your implementation as requested in Part II-2.
     (d). What difficulties did you encounter when implementing this assignment?
     (e). Any feedback you would like to let us know.

II. Instructions

Below are the basic instructions. More information can be found in the NachOS tutorial slides.

1. Login server
   - 140.114.78.227 port:22
   - Username: 2019osteam + your teamID (e.g. 2019osteam01)
   - Passwd: You are required to reset the password once you login
2. Install NachOS
   - cp -r /home/os2019/share/NachOS-4.0_MP1 .
   - cd NachOS-4.0_MP1/code/build.linux
   - make clean
   - make
3. Compile/Rebuild NachOS
   - cd NachOS-4.0_MP1/code/build.linux
   - make clean
   - make
4. Test NachOS
   - cd NachOS-4.0_MP1/code/test
   - make clean
   - make halt
   - ../build.linux/nachos -e halt

IV. Grading

1. Implementation correctness – 50%
   - Pass all the test cases.
   - You **DO NOT** need to upload NachOS code to iLMS, just create and put your code to the folder named **"2019osteam[GroupNumber]/MP1"** in your home directory**.**
   - **Your working folder will be locked after deadline**.
2. Report – 30%
   - Name the report "**MP1_report_[GroupNumber].pdf"**, and upload it to iLMS.
3. Demo– 20%
   - We will be asked several questions about your codes.
   - Demo will take place on our server, so you are responsible to make sure your code works on our server.

***Late submissions will not be accepted. Refer to the course syllabus for detailed homework rules and policies.**