

## Stack Animations

CompOrg - Stack Animations

1

---

---

---

---

---

---

---

---

## Sample Code

- Silly code (we wouldn't actually use these functions for anything other than using to study how the stack is used).
  - Example 1: recursive function that is called and passed 2 parameter values. No local variables!
  - Example 2: functions that have no parameters, but have some local variables.
  - Example 3: crash and burn.

CompOrg - Stack Animations

2

---

---

---

---

---

---

---

---

## Recursive Function add( )

```
// This function computes the sum of x and y
// using the property: x+y = (x+1) + (y-1)
// and the special case when y=0 (x+y=x)

unsigned int add(unsigned int x, unsigned int y)
{
    if (y==0)
        return(x);
    else
        return(add(x+1,y-1));
}

int main() {
    add(4,3);
}
```

CompOrg - Stack Animations

3

---

---

---

---

---

---

---

---

```

_add:      add ( ) Assembly Code
          pushl %ebp
          movl %esp,%ebp
          movl 8(%ebp),%eax      # eax is x
          movl 12(%ebp),%edx     # edx is y

          testl %edx,%edx       # is y == 0 ?
          je _add_ret           # yes - jump
          incl %eax              # eax = x+1
          decl %edx              # edx = y-1
          pushl %edx             # pass y-1 to add
          pushl %eax             # pass x+1 to add
          call _add2             # call add
_add_ret:
          movl %ebp,%esp
          popl %ebp
          ret

```

---

---

---

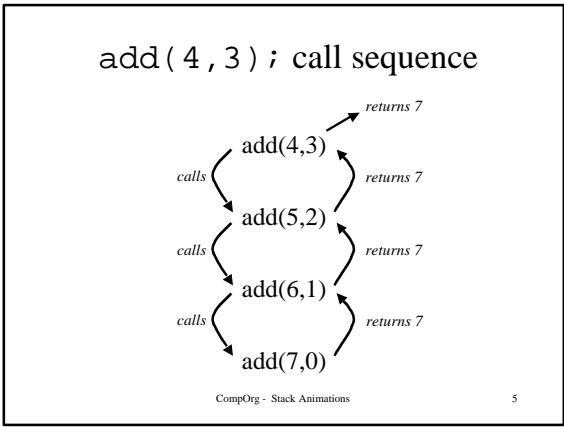
---

---

---

---

---




---

---

---

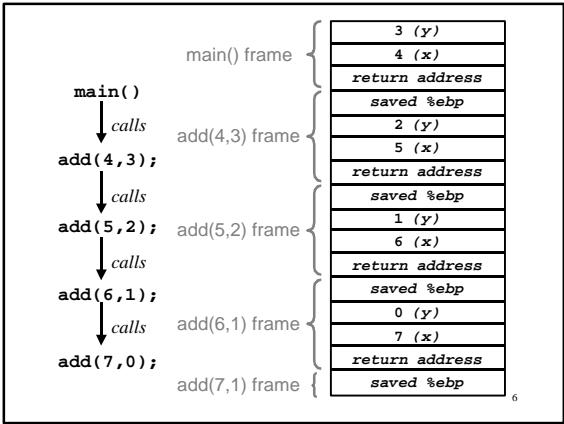
---

---

---

---

---




---

---

---

---

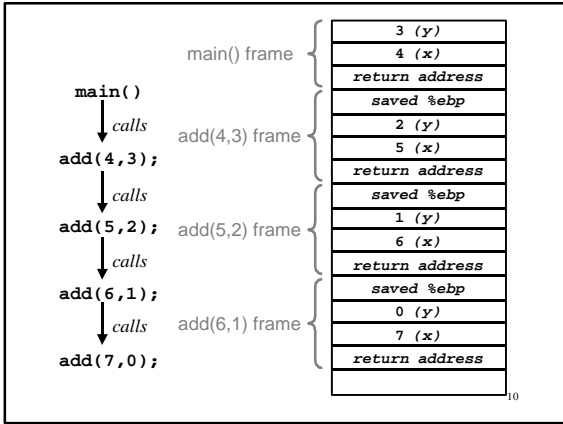
---

---

---

---






---

---

---

---

---

---

---

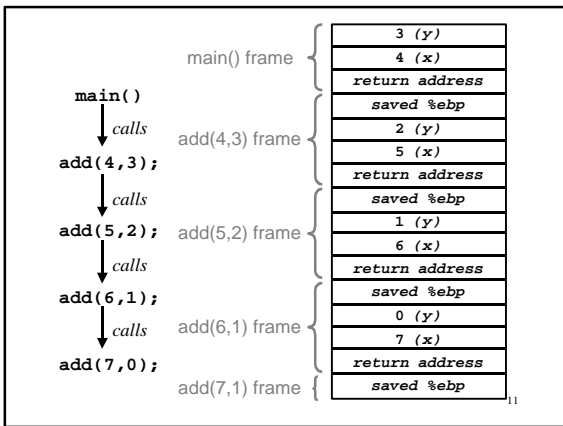
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

## Local Variables

- Functions that have no parameters.
- Two local variables.

CompOrg - Stack Animations 12

---

---

---

---

---

---

---

---

---

---

---

---

## blah() and foo()

```
int blah() {
    int blah_a=1;
    int blah_b=2;
    return(blah_a + blah_b);
}

int foo() {
    int foo_a=10;
    int foo_b=20;
    return(blah()+foo_a+foo_b);
}

int main() {
    foo();
}
```

CompOrg - Stack Animations

13

---

---

---

---

---

---

---

---

## blah() Assembly Code

```
_blah:
    pushl %ebp
    movl %esp,%ebp
    subl $8,%esp      # allocate space for locals
    movl $1,-4(%ebp)  # blah_a = 1
    movl $2,-8(%ebp)  # blah_b = 2
    movl -4(%ebp),%eax # eax = blah_a
    movl -8(%ebp),%ecx # ecx = blah_b
    leal (%ecx,%eax),%edx # edx = blah_a + blah_b
    movl %edx,%eax
    movl %ebp,%esp
    popl %ebp
    ret
```

CompOrg - Stack Animations

14

---

---

---

---

---

---

---

---

## foo() Assembly Code

```
_foo:
    pushl %ebp
    movl %esp,%ebp
    subl $8,%esp      # allocate space for locals
    movl $10,-4(%ebp) # foo_a = 10
    movl $20,-8(%ebp) # foo_b = 20
    call _blah        # eax = blah()
    addl -4(%ebp),%eax # eax = blah()+foo_a
    addl -8(%ebp),%eax # eax = blah()+foo_a+foo_b
    movl %ebp,%esp
    popl %ebp
    ret
```

CompOrg - Stack Animations

15

---

---

---

---

---

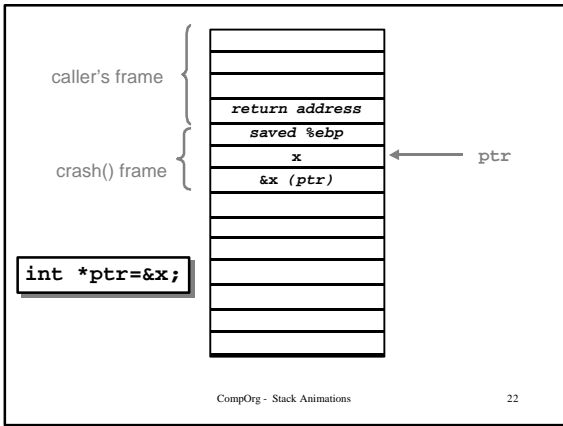
---

---

---








---

---

---

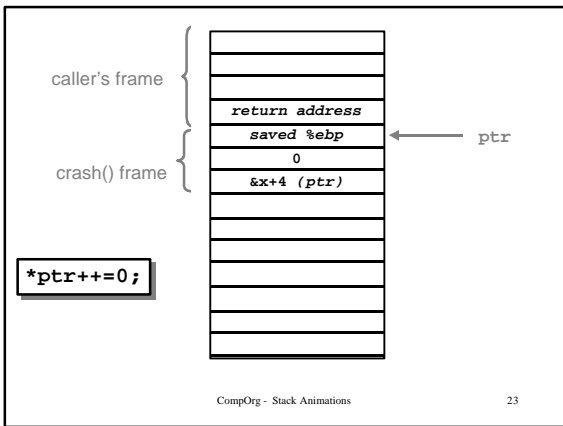
---

---

---

---

---




---

---

---

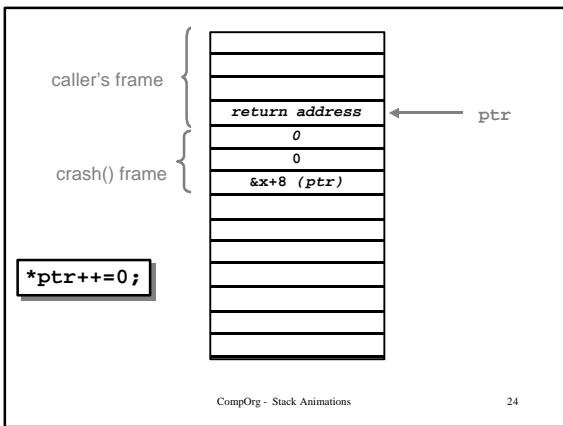
---

---

---

---

---




---

---

---

---

---

---

---

---

