بسم الله الرحمن الرحیم

۱ «سیستم عامل»

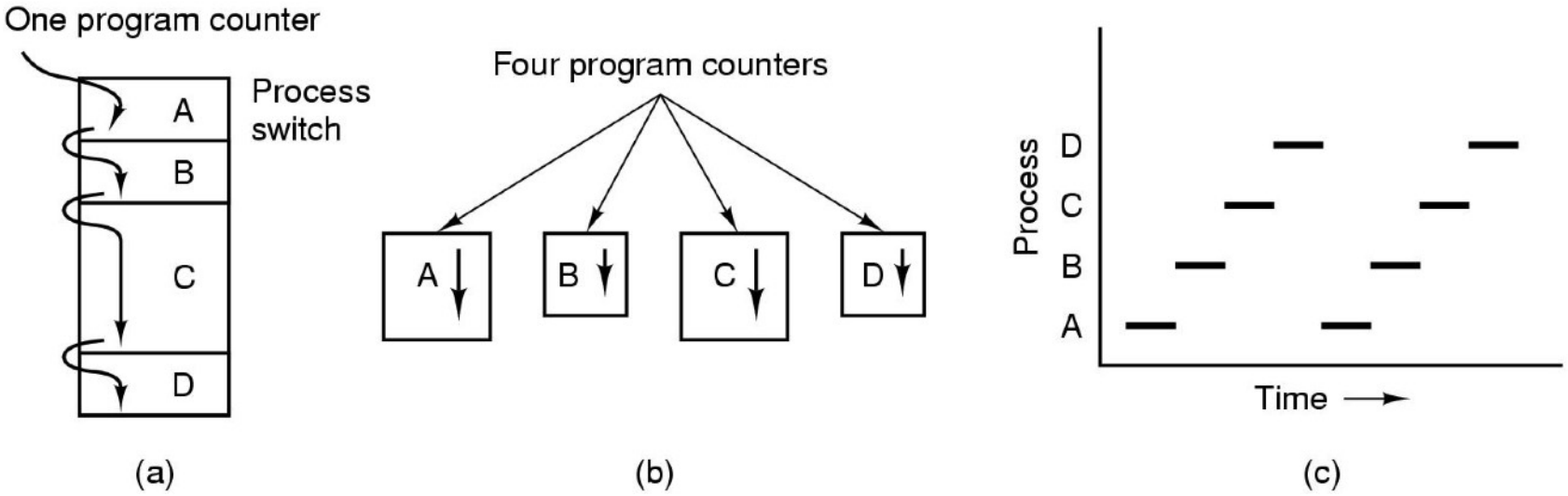
جلسه ۴ : پردازه

The Process Concept

The Process Concept

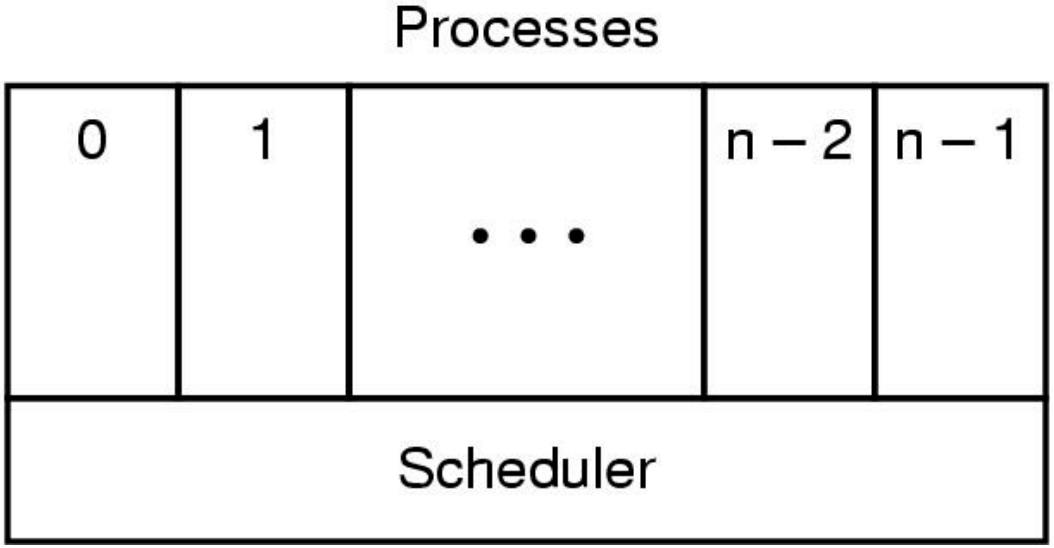
- **Process – a program in execution**
  - Program
    - **description of how to perform an activity**
    - **instructions and static data values**
  - Process
    - **a snapshot of a program in execution**
    - **memory (program instructions, static and dynamic data values)**
    - **CPU state (registers, PC, SP, etc)**
    - **operating system state (open files, accounting statistics etc)**

Why use the process abstraction?



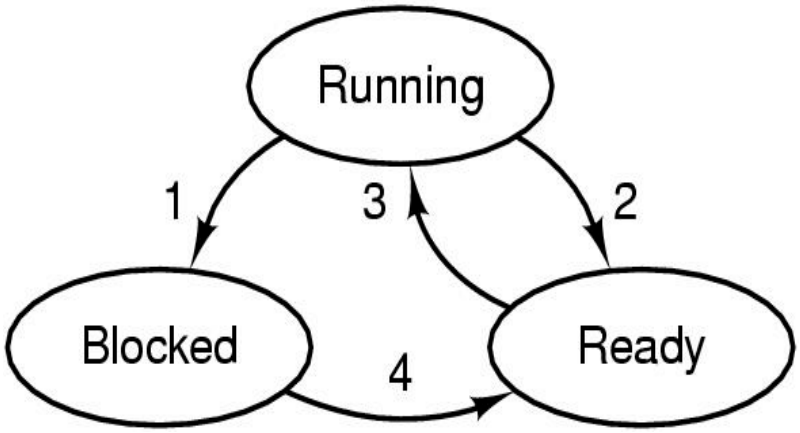
- Multiprogramming of four programs in the same address space
- Conceptual model of 4 independent, sequential processes
- Only one program active at any instant

The role of the scheduler



- **Lowest layer of process-structured OS**
  - handles interrupts & scheduling of processes
- **Sequential processes only exist above that layer**

Process states



1. Process blocks for input
2. Scheduler picks another process
3. Scheduler picks this process
4. Input becomes available

- **Possible process states**
  - running
  - blocked
  - ready

How do processes get created?

Principal events that cause process creation

- System initialization
- Initiation of a batch job
- User request to create a new process
- Execution of a process creation system call from another process

Process hierarchies

- **Parent creates a child process,**
  - special system calls for communicating with and waiting for child processes
  - each process is assigned a unique identifying number or process ID (PID)
- **Child processes can create their own child processes**
  - Forms a hierarchy
  - UNIX calls this a "process group"

Process creation in UNIX

- **All processes have a unique process id**
  - getpid(), getppid() system calls allow processes to get their information
- **Process creation**
  - fork() system call creates a copy of a process and returns in both processes (parent and child), but with a different return value
  - exec() replaces an address space with a new program
- **Process termination, signaling**
  - signal(), kill() system calls allow a process to be terminated or have specific signals sent to it

Example: process creation in UNIX

csh (pid = 22)

```
…

pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

Process creation in UNIX example

csh (pid = 22)

```
…
pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

Process creation in UNIX example

csh (pid = 22)

```
…
pid = fork()
if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

csh (pid = 24)

```
…
pid = fork()
if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

Process creation in UNIX example

csh (pid = 22)

```
…

pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

csh (pid = 24)

```
…

pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

Process creation in UNIX example

csh (pid = 22)

```
…

pid = fork()

if (pid == 0) {
   // child…
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   exec();
   }
else {
   // parent
   wait();
   }
…
```

csh (pid = 24)

```
…

pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

Process creation in UNIX example

csh (pid = 22)

```
…

pid = fork()

if (pid == 0) {
   // child…
   …
   exec();
   }
else {
   // parent
   wait();
   }
…
```

ls (pid = 24)

```
//ls program

main(){

   //look up dir

   …

}
```

Process creation (fork)

- **Fork creates a new process by copying the calling process**
- **The new process has its own**
  - memory address space (copied from parent)
    - **Instructions**
    - **Data**
    - **Stack**
  - Register set (copied from parent)
  - Process table entry in the OS

Killing a process

- Sending kill signal to kernel
- Killing a process does not kill its descendants
  -

wait()

- Waits until:
  - A child is killed, or
  - A signal is received from OS