

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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- 报告阶段：PA0
- 完成日期：2022.3.13
- 本次实验，我完成了所有内容。

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思考题

1. Linux and Linux?

共同点：都是linux架构

不同点：

Debian 是适合于服务器的操作系统，不仅稳定，而且占用硬盘空间小，占用内存小。

Ubuntu 有着漂亮的用户界面，完善的包管理系统，强大的软件源支持，丰富的技术社区，但是它最佳的应用领域是桌面操作系统而非服务器操作系统。

Red Hat 是商业版本，在系统的稳定性，前瞻性和安全性上有着极大的优势。

CentOS 是从 redhat 源代码编译重新发布版，系统简单但非常稳定，命令行操作可以方便管理系统和应用，并且有帮助文档和社区的支持。

2. Can't memory be larger?

32位架构只能处理4GB的物理寻址空间。32位表示 2^{32} 个内存地址，而每一个地址是指向的是 8bit为一组的 byte，也就是 2^{35} 个bit，这样再换算为GB就是 4GB了。

3. Why Windows is quite 'fat'?

windows自带大量驱动，保留过去的各种API，默认情况下分页文件和休眠缓存都在系统分区，再加上系统还原，这些也要占去很多空间，还有大量向系统分区写文件的程序。

debian系统对于系统内存控制比较好，磁盘要求要低。

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

确保不会错误输入命令，导致工作没保存就关机等情况出现

5. Have a try! (in PA0.5)

```
touch hello.c    # 创建hello.c文件
vim hello.c      # 编辑代码
```

写入代码

```
#include<stdio.h>
int main()
{
    printf("Hello world!\n");
    return 0;
}
```



```
gcc -o ./hello hello.c    #编译
./hello                   #运行
```

```
shaozhenzhe@Debian:~$ gcc -o ./hello hello.c
shaozhenzhe@Debian:~$ ls
hello hello.c ics2017 project
shaozhenzhe@Debian:~$ ./hello
Hello world!
shaozhenzhe@Debian:~$
```

6. Have a try!!

```
gdb ./hello    # gdb中加载hello程序
br main        # 在main处下断点
r              # 执行程序
disas          # 查看反汇编
c              # 继续运行
q              # 退出
```

```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
(gdb) br main
Breakpoint 1 at 0x11a8
(gdb) r
Starting program: /home/shaozhenzhe/hello

Breakpoint 1, 0x004011a8 in main ()
(gdb) disas
Dump of assembler code for function main:
   0x00401199 <+0>:    lea     0x4(%esp),%ecx
   0x0040119d <+4>:    and     $0xffffffff0,%esp
   0x004011a0 <+7>:    pushl   -0x4(%ecx)
   0x004011a3 <+10>:   push    %ebp
   0x004011a4 <+11>:   mov     %esp,%ebp
   0x004011a6 <+13>:   push    %ebx
   0x004011a7 <+14>:   push    %ecx
=>  0x004011a8 <+15>:   call    0x4011d5 <__x86.get_pc_thunk.ax>
   0x004011ad <+20>:   add     $0x2e53,%eax
   0x004011b2 <+25>:   sub     $0xc,%esp
   0x004011b5 <+28>:   lea     -0x1ff8(%eax),%edx
   0x004011bb <+34>:   push    %edx
   0x004011bc <+35>:   mov     %eax,%ebx
   0x004011be <+37>:   call    0x401030 <puts@plt>
   0x004011c3 <+42>:   add     $0x10,%esp
   0x004011c6 <+45>:   mov     $0x0,%eax
   0x004011cb <+50>:   lea     -0x8(%ebp),%esp
   0x004011ce <+53>:   pop     %ecx
   0x004011cf <+54>:   pop     %ebx
   0x004011d0 <+55>:   pop     %ebp
   0x004011d1 <+56>:   lea     -0x4(%ecx),%esp
   0x004011d4 <+59>:   ret
End of assembler dump.
(gdb) c
Continuing.
Hello world!
[Inferior 1 (process 1142) exited normally]
(gdb) q
shaozhenzhe@Debian:~$
```

7. Have a try!!!

```
cd ~                # 回到主目录
mkdir helloproject/ # 创建新目录helloproject
mv hello.c helloproject/ # 把hello.c移动到helloproject
cd helloproject/    # 进入helloproject目录
touch Makefile      # 创建Makefile文件
vim Makefile        # 编辑Makefile
```

```
shaozhenzhe@Debian:~$ ls
hello  hello.c  ics2017
shaozhenzhe@Debian:~$ mkdir helloproject/
shaozhenzhe@Debian:~$ mv hello.c helloproject/
shaozhenzhe@Debian:~$ cd helloproject/
shaozhenzhe@Debian:~/helloproject$ touch Makefile
shaozhenzhe@Debian:~/helloproject$ ls
hello.c  Makefile
shaozhenzhe@Debian:~/helloproject$ vim Makefile _
```

编辑Makefile

```
hello: hello.c
    gcc hello.c -o ./hello

.PHONY: clean run

run: hello
    ./hello

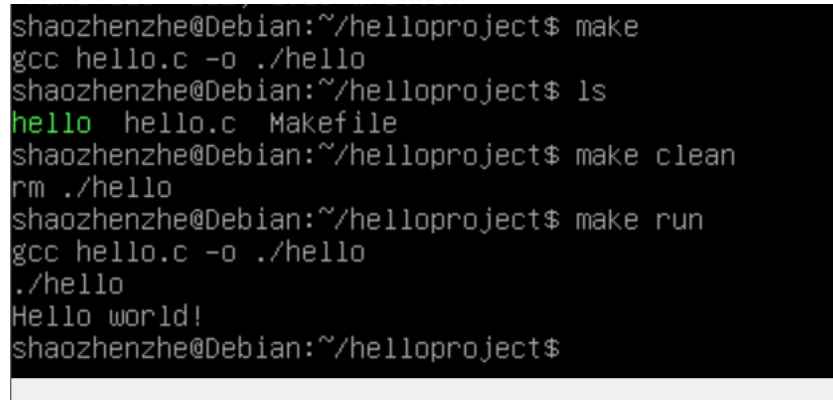
clean:
    rm ./hello
```



The screenshot shows a terminal window titled "Debian [正在运行] - Oracle VM VirtualBox". The terminal displays the same Makefile content as the previous block, with syntax highlighting: blue for targets, green for commands, and yellow for the .PHONY declaration.

通过命令编译

```
make
make clean
make run
```

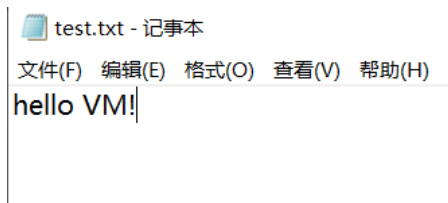


The screenshot shows a terminal window with the following commands and output:

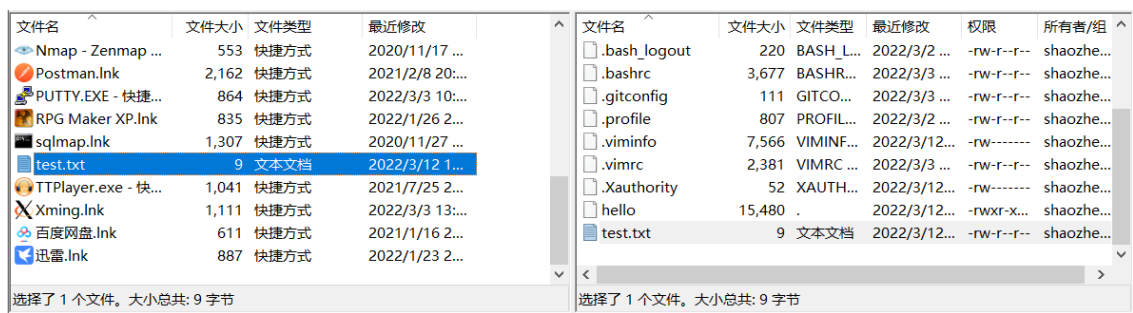
```
shaozhenzhe@Debian:~/helloproject$ make
gcc hello.c -o ./hello
shaozhenzhe@Debian:~/helloproject$ ls
hello hello.c Makefile
shaozhenzhe@Debian:~/helloproject$ make clean
rm ./hello
shaozhenzhe@Debian:~/helloproject$ make run
gcc hello.c -o ./hello
./hello
Hello world!
shaozhenzhe@Debian:~/helloproject$
```

8. Have a try! (in PA0.6)

在主机桌面上新建一个 `test.txt`，内容为hello VM!



双击传输到VM内



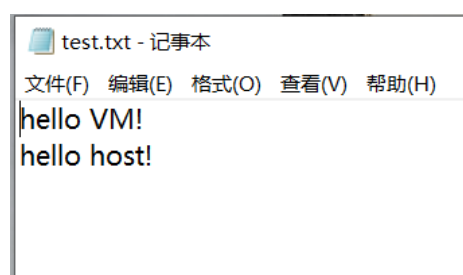
vim test.txt 修改内容，添加hello host!



双击VM里的 test.txt，覆盖掉主机桌面的原文件



再次查看，发现内容已经被改变

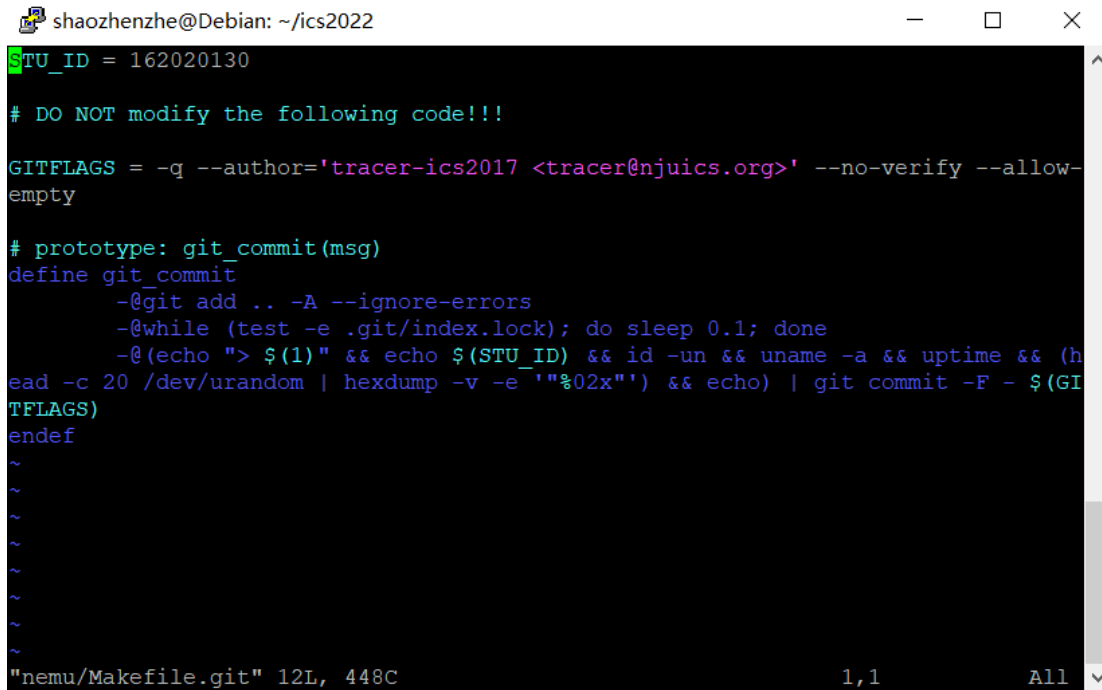


9. have a try! (in PA0.7)

在 PA 项目中设置学号等个人信息

```
git branch          # 列出所有分支
git checkout -b pa0  # 创建pa0分支
vim nemu/Makefile.git # 修改项目文件
```

修改 STU_UD 为162020130



A terminal window titled 'shaozhenzhe@Debian: ~/ics2022' showing the editing of 'nemu/Makefile.git'. The user has set 'STU_ID = 162020130'. The file contains a warning not to modify the following code, followed by 'GITFLAGS' and a 'git_commit' function prototype and definition. The function definition includes a loop that adds the file to the index and commits it with the current STU_ID. The terminal shows the file is 12 lines long and 448 characters.

```
shaozhenzhe@Debian: ~/ics2022
STU_ID = 162020130

# DO NOT modify the following code!!!

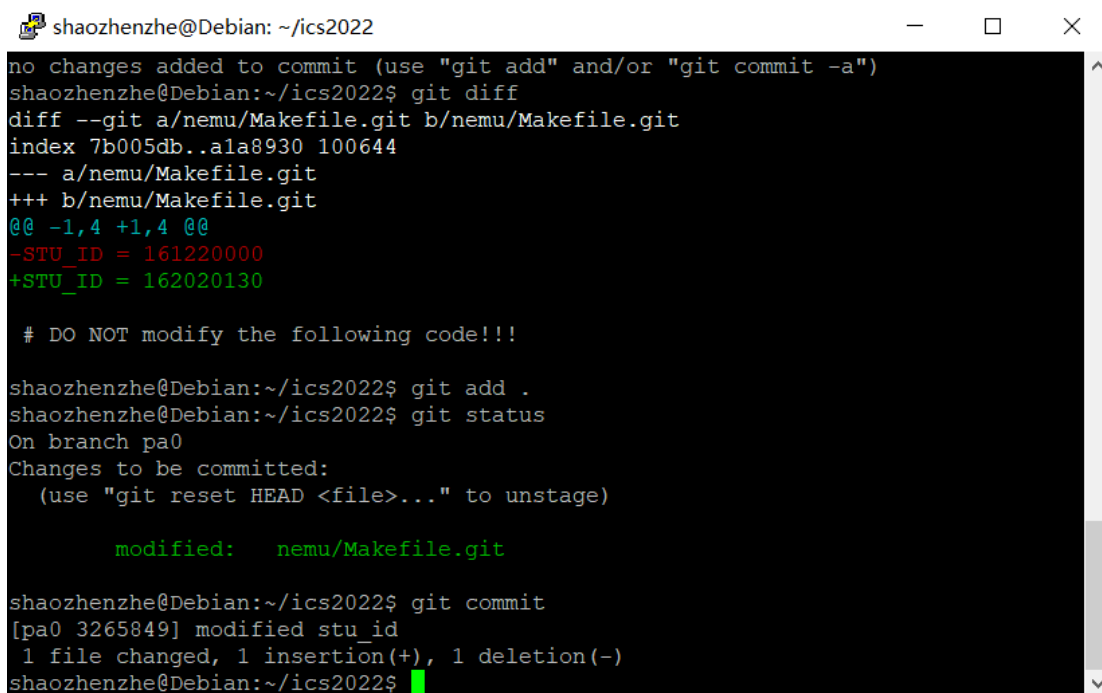
GITFLAGS = -q --author='tracer-ics2017 <tracer@njuics.org>' --no-verify --allow-empty

# prototype: git_commit(msg)
define git_commit
    -@git add .. -A --ignore-errors
    -@while (test -e .git/index.lock); do sleep 0.1; done
    -@ (echo "> $(1)" && echo $(STU_ID) && id -un && uname -a && uptime && (head -c 20 /dev/urandom | hexdump -v -e "%02x") && echo) | git commit -F - $(GITFLAGS)
endef

"nemu/Makefile.git" 12L, 448C
```

提交一次 commit

```
git diff          # 列出上次提交的修改
git add .         # 将更改添加到 commit
git status        # 查看上次提交修改的文件
git commit        # 提交
```



A terminal window titled 'shaozhenzhe@Debian: ~/ics2022' showing the execution of git commands. It starts with 'no changes added to commit', followed by 'git diff' showing a change in 'nemu/Makefile.git' where 'STU_ID' was updated from 161220000 to 162020130. Then 'git add .' is run, followed by 'git status' showing the file is staged. Finally, 'git commit' is run, creating a new commit on the 'pa0' branch with the message '[pa0 3265849] modified stu_id'.

```
shaozhenzhe@Debian: ~/ics2022
no changes added to commit (use "git add" and/or "git commit -a")
shaozhenzhe@Debian:~/ics2022$ git diff
diff --git a/nemu/Makefile.git b/nemu/Makefile.git
index 7b005db..a1a8930 100644
--- a/nemu/Makefile.git
+++ b/nemu/Makefile.git
@@ -1,4 +1,4 @@
-STU_ID = 161220000
+STU_ID = 162020130

# DO NOT modify the following code!!!

shaozhenzhe@Debian:~/ics2022$ git add .
shaozhenzhe@Debian:~/ics2022$ git status
On branch pa0
Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        modified:   nemu/Makefile.git

shaozhenzhe@Debian:~/ics2022$ git commit
[pa0 3265849] modified stu_id
1 file changed, 1 insertion(+), 1 deletion(-)
shaozhenzhe@Debian:~/ics2022$
```

```
git log          # 查看日志
```

```
shaozhenzhe@Debian: ~/ics2022
commit 3265849835bc752ac62d7e6a4429b846d7fd4214 (HEAD -> pa0)
Author: 162020130-Shao Zhenzhe <1925861393@qq.com>
Date: Sun Mar 13 09:43:57 2022 +0800

    modified stu_id

commit 4e209a8c3237e9281a5e7332eff0fa441fbc5c37 (origin/HEAD, origin/2021, master)
Author: CBrilliant <2423459133@qq.com>
Date: Sun Feb 28 10:39:49 2021 +0800

    modify readme

commit 27d912e8a80fdde55537461a399edb3642effb9c (origin/2020)
Author: Wangshanyue <1466979753@qq.com>
Date: Sun May 3 11:14:43 2020 +0800

    open debug

commit c6e3460dfd580fe14164a0ceafa2d2256ebfa7e6
Merge: 15bfd48 cf2f2a5
Author: Wangshanyue <1466979753@qq.com>
Date: Sun May 3 01:10:15 2020 +0800

:
```

10. What happened?

1. 依次读取变量“MAKEFILES”定义的 makefile 文件列表
2. 读取工作目录下的 makefile 文件（根据命名的查找顺序“GNUmakefile”，“makefile”，“Makefile”，首先找到那个就读取那个）
3. 依次读取工作目录 makefile 文件中使用指示符“include”包含的文件
4. 查找重建所有已读取的 makefile 文件的规则（如果存在一个目标是当前读取的某一个 makefile 文件，则执行此规则重建此 makefile 文件，完成以后从第一步开始重新执行）
5. 初始化变量值并展开那些需要立即展开的变量和函数并根据预设条件确定执行分支
6. 根据“终极目标”以及其他目标的依赖关系建立依赖关系链表
7. 执行除“终极目标”以外的所有的目标的规则（规则中如果依赖文件中任一个文件的时间戳比目标文件新，则使用规则所定义的命令重建目标文件）
8. 执行“终极目标”所在的规则

11. How will you do?

最简单的方法是用 FPGA

难一点需要用数电知识设计出寄存器、加法器，使用74xx系列的芯片设计一个简易的计算器，学习计算机接口技术，汇编语言，搞明白如何把数字信号输入输出，最后设计一套合适的指令集和微指令，把各种门电路结合到一起。

实验内容

PA0.1 Installing a GNU/Linux VM

- 安装 VirtualBox



- 安装 Debian 虚拟机

1. 打开 Oracle VM VirtualBox Manager .



2. 点击 **New** 按钮建立一个新的虚拟机；
3. 设定虚拟机名称 **Debian**，选择操作系统类型为 **Debian (32-bit)**，点击 **Next**；
4. 设定内存大小 **2048MB**
5. 创建硬盘，**8G** 的空间
6. 加载 **Debian** 安装映像
7. 在虚拟机中安装 **Debian**

PA0.2 First Step into Linux

- 跟随讲义逐步操作
打开虚拟机，先登录系统：


```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助

Debian GNU/Linux 10 Debian tty1

Debian login: shaozhenzhe
Password:
Last login: Sat Mar 12 15:17:31 CST 2022 from 10.0.2.2 on pts/0
Linux Debian 4.19.0-18-686 #1 SMP Debian 4.19.208-1 (2021-09-29) 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.
shaozhenzhe@Debian:~$
```

用命令

```
df -h
```

可以看到 Debian 占用了多少硬盘空间，这个空间比安装 Windows 要小得多

```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助

Debian GNU/Linux 10 Debian tty1

Debian login: shaozhenzhe
Password:
Last login: Sat Mar 12 15:17:31 CST 2022 from 10.0.2.2 on pts/0
Linux Debian 4.19.0-18-686 #1 SMP Debian 4.19.208-1 (2021-09-29) 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.
shaozhenzhe@Debian:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            998M   0  998M   0% /dev
tmpfs           202M  3.0M  199M   2% /run
/dev/sda1       5.9G  2.0G  3.7G  35% /
tmpfs           1009M   0  1009M   0% /dev/shm
tmpfs           5.0M   0   5.0M   0% /run/lock
tmpfs           1009M   0  1009M   0% /sys/fs/cgroup
tmpfs           202M   0   202M   0% /run/user/1000
shaozhenzhe@Debian:~$ _
```

切换到root尝试 `poweroff` 发现失败，从PA0.3可知 `su` 只能将身份切换为 root 但是没有对应环境变量因输入

```
su -
```

完全切换到root帐户，尝试

```
poweroff
```

成功关机

```
shaozhenzhe@Debian:~$ su
Password:
root@Debian:/home/shaozhenzhe# poweroff
bash: poweroff: command not found
root@Debian:/home/shaozhenzhe# su -
root@Debian:~# poweroff_
```

PA0.3 Installing Basic Tools

- 安装提及的基本工具

安装sudo，并将我的用户账号添加到sudo组

由于我已经做过，可以通过命令

```
groups user_name
```

查看是否属于sudo组，这里可以看到 shaozhenzhe 属于sudo组

```
shaozhenzhe@Debian:~$ sudo -v
[sudo] password for shaozhenzhe:
shaozhenzhe@Debian:~$ groups shaozhenzhe
shaozhenzhe : shaozhenzhe cdrom floppy sudo audio dip video plugdev netdev
shaozhenzhe@Debian:~$
```

安装 ssh

```
shaozhenzhe@Debian:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
openssh-server is already the newest version (1:7.9p1-10+deb10u2).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
shaozhenzhe@Debian:~$
```

- 尝试使用vim



PA0.4 Installing More Tools

- 配置虚拟机网络



2.配置操作系统设置

修改 `interfaces` 的设置

```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助

# 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

auto enp0s3
iface enp0s3 inet dhcp
~
~
~
```

```
ip addr
```

查看发现接口 `enp0s3` 分配了一个ip地址

```
ping www.baidu.com -c 4
```

检查网络是否正常工作

```
shaozhenzhe@Debian:/etc/network$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    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 ql
000
    link/ether 08:00:27:9e:a3:39 brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic enp0s3
        valid_lft 86192sec preferred_lft 86192sec
    inet6 fe80::a00:27ff:fe9e:a339/64 scope link
        valid_lft forever preferred_lft forever
shaozhenzhe@Debian:/etc/network$ ping www.baidu.com -c 4
PING www.a.shifen.com (112.80.248.75) 56(84) bytes of data.
64 bytes from 112.80.248.75 (112.80.248.75): icmp_seq=1 ttl=57 time=6.37 ms
64 bytes from 112.80.248.75 (112.80.248.75): icmp_seq=2 ttl=57 time=6.27 ms
64 bytes from 112.80.248.75 (112.80.248.75): icmp_seq=3 ttl=57 time=6.14 ms
64 bytes from 112.80.248.75 (112.80.248.75): icmp_seq=4 ttl=57 time=6.10 ms

--- www.a.shifen.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 30ms
rtt min/avg/max/mdev = 6.103/6.222/6.374/0.108 ms
shaozhenzhe@Debian:/etc/network$
```

- 添加 APT 源

```
cd /etc/apt/                                # 进入/etc/apt/目录
sudo cp sources.list sources.list.bak       # 备份
sudo vim sources.list                       # 修改源
```

写入

```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助

#
# deb cdrom:[Debian GNU/Linux 10.3.0 _Buster_ - Official i386 NETINST 20200208-13:41]/ buster main
#deb cdrom:[Debian GNU/Linux 10.3.0 _Buster_ - Official i386 NETINST 20200208-13:41]/ buster main
# Line commented out by installer because it failed to verify:
#deb http://security.debian.org/debian-security buster/updates main
# Line commented out by installer because it failed to verify:
#deb-src http://security.debian.org/debian-security buster/updates main
#
# buster-updates, previously known as 'volatile'
# A network mirror was not selected during install. The following entries
# are provided as examples, but you should amend them as appropriate
# for your mirror of choice.
#
# deb http://deb.debian.org/debian/ buster-updates main
# deb-src http://deb.debian.org/debian/ buster-updates main
#
deb http://mirrors.aliyun.com/debian/ buster main non-free contrib
deb-src http://mirrors.aliyun.com/debian/ buster main non-free contrib
deb http://mirrors.aliyun.com/debian-security buster/updates main
deb-src http://mirrors.aliyun.com/debian-security buster/updates main
deb http://mirrors.aliyun.com/debian/ buster-updates main non-free contrib
deb-src http://mirrors.aliyun.com/debian/ buster-updates main non-free contrib
deb http://mirrors.aliyun.com/debian/ buster-backports main non-free contrib
deb-src http://mirrors.aliyun.com/debian/ buster-backports main non-free contrib
~
~
```

更新源

```
sudo apt update
sudo apt upgrade -y
```

- 安装 PA 所需软件

由于我在比较早之前就完成了PA0，那时候没有保留截图，因此这里的截图都是完成安装后的

```
sudo apt install man
sudo apt install build-essential
sudo apt install gcc-doc
```

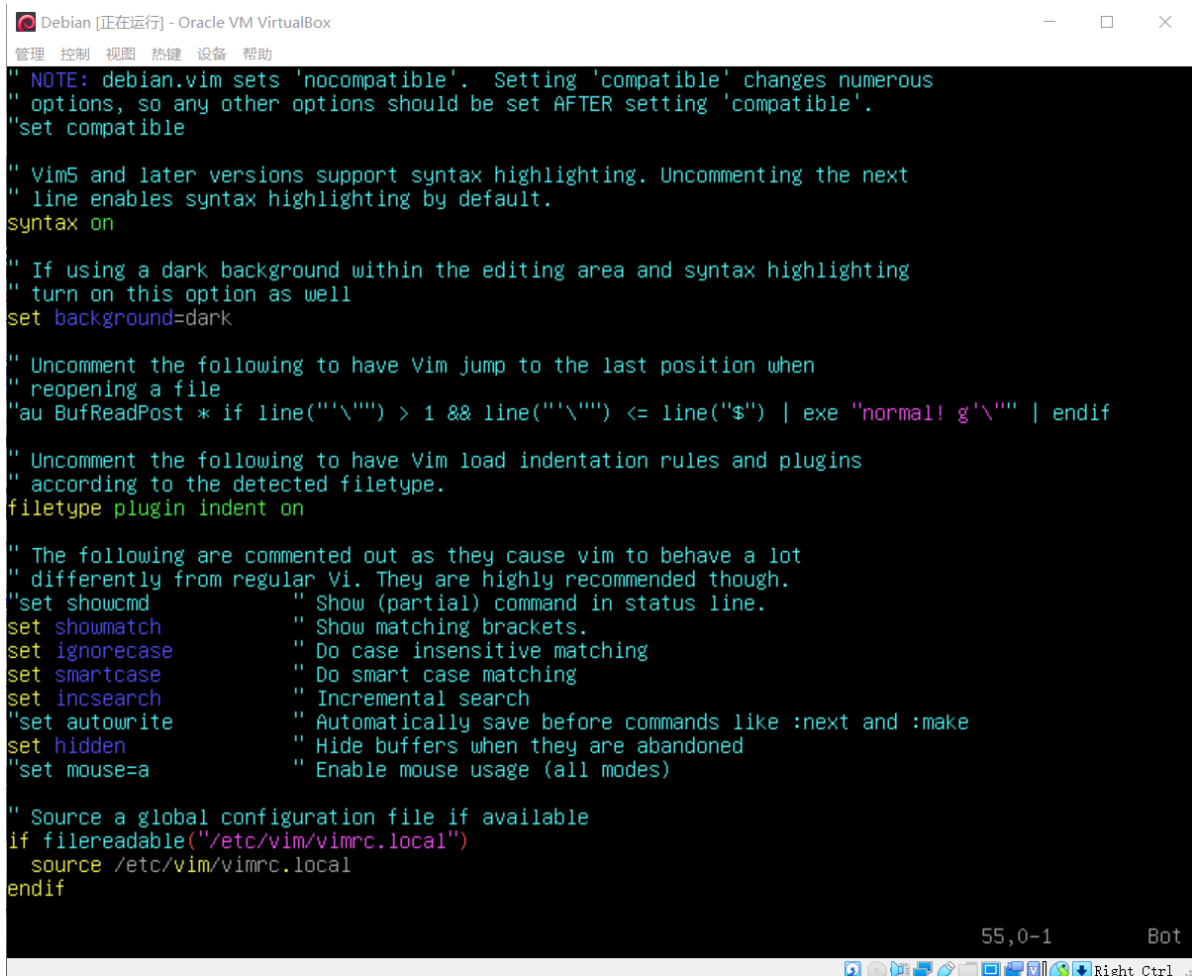
```
shaozhenzhe@Debian:/etc/apt$ sudo apt install man
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'man-db' instead of 'man'
man-db is already the newest version (2.8.5-2).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install build-essential
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.6).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install gcc-doc
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc-doc is already the newest version (5:8.3.0-1~bpo10+1).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$
```

```
sudo apt install gdb
sudo apt install git
sudo apt install gcc-multilib
sudo apt install libreadline-dev
sudo apt install libssl-dev
sudo apt install qemu-system-x86
```

```
shaozhenzhe@Debian:/etc/apt$ sudo apt install gdb
Reading package lists... Done
Building dependency tree
Reading state information... Done
gdb is already the newest version (8.2.1-2+b3).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install git
Reading package lists... Done
Building dependency tree
Reading state information... Done
git is already the newest version (1:2.20.1-2+deb10u3).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install gcc-multilib
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc-multilib is already the newest version (4:8.3.0-1).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install libreadline-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
libreadline-dev is already the newest version (7.0-5).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install libsdl2-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
libsdl2-dev is already the newest version (2.0.9+dfsg1-1).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ sudo apt install qemu-system-x86
Reading package lists... Done
Building dependency tree
Reading state information... Done
qemu-system-x86 is already the newest version (1:3.1+dfsg-8+deb10u8).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:/etc/apt$ _
```

PA0.5 More Exploration

- 配置vim



```
" NOTE: debian.vim sets 'nocompatible'. Setting 'compatible' changes numerous
" options, so any other options should be set AFTER setting 'compatible'.
"set compatible

" 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
"au BufReadPost * if line("\n") > 1 && line("\n") <= line("$") | exe "normal! g'\n" | endif

" Uncomment the following to have Vim load indentation rules and plugins
" according to the detected filetype.
filetype plugin indent on

" The following are commented out as they cause vim to behave a lot
" differently from regular Vi. They are highly recommended though.
"set showcmd          " Show (partial) command in status line.
set showmatch          " Show matching brackets.
set ignorecase          " Do case insensitive matching
set smartcase          " Do smart case matching
set incsearch          " Incremental search
"set autowrite        " Automatically save before commands like :next and :make
set hidden              " Hide buffers when they are abandoned
"set mouse=a           " Enable mouse usage (all modes)

" Source a global configuration file if available
if filereadable("/etc/vim/vimrc.local")
    source /etc/vim/vimrc.local
endif
```

- 使用 gcc 编译 helloworld 并运行

```
touch hello.c    # 创建hello.c文件
vim hello.c      # 编辑代码
```

写入代码

```
#include<stdio.h>
int main()
{
    printf("Hello world!\n");
    return 0;
}
```



```
#include<stdio.h>
int main()
{
    printf("Hello world!\n");
    return 0;
}
~
~
```

```
gcc -o ./hello hello.c    #编译
./hello                    #运行
```



```
shaozhenzhe@Debian:~$ gcc -o ./hello hello.c
shaozhenzhe@Debian:~$ ls
hello hello.c ics2017 project
shaozhenzhe@Debian:~$ ./hello
Hello world!
shaozhenzhe@Debian:~$
```

- 使用 gdb 调试 helloworld

```
Debian [正在运行] - Oracle VM VirtualBox
管理 控制 视图 热键 设备 帮助
(gdb) br main
Breakpoint 1 at 0x11a8
(gdb) r
Starting program: /home/shaozhenzhe/hello

Breakpoint 1, 0x004011a8 in main ()
(gdb) disas
Dump of assembler code for function main:
   0x00401199 <+0>:    lea     0x4(%esp),%ecx
   0x0040119d <+4>:    and     $0xffffffff0,%esp
   0x004011a0 <+7>:    pushl   -0x4(%ecx)
   0x004011a3 <+10>:   push    %ebp
   0x004011a4 <+11>:   mov     %esp,%ebp
   0x004011a6 <+13>:   push    %ebx
   0x004011a7 <+14>:   push    %ecx
=>  0x004011a8 <+15>:   call    0x4011d5 <__x86.get_pc_thunk.ax>
   0x004011ad <+20>:   add     $0x2e53,%eax
   0x004011b2 <+25>:   sub     $0xc,%esp
   0x004011b5 <+28>:   lea     -0x1ff8(%eax),%edx
   0x004011bb <+34>:   push    %edx
   0x004011bc <+35>:   mov     %eax,%ebx
   0x004011be <+37>:   call    0x401030 <puts@plt>
   0x004011c3 <+42>:   add     $0x10,%esp
   0x004011c6 <+45>:   mov     $0x0,%eax
   0x004011cb <+50>:   lea     -0x8(%ebp),%esp
   0x004011ce <+53>:   pop     %ecx
   0x004011cf <+54>:   pop     %ebx
   0x004011d0 <+55>:   pop     %ebp
   0x004011d1 <+56>:   lea     -0x4(%ecx),%esp
   0x004011d4 <+59>:   ret
End of assembler dump.
(gdb) c
Continuing.
Hello world!
[Inferior 1 (process 1142) exited normally]
(gdb) q
shaozhenzhe@Debian:~$
```

- 使用 make 组织 helloworld

```
cd ~                # 回到主目录
mkdir helloproject/ # 创建新目录helloproject
mv hello.c helloproject/ # 把hello.c移动到helloproject
cd helloproject/    # 进入helloproject目录
touch Makefile      # 创建Makefile文件
vim Makefile        # 编辑Makefile
```

```
shaozhenzhe@Debian:~$ ls
hello  hello.c  ics2017
shaozhenzhe@Debian:~$ mkdir helloproject/
shaozhenzhe@Debian:~$ mv hello.c  helloproject/
shaozhenzhe@Debian:~$ cd helloproject/
shaozhenzhe@Debian:~/helloproject$ touch Makefile
shaozhenzhe@Debian:~/helloproject$ ls
hello.c  Makefile
shaozhenzhe@Debian:~/helloproject$ vim Makefile _
```

编辑Makefile

```
hello: hello.c
    gcc hello.c -o ./hello

.PHONY: clean run

run: hello
    ./hello

clean:
    rm ./hello
```

Debian [正在运行] - Oracle VM VirtualBox

管理 控制 视图 热键 设备 帮助

```
hello: hello.c
    gcc hello.c -o ./hello

.PHONY: clean run

run: hello
    ./hello

clean:
    rm ./hello
~
~
~
```

通过命令编译

```
make
make clean
make run
```

```
shaozhenzhe@Debian:~/helloproject$ make
gcc hello.c -o ./hello
shaozhenzhe@Debian:~/helloproject$ ls
hello  hello.c  Makefile
shaozhenzhe@Debian:~/helloproject$ make clean
rm ./hello
shaozhenzhe@Debian:~/helloproject$ make run
gcc hello.c -o ./hello
./hello
Hello world!
shaozhenzhe@Debian:~/helloproject$
```

- 设定虚拟机时间

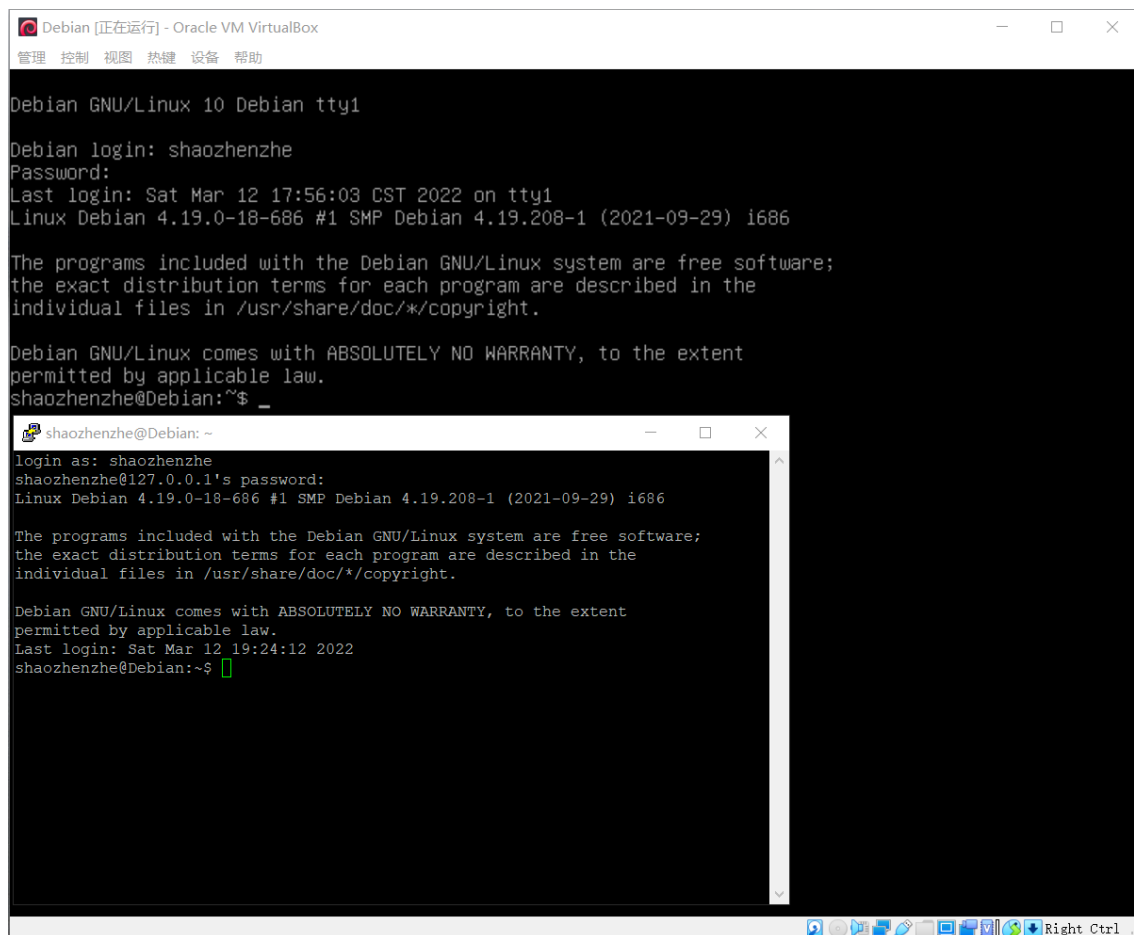
```
date # 查看VM当前时间
sudo apt install ntpdate # 安装ntpdate
sudo ntpdate ntp.ntsc.ac.cn # 与NTSC的 NTP 服务器同步时间
```

```
shaozhenzhe@Debian:~$ date
Sat 12 Mar 2022 05:48:53 PM CST
shaozhenzhe@Debian:~$ sudo apt install ntpdate
[sudo] password for shaozhenzhe:
Reading package lists... Done
Building dependency tree
Reading state information... Done
ntpdate is already the newest version (1:4.2.8p12+dfsg-4).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
shaozhenzhe@Debian:~$ sudo ntpdate ntp.ntsc.ac.cn
12 Mar 17:50:14 ntpdate[1299]: adjust time server 114.118.7.161 offset 0.002551 sec
shaozhenzhe@Debian:~$ _
```

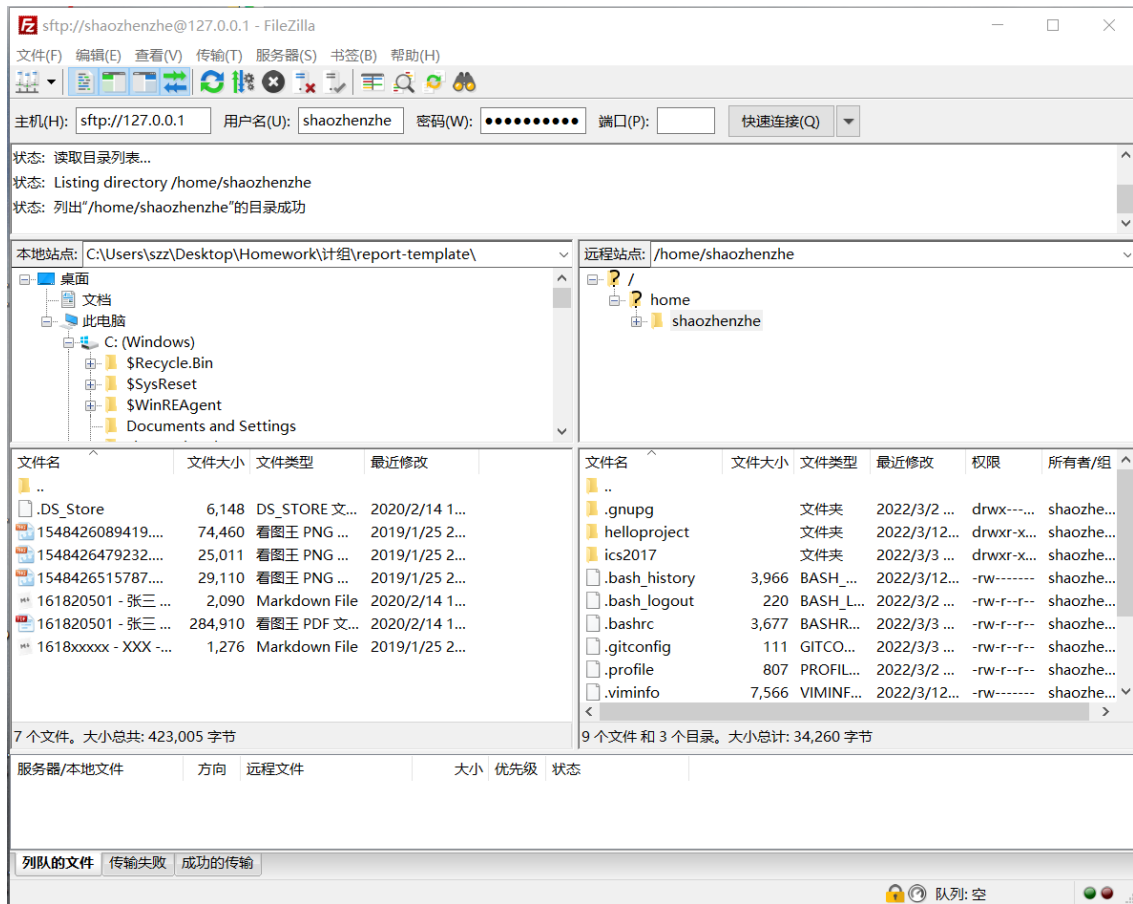
PA0.6 Logging in and Transferring Files via SSH

- 通过 SSH 工具登录 Debian

putty登录

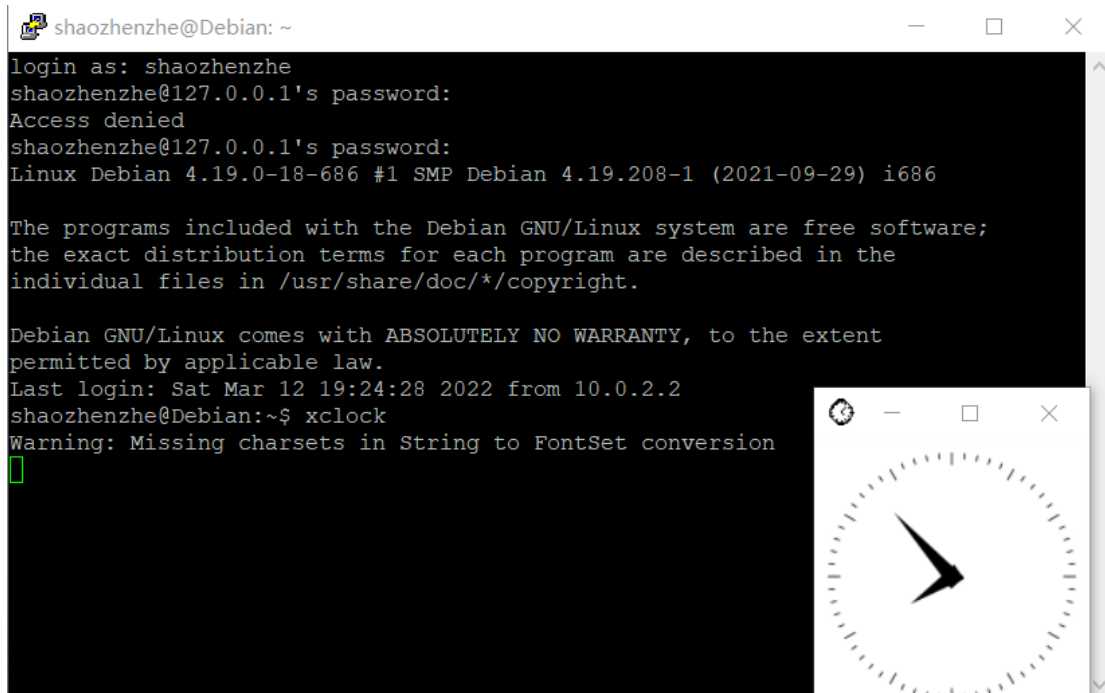


- 使用 SFTP 工具在主机和虚拟机之间传输文件

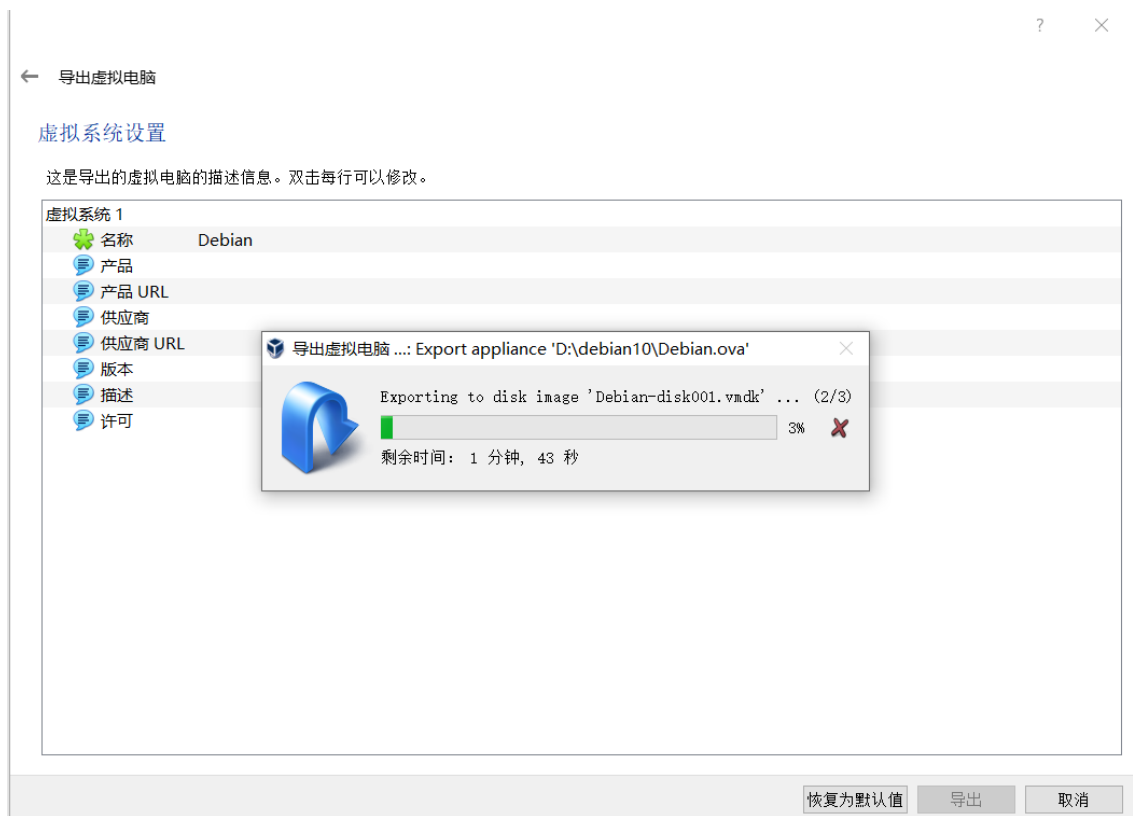


- 配置 X11 服务器

```
sudo apt install x11-apps      # 安装x11-apps
xclock                        # 打开图形时钟
```



- 备份虚拟机



PA0.7 Acquiring Source Code for PAs

- 配置 git 全局配置

```
git config --global user.name "162020130-Shao Zhenzhe" # 设置我的ID和姓名
git config --global user.email "1925861393@qq.com" # 设置我的邮箱
git config --global core.editor vim # 设置编辑器
git config --global color.ui true
```

```
shaozhenzhe@Debian:~$ git config --global user.name "162020130-Shao Zhenzhe"
shaozhenzhe@Debian:~$ git config --global user.email "1925861393@qq.com"
shaozhenzhe@Debian:~$ git config --global core.editor vim
shaozhenzhe@Debian:~$ git config --global color.ui true
shaozhenzhe@Debian:~$
```

- 从指定位置下载 PA 项目代码

```
git clone https://gitee.com/nuaa-pa-2021/ics-pa.git ics2022
```

```
shaozhenzhe@Debian:~$ ls
hello helloproject
shaozhenzhe@Debian:~$ git clone https://gitee.com/nuaa-pa-2021/ics-pa.git ics2022
Cloning into 'ics2022'...
remote: Enumerating objects: 1136, done.
remote: Total 1136 (delta 0), reused 0 (delta 0), pack-reused 1136
Receiving objects: 100% (1136/1136), 2.24 MiB | 1.54 MiB/s, done.
Resolving deltas: 100% (208/208), done.
shaozhenzhe@Debian:~$ ls
hello helloproject ics2022
shaozhenzhe@Debian:~$
```

- 在 PA 项目中设置学号等个人信息

```
git branch # 列出所有分支
git checkout -b pa0 # 创建pa0分支
vim nemu/Makefile.git # 修改项目文件
```



```
shaozhenzhe@Debian: ~/ics2022
commit 3265849835bc752ac62d7e6a4429b846d7fd4214 (HEAD -> pa0)
Author: 162020130-Shao Zhenzhe <1925861393@qq.com>
Date: Sun Mar 13 09:43:57 2022 +0800

    modified stu_id

commit 4e209a8c3237e9281a5e7332eff0fa441fbc5c37 (origin/HEAD, origin/2021, master)
Author: CBrilliant <2423459133@qq.com>
Date: Sun Feb 28 10:39:49 2021 +0800

    modify readme

commit 27d912e8a80fdde55537461a399edb3642effb9c (origin/2020)
Author: Wangshanyue <1466979753@qq.com>
Date: Sun May 3 11:14:43 2020 +0800

    open debug

commit c6e3460dfd580fe14164a0ceafa2d2256ebfa7e6
Merge: 15bfd48 cf2f2a5
Author: Wangshanyue <1466979753@qq.com>
Date: Sun May 3 01:10:15 2020 +0800

:
```

- 在 github(或国内基于 git 的仓库)上开创账号, 上传项目并设置为私有项目




```
git remote add myrepo https://e.coding.net/shaozhenzhe/ics2022/ics2022.git
# 项目推送地址
git checkout master           # 切换到master分支
git push -u myrepo master     # push master分支
git checkout pa0              # 切换到pa0分支
git push myrepo pa0           # push pa0分支
```

```
shaozhenzhe@Debian: ~/ics2022
cd .. && tar cj ics2022 > 162020130.tar.bz2
shaozhenzhe@Debian:~/ics2022$ git remote add myrepo https://e.coding.net/shaozhenzhe/ics2022/ics2022.git
shaozhenzhe@Debian:~/ics2022$ git remote
myrepo
origin
shaozhenzhe@Debian:~/ics2022$ git remote get-url origin
https://gitee.com/nuaa-pa-2021/ics-pa.git
shaozhenzhe@Debian:~/ics2022$ git remote get-url myrepo
https://e.coding.net/shaozhenzhe/ics2022/ics2022.git
shaozhenzhe@Debian:~/ics2022$ git branch
  master
* pa0
shaozhenzhe@Debian:~/ics2022$ git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/2021'.
shaozhenzhe@Debian:~/ics2022$ git push -u myrepo master
Username for 'https://e.coding.net': 1925861393@qq.com
Password for 'https://1925861393@qq.com@e.coding.net':
```

```
shaozhenzhe@Debian: ~/ics2022
Writing objects: 100% (1136/1136), 2.24 MiB | 645.00 KiB/s, done.
Total 1136 (delta 208), reused 1133 (delta 208)
remote: Resolving deltas: 100% (208/208), done.
To https://e.coding.net/shaozhenzhe/ics2022/ics2022.git
* [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'myrepo'.
shaozhenzhe@Debian:~/ics2022$ git checkout pa0
Switched to branch 'pa0'
shaozhenzhe@Debian:~/ics2022$ git branch
  master
* pa0
shaozhenzhe@Debian:~/ics2022$ git push -u myrepo pa0
Username for 'https://e.coding.net': 1925861393@qq.com
Password for 'https://1925861393@qq.com@e.coding.net':
Enumerating objects: 10, done.
Counting objects: 100% (10/10), done.
Compressing objects: 100% (4/4), done.
Writing objects: 100% (7/7), 898 bytes | 898.00 KiB/s, done.
Total 7 (delta 6), reused 4 (delta 3)
To https://e.coding.net/shaozhenzhe/ics2022/ics2022.git
* [new branch]      pa0 -> pa0
Branch 'pa0' set up to track remote branch 'pa0' from 'myrepo'.
shaozhenzhe@Debian:~/ics2022$
```

项目动态

2022-03-13 星期日

- 10:19  shaozhenzhe 推送了新的分支 [pa0](#) 到代码仓库: [ics2022](#)
- 10:17  shaozhenzhe 推送了新的分支 [master](#) 到代码仓库: [ics2022](#)
- 10:04  shaozhenzhe 创建了代码仓库: [ics2022](#)

遇到的问题及解决办法

- 遇到问题: 安装好debian后开机, 发现报 `fixing recursive fault but reboot is needed` 错误
解决方案: 上网搜索得到解决, 打开VirtualBox设置->系统->勾选启用 I/O APIC, 问题解决
- 遇到问题: 输入 `addgroup shaozhenzhe sudo` 后尝试 `sudo apt install vim` 会显示 `is not in the su doers file`
解决方案: 先登出当前用户, 再次登录, 这样sudo组就会更新
- 遇到问题: 输入安装命令 `sudo apt install man build-essential gcc-doc gdb git gcc-multilib libreadline-dev libssl-dev qemu-system-x86 -y` 后报错
解决方案: 尝试一个一个安装, 但是还是报错, 经过仔细检查, 发现配置APT源时输入错误, 修改后尝试一个一个安装成功

实验心得

安装了Debian, 熟悉了Linux的操作, 完成了基础的环境配置, 对于一些报错也能做到自行网上搜索并解决, 英语阅读能力提高了。增加了安装虚拟机的知识, 了解了putty可以连接主机和虚拟机, 学会了用FileZilla传输文件。期待后面的实验能够更加了解Linux。

其他备注

无