L7: Process concepts, Process state, Process control block

Dr. Rajashree Dash

Associate Professor,
Department of CSE,
ITER, Siksha O Anusandhan Deemed to be University

Outline

Process

- Process is a program in execution.
- Process needs certain resources such as CPU time, memory, files and I/O devices to accomplish its task.
- The resources are allocated to the process either when it is created or while it is executing.
- There are two types of processes:
  - Operating system processes that execute system code.
  - User processes that execute user code.

Program vs Process

Program	Process
A static object that exist in file.	A dynamic object i.e. a program in execution.
A passive entity such as the contents of files stored on disk.	An active entity with a program counter specifying the next instruction to be executed and a set of associated resources.
It resides in secondary memory.	It resides in main memory.
Span of time is unlimited.	Span of time is limited

Different parts of a Process

- The program code also called the text section.
- The current activity, as represented by the value of the program counter and the contents of the processor's registers.
- The process stack, which contains temporary data (such as function parameters, return addresses, and local variables).
- Data section, which contains global variables.
- A process may also include a heap, which is memory that is dynamically allocated during process run time.

Memory layout of process

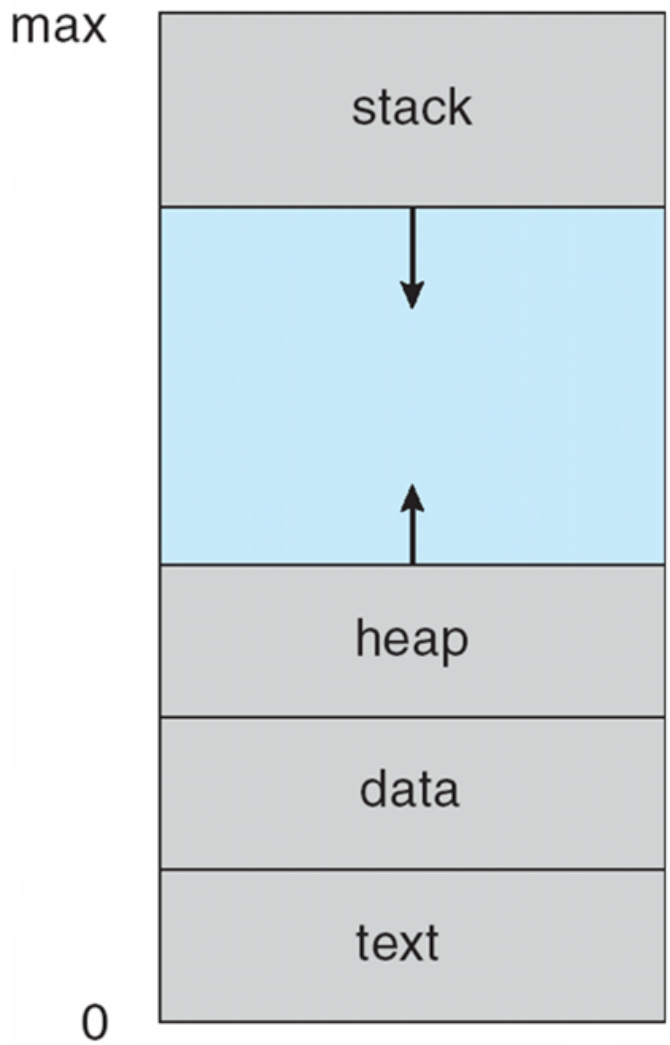

Figure: Memory layout of a process

Process state

As a process executes, it changes state. The state of a process specifies 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.

Process state

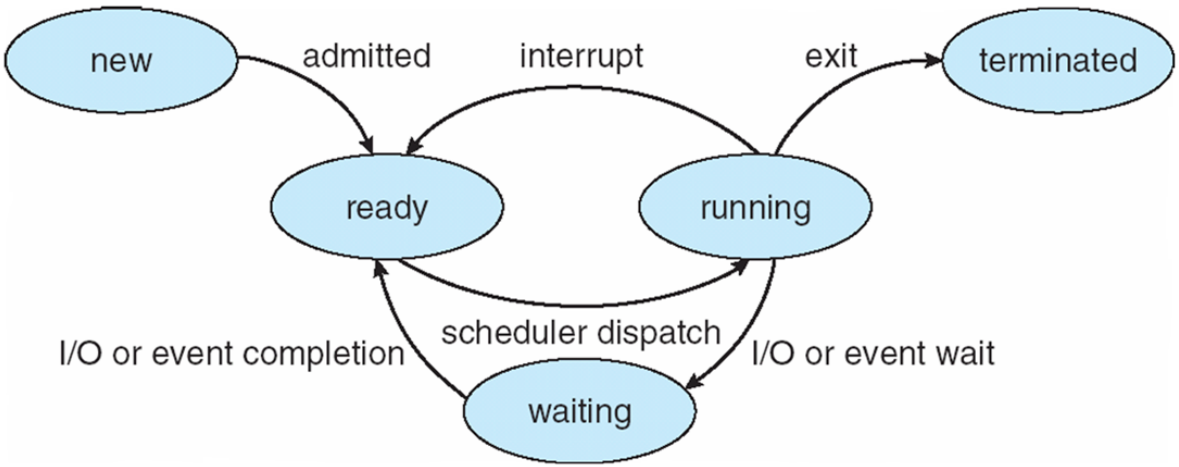

Figure: State diagram of a process

Process Control Block

The collection of attributes or information used by the OS to handle a process, is represented by a process control block (PCB) or a task control block.It simply serves as the repository for any information that may vary from process to process

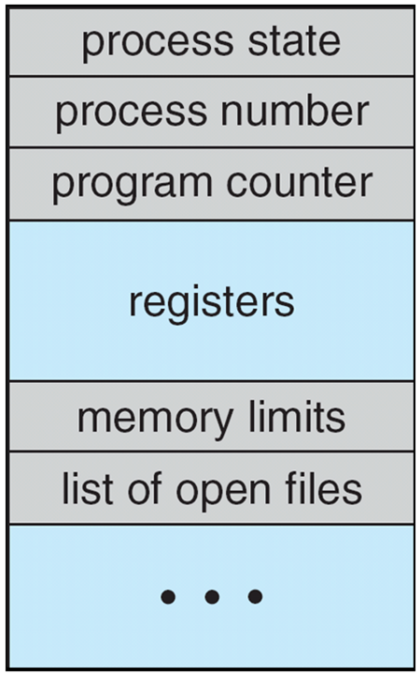

Figure: Process Control Block

Process Control Block

Content of PCB includes:

- 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. Along with the program counter, this state information must be saved when an interrupt occurs, to allow the process to be correctly afterward.
- CPU-scheduling information: This information includes a process priority, pointers to scheduling queues, and any other scheduling parameters.

Process Control Block

- 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.