

南京航空航天大学《计算机组成原理II课程设计》报告

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- 完成日期：2019.2.18
- 本次实验，我完成了所有内容。

目录

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目录

思考题

PA0.1 Installing a GNU/Linux VM
PA0.2 First Step into Linux
PA0.3 Installing Basic Tools
PA0.4 Installing More Tools
PA0.5 More Exploration
PA0.6 Logging in and Transferring Files via SSH
PA0.7 Acquiring Source Code for PAs

实验内容

PA0.1 Installing a GNU/Linux VM
PA0.2 First Step into Linux
PA0.3 Installing Basic Tools
PA0.4 Installing More Tools
PA0.5 More Exploration
PA0.6 Logging in and Transferring Files via SSH
PA0.7 Acquiring Source Code for PAs

遇到的问题及解决办法

实验心得

其他备注

思考题

PA0.1 Installing a GNU/Linux VM

1. Linux and Linux?

Linux 是一种自由和开放源码的类 UNIX 操作系统，只要遵循 GNU 通用公共许可证，任何个人和机构都可以自由地使用 Linux 的所有底层源代码，也可以自由地修改和再发布。Linux 严格来说是单指操作系统的内核，因操作系统中包含了許多用户图形接口和其他实用工具。如今 Linux 常用来指基于 Linux 的完整操作系统，内核则改以 Linux 内核称之。除了一部分专家之外，大多数人都是直接使用 Linux 发行版，而不是自己选择每一样组件或自行设置。常用的 Linux 发行版有 Ubuntu, Debian, Centos 等。

2. Can't memory be larger?

xx位系统中的多少位即指操作系统的字长，即指针的大小，这就限制了寻址空间，比如我们用的32位系统正常情况下寻址范围就是 `0 ~ 4294967295`，也就是 4GB。

PA0.2 First Step into Linux

1. Why Windows is quite 'fat'?

Windows面向普通用户，它提供GUI供人操作而不是命令行，且有很多默认的系统设置和对应的维护程序，比如自动更新（手动滑稽）。

2. Why executing the 'poweroff' command requires superuser privilege?

假设不需要，那么任何用户都可以把你正在运行的服务器关掉。就像任何人都可以宣布这节课取消一样（手动滑稽）。

PA0.3 Installing Basic Tools

无

PA0.4 Installing More Tools

无

PA0.5 More Exploration

1. Have a try!

主要考察对于 `gcc`，`gdb` 和 `make` 的使用，详情见 PA0.5 的实验内容。

PA0.6 Logging in and Transferring Files via SSH

1. Have a try!

考察对 `FileZilla` 的使用，详情见 PA0.6 的实验内容。

PA0.7 Acquiring Source Code for PAs

1. Have a try!

考察对 `git` 的使用，详情见 PA0.7 的实验内容。

2. What happened?

`make` 依据 `Makefile` 文件编译项目文件。查看文件内容发现先是在遍历编译源代码，最后链接生成 `.build/nemu`。

3. How will you do?

首先选择一个指令体系结构，设计数据类型，通过底层 `io` 和驱动交互与其他硬件交互（比如硬盘以存储程序，显卡以显示界面），通过寄存器操作完成对应的数据结构的操作等等。

实验内容

PA0.1 Installing a GNU/Linux VM

1. 安装 Oracle Virtual Box , 然后新建一个32位的 Debian 虚拟机。

The screenshot shows the 'New' wizard in Oracle VM VirtualBox. The 'General' tab is selected, showing the VM name 'ics', operating system 'Debian (32-bit)', and the location 'C:\Users\w4rd3n\VirtualBox VMs\ics'. The 'System' tab shows memory of 4096 MB, boot order (Hard disk, CD/DVD, Floppy), and hardware acceleration settings. The 'Display' tab shows video memory of 16 MB and VMSVGA controller. The 'Storage' tab shows an IDE controller with no disk, and a SATA controller with a disk 'ics.vdi (普通, 8.00 GB)'.

名称:	ics
操作系统:	Debian (32-bit)
设置文件位置:	C:\Users\w4rd3n\VirtualBox VMs\ics

内存大小:	4096 MB
启动顺序:	软驱, 光驱, 硬盘
硬件加速:	VT-x/AMD-V, 嵌套分页, KVM 半虚拟化

显存大小:	16 MB
显卡控制器:	VMSVGA
远程桌面服务器:	已禁用
录像:	已禁用

控制器:	IDE
第二IDE控制器主通道:	[光驱] 没有盘片
控制器:	SATA
SATA 端口 0:	ics.vdi (普通, 8.00 GB)

2. 加载光驱, 打开虚拟机, 然后一路按着文档选, 中间由于我是连接网络安装, 所以包管理器那里我选择了 China 和 mirrors.163.com, 且http代理为空。成功安装系统后 Virtual Box 自动移除光驱。

```
Debian GNU/Linux 9 debian tty1

debian login: caoweisi
Password:
Linux debian 4.9.0-8-686 #1 SMP Debian 4.9.144-3.1 (2019-02-19) i686

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
caoweisi@debian:~$ -df
-bash: -df: command not found
caoweisi@debian:~$ df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            1805008         0   1805008    0% /dev
tmpfs           362748      4940    357808    2% /run
/dev/sda1       4061888 829840   3006000   22% /
tmpfs           1813728         0   1813728    0% /dev/shm
tmpfs            5120         0        5120    0% /run/lock
tmpfs           1813728         0   1813728    0% /sys/fs/cgroup
caoweisi@debian:~$
```

PA0.2 First Step into Linux

1. 登录, 输入命令 `df -h`, 然后 `poweroff`, 提示无此命令, `su` 切换到 `root`, 再次执行成功。

```

Debian GNU/Linux 9 debian tty1

debian login: caoweisi
Password:
Last login: Sun Mar 10 01:54:52 CST 2019 on tty1
Linux debian 4.9.0-8-686 #1 SMP Debian 4.9.144-3.1 (2019-02-19) i686

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
caoweisi@debian:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            1.8G   0    1.8G   0% /dev
tmpfs           355M  4.9M  350M   2% /run
/dev/sda1       3.9G  811M  2.9G  22% /
tmpfs           1.8G   0    1.8G   0% /dev/shm
tmpfs           5.0M   0    5.0M   0% /run/lock
tmpfs           1.8G   0    1.8G   0% /sys/fs/cgroup
caoweisi@debian:~$ sudo poweroff
-bash: poweroff: command not found
caoweisi@debian:~$ su
Password:
root@debian:/home/caoweisi# poweroff

```

PA0.3 Installing Basic Tools

1. 加载光驱，登录普通用户然后切换到 root 执行 `apt-cdrom add`。
2. 安装 `sudo`，执行 `addgroup caoweisi sudo` 使这个普通用户可以使用 `sudo`。 `exit` 退出 root 然后再 `exit` 注销。

```

caoweisi@debian:~$ su
Password:
root@debian:/home/caoweisi# history
1  apt-cdrom add
2  apt-get install sudo
3  addgroup caoweisi sudo
4  exit

```

3. 安装 `vim` 和 `openssh-server`，然后手动移除光驱并 `sudo poweroff`。

```

caoweisi@debian:~$ sudo history
1  su
2  exit
3  sudo apt-get install vim
4  sudo apt-get install openssh-server

```

PA0.4 Installing More Tools

1. 更换为桥接网络模式。（NAT模式没看到局域网的ip）
2. `ping 114.114.114.114 -c 4` 成功， `ip addr` 正常。

```

caoweisi@debian:~$ ping 114.114.114.114 -c 4
PING 114.114.114.114 (114.114.114.114) 56(84) bytes of data.
64 bytes from 114.114.114.114: icmp_seq=1 ttl=73 time=19.6 ms
64 bytes from 114.114.114.114: icmp_seq=3 ttl=66 time=17.7 ms
64 bytes from 114.114.114.114: icmp_seq=4 ttl=78 time=21.4 ms

--- 114.114.114.114 ping statistics ---
4 packets transmitted, 3 received, 25% packet loss, time 301ms
rtt min/avg/max/mdev = 17.770/19.614/21.460/1.506 ms
caoweisi@debian:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default
    link/ether 08:00:27:7f:9e:c8 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.105/24 brd 192.168.1.255 scope global enp0s3
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe7f:9ec8/64 scope link
        valid_lft forever preferred_lft forever
caoweisi@debian:~$ cat /etc/network/interfaces
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
allow-hotplug enp0s3
iface enp0s3 inet dhcp

```

3. `sudo vim etc/apt/sources.list` 换源。

WCF

4. `sudo apt-get update` 更新apt包管理器源。

```
caoweisi@debian:~$ sudo apt-get update
Ign:1 http://mirrors.ustc.edu.cn/debian stretch InRelease
Ign:2 http://mirrors.163.com/debian stretch InRelease
Ign:3 http://mirrors.aliyun.com/debian stretch InRelease
Hit:4 http://mirrors.aliyun.com/debian stretch Release
Get:5 http://mirrors.ustc.edu.cn/debian stretch Release [118 kB]
Hit:6 http://mirrors.163.com/debian stretch Release
Get:9 http://mirrors.ustc.edu.cn/debian stretch Release.gpg [2,434 B]
Get:10 http://mirrors.ustc.edu.cn/debian stretch/main i386 Packages [7,064 kB]
Get:12 http://mirrors.ustc.edu.cn/debian stretch/non-free i386 Packages [69.4 kB]
Get:13 http://mirrors.ustc.edu.cn/debian stretch/non-free Translation-en [80.3 kB]
Get:14 http://mirrors.ustc.edu.cn/debian stretch/contrib i386 Packages [47.9 kB]
Get:15 http://mirrors.ustc.edu.cn/debian stretch/contrib Translation-en [45.9 kB]
Get:11 http://mirrors.ustc.edu.cn/debian stretch/main Translation-en [5,384 kB]
Fetched 12.8 MB in 4s (2,710 kB/s)
Reading package lists... Done
caoweisi@debian:~$
```

5. 安装一系列工具（就不一一截图了）。

PA0.5 More Exploration

1. `cp /etc/vim/vimrc ~/.vimrc`, 然后 `vim .vimrc` 来设置 vim, 此设置将对当前用户生效。

```

" Vim5 and later versions support syntax highlighting. Uncommenting the next
" line enables syntax highlighting by default.
syntax on

" If using a dark background within the editing area and syntax highlighting
" turn on this option as well
set background=dark

" Uncomment the following to have Vim jump to the last position when
" reopening a file
"if has("autocmd")
"  au BufReadPost * if line("'\"") > 1 && line("'\"") <= line("$") | exe "no
! g'\"" | endif
"endif

" Uncomment the following to have Vim load indentation rules and plugins
" according to the detected filetype.
if has("autocmd")
  filetype plugin indent on
endif

" The following are commented out as they cause vim to behave a lot
" differently from regular Vi. They are highly recommended though.

```

2. 写一个 `helloworld` 查询并编译运行。

```

110 touch hello.c
111 ls
112 vim hello.c
113 history
caoweisi@debian:~$ gcc -o ./hello hello.c
caoweisi@debian:~$ ls
hello hello.c
caoweisi@debian:~$ ./hello
Hello World!!
caoweisi@debian:~$ _

```

3. 学习使用 `gdb` 调试程序。

```

(gdb) br main
Breakpoint 1 at 0x59f
(gdb) r
Starting program: /home/caoweisi/hello

Breakpoint 1, 0x0040059f in main ()
(gdb) disas
Dump of assembler code for function main:
   0x00400590 <+0>:    lea     0x4(%esp),%ecx
   0x00400594 <+4>:    and     $0xffffffff0,%esp
   0x00400597 <+7>:    pushl   -0x4(%ecx)
   0x0040059a <+10>:   push    %ebp
   0x0040059b <+11>:   mov     %esp,%ebp
   0x0040059d <+13>:   push    %ebx
   0x0040059e <+14>:   push    %ecx
=> 0x0040059f <+15>:   call    0x4005cc <__x86.get_pc_thunk.ax>
   0x004005a4 <+20>:   add     $0x1a5c,%eax
   0x004005a9 <+25>:   sub     $0xc,%esp
   0x004005ac <+28>:   lea     -0x19b0(%eax),%edx
   0x004005b2 <+34>:   push    %edx
   0x004005b3 <+35>:   mov     %eax,%ebx
   0x004005b5 <+37>:   call    0x4003f0 <puts@plt>
   0x004005ba <+42>:   add     $0x10,%esp
   0x004005bd <+45>:   mov     $0x0,%eax
   0x004005c2 <+50>:   lea     -0x8(%ebp),%esp
   0x004005c5 <+53>:   pop     %ecx
   0x004005c6 <+54>:   pop     %ebx
   0x004005c7 <+55>:   pop     %ebp
   0x004005c8 <+56>:   lea     -0x4(%ecx),%esp
   0x004005cb <+59>:   ret
End of assembler dump.
(gdb) c
Continuing.
Hello World!!
[Inferior 1 (process 5581) exited normally]
(gdb) q

```

4. 学习使用 `make` 进行项目管理。

```

caoweisi@debian:~$ make
make: 'hello' is up to date.
caoweisi@debian:~$ make clean
rm hello
caoweisi@debian:~$ make
gcc hello.c -o hello
caoweisi@debian:~$ make run
./hello
Hello World!!
caoweisi@debian:~$ _

```

5. 与 NTP 服务器同步时间。


```

caoweisi@debian:~$ sudo apt-get install ntpdate
[sudo] password for caoweisi:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  ntpdate
0 upgraded, 1 newly installed, 0 to remove and 1 not upgraded.
Need to get 74.4 kB of archives.
After this operation, 167 kB of additional disk space will be used.
Get:1 http://mirrors.163.com/debian stretch/main i386 ntpdate i386 1:4.2.8p10+dfsg-3+deb9u2 [74.4 kB]
Fetched 74.4 kB in 0s (595 kB/s)
Selecting previously unselected package ntpdate.
(Reading database ... 41554 files and directories currently installed.)
Preparing to unpack .../ntpdate_1:4.2.8p10+dfsg-3+deb9u2_i386.deb ...
Unpacking ntpdate (1:4.2.8p10+dfsg-3+deb9u2) ...
Setting up ntpdate (1:4.2.8p10+dfsg-3+deb9u2) ...
Processing triggers for man-db (2.7.6.1-2) ...
caoweisi@debian:~$ sudo ntpdate ntp.ntsc.edu.cn
Error resolving ntp.ntsc.edu.cn: Name or service not known (-2)
10 Mar 04:28:03 ntpdate[5690]: Can't find host ntp.ntsc.edu.cn: Name or service not known (-2)
10 Mar 04:28:03 ntpdate[5690]: no servers can be used, exiting
caoweisi@debian:~$ sudo ntpdate ntp.ntsc.ac.cn
^[[A^[[A10 Mar 04:28:22 ntpdate[5692]: adjust time server 114.118.7.161 offset -0.037623 sec
caoweisi@debian:~$ date
Sun Mar 10 04:28:27 CST 2019

```

PA0.6 Logging in and Transferring Files via SSH

1. `putty` 连接虚拟机。

```

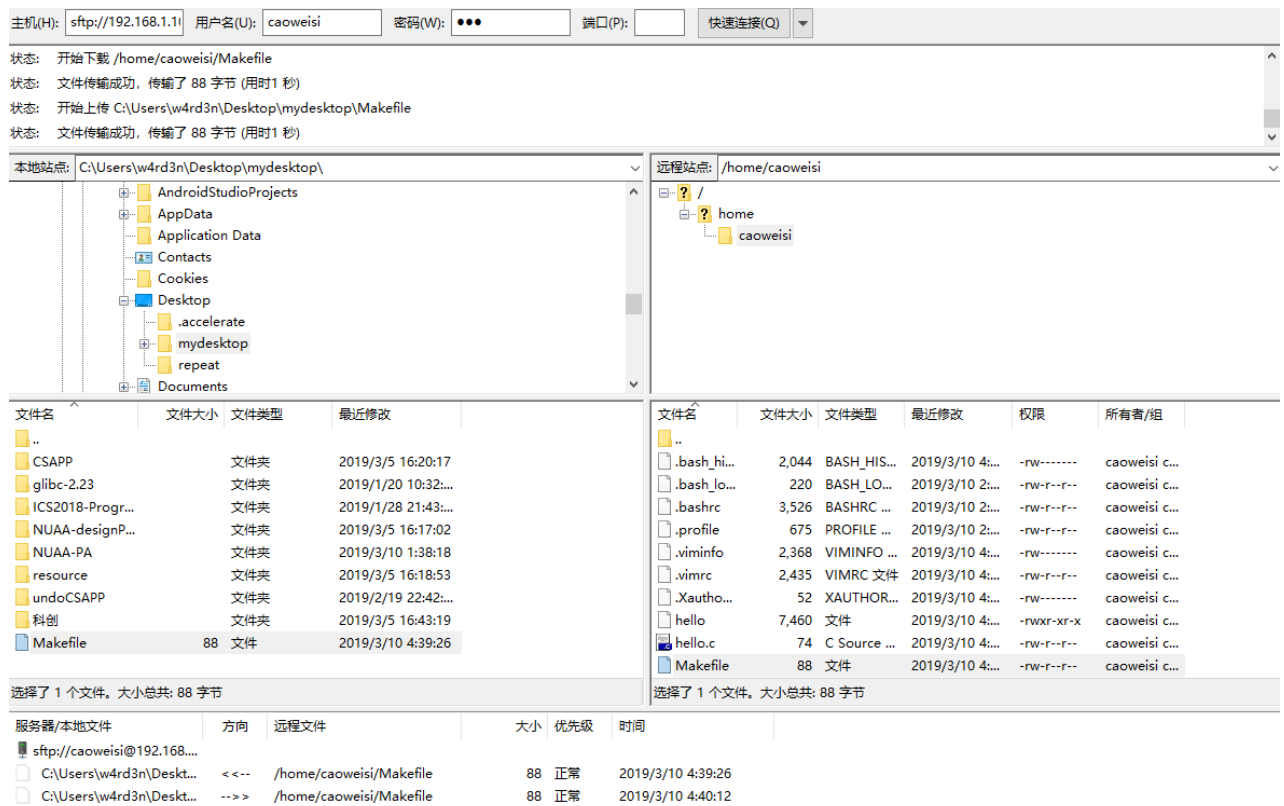
caoweisi@debian: ~
login as: caoweisi
caoweisi@192.168.1.105's password:
Linux debian 4.9.0-8-686 #1 SMP Debian 4.9.144-3.1 (2019-02-19) i686

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

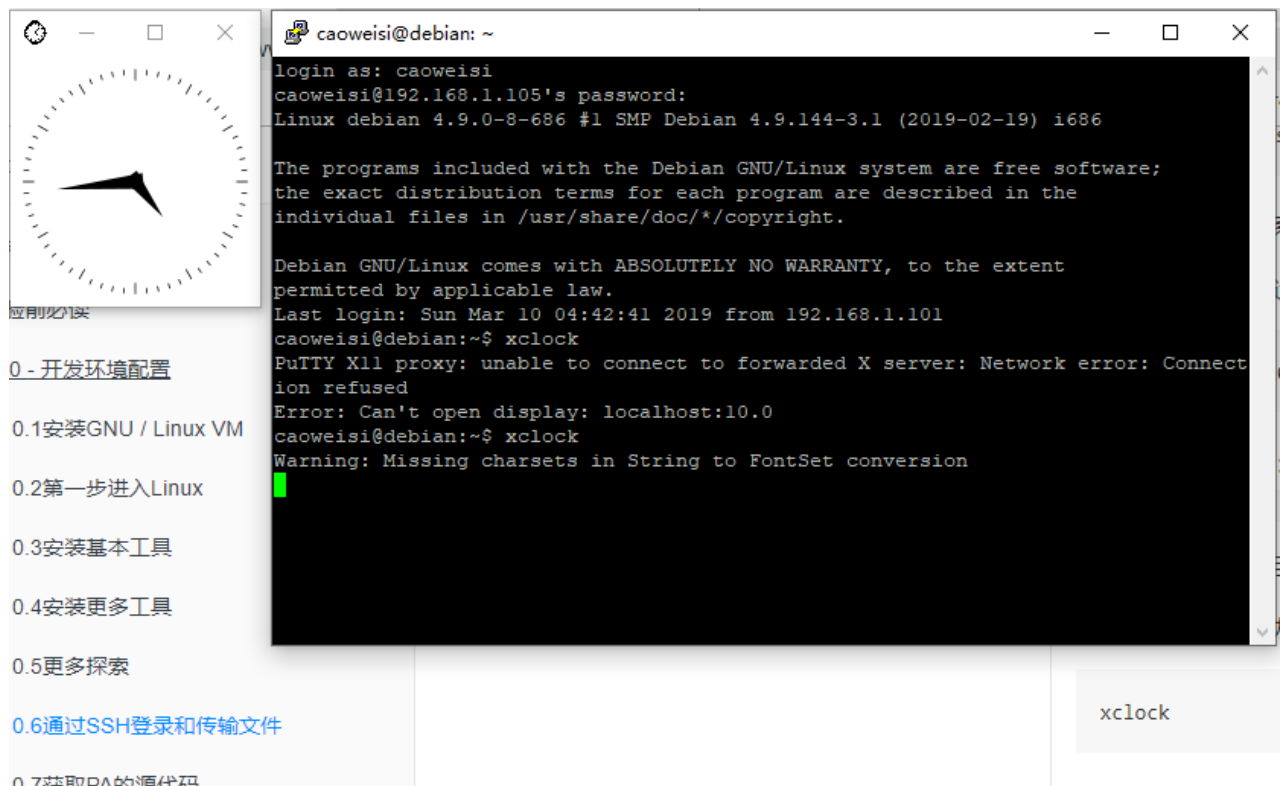
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sun Mar 10 04:08:38 2019 from 192.168.1.101
caoweisi@debian:~$

```

2. 使用 `Filezilla` 和虚拟机交换并修改文件。



3. 配置 X server，运行 xclock。



4. 备份 VM。

PA0.7 Acquiring Source Code for PAs

1. 使用 git 从远程仓库克隆项目到本地，更改 git 全局设置。进入项目文件夹输入 `bash init.sh` 初始化 bash 的环境变量。

```

135 git clone https://github.com/jinhang1997/ics2017 ics2017
136 git config --global user.name "16730213-Cao WeiSi"
137 git config --global user.email "543546992@qq.com"
138 git config --global core.editor vim
139 git config --global color.ui true
140 cd ics2017/
141 ls
142 git branch
143 git branch -m master
144 git branch
145 bash init.sh

```

2. 新建并切换到分支 `PA0`，修改 `STU_ID`，使用 `git status` 查看修改状态，使用 `git diff` 查看修改细节，使用 `git add .` 将所有修改加入暂存区，使用 `git commit` 提交暂存区中的修改，最后使用 `git log` 查看所有提交简要。

```

commit b8b6ee52de1bdfb6d99f02ef1e10b3d24d145888
Author: 16730213-Cao WeiSi <543546992@qq.com>
Date:   Sun Mar 10 05:39:05 2019 +0800

    edit STU_ID

```

3. 切回 `master` 分支发现 `PA0` 分支的操作并未对其产生影响。
4. 尝试 `make`，`make clean`，`make run`，`make gdb` 指令。`git log` 发现开发跟踪功能正常。
5. `make submit`。
6. 推送 `master` 和 `pa0` 分支到远端仓库。

Your recently pushed branches:

🔗 pa0 (3 minutes ago) [Compare & pull request](#)

Branch: master ▾
New pull request

Create new file
Upload files
Find File
Clone or download ▾

Switch branches/tags

Branches
Tags

✓ master
pa0

		Latest commit 82c241a 10 days ago
		a year ago
		a year ago
		a year ago
		a year ago
📄 .gitignore	add README.md	2 years ago
📄 Makefile	Makefile: print a message by default, instead of cleaning everything	2 years ago
📄 README.md	add README.md	2 years ago
📄 init.sh	modify init.sh	10 days ago

📄 README.md

ICS2017 Proqrammina Assianment

遇到的问题及解决办法

1. `PA0.5` 部分的 `sudo apt-get install libstdc++6` 报错，发现是其依赖的一个包 `libudev-dev` 没安装。
`sudo apt-get install libudev-dev` 依旧报错，这次是 `libudev-dev` 依赖的 `libudev1` 版本不对。研究后发现原来是因为 `libudev-dev` 最新版本属于 `security`，更新源成功安装

```
deb http://mirrors.163.com/debian/ stretch main non-free contrib
deb http://mirrors.163.com/debian/ stretch-updates main non-free contrib
deb http://mirrors.163.com/debian-security/ stretch/updates main non-free contrib
deb http://mirrors.163.com/debian/ stretch-proposed-updates main non-free contrib
deb http://mirrors.ustc.edu.cn/debian/ stretch main non-free contrib
deb http://mirrors.aliyun.com/debian/ stretch main non-free contrib

~
~
~
```

实验心得

Linux 中大部分软件包括部分底层驱动都是可以根据需要更换的，包括内核版本，这就给予我们更大的选择。

脱离 IDE 之后才能发现更多底层的东西和原理。

版本管理是软件开发的瑞士军刀，而 git 是其中的佼佼者。

其他备注

无