操作系统课程设计实验报告

实验名称	编译 Linux 内核		
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一、实验目的

Linux 的内核是完全公开的，任何人在遵循 GPL 的情况下都可以参与内核修改。新版本修订了旧内核的缺陷，并增加了许多新特性。用户可以重新编译内核来获得更新。

本实验目的是在编译内核的过程中熟悉 Linux 系统，为以后进一步学习做铺垫。

二、实验内容

Linux 常用命令的使用，编译并安装 Liunx 新内核，更新 grub 引导

三、实验环境及配置方法

处理器：**Inel(R) Core(TM)i7-6500U**

内存：8.0GB DDR3

操作系统：Ubuntu 16.04 LTS 64-bit

内核版本：4.10.0

Gcc 版本：5.4.0

Make 版本：4.1

四、实验方法和实验步骤（程序设计与实现）

1. 下载内核源代码：
   1）下载地址：https://www.kernel.org 下载最新的 4.15.7 版本内核
   2）也可以使用 Ubuntu 的下载工具 wget 进行下载

```
wget https://www.kernel.org/pub/linux/kernel/v4.x/linux-4.15.7.tar.gz
```

   3）解压源代码

```
tar xzvf linux-4.15.7.tar.gz
```

2. 查看当前内核版本

```
yuheng@ubuntu: ~
yuheng@ubuntu:~$ uname -r
4.10.0-28-generic
yuheng@ubuntu:~$
```

3. 配置内核编译选项

1）使用原有内核配置

```
Sudo make oldconfig
```

```
yuheng@ubuntu: ~/Downloads/linux-4.15.7
yuheng@ubuntu:~$ dir
Desktop     Downloads         Music     Public     Videos
Documents   examples.desktop  Pictures  Templates
yuheng@ubuntu:~$ cd Downloads/
yuheng@ubuntu:~/Downloads$ cd linux-4.15.7/
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make oldconfig
[sudo] password for yuheng:
scripts/kconfig/conf  --oldconfig Kconfig
#
# configuration written to .config
#
```

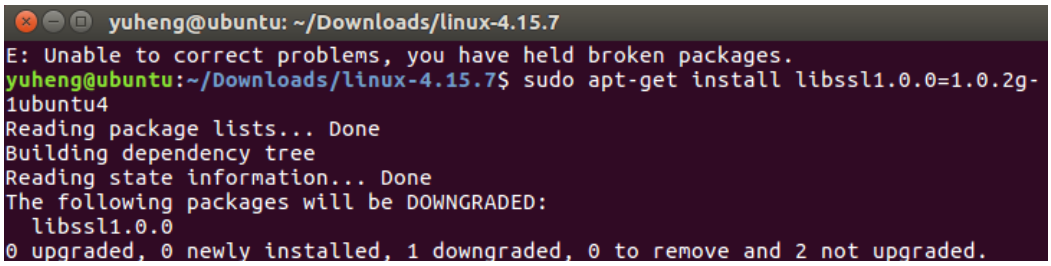
4. 编译内核和模块

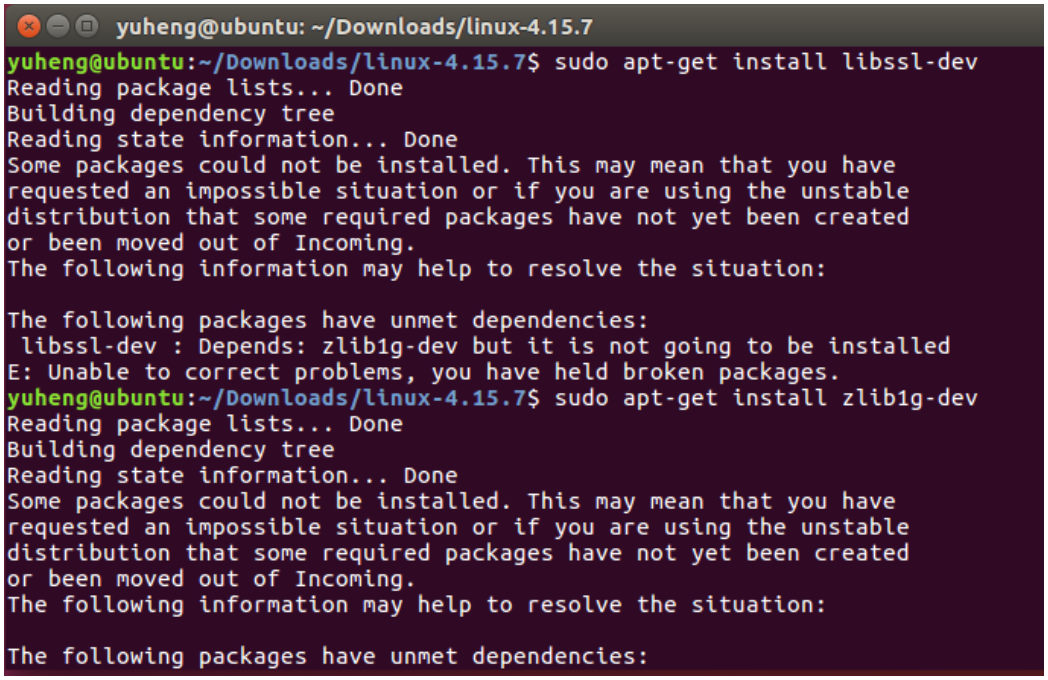
1）编译内核

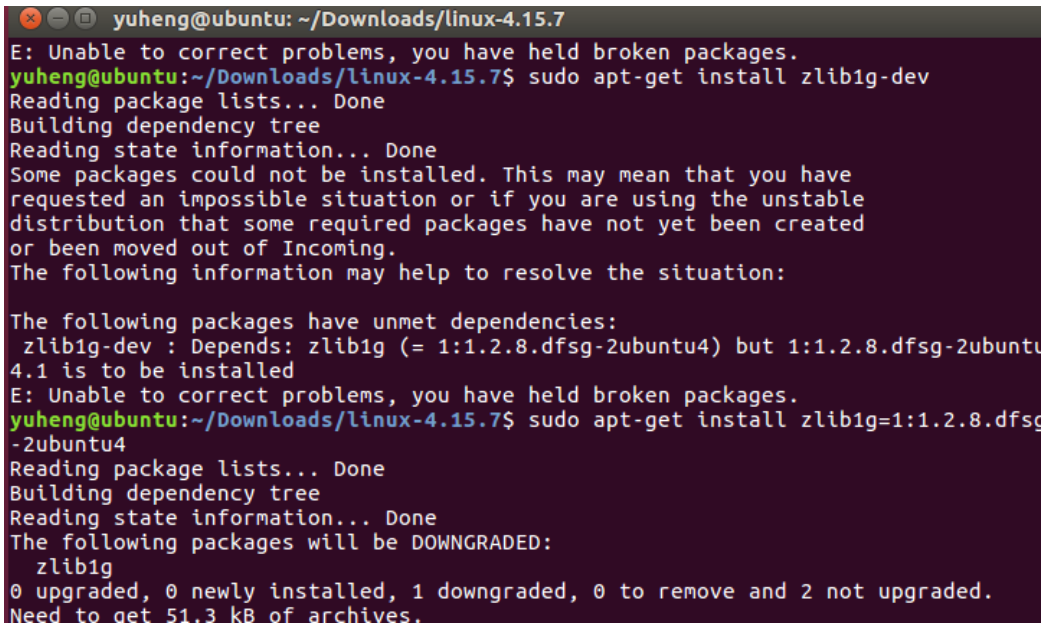
```
Sudo make baImage
```

缺少安装环境，报错，解决步骤如下

```
yuheng@ubuntu: ~/Downloads/linux-4.15.7
#
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make bzImage
scripts/kconfig/conf  --silentoldconfig Kconfig
  CHK     include/config/kernel.release
  CHK     include/generated/uapi/linux/version.h
  CHK     include/generated/utsrelease.h
  CHK     include/generated/timeconst.h
  CHK     include/generated/bounds.h
  CHK     include/generated/asm-offsets.h
  CALL    scripts/checksyscalls.sh
  DESCEND  objtool
  CHK     scripts/mod/devicetable-offsets.h
  HOSTCC  scripts/sign-file
scripts/sign-file.c:25:30: fatal error: openssl/opensslv.h: No such file or dire
ctory
compilation terminated.
scripts/Makefile.host:90: recipe for target 'scripts/sign-file' failed
make[1]: *** [scripts/sign-file] Error 1
Makefile:557: recipe for target 'scripts' failed
make: *** [scripts] Error 2
```


yuheng@ubuntu: ~/Downloads/linux-4.15.7
E: Unable to correct problems, you have held broken packages.
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install libssl1.0.0=1.0.2g-1ubuntu4
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be DOWNGRADED:
libssl1.0.0
0 upgraded, 0 newly installed, 1 downgraded, 0 to remove and 2 not upgraded.


yuheng@ubuntu: ~/Downloads/linux-4.15.7
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install libssl-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
Some packages could not be installed. This may mean that you have
requested an impossible situation or if you are using the unstable
distribution that some required packages have not yet been created
or been moved out of Incoming.
The following information may help to resolve the situation:
The following packages have unmet dependencies:
libssl-dev : Depends: zlib1g-dev but it is not going to be installed
E: Unable to correct problems, you have held broken packages.
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install zlib1g-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
Some packages could not be installed. This may mean that you have
requested an impossible situation or if you are using the unstable
distribution that some required packages have not yet been created
or been moved out of Incoming.
The following information may help to resolve the situation:
The following packages have unmet dependencies:


yuheng@ubuntu: ~/Downloads/linux-4.15.7
E: Unable to correct problems, you have held broken packages.
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install zlib1g-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
Some packages could not be installed. This may mean that you have
requested an impossible situation or if you are using the unstable
distribution that some required packages have not yet been created
or been moved out of Incoming.
The following information may help to resolve the situation:
The following packages have unmet dependencies:
zlib1g-dev : Depends: zlib1g (= 1:1.2.8.dfsg-2ubuntu4) but 1:1.2.8.dfsg-2ubuntu4.1 is to be installed
E: Unable to correct problems, you have held broken packages.
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install zlib1g=1:1.2.8.dfsg-2ubuntu4
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be DOWNGRADED:
zlib1g
0 upgraded, 0 newly installed, 1 downgraded, 0 to remove and 2 not upgraded.
Need to get 51.3 kB of archives.

```
yuheng@ubuntu: ~/Downloads/linux-4.15.7
Setting up zlib1g:amd64 (1:1.2.8.dfsg-2ubuntu4) ...
Processing triggers for libc-bin (2.23-0ubuntu9) ...
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install zlib1g-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  zlib1g-dev
0 upgraded, 1 newly installed, 0 to remove and 2 not upgraded.
Need to get 168 kB of archives.
After this operation, 426 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu xenial/main amd64 zlib1g-dev amd64 1:1
.2.8.dfsg-2ubuntu4 [168 kB]
Fetched 168 kB in 5s (28.9 kB/s)
Selecting previously unselected package zlib1g-dev:amd64.
(Reading database ... 178709 files and directories currently installed.)
Preparing to unpack .../zlib1g-dev_1%3a1.2.8.dfsg-2ubuntu4_amd64.deb ...
Unpacking zlib1g-dev:amd64 (1:1.2.8.dfsg-2ubuntu4) ...
Processing triggers for man-db (2.7.5-1) ...
Setting up zlib1g-dev:amd64 (1:1.2.8.dfsg-2ubuntu4) ...
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo apt-get install libssl-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
```

```
yuheng@ubuntu: ~/Downloads/linux-4.15.7
Setting up libssl-dev:amd64 (1.0.2g-1ubuntu4) ...
Setting up libssl-doc (1.0.2g-1ubuntu4) ...
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make bzImage
  CHK     include/config/kernel.release
  CHK     include/generated/uapi/linux/version.h
  CHK     include/generated/utsrelease.h
```

在编译内前需要安装一些依赖。成功编译的步骤如下

由于已经包含更高版本的 libssl，需要先对版本进行降级
sudo apt-get install libssl1.0.0=1.0.0g1ubuntu4
sudo apt-get install zlib1g-dev
sudo apt-get install zlib1g=1:1.2.8.dfsg2ubuntu4
sudo apt-get install libssl-dev
sudo make baImage

2）编译模块

```
sudo make modules
```

```
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make modules
[sudo] password for yuheng:
  CHK     include/config/kernel.release
  CHK     include/generated/uapi/linux/version.h
  CHK     include/generated/utsrelease.h
```

3）安装内核模块

```
sudo make modules_install
```

```
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make modules_install
[sudo] password for yuheng:
  INSTALL arch/x86/crypto/aes-x86_64.ko
  INSTALL arch/x86/crypto/aesni-intel.ko
  INSTALL arch/x86/crypto/blowfish-x86_64.ko
```

4）安装内核

```
sudo make install
```

```
yuheng@ubuntu: ~/Downloads/linux-4.15.7
yuheng@ubuntu:~/Downloads/linux-4.15.7$ sudo make install
sh ./arch/x86/boot/install.sh 4.15.7 arch/x86/boot/bzImage \
        System.map "/boot"
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 4.15.7 /boot/vmlinu
z-4.15.7
```

5. 配置启动项

```
sudo update-grub
```

五、实验结果和分析

重新启动虚拟机，按住 shift 键即可进入引导菜单

```
*Ubuntu, with Linux 4.15.7
 Ubuntu, with Linux 4.15.7 (upstart)
 Ubuntu, with Linux 4.15.7 (recovery mode)
 Ubuntu, with Linux 4.10.0-28-generic
 Ubuntu, with Linux 4.10.0-28-generic (upstart)
 Ubuntu, with Linux 4.10.0-28-generic (recovery mode)
```

选择新安装的 linux 内核 4.15.7.进入后查看内核版本

```
yuheng@ubuntu: ~
yuheng@ubuntu:~$ uname -r
4.15.7
yuheng@ubuntu:~$
```

六、讨论、心得

通过本次实验中，逐步熟悉了 linux 操作系统的使用方式，熟悉了 Linux 的基本命令。在进行编译的过程中遇到了许多书本上没有提示的 bug。通过百度，google 查询报错提示，逐个解决。而问题往往是一环套一环的。必须一层一层的解决。这个自己懂手逐步解决问题的过程才是我在本次实验中获得的最大的收获。