把玩链接器

1 原　sunnyxx iOS Developer | 滴滴出行

Weibo · @我就叫 Sunny 怎么了

Blog · http://blog.sunnyxx.com

GitHub · github.com/forkingdog

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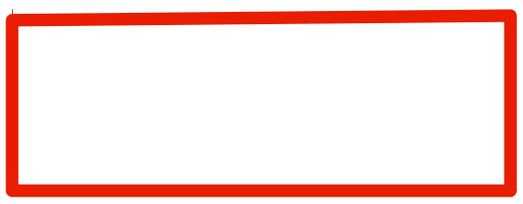
在一排开
关上 手撞机器码

PDP-11 / 40 1970s

打孔纸带读取器

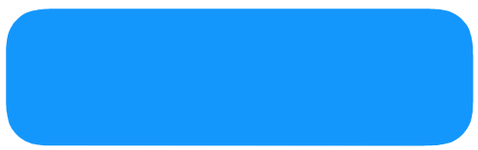
JMP 2000



PDP-11 Machine Code Sample

中间层

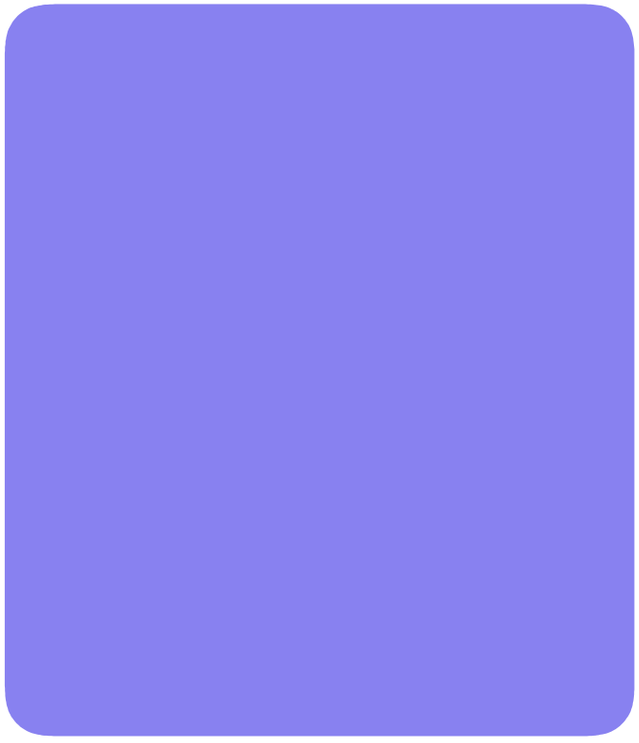
- 尼古拉斯 · 赵四



x86_64

翻译机器码

地址绋 ㄒ



Compiler Linker

```c
// my_math.c

int          int          int
      return

int          int          int
      return
```

```c
// main.c

int
      int                  1  2    return 0
```

```
// clang -c my_math.c -o
// my_math.o

int       int     int       return
```

```
int       int     int       return
```

my_math.o

记录当前文件中：

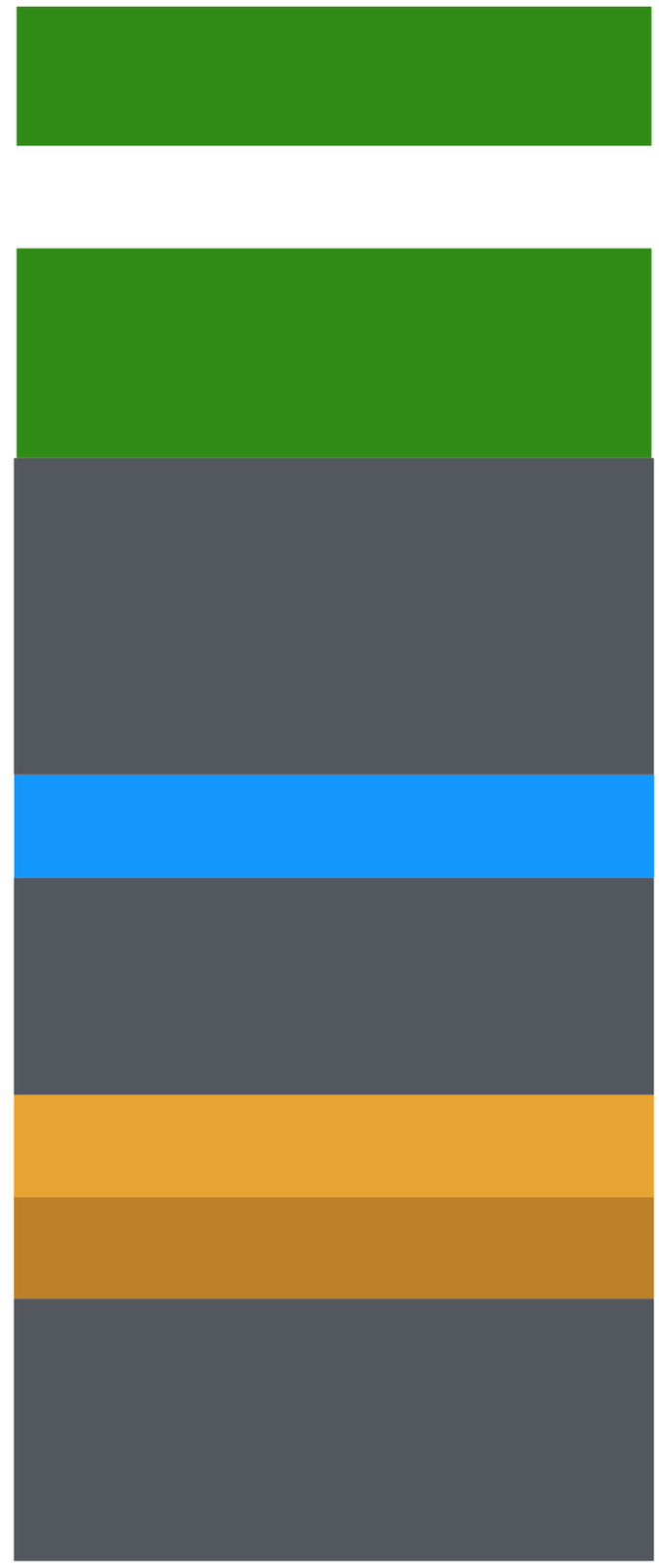
已定义

未定义

my_math.o

```
 callq 0x00000000

//    clang  -c  main.c
//    main.o

int
      int                  1   2
r
e
t
u
r
n
0
```

main.o



main.o

my_math.o

clang

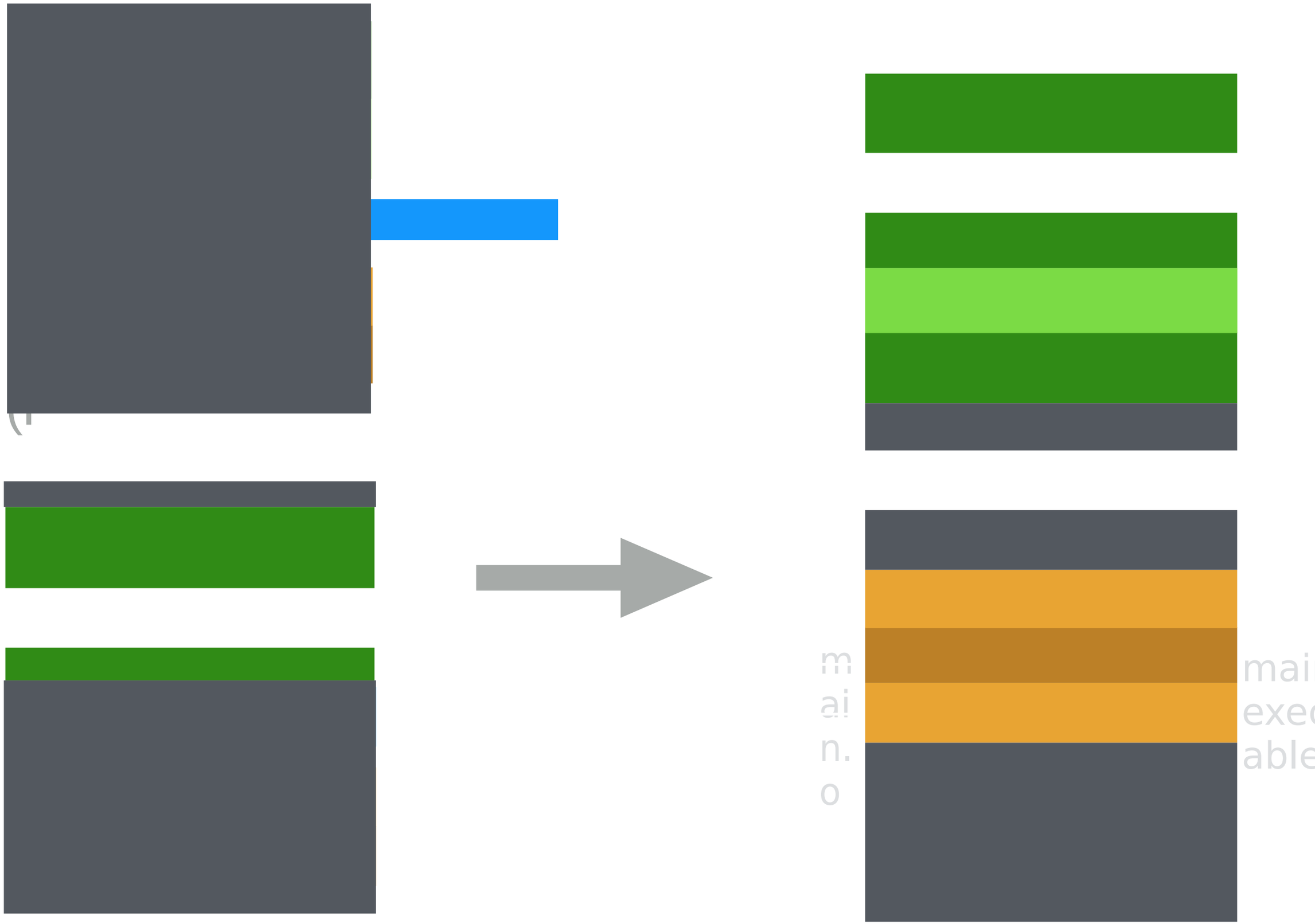
main

```
callq 0x000000000
```

my
_m
ath.
o

llq
0x00000000

ca

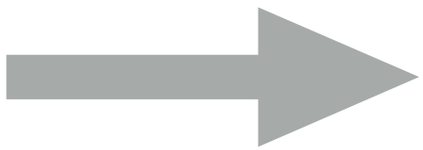

main.o
main
executable

```
callq 0x000000000
```

my
_m
ath.
o

llq
0x00000000

ca




main.o
main
executable

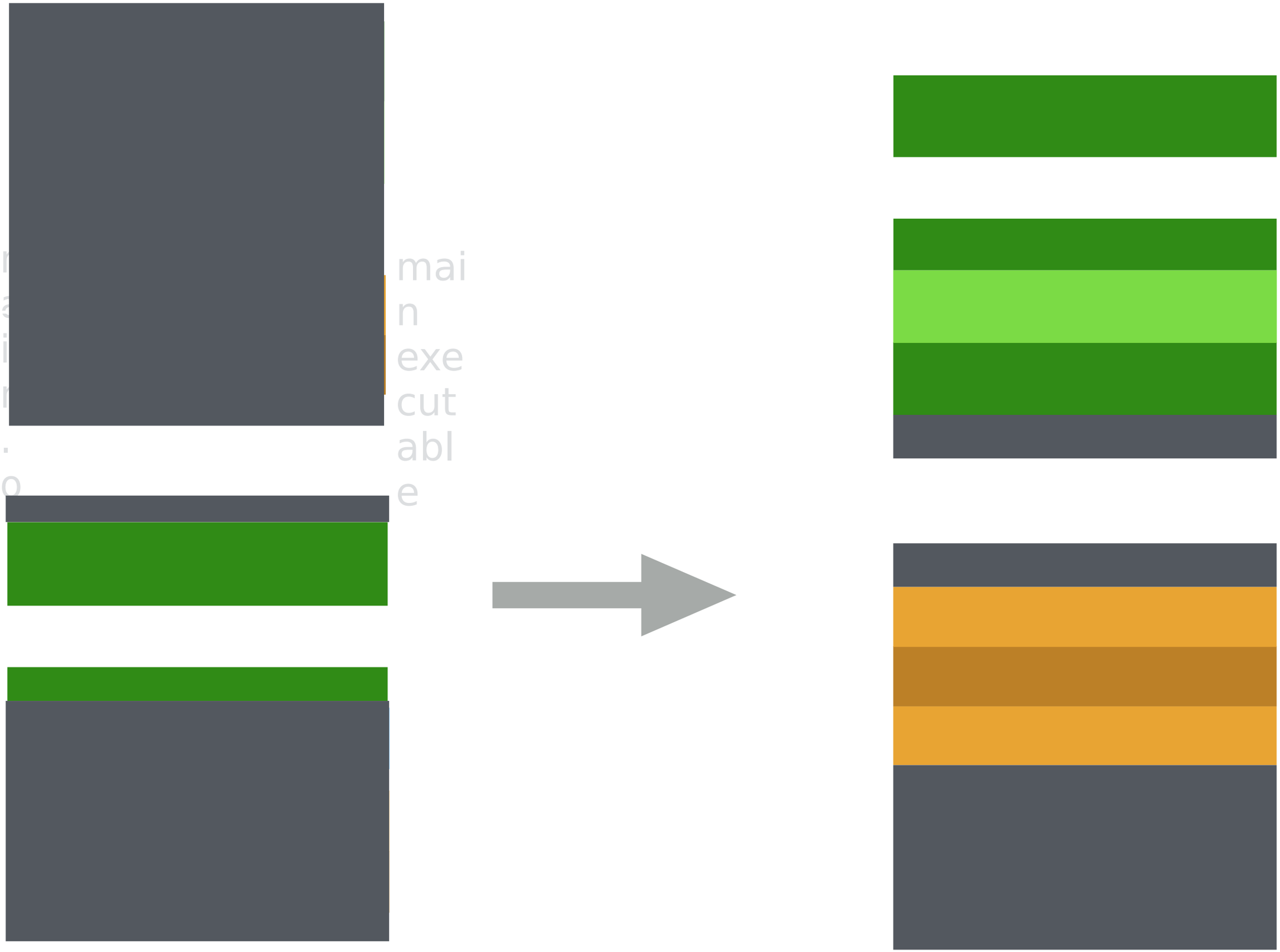
```
callq 0x000000000
```

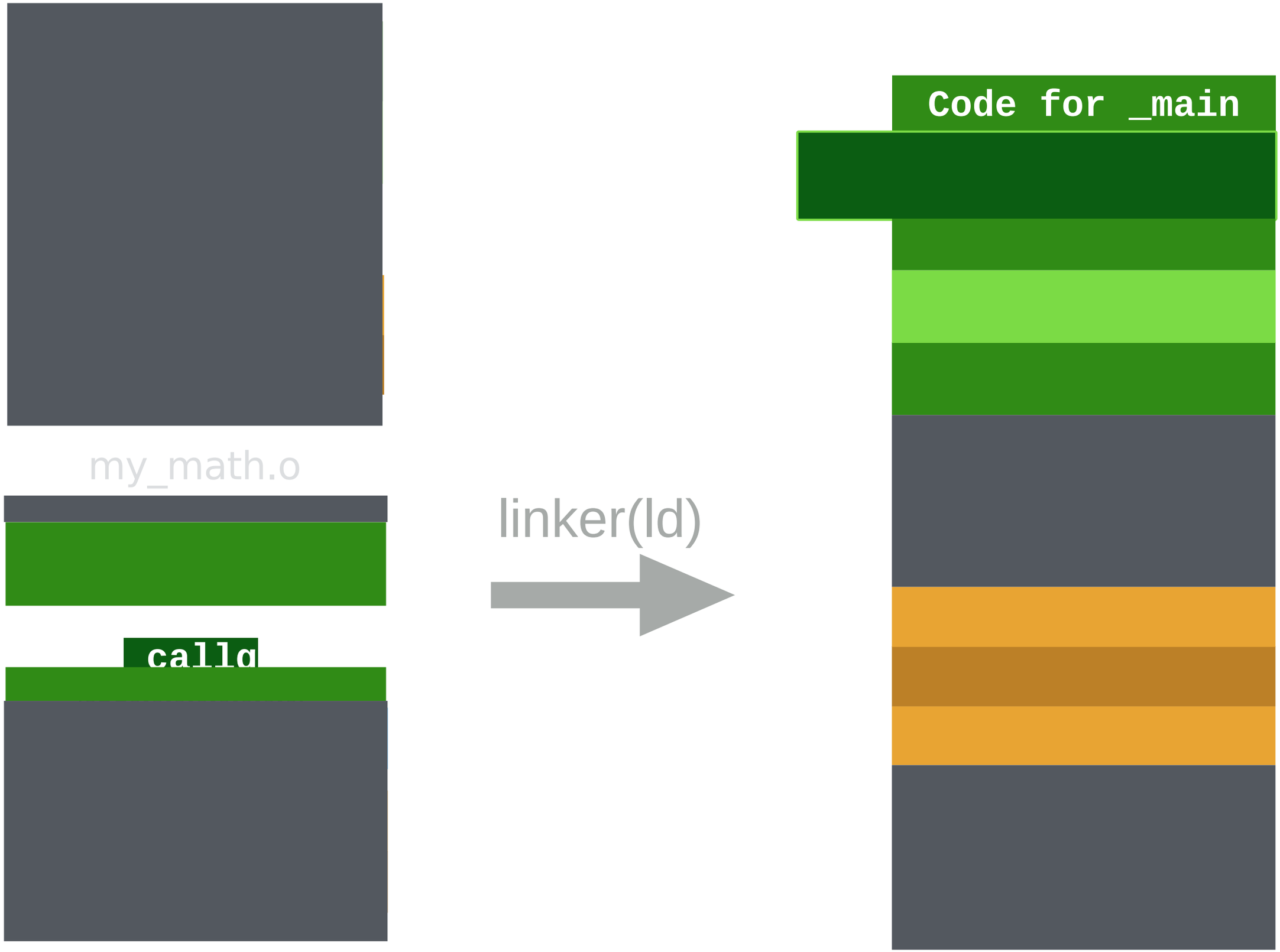
my_math.o

linker (ld)

ca

```
relocate _add!
```

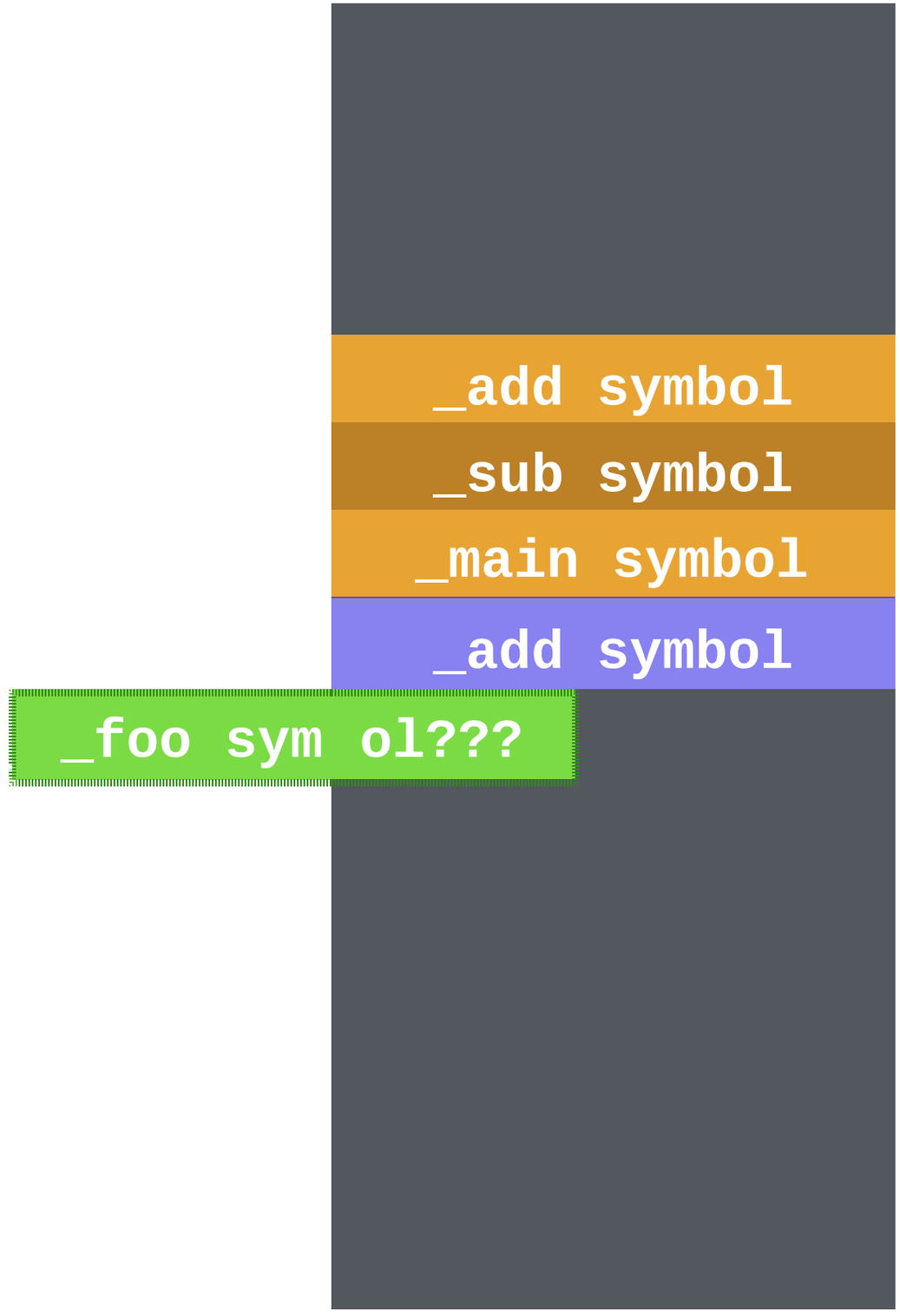

main.o
main
executable


my_math.o
callq
main.o
linker(ld)
Code for _main
main executable

duplicate symbols

Undefined symbols

_foo



A_x86_64.o

B_x86_64.o

AB_x86_64.a

A_arm64.o

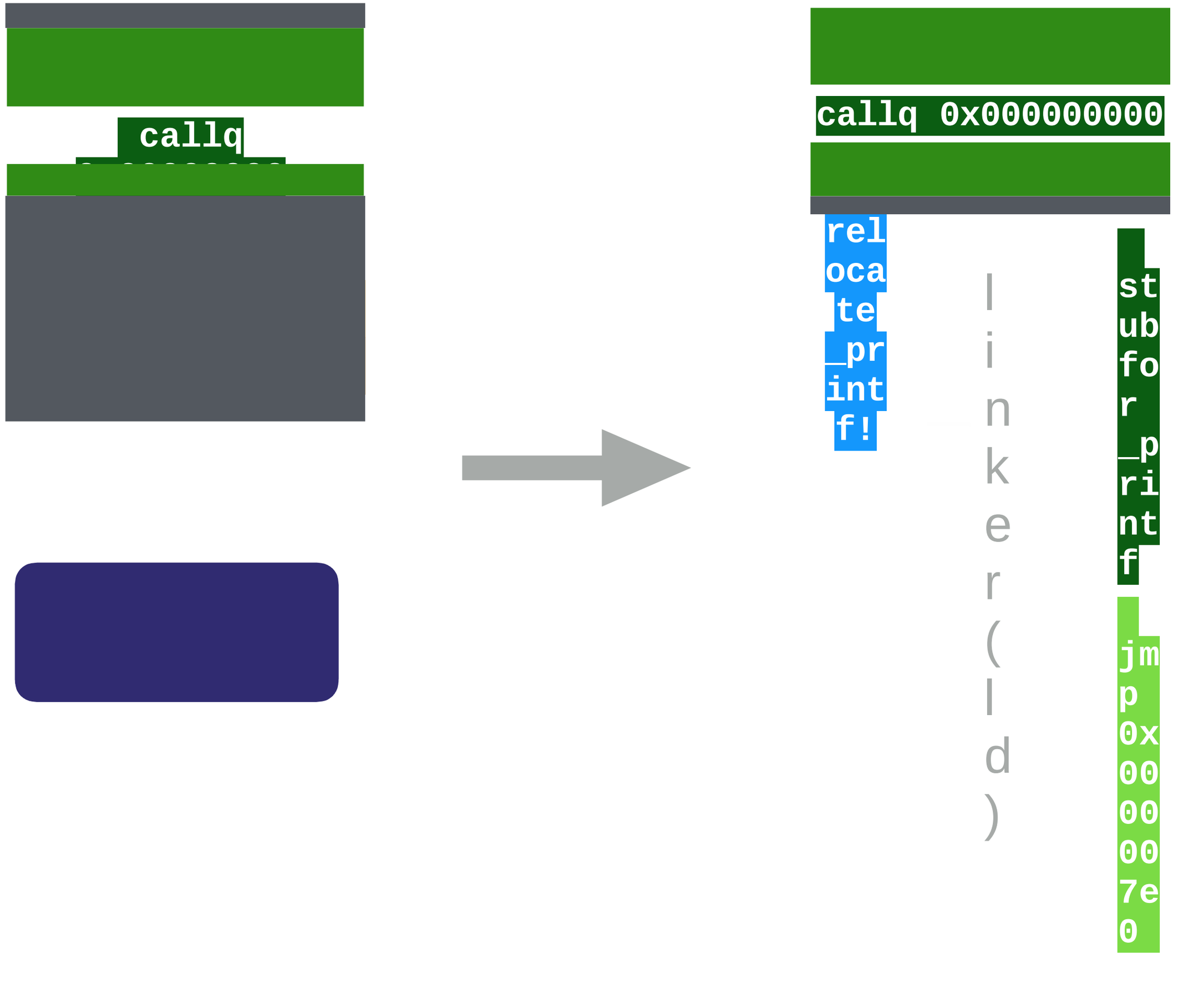
B_arm64.o

```
//    clang  -c  main.c
//    main.o

int                 "he
llo
wo
rld
"

ret
urn
0
```

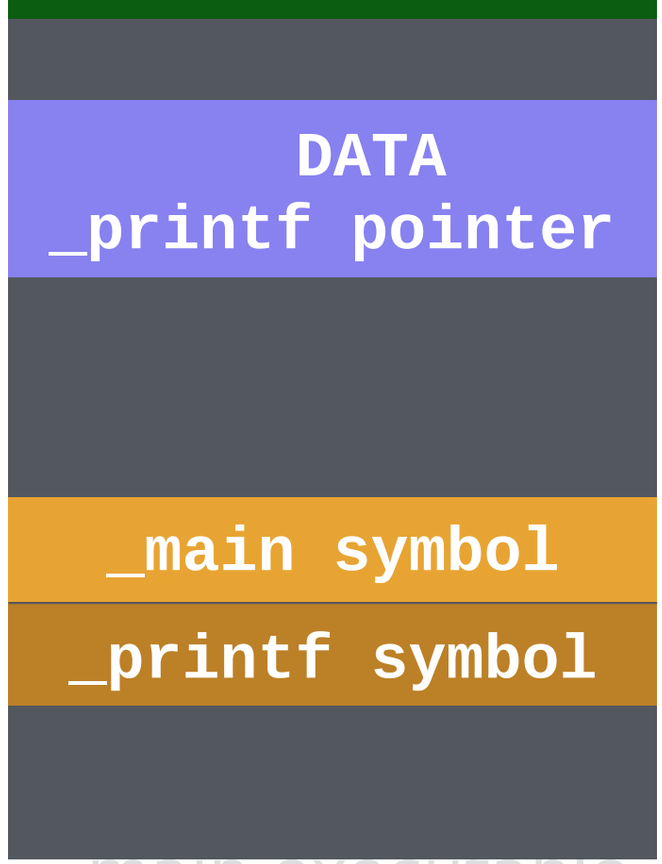
relocate _printf!

_print f symbol ???

main.o


callq
callq 0x000000000
relocate_printf!
linker(ld)
stub for _printf
jmp 0x0000007e0

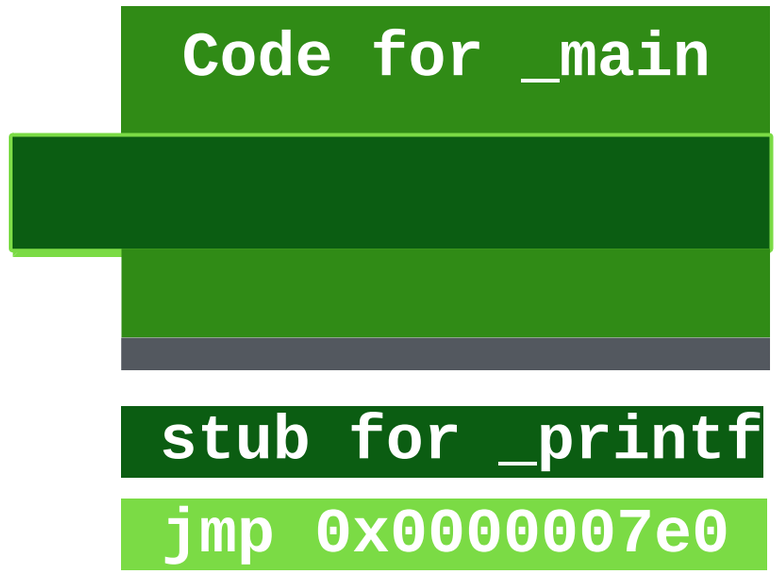
main.o

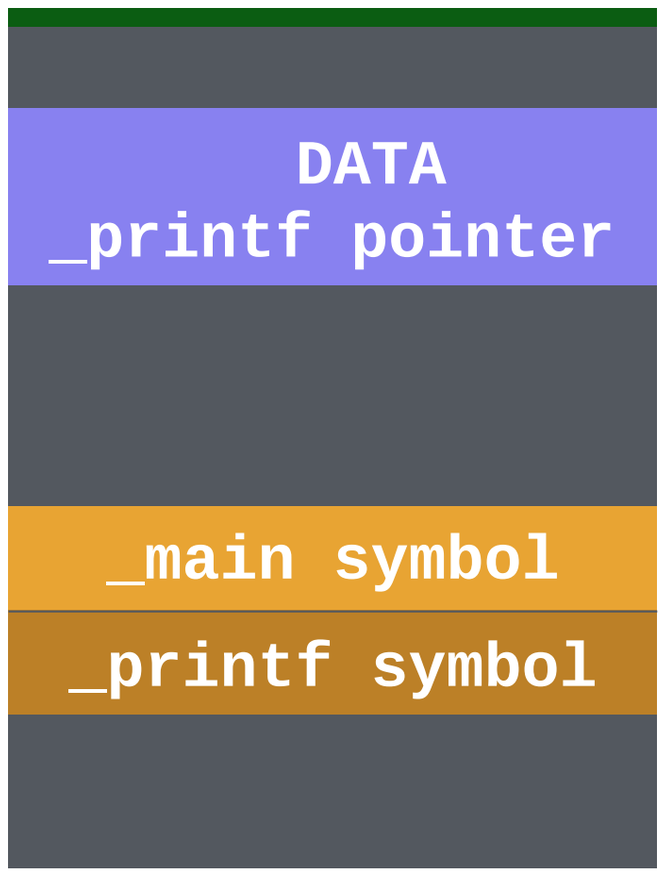


main executable


callq 0x00000000

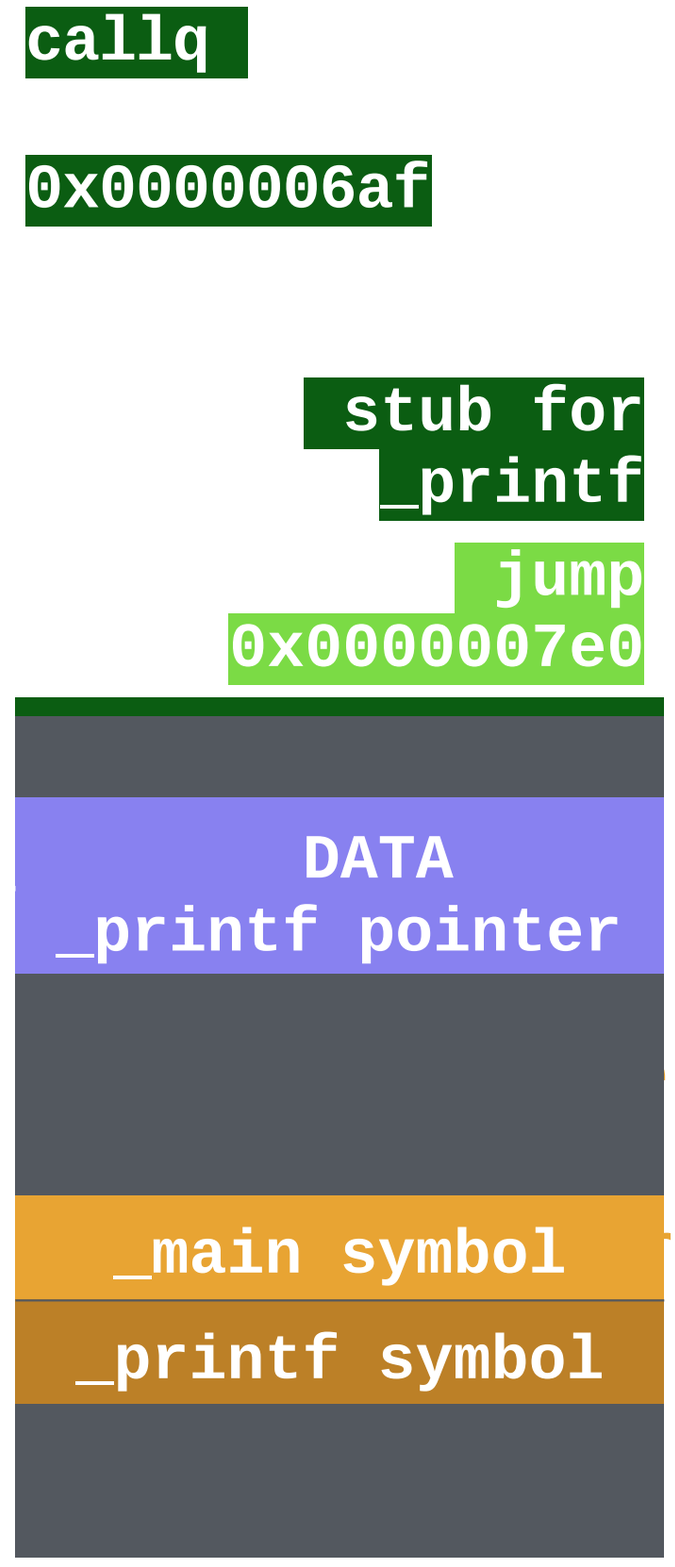
linker(ld)


Code for _main
stub for _printf
jmp 0x0000007e0


DATA
_printf pointer
_main symbol
_printf symbol

main executable

dyld


callq
0x0000006af
stub for _printf
jump 0x0000007e0
DATA
_printf pointer
_main symbol
_printf symbol

main
execut
able

Clang

ld

dyld

remove