Lab Experiment Sheet-1

School of Engineering and Technology
Course Code & Name: ENCS351 Operating System
Program Name: B.Tech CSE, AI ML, Data Science, Cyber, FSD, UX/UI

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Course – BTECH CSE DS -Sem 5

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Summary of objectives

Task 1: Process Creation Utility

To accomplish this, I wrote a Python function called task1. I used a

for loop to call **os.fork()** three times, which created three distinct child processes. Inside the code block for each child (where

pid == 0), I used os.getpid() and os.getppid() to print its own Process ID and its parent's ID, along with a custom message. In the parent's code block, I made sure the parent process wouldn't exit prematurely by calling

os.waitpid() for each child, ensuring it waited for all of them to finish their execution.

Task 2: Command Execution Using exec()

For this task, I created a function task2 that forked a single child process. In the section of code executed by the child, I used

os.execvp("ls", ["ls", "-l"]). This system call replaced the child process's own code with the

ls -l command, effectively making the child execute that command in the terminal. The parent process simply waited for the command to finish before the script continued.

Task 3: Zombie & Orphan Processes

I simulated these two special process states in separate functions.

- **Zombie Process**: I created a child that printed a message and exited immediately using os._exit(0). The key to creating a zombie was making the parent process

skip the os.wait() call. Instead, I made the parent sleep for 10 seconds. During this time, the child was "defunct" or a zombie because it had terminated, but the parent hadn't yet acknowledged its termination to clean it up from the process table.

- **Orphan Process**: I did the reverse for the orphan process. I made the

parent process exit immediately after forking, while the child process was programmed to sleep for 5 seconds. By the time the child woke up, its original parent was gone. I confirmed it had become an orphan by printing its new parent's PID (

os.getppid()), which had changed to 1 (the system's init process).

Task 4: Inspecting Process Info from /proc

I wrote a function

inspect_process that accepts a Process ID (PID) as an input. To get the required information, my script directly interacted with the

/proc virtual filesystem:

- I read and printed the

Name, State, and VmSize by opening and parsing lines from the /proc/[pid]/status file.

- I found the

executable's full path by using os.readlink() on the /proc/[pid]/exe symbolic link.

- I listed all

open file descriptors by using os.listdir() on the /proc/[pid]/fd directory.

Task 5: Process Prioritization

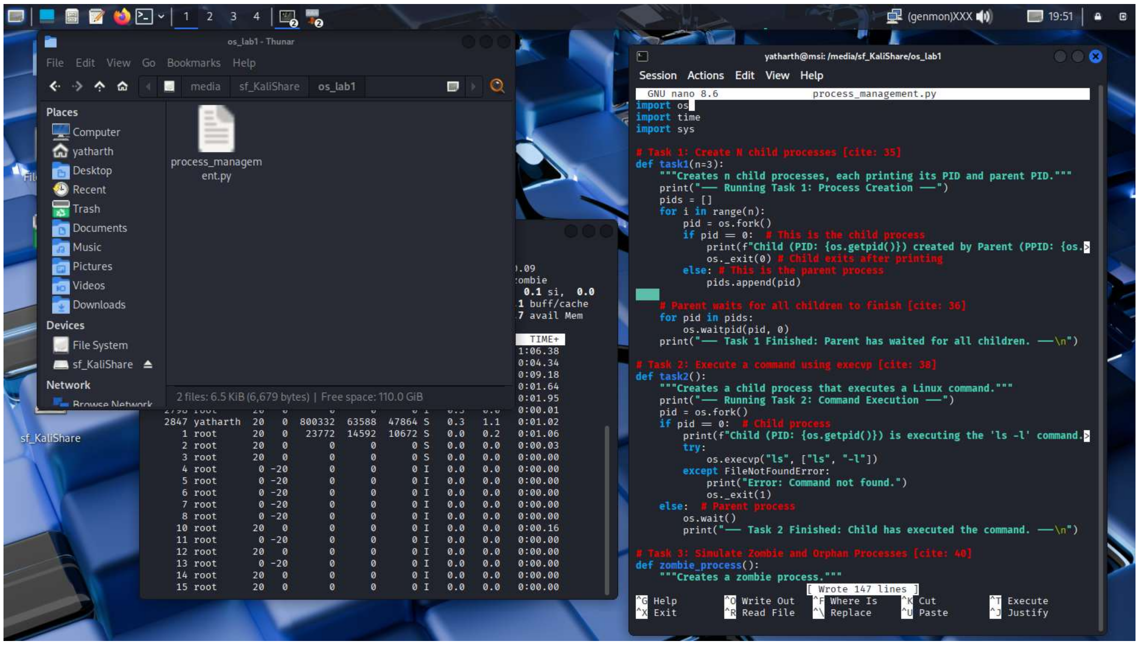
To demonstrate the effect of priority, my task5 function forked multiple child processes. Inside each child, I assigned a different priority using the

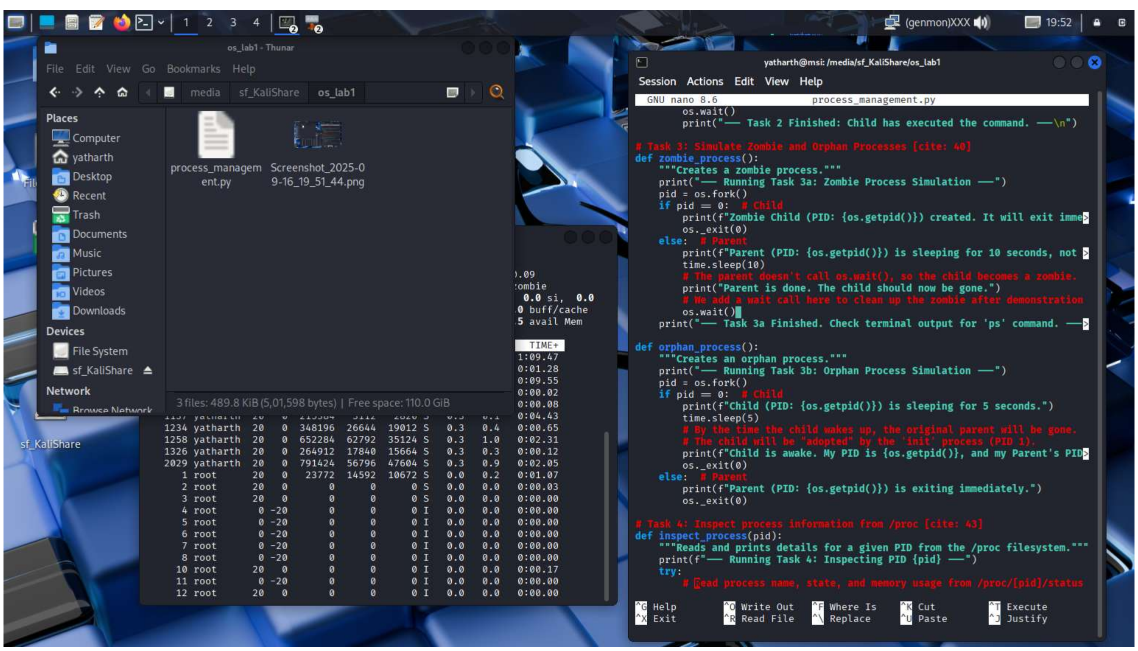
os.nice() call, with values of 0, 5, and 10. A lower

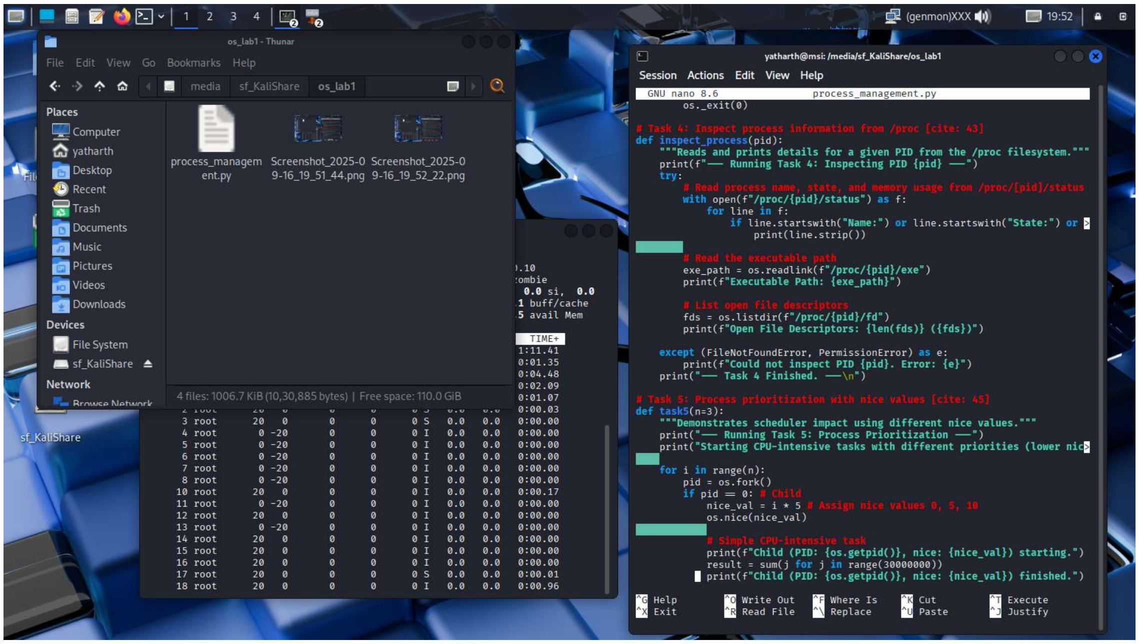
nice value corresponds to a higher priority. After setting the priority, each child performed an identical, CPU-intensive calculation (a large summation loop). By observing the output, I confirmed that the child with the highest priority (the lowest

nice value) consistently finished its task first, showing the scheduler was giving it more CPU time

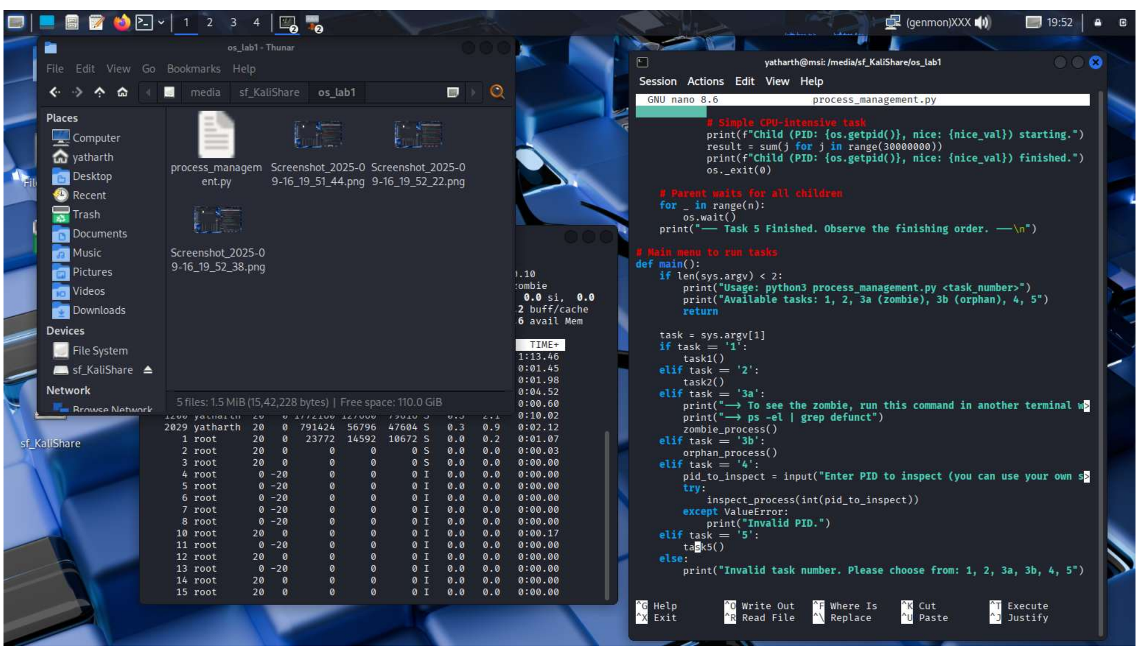
Code snippets







os_lab1 - Thunar
yatharth@msi: /media/sf_KaliShare/os_lab1
GNU nano 8.6 process_management.py
os._exit(0)
# Task 4: Inspect process information from /proc [cite: 43]
def inspect_process(pid):
"""Reads and prints details for a given PID from the /proc filesystem."""
print(f"—— Running Task 4: Inspecting PID {pid} ——")
try:
# Read process name, state, and memory usage from /proc/[pid]/status
with open(f"/proc/{pid}/status") as f:
for line in f:
if line.startswith("Name:") or line.startswith("State:") or
print(line.strip())
# Read the executable path
exe_path = os.readlink(f"/proc/{pid}/exe")
print(f"Executable Path: {exe_path}")
# List open file descriptors
fds = os.listdir(f"/proc/{pid}/fd")
print(f"Open File Descriptors: {len(fds)} ({fds})")
except (FileNotFoundError, PermissionError) as e:
print(f"Could not inspect PID {pid}. Error: {e}")
print("—— Task 4 Finished. ——\n")
# Task 5: Process prioritization with nice values [cite: 45]
def task5(n=3):
"""Demonstrates scheduler impact using different nice values."""
print("—— Running Task 5: Process Prioritization ——")
print("Starting CPU-intensive tasks with different priorities (lower nic
for i in range(n):
pid = os.fork()
if pid == 0: # Child
nice_val = i * 5 # Assign nice values 0, 5, 10
os.nice(nice_val)
# Simple CPU-intensive task
print(f"Child (PID: {os.getpid()}, nice: {nice_val}) starting.")
result = sum(j for j in range(30000000))
print(f"Child (PID: {os.getpid()}, nice: {nice_val}) finished.")



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# Simple CPU-intensive task
print(f"Child (PID: {os.getpid()}, nice: {nice_val}) starting.")
result = sum(j for j in range(30000000))
print(f"Child (PID: {os.getpid()}, nice: {nice_val}) finished.")
os._exit(0)
# Parent waits for all children
for _ in range(n):
os.wait()
print("—— Task 5 Finished. Observe the finishing order. ——\n")
# Main menu to run tasks
def main():
if len(sys.argv) < 2:
print("Usage: python3 process_management.py <task_number>")
print("Available tasks: 1, 2, 3a (zombie), 3b (orphan), 4, 5")
return
task = sys.argv[1]
if task == '1':
task1()
elif task == '2':
task2()
elif task == '3a':
print("—> To see the zombie, run this command in another terminal w
print("—> ps -el | grep defunct")
zombie_process()
elif task == '3b':
orphan_process()
elif task == '4':
pid_to_inspect = input("Enter PID to inspect (you can use your own s
try:
inspect_process(int(pid_to_inspect))
except ValueError:
print("Invalid PID.")
elif task == '5':
task5()
else:
print("Invalid task number. Please choose from: 1, 2, 3a, 3b, 4, 5")