

# 南昌大学实验报告3

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专业班级：计算机科学与技术153

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课程名称：Linux程序设计实验

## 实验项目名称

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## C Programming in Linux

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### 实验目的

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- 1.在Linux下进行C语言程序设计
- 2.使用Makefile
- 3.使用GDB

### 实验基础

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C语言、Makefile、GDB

### 实验步骤

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#### 实验一 -- Use C and Makefile for Coding

##### TASK1 -- 编译运行 Linux Poem: The American C

step1.摘抄源代码: Linux Poem: The American C

```

long long time, ago,
i, can, still, remember, how;
typedef struct s{} was,
all, we, had;

s o, I, knew, If=I; had my, chance =
I, could, code, a, perfect, prance;

s ee; was ruling;
we were, happy
,good ,ole, times;

all that, changed, when; class es{} came;
we got, spoiled, And, thats = a, shame;

all is, broken, noting;s same
,c_plus_plus, has, killed, the, flame;

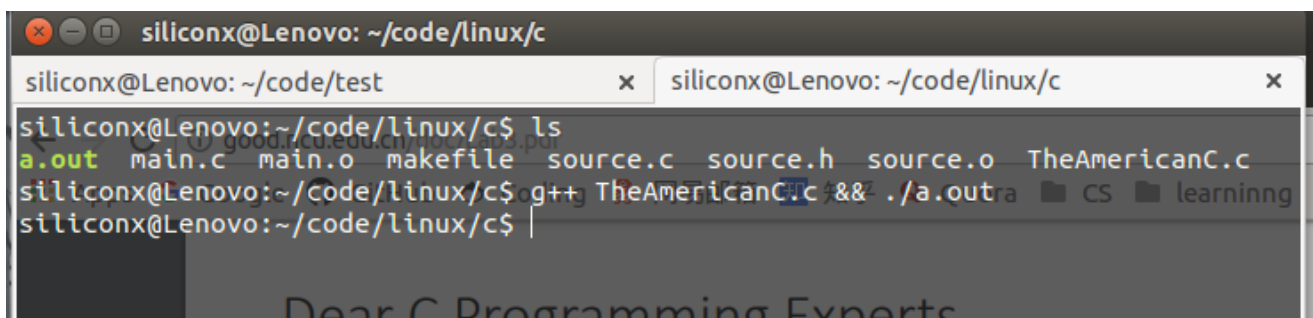
had We, believed, iin, rocknroll=
could,ve, coding, cured, our, mortal, souls;

we met=a, girl, who, sang= the, blues;
we asked, her, For, some= happy, news;

s he, said, to, me, with, pretty, smile
=If, you, are; main(){
    return
        the,
        time;
}

```

## step2.编译运行



```

siliconx@Lenovo: ~/code/linux/c
siliconx@Lenovo: ~/code/test x siliconx@Lenovo: ~/code/linux/c x
siliconx@Lenovo:~/code/linux/c$ ls
a.out  main.c  main.o  makefile  source.c  source.h  source.o  TheAmericanC.c
siliconx@Lenovo:~/code/linux/c$ g++ TheAmericanC.c && ./a.out
siliconx@Lenovo:~/code/linux/c$

```

## TASK2 -- 分割代码

### 1.source.h

```
#ifndef SOURCE_H
```

```

#define SOURCE_H

long long time, ago,
i, can, still, remember, how;
typedef struct s{} was,
all, we, had;

s o, I, knew, If=I; had my, chance =
I, could, code, a, perfect, prance;

s ee; was ruling;
we were, happy
,good ,ole, times;

all that, changed, when; class es{} came;
we got, spoiled, And, thats = a, shame;

all is, broken, noting;s same
,c_plus_plus, has, killed, the, flame;

had We, believed, iin, rocknroll=
could,ve, coding, cured, our, mortal, souls;

we met=a, girl, who, sang= the, blues;
we asked, her, For, some= happy, news;

s he, said, to, me, with, pretty, smile
=If, you, are;

#endif

```

## 2.source.c

```
// source.c 为空
```

## 3.main.c

```

#include "source.h"

main(){
    return
        the,
        time;
}

```

## TASK3 -- 通过make编译上述代码

### step1.编写Makefile

```
#main/Makefile

all: executable

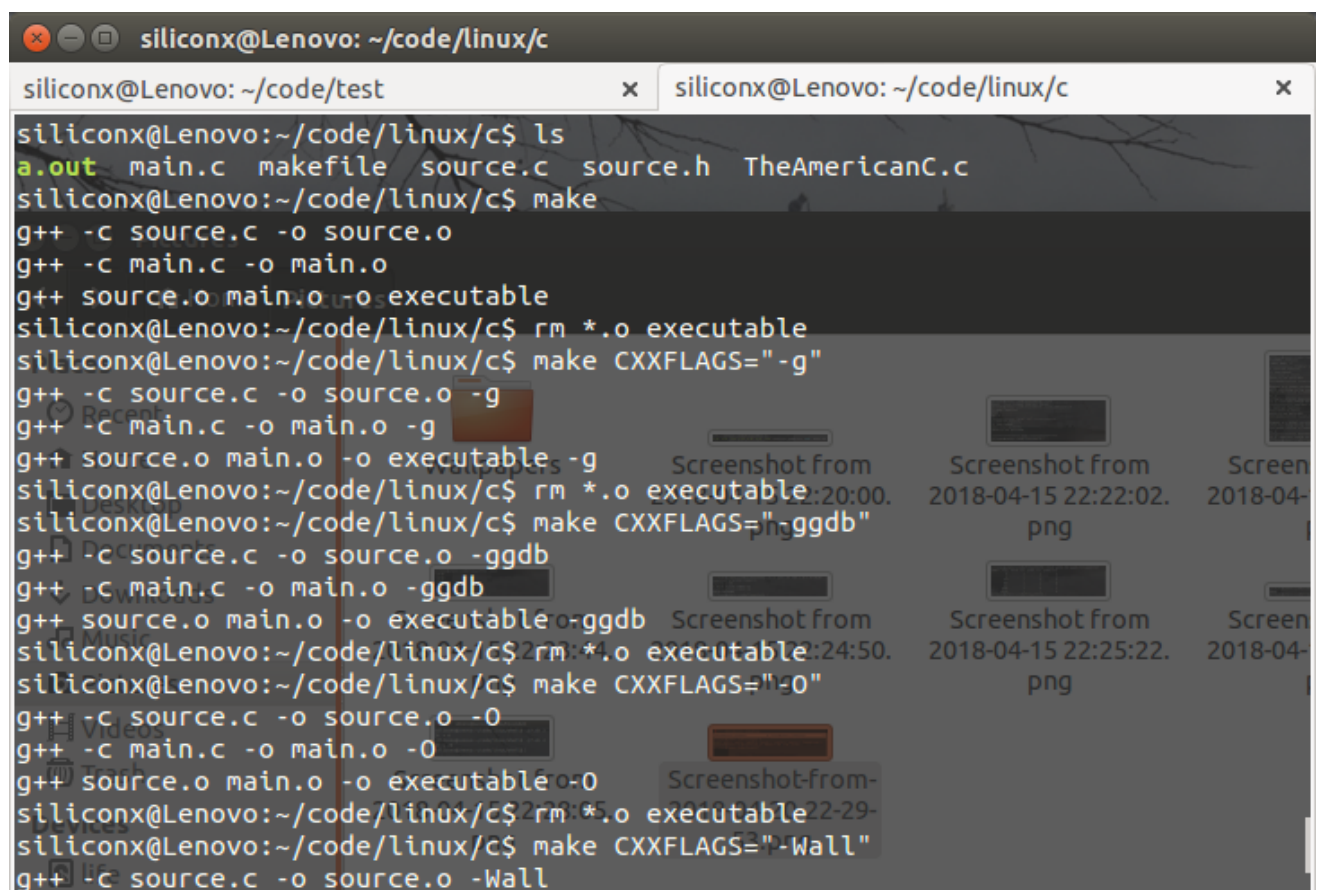
executable: source.o main.o
    g++ source.o main.o -o executable $(CXXFLAGS)

source.o: source.c source.h
    g++ -c source.c -o source.o $(CXXFLAGS)

main.o: main.c
    g++ -c main.c -o main.o $(CXXFLAGS)
```

### step2.使用不同的flag进行编译

使用 -g, -ggdb, -O参数均可正常编译



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

```
siliconx@Lenovo: ~/code/linux/c
siliconx@Lenovo: ~/code/test
siliconx@Lenovo: ~/code/linux/c$ ls
a.out  main.c  makefile  source.c  source.h  TheAmericanC.c
siliconx@Lenovo: ~/code/linux/c$ make
g++ -c source.c -o source.o
g++ -c main.c -o main.o
g++ source.o main.o -o executable
siliconx@Lenovo: ~/code/linux/c$ rm *.o executable
siliconx@Lenovo: ~/code/linux/c$ make CXXFLAGS="-g"
g++ -c source.c -o source.o -g
g++ -c main.c -o main.o -g
g++ source.o main.o -o executable -g
siliconx@Lenovo: ~/code/linux/c$ rm *.o executable
siliconx@Lenovo: ~/code/linux/c$ make CXXFLAGS="-ggdb"
g++ -c source.c -o source.o -ggdb
g++ -c main.c -o main.o -ggdb
g++ source.o main.o -o executable -ggdb
siliconx@Lenovo: ~/code/linux/c$ rm *.o executable
siliconx@Lenovo: ~/code/linux/c$ make CXXFLAGS="-O"
g++ -c source.c -o source.o -O
g++ -c main.c -o main.o -O
g++ source.o main.o -o executable -O
siliconx@Lenovo: ~/code/linux/c$ rm *.o executable
siliconx@Lenovo: ~/code/linux/c$ make CXXFLAGS="-Wall"
g++ -c source.c -o source.o -Wall
```

使用-Wall参数编译报错

```
siliconx@Lenovo:~/code/linux/c$ make CXXFLAGS="-Wall"
g++ -c source.c -o source.o -Wall
g++ -c main.c -o main.o -Wall
main.c:3:6: warning: ISO C++ forbids declaration of 'main' with no type [-Wreturn-type]
main(){
main.c: In function 'int main()':
main.c:6:9: warning: left operand of comma operator has no effect [-Wunused-value]
    time;
g++ source.o main.o -o executable -Wall
siliconx@Lenovo:~/code/linux/c$
```

## 实验二 -- 使用sys/stat.h等库进行文件统计并使用Makefile编译

### step1.编写代码

main.c

```
#include <sys/types.h>
#include <sys/stat.h>
#include <unistd.h>
#include <stdio.h>
#include "functions.h"

int main(int argc, char* argv[]) {
    char* path = argv[1];
    if (argc != 2) {
        printf("ARGS ERROR\n");
        return 1;
    }

    struct stat path_stat;
    if (stat(path, &path_stat) != 0) {
        printf("PATH INCORRECT!!!\n");
        return 1;
    }

    if (S_ISREG(path_stat.st_mode)) {
        printf("`%s` is a file\n", path);

        if (is_owner(path_stat.st_uid)) {
            printf("you are the owner of the file, and now changing the permissions to 777 of the file\n");
            chmod_to_777(path);
            printf("done!\n");
        } else {
            printf("you are NOT the owner of the file\n");
        }
    }
}
```

```
    } else {  
        printf("`%s` is a dir\n", path);  
    }  
}
```

functions.h

```
#include <sys/types.h>  
#include <sys/stat.h>  
#include <unistd.h>  
  
int is_owner(int);  
int chmod_to_777(char*);
```

functions.c

```
#include "functions.h"  
  
int is_owner(int file_uid) {  
    return getuid() == file_uid;  
}  
  
int chmod_to_777(char* path) {  
    chmod(path, S_IRWXU | S_IRWXG | S_IRWXO);  
    return 0;  
}
```

makefile

```
#main/Makefile  
  
out: functions.o main.o  
    g++ functions.o main.o -o out  
  
functions.o: functions.c functions.h  
    g++ -c functions.c -o functions.o  
  
main.o: main.c  
    g++ -c main.c -o main.o
```

**step2.使用make编译**

```
siliconx@Lenovo:~/code/linux/c/statistics$ make
g++ -c functions.c -o functions.o
g++ -c main.c -o main.o
g++ functions.o main.o -o out
```

### step3.测试运行代码

```
siliconx@Lenovo:~/code/linux/c/statistics$ ls -la test
----- 1 siliconx siliconx 6 Apr 21 09:04 test
siliconx@Lenovo:~/code/linux/c/statistics$ ./out test
'test' is a file
you are the owner of the file, and now changing the permissions to 777 of the fi
le
done!
siliconx@Lenovo:~/code/linux/c/statistics$ ./out
ARGS ERROR
siliconx@Lenovo:~/code/linux/c/statistics$ ./out /abc
PATH INCORRECT!!!
siliconx@Lenovo:~/code/linux/c/statistics$ ./out /etc-c functions.c -o functions.
'/etc' is a dir
siliconx@Lenovo:~/code/linux/c/statistics$ ./out /etc/profile
'/etc/profile' is a file
you are NOT the owner of the file
siliconx@Lenovo:~/code/linux/c/statistics$ sudo su
[sudo] password for siliconx:
root@Lenovo:/home/siliconx/code/linux/c/statistics# ./out test
'test' is a file
you are NOT the owner of the file
root@Lenovo:/home/siliconx/code/linux/c/statistics# exit
exit
siliconx@Lenovo:~/code/linux/c/statistics$
```

## 实验三 -- GDB

### step1.编译可调试的可执行文件

```
siliconx@Lenovo:~/code/test
siliconx@Lenovo:~/code/linux/c$ ls
a.out main.c main.o makefile source.c source.h source.o TheAmericanC.c
siliconx@Lenovo:~/code/linux/c$ g++ TheAmericanC.c -g
siliconx@Lenovo:~/code/linux/c$
```

### step2.打断点



```
siliconx@Lenovo: ~/code/linux/c
siliconx@Lenovo:~$ cd code/linux/c/
siliconx@Lenovo:~/code/linux/c$ ls
a.out  main.o  main.c  source.c  source.o  TheAmericanC.c
siliconx@Lenovo:~/code/linux/c$ gdb a.out
GNU gdb (Ubuntu 7.7.1-0ubuntu5~14.04.3) 7.7.1
Copyright (C) 2014 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from a.out...done.
(gdb) break 1
Breakpoint 1 at 0x4004f1: file TheAmericanC.c, line 1.
(gdb)
```

## 实验三 -- GDB

step1.编译可调试的可执行

step3.运行并打印栈信息

```
siliconx@Lenovo: ~/code/linux/c
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from a.out...done.
(gdb) break 1
Breakpoint 1 at 0x4004f1: file TheAmericanC.c, line 1.
(gdb) r
Starting program: /home/siliconx/code/linux/c/a.out

Breakpoint 1, main () at TheAmericanC.c:29
29      time;
(gdb) bt
#0  main () at TheAmericanC.c:29
(gdb) c
Continuing.
[Inferior 1 (process 3084) exited normally]
(gdb)
```

## 实验三 -- GDB

step1.编译可调试的可执行

step2.打断点



## 实验思考

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1.注意Makefile的编写规则

2.GDB的各个参数

3.sys/stat库的使用

## 参考资料

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《Linux程序设计》

《C语言程序设计》