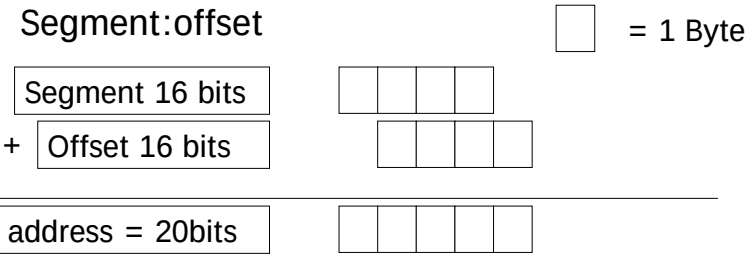
X86 assembly quick tutorial

Memory model

- Real mode (address up to 2^20 bytes)
- Memory access is done by

Segment:offset



Memory access

- Remember the default segment register
- Data access: (general registers)

  Movw (%si), %ax

  == movw %ds: (%si), %ax

- Stack access: (%bp, %sp)

  Movw 4(%bp), %ax

  == movw %ss : 4(%bp), %ax

Memory access (cont)

- Code access:

  Normally you do not explicitly change %IP.
  Use jmp, jz, call etc instead.

  - Short jump: jmp label

    actually this is to jmp %cs, offset of label
  - Long jump: ljmp NEW_CS, offset

Calling convention (Gcc style)

```
int foo2(int n) {
        return n + 2;
}
int foo( int n ) {
        return foo2(n - 1);
}
int main (void) {
         return foo( 5);
}
```

C -> Assembly (passing parameter)

```
int foo2(int n)
{
        return n + 2;
}
```

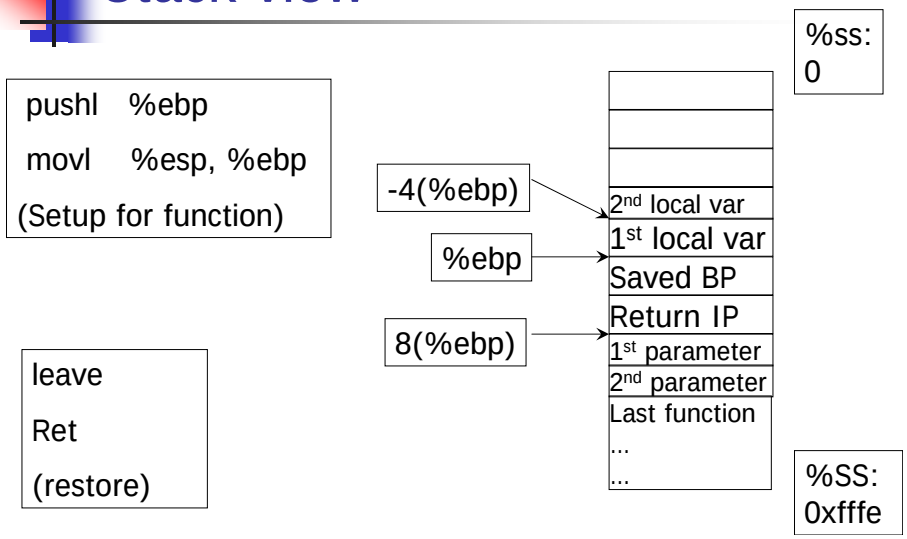
```
foo2:
        pushl   %ebp
        movl    %esp, %ebp
        movl    8(%ebp), %eax
        addl    $2, %eax
        leave
        ret
```

C -> assembly: (local variable)

```
int foo3(int n)
{
        int i;
        i = n + 2;
        return i;
}h
```

```
foo3:
        pushl   %ebp
        movl    %esp, %ebp
        subl    $4, %esp
        movl    8(%ebp), %eax
        addl    $2, %eax
        movl    %eax, -4(%ebp)
        movl    -4(%ebp), %eax
        leave
        ret
```

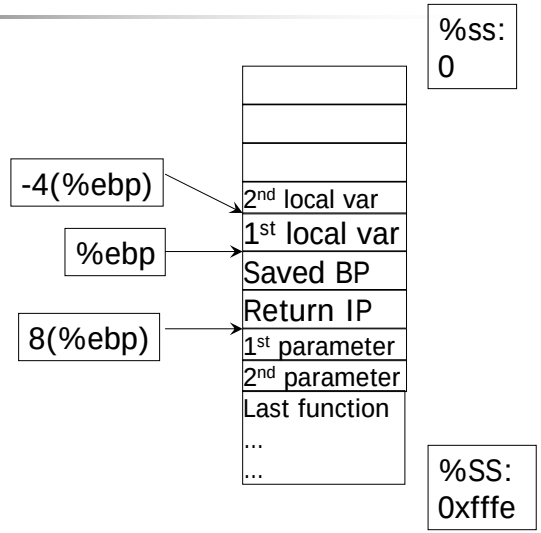
Stack view



Calling a function

```
pushw  %ax
call  foo2

(%ax can be
accessed by 8(%bp)
within function)
```



Note for project 1

- In our project, the bootloader is working in real mode (16 bits).
- The gcc example given earlier is compiled in 32 bits mode.
- So beware of the difference of accessing the calling parameter:
  - 32 bits -> 8(%ebp)
  - 16 bits -> 4(%bp)

More notes for bootloader

- Bootloader code is loaded by BIOS, so it did not have %ds, %ss, %sp setup properly when it is loaded.
- You shall put strings and extra instructions after “over:” so that BIOS will not run into those code.
- In bootloader, all the code and data share the same 512 bytes. So data will have the same segment as code.