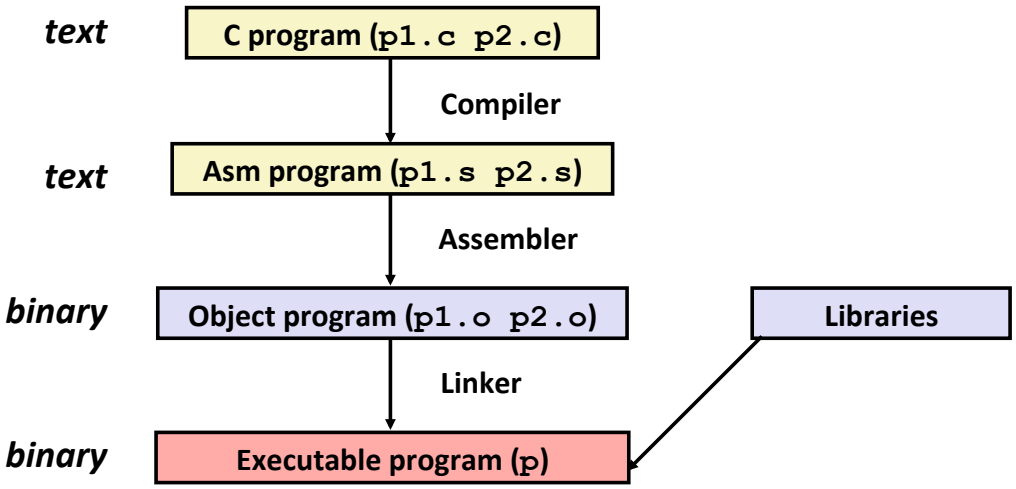
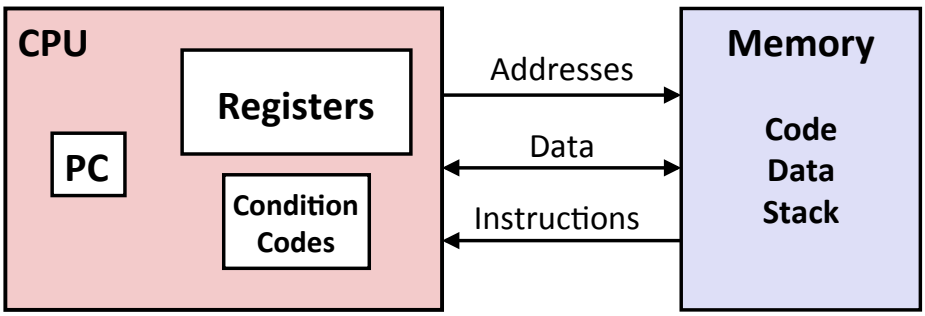
From C to Executable Code



Assembly View of the Machine



x86-64 Integer Registers

%rax	%eax	%r8	%r8d
%rbx	%ebx	%r9	%r9d
%rcx	%ecx	%r10	%r10d
%rdx	%edx	%r11	%r11d
%rsi	%esi	%r12	%r12d
%rdi	%edi	%r13	%r13d
%rsp	%esp	%r14	%r14d
%rbp	%ebp	%r15	%r15d

(not pictured: **%rip** = PC)

movq Operand Combinations

	Source	Dest	Src, Dest	C Analog
movq	*Imm*	*Reg*	`movq $0x4,%rax`	`temp = 0x4;`
		Mem	`movq $-147,(%rax)`	`*p = -147;`
	Reg	*Reg*	`movq %rax,%rdx`	`temp2 = temp1;`
		Mem	`movq %rax,(%rdx)`	`*p = temp;`
	Mem	*Reg*	`movq (%rax),%rdx`	`temp = *p;`

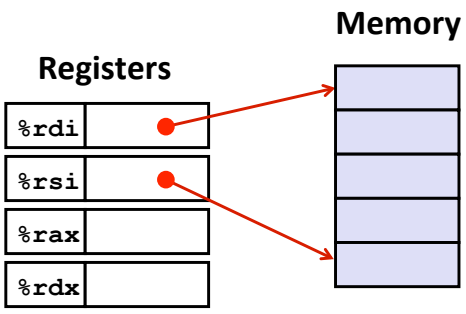
Addressing Example

```
void swap(long *xp, long *yp) {
  long t0 = *xp;
  long t1 = *yp;
  *xp = t1;
  *yp = t0;
}
```

```
swap:
    movq    (%rdi), %rax
    movq    (%rsi), %rdx
    movq    %rdx, (%rdi)
    movq    %rax, (%rsi)
    ret
```


Understanding Swap

```
void swap
    (long *xp, long *yp)
{
  long t0 = *xp;
  long t1 = *yp;
  *xp = t1;
  *yp = t0;
}
```



Register	Value
%rdi	xp
%rsi	yp
%rax	t0
%rdx	t1

```
swap:
    movq    (%rdi), %rax  # t0 = *xp
    movq    (%rsi), %rdx  # t1 = *yp
    movq    %rdx, (%rdi)  # *xp = t1
    movq    %rax, (%rsi)  # *yp = t0
    ret
```

General Memory Addressing

- Most General Form

  D(Rb,Ri,S) **Mem[D + Reg[Rb]+S*Reg[Ri]]**

  - D: Constant "displacement"
  - Rb: Base register
  - Ri: Index register
  - S: Scale: 1, 2, 4, or 8

- Special cases

(Rb,Ri)	Mem[Reg[Rb]+Reg[Ri]]
D(Rb,Ri)	Mem[D + Reg[Rb]+Reg[Ri]]
(Rb,Ri,S)	Mem[Reg[Rb]+S*Reg[Ri]]
(,Ri,S)	Mem[S*Reg[Ri]]
D(,Ri,S)	Mem[D + S*Reg[Ri]]