

This is CS 50.



Harvard College's Introduction to Computer Science I

# COMPUTER SCIENCE 50

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**WEEK 10**

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# cs50.net/apply



Image from <http://members.memlane.com/gromboug/P16MvSig.htm>.

# Underneath the Hood

## Software

- ▶ Pre-Processing
- ▶ Compiling
- ▶ Assembling
- ▶ Linking
- ▶ Executing

# From Source Code to Object Code

source code

```
#include <stdio.h>

int
main(int argc, char *argv[])
{
    printf("hello, world\n");
}
```

compile

assembly code

```
.file "hello.c"
.section .rodata
.LC0:
.string "hello, world\n"
.text
.globl main
.type main, @function
main:
    pushl   %ebp
    movl   %esp, %ebp
    subl   $8, %esp
    andl   $-16, %esp
    movl   $0, %eax
    addl   $15, %eax
    addl   $15, %eax
    shrl   $4, %eax
    sall   $4, %eax
    subl   %eax, %esp
    subl   $12, %esp
    pushl   $.LC0
    call   printf
    addl   $16, %esp
    leave
    ret
.size   main, .-main
.section .note.GNU-stack,"",@progbits
.ident "GCC: (GNU) 3.4.6 20060404 (Red Hat 3.4.6-10)"
```

assemble

object code

```
01101001 01001010 10000010 11011001
00101011 01100000 10001011 10111010
```

# Linking against Libraries

hello.c  
[uses printf]



compile

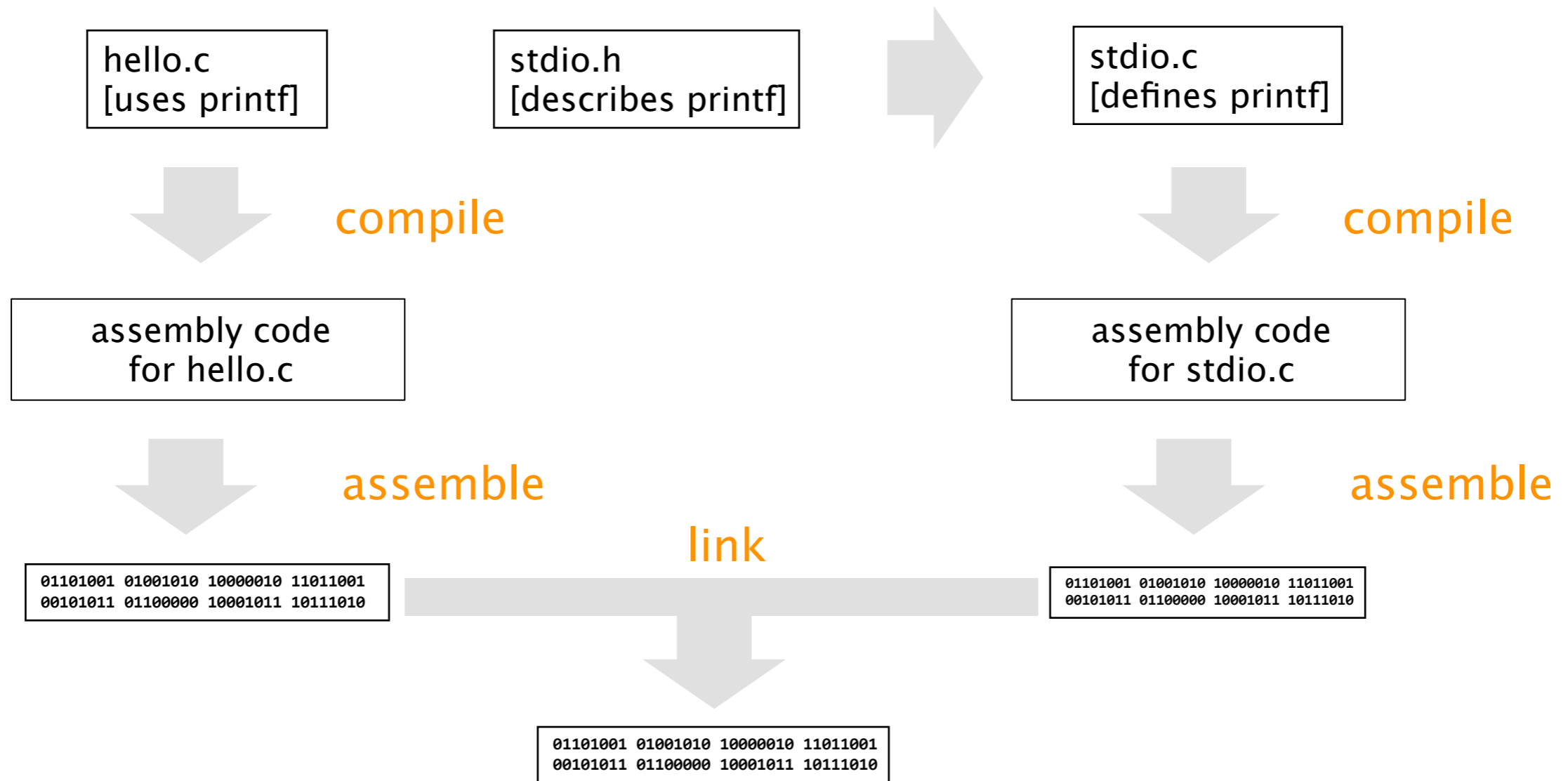
assembly code  
for hello.c



assemble

```
01101001 01001010 10000010 11011001  
00101011 01100000 10001011 10111010
```

# Linking against Libraries



# Underneath the Hood

## Hardware

