

1. There are 4 child processes created.  $2^n$  and there are two n, so =4.

2. starting a browser from Firefox

It consumed a lot of CPU at the start

```
top - 11:21:41 up 24 min, 1 user, load average: 0.54, 0.12, 0.04
Tasks: 295 total, 2 running, 293 sleeping, 0 stopped, 0 zombie
%Cpu(s): 22.0 us, 33.1 sy, 0.0 ni, 44.1 id, 0.3 wa, 0.0 hi, 0.5 si, 0.0 st
MiB Mem : 7915.8 total, 4523.6 free, 1548.8 used, 1843.5 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used. 6053.6 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2544	hunter	20	0	11.4g	528544	184140	S	94.7	6.5	0:07.28	firefox
2766	hunter	20	0	10.3g	137472	87524	S	6.0	1.7	0:00.67	Privileged Cont
1834	hunter	20	0	238600	82564	57968	S	4.3	1.0	0:00.49	Xwayland
1308	hunter	20	0	4128008	260772	126652	S	3.3	3.2	0:06.95	gnome-shell
22	root	20	0	0	0	0	S	0.3	0.0	0:00.09	ksoftirqd/1
91	root	0	-20	0	0	0	I	0.3	0.0	0:00.14	kworker/0:1H-kblockd
287	root	20	0	0	0	0	I	0.3	0.0	0:00.41	kworker/u256:24-events_unbound

Then the CPU % goes down and memory stays around the same

```
top - 11:22:20 up 24 min, 1 user, load average: 0.41, 0.13, 0.05
Tasks: 295 total, 1 running, 294 sleeping, 0 stopped, 0 zombie
%Cpu(s): 1.5 us, 9.2 sy, 0.0 ni, 89.0 id, 0.0 wa, 0.0 hi, 0.3 si, 0.0 st
MiB Mem : 7915.8 total, 4607.7 free, 1453.3 used, 1854.9 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used. 6148.5 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
2544	hunter	20	0	3537664	444428	184560	S	9.0	5.5	0:08.79	firefox
1834	hunter	20	0	239992	82884	57984	S	7.3	1.0	0:01.17	Xwayland
1308	hunter	20	0	4128064	260536	126668	S	5.0	3.2	0:07.53	gnome-shell
2766	hunter	20	0	2464608	128720	89740	S	1.7	1.6	0:01.14	Privileged Cont
477	root	-51	0	0	0	0	S	0.3	0.0	0:00.08	irq/16-vmwgfx

3. Amount of memory available

```
MiB Mem : 7915.8 total, 5000.7 free, 1058.8 used,
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used
```

In total there is 7915.8 MiB

4. Process consuming CPU most

Is the 'gnome-shell' at 4.7%

```

top - 11:20:08 up 22 min, 1 user, load average: 0.00, 0.00, 0.00
Tasks: 287 total, 1 running, 286 sleeping, 0 stopped, 0 zombie
%Cpu(s): 1.2 us, 1.0 sy, 0.0 ni, 97.8 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 7915.8 total, 5363.6 free, 1032.3 used, 1519.9 buff/cache
MiB Swap: 2048.0 total, 2048.0 free, 0.0 used, 6589.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1308 hunter    20   0 4130216 260256 126640 S   4.7   3.2   0:06.27 gnome-shell
  665 systemd+  20   0  14824    6068   5268 S   0.3   0.1   0:00.80 systemd-oomd
 1683 hunter    20   0 355912   28212  17496 S   0.3   0.3   0:00.62 ibus-extension-
 2430 hunter    20   0 577868   58948  46420 S   0.3   0.7   0:00.35 gnome-terminal-
 2527 hunter    20   0 22004    4084   3220 R   0.3   0.1   0:00.04 top
    1 root       20   0 167856   13112   8160 S   0.0   0.2   0:01.51 systemd
    2 root       20   0      0      0      0 S   0.0   0.0   0:00.02 kthreadd
    3 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp
    5 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 slub_flushwq
    6 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 netns
    8 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
   10 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 mm_percpu_wq
   11 root       20   0      0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_rude_
   12 root       20   0      0      0      0 S   0.0   0.0   0:00.00 rcu_tasks_trace
   13 root       20   0      0      0      0 S   0.0   0.0   0:00.04 ksoftirqd/0
   14 root       20   0      0      0      0 I   0.0   0.0   0:00.22 rcu_sched
   15 root       rt   0      0      0      0 S   0.0   0.0   0:00.00 migration/0
   16 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 idle_inject/0
   18 root       20   0      0      0      0 S   0.0   0.0   0:00.00 cpuhp/0
   19 root       20   0      0      0      0 S   0.0   0.0   0:00.00 cpuhp/1
   20 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 idle_inject/1
   21 root       rt   0      0      0      0 S   0.0   0.0   0:00.70 migration/1
   22 root       20   0      0      0      0 S   0.0   0.0   0:00.08 ksoftirqd/1
   24 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
   25 root       20   0      0      0      0 S   0.0   0.0   0:00.00 kdevtmpfs
   26 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 inet_frag_wq
   27 root       20   0      0      0      0 S   0.0   0.0   0:00.00 kauditd
   29 root       20   0      0      0      0 S   0.0   0.0   0:00.00 khungtaskd
   30 root       20   0      0      0      0 S   0.0   0.0   0:00.00 oom_reaper
   31 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 writeback
   32 root       20   0      0      0      0 S   0.0   0.0   0:00.02 kcompactd0
   33 root       25   5      0      0      0 S   0.0   0.0   0:00.00 ksmd
   34 root       39  19      0      0      0 S   0.0   0.0   0:00.00 khugepaged
   39 root       20   0      0      0      0 I   0.0   0.0   0:00.02 kworker/1:1-rcu_par_gp
   81 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kintegrityd
   82 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kblockd
   83 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 blkcg_punt_bio
   84 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 tpm_dev_wq
   85 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 ata_sff
   86 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 md
   87 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 edac-poller
   88 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 devfreq_wq
   89 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 watchdogd
   91 root       0 -20      0      0      0 I   0.0   0.0   0:00.12 kworker/0:1H-kblockd
   93 root       20   0      0      0      0 S   0.0   0.0   0:00.00 kswapd0
   94 root       20   0      0      0      0 S   0.0   0.0   0:00.00 ecryptfs-kthrea
   96 root       0 -20      0      0      0 I   0.0   0.0   0:00.00 kthrotld
   97 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/24-pciehp
   98 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/25-pciehp
   99 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/26-pciehp
  100 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/27-pciehp
  101 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/28-pciehp
  102 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/29-pciehp
  103 root      -51   0      0      0      0 S   0.0   0.0   0:00.00 irq/30-pciehp

```

5. the process that has the most memory when the browser is running is Firefox but then when I close the browser it is: 'gnome-shell'

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1308	hunter	20	0	4128036	260452	126648	S	1.0	3.2	0:07.93	gnome-shell

Which is the terminal so it makes sense, since that is the only thing running

6. apt-get: can update, remove, and install packages using it.

yum: install, remove, and update packages and functions similarly to apt-get.

wget: to download files from the internet. The HTTP, HTTPS, and FTP protocols are supported.

gzip: This program uses the Gzip algorithm to compress files. Before files are transferred over a network or to conserve disk space, compression is frequently used.

tar: Using this archive tool, you can put several files into one archive file. Since tape backups were the original purpose of "tar," its name is derived from "tape archive".

rar: file compression and archiving

7. Write a program that will generate a child process. In a loop, the child process writes "I am a child process" 200 times and the parent process repeatedly prints "I am a parent process" in a loop.

```
#include <unistd.h>
#include <iostream>

int main() {
    pid_t pid = fork();

    if (pid == 0) {
        for (int i = 0; i < 200; ++i) {
            std::cout << "I am a child process" << std::endl;
        }
    } else {
        for (int i = 0; i < 200; ++i) {
            std::cout << "I am a parent process" << std::endl;
        }
    }

    return 0;
}
```

[illegible]

8. Write a program that create a child process with the fork () system call. The parent process waits for the child process to finish before printing the contents of the current directory.

```

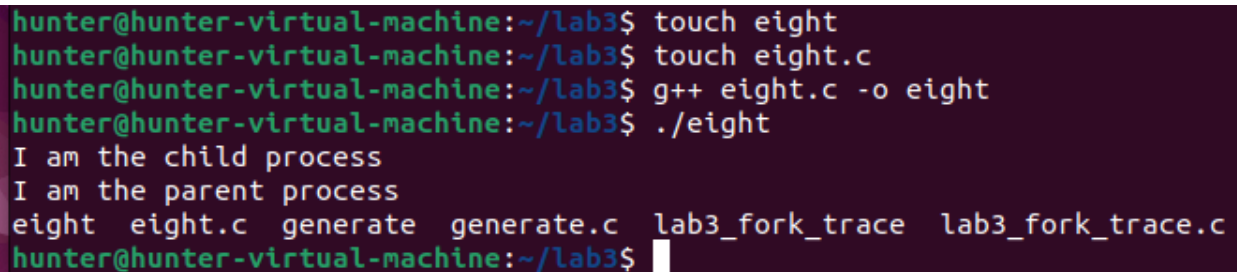
#include <unistd.h>
#include <iostream>
#include <sys/wait.h>
#include <cstdlib>

int main() {
    pid_t pid = fork();

    if (pid == 0) {
        std::cout << "I am the child process" << std::endl;
        exit(0);
    } else {
        int status;
        waitpid(pid, &status, 0);
        std::cout << "I am the parent process" << std::endl;
        system("ls");
    }

    return 0;
}

```



```

hunter@hunter-virtual-machine:~/lab3$ touch eight
hunter@hunter-virtual-machine:~/lab3$ touch eight.c
hunter@hunter-virtual-machine:~/lab3$ g++ eight.c -o eight
hunter@hunter-virtual-machine:~/lab3$ ./eight
I am the child process
I am the parent process
eight eight.c generate generate.c lab3_fork_trace lab3_fork_trace.c
hunter@hunter-virtual-machine:~/lab3$

```

9. Write a program that create a child process with the fork () system call and print its PID. Following a fork () system call, both parent and child processes print their process type and PID. Additionally, the parent process prints the PID of its child, and the child process prints the PID of its parent.

```

#include <unistd.h>
#include <iostream>
#include <sys/types.h>

```

```

int main() {
    pid_t pid = fork();

```

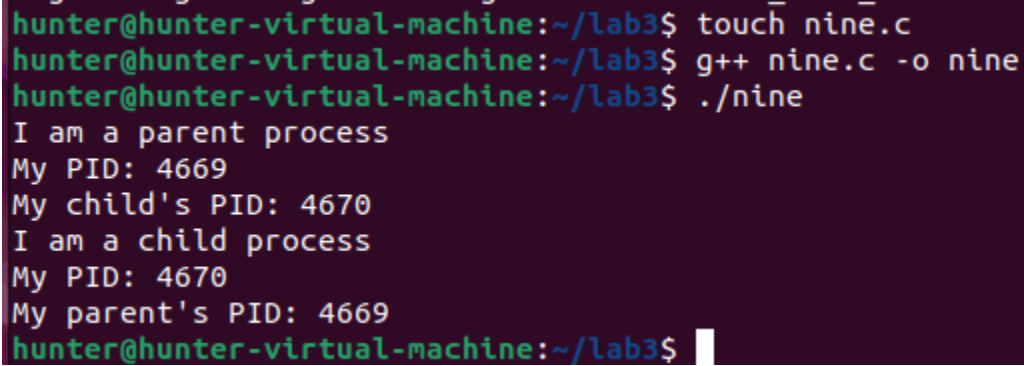
```

    if (pid == 0) {

```

```
std::cout << "I am a child process" << std::endl;
std::cout << "My PID: " << getpid() << std::endl;
std::cout << "My parent's PID: " << getppid() << std::endl;
} else {
std::cout << "I am a parent process" << std::endl;
std::cout << "My PID: " << getpid() << std::endl;
std::cout << "My child's PID: " << pid << std::endl;
}

return 0;
}
```



```
hunter@hunter-virtual-machine:~/lab3$ touch nine.c
hunter@hunter-virtual-machine:~/lab3$ g++ nine.c -o nine
hunter@hunter-virtual-machine:~/lab3$ ./nine
I am a parent process
My PID: 4669
My child's PID: 4670
I am a child process
My PID: 4670
My parent's PID: 4669
hunter@hunter-virtual-machine:~/lab3$
```