Individual Semester Project (for Unix Systems Programming part): Machine Problem on Linux Character Device Driver

In this project, you are supposed to build a Linux character device driver on your own machine, or on a desktop (including the attached ARM embedded computer) in PQ603 and demonstrate its use.

Task Details:

You are supposed to build a Linux character device driver that can take in user inputted string and echo it on the display. Specifically, when the user application writes ASCII printable bytes to a device file linked to this driver, whatever the user application writes will be echoed **by the driver** to the display (in case your Linux does not support direct display of `printk`, `dmseg` command can be used to show what has been `printk`-ed).

Evaluation Methods:

You must choose one and only one of the following two evaluation methods.

Evaluation Method 1 (for face-to-face-in-PQ603-on-campus (using COMP desktop) presentation only, prerequisite: having got "pass" in Lab Assignment 6-2):

If you choose this method, you are going to present your project face-to-face in PQ603 on campus. As a prerequisite, you must have got a "pass" in Lab Assignment 6-2 before the lab assignment's deadline. Failure to fulfill this prerequisite means you automatically get a 0 mark for this project.

Other details of this evaluation method are listed as follows.

Item 1. During week 10-13 and the final exam weeks of the semester, you will be arranged a face-to-face meeting in PQ603 to do this project with the examiner (referred to as the "meeting" in the following). At the start of the meeting, you need to authenticate yourself by showing your face and your student ID (or government issued ID, in case you do not yet have student ID). The meeting will be recorded, and the recording may be used within COMP and PolyU for administrative/educational purposes.

Item 2. The setup of the environment shall follow that of Lab Assignment 6-2. Particularly, you must open the preinstalled Ubuntu Linux virtual machine upon VirtualBox on a PQ603 desktop before the meeting starts (see the department's "apps" drive `\Subject\vm_image\EmbeddedSystem\StartTheVM`). You also need to turn on the desktop's attached ARM embedded computer, open the desktop Windows PuTTY to connect to the embedded ARM computer, and set up NFS remote directory mounting between the desktop Ubuntu Linux and the ARM

embedded computer. This is because the Ubuntu Linux can only compile for the ARM embedded computer, hence the kernel/driver/application can only be run on the ARM embedded computer. In addition, throughout the meeting, the desktop screen should be shared via MS Teams to the examiner, so as to be recorded. The recording may be used within COMP and PolyU for administrative/educational purposes. **During the meeting, you must first demonstrate you have fulfilled all the requirements of this item. If not, you must fulfill all the requirements of this item before you can proceed to any other task(s); and all the time cost henceforth incurred will be counted as part of your accumulated time cost (see Item 3).**

Item 3. During the meeting, you are given 12 **accumulated** minutes (plus 5 additional accumulated minutes for compiling/linking programs) to finish the project's tasks **from scratch**. The clock starts at the start of the meeting. The examiner can pause the clock at any time and ask questions for as long as necessary.

Item 4. You can only reference the following materials during the meeting:

> Material 1: All the lecture materials (including the source codes, particularly, **you can reuse them**) put online by the lecturer in Learn@PolyU for the COMP3438 Fall 2023 semester. You must retrieve these materials from Learn@PolyU during the meeting (you cannot retrieve them from other sources).
> Material 2: All the standard `man` pages in Linux displayed in the shell using the `man` command. You must retrieve these materials from a Linux shell using the `man` command during the meeting (you cannot retrieve them from other sources).
> Material 3: The Linux kernel source code and related documents on the https://elixir.bootlin.com/ website. You must retrieve these materials from the https://elixir.bootlin.com/ website during the meeting (you cannot retrieve them from other sources).

Use of any other reference materials, including printed paper materials, may be counted as cheating, and you may hence get 0 mark for the entire project.

Note programming suggestions from the source code editor/IDE (e.g. Visual Studio's prompt on what functions to use) are considered as **illegal** reference materials, and risk being considered as cheating and get 0 mark for the entire project. So use a dumb source code editor (e.g. Linux vi or Windows Notepad) instead.

Item 5. To be fair to all students, at the start of the meeting, you may be logged into your Linux (including the Ubuntu Linux on the desktop, and the PuTTY terminal connected to the ARM embedded computer), but **no** GUI application window of the Linux can be opened. Particularly, shell window, editor, web browser etc. can be opened only after the meeting starts. Same way, Web browser of any other OS(s) (e.g. a web browser of MS Windows) can be opened only after the meeting starts. Violations of this item will be regarded as cheating, and hence get 0 mark for the entire project.

Item 6. Rubrics are also available online in Learn@PolyU. Please read the rubrics for details.

Evaluation Method 2 (for face-to-face-in-PQ603-on-campus (using your own laptop) presentation only, prerequisite: having got "pass" in Lab Assignment 5-2-1):

If you choose this method, you are going to demonstrate/present your project face-to-face in PQ603 on campus. As a prerequisite, you must have got a "pass" in Lab Assignment 6-2 before the lab assignment's deadline. Failure to fulfill this prerequisite means you automatically get a 0 mark for this project.

Other details of this evaluation method are listed as follows.

Item 1. During week 10-13 and the final exam weeks of the semester, you will be arranged a face-to-face meeting in PQ603 to do this project with the examiner (referred to as the "meeting" in the following). At the start of the meeting, you need to authenticate yourself by showing your face and your student ID (or government issued ID, in case you do not yet have student ID). The meeting will be recorded, and the recording may be used within COMP and PolyU for administrative/educational purposes.

Item 2. The setup of the environment shall follow that of Lab Assignment 6-2. However, you are using Linux on your own laptop. In addition, throughout the meeting, the desktop screen should be shared via MS Teams to the examiner (you are strongly suggested to install the Linux on a virtual machine upon Windows, and run the MS Teams in Windows; MS Teams does not cope well with Linux), so as to be recorded. The recording may be used within COMP and PolyU for administrative/educational purposes. Furthermore, you must have installed your own Linux system, and downloaded and **built** (compiled and linked) your own Linux kernel source tree (same way as required by Lab 9) **before the meeting**. The kernel source tree must have been built for at least once. This is because the first time building of kernel source tree takes hours to finish; if you do not do this before your meeting, you can certainly not finish building your programs during the meeting. In case you installed the Linux upon VirtualBox, the Guest Additional Disk of the VirtualBox must have been installed; otherwise, the Linux will be intolerably slow, and cannot finish building your programs during the meeting. **During the meeting, you must first demonstrate you have fulfilled all the requirements of this item. If not, you must fulfill all the requirements of this item before you can proceed to any other task(s); and all the time cost henceforth incurred will be counted as part of your accumulated time cost (see Item 3).**

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