

## Process

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### What is a process?

The process is an example of a computer program used. Contains the program code and its current function. Depending on the operating system (OS), a process can be performed with multiple configurations that issue commands simultaneously. Each process has a complete set of variations.

### Process Conditions:

- **New State:** This is the state when the process is just created. It is the first state of a process.
- **Ready State:** After the creation of the process, when the process is ready for its execution then it goes into the ready state. In a ready state, the process is ready for its execution by the CPU but it is waiting for its turn to come. There can be more than one process in the ready state.
- **Ready Suspended State:** There can be more than one process in the ready state but due to memory constraint, if the memory is full then some process from the ready state gets placed in the ready suspended state.
- **Running State:** Amongst the process present in the ready state, the CPU chooses one process amongst them by using some CPU scheduling algorithm. The process will now be executed by the CPU and it is in the running state.
- **Waiting or Blocked State:** During the execution of the process, the process might require some I/O operation like writing on file or some more priority process might come. In these situations, the running process will have to go into the waiting or blocked state and the other process will come for its execution. So, the process is waiting for something in the waiting state.
- **Waiting Suspended State:** When the waiting queue of the system becomes full then some of the processes will be sent to the waiting suspended state.

- **Terminated State:** After the complete execution of the process, the process comes into the terminated state and the information related to this process is deleted.

## Process Control Block(PCB)

Each process is represented in the operating system by a process control block (PCB) also called a task control block. It contains many pieces of information associated with a specific process, including these:

- **Process:** The state may be new, ready, running, and so on
- **Program counter:** It indicates the address of the next instruction to be executed for this program.
- **CPU registers:** These vary in number and type based on architecture. They include accumulators, stack pointers, general-purpose registers, etc.
- **CPU scheduling:** This includes process priority, pointers to scheduling queues, and any scheduling parameters.
- **Memory-management:** This includes the value of base and limit registers (protection) and page tables, segment tables depending on memory.
- **Accounting:** It includes the amount of CPU and real-time used, account numbers, process numbers, etc
- **I/O status information:** It includes a list of I/O devices allocated to this process, a list of open files, etc

## Program vs Process

Process

Program

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|---|--|
| 1. Process is an instance of an executing program.  | 1. Program contains a set of instructions designed to complete a task.                   |
| 2. Lifespan of process is less than program.  | 2. Lifespan of program is longer   |
| 3. Process exists for a limited span of time as it gets terminated after the completion of a task.                            | 3. Program exists at a single place and continues to exist until it is deleted.          |
| 4. Process is a dynamic entity.   | 4. Program is a static entity.   |
| 5. The process has a high resource requirement, it requires resources such as CPU, memory address, O / O during its lifetime. | 5. Program has no resource requirement, it only requires memory space to store commands. |

## Multiprogramming

A computer running more than one program at a time (like running Excel and Firefox simultaneously).

Multiprogramming increases CPU utilization by keeping multiple jobs (code and data) in the memory so that the CPU always has one to execute.

## Multitasking

Multitasking has the same meaning of multiprogramming but in a more general sense, as it refers to having multiple (programs, processes, tasks, threads)

running at the same time. Multitasking is a logical extension of multiprogramming.

CPU executes multiple tasks by switching among them.

The switching is very fast.

Requires an interactive (hands-on) computer where the user can directly interact with the computer.

## Multiprocessing

Multi Processing sometimes refers to executing multiple processes (programs) at the same time.

A system can be both multi programmed by having multiple programs running at the same time and multiprocessing by having more than one physical processor.