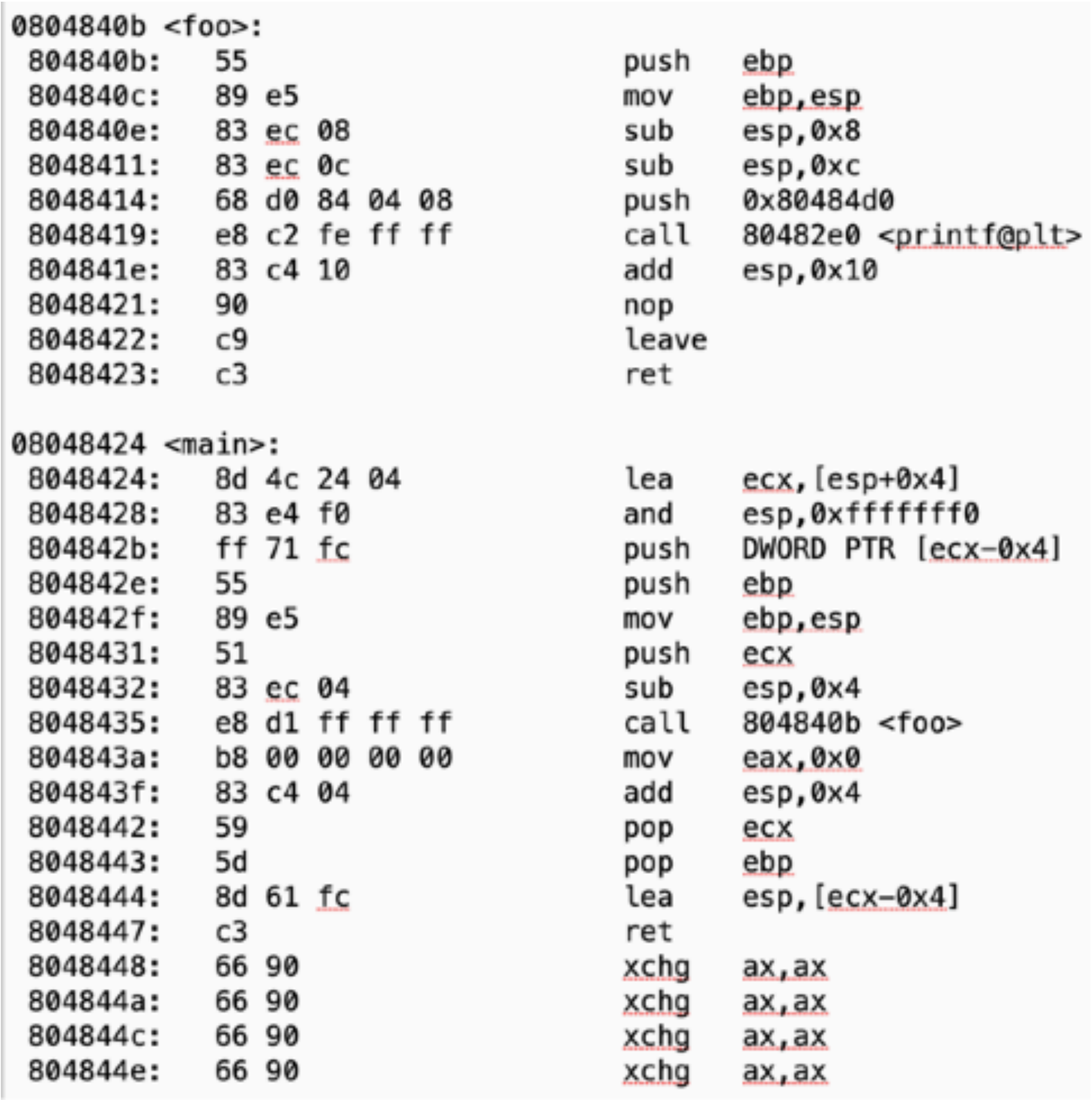
Let's look at some C code and its binary



```
0804840b <foo>:
 804840b:   55                      push   ebp
 804840c:   89 e5                   mov    ebp,esp
 804840e:   83 ec 08                sub    esp,0x8
 8048411:   83 ec 0c                sub    esp,0xc
 8048414:   68 d0 84 04 08          push   0x80484d0
 8048419:   e8 c2 fe ff ff          call   80482e0 <printf@plt>
 804841e:   83 c4 10                add    esp,0x10
 8048421:   90                      nop
 8048422:   c9                      leave
 8048423:   c3                      ret

08048424 <main>:
 8048424:   8d 4c 24 04             lea    ecx,[esp+0x4]
 8048428:   83 e4 f0                and    esp,0xfffffff0
 804842b:   ff 71 fc                push   DWORD PTR [ecx-0x4]
 804842e:   55                      push   ebp
 804842f:   89 e5                   mov    ebp,esp
 8048431:   51                      push   ecx
 8048432:   83 ec 04                sub    esp,0x4
 8048435:   e8 d1 ff ff ff          call   804840b <foo>
 804843a:   b8 00 00 00 00          mov    eax,0x0
 804843f:   83 c4 04                add    esp,0x4
 8048442:   59                      pop    ecx
 8048443:   5d                      pop    ebp
 8048444:   8d 61 fc                lea    esp,[ecx-0x4]
 8048447:   c3                      ret
 8048448:   66 90                   xchg   ax,ax
 804844a:   66 90                   xchg   ax,ax
 804844c:   66 90                   xchg   ax,ax
 804844e:   66 90                   xchg   ax,ax
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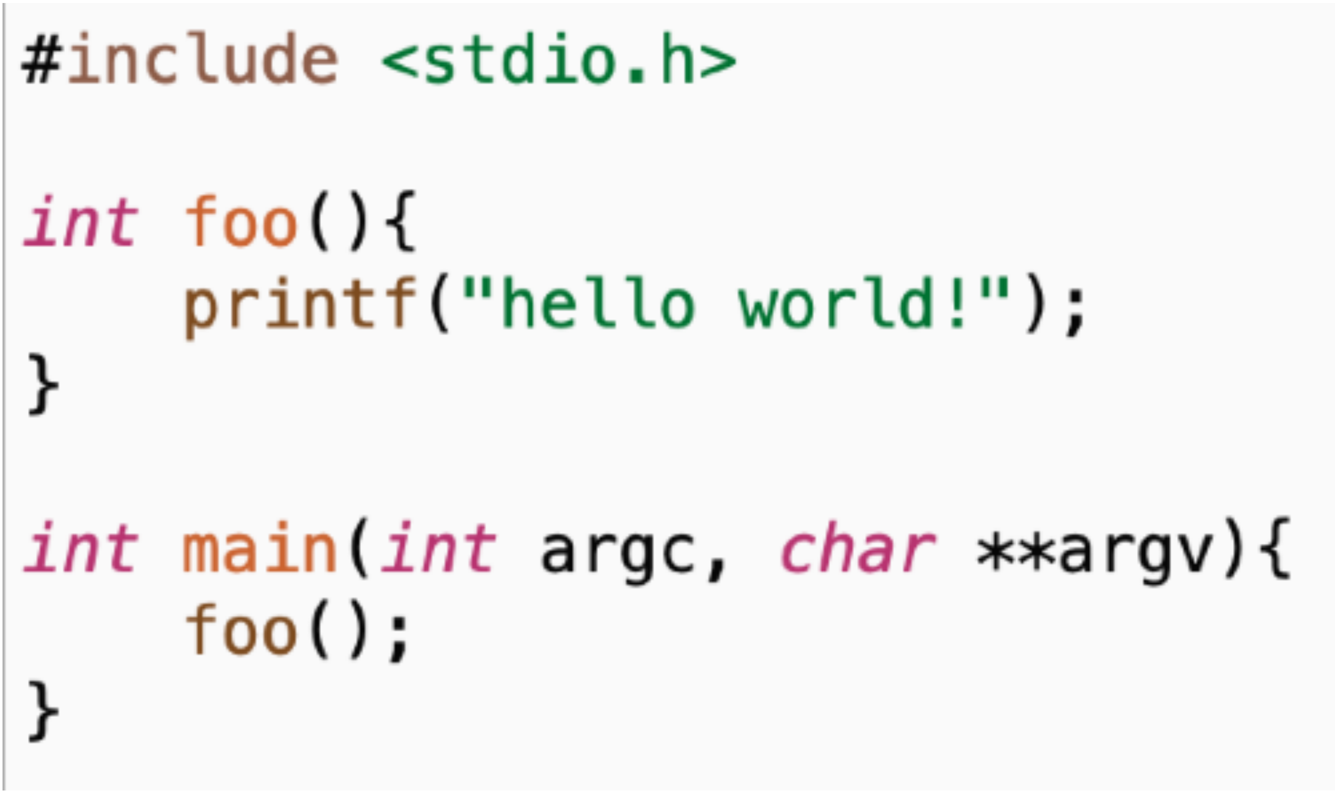

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#include <stdio.h>

int foo(){
    printf("hello world!");
}

int main(int argc, char **argv){
    foo();
}
```

Since function addresses and others are hard-encoded in the binary, the program cannot be placed at random locations in memory

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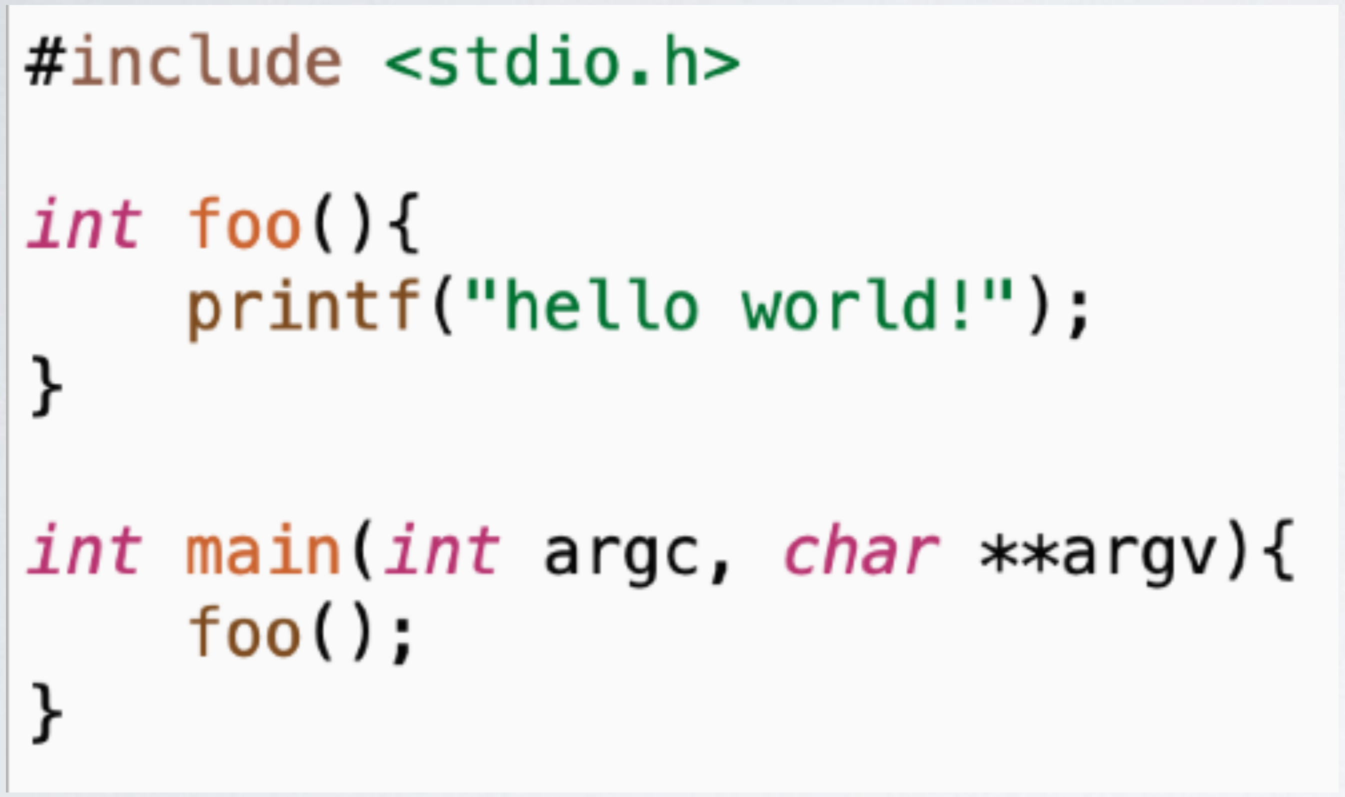

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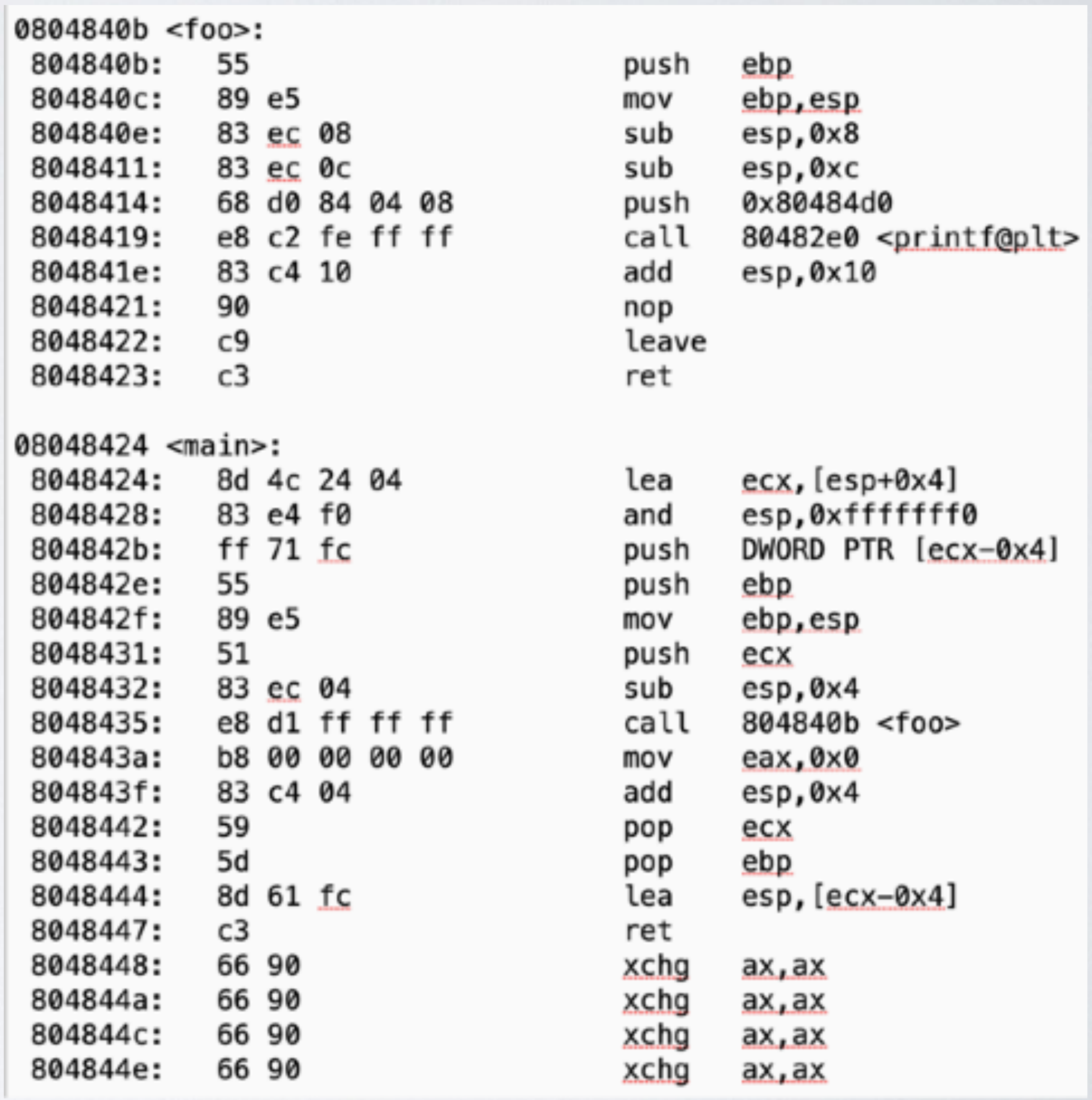

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Naive Idea : load time linking

How about doing the linking when process executed, not at compile time

➡ Determine where process will reside in memory and adjust all references within program

- How to relocate the program in memory during execution? (consider functions but also data pointers now)
- What if no contiguous free region fits program?
- How to avoid programs interfering with each others?