操 作 系 统 原 理

实

验

报

告

学　　院 智能与计算学部

年　　级 2019 级

班　　级 留学生班

学　　号 6319000359

姓　　名 张明君

2020 年　12 月　5 日

天津大学

操作系统原理实验报告

题目：xv6 locking

学院名称 智能与计算学部

专　　业 计算机科学与技术

学生姓名 张明君

学　　号 6319000359

年　　级 2019 级

班　　级 留学生班

时　　间 2020.12.05

目　录

Homework: xv6 locking

1. 实验目的

-Don't do this： Explain in one sentence what happens.

-Interrupts in ide.c： Explain in a few sentences why the kernel panicked. You may find it useful to look up the stack trace (the sequence of %eip values printed by panic) in the kernel.asm listing.

-Interrupts in file.c： Explain in a few sentences why the kernel didn't panic. Why do file_table_lock and ide_lock have different behavior in this respect?

-xv6 lock implementation： Why does release() clear lk->pcs[0] and lk->cpu before clearing lk->locked? Why not wait until after?

2. 实验内容

Don't do this

Make sure you understand what would happen if the xv6 kernel executed the following code snippet:

```
  struct spinlock lk;
  initlock(&lk, "test lock");
  acquire(&lk);
  acquire(&lk);
```

(Feel free to use QEMU to find out. `acquire` is in `spinlock.c`.)

Interrupts in ide.c

An `acquire` ensures that interrupts are off on the local processor using the `cli` instruction (via `pushcli()`), and that interrupts remain off until the `release` of the last lock held by that processor (at which point they are enabled using `sti`).

Let's see what happens if we turn on interrupts while holding the `ide` lock.

In `iderw` in `ide.c`, add a call to `sti()` after the `acquire()`, and a call to `cli()` just before the `release()`. Rebuild the kernel and boot it in QEMU. Chances are the kernel will panic soon after boot; try booting QEMU a few times if it doesn't.

Interrupts in file.c

Remove the sti() and cli() you added, rebuild the kernel, and make sure it works again.

Now let's see what happens if we turn on interrupts while holding the file_table_lock. This lock protects the table of file descriptors, which the kernel modifies when an application opens or closes a file. In filealloc() in file.c, add a call to sti() after the call to acquire(), and a cli() just before each of the release()es. You will also need to add #include "x86.h" at the top of the file after the other #include lines. Rebuild the kernel and boot it in QEMU. It most likely will not panic.

xv6 lock implementation

Why does release() clear lk->pcs[0] and lk->cpu before clearing lk->locked? Why not wait until after?

3. 实验步骤和分析（要细化如何实现的思路或流程图）

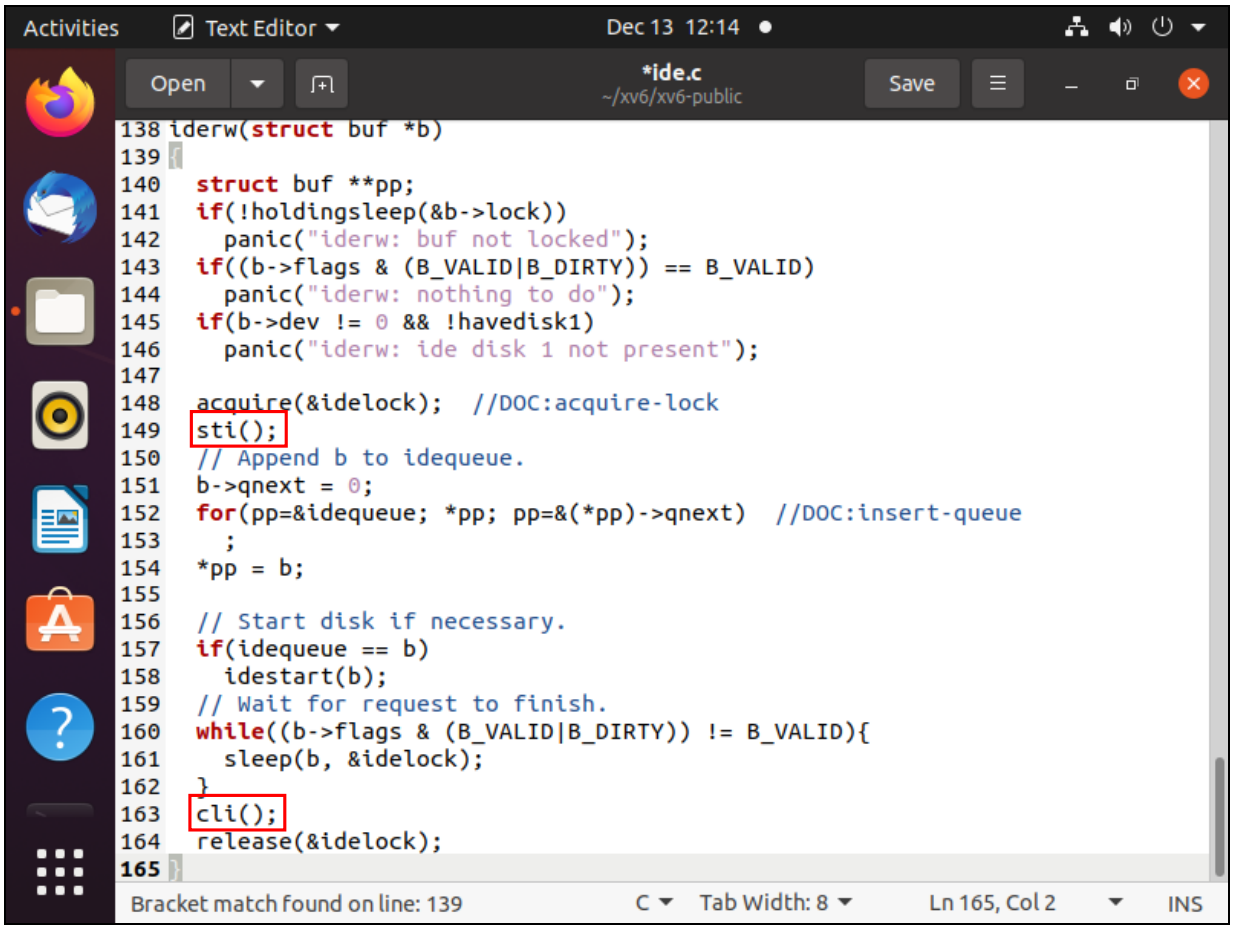
Don't do this

```
struct spinlock lk;
  initlock(&lk, "test lock");
  acquire(&lk);
  acquire(&lk);
```

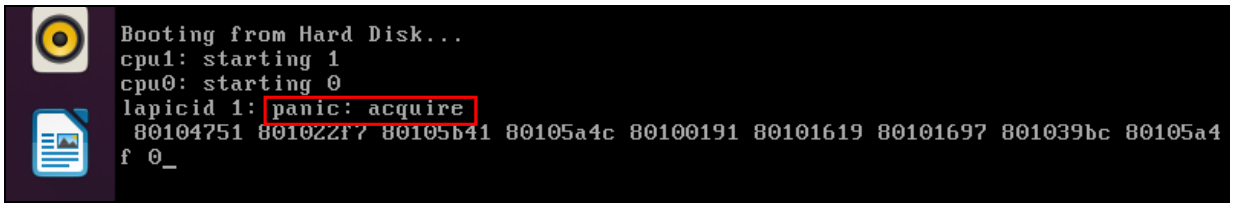
First of all, take a look at the note of **acqurie()** function acquire the lock. Loops (spins) until the lock is required. Therefore, if you do not apply for that lock, you will have to wait in a loop. Then, at the beginning of the **acqurie()** function, there is a line of code if (holding (lk)) panic ("acquire"); therefore, applying for the same spinlock twice in succession will cause panic.

Interrupts in ide.c

1/Let's see what happens if we turn on interrupts while holding the ide lock.
In **iderw** in **ide.c**, add a call to **sti()** after the acquire(), and a call to **cli()** just before the release().

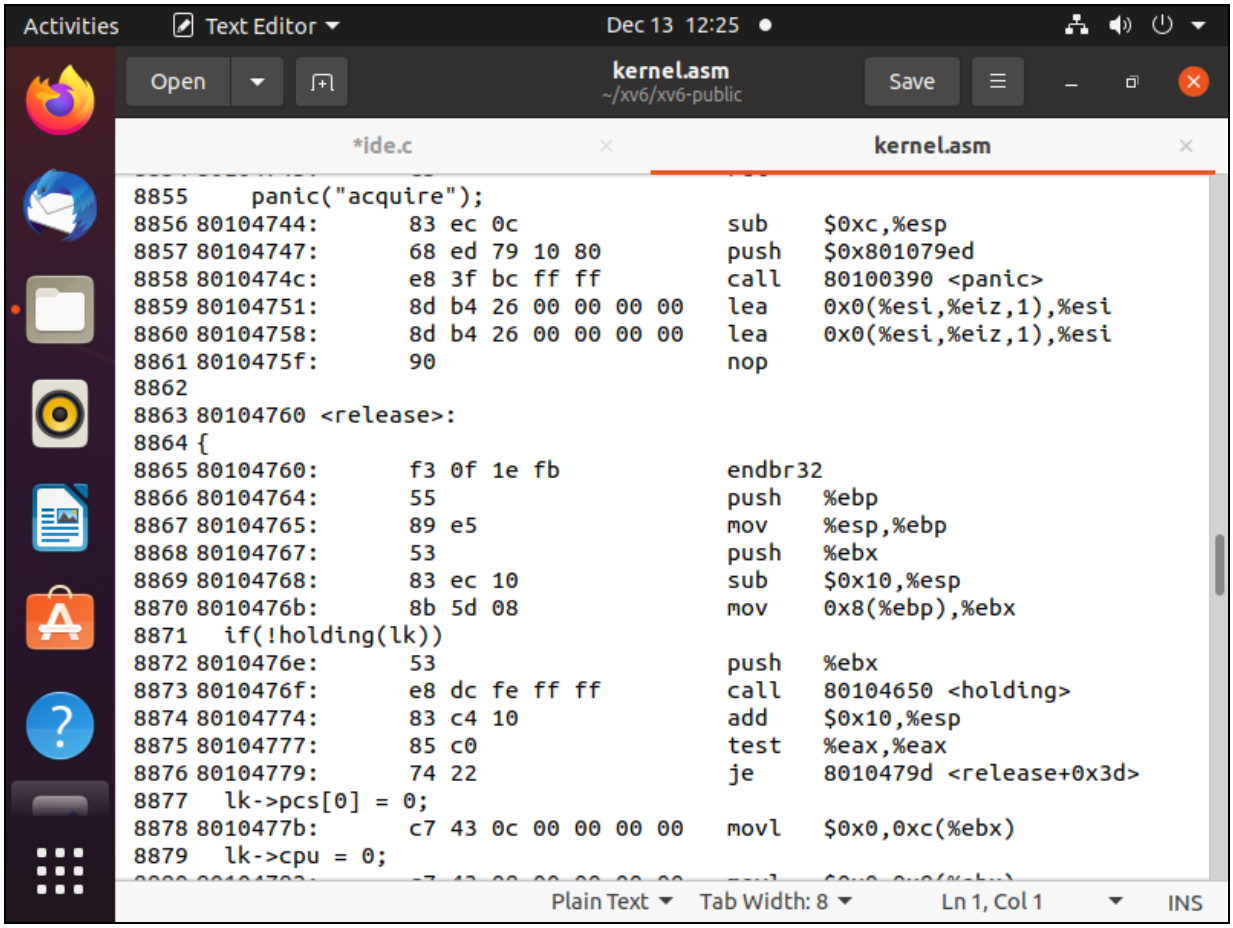


After we changed the code in **ide.c** so now we have to rebuild the kernel and boot it in QEMU. Chances are the kernel will panic soon after boot; try booting QEMU a few times if it doesn't.



Finally, we can see in the picture it's already panic and I tried to booting the qemu about 5 times to get that panic.

Now we can look up the stack trace (the sequence of %eip values printed by panic) in the `kernel.asm` listing.



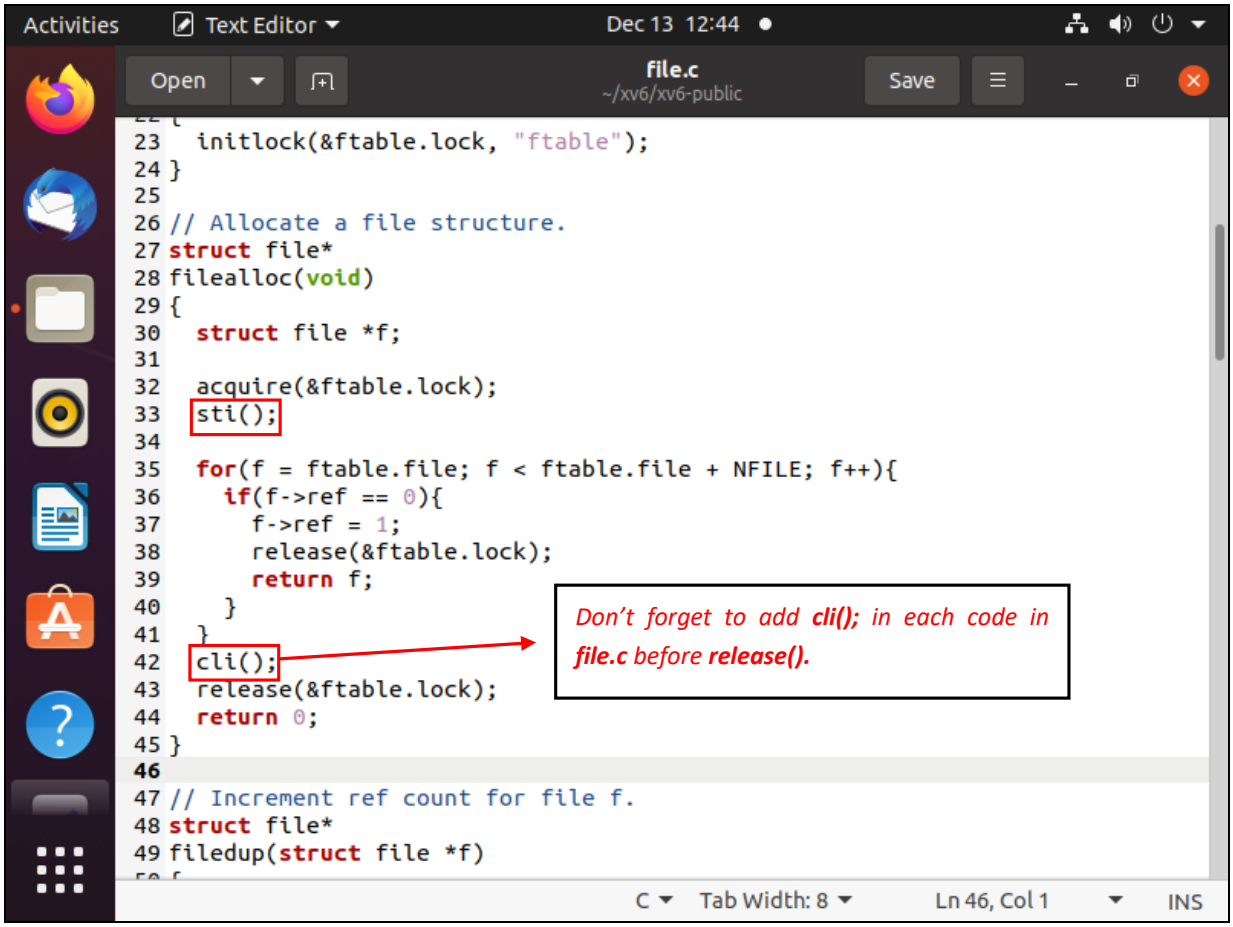
why the kernel panicked?

At First, We have to look at the **ide.c** file. So we can see that both **iderw()** and **identr()** call acquire() for the same lock so after one acquire closes the interrupt, a process switch occurs. The other acquire executes and obtains the optional lock. After that, the interrupt is opened again. The interrupt handler returns to the original state and starts to try to obtain the optional lock. At this time, the panic is generated.

Interrupts in file.c

At this point we have to remove the **sti()** and **cli()** that we have added in the **ide.c** file, Then rebuild the kernel, and make sure it works again.

Now we have to take a look at **file.c** file. We have to add a call to **sti()** after the call to acquire(), and a **cli()** just before **each** of the release()es.



One more thing is that we also need to add `#include "x86.h"` at the top of the file after the other #include lines. After that we have to re-boot the qemu and it will not panic. And **file_table_lock** and **ide_lock** have different behavior in this respect because compared with ide lock, the number of times and time for kernel to open or close files are very small. It is basically impossible to read and write two files at the same time, so the possibility of conflict is very small.

xv6 lock implementation

We do release() clear **lk->pcs[0]** and **lk->cpu** before clearing **lk->locked** is because if we releasing the lock, it will happen that:
1/Lock release, **lk->pcs[0]** and **lk->cpu** are not cleared
2/Another CPU attempts to acquire the lock and succeeds. Set **lk->pcs[0]** and **lk->cpu**
3/The current CPU clears **lk->pcs[0]** and **lk->cpu**
So this results in incorrect lock information.

4. 实验结论与心得体会

In this experiment in the first part we have to explained why it’ ll be panic and the second part is u have to make it panic by adding some code in to file that I have explained above and it’ s not that easy to see the panic ,I have to run it many times to get the panic and there’ re two different panic one is **panic acquire** and another one is **panic sched lock** and my pc it’ s show the panic acquire and I already explained. After that, In the interrupt file.c part we have to change the code to default and make it run again without panic.