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Lab 5 Report: The Linux Kernel

Summary:

For this lab we were introduced to the Linux Kernel. We setup a working kernel on our computers so we can perform operations on it. Like loading and unloading a module, and performing operations associated to the driver.

1. List five architectures that the Linux kernel supports.
 - ARM
 - x86 Architecture
 - MIPS architecture
 - PowerPC architecture
 - SPARC
2. In your report list three filesystem types Linux supports
 - jfs
 - XFS
 - ext4
3. On the usermode terminal cd into the hello-world directory in the /host filetree. In that directory run the following commands and include their outputs in your lab report.
 - Outputs for the hello-world commands:

```
root@shubham_host:/host/CPRE308/lab5/src/hello-world# lsmod
Module                  Size Used by
root@shubham_host:/host/CPRE308/lab5/src/hello-world# modinfo hello_world.ko
filename:                /host/CPRE308/lab5/src/hello-world/hello_world.ko
description:             A simple hello world driver for CPRE308
author:                  Shubham Sharma shubham@iastate.edu
license:                 GPL
depends:
vermagic:                4.10.1shubham mod_unload
root@shubham_host:/host/CPRE308/lab5/src/hello-world# lsmod
Module                  Size Used by
root@shubham_host:/host/CPRE308/lab5/src/hello-world# insmod hello_world.ko
hello_world: loading out-of-tree module taints kernel.
Hello from init function!
root@shubham_host:/host/CPRE308/lab5/src/hello-world# lsmod
Module                  Size Used by
hello_world             931  0
root@shubham_host:/host/CPRE308/lab5/src/hello-world# rmmod hello_world.ko
Goodbye from exit function!
root@shubham_host:/host/CPRE308/lab5/src/hello-world# ls
Makefile Module.symvers hello_world.c hello_world.ko hello_world.mod.c hello_w
root@shubham_host:/host/CPRE308/lab5/src/hello-world# lsmod
Module                  Size Used by
root@shubham_host:/host/CPRE308/lab5/src/hello-world#
```

4. In your lab report comment on why the prototypes are not identical and what the extra parameters are for (use your intuition to help answer this question)
 - I think it is not identical because of the static state for the kernel. Also, looking at the arguments it makes more sense to use the `ssize_t read(struct file *file, char *buffer, size_t length, loff_t *offset)` prototype as the arguments matches the character device example in the lab (while the other prototype does not).
5. In your report list six operations that files can support
 - `read`
 - `write`
 - `open`
 - `iterate`
 - `lseek`
 - `read_iter`
6. In your report give your expected output when the file is opened, written to, read from, and closed.
 - Opened
 - I already told you 0 times Hello World!
 - Written
 - Sorry, this operation isn't supported
 - Read
 - `<None>`
 - Closed
 - `<None>`
7. From the um kernel cd into the hellofile directory and run `insmod hello_file.ko`. In your lab report include the major number of the module
 - Output on running the command '`insmod hello_file.ko`':

```
root@shubham_host:/host/CPRE308/lab5/src/hello-file# insmod hello_file.ko
hello_file: loading out-of-tree module taints kernel.
hello_file: module license 'unspecified' taints kernel.
Disabling lock debugging due to kernel taint
I was assigned major number 254. To talk to
the driver, create a dev file with
'mknod /dev/cpre308 c 254 0'.
Try various minor numbers. Try to cat and echo to
the device file.
root@shubham_host:/host/CPRE308/lab5/src/hello-file#
```

8. In your lab report mention the output of each of these:

```
root@shubham_host:/host/CPRE308/lab5/src/hello-file# insmod hello_file.ko
hello_file: loading out-of-tree module taints kernel.
hello_file: module license 'unspecified' taints kernel.
Disabling lock debugging due to kernel taint
I was assigned major number 254. To talk to
the driver, create a dev file with
'mknod /dev/cpre308 c 254 0'.
Try various minor numbers. Try to cat and echo to
the device file.
root@shubham_host:/host/CPRE308/lab5/src/hello-file# mknod /dev/cpre308-0 c 254 0
root@shubham_host:/host/CPRE308/lab5/src/hello-file# cat /dev/cpre308-0
I already told you 0 times Hello World!
root@shubham_host:/host/CPRE308/lab5/src/hello-file# cat /dev/cpre308-0
I already told you 1 times Hello World!
root@shubham_host:/host/CPRE308/lab5/src/hello-file# echo "hello" > /dev/cpre308-0
Sorry, this operation isn't supported.
bash: echo: write error: Invalid argument
root@shubham_host:/host/CPRE308/lab5/src/hello-file# mknod /dev/cpre308-1 c 254 1
root@shubham_host:/host/CPRE308/lab5/src/hello-file# cat /dev/cpre308-0
I already told you 3 times Hello World!
root@shubham_host:/host/CPRE308/lab5/src/hello-file# cat /dev/cpre308-1
I already told you 4 times Hello World!
root@shubham_host:/host/CPRE308/lab5/src/hello-file# rmmod hello_file.ko
root@shubham_host:/host/CPRE308/lab5/src/hello-file# cat /dev/cpre308-0
cat: /dev/cpre308-0: No such device or address
root@shubham_host:/host/CPRE308/lab5/src/hello-file#
```

Any Comments, please email: shubham@iastate.edu