

## 操作系统实验 1

熟悉 Ubuntu 系统的简单操作并编译运行 Linux 内核

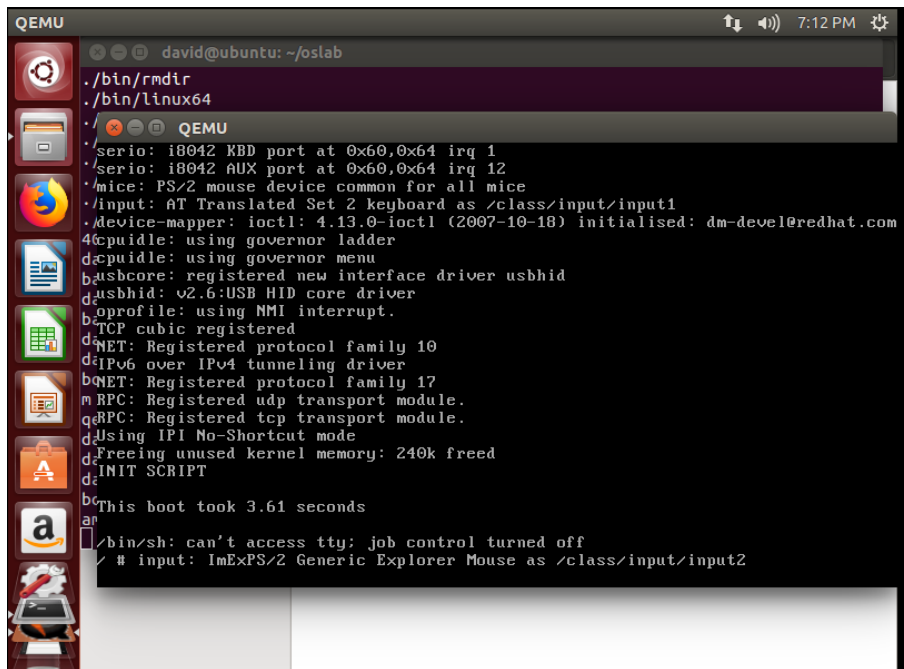
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### 1. 主要步骤

(1) 编译系统内核，准备模拟器 QEMU，并熟悉两种制作根文件系统的方法。着重利用 busybox 生成根文件系统的方法。

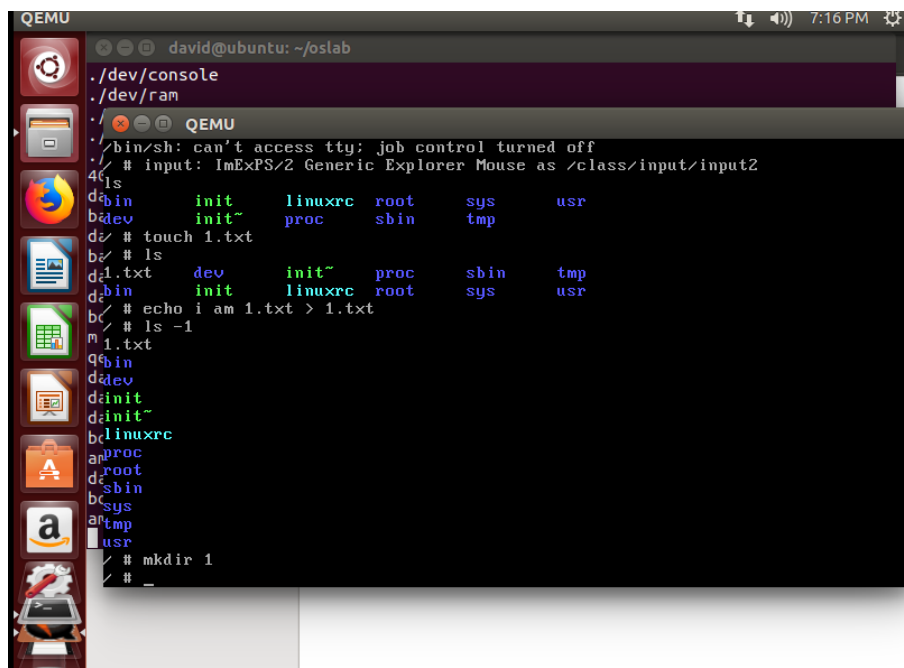
(2) 用 gdb+QEMU 调试系统内核。

### 2. 运行结果截图



```
QEMU
david@ubuntu: ~/oslab
./bin/rmdir
./bin/linux64
./bin/QEMU
serio: i8042 KBD port at 0x60,0x64 irq 1
serio: i8042 AUX port at 0x60,0x64 irq 12
mice: PS/2 mouse device common for all mice
input: AT Translated Set 2 keyboard as /class/input/input1
device-mapper: ioctl: 4.13.0-ioctl (2007-10-18) initialised: dm-devel@redhat.com
cpuidle: using governor ladder
cpuidle: using governor menu
usbcore: registered new interface driver usbhid
usbhid: v2.6:USB HID core driver
acpi: using NMI interrupt.
TCP cubic registered
NET: Registered protocol family 10
ip6: over IPv4 tunneling driver
bnep: Registered protocol family 17
RPC: Registered udp transport module.
RPC: Registered tcp transport module.
Using IPI No-Shortcut mode
Freeing unused kernel memory: 240k freed
INIT SCRIPT
This boot took 3.61 seconds
/bin/sh: can't access tty: job control turned off
# input: ImExPS/2 Generic Explorer Mouse as /class/input/input2
```

打开 QEMU



```
QEMU
david@ubuntu: ~/oslab
./dev/console
./dev/ram
./bin/QEMU
/bin/sh: can't access tty: job control turned off
# input: ImExPS/2 Generic Explorer Mouse as /class/input/input2
ls
d/bin      init      linuxrc   root      sys       usr
bdev      init~     proc      sbin      tmp
d/ # touch 1.txt
b/ # ls
d1.txt    dev      init~     proc      sbin      tmp
d/bin      init      linuxrc   root      sys       usr
b/ # echo i am 1.txt > 1.txt
b/ # ls -l
-rw-r--r-- 1 root root 1024 2017-10-18 11:11:11 1.txt
d/bin
ddev
dinit
dinit~
blinuxrc
bproc
aproc
aroot
dsbin
bsys
aptmp
usr
# mkdir 1
#
```

在 QEMU 中创建 1.txt 并编辑内容

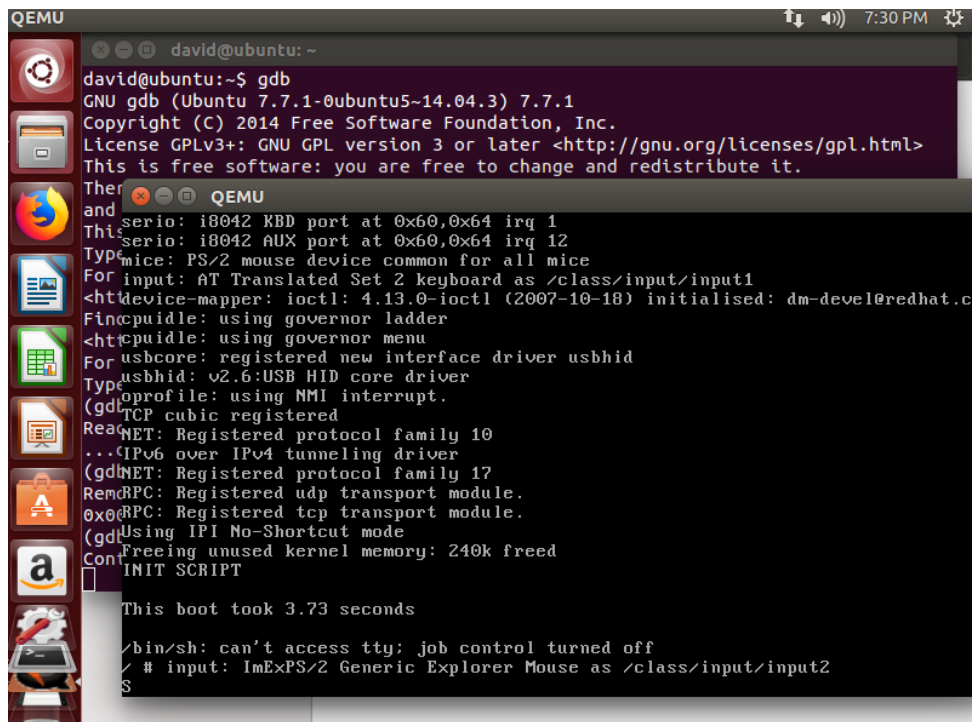
```
QEMU
PATH-T0- dev init~ linuxrc proc sbin tmp
bin init linuxrc root sys usr
/ # touch 1.txt
/ # ls
1.txt bin init linuxrc root sys usr
PATH-T0- dev init~ linuxrc proc sbin tmp
/ # echo i am 1.txt > 1.txt
/ # cat 1.txt
i am 1.txt
/ # ls -l
total 16
-rw-r--r-- 1 0 0 11 Apr 8 11:21 1.txt
-rw-rw-r-- 1 1000 1000 20 Apr 8 11:19 PATH-T0-
drwxrwxr-x 2 1000 1000 0 Apr 8 11:19 bin
drwxr-xr-x 2 0 0 0 Apr 8 11:19 dev
-rwxrwxr-x 1 1000 1000 217 Apr 8 11:19 init
-rwxrwxr-x 1 1000 1000 217 Apr 8 11:19 init~
lrwxrwxrwx 1 1000 1000 11 Apr 8 11:19 linuxrc -> bin/busybox
dr-xr-xr-x 38 0 0 0 Apr 8 11:19 proc
drwx----- 2 0 0 0 Apr 8 11:19 root
drwxrwxr-x 2 1000 1000 0 Apr 8 11:19 sbin
drwxr-xr-x 11 0 0 0 Apr 8 11:19 sys
drwxrwxrwt 2 0 0 40 Apr 8 11:19 tmp
drwxrwxr-x 4 1000 1000 0 Apr 8 11:19 usr
/ # ls_
```

查看 1.txt 的内容

```
Terminal
david@ubuntu: ~
david@ubuntu: ~
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "i686-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word".
(gdb) file ~/oslab/linux-2.6.26/vmlinux
Reading symbols from ~/oslab/linux-2.6.26/vmlinux...(no debugging symbols found)
...done.
(gdb) target remote:1234
Remote debugging using :1234
0x0000fff0 in ?? ()
(gdb) break start_kernel
Breakpoint 1 at 0xc059d57a
(gdb) c
Continuing.

Breakpoint 1, 0xc059d57a in start_kernel ()
(gdb) |
```

设置断点



```
david@ubuntu:~$ gdb
GNU gdb (Ubuntu 7.7.1-0ubuntu5~14.04.3) 7.7.1
Copyright (C) 2014 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
The
and
This
This
Type
For
For
<ht
device-mapper: ioctl: 4.13.0-ioctl (2007-10-18) initialised: dm-devel@redhat.c
Fin
cpuidle: using governor ladder
<ht
cpuidle: using governor menu
For
usbcore: registered new interface driver usbhid
Type
usbhid: v2.6:USB HID core driver
Type
oprofile: using NMI interrupt.
(gd
TCP cubic registered
Rea
NET: Registered protocol family 10
...<IPv6 over IPv4 tunneling driver
(gd
NET: Registered protocol family 17
Rem
RPC: Registered udp transport module.
0x0
RPC: Registered tcp transport module.
(gd
Using IPI No-Shortcut mode
Freeing unused kernel memory: 240k freed
Con
INIT SCRIPT

This boot took 3.73 seconds

/bin/sh: can't access tty: job control turned off
# input: ImExPS/2 Generic Explorer Mouse as /class/input/input2
$
```

QEMU 由 stop 变为 continue, 试验完成

### 3. 实验过程中遇到的技术问题和解决方法

本次实验中遇到了一个技术问题——按照 pdf 更改镜像源为科大镜像, 致使系统变得一半 14.04 一半 16.04, 导致接下来遇到了一连串 bug。解决方法: 靠某大佬帮助, 重新更改了镜像并降级已经更新的软件包, 成功解决了问题。

### 4. 实验总结

本次试验作为第一次操作系统实验, 主要学习 Ubuntu 的一些基础操作, 例如查看文件列表, 创建文件, 写文件等。编译内核并用 gdb 调试内核, 为以后的实验打下基础。