x86 Function Call Conventions

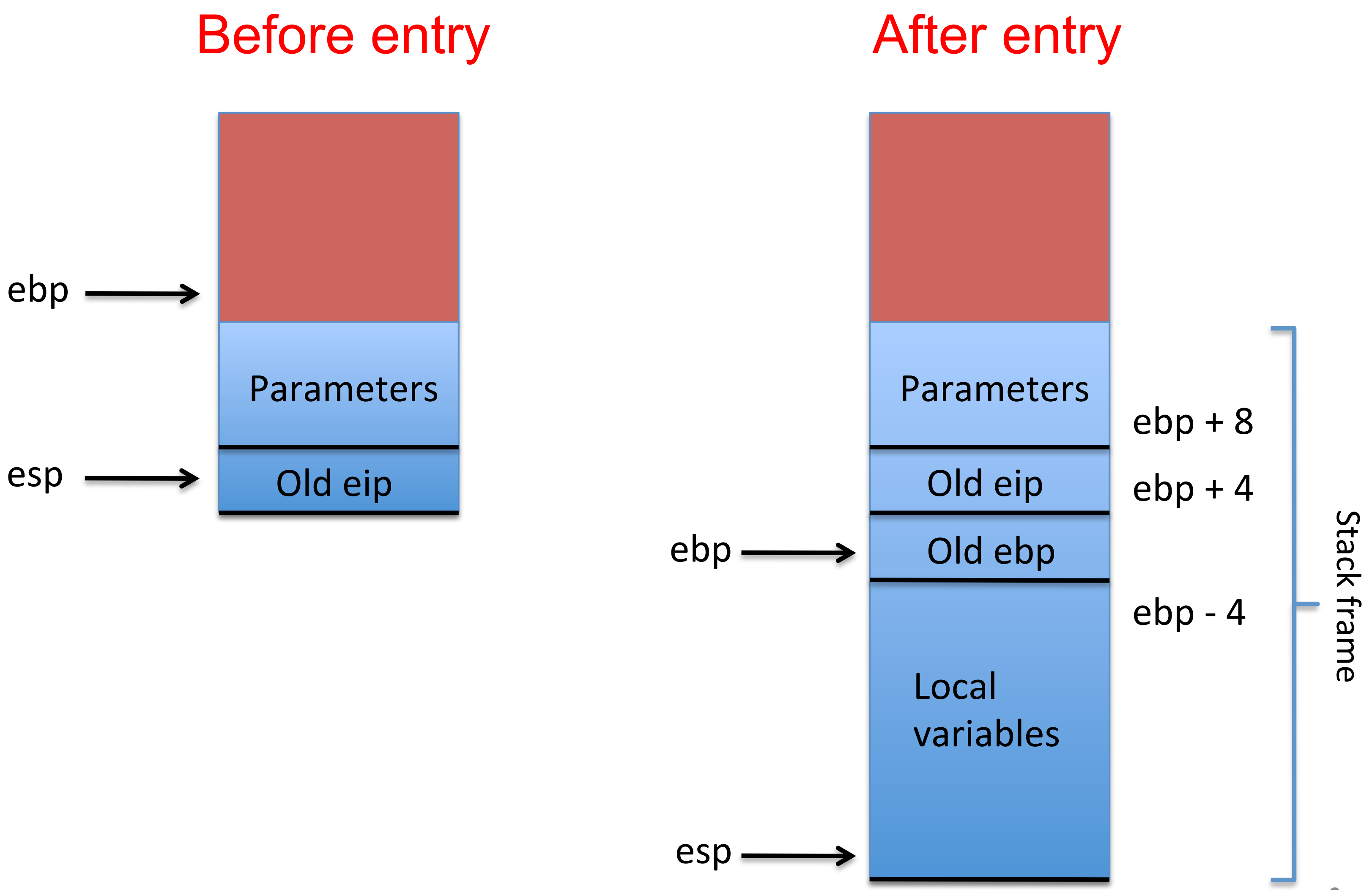
Register use in the stack frame

%ESP - Stack Pointer
This 32-bit register always points to the last element used on the stack.

%EBP - Base Pointer
This 32-bit register is used to reference all the function parameters and local variables in the current stack frame.

%EIP - Instruction Pointer
This holds the address of the next CPU instruction to be executed.
It is saved onto the stack as part of the CALL instruction.

Stack frame



Before entry
After entry
ebp
esp
Parameters
Old eip
ebp
esp
Parameters
Old eip
Old ebp
Local variables
ebp + 8
ebp + 4
ebp - 4
Stack frame

Calling a function

1. Push parameters onto the stack, from right to left.

2. Call the function. The contents of the %EIP (instruction pointer) is pushed onto the stack. It points to the first byte *after* the CALL instruction*.*

Executing a function

3. Save and update the %ebp.

```
    pushl %ebp
    movl  %esp, %ebp
```

4.Save CPU registers used for temporaries.

5. Allocate local variables.

6. Perform the function's purpose.
   Store return value, if any, in `%eax`.

7. Restore saved CPU registers.

8. Release local storage.

```
      movl %ebp, %esp
```

9. Restore the old base pointer.

```
      popl %ebp
```

`leave`

10. Return from the function.

```
      ret
```

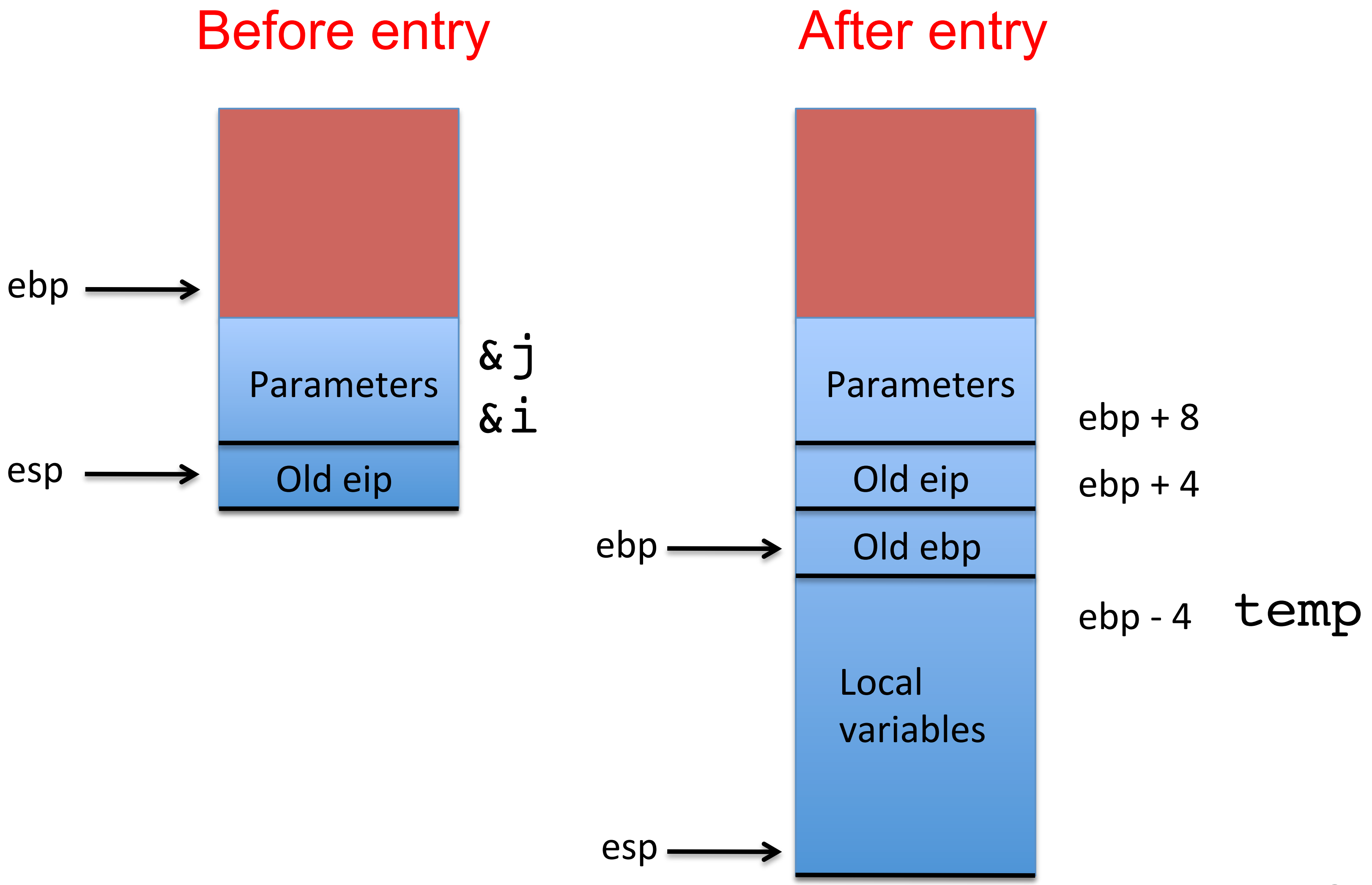
11. Clean up pushed parameters.
    The *caller* must clean up the parameters pushed onto the stack.

An example

```
int main() {
    int i = 7;
    int j = 13;
    swap(&i, &j);
}

void swap(int *a, int *b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}
```

Stack frame



Before entry
After entry
ebp
esp
Parameters
Old eip
&j
&i
Parameters
Old eip
Old ebp
Local variables
ebp
esp
ebp + 8
ebp + 4
ebp - 4
temp