Assignment One

Adding a System Call to a Linux Kernel

25 marks

This is an individual assignment. You need demonstrate your work in front of a lab teacher and submit a written document. Missing the demonstration will directly lead to 0 in this assignment.

- **Late submission penalties apply**
  Unless an extension has been granted (for procedures and grounds see
  http://www.rmit.edu.au/students/assessment/extension), a penalty of 10% of the total project
  score will be deducted per day, and no submissions will be accepted 5 days beyond the due
  date.

- **Special Consideration**
  With the exception of dire circumstances, no extension requests will be considered within 5
  working days of the submission date. ("Dire Circumstances" means things like hospitalization of
  you or a close relative, etc.) Persons requesting a late extension may be required to prove that
  a significant body of the work has already been completed.

STAGE 1. Install virtual machine and operating system Ubuntu in your computer

Tips:
1. Download Linux operating system Ubuntu from http:// http://releases.ubuntu.com/16.04/ (for
   example, ubuntu-16.04.2-desktop-i386.iso);
2. Download virtualbox from https://www.**virtualbox**.org/ (Windows or Mac);
3. Install virtualbox in your computer;
4. Open Virtualbox Manager and
   a. create a new virtual machine with the following information
            Name: xxx
            Type: Linux
            Version: Ubuntu
      (Tips: 2G memory for running speed, ensure at least 20G free space in hard disk for .vdi)
   b. highlight the new virtual machine xxx, click "Setting", then click "Storage", then click the disk
      in "Contorller:IDE", and then click the disk with a small downside arrow at the right to select
      the downloaded "ubuntu-14.04.2-desktop-i386.iso". click "ok"
   c. highlight the new virtual machine xxx, click "start"
   d. Install Ubuntu.

STAGE 2. Download and Compile Linux kernel source codes

Tips:
1. Open browser in Ubuntu in the virtual machine, download a linux kernel source code distribution
   from www.kernel.org (for example, linux-4.1.2.tar.xz). The default location of download is
   ~/Downloads
2. In ~/Downloads, execute the following commands: (takes about few hours)

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   a. # tar xvf linux-4.1.2.tar.xz
   b. cd ~/Downloads/linux-4.1.2/,
       # make config (create .config file)
       # make (compile Linux kernel)
       # make modules
       # make mudules_install (require root privilege, sudo su -)
       # make install
       # reboot (the new kernel is added as default boot)
       After reboot
       # uname –r (check whether the new kernel is installed)

STAGE 3. Add a system call helloworld() to linux kernel and recompile linux kernel

Now that you are familiar with building and booting Linux kernels, you can begin the process of adding a new system call to the Linux kernel. In this assignment, the system call will have limited functionality; it will simply transition from user mode to kernel mode, print the message "This is (your family name)'s message" that is logged with the kernel messages, and transition back to user mode. We will call this the *helloworld* system call. While it has only limited functionality, it illustrates the system call mechanism and sheds light on the interaction between user programs and the kernel. This step consists of at least three tasks

1. Add a system call to relevant files
2. Recompile linux kernel and reinstall the kernel
3. Write a user program to invoke the new system call which print the message "This is (your family name)'s message" to system log.

You may do online research in order to know how to fulfil each task.

Additional Study - Understanding a system call in Linux (optional)

Try to read and understand system call *fork* http://elixir.free-electrons.com/linux/latest/source/kernel/fork.c

Assignment Written Report

The report should include a cover page to indicate the course title, course code (COSC1112/COSC1114), semester information, assignment #, assignment total marks, your lab time, your lab assistant name, your name, your student identity.

1. Introduce Running Environment (hardware and software information of your computer)
2. Progress Diary

Stage	Step	Task Description	Comments	Time
e.g. 1	e.g. 1	e.g. download ubuntu-14.04.2-desktop-i386.iso from Linux operating system Ubuntu (32-bit) from ubuntu.com	e.g. self-reflection, problems encountered, feedback, suggestions	Start date Complete date Demo date

3. The files modified and created in the stage 3.
   a. Show complete code of the user program and the new system call.
   b. Describe what modifications you have made to the relevant files in the kernel (need not to show the complete file).

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Assessment Rubrics (25 marks)

Components	Assessment	Criteria
Demonstration	0	Not demonstrated (directly lead to 0 of this assignment)
	1-5	Partially demonstrated (Stage 1 and 2)
	6-10	Successfully demonstrated with minor errors (Stage 1, 2 and 3)
	11-15	Successfully demonstrated in time
Assignment Report	0	Not submitted
	1-3	Submitted but not complete or too simple
	4-6	Submitted but the presentation is not formatted as required.
	7-10	Submitted and well presented.

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Getting Help

You are encouraged to discuss any issues you have with the Lecturer, your Tutor and Lab Assistant, or ask questions on the discussion forums in blackboard.