

HW5

Operating Systems

HW5 Tasks

- Implement the following system calls
 - Fork
 - Exit
 - Join

Fork

This list doesn't include all the tasks.

- `Handle_Sys_Fork`
 - Gets old user pc from `GetOldUserPCFromSystemStack()`
 - Invokes `ForkNewProcess` and pass it the program counter
- `ForkNewProcess`
 - Copy address space using `MemoryCopy`
 - Iterate over all frames.
 - Save user registers using `SaveUserRegs`
 - Copy file references, and set working directory
 - Call `Fork(Finish_Fork_For_Child, userPC)`
- `Finish_Fork_For_Child`
 - Compute stacks
 - Restore User Registers using `RestoreUserRegisters`
 - Set page table
 - Call `Become User Thread` → pass 0 for args

Join and Exit

- PCBs should be set to Zombie so that their exit status can be retrieved by the parent process.
- Zombies can be freed if
 - Parent either die or become zombies themselves
 - Parent executes a join, which retrieves the exit status
 - Parent doesn't exist.

Join and Exit

- Join and Exit Implementation will also use
 - ProcessFinish
 - Release all the resources (return frames, close files ...)
 - Set currProcess to null and also the thread of the PCB
 - Don't return the PCB to the free PCBs, instead invoke TurnIntoZombie followed by ThreadFinish()
 - TurnIntoZombie
 - Set parentPID of Children to -1
 - Free all zombie children
 - If parent's PID is -1, free the process instead of turning it to zombie.
 - Keep track of how many you freed so you can signal the same number.
 - WaitForZombie
 - Waits on a child process to become a zombie. Then retrieves the exit status and errors and frees the PCB.

- `Handle_Sys_Join`
 - Finds a child process and call `WaitForZombie` on it.
 - Check for errors, and set them properly (example: process is not found or process is not child of calling process)
- `Handle_Sys_Exit`
 - Will now call `processFinish`, passing it the return status
- You might need to change your process manager:
 - You might need an additional condition variable for processes dying (being turned into zombies) that's separate than the condition variable(s) used for when a process becomes free and usable.

Methods or Functions to Modify

- 1) ProcessControlBlock.Init
- 2) ForkNewProcess
- 3) FinishForForChild
- 4) ErrorInUserProcess
- 5) Handle_Sys_Join
- 6) Handle_Sys_Fork
- 7) Handle_Sys_Exit
- 8) ProcessFinish
- 9) WaitForZombie
- 10) TurnIntoZombie
- 11) Find Process