Makefile GCC

6. Makefile GCC

6.1

6.1.1

PC PC ARM

ARM ARM PC ARM ARM GCC ARM ARM

ARM PC PC ARM

1) gcc PC X86

2) ARM

X86 ARM

“ ”

PC

ARM

PC ARM

PC ARM “ ” PC ARM “ ”

1) Ubuntu arm-linux-gcc

2) Windows ADS ARM armcc

3) Windows cygwin arm-elf-gcc

6.1.2

1)

2)

3)

6.1.3

main.c gcc

main.c

```
#include <stdio.h>

int main()
{
    printf("100ask\n");
    return 0;
}
```

```
$ gcc main.c –o 100ask
$ ./100ask
100ask
$
```

```
$ chmod 777 100ask
$ ./100ask
./100ask: line 1: syntax error: unexpected “(”
$
```

X86

Ubuntu gcc 1.2 SDK gcc arm-linu

gcc x86

arm-linux- gcc RSIC ARM

6.2 gcc 1_gcc __gcc

6.2.1 gcc

C/C++ (preprocessing) (compilation) (assembly) (linking) 4

Image not found or type unknown

6.1.2.1

C/C++ “#” “#include” “#define” “#if” “#ifdef” (inclu

6.1.2.2

“.s”

6.1.2.3

“.o”

6.1.2.4

4

.c	C	
.C	C++	
.cc	C++	
.cxx	C++	
.m	Objective-C	
.i	C	
.ii	C++	
.s		

.S		
.h		

(linker)

.o (Object file OBJ)

.a (Archive file)

“-c” “-S” “-E” ( ) .o “-l” (

6.2.2 gcc

gcc

```
gcc [  ]
```

gcc c gcc gcc gcc

gcc mian.c

main.c:

```
#include <stdio.h>

#define HUNDRED 100

int main()
{
  printf("%d ask\n",HUNDRED);
  return 0;
}
```

: Git NoosProgramProject/ 6_Makefile GCC/001_gcc_01001_gcc_01

6.2.2.1

gcc gcc

1 (-E)

C/C++ “#” “#include” “#define” “#if” “#ifdef” (inclu

```
$ gcc -E main.c -o main.i
```

main.i main.i

```
extern int ftrylockfile (FILE *__stream) __attribute__ ((__nothrow__ , __leaf__)) ;

extern void funlockfile (FILE *__stream) __attribute__ ((__nothrow__ , __leaf__));

# 942 "/usr/include/stdio.h" 3 4

# 2 "main.c" 2

# 5 "main.c"

int main()

{

printf("%d ask\n",100);

return 0;

}
```

printf HUNDRED

2 (-S)

C/C++ (“.i”)“ ”

```
$ gcc -S main.c -o main.s
```

main.s main.s

```
        .file   "main.c"
        .text
        .section        .rodata
.LC0:
        .string "%d ask\n"
        .text
        .globl  main
```

```
	.type	main, @function
main:
.LFB0:
	.cfi_startproc
	pushq	%rbp
	.cfi_def_cfa_offset 16
	.cfi_offset 6, -16
	movq	%rsp, %rbp
	.cfi_def_cfa_register 6
	movl	$100, %esi
	leaq	.LC0(%rip), %rdi
	movl	$0, %eax
	call	printf@PLT
	movl	$0, %eax
	popq	%rbp
	.cfi_def_cfa 7, 8
	ret
	.cfi_endproc
.LFE0:
	.size	main, .-main
	.ident	"GCC: (Ubuntu 7.5.0-3ubuntu1~18.04) 7.5.0"
	.section	.note.GNU-stack,"",@progbits
```

3 (-c)

“.s” Linux ELF (OBJ)

```
$ gcc -c main.c -o main.o
```

main.o( )

6.2.2.2

gcc

1 *filename*-o

-o*filename*

```
$ gcc main.c -o main
```

main

```
$ ls
main.c main
$ ./main
$ 100 ask
```

a.out

```
$ gcc main.c
```

a.out

```
$ ls
a.out main.c
$ ./a.out
$ 100 ask
```

2 -Wall

Git NoosProgramProject/(6_Makefile GCC/001_gcc_02)

main.c:

```
#include <stdio.h>

#define HUNDRED 100

int main()
{
    int a = 0;
    printf("%d ask\n",HUNDRED);
    return 0;
}
```

-Wall

```
$ gcc main.c -o main.c
```

-Wall

```
$ gcc main.c -Wall -o main.c


main.c: In function ‘main’:
```

```
main.c:7:6: warning: unused variable ‘a’ [-Wunused-variable]

 int a=0;

   ^
```

6.2.2.3

dirname -I

dirname gcc **Git** test.h main.c **NoosProgramProject/(6_Makefile GCC/001_gcc_03)**

```
$ tree

.

├── inc

│   └── test.h

└── main.c



1 directory, 2 files

$
```

test.h:

```
#ifndef __TEST_H

#define __TEST_H

/*

  code

*/
```

```
#endif
```

```
$ gcc main.c -I inc -o main
```

```
$ gcc main.c -o main
  main.c:2:18: fatal error: test.h: No such file or directory
  compilation terminated.
```

test.h

6.2.2.3

gcc 2_

1) *dirname* -L

dirname

2) *name* -l

lib*name*.a lib*name*.so -lm libm.so

3) -static

6.2.2.4

gcc *level* 0 01 2 3 s -O

1 -O

2 -O2 O2

3 -Os

6.2.2.5

git (6_Makefile GCC/001_gcc_02)

gcc

-g GDB

,

```
$ gcc main.c -g -o main
```

GDB :

1 run

run run

run [ ]

```
$ gdb -q main□□<---
Reading symbols from output...done.
(gdb) run□□□<---
Starting program: /home/100ask/makefile/
100 ask
[Inferior 1 (process 7425) exited normally]
(gdb)
```

2 list

list list

list [ ]

```
(gdb) list 1□□□<---           10
#include <stdio.h>

#define HUNDRED 100

int main()
{
□int a = 100;

□printf("%d ask\n",HUNDRED);
□return 0;
(gdb) <Enter>□□□<--- Enter    10
}
(gdb)
```

3

1 break   break   break <   > | <   >

```
(gdb) break 7

Breakpoint 1 at 0x40052e: file main.c, line 7.

(gdb)
```

2 info break

```
(gdb) info break

Num  Type    Disp Enb Address       What

1  breakpoint  keep y  0x000000000040052e in main at main.c:7

(gdb)
```

3 delete breakpoint   delete breakpoint   delete breakpoint <   >

```
(gdb) delete breakpoint 1

(gdb) info break

No breakpoints or watchpoints.

(gdb)
```

4

1 print   print   print[/] <   >

2 display   display   display <   >

3 step next   step next   step <   >   next <   >

4 continue

```
(gdb) break 7
Breakpoint 1 at 0x40052e: file main.c, line 7.
(gdb) break 9
Breakpoint 2 at 0x400535: file main.c, line 9.
(gdb) run
Starting program: /home/100ask/makefile/

Breakpoint 1, main () at main.c:7
7	int a = 100;
(gdb) continue
Continuing.

Breakpoint 2, main () at main.c:9
9	printf("%d ask\n",HUNDRED);
(gdb) print a
$1 = 100
(gdb)
```

6.2.3

gcc

main.c

```
#include <stdio.h>
#include "hander.h"

int main()
{
        float a = 0.0;
        int b = a;
        char c = 'a'

        printf("100ask: \n",a);

        return 0;
}
```

2

8

10 a

-Wall

```
$ gcc main.c -Wall -o output
main.c: In function ‘main’:
main.c:2:20: fatal error: hander.h: No such file or directory
compilation terminated.
```

hander.h hander.h hander.h

```
$ gcc -Wall main.c  -o output
main.c: In function ‘main’:
main.c:10:2: error: expected ‘,’ or ‘;’ before ‘printf’
  printf("100ask: \n",a);
  ^
main.c:8:7: warning: unused variable ‘c’ [-Wunused-variable]
  char c = 'a'
       ^
main.c:7:6: warning: unused variable ‘b’ [-Wunused-variable]
  int b = a;
      ^
```

10 prntf 7 8 printf

```
$ gcc -Wall main.c  -o output
main.c: In function ‘main’:
main.c:8:9: warning: too many arguments for format [-Wformat-extra-args]
  printf("100ask: \n",a);
         ^
```

printf a a

```
$ gcc -Wall main.c  -o output
$ tree
.
```

```
├── main.c
└── output
```

6.3 gcc 2_

OBJ OBJ

```
$ gcc main.c -c
$ gcc -o output main.o
$ gcc -o output_static main.o  --static
$ ls -alh
drwxrwxr-x 2 tym tym 4.0K 2   20 07:27 .
drwxrwxr-x 6 tym tym 4.0K 2   20 07:25 ..
-rw-rw-r-- 1 tym tym   96 2   20 07:25 main.c
-rw-rw-r-- 1 tym tym 1.5K 2   20 07:26 main.o
-rwxrwxr-x 1 tym tym 8.5K 2   20 07:27 output
-rwxrwxr-x 1 tym tym 892K 2   20 07:27 output_static
```

output_static output

6.3.1

main.c add.c add.h

main.c:

```
#include <stdio.h>
#include "add.h"

int main(int argc, char *argv[])
{
printf("%d\n",add(10, 10));
```

```
	printf("%d\n",add(20, 20));
	return 0;
}
```

add.c:

```
#include "add.h"

int add(int a, int b)
{
	return a + b;
}
```

add.h:

```
#ifndef __ADD_H
#define __ADD_H

int add(int a, int b);

#endif
```

** ** Git NoosProgramProject/(6_Makefile GCC/001_gcc_04)

6.3.1.1

"libxxx.a"

1.

2.

1.

2.

```
$ gcc add.c -o add.o -c
$ ar -rc libadd.a add.o
$ gcc main.c -o output -ladd -L.
```

```
$ ./output
20
40
```

6.3.1.2

“libxxx.so”

**   **

**   **

```
$ gcc -shared -fPIC lib.c -o libtest.so


$ sudo cp libtest.so /usr/lib/
```

```
$ gcc main.c -L. -ltest -o output
```

```
$ ./output
20
40
```

6.4 Makefile

6.4.1 Makefile?

GCC C gcc

6.4.2 Makefile

Makefile Makefile main.c sub.c sub.h a

main.c

```
#include <stdio.h>
#include "add.h"
#include "sub.h"

int main()
{
	printf("100 ask, add:%d\n", add(10, 10));
	printf("100 ask, sub:%d\n", sub(20, 10));
	return 0;
}
```

add.c

```
#include "add.h"

int add(int a, int b)
{
	return a + b;
}
```

add.h

```
#ifndef __ADD_H
#define __ADD_H

int add(int a, int b);

#endif
```

sub.c

```
#include "sub.h"

int sub(int a, int b)
{
	return a - b;
}
```

sub.h

```
#ifndef __SUB_H
#define __SUB_H

int sub(int a, int b);

#endif
```

Git NoosProgramProject/(6_Makefile GCC/001_Makefile_01)

gcc

```
$ gcc main.c sub.c add.c -o ouput
$ ls
add.c  add.h  main.c  output  sub.c  sub.h
$ ./output
100 ask, add:20
100 ask, sub:10
```

gcc main.c sub.c add.c output

```
$ gcc -c main.c
$ gcc -c sub.c
$ gcc -c add.c
$ gcc main.o sub.o add.o -o output
```

```
$ gcc -c add.c
$ gcc main.o sub.o add.o -o output
```

1

2

3

Makefile Makefile

Makefile

```
output:  main.o add.o sub.o
        gcc -o output main.o add.o sub.o
main.o:  main.c
        gcc -c main.c
add.o:  add.c
        gcc -c add.c
sub.o:  sub.c
        gcc -c sub.c

clean:
        rm *.o output
```

Makefile make make Makefile

```
$ ls
add.c  add.h  main.c  Makefile  sub.c  sub.h
$ make
gcc -c main.c
gcc -c add.c
gcc -c sub.c
gcc -o output main.o add.o sub.o
$ ls
add.c  add.h  add.o  main.c  main.o  Makefile  output  sub.c  sub.h  sub.o
```

make .o make

```
$ make
make: 'output' is up to date.
```

make add.c

```
$ make
gcc -c add.c
gcc -o output main.o add.o sub.o
```

.c

Makefile

6.4.3 Makefile

6.4.3.1

Makefile Makefile makefile Makefile Makefile makefile.linux

```
make -f makefile.linux
```

6.4.3.2

```
  target   prerequisites


[Tab]  command
```

1 target

2 prerequisites target

3 command

target prerequisites command

```
$ gcc main.c -o main
```

Makefile

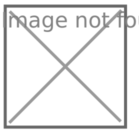
```
01 main:main.c


02 gcc main.c -o main
```

** **Makefile**Tab **

6.4.3.3

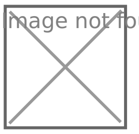
1

2



1

2



Makefile

```
output: main.o add.o sub.o
        gcc -o output main.o add.o sub.o
main.o: main.c
        gcc -c main.c
add.o: add.c
        gcc -c add.c
sub.o: sub.c
        gcc -c sub.c

clean:
        rm *.o output
```

```
$ make
gcc -c main.c
gcc -c add.c
gcc -c sub.c
gcc -o output main.o add.o sub.o
```

make add.c make

```
$ make
gcc -c add.c
gcc -o output main.o add.o sub.o
```

make

6.5 Makefile

6.5.1

Makefile Makefile

** ** C

```
DIR = ./100ask/
```

** **

```
FOO = $(DIR)
```

Makefile Makefile

```
output: main.o add.o sub.o
        gcc -o output main.o add.o sub.o
main.o: main.c
        gcc -c main.c
add.o: add.c
        gcc -c add.c
sub.o: sub.c
        gcc -c sub.c

clean:
        rm *.o output
```

```
#Makefile
OBJ = main.o add.o sub.o
output: $(OBJ)
        gcc -o output $(OBJ)
main.o: main.c
```

```
        gcc -c main.c
add.o: add.c
        gcc -c add.c
sub.o: sub.c
        gcc -c sub.c

clean:
        rm $(OBJ) output
```

Makefile Makefile ‘#’ C OBJ ”main.o add.o su

Makefile ‘=’ ‘:=’ ‘?=’

6.5.2.1 ‘=’

‘=’ Makefile

```
PARA = 100
CURPARA = $(PARA)
PARA = ask

print:
	@echo $(CURPARA)
```

PARA “100” CURPARA PARA CURPARA PARA PARA

“make print” Makefile

```
$ make print
ask
```

CURPARA “100” PARA “=” ,

C

```
int a = 10;
int *b = &a;
a=20;
```

6.5.2.2 ‘:=’

‘:=’ Makefile

```
PARA = 100
CURPARA := $(PARA)
PARA = ask

print:
	@echo $(CURPARA)
```

Makefile “=” “:=”

```
$ make print
100
$
```

CURPARA “100” “=” “:=” “:=”

6.5.2.3 ‘?=’

Makefile ‘?=’

Makefile

```
PARA = 100
PARA ?= ask

print:
	@echo $(PARA)
```

```
$ make print
100
$
```

Makefile:

```
PARA ?= ask

print:
	@echo $(PARA)
```

```
$ make print
ask
$
```

PARA “ask”

6.5.2.4 ‘+=’

Makefile , “+=”

```
OBJ = main.o add.o
OBJ += sub.o
```

OBJ ”main.o add.o sub.o“ “+=”

6.5.2

CC PWD CLFAG

1 CPPFLAGS -I

2 CFLAGS -Wall -g -c

3 LDFLAGS -L -l

CC cc gcc CC=gcc

```
OBJ = main.o add.o sub.o
output: $(OBJ)
        gcc -o output $(OBJ)
main.o: main.c
        gcc -c main.c
add.o: add.c
        gcc -c add.c
sub.o: sub.c
        gcc -c sub.c

clean:
        rm $(OBJ) output
```

```
CC = gcc
OBJ = main.o add.o sub.o
output: $(OBJ)
	$(CC) -o output $(OBJ)
main.o: main.c
	$(CC) -c main.c
add.o: add.c
	$(CC) -c add.c
sub.o: sub.c
	$(CC) -c sub.c

clean:
	rm $(OBJ) output
```

CC gcc

6.5.3

Makefile Makefile

1 $@

2 $<

3 $^

:

```
CC = gcc
OBJ = main.o add.o sub.o
output: $(OBJ)
	$(CC) -o $@ $^
main.o: main.c
	$(CC) -c $<
add.o: add.c
	$(CC) -c $<
sub.o: sub.c
	$(CC) -c $<

```

```
12 clean:
13         rm $(OBJ) output
```

4 $^ OBJ main.o add.o sub.o $< main.c add.c sub.c $@ output

6.5.4

%

```
CC = gcc
OBJ = main.o add.o sub.o
output: $(OBJ)
        $(CC) -o $@ $^
%.o: %.c
        $(CC) -c $<

clean:
        rm $(OBJ) output
```

%.o: %.

1.main.o main.c

2.add.o add.c

3.sub.o sub.c

6.5.5

make

make make clean

```
$make
gcc -c main.c
gcc -c add.c
gcc -c sub.c
gcc -o output main.o add.o sub.o
$make clean
rm *.o output
```

Makefile clean make make clean

```
$touch clean
$make
gcc -c main.c
gcc -c add.c
gcc -c sub.c
gcc -o output main.o add.o sub.o
$make clean
make: 'clean' is up to date.
```

clean Makefile Makefile clean

```
CC = gcc
OBJ = main.o add.o sub.o
output: $(OBJ)
        $(CC) -o $@ $^
%.o: %.c
        $(CC) -c $<

.PHONY: clean
clean:
        rm $(OBJ) output
```

```
$make
gcc -c main.c
gcc -c add.c
gcc -c sub.c
gcc -o output main.o add.o sub.o
$make clean
rm *.o output
```

rm make make

1.

2. Makefile

6.5.6 Makefile

Makefile (wildcard patsubst) Makefile src

```
.
├── Makefile
└── src
    ├── 100.c
    └── ask.c
```

** ** Git NoosProgramProject/(6_Makefile GCC/001_Makefile_02)

6.5.6.1 wildcard

+

```
$(wildcard    )
```

```
SRC = $(wildcard ./src/*.c)

print:
	@echo $(SRC)
```

make

```
$ make
./src/ask.c ./src/100.c
```

./src .c SRC SRC ./src/ask.c ./src/100.c

6.5.6.2 patsubst

+ + :

```
$( patsubst  ,   ,   )
```

./src .c .o obj

```
SRC = $(wildcard ./src/*.c)
OBJ = $(patsubst %.c, %.o, $(SRC))
```

```
print:
	@echo $(OBJ)
```

make

```
$ make
./src/ask.o ./src/100.o
```

.c .o OBJ ./src/ask.o ./src/100.o

6.6 Makefile

inc src **

```
$ tree
.
├── inc
│   ├── add.h
│   └── sub.h
├── Makefile
└── src
    ├── add.c
    ├── main.c
    └── sub.c
```

Makefile

```
SOURCE = $(wildcard ./src/*.c)
OBJECT = $(patsubst %.c, %.o, $(SOURCE))

INCLUEDS = -I ./inc

TARGET  = 100ask
CC      = gcc
CFLAGS  = -Wall -g

$(TARGET): $(OBJECT)
        @mkdir -p output/
```

```
12        $(CC) $^ $(CFLAGES) -o output/$(TARGET)
13
14 %.o: %.c
15        $(CC) $(INCLUEDS) $(CFLAGES) -c $< -o $@
16
17 .PHONY: clean
18 clean:
19        @rm -rf $(OBJECT) output/
```

1 src .c SOURCE

2 ./src .c .o OBJECT

4 -I INCLUDES

6 100ask TARGET

7 CC cc gcc

8 gdb CFLAGS

11 output

12 100ask output

15

17 clean

19 make clean

:

```
$ make
gcc -I ./inc  -c src/main.c -o src/main.o
gcc -I ./inc  -c src/add.c -o src/add.o
gcc -I ./inc  -c src/sub.c -o src/sub.o
gcc src/main.o src/add.o src/sub.o  -o output/100ask
$tree
.
├── inc
│   ├── add.h
│   └── sub.h
├── Makefile
├── output
│   └── 100ask
└── src
    ├── add.c
    ├── add.o
    ├── main.c
    ├── main.o
    ├── sub.c
    └── sub.o
```

Makefile

```
01 VERSION = 1.0.0
02 SOURCE  = $(wildcard ./src/*.c)
03 OBJECT   = $(patsubst %.c, %.o, $(SOURCE))
04
05 INCLUEDS = -I ./inc
06
07 TARGET  = 100ask
08 CC      = gcc
09 CFLAGS  = -Wall -g
10
11 $(TARGET): $(OBJECT)
12 	@mkdir -p output/
13 	$(CC) $^ $(CFLAGES) -o output/$(TARGET)_$(VERSION)
14
15 %.o: %.c
16 	$(CC) $(INCLUEDS) $(CFLAGES) -c $< -o $@
17
18 .PHONY:clean
19 clean:
20 	@rm -rf $(OBJECT) output/
```

1 VERSION

13

```
$ tree
.
├── inc
│   ├── add.h
│   └── sub.h
├── Makefile
├── output
│   └── 100ask_1.0.0
└── src
    ├── add.c
    ├── add.o
    ├── main.c
    ├── main.o
    ├── sub.c
    └── sub.o
```