

# ST. XAVIER'S COLLEGE

(Affiliated to Tribhuvan University)  
Maitighar, Kathmandu



## **OS Lab Assignment #4**

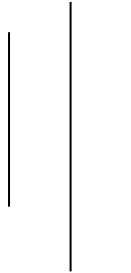
Process Termination

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2<sup>nd</sup> Year/4<sup>th</sup> Sem



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# TITLE: Implementing Process Termination in Linux.

## 1. PROCESS TERMINATION:

Processes termination occurs either of two ways

- Normal exit: when the program calls exit function or or program, main function returns.
- Killed by another process: Terminated abnormally in response to a signal.

kill [signal] pid

Signals: (signal system calls are defined under the header <signal.h> and <sys/types.h>) KILL

– Forcefully make free (used in hang).

TERM – Kill process.

e.g. kill -KILL pid -send the signal to the targeted pid process.

## Waiting for process termination

Waiting can be done with the wait family of system call. These functions allow to wait for process to finish executing, and enable the parent process to retrieve information about child's termination.

## 2. PROCESSES STATES:

The basic processes states in Linux are

Running - R, Sleeping – S, Stopped – T and Zombie – Z.

If the parent process terminates before the child process, the executing child is a orphan process.

A zombie process is a process that has terminated but has not been cleaned up yet.

If the child process finishes before the parent process calls wait, the child process becomes a zombie.

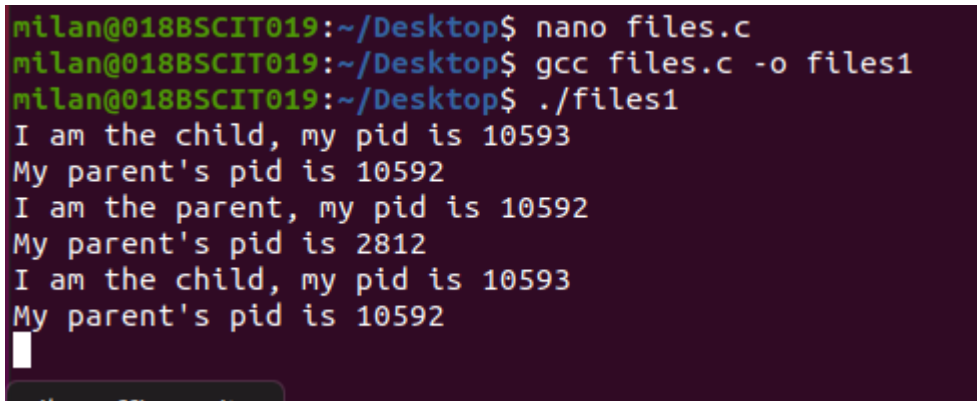
\$ ps -el :- look process with state information.

```
milan@0188SCIT019:~/Desktop$ ps
  PID TTY          TIME CMD
 2812 pts/0    00:00:00 bash
10513 pts/0    00:00:00 ps
milan@0188SCIT019:~/Desktop$ ps -el
 F S  UID          PID    PPID  C PRI  NI ADDR SZ  WCHAN  TTY          TIME CMD
 4 S   0             1         0  0  80   0  - 41962  -    ?           00:00:01 systemd
 1 S   0             2         0  0  80   0  - 0      -    ?           00:00:00 kthreadd
 1 I   0             3         2  0  60 -20  - 0      -    ?           00:00:00 rcu_gp
 1 I   0             4         2  0  60 -20  - 0      -    ?           00:00:00 rcu_par_gp
 1 I   0             6         2  0  60 -20  - 0      -    ?           00:00:00 kworker/0:0H-events_highpri
 1 I   0             9         2  0  60 -20  - 0      -    ?           00:00:00 mm_percpu_wq
 1 S   0            10         2  0  80   0  - 0      -    ?           00:00:00 rcu_tasks_rude_
 1 S   0            11         2  0  80   0  - 0      -    ?           00:00:00 rcu_tasks_trace
 1 S   0            12         2  0  80   0  - 0      -    ?           00:00:00 ksoftirqd/0
 1 I   0            13         2  0  80   0  - 0      -    ?           00:00:00 rcu_sched
 1 S   0            14         2  0 -40   -  - 0      -    ?           00:00:00 migration/0
 1 S   0            15         2  0  9    -  - 0      -    ?           00:00:00 idle_inject/0
 1 S   0            16         2  0  80   0  - 0      -    ?           00:00:00 cpuhp/0
 1 S   0            17         2  0  80   0  - 0      -    ?           00:00:00 cpuhp/1
 1 S   0            18         2  0  9    -  - 0      -    ?           00:00:00 idle_inject/1
 1 S   0            19         2  0 -40   -  - 0      -    ?           00:00:00 migration/1
 1 S   0            20         2  0  80   0  - 0      -    ?           00:00:00 ksoftirqd/1
 1 I   0            22         2  0  60 -20  - 0      -    ?           00:00:00 kworker/1:0H-events_highpri
 1 S   0            23         2  0  80   0  - 0      -    ?           00:00:00 cpuhp/2
 1 S   0            24         2  0  9    -  - 0      -    ?           00:00:00 idle_inject/2
 1 S   0            25         2  0 -40   -  - 0      -    ?           00:00:00 migration/2
 1 S   0            26         2  0  80   0  - 0      -    ?           00:00:00 ksoftirqd/2
 1 I   0            28         2  0  60 -20  - 0      -    ?           00:00:00 kworker/2:0H-events_highpri
 1 S   0            29         2  0  80   0  - 0      -    ?           00:00:00 cpuhp/3
 1 S   0            30         2  0  9    -  - 0      -    ?           00:00:00 idle_inject/3
 1 S   0            31         2  0 -40   -  - 0      -    ?           00:00:00 migration/3
 1 S   0            32         2  0  80   0  - 0      -    ?           00:00:00 ksoftirqd/3
 1 I   0            34         2  0  60 -20  - 0      -    ?           00:00:00 kworker/3:0H-kblockd
 5 S   0            35         2  0  80   0  - 0      -    ?           00:00:00 kdevtmpfs
 1 I   0            36         2  0  60 -20  - 0      -    ?           00:00:00 netns
 1 I   0            37         2  0  60 -20  - 0      -    ?           00:00:00 inet_frag_wq
 1 S   0            38         2  0  80   0  - 0      -    ?           00:00:00 kauditd
 1 S   0            39         2  0  80   0  - 0      -    ?           00:00:00 khungtaskd
 1 S   0            40         2  0  80   0  - 0      -    ?           00:00:00 oom_reaper
 1 I   0            41         2  0  60 -20  - 0      -    ?           00:00:00 writeback
 1 S   0            42         2  0  80   0  - 0      -    ?           00:00:00 kcompactd0
```

### Ex 1.1: Checking process state (pstat.c).

```
#include<stdlib.h>
#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
int main(){
    int pid = fork();
    if(pid==0){
        printf("I am the child, my pid is %d\n", (int) getpid());
        printf("My parent's pid is %d\n", (int) getppid()); sleep(20);
        printf("I am the child, my pid is %d\n", (int) getpid());
        printf("My parent's pid is %d\n", (int) getppid());
    }else {
        sleep(10);
        printf("I am the parent, my pid is %d\n", (int) getpid());
        printf("My parent's pid is %d\n", (int) getppid()); for(;;);
    }
}
```

### OUTPUT:



```
milan@018BSCIT019:~/Desktop$ nano files.c
milan@018BSCIT019:~/Desktop$ gcc files.c -o files1
milan@018BSCIT019:~/Desktop$ ./files1
I am the child, my pid is 10593
My parent's pid is 10592
I am the parent, my pid is 10592
My parent's pid is 2812
I am the child, my pid is 10593
My parent's pid is 10592
```

### Ex 1.2 : Process switching (pswitch.c)

```
#include<unistd.h>
#include<stdio.h>
int main(void){
    int pid =fork();
    if (pid == 0) for(;;) printf("C");
    else if (pid > 0) for (;) printf("P");
}
```

**OUTPUT:**

[illegible]

### 1.3

```
#include <stdio.h>
#include <stdlib.h>
#include <sys/types.h>
#include <sys/wait.h>
#include <unistd.h>
int main(void){
    int p1=fork(),p2=fork(); float a=5,b=2;
```

```

if (p1 != 0 && p2 !=0 ){
    printf("[0] Parent Process:-%d\n",getpid());
    printf("The sum:-%f\n",a+b);
} else if (p1 == 0 && p2 !=0){
    sleep(10);
    printf("[1] Child Process:-%d\n",getpid());
    printf("The sub:-%f\n",a-b);
} else if (p1 != 0 && p2 ==0){
    sleep(10);
    printf("[2] Child Process:-%d\n",getpid());
    printf("The mult:-%f\n",a*b);
} else if (p1 == 0 && p2 ==0){
    printf("[3] Child Process:-%d\n",getpid());
    printf("The div:-%f\n",a/b);
}

sleep(5); pid_t child_pid; child_pid = fork ();
(child_pid > 0) ? sleep (5) : exit (0);
}

```

## OUTPUT

```

milan@018BSCIT019:~/Desktop$ nano psstat.c
milan@018BSCIT019:~/Desktop$ gcc pss
psstat.c  psswitch.c
milan@018BSCIT019:~/Desktop$ gcc psstat.c -o pstat
milan@018BSCIT019:~/Desktop$ ./pstat
[0] Parent Process:-10730
The sum:-7.000000
[3] Child Process:-10733
The div:-2.500000
[1] Child Process:-10731
The sub:-3.000000
[2] Child Process:-10732
The mult:-10.000000

```

```

milan@018BSCIT019:~/Desktop$ ps
  PID TTY          TIME CMD
  2812 pts/0    00:00:00 bash
 10592 pts/0    00:02:20 files1
 10593 pts/0    00:00:00 files1 <defunct>
 10603 pts/0    00:00:00 nano
 10776 pts/0    00:00:00 ps

```

```

milan@018BSCIT019:~/Desktop$ ps -el
 F S  UID        PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
 4 S   0            1      0  0  80   0  -  41962  -    ?           00:00:01 systemd
 1 S   0            2      0  0  80   0  -     0  -    ?           00:00:00 kthreadd
 1 S   0            3      2  0  60  -20  -     0  -    ?           00:00:00 rcu_gp
 1 I   0            4      2  0  60  -20  -     0  -    ?           00:00:00 rcu_par_gp
 1 I   0            6      2  0  60  -20  -     0  -    ?           00:00:00 kworker/0:0H-events_highpri
 1 I   0            9      2  0  60  -20  -     0  -    ?           00:00:00 mm_percpu_wq
 1 S   0           10      2  0  80   0  -     0  -    ?           00:00:00 rcu_tasks_rude_
 1 S   0           11      2  0  80   0  -     0  -    ?           00:00:00 rcu_tasks_trace
 1 S   0           12      2  0  80   0  -     0  -    ?           00:00:00 ksoftirqd/0
 1 I   0           13      2  0  80   0  -     0  -    ?           00:00:00 rcu_sched
 1 S   0           14      2  0 -40   0  -     0  -    ?           00:00:00 migration/0
 1 S   0           15      2  0  9    -  -     0  -    ?           00:00:00 idle_inject/0
 1 S   0           16      2  0  80   0  -     0  -    ?           00:00:00 cpuhp/0
 1 S   0           17      2  0  80   0  -     0  -    ?           00:00:00 cpuhp/1
 1 S   0           18      2  0  9    -  -     0  -    ?           00:00:00 idle_inject/1
 1 S   0           19      2  0 -40   0  -     0  -    ?           00:00:00 migration/1
 1 S   0           20      2  0  80   0  -     0  -    ?           00:00:00 ksoftirqd/1
 1 I   0           22      2  0  60  -20  -     0  -    ?           00:00:00 kworker/1:0H-events_highpri
 1 S   0           23      2  0  80   0  -     0  -    ?           00:00:00 cpuhp/2
 1 S   0           24      2  0  9    -  -     0  -    ?           00:00:00 idle_inject/2
 1 S   0           25      2  0 -40   0  -     0  -    ?           00:00:00 migration/2
 1 S   0           26      2  0  80   0  -     0  -    ?           00:00:00 ksoftirqd/2
 1 I   0           28      2  0  60  -20  -     0  -    ?           00:00:00 kworker/2:0H-events_highpri
 1 S   0           29      2  0  80   0  -     0  -    ?           00:00:00 cpuhp/3
 1 S   0           30      2  0  9    -  -     0  -    ?           00:00:00 idle_inject/3
 1 S   0           31      2  0 -40   0  -     0  -    ?           00:00:00 migration/3
 1 S   0           32      2  0  80   0  -     0  -    ?           00:00:00 ksoftirqd/3

```