Shanghai Jiao Tong University

CS353 Linux kernel

Project1: Compile the Linux Kernel

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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.

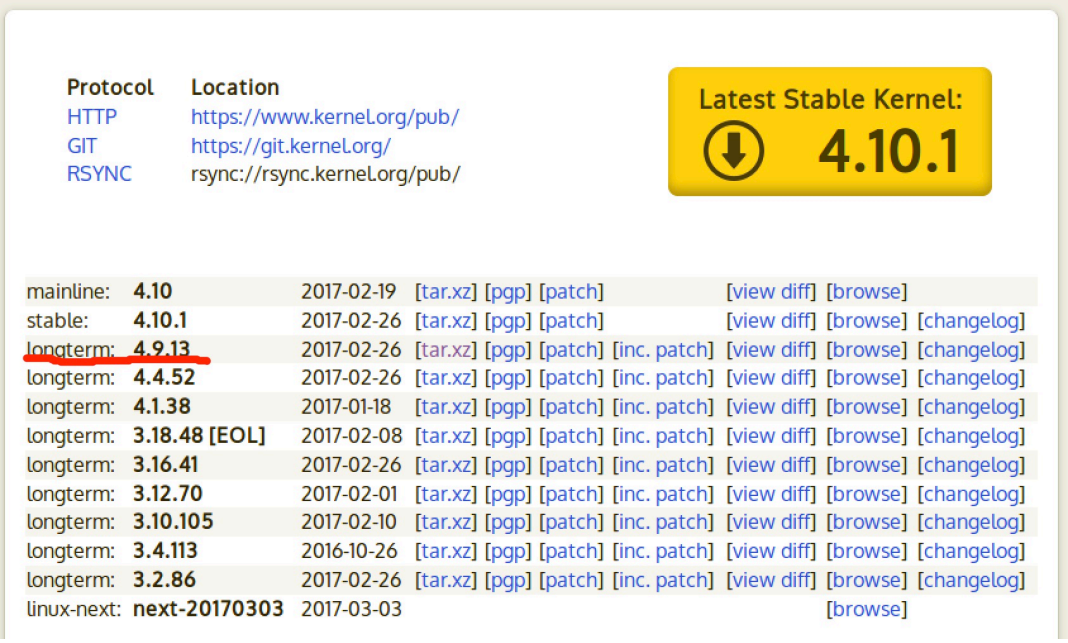
2 Environment

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
HTTP	https://www.kernel.org/pub/
GIT	https://git.kernel.org/
RSYNC	rsync://rsync.kernel.org/pub/

Latest Stable Kernel: 4.10.1

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

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

3.3 Preparation

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

3.4 Compile and install the kernel

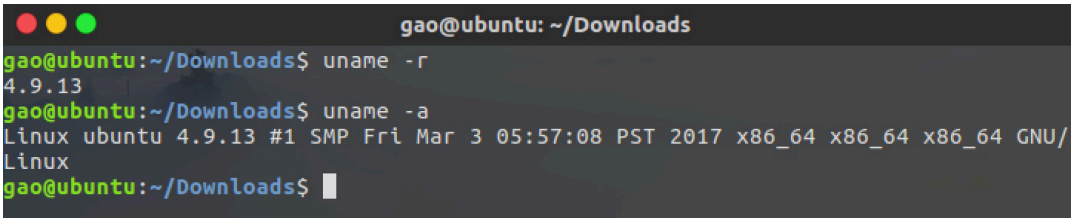
```
make -j4
make modules_install
make install
```

3.5 Update grub

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

3.6 Check result

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



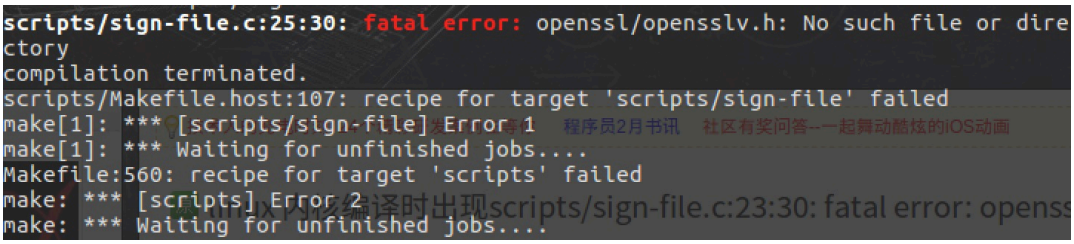
So it can be seen the kernel has been replaced. The project has already been done.

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.

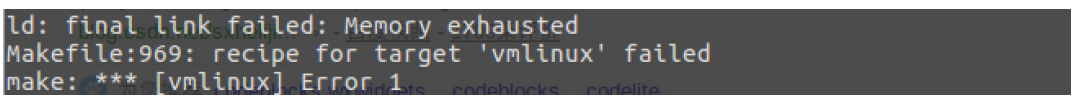


I copy the error message to search the Internet, and luckily I find the solution, that is some packages need to be installed.

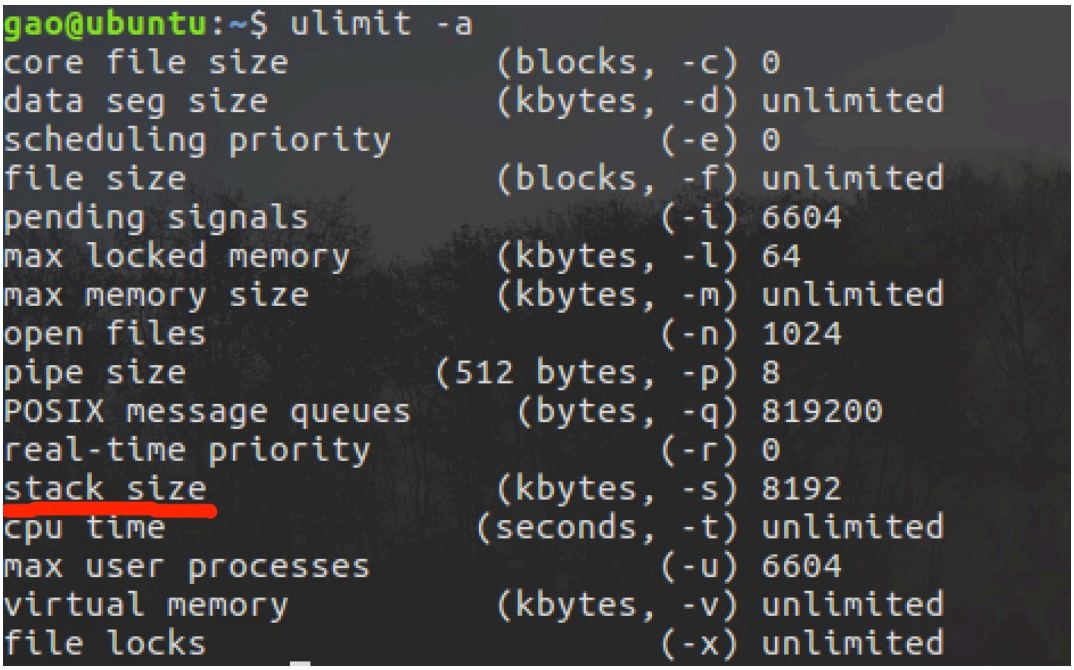
```
1 sudo apt-get install libssl-dev
```

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.



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




```
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 guidence 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.