**CS342301: Operating System** 

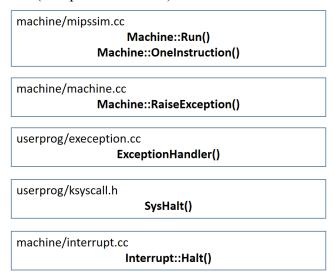
MP1: System Call Deadline: 2021/10/24 23:59

### 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)

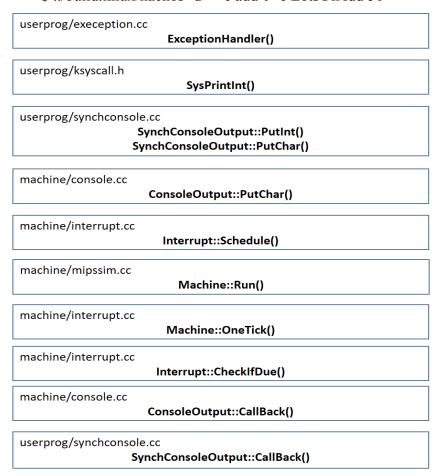


(b). Trace the **SC\_Create** system call to understand the basic operations and data structure in a file system. (Sample code: createFile.c)



(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 and LotsOfAdd)

\$ ../build.linux/nachos -d + -e add 0 -e LotsOfAdd 50



#### • 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 return 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. Need to delete the OpenFile after you close the file (Can't only set the table content to NULL)

- Requirements:
- (a). Must maintain OpenFileTable and use the table entry number of OpenFileTable as the OpenFileId.
- (b). Must use OpenFile object to access file. Do Not directly use the function in "sysdep.h" to access file.
- (c). Must handle invalid file open requests, including the non-existent file, exceeding opened file limit (at most 20 files), etc.
- (d). All valid file open requests must be accepted if the opened file limit (at most 20 files) is not reached.
- (e). Must handle invalid file read, write, close requests, including invalid id, etc.
- **(f).** DO NOT use any IO functions from standard libraries (e.g. printf(), cout, fopen(), fwrite(), write(), etc.).
- (g). DO NOT change any code under "machine/" folder
- (h). DO NOT modify the content of OpenFileTable outside "filesystem/" folder
- (i). DO NOT modify the declaration of OpenFileTable, including the size.
- Hint & Reminder:
- (a). 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. Set VPN
  - https://reurl.cc/NZpGOQ
- 2. Login server
  - 10.121.187.197
  - Username: os21team + your teamID (e.g. os21team01)
  - Password: You are required to reset the password once you login
- 3. Install NachOS
  - cp -r /home/os2021/share/NachOS-4.0\_MP1.
  - cd NachOS-4.0 MP1/code/build.linux
  - make clean
  - make
- 4. Compile/Rebuild NachOS
  - cd NachOS-4.0\_MP1/code/build.linux
  - make clean
  - make
- 5. 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 the public and hidden test cases.
  - You DO NOT need to upload NachOS code to iLMS, and just put your code to the folder named "NachOS-4.0\_MP1" in your home directory.
  - Your working directory will be copied for validation after the deadline.
- 2. Report 30%
  - Name the report "MP1 report [GroupNumber].pdf", and upload it to iLMS.
- 3. Demo-20%
  - We will ask 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.