

SHANGHAI JIAO TONG UNIVERSITY

CS353 LINUX KERNEL

Project1: Compile the Linux Kernel

Chao Gao

5142029014

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1 Introduction

This project is aimed to compile the linux kernel which I downloaded from the Internet. And it helps us have a better understanding about linux. Actually, this project is quite simple but costs time, and I also meet some challenges. The details are as follows.

2 Environment

Virtual OS: Ubuntu 16.04.


kernel version(origin): 4.8.0.

kernel version(new): 4.9.13.

3 Overall Procedure

Here I will present the whole process of this project.

3.1 Download the linux kernel

Protocol	Location	Latest Stable Kernel:		
HTTP	https://www.kernel.org/pub/	 4.10.1		
Git	https://git.kernel.org/			
RSYNC	rsync://rsync.kernel.org/pub/			
mainline:	4.10	2017-02-19	[tar.xz] [pgp] [patch]	[view diff] [browse]
stable:	4.10.1	2017-02-26	[tar.xz] [pgp] [patch]	[view diff] [browse] [changelog]
longterm:	4.9.13	2017-02-26	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	4.4.52	2017-02-26	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	4.1.38	2017-01-18	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.18.48 [EOL]	2017-02-08	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.16.41	2017-02-26	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.12.70	2017-02-01	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.10.105	2017-02-10	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.4.113	2016-10-26	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
longterm:	3.2.86	2017-02-26	[tar.xz] [pgp] [patch] [inc. patch]	[view diff] [browse] [changelog]
linux-next:	next-20170303	2017-03-03		[browse]

Here I choose the longterm version 4.9.13.

3.2 Install some packages

```
1 sudo apt-get install libncurses5-dev
2 sudo apt-get install libssl-dev
```

3.3 Preparation

```
1 cp linux-4.9.13.tar.xz /usr/src
2 cd /usr/src
3 tar xvf linux-4.9.13.tar.xz #extract the kernel
4 cd /usr/src/linux-4.9.13
5 make menuconfig             #configure the kernel
```

3.4 Compile and install the kernel

```
1 make -j4
2 make modules_install
3 make install
```

3.5 Update grub

```
1 cd /boot
2 mkinitramfs 4.9.13 -o /boot/initrd.img
3 update-grub
```

3.6 Check result

After all the steps above, reboot the system, now we can check the kernel version.

```
gao@ubuntu: ~/Downloads
gao@ubuntu:~/Downloads$ uname -r
4.9.13
gao@ubuntu:~/Downloads$ uname -a
Linux ubuntu 4.9.13 #1 SMP Fri Mar 3 05:57:08 PST 2017 x86_64 x86_64 x86_64 GNU/
Linux
gao@ubuntu:~/Downloads$
```

So it can be seen the kernel has been replaced. The project has already been done.

4 Analysis

Since the project is not that difficult and the instructions provided are very detailed, I don't have to do too much exploration. However, there are still some problems along the procedure, which will be discussed in this part.

4.1 Package

First time I start the compilation, suddenly a mistake occurs.

```
scripts/sign-file.c:25:30: fatal error: openssl/opensslv.h: No such file or dire
ctory
compilation terminated.
scripts/Makefile.host:107: recipe for target 'scripts/sign-file' failed
make[1]: *** [scripts/sign-file] Error 1
make[1]: *** Waiting for unfinished jobs....
Makefile:560: recipe for target 'scripts' failed
make: *** [scripts] Error 2
make: *** Waiting for unfinished jobs....
```

I copy the error message to search the Internet, and luckily I find the solution, that is some packages need to be installed.

```
1 sudo apt-get install libssl-dev
```

4.2 Memory exhausted

After solving the above problem, I start the compilation again, it takes lots of time, but about one and a half hours later, another error message appears.

```
ld: final link failed: Memory exhausted
Makefile:969: recipe for target 'vmlinux' failed
make: *** [vmlinux] Error 1
```

I also find a solution on the Internet. That is to expand the stack size.

```
gao@ubuntu:~$ ulimit -a
core file size          (blocks, -c) 0
data seg size           (kbytes, -d) unlimited
scheduling priority     (-e) 0
file size               (blocks, -f) unlimited
pending signals         (-i) 6604
max locked memory       (kbytes, -l) 64
max memory size         (kbytes, -m) unlimited
open files              (-n) 1024
pipe size               (512 bytes, -p) 8
POSIX message queues    (bytes, -q) 819200
real-time priority      (-r) 0
stack size              (kbytes, -s) 8192
cpu time                (seconds, -t) unlimited
max user processes      (-u) 6604
virtual memory          (kbytes, -v) unlimited
file locks              (-x) unlimited
```

```
1 ulimit -s 16384
```

Again, I start to compile the kernel, another one and a half hours elapses, but this error appears again. It is very disappointing, but I still try other ways. Since the memory is exhausted, it is a direct thought to expand the memory of the virtual machine. So I change the memory size from 1G to 2G.

I start the compilation the third time, and luckily this time I succeed finally.

4.3 Update grub

The guidance provided is as follows.

```
1 mkinitrd -o initrd.img<kernel version>
```

However, there is no such command in Ubuntu, it is for the linux distribution called Fedora. I have to change it to another command as follows.

```
1 mkinitramfs 4.9.13 -o /boot/initrd.img
```

5 Summary

From this project, I start the long way of learning linux kernel. Though the beginning is painful, I really gain a lot. This project is simple but time-costing, only patience can survive, luckily I accomplish the project finally by myself. Thanks Prof.Chen for the guidance about the linux kernel.