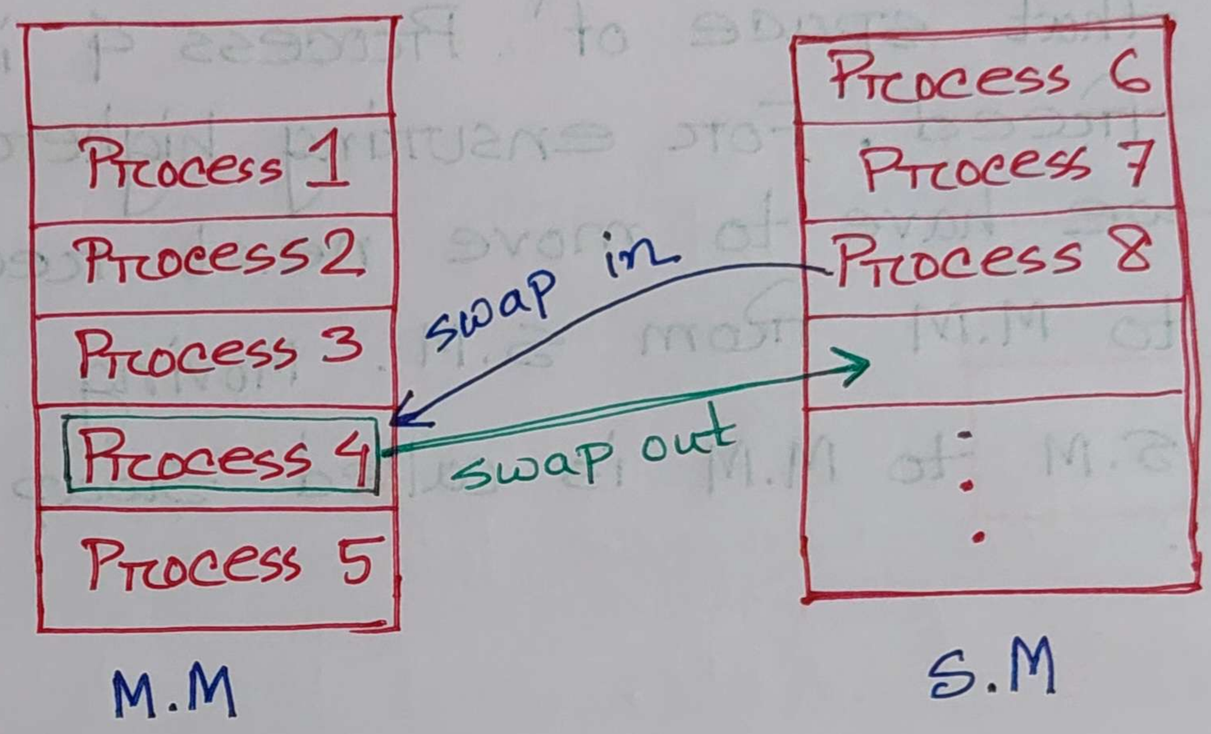
Swapping

↳ moving data between the M.M and S.M to free up space in RAM for process that needs.



⇒ Degree of multiprogramming refers to the number of programs/processes that can be con-currently loaded into M.M and ready to execute.

⇒ Higher Degree of multi-P. → higher number of processes resides in M.M waiting for CPU execution.

⇒ Higher Degree of M.P ensures proper CPU resource utilization.

- if process 4 has completed its execution or goes for I/O operation, then Process 4 must be moved for M.M to S.M which is called swap out

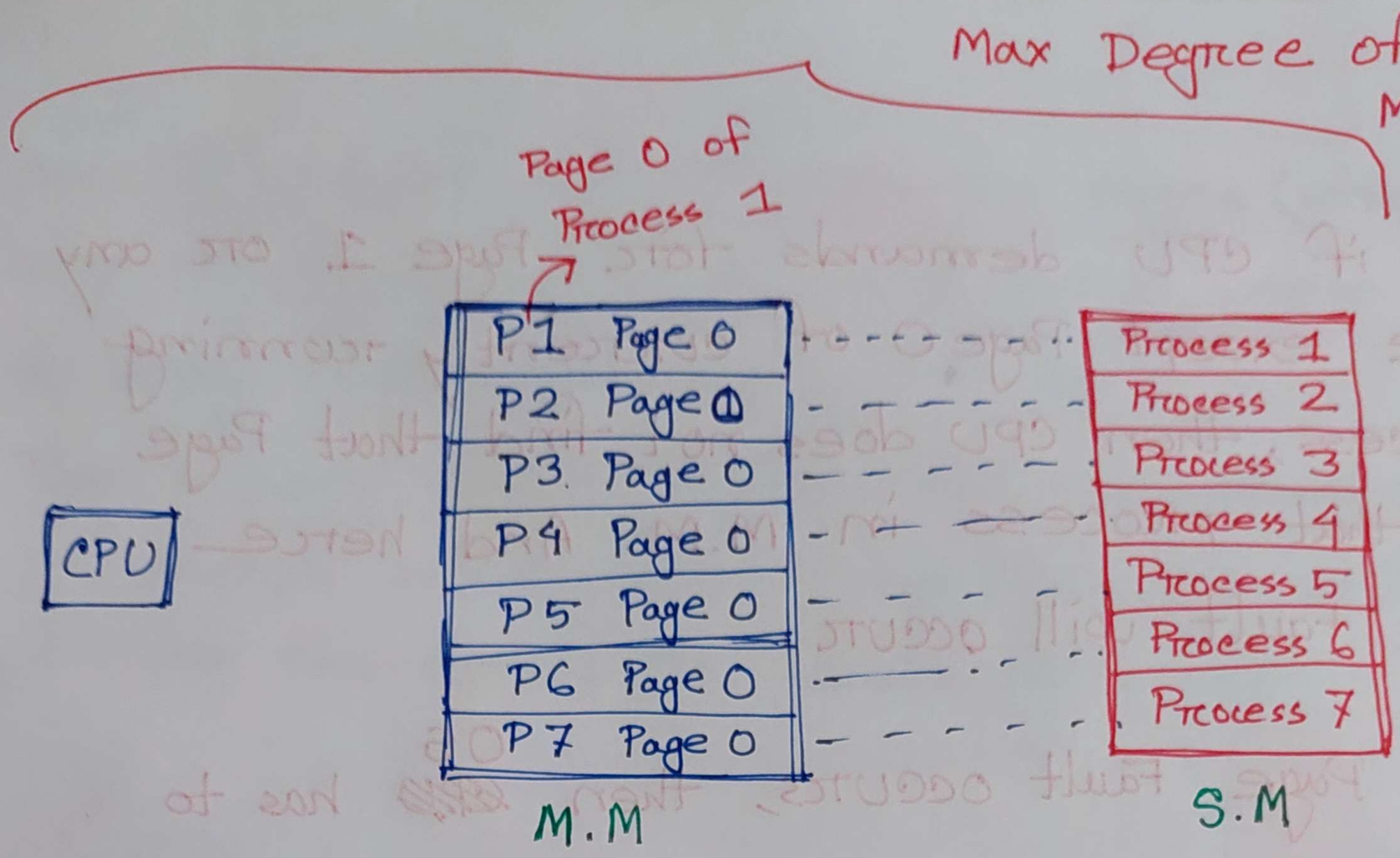
- When Process 4 has been swapped out, then that space of Process 4 in M.M will be freed. For ensuring higher degree of M.P, we have to move next requested Process 8 to M.M from S.M. Moving Process from S.M to M.M is called Swap In.

Virtual Memory

VM provides the programmer an illusion of a larger M.M than physically available.

VM gives an illusion that a process whose size is larger than the physical size of M.M can also be executed in the system.

- VM gives an illusion of ~~infinite~~ any number of processes of any sizes can be executed in the CPU.



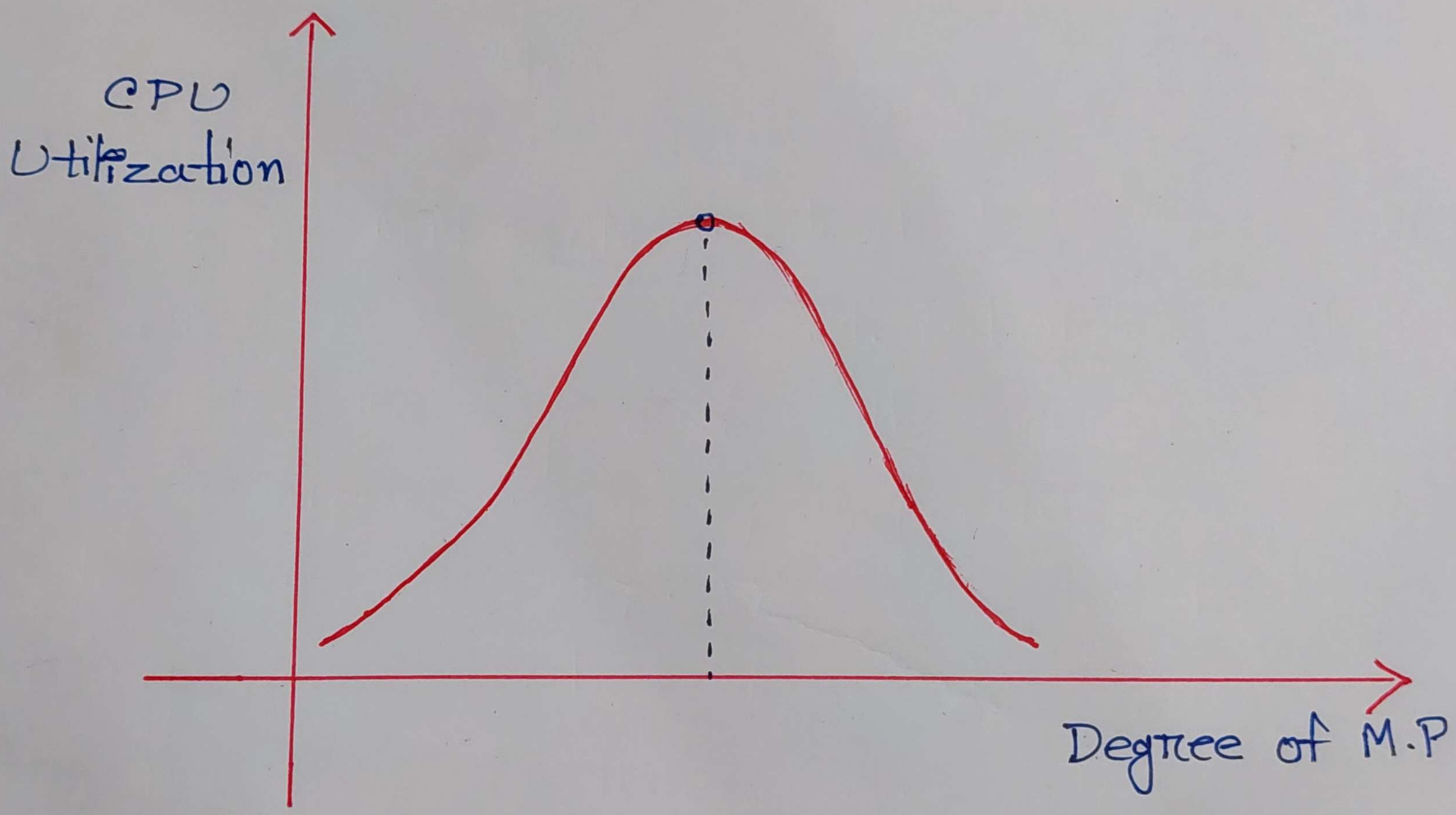
As size of M.M (RAM) is limited, we can not store all process resides in S.M. But if we want to maximize the degree of multi-programming, we have to store as many as possible processes in the main memory. We can solve this by storing some portion of almost all processes in the Main Memory from S.M.

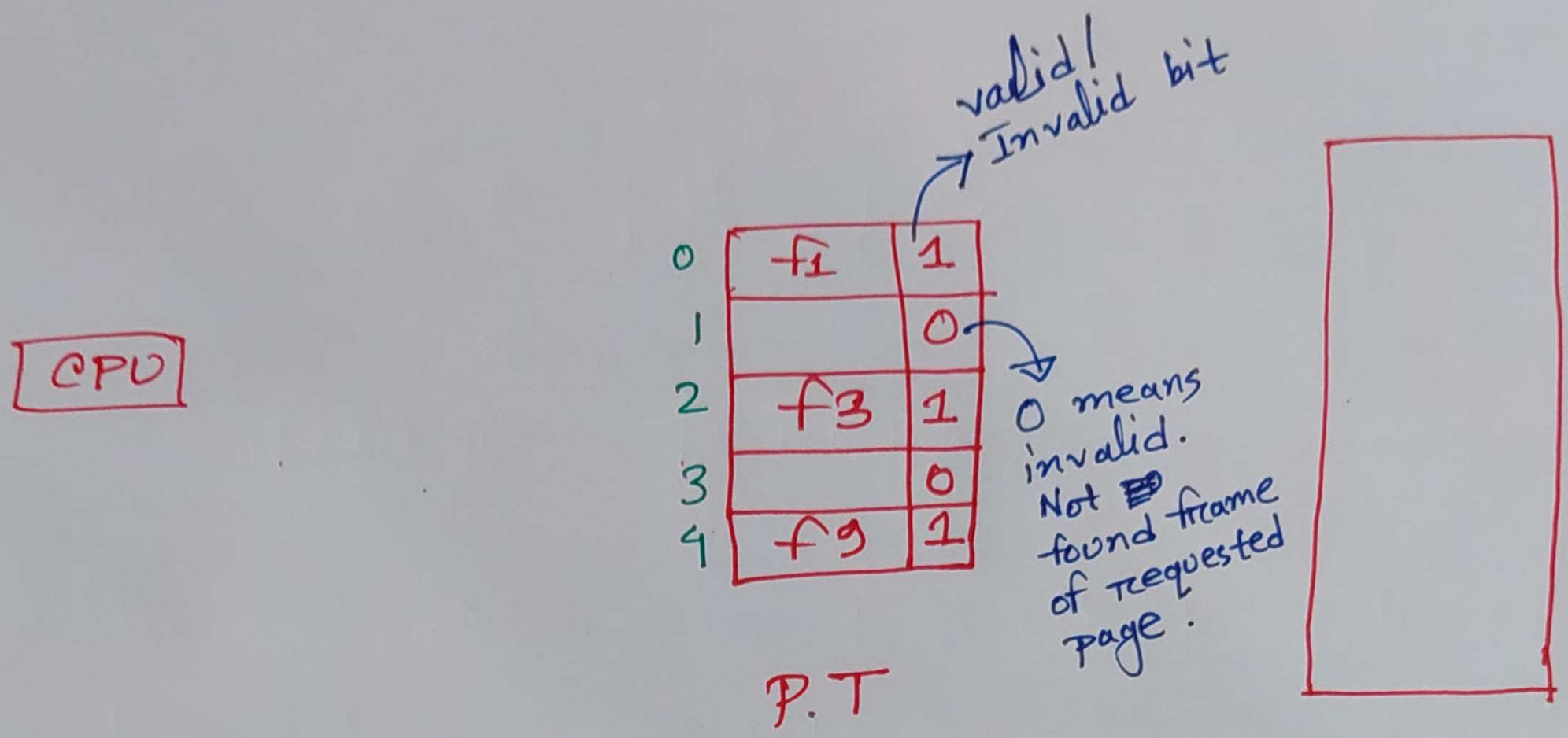
For example, we can store Page 0 of all Processes in M.M from S.M. So, CPU feels like all Processes are in M.M. It can call any waiting Processes for execution.

But if CPU demands for Page 1 or any page except Page 0 of currently running process, then CPU does not find that Page for that process in M.M. And here Page Fault will occur.

If Page Fault occurs, then OS has to bring that process from S.M to M.M. This process takes a lot of time in terms of CPU, and this time is called Page Fault Service Time.

Now if number of requests for pages (without page 0) increases, OS must spend more times to bring that page from S.M to M.M.
That means more page fault will occure and OS spends more times (Page Fault Service Time). During this time, CPU seats idle.





If CPU wants frame for Page 1 then CPU finds 0 in the valid/invalid bit portion of page 1. so CPU does not find that page and a Page Fault occurs. When Page Fault happens, it generates an interrupt called Trap.

When trap is generated, system control will be switched from user to OS.

OS checks the authenticity of the user who requested for that page. That means OS checks whether the user is permitted to access that page.