CSE320 System Fundamentals II
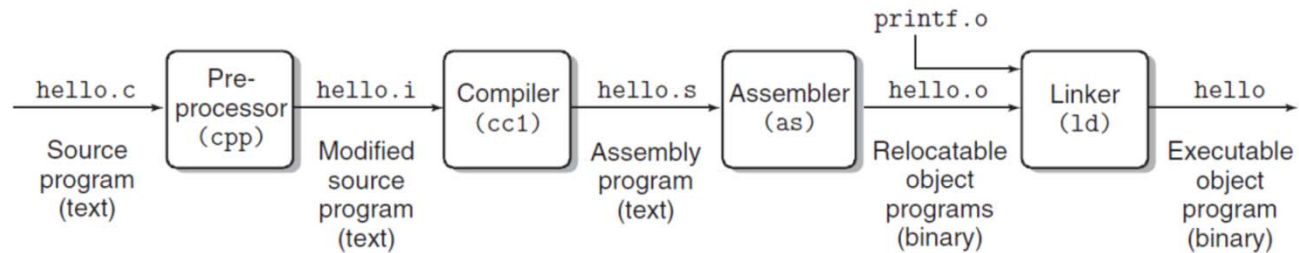
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Process: C Programming

- C Programming

```c
#include <stdio.h>
int main(int argc, char** argv) {
    printf("Hello World");
    return 0;
}
```
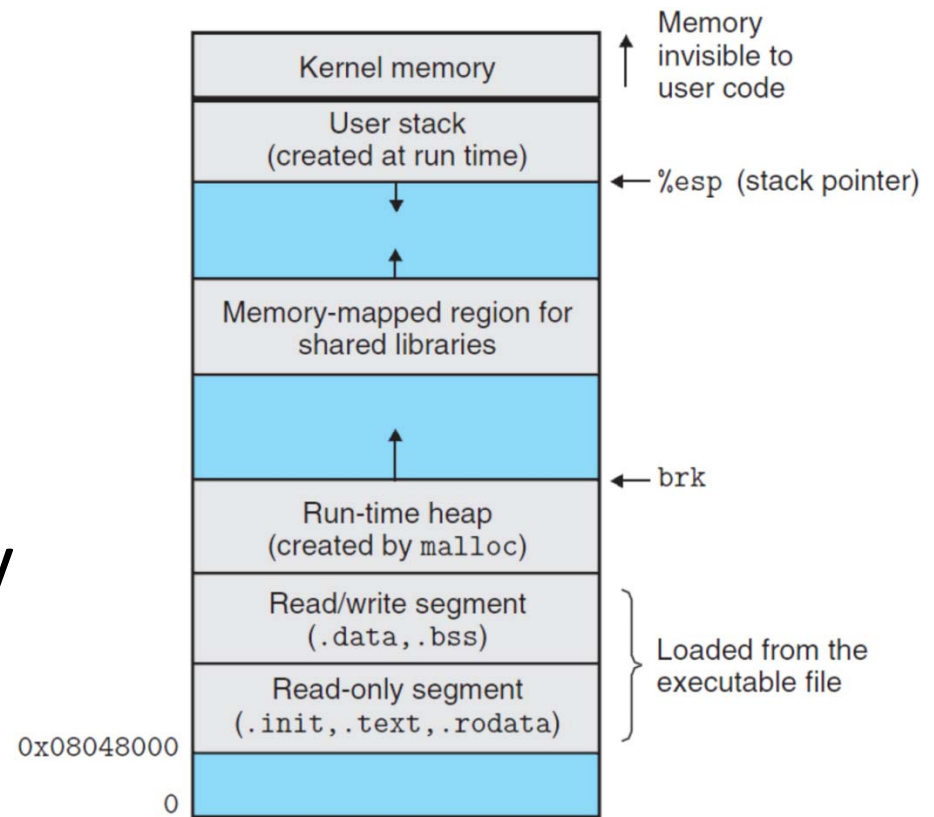
- Compilation

- gcc hello.c
- gcc –E hello.c –o hello.i
- gcc –S hello.c
- gcc hello.s

Process: Run-time Environments

- Variables
- Flow control
- Function calls
- Structures
- Pointers
- Dynamic memory allocation
- Run-time env.

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```c
#include <stdio.h>
void foo(
    char* msg)
{

    int a = 100;
    printf(
        "%s %d\n",
        msg,
        a);
}


int main(
    int argc,
    char** argv)
{

    foo("Hello World");
    return 0;
}
```
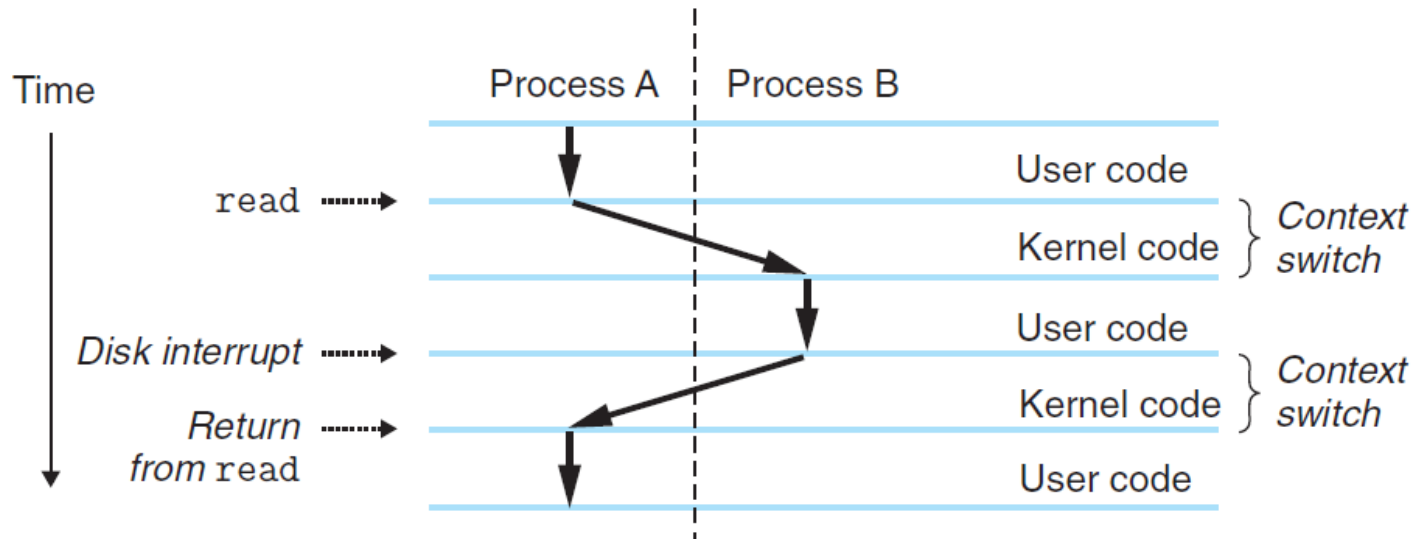
```asm
        .section    .rodata
.LC0: .string    "%s %d\n"
.LC1: .string    "Hello World"
        .text
        .globl  foo, main
foo:
    pushq   %rbp
    movq    %rsp, %rbp
    subq    $32, %rsp
    movq    %rdi, -24(%rbp)
    movl    $100, -4(%rbp)
    movl    -4(%rbp), %edx
    movq    -24(%rbp), %rax
    movq    %rax, %rsi
    movl    $.LC0, %edi
    movl    $0, %eax
    call    printf
    leave
    ret
main:
    pushq   %rbp
    movq    %rsp, %rbp
    subq    $16, %rsp
    movl    %edi, -4(%rbp)
    movq    %rsi, -16(%rbp)
    movl    $.LC1, %edi
    call    foo
    movl    $0, %eax
    leave
    ret
```
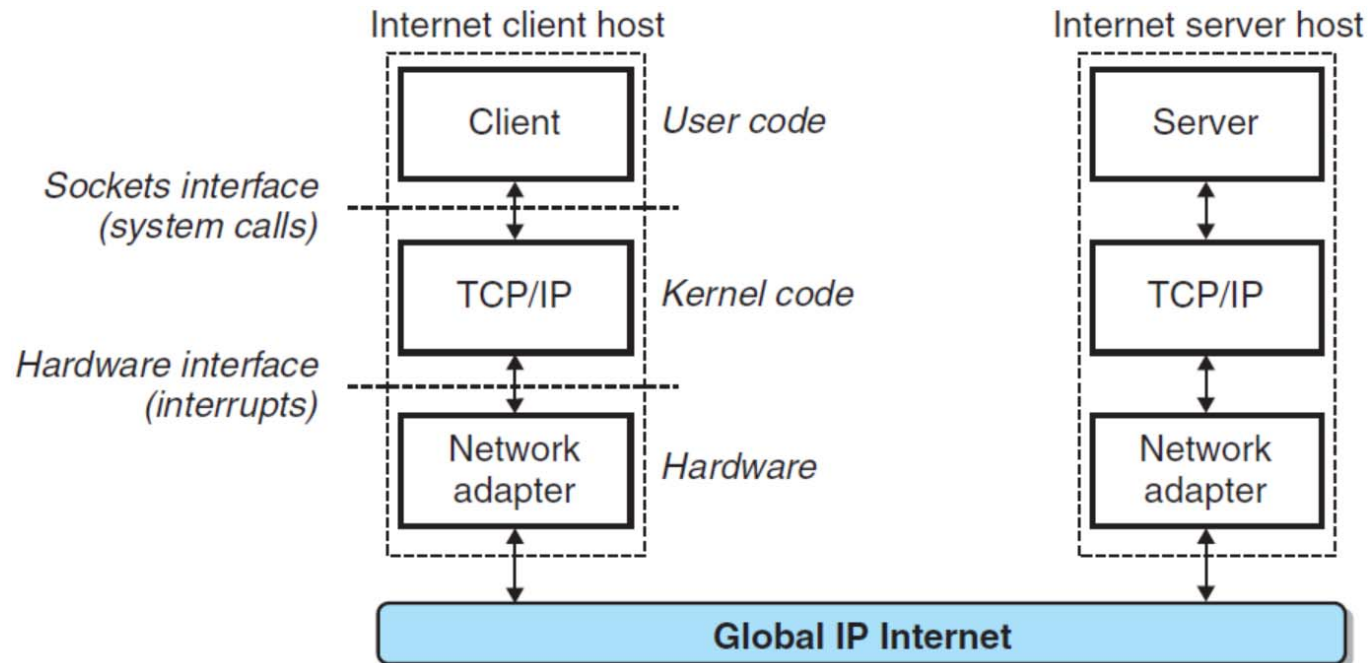
Using OS: System Calls

- User mode code cannot access resources directly
- Ask the OS to handle the request
- `read, write, fork, execv, _exit, …`

Using OS: Networks

- Client-Server Model
- Socket programming

Using OS: Threads and Locks

If two processes are printing simultaneously without coordination…


```
#include <stdio.h>
void foo(Repetition Is not generality. Repetition and generality
    char* msg)
{
    int amust be distinguished in several ways. Every formula
which = 100; implies their

    printf("%s %d\n", confusion is regrettable:

msg, a);
}
for example, when we say that two things are as alike as int
main(two drops of water; or when we identify 'there is only a
science of the general'
 int with argc,

'there is only a science of that which is repeated.'char** argv)
Repetition and resemblance are different in kind – extremely so.
{
    foo("Hello World");
    return 0;
}
```
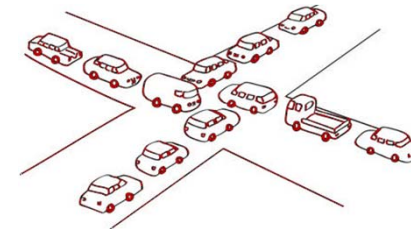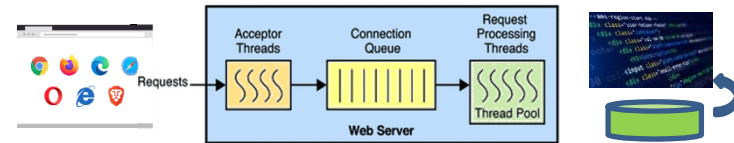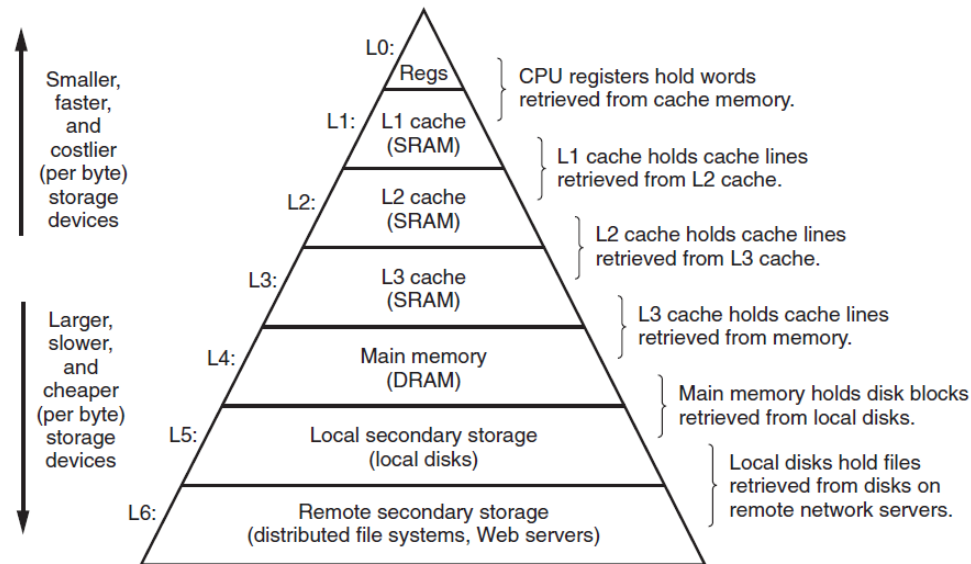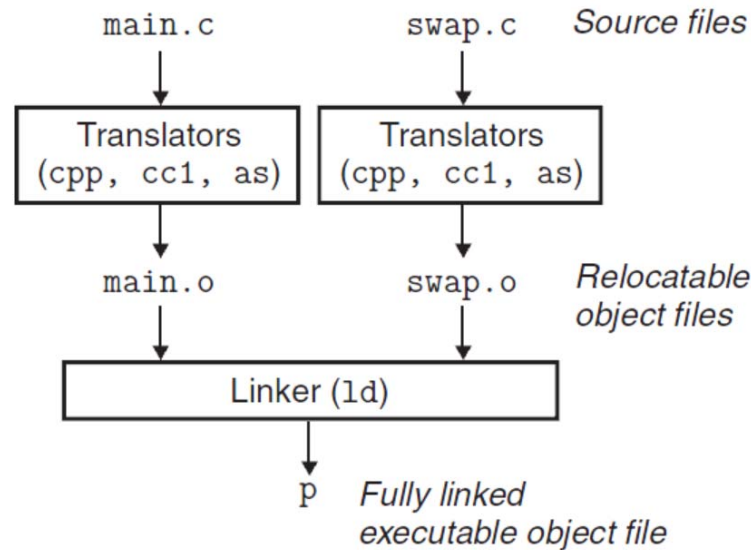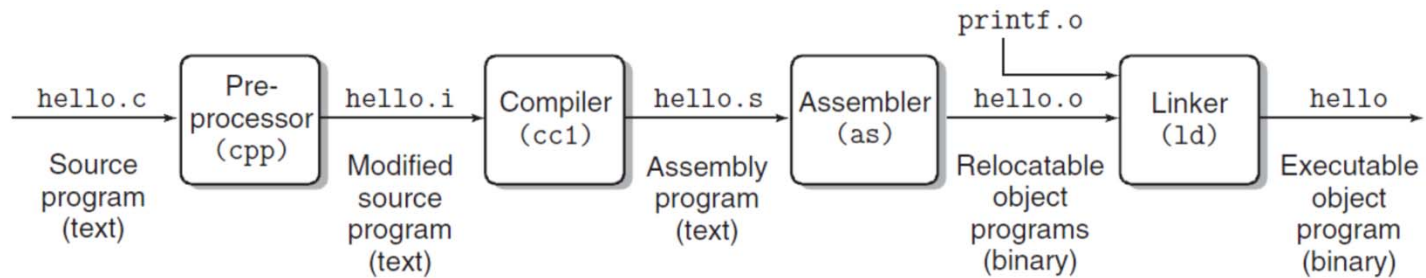
OS Inside: Memory

- ## Memory Hierarchy

- ## Magic?

  - I bought a PC with 8GB of memory, but I got 100 processes running each with 4GB of memory.

OS Inside: Memory Mapping & Linking

Questions?