

# Operating Systems - Assignment Report

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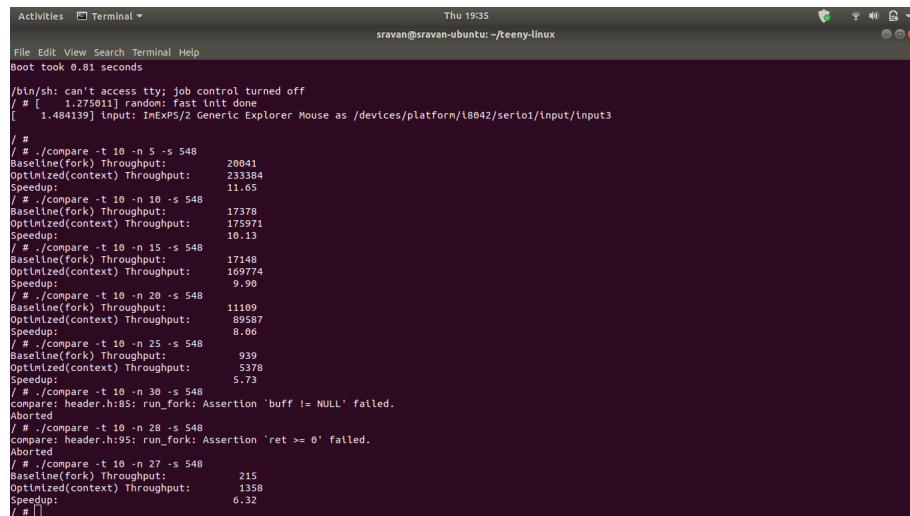
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## Design:

1. When a program calls the system call to save context:
  - a) *context\_saved\_status* flag of *mm\_struct* of the program is set to 1
  - b) all pages of the program which are anonymous are marked read only
2. When the program tries to write to an anonymous page, it raises a fault which is handled in *handle\_pte\_fault* in *memory.c*:
  - a) The page is copied from user space to kernel space and the addresses of user space page and kernel space page are stored in a linked list pointed by *program\_state* of *mm\_struct*.
3. When system call is called to restore context:
  - a) all the pages are restored from kernel space to user space based on information in list pointed by *program\_state* of *mm\_struct*.
  - b) *context\_saved\_status* is reset to 0.
4. If the program is terminated before restoring, *\_mmdrop()* function is called in *fork.c*:
  - a) all the pages of the kernel space pointed by the list are dropped.

## Performance comparison:

The performance of the implementation is as below:



```
Activities Terminal Thu 19:35
sraavan@sraavan-ubuntu: ~/reany-linux

File Edit View Search Terminal Help
Boot took 0.81 seconds

/bin/sh: can't access tty: job control turned off
/ # [ 1.275011] random: fast init done
[ 1.484139] Input: INEXP5/2 Generic Explorer Mouse as /devices/platform/l8042/serio1/input/input3

/ #
/ # ./compare -t 10 -n 5 -s 548
Baseline(fork) Throughput: 20041
Optimized(context) Throughput: 233384
Speedup: 11.65
/ # ./compare -t 10 -n 10 -s 548
Baseline(fork) Throughput: 17378
Optimized(context) Throughput: 175971
Speedup: 10.13
/ # ./compare -t 10 -n 15 -s 548
Baseline(fork) Throughput: 17148
Optimized(context) Throughput: 169774
Speedup: 9.90
/ # ./compare -t 10 -n 20 -s 548
Baseline(fork) Throughput: 11109
Optimized(context) Throughput: 89587
Speedup: 8.06
/ # ./compare -t 10 -n 25 -s 548
Baseline(fork) Throughput: 939
Optimized(context) Throughput: 5378
Speedup: 5.73
/ # ./compare -t 10 -n 30 -s 548
compare: header.h:85: run_fork: Assertion 'buff != NULL' failed.
Aborted
/ # ./compare -t 10 -n 28 -s 548
compare: header.h:95: run_fork: Assertion 'ret >= 0' failed.
Aborted
/ # ./compare -t 10 -n 27 -s 548
Baseline(fork) Throughput: 215
Optimized(context) Throughput: 1358
Speedup: 6.32
/ # []
```

## Further improvements:

Further improvements in performance can be achieved by decreasing the number of pages to be made read only in step 1, by implementing THP(transparent huge pages).