Al-Hamdaniya University

College of Education

Computer Science

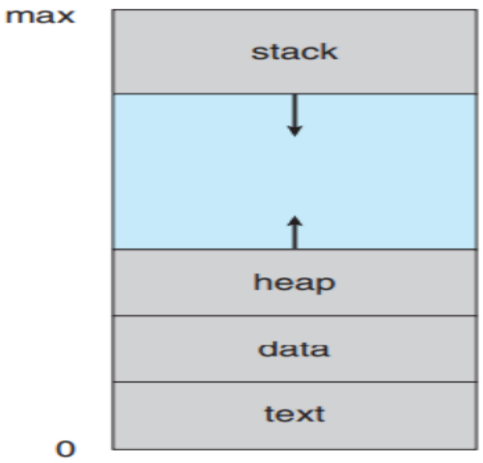
Stage: 4th

Process Concept

Process Detention

A process is a program in execution. The status of the current activity of a process is represented by the value of the program counter and the contents of the processor's registers. The memory layout of a process is typically divided into multiple sections, These sections include:

- Text section— the executable code
- Data section—global variables
- Heap section—memory that is dynamically allocated during program run time
- Stack section— temporary data storage when invoking functions (such as function parameters, return addresses, and local variables)



Layout of a process in memory

Process States: Life cycle of Process

As a process executes, it changes state. The state of a process is defined in part by the current activity of that process. A process may be in one of the following states:

- **New**. The process is being created.
- **Running**. Instructions are being executed.
- **Waiting**. The process is waiting for some event to occur (such as an I/O completion or reception of a signal).
- **Ready**. The process is waiting to be assigned to a processor.
- **Terminated**. The process has finished execution.

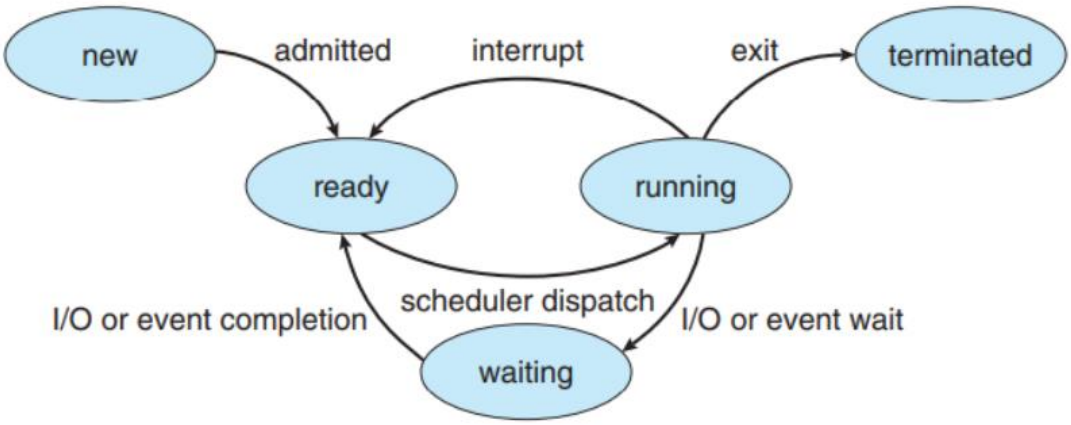


Diagram of process state

Process Control Block PCB

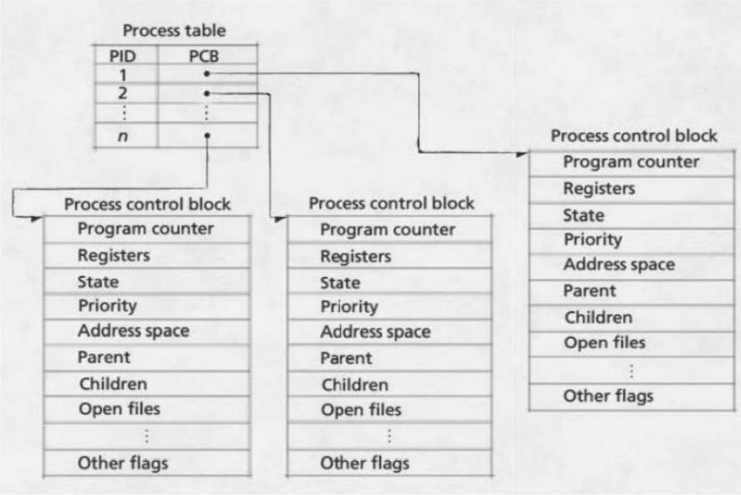
Each process is represented in the operating system by a process control block (PCB)—also called a task control block. Most operating systems (including UNIX, Linux, and Windows) identify processes according to a unique Process Identification number(or PID), which is typically an integer number. The PID provides a unique value for each process in the system, and it can be used as an index to access various attributes of a process within the kernel.

A PCB contains many pieces of information associated with a specific process, including these:

- **PID** (**Process Identification number)**

- **Process state**. The state may be new, ready, running, waiting, halted, and so on.
- **Program counter**. The counter indicates the address of the next instruction to be executed for this process.
- **CPU registers**. The registers vary in number and type, depending on the computer architecture. They include accumulators, index registers, stack pointers, and general-purpose registers, plus any condition-code information.
- **CPU-scheduling information**. This information includes a process priority, pointers to scheduling queues, and any other scheduling parameters. (describes process scheduling.)
- **Memory-management information**. This information may include such items as the value of the base and limit registers and the page tables, or the segment tables, depending on the memory system used by the operating system.

- **Accounting information**. This information includes the amount of CPU and real time used, time limits, account numbers, job or process numbers, and so on.
- **I/O status information**. This information includes the list of I/O devices allocated to the process, a list of open files, and so on.



Accounting information and PCB for processes

Process Operations

Operating systems must be able to perform certain six process operations, including:

- **create a process**
- **destroy a process**
- **suspend a process**
- **resume a process** change a process's priority
- **block a process**
- **wake up a process**
- **dispatch a process**
- **enable a process to communicate with another process** (this is called interprocess communication).