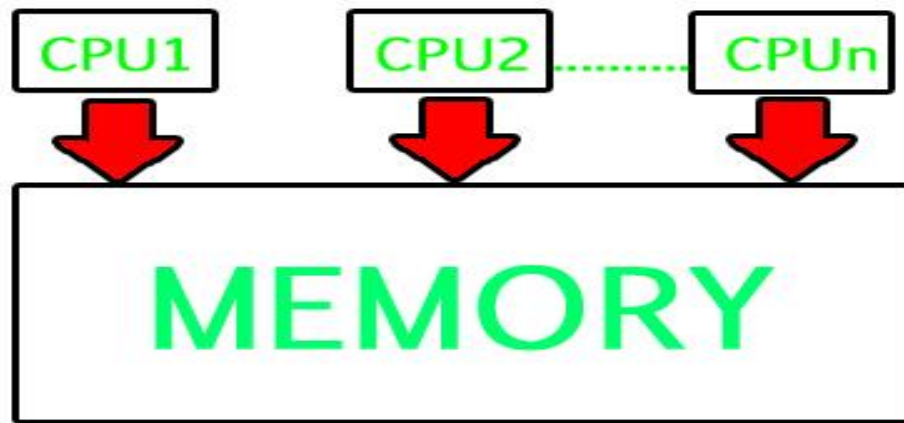


Multi processing system's working –

- With the help of multiprocessing, many processes can be executed simultaneously. Say processes P1, P2, P3 and P4 are waiting for execution. Now in a single processor system, firstly one process will execute, then the other, then the other and so on.
- But with multiprocessing, each process can be assigned to a different processor for its execution. If its a dual-core processor (2 processors), two processes can be executed simultaneously and thus will be two times faster, similarly a quad core processor will be four times as fast as a single processor.

Why use multi processing –

- The main advantage of multiprocessor system is to get more work done in a shorter period of time. These types of systems are used when very high speed is required to process a large volume of data. Multi processing systems can save money in comparison to single processor systems because the processors can share peripherals and power supplies.
- It also provides increased reliability in the sense that if one processor fails, the work does not halt, it only slows down. e.g. if we have 10 processors and 1 fails, then the work does not halt, rather the remaining 9 processors can share the work of the 10th processor. Thus the whole system runs only 10 percent slower, rather than failing altogether.



Multiprocessing refers to the hardware (i.e., the CPU units) rather than the software (i.e., running processes). If the underlying hardware provides more than one processor then that is multiprocessing. It is the ability of the system to leverage multiple processors' computing power.

Difference between Multi programming and Multi processing –

- 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. The difference between multiprocessing and multi programming is that Multiprocessing is basically executing multiple processes at the same time on multiple processors, whereas multi programming is keeping several programs in main memory and executing them concurrently using a single CPU only.
- Multiprocessing occurs by means of parallel processing whereas Multi programming occurs by switching from one process to other (phenomenon called as context switching).

3. Multitasking –

As the name itself suggests, multi tasking refers to execution of multiple tasks (say processes, programs, threads etc.) at a time. In the modern operating systems, we are able to play MP3 music, edit documents in Microsoft Word, surf the Google Chrome all simultaneously, this is accomplished by means of multi tasking.

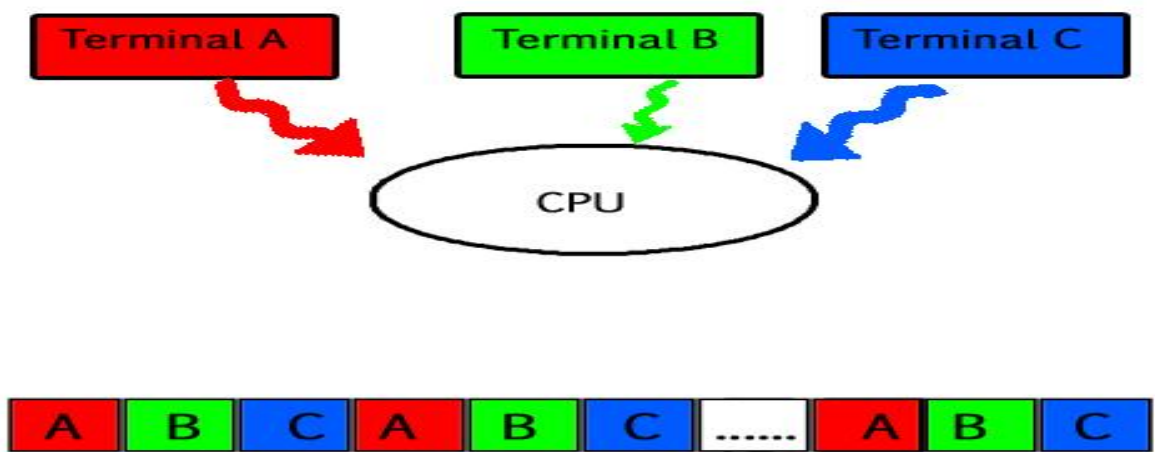
Multitasking is a logical extension of multi programming. The major way in which multitasking differs from multi programming is that **multi programming works solely on the concept of context switching whereas multitasking is based on time sharing alongside the concept of context switching.**

Multi tasking system's working –

- In a time sharing system, each process is assigned some specific quantum of time for which a process is meant to execute. Say there are 4 processes P1, P2, P3, P4 ready to execute. So each of them are assigned some time quantum for which they will execute e.g time quantum of 5 nanoseconds (5 ns). As one process begins execution (say P2), it executes for that quantum of time (5 ns). After 5 ns the CPU starts the execution of the other process (say P3) for the specified quantum of time.
- Thus the CPU makes the processes to share time slices between them and execute accordingly. As soon as time quantum of one process expires, another process begins its execution.
- Here also basically a context switch is occurring but it is occurring so fast that the user is able to interact with each program separately while it is running. This way, the user is given the illusion that multiple processes/ tasks are executing simultaneously. But actually only one process/ task is executing at a particular instant of time. In multitasking,

time sharing is best manifested because each running process takes only a fair quantum of the CPU time.

In a more general sense, multitasking refers to having multiple programs, processes, tasks, threads running at the same time. This term is used in modern operating systems when multiple tasks share a common processing resource (e.g., CPU and Memory).



- As depicted in the above image, At any time the CPU is executing only one task while other tasks are waiting for their turn. The illusion of parallelism is achieved when the CPU is reassigned to another task. i.e all the three tasks A, B and C are appearing to occur simultaneously because of time sharing.
- So for multitasking to take place, firstly there should be multiprogramming i.e. presence of multiple programs ready for execution. And secondly the concept of time sharing.

4. Multi threading –

A thread is a basic unit of CPU utilization. Multi threading is an execution model that allows a single process to have multiple code segments (i.e., threads) running concurrently within the “context” of that process.

e.g. VLC media player, where one thread is used for opening the VLC media player, one thread for playing a particular song and another thread for adding new songs to the playlist.

Multi threading is the ability of a process to manage its use by more than one user at a time and to manage multiple requests by the same user without having to have multiple copies of the program.

Multi threading system’s working –

Example 1 –

- Say there is a web server which processes client requests. Now if it executes as a single threaded process, then it will not be able to process multiple requests at a time. Firstly one client will make its request and finish its execution and only then, the server will be able to process another client request. This is really costly, time consuming and tiring task. To avoid this, multi threading can be made use of.
- Now, whenever a new client request comes in, the web server simply creates a new thread for processing this request and resumes its execution to hear more client requests. So the web server has the task of listening to new client requests and creating threads for each individual request. Each newly created thread processes one client request, thus reducing the burden on web server.

Example 2 –

- We can think of threads as child processes that share the parent process resources but execute independently. Now take the case of a GUI. Say we are performing a calculation on the GUI (which is taking very long time to finish). Now we can not interact with the rest of the GUI until this command finishes its execution. To be able to interact with the rest of the GUI, this command of calculation should be assigned to a separate thread. So at this point of time, 2 threads will be executing i.e. one for calculation, and one for the rest of the GUI. Hence here in a single process, we used multiple threads for multiple functionality.

The image below completely describes the VLC player example:



Advantages of Multi threading –

- Benefits of Multi threading include increased responsiveness. Since there are multiple threads in a program, so if one thread is taking too long to execute or if it gets blocked, the rest of the threads keep

executing without any problem. Thus the whole program remains responsive to the user by means of remaining threads.

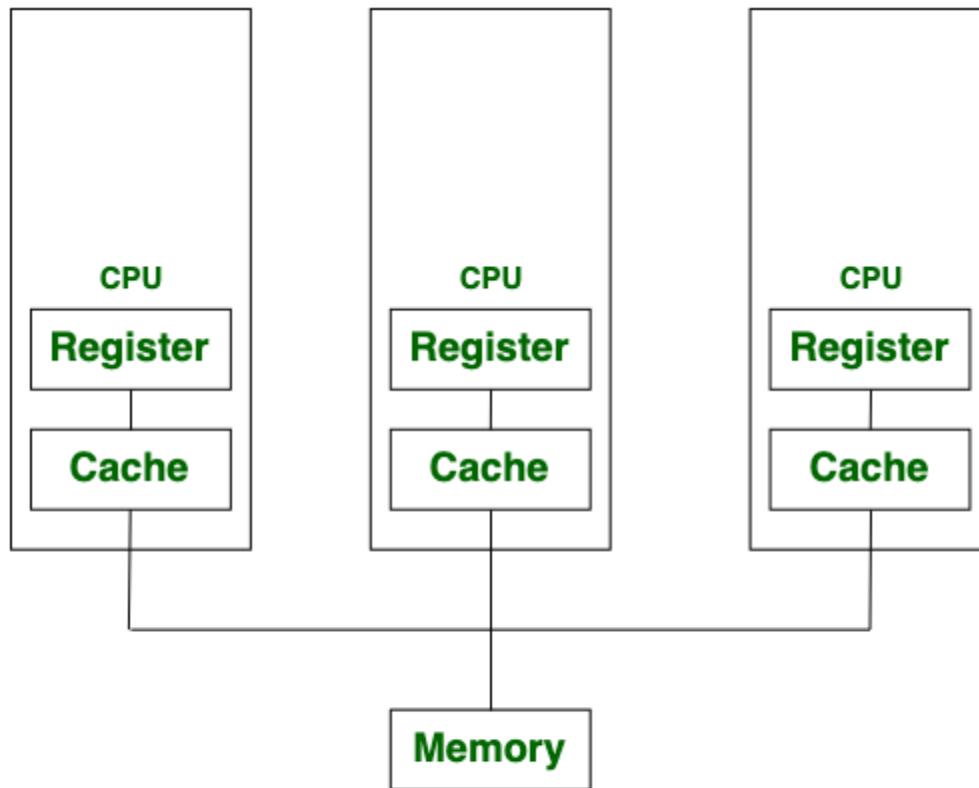
- Another advantage of multi threading is that it is less costly. Creating brand new processes and allocating resources is a time consuming task, but since threads share resources of the parent process, creating threads and switching between them is comparatively easy. Hence multi threading is the need of modern Operating Systems.

Both **Multiprocessing** and **Multithreading** are used to increase the computing power of a system.

Multiprocessing:

Multiprocessing is a system that has more than one or two processors. In Multiprocessing, CPUs are added for increasing computing speed of the system. Because of Multiprocessing, There are many processes are executed simultaneously. Multiprocessing are classified into two categories:

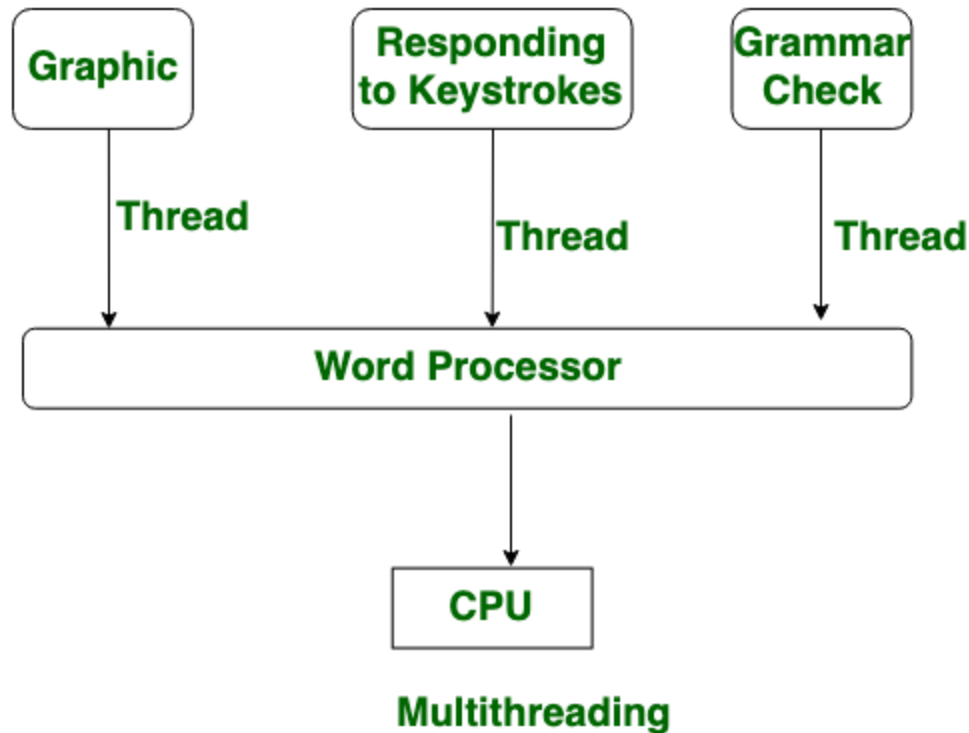
1. Symmetric Multiprocessing
2. Asymmetric Multiprocessing



Multiprocessing

Multithreading:

Multithreading is a system in which multiple threads are created of a process for increasing the computing speed of the system. In multithreading, many threads of a process are executed simultaneously and process creation in multithreading is done according to economical.



Difference between Multiprocessing and Multithreading:

S.N
O Multiprocessing

Multithreading

1 . In Multiprocessing, CPUs are added for increasing computing power.

While In Multithreading, many threads are created of a single process for

increasing computing power.

- 2 . In Multiprocessing, Many processes are executed simultaneously.

While in multithreading, many threads of a process are executed simultaneously.

- 3 . Multiprocessing are classified into Symmetric and Asymmetric.

While Multithreading is not classified in any categories.

- 4 . In Multiprocessing, Process creation is a time-consuming process.

While in Multithreading, process creation is according to economical.

- 5 . In Multiprocessing, every process owned a separate address space.

While in Multithreading, a common address space is shared by all the threads.

