OPERATING SYSTEMS

REPORT

BY: - (Group-4)

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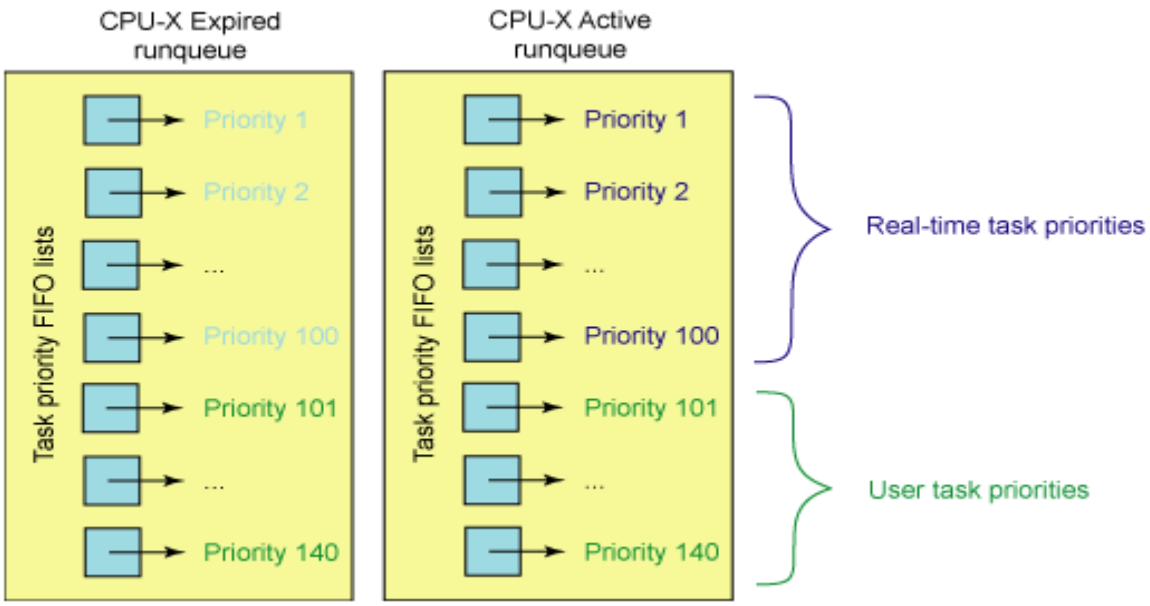
PROBLEM STATEMENT: -

To modify the Linux scheduler to implement a new scheduling class, called background scheduling. We will evaluate how our new scheduling class performs.

KERNEL 2.6: -

- Each CPU in this kernel has a runqueue made up of 140 priority lists that are serviced in FIFO order. Tasks that are scheduled to execute are added to the end of their respective runqueue's priority list.
- Each task has a time slice that determines how much time it's permitted to execute.
- The first 100 priority lists of the runqueue are reserved for real-time tasks, and the last 40 are used for user tasks (MAX_RT_PRIO=100 and MAX_PRIO=140).
- In addition to the CPU's runqueue, which is called the active runqueue, there's also an expired runqueue.
- When a task on the active runqueue uses all of its time slice, it's moved to the expired runqueue. During the move, its time slice is recalculated (and so is its priority).
- If no tasks exist on the active runqueue for a given priority, the pointers for the active and expired runqueues are swapped, thus making the expired priority list the active one.



Kernel 2.6 Scheduler Policies:

- **SCHED_NORMAL** - A conventional, time-shared process (used to be called SCHED_OTHER), for normal tasks.

1. Each task assigned a “Nice” value
2. PRIO = MAX_RT_PRIO + NICE + 20
3. Assigned a time slice
4. Tasks at the same PRIO(rity) are round-robined.
5. Ensures Priority + Fairness

- **SCHED_FIFO** - A First-In, First-Out real-time process

1. Run until they relinquish the CPU voluntarily
2. Priority levels maintained
3. Not pre-empted!!

- **SCHED_RR** - A Round Robin real-time process

1. Assigned a timeslice and run till the timeslice is exhausted.
2. Once all RR tasks of a given PRIO(rity) level exhaust their timeslices, their timeslices are refilled and they continue running
3. PRIO(rity) levels are maintained

- **SCHED_BATCH** - for "batch" style execution of processes

1. For computing-intensive tasks
2. Timeslices are long and processes are round robin scheduled
3. lowest priority tasks are batch-processed (nice +19)

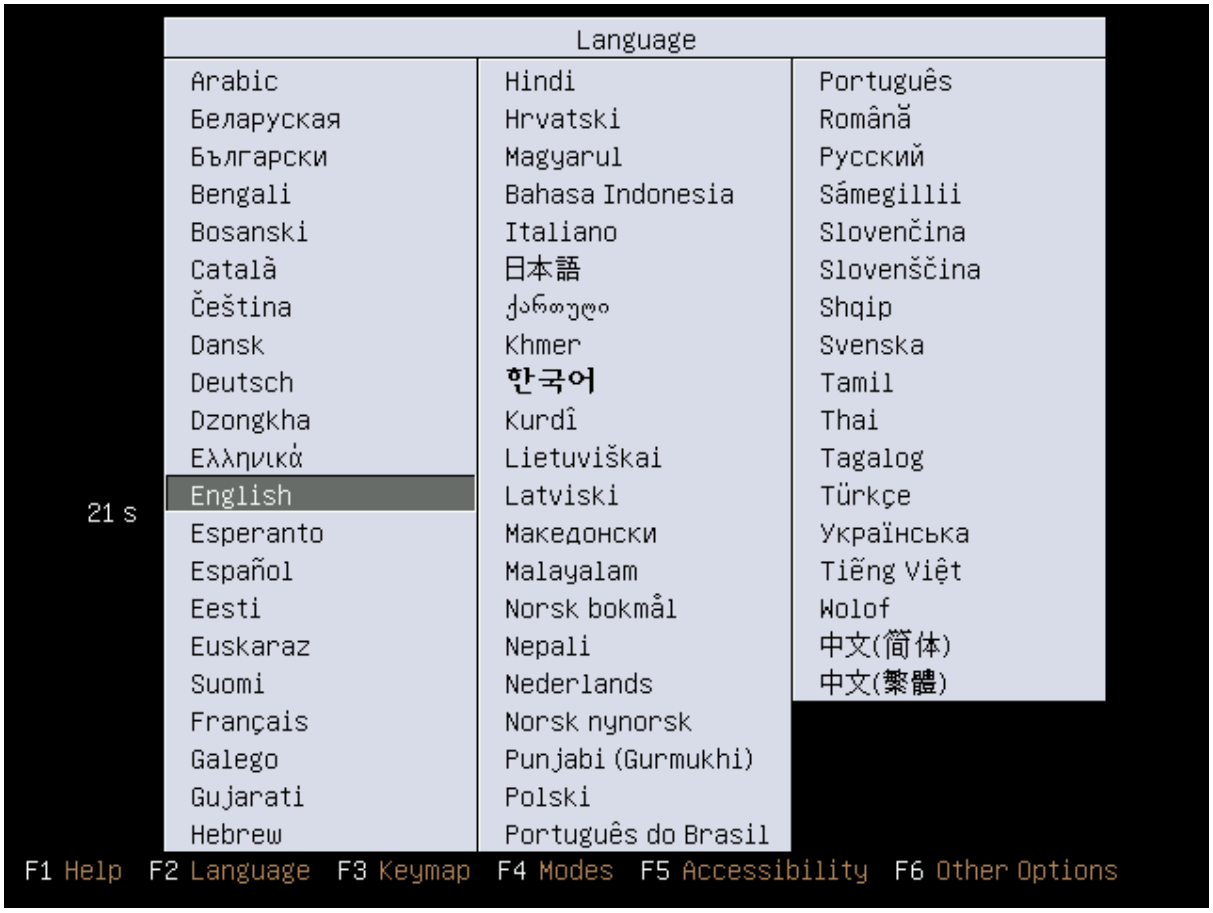
- **SCHED_IDLE** - for running very low priority background job

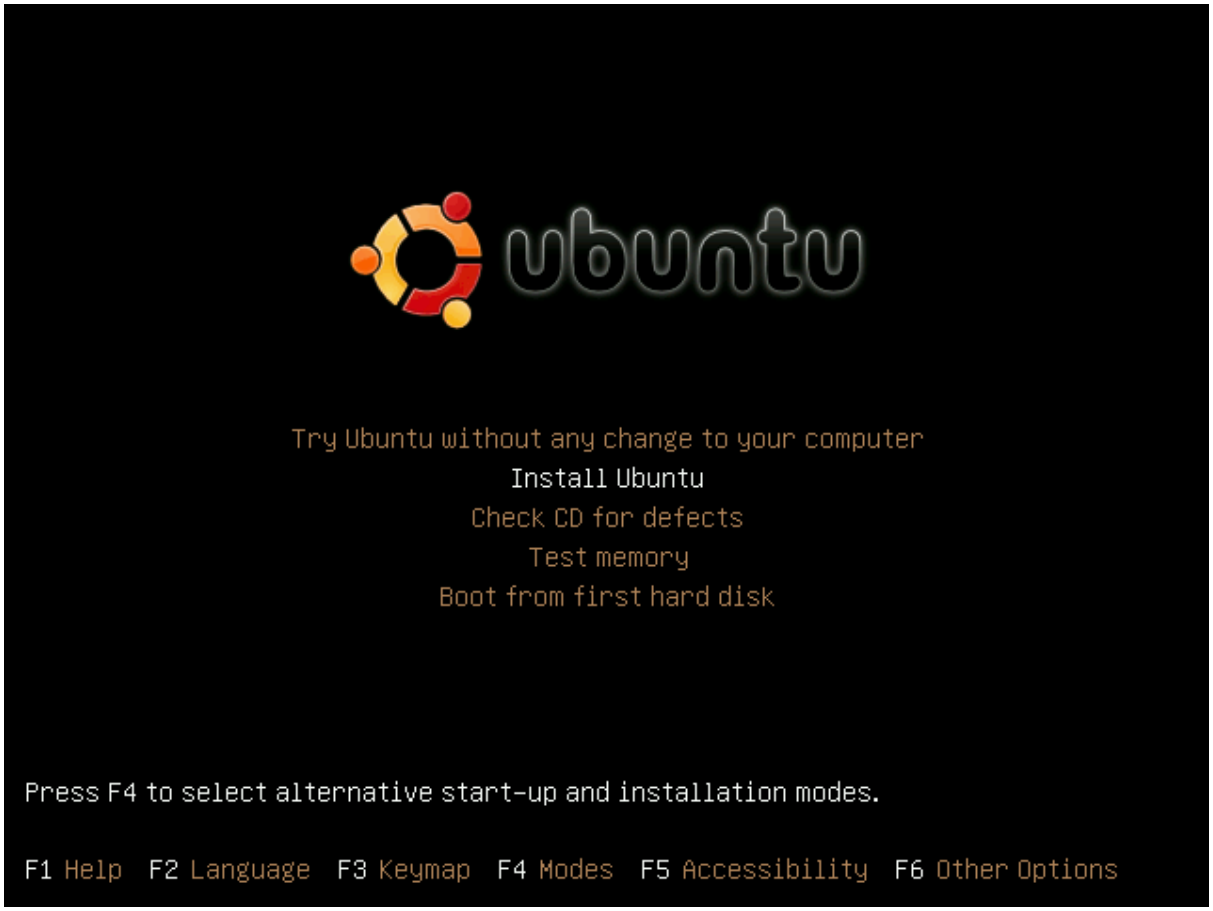
1. nice value has no influence for this policy
2. extremely low priority (lower than +19 nice)

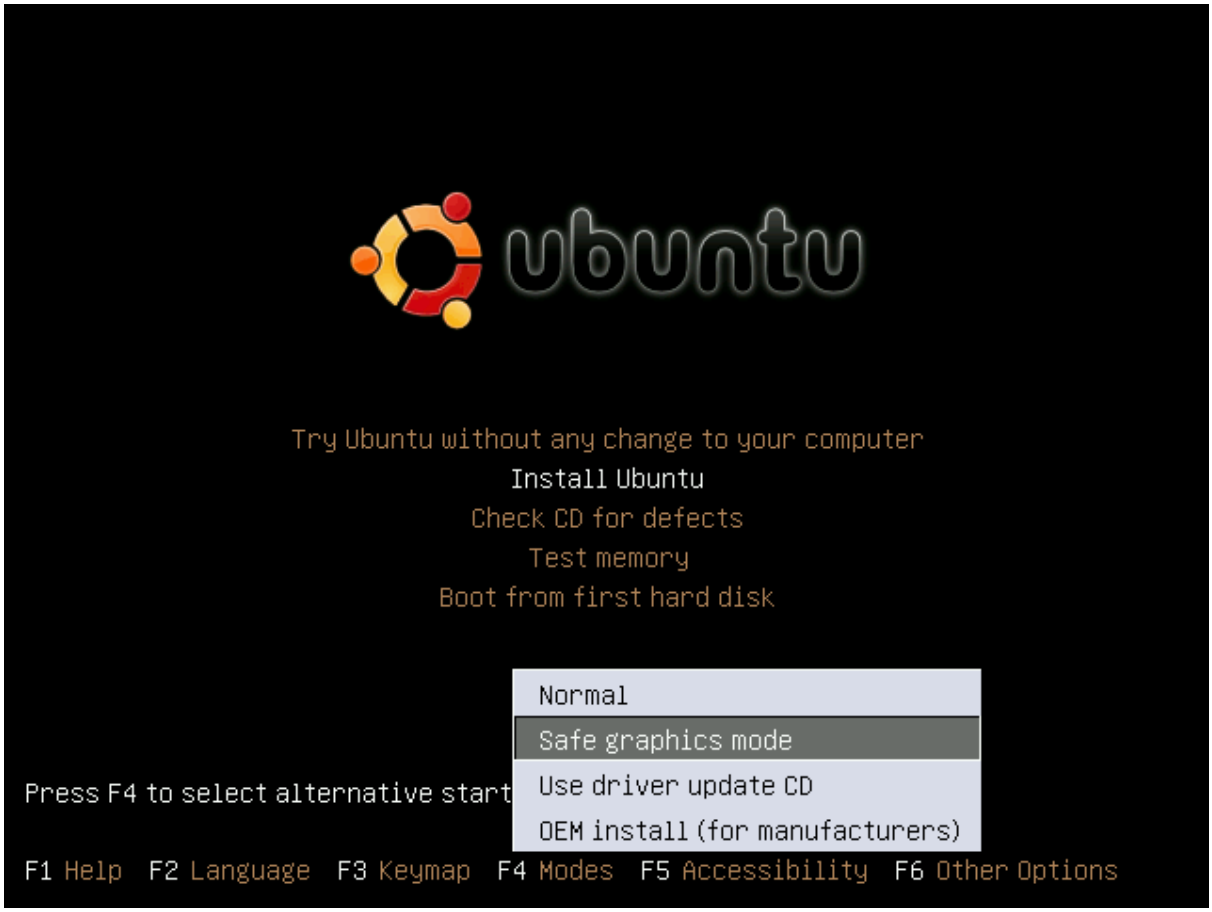
HOW TO PROCEED:

- We need to add a new scheduling policy called SCHED_BACKGROUND. This policy is designed to support processes that only need to run when the system has no other process to do.
- When there are no processes which are managed by the SCHED_OTHER, SCHED_RR or SCHED_FIFO classes, our SCHED_BACKGROUND policy will run the background processes.
- When there is more than one SCHED_BACKGROUND process ready to run, they should compete for the CPU as do SCHED_OTHER processes using CFS i.e., 'Complete Fair Scheduling'.
- We found out that in the latest version of the linux Ubuntu 18.04 having kernel version 4.15, the sched.c file is not present, instead a sched directory which is consist of many different parts old scheduler. As it was somewhat difficult to modify those many parts due to higher level of encapsulation and also the sched.c file exists below kernel version 3.0, we switched to the Ubuntu version 8.04 with kernel version 2.6.24.
- We have to make the changes in the sched.c and the sched.h files which are responsible for handling scheduler function in kernel. We also need to modify an auxiliary file chrt.c in the kernel source which handles all the system calls to kernel-scheduler.
- In linux-2.6.24 there is already a policy named SCHED_IDLE which already handles background task.
- We will implement a new policy SCHED_BACKGROUND to handle background tasks with lower priority than SCHED_IDLE. This will handle tasks only if queues of all other policies are empty.
- We define this new policy in sched.h and make required changes in sched.c. To support making system calls from terminal, we also add this policy in chrt.c, generate its object file and replace it with the default system file.
- We can also use the sched_setschduler method which assigns a particular policy to a process instead of updating the chrt.c file.

STEPS: - First we need to install Ubuntu kernel version 2.6.24


Language
Arabic
Беларуская
Български
Bengali
Bosanski
Català
Čeština
Dansk
Deutsch
Dzongkha
Ελληνικά
English
Esperanto
Español
Eesti
Euskaraz
Suomi
Français
Galego
Gujarati
Hebrew
Hindi
Hrvatski
Magyarul
Bahasa Indonesia
Italiano
日本語
ქართული
Khmer
한국어
Kurdî
Lietuviškai
Latviski
Македонски
Malayalam
Norsk bokmål
Nepali
Nederlands
Norsk nynorsk
Punjabi (Gurmukhi)
Polski
Português do Brasil
Português
Română
Русский
Sámegillii
Slovenčina
Slovenščina
Shqip
Svenska
Tamil
Thai
Tagalog
Türkçe
Українська
Tiếng Việt
Wolof
中文(简体)
中文(繁體)
21 s
F1 Help F2 Language F3 Keymap F4 Modes F5 Accessibility F6 Other Options

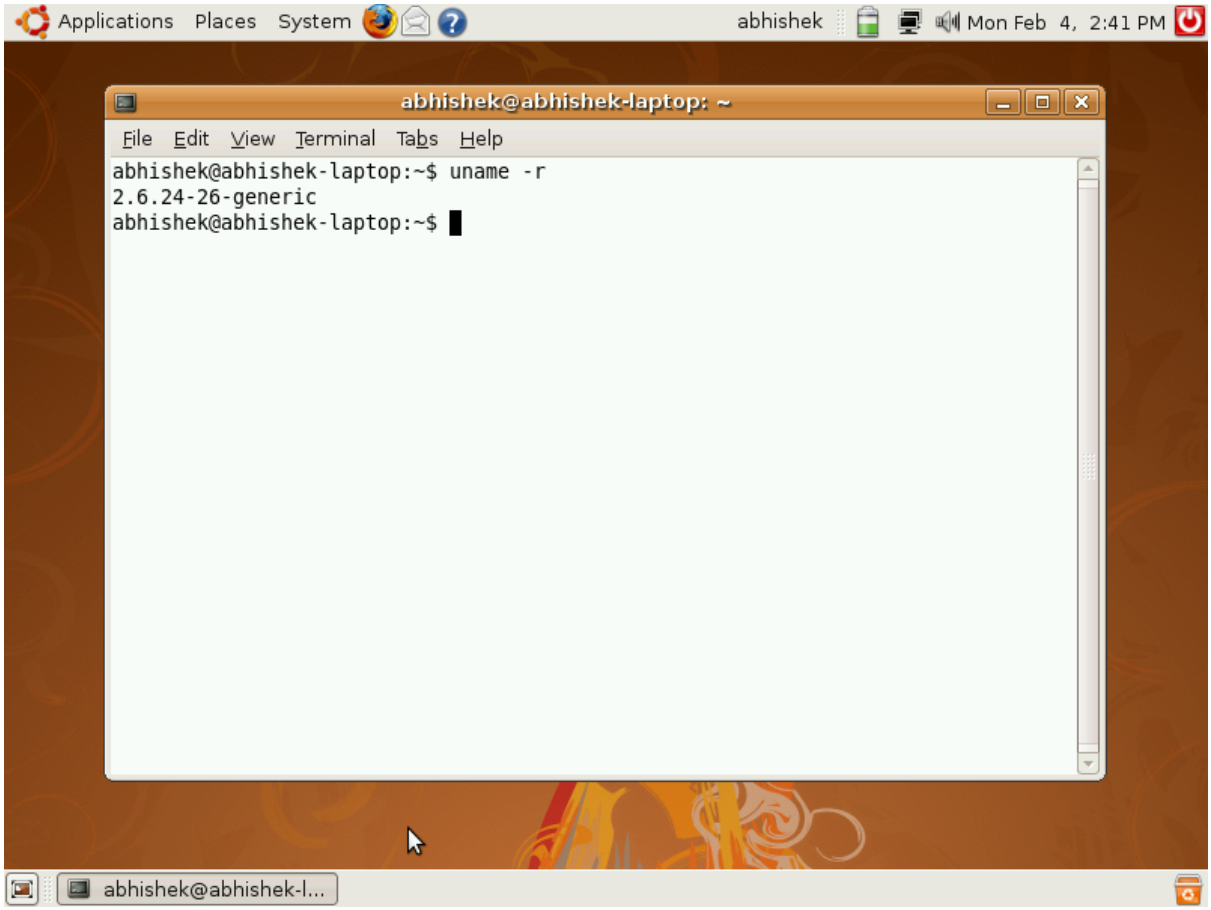




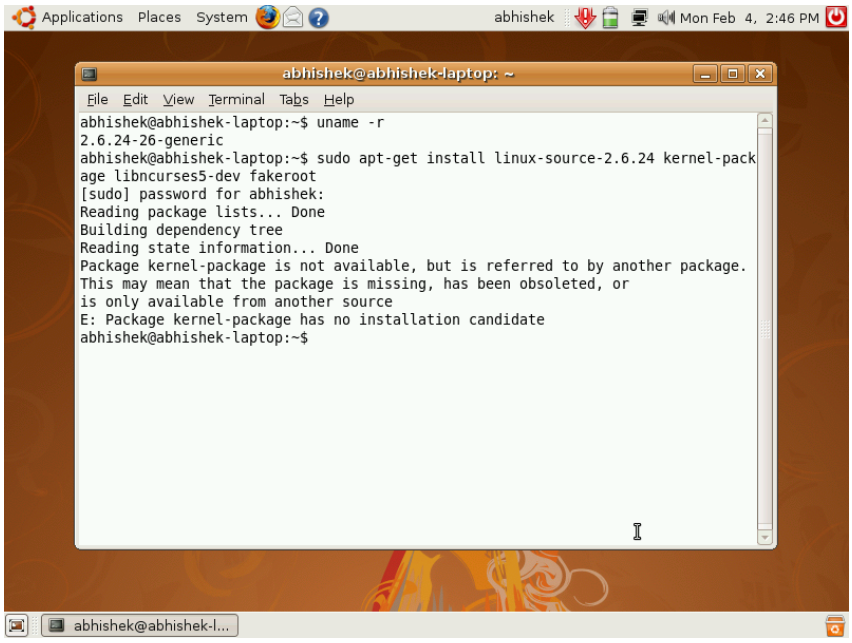
Press F4 to enter the graphical mode otherwise you have to completely use the CLI.

- First, we have to confirm that our kernel version is correct. So, we use the following command:

$ uname -r
2.6.24-26-generic

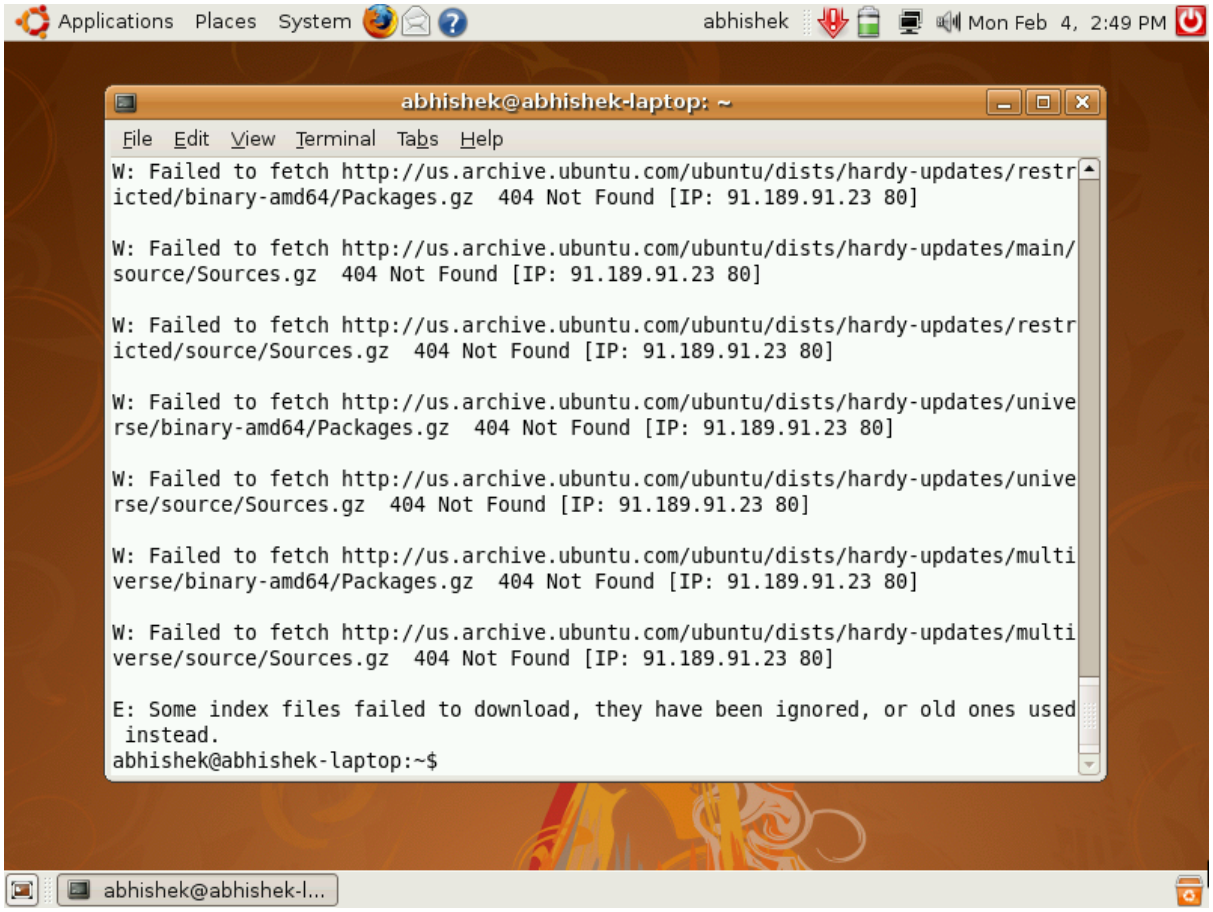


- Now we need to install the Linux source for our kernel, we also need to install the curses library and other tools to help us compile.
  $ sudo apt-get install linux-source-2.6.24 kernel-package libncurses5-dev fakeroot



We encountered an error due to the absence of packages, so we had to update the packages using the command:

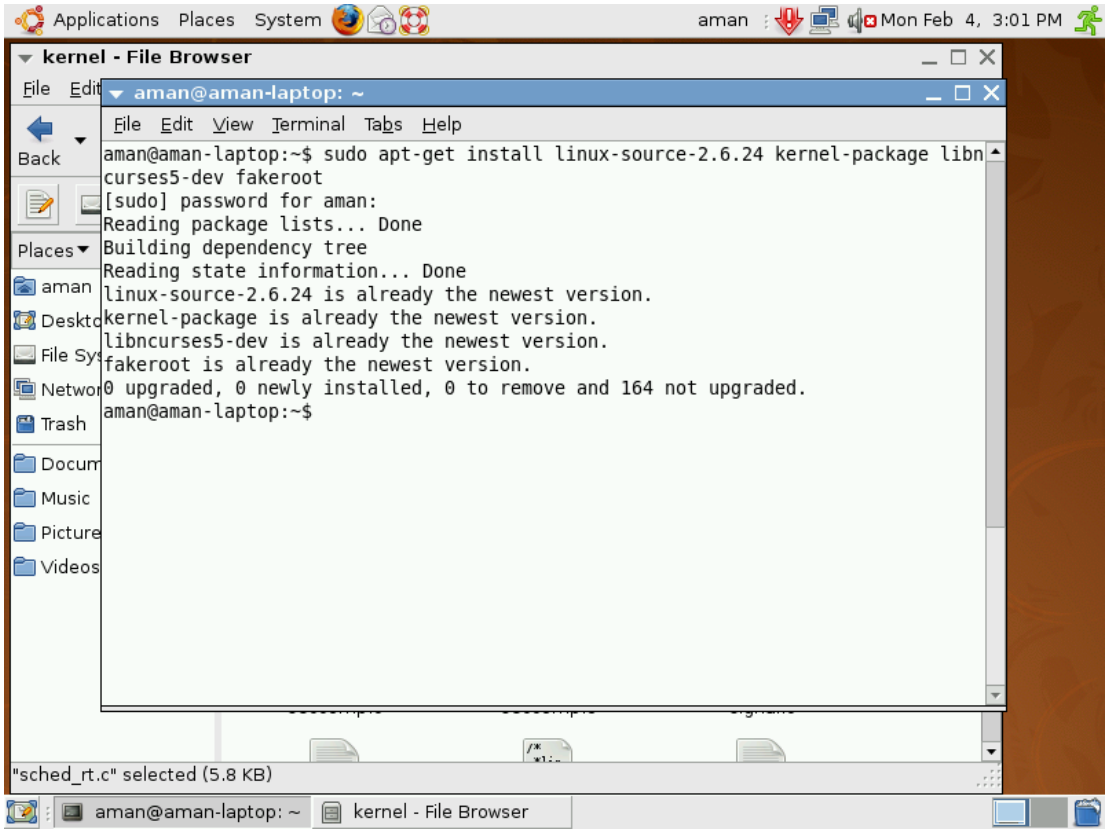
$ sudo apt-get update



- Due to the ubuntu version being too old, we were not able to use these commands as these links died. Hence, we need to update all of our deprecated urls **http://archive.ubuntu.com** to the working urls **http://old-releases.ubuntu.com** using the command:

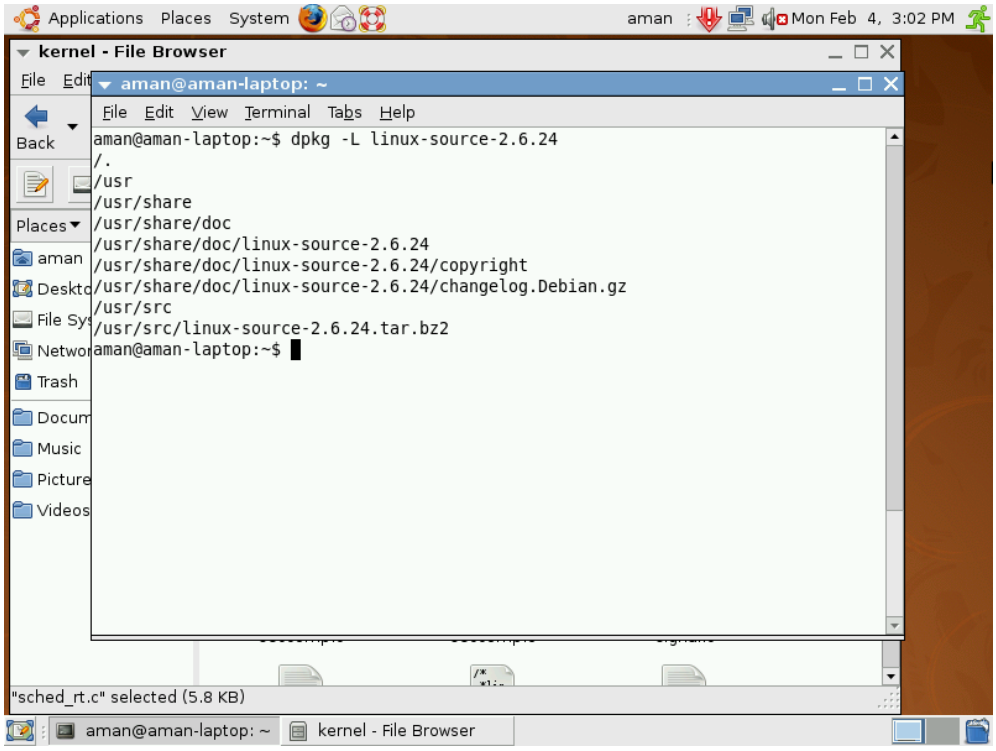
  sudo sed -i -e 's/:\/\/(archive.ubuntu.com\|security.ubuntu.com)/old-releases.ubuntu.com/g' /etc/apt/sources.list

- After this the packages will be updated and you can run the previous command to install the kernel source.

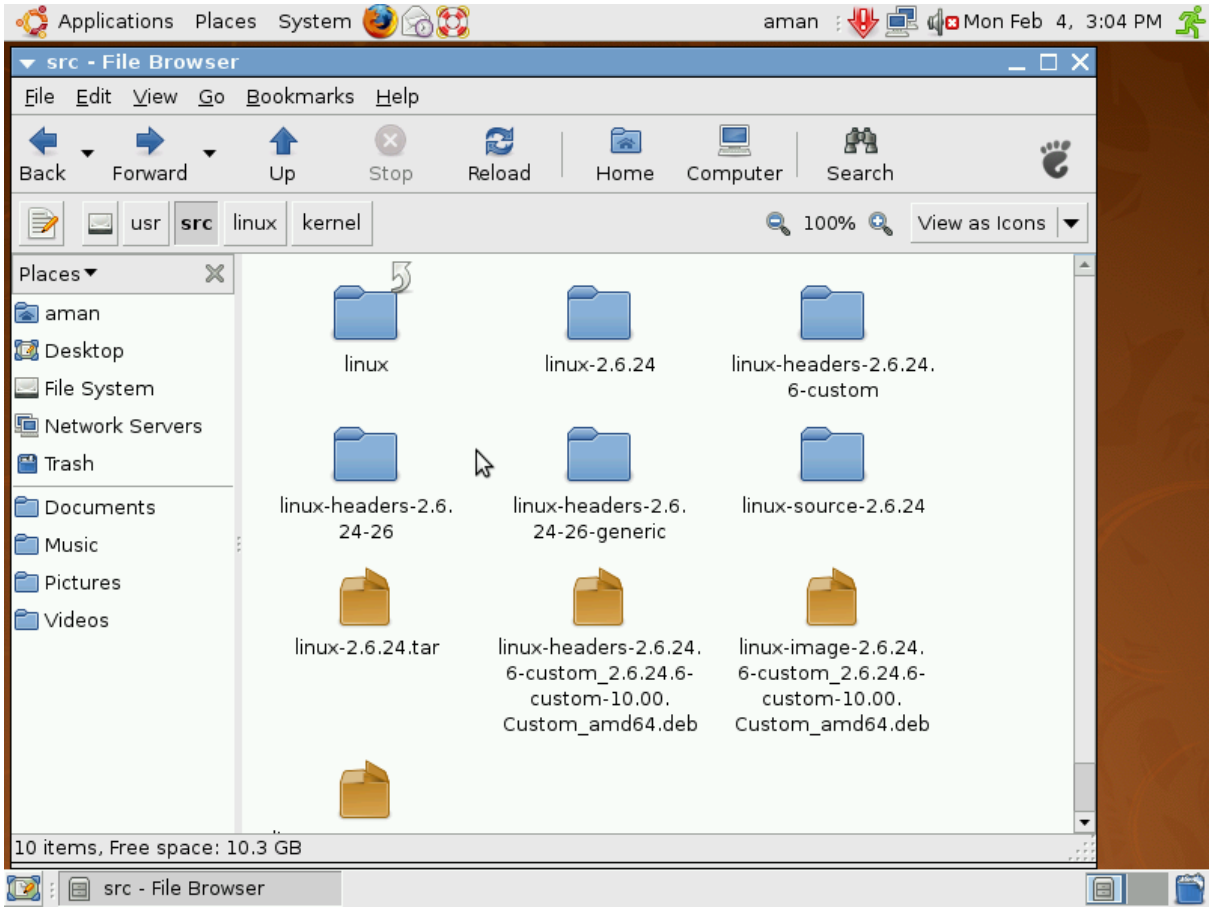


- To find out where the Linux source gets installed to, you can use the dpkg command to tell you the files within a package:

  $ dpkg -L linux-source-2.6.24

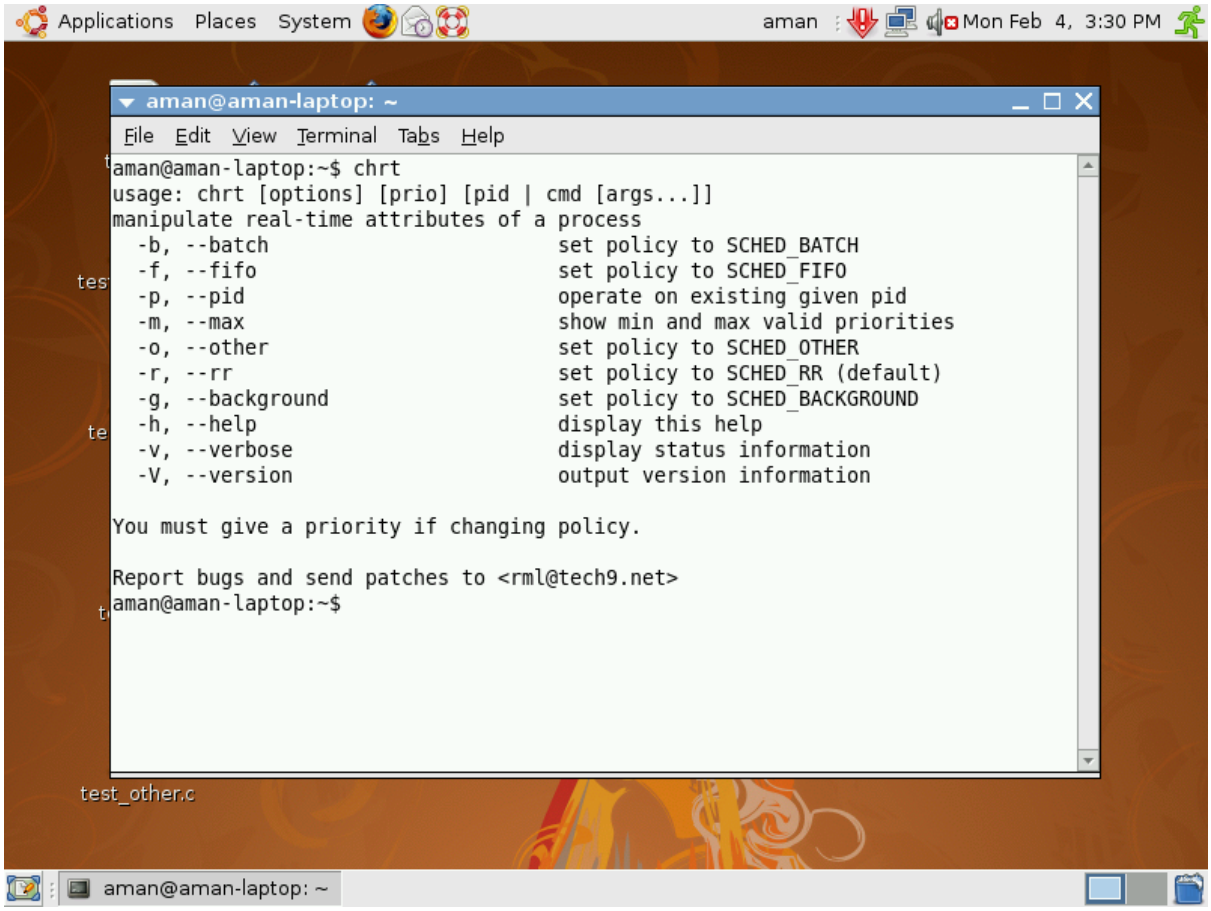


- Then we become the super-user to perform administrative tasks
  $ sudo /bin/bash
- Now we change the directory into the source location so that we can install the linux source. We then unzip the source file and save it in a folder named ‘linux’:
  $ cd /usr/src
  $ bunzip2 linux-source-2.6.24.tar.bz2
  $ tar xvf linux-source-2.6.24.tar
  $ ln -s linux-source-2.6.24 linux



- Then we modify the sched.c and the sched.h files to include our SCHED_BACKGROUND policy. We also modified the chrt.c file which manages our system calls for scheduling policies. We will also include our custom command to run the sched_background policy.

- To support making system calls from terminal, we also generate the object file of chrt.c and replace it with the default system file.
  $ gcc chrt.c -o chrt



- So, the primarily modified files are:
  - **/include/linux/sched.h**
  - **/kernel/sched.c**
  - **/usr/bin/chrt**
- There are mainly two scheduling classes in linux-2.6.24:
  - **sched_rt.c (for real time processes)**
  - **sched_fair.c (for fair scheduling)**

- The SCHED_BACKGROUND policy needs to handle processes in its queue similar to SCHED_OTHER which follows fair scheduling so it also follows fair scheduling. Thus its operating class is sched_fair.c.
- Next, we have to make a copy of our existing kernel configuration to use for the custom compile process. We can do this by using the command:

  $ cp /boot/config- 2.6.24-generic /usr/src/linux/.config

- First, we'll do a make clean, just to make sure everything is ready for the compile

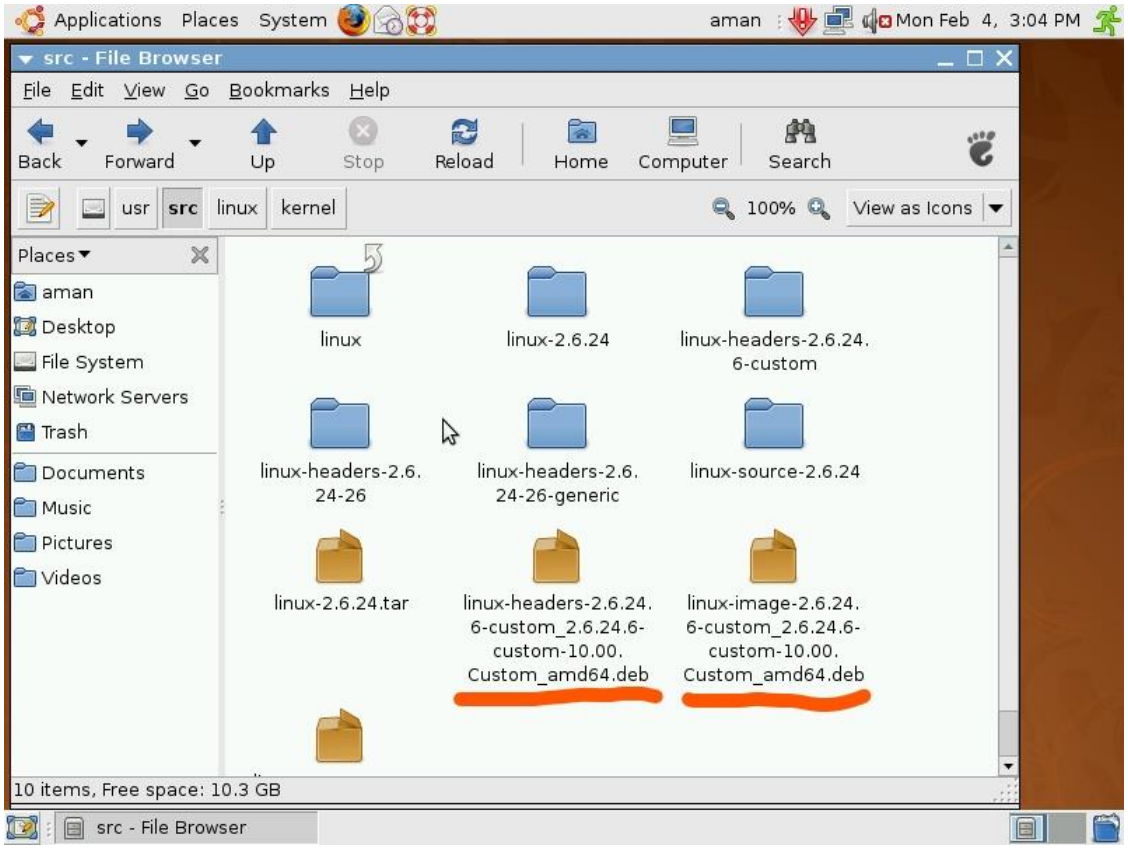
  $ make-kpkg clean

- We'll actually compile the kernel. This will take a “LONG TIME” maybe 40-50 mins.

$ fakeroot make-kpkg --initrd --append-to-version=-custom kernel_image kernel_headers

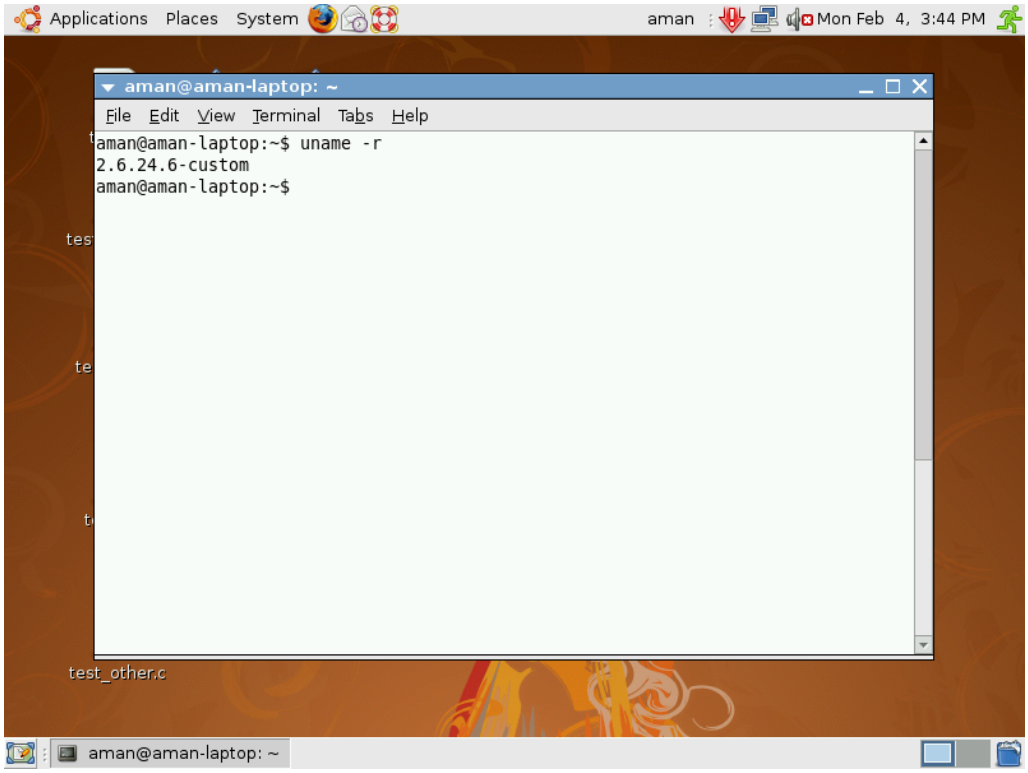
- This process will create two .deb files in /usr/src that contain the kernel
  Please note that when you run these next commands, this will set the new kernel as the new default kernel. This could break things! If your machine doesn't boot, you can hit Esc at the GRUB loading menu, and select your old kernel. You can then disable the kernel in /boot/grub/menu.lst or try and compile again.

  $ dpkg -i linux-image-2.6.24.6-custom_2.6.24.6-custom-10.00.Custom_amd64.deb
  $ dpkg -i linux-headers-2.6.24.6-custom_2.6.24.6-custom-10.00.Custom_amd64.deb

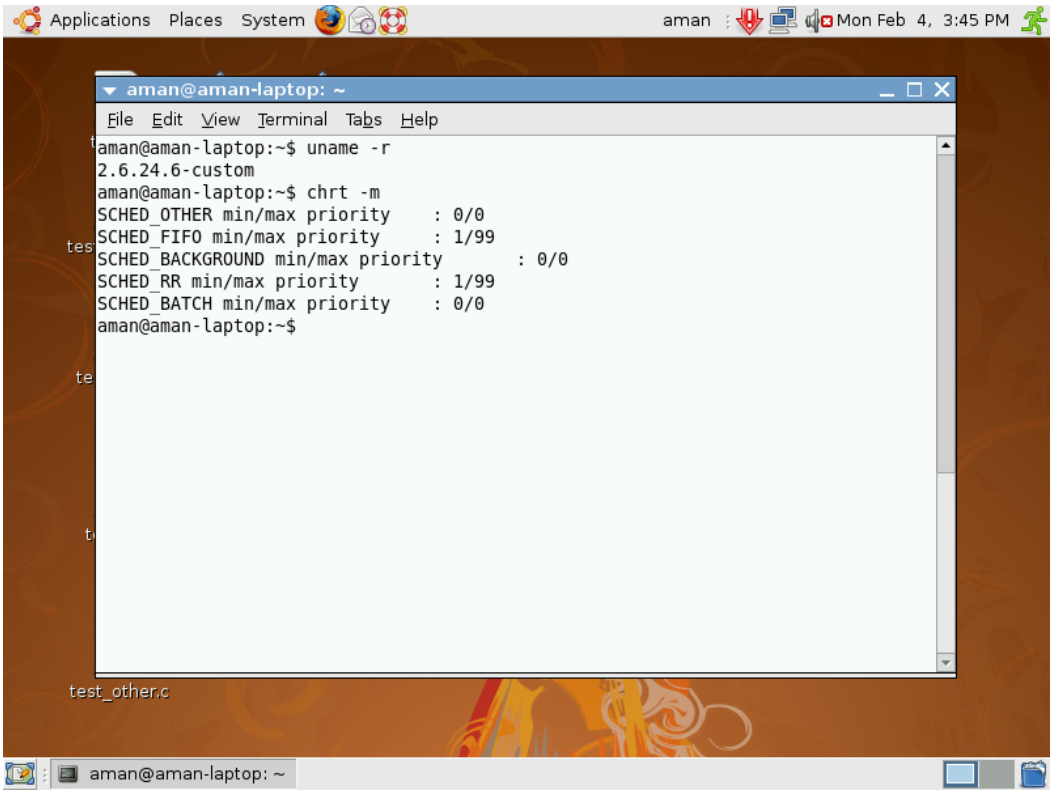


- Now we reboot our machine. After rebooting we can check whether our custom kernel version is correct or not:

  $ uname -r



We can also get the priorities of the current policies using chrt -m command.



EVALUATION:

- For the evaluation purpose we have written C programs that execute z process for a counter of order of 1000000000, and finishes its execution in about 15 seconds. We used the method sched_setscheduler() to set the required policy for a process. This can also be done in shell script using chrt –[policy] -p [prio] [PID]

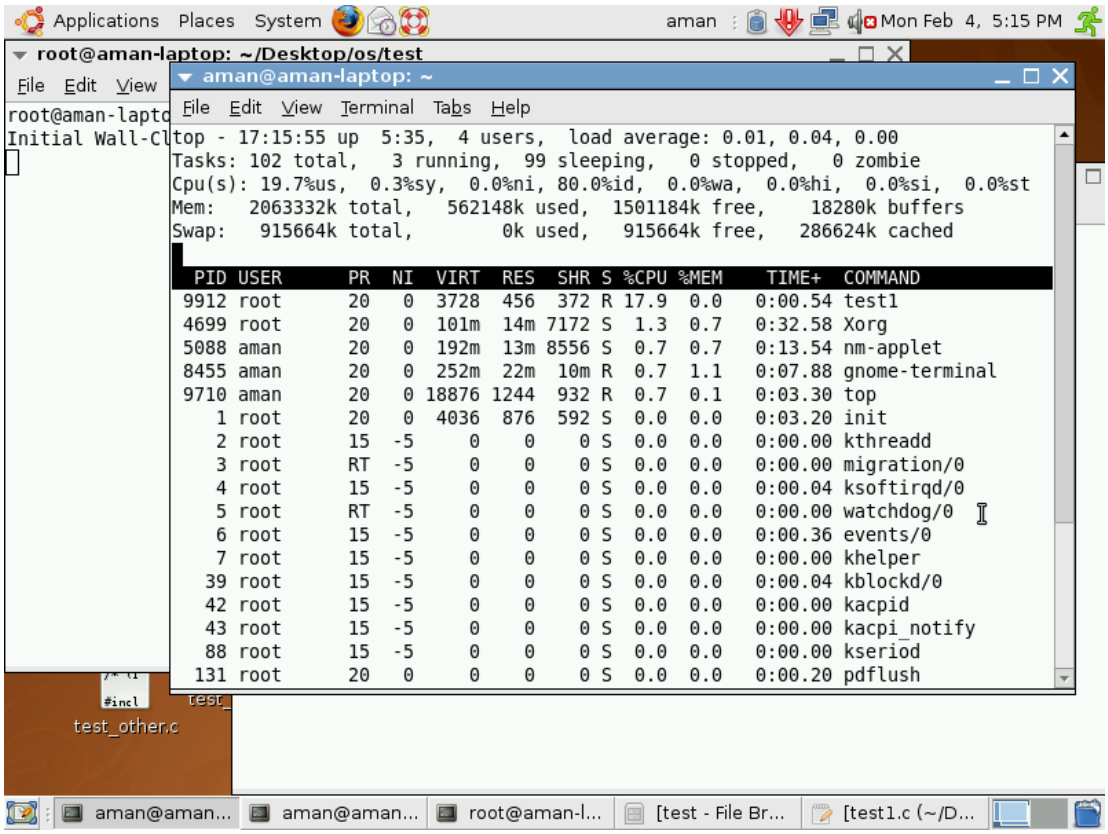
- We used getrusage() to get the user time and the system time for a particular process. We also use gettimeoftheday() to get the wall-clock time for our process. To run multiple process files simultaneously, we used shell-script.

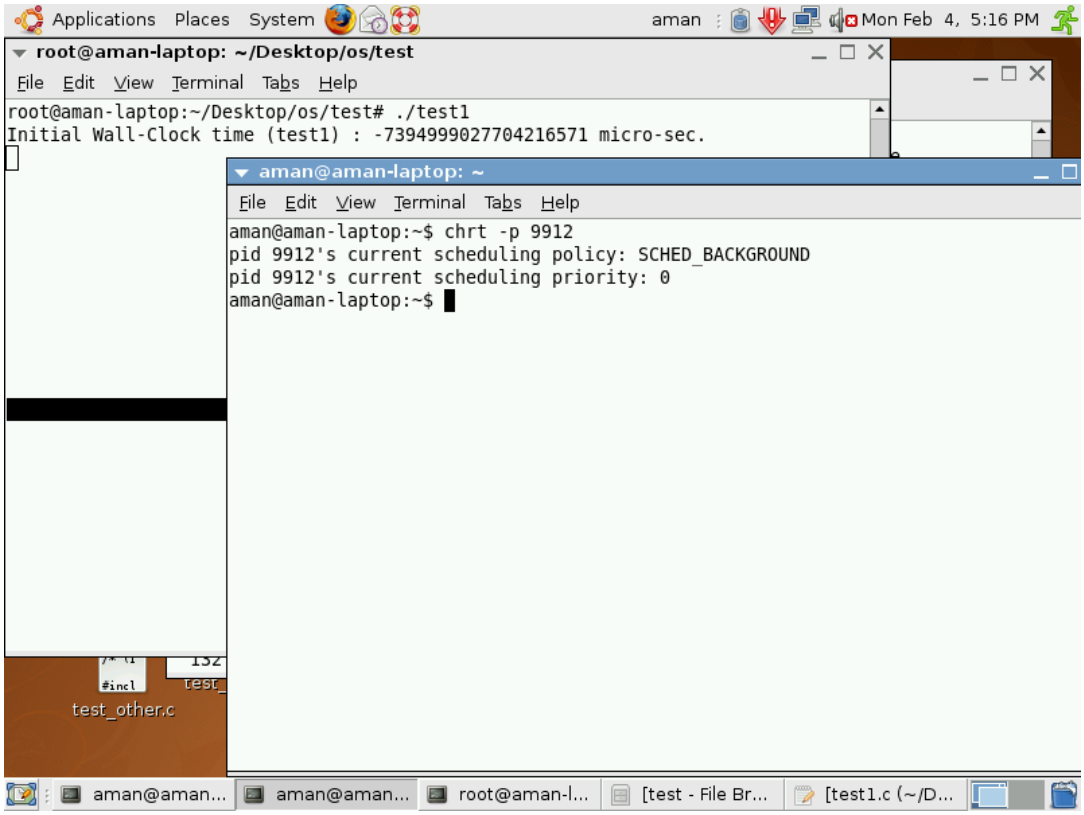
- For evaluating a file compile the corresponding C code using command :

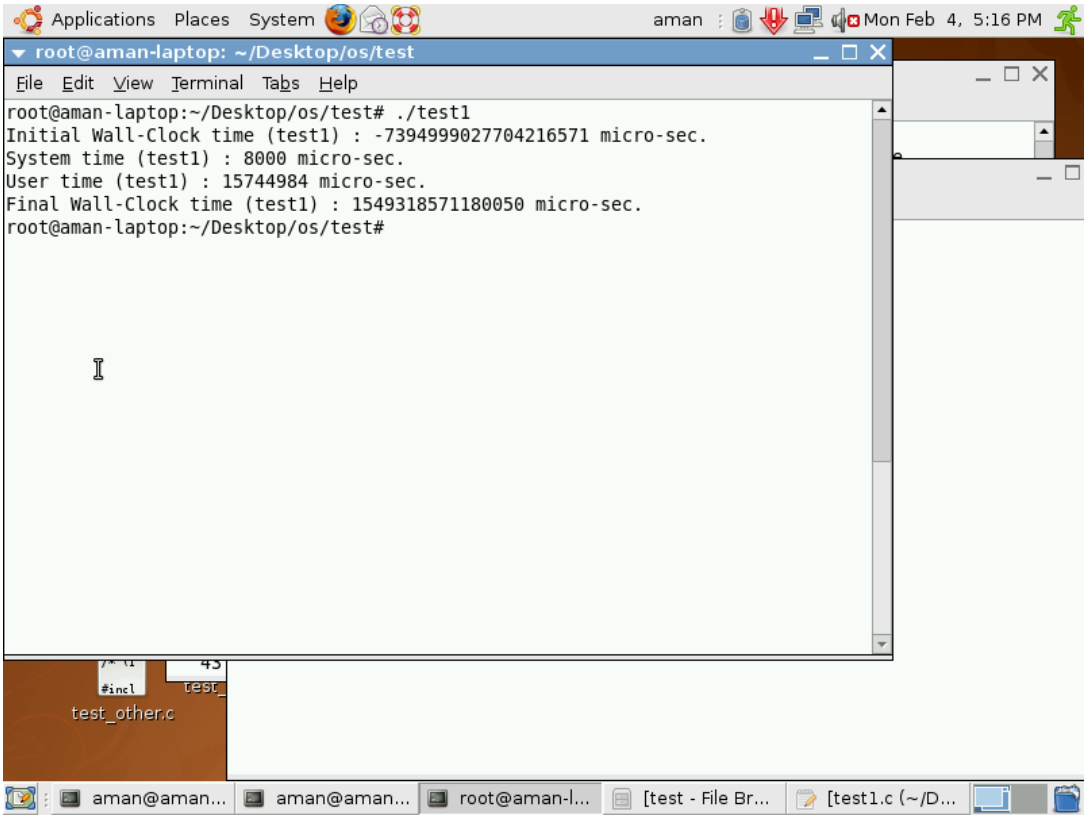
  gcc test1.c -o test1

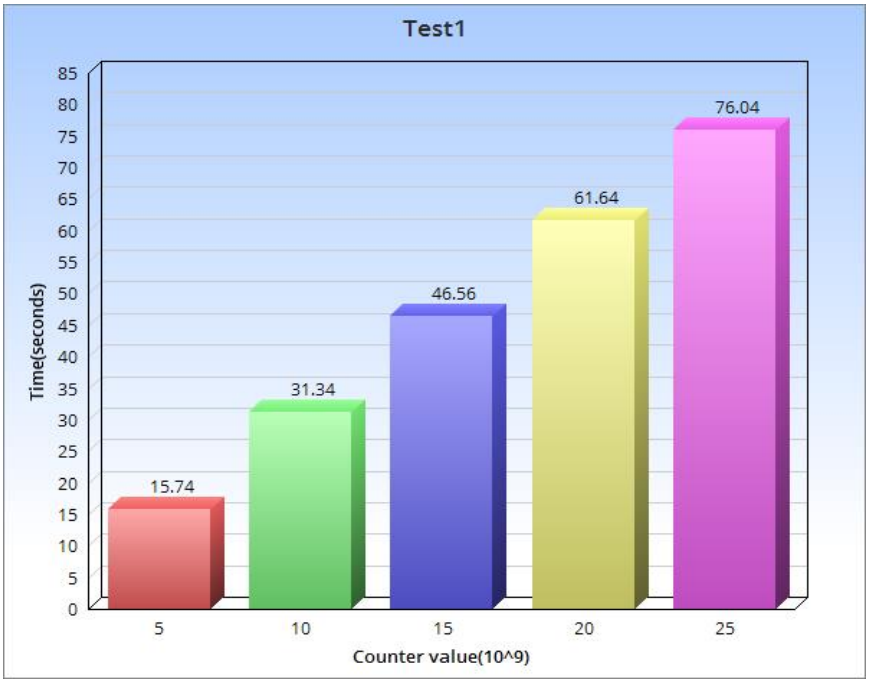
  To run the C file use : **./test1**

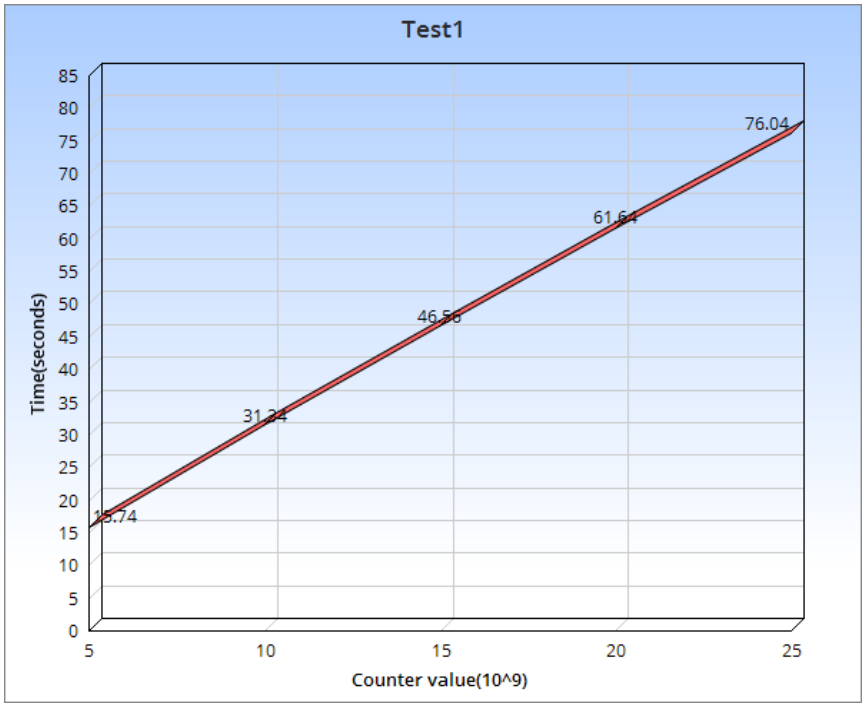
1.) Run your counter as a SCHED_BACKGROUND. Record how long it takes to count.



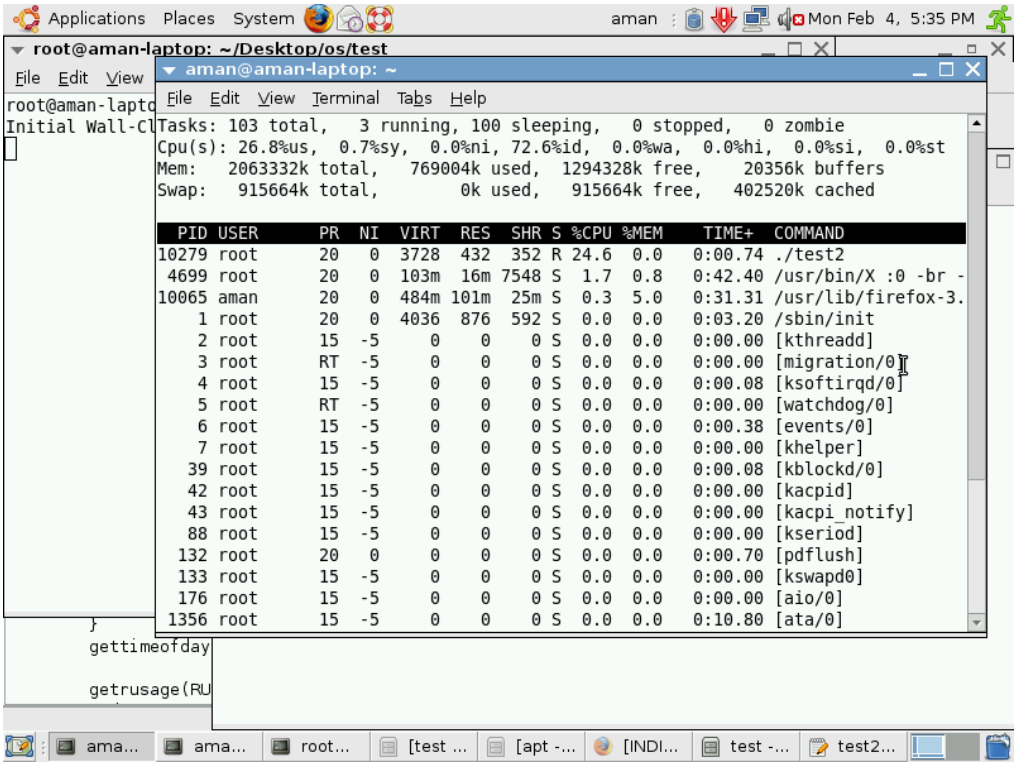

Applications Places System
aman
Mon Feb 4, 5:16 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test1
Initial Wall-Clock time (test1) : -7394999027704216571 micro-sec.
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
aman@aman-laptop:~$ chrt -p 9912
pid 9912's current scheduling policy: SCHED_BACKGROUND
pid 9912's current scheduling priority: 0
aman@aman-laptop:~$
test_other.c
aman@aman...
aman@aman...
root@aman-l...
[test - File Br...
[test1.c (~/D...

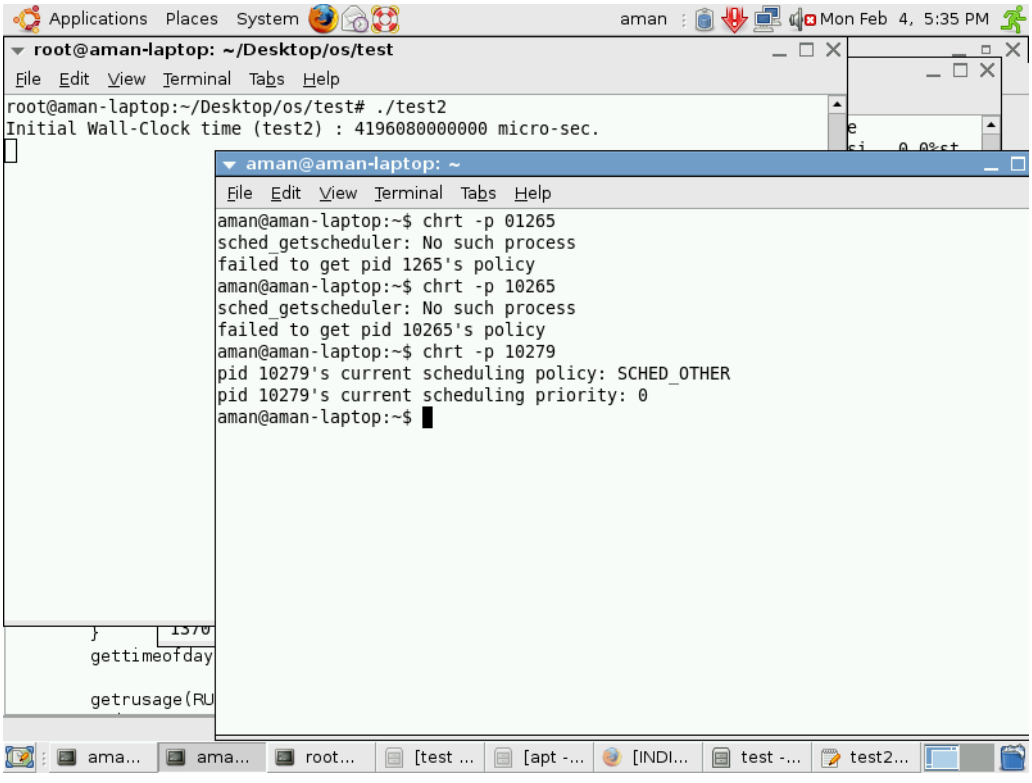

Applications Places System
aman
Mon Feb 4, 5:16 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test1
Initial Wall-Clock time (test1) : -7394999027704216571 micro-sec.
System time (test1) : 8000 micro-sec.
User time (test1) : 15744984 micro-sec.
Final Wall-Clock time (test1) : 1549318571180050 micro-sec.
root@aman-laptop:~/Desktop/os/test#
test_other.c
aman@aman...
aman@aman...
root@aman-l...
[test - File Br...
[test1.c (~/D...

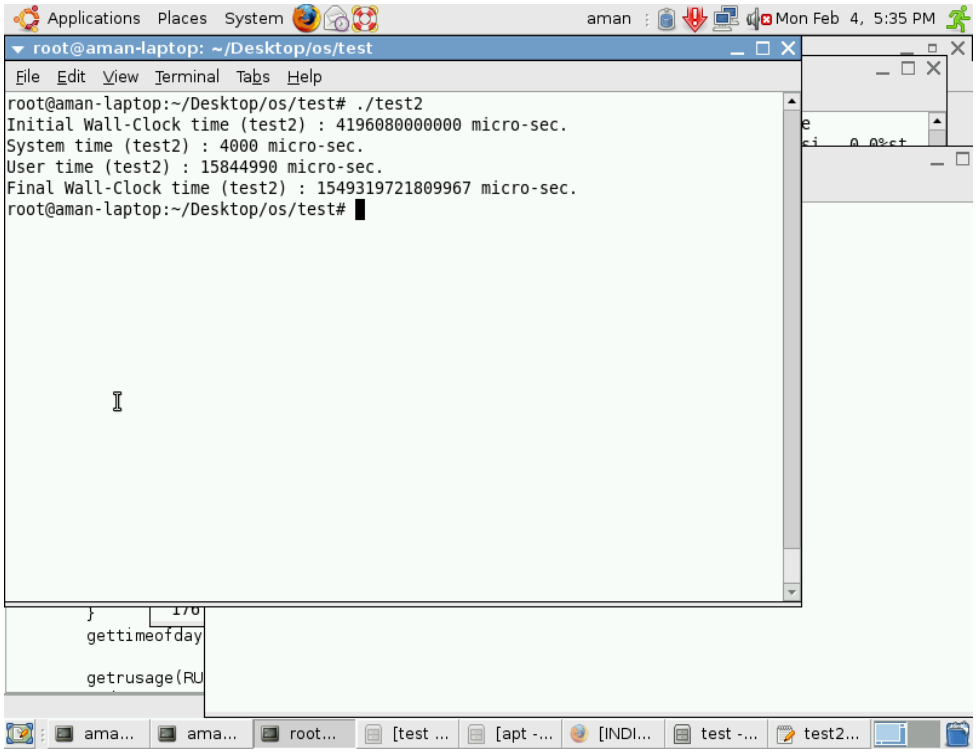

Test1
Time(seconds)
Counter value(10^9)
15.74
31.34
46.56
61.64
76.04
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85

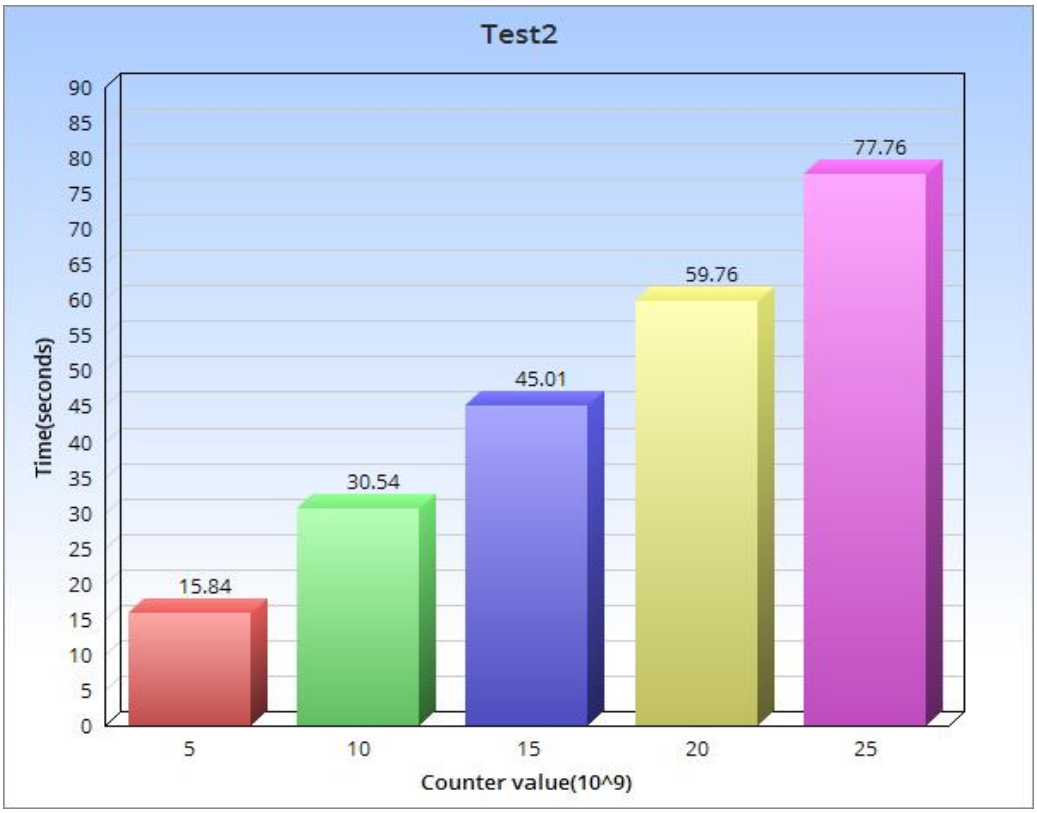

Test1
Time(seconds)
Counter value(10^9)
15.74
31.34
46.56
61.64
76.04
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85

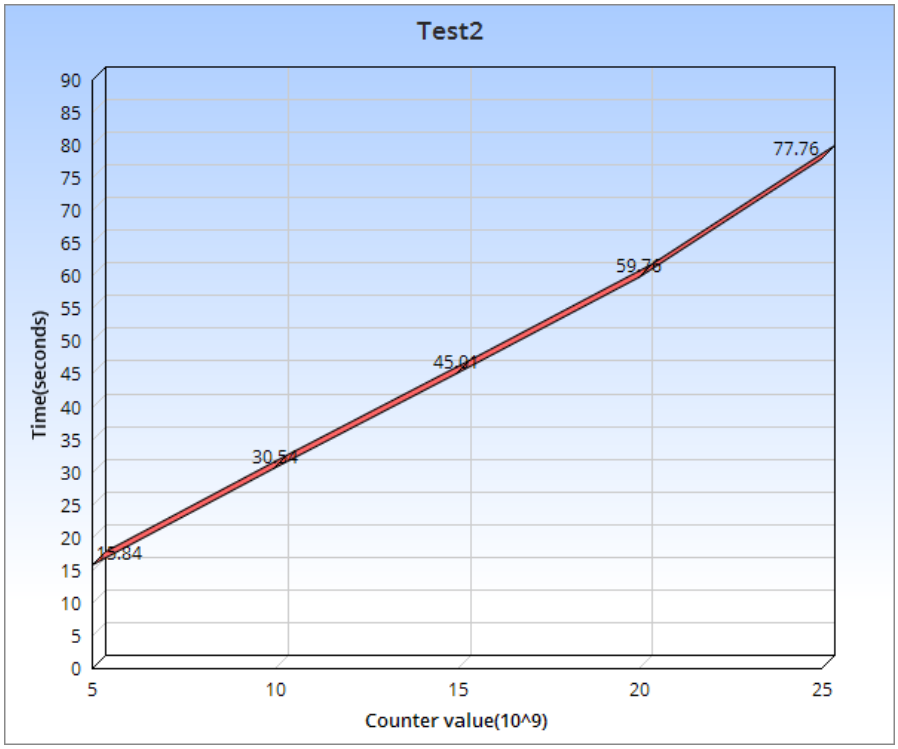
2.) Run your counter as a normal process. Record how long it takes to count.



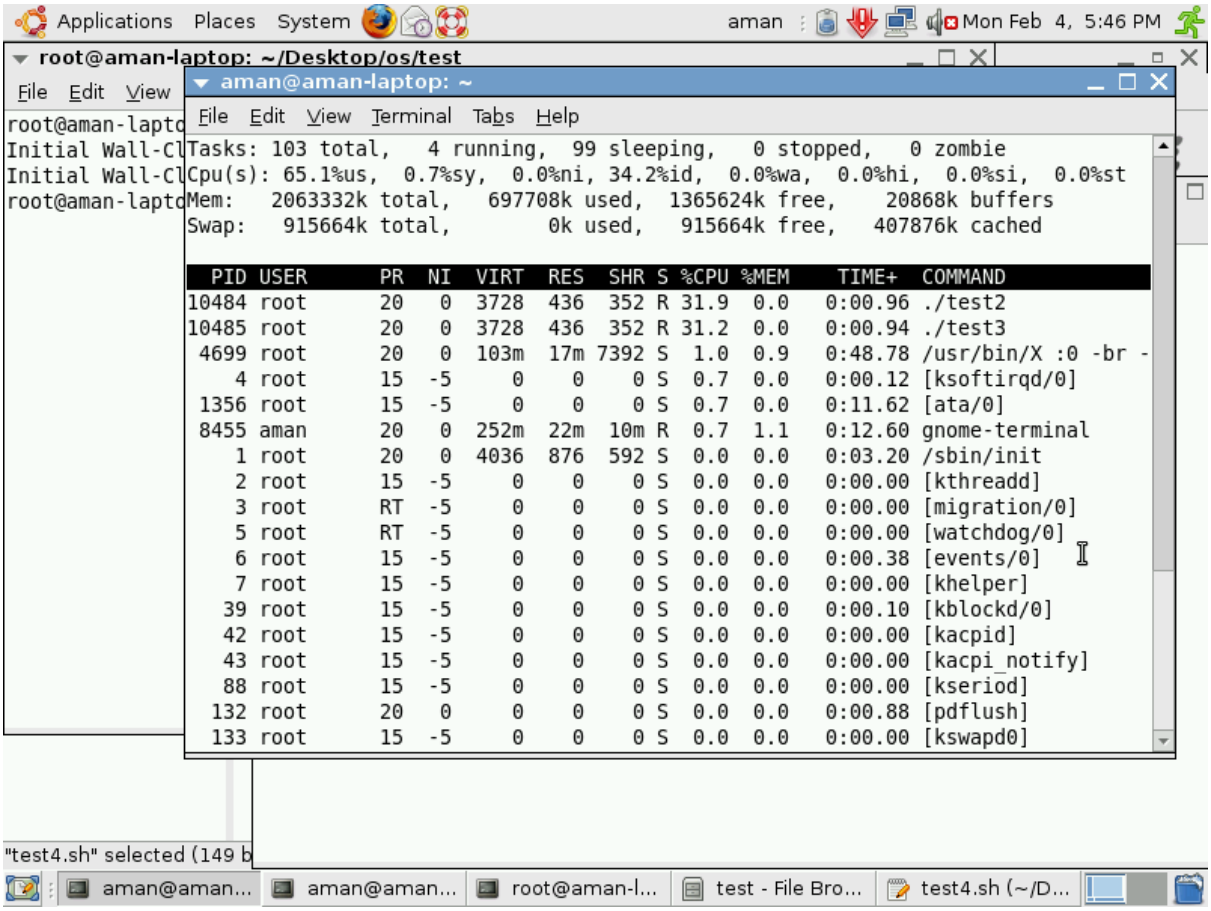


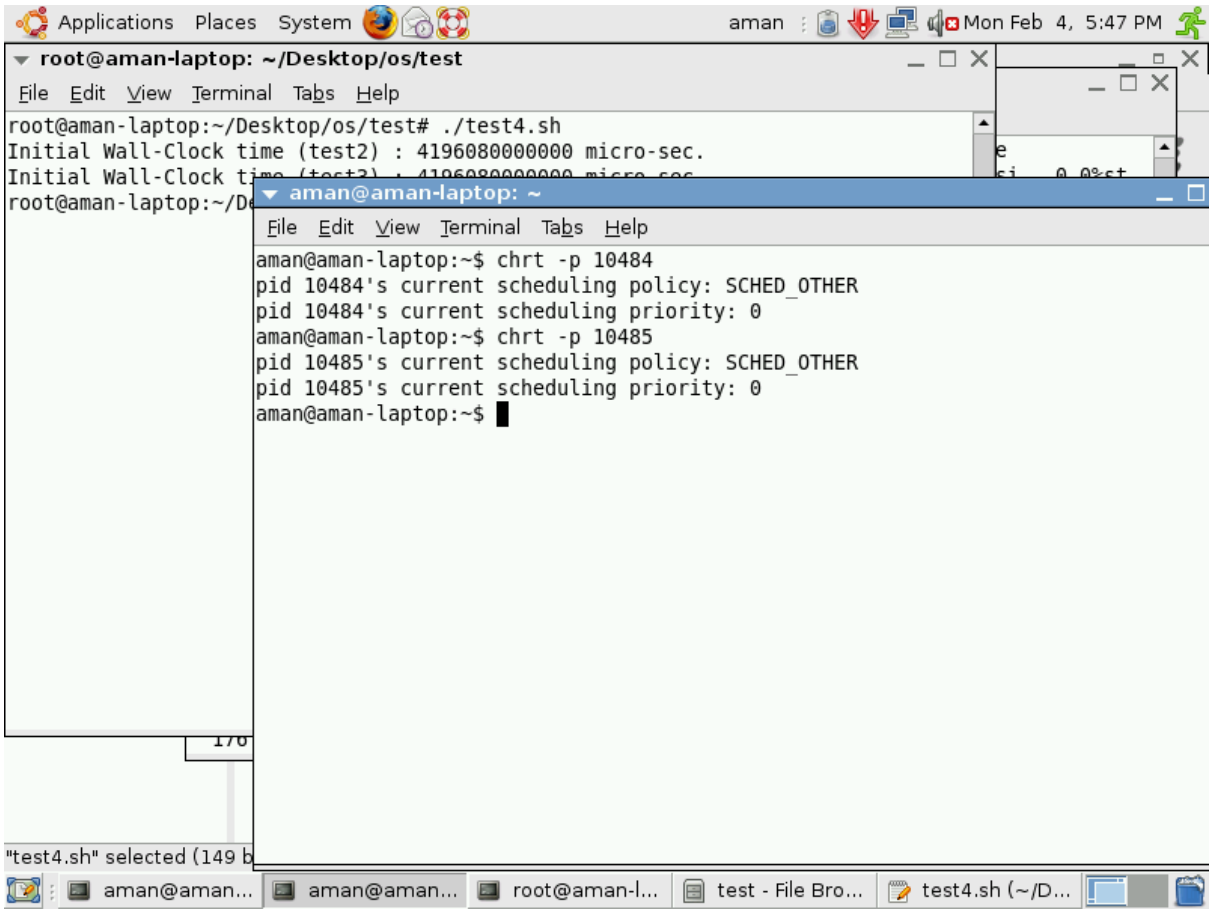

Applications Places System
aman
Mon Feb 4, 5:35 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test2
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
System time (test2) : 4000 micro-sec.
User time (test2) : 15844990 micro-sec.
Final Wall-Clock time (test2) : 1549319721809967 micro-sec.
root@aman-laptop:~/Desktop/os/test#
gettimeofday
getrusage(RU

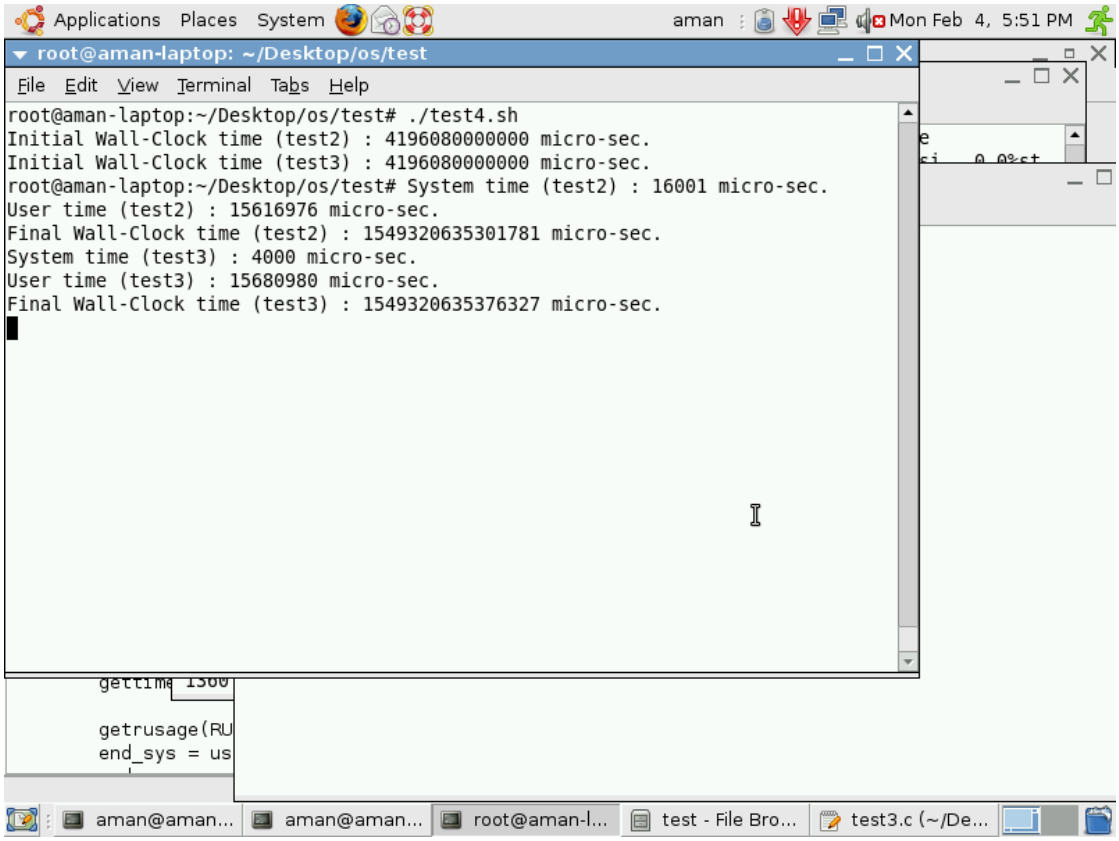

Test2
Time(seconds)
Counter value(10^9)
15.84
30.54
45.01
59.76
77.76
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

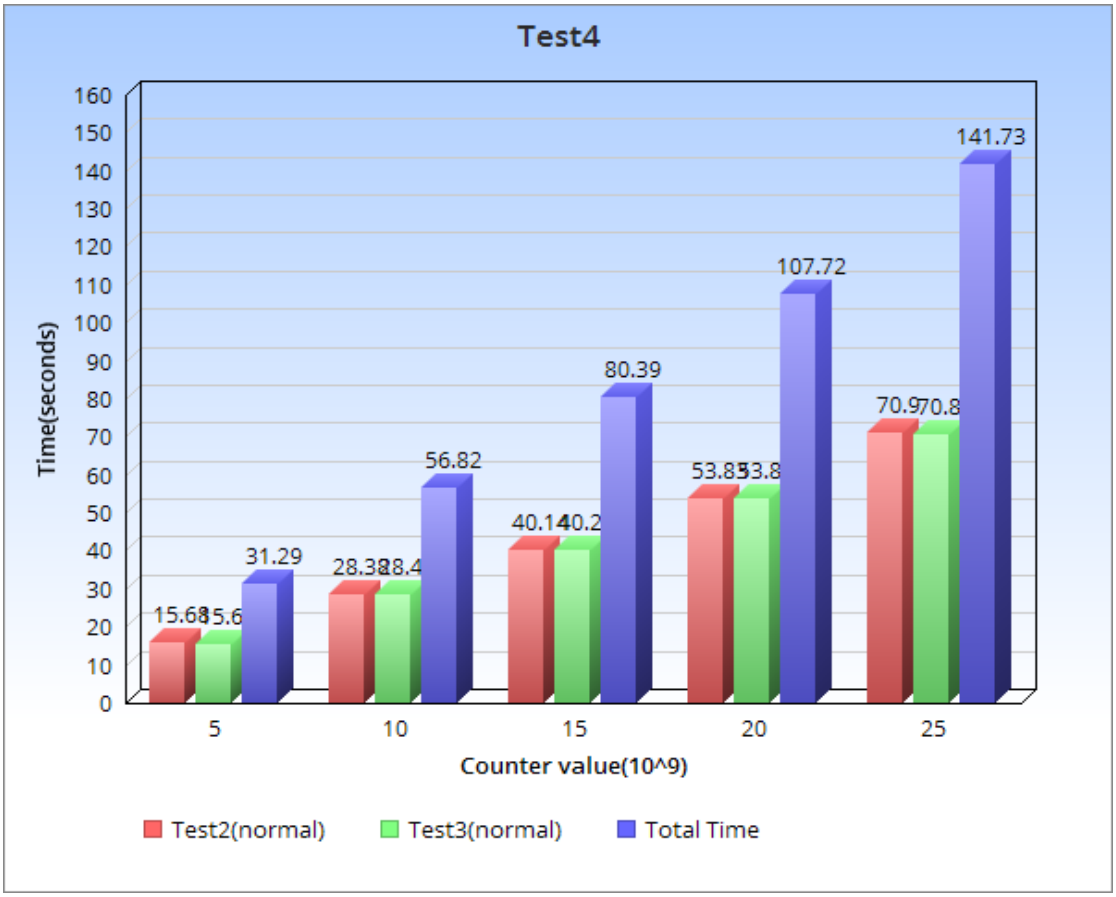


3.) Run your counter simultaneously with another counter, both as normal processes. How long does it take to count?

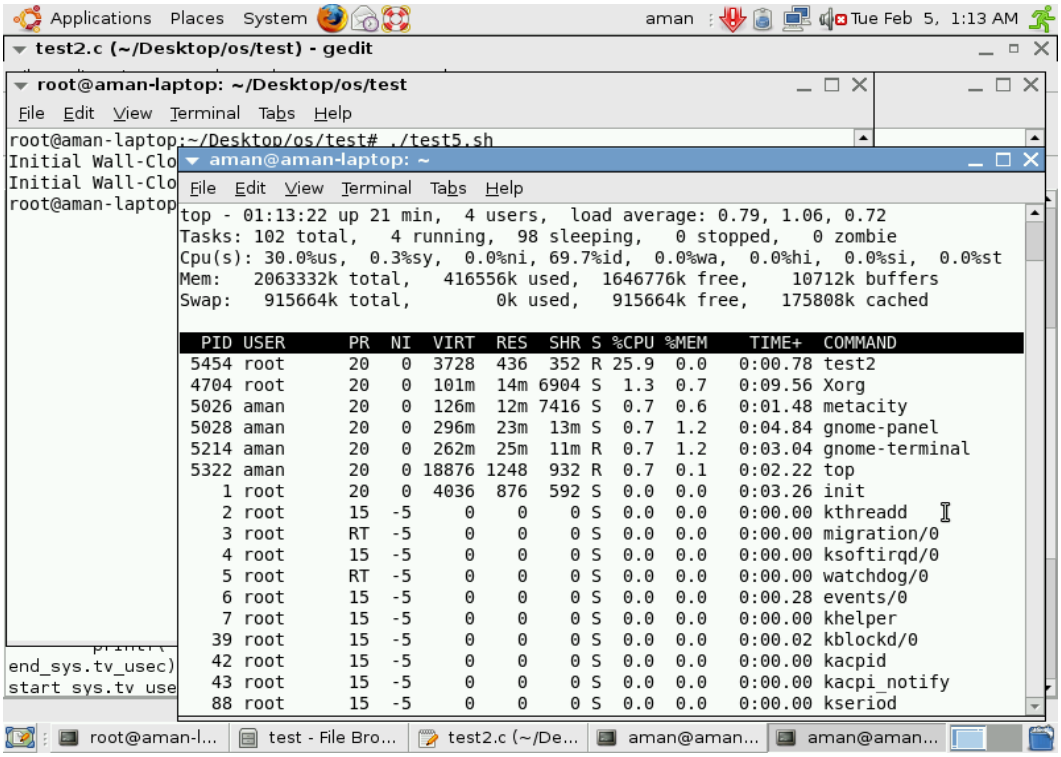

Applications Places System
aman
Mon Feb 4, 5:46 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
Tasks: 103 total, 4 running, 99 sleeping, 0 stopped, 0 zombie
Cpu(s): 65.1%us, 0.7%sy, 0.0%ni, 34.2%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 2063332k total, 697708k used, 1365624k free, 20868k buffers
Swap: 915664k total, 0k used, 915664k free, 407876k cached
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
10484 root 20 0 3728 436 352 R 31.9 0.0 0:00.96 ./test2
10485 root 20 0 3728 436 352 R 31.2 0.0 0:00.94 ./test3
4699 root 20 0 103m 17m 7392 S 1.0 0.9 0:48.78 /usr/bin/X :0 -br -
4 root 15 -5 0 0 0 S 0.7 0.0 0:00.12 [ksoftirqd/0]
1356 root 15 -5 0 0 0 S 0.7 0.0 0:11.62 [ata/0]
8455 aman 20 0 252m 22m 10m R 0.7 1.1 0:12.60 gnome-terminal
1 root 20 0 4036 876 592 S 0.0 0.0 0:03.20 /sbin/init
2 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [kthreadd]
3 root RT -5 0 0 0 S 0.0 0.0 0:00.00 [migration/0]
5 root RT -5 0 0 0 S 0.0 0.0 0:00.00 [watchdog/0]
6 root 15 -5 0 0 0 S 0.0 0.0 0:00.38 [events/0]
7 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [khelper]
39 root 15 -5 0 0 0 S 0.0 0.0 0:00.10 [kblockd/0]
42 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [kacpid]
43 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [kacpi_notify]
88 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [kseriod]
132 root 20 0 0 0 0 S 0.0 0.0 0:00.88 [pdflush]
133 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 [kswapd0]
"test4.sh" selected (149 b
aman@aman...
aman@aman...
root@aman-l...
test - File Bro...
test4.sh (~/D...

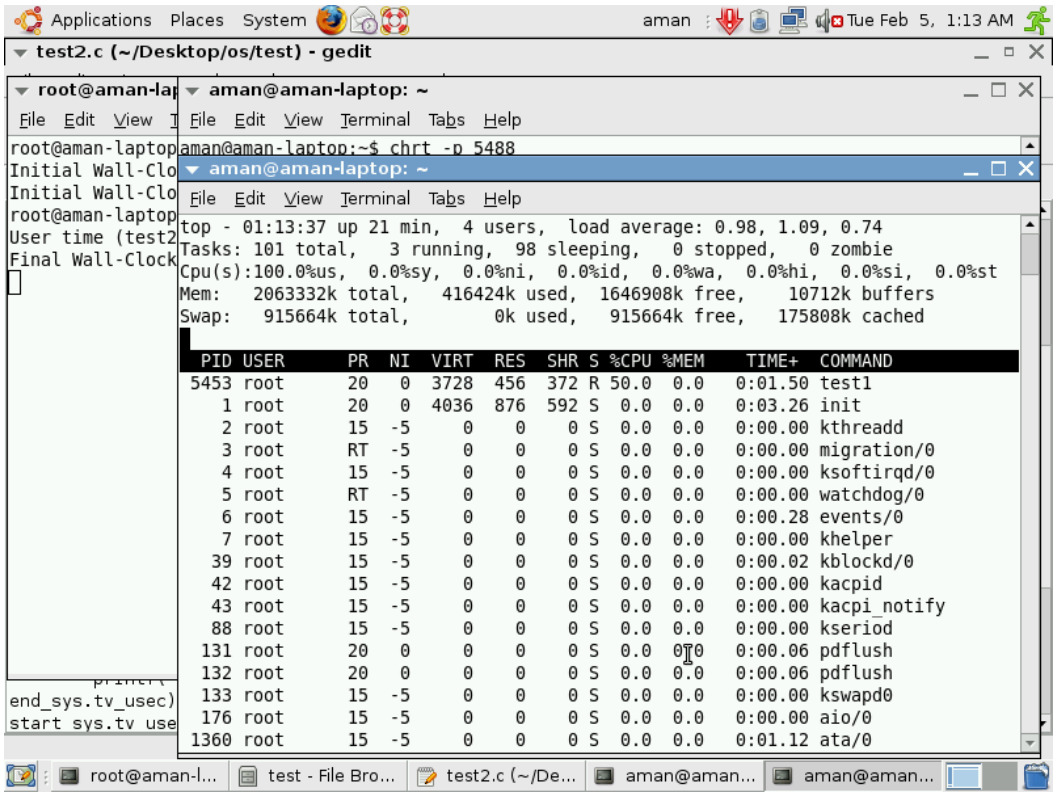

Applications Places System
aman
Mon Feb 4, 5:47 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test4.sh
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
aman@aman-laptop:~$ chrt -p 10484
pid 10484's current scheduling policy: SCHED_OTHER
pid 10484's current scheduling priority: 0
aman@aman-laptop:~$ chrt -p 10485
pid 10485's current scheduling policy: SCHED_OTHER
pid 10485's current scheduling priority: 0
aman@aman-laptop:~$
"test4.sh" selected (149 b
aman@aman...
aman@aman...
root@aman-l...
test - File Bro...
test4.sh (~/D...

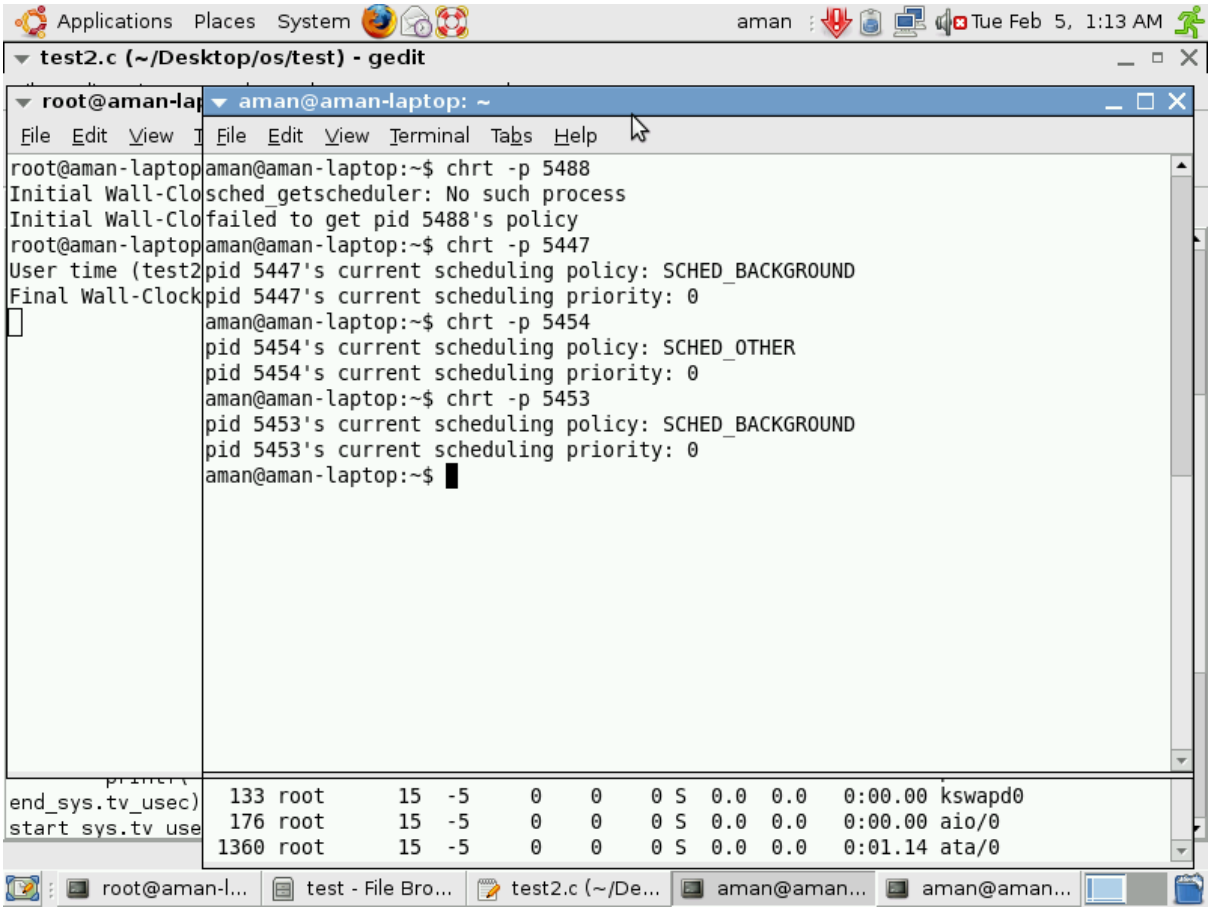

Applications Places System
aman
Mon Feb 4, 5:51 PM
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test4.sh
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
Initial Wall-Clock time (test3) : 4196080000000 micro-sec.
root@aman-laptop:~/Desktop/os/test# System time (test2) : 16001 micro-sec.
User time (test2) : 15616976 micro-sec.
Final Wall-Clock time (test2) : 1549320635301781 micro-sec.
System time (test3) : 4000 micro-sec.
User time (test3) : 15680980 micro-sec.
Final Wall-Clock time (test3) : 1549320635376327 micro-sec.
getrusage(RU
end_sys = us
aman@aman...
aman@aman...
root@aman-l...
test - File Bro...
test3.c (~/De...

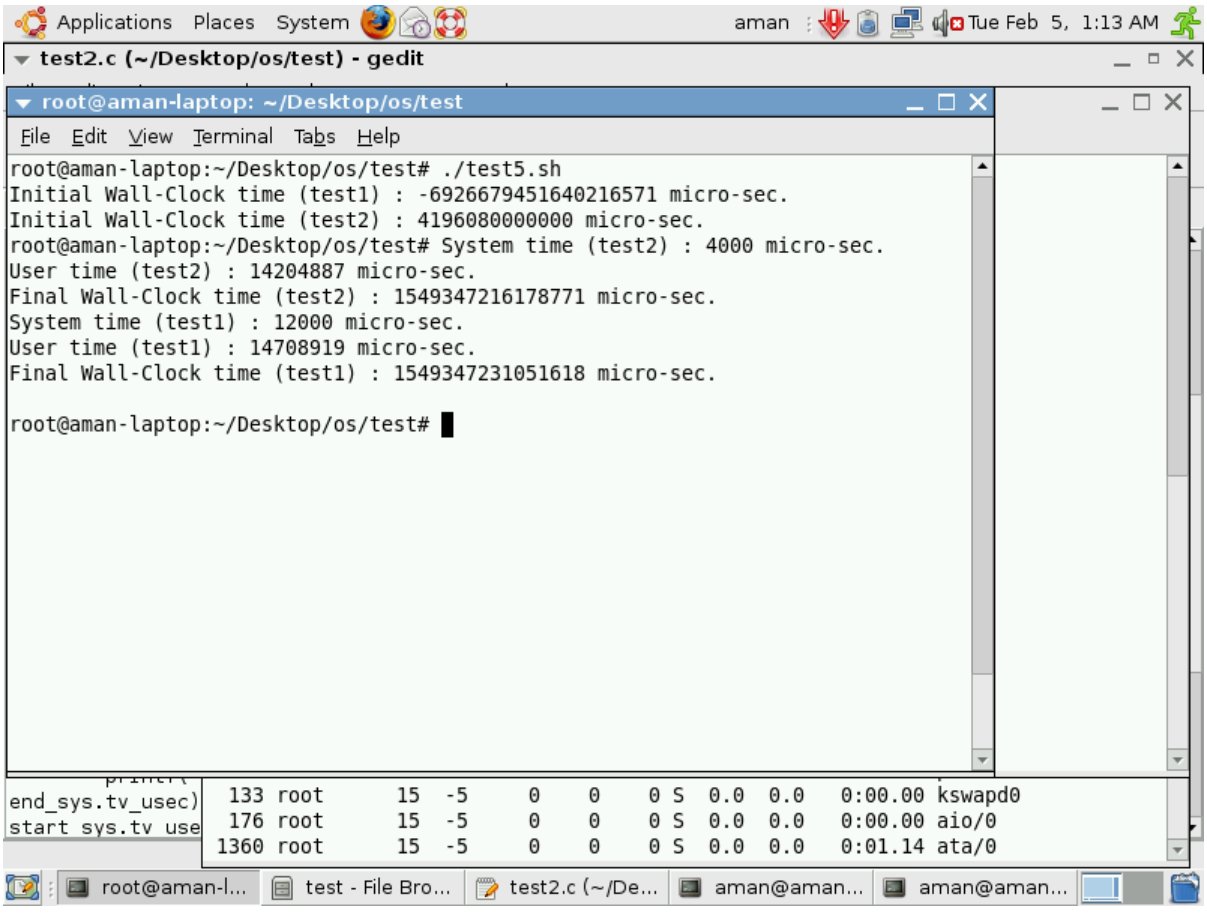

Test4
Time(seconds)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
15.68
15.6
31.29
28.38
28.4
56.82
40.14
40.2
80.39
53.85
53.8
107.72
70.9
70.8
141.73
5
10
15
20
25
Counter value(10^9)
Test2(normal)
Test3(normal)
Total Time

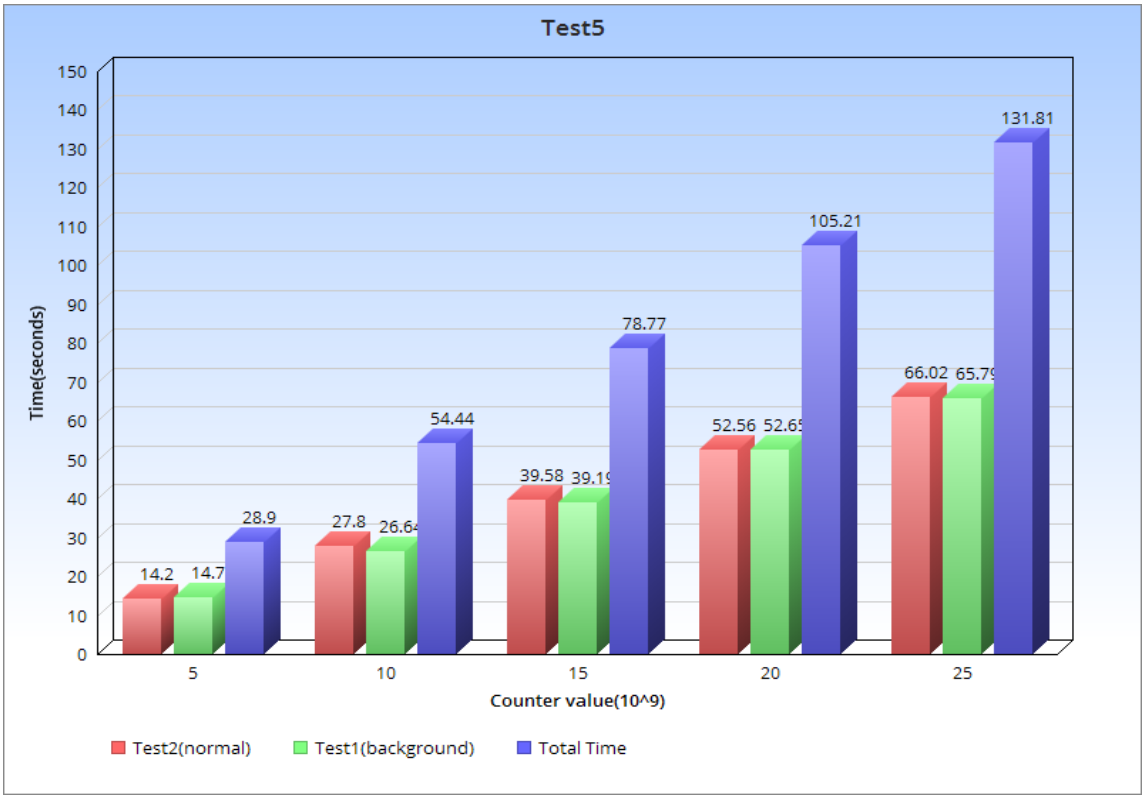
4.) Run your counter as a SCHED_BACKGROUND process, simultaneously with another counter that is running as a normal process. How long does your SCHED_BACKGROUND process take to count?



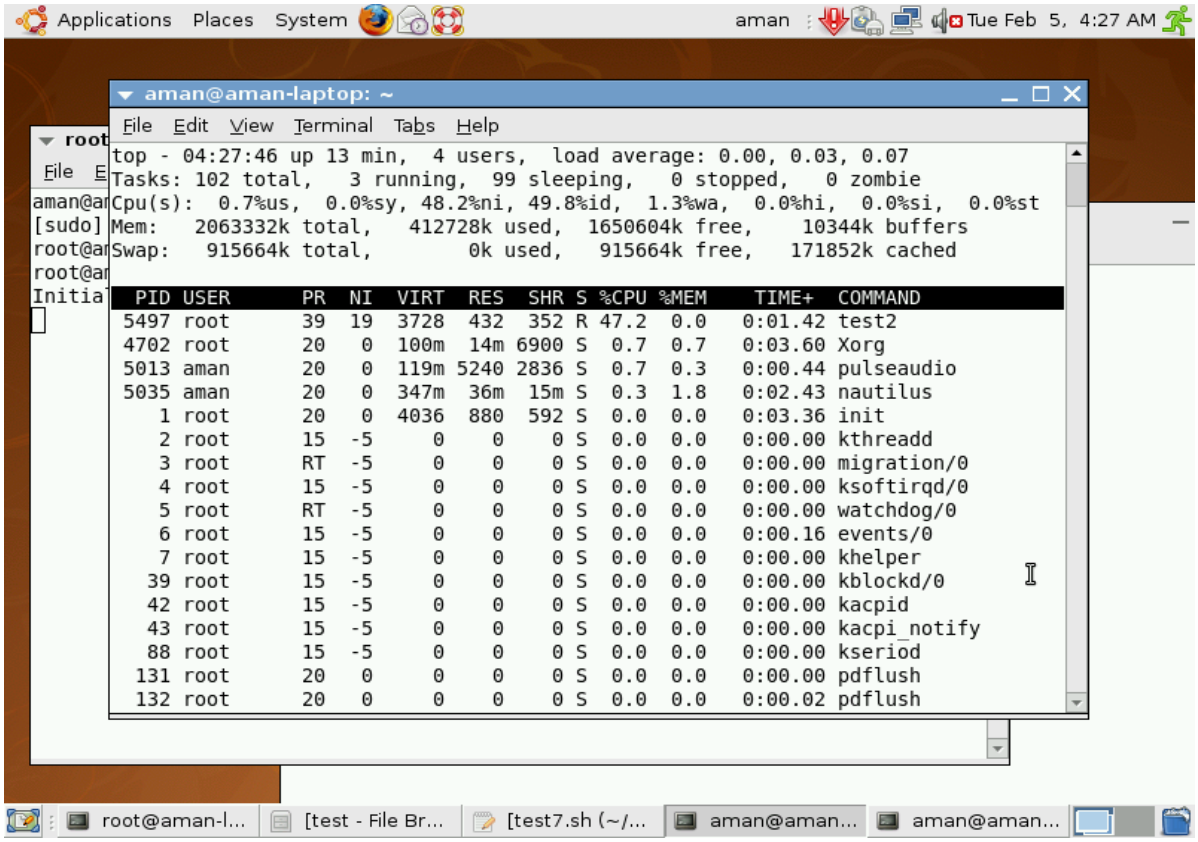


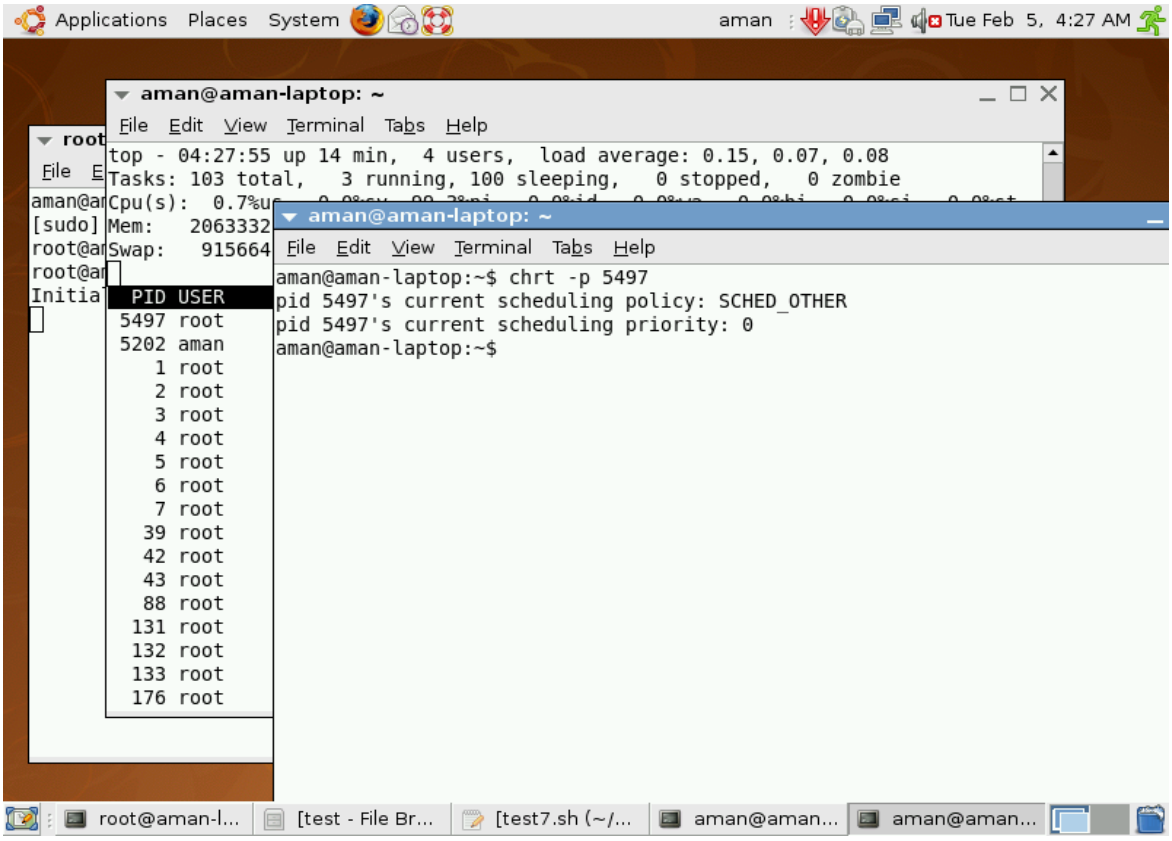

Applications Places System
aman
Tue Feb 5, 1:13 AM
test2.c (~/Desktop/os/test) - gedit
root@aman-lap
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
root@aman-laptop
Initial Wall-Clo
Initial Wall-Clo
root@aman-laptop
User time (test2
Final Wall-Clock
aman@aman-laptop:~$ chrt -p 5488
sched_getscheduler: No such process
failed to get pid 5488's policy
aman@aman-laptop:~$ chrt -p 5447
pid 5447's current scheduling policy: SCHED_BACKGROUND
pid 5447's current scheduling priority: 0
aman@aman-laptop:~$ chrt -p 5454
pid 5454's current scheduling policy: SCHED_OTHER
pid 5454's current scheduling priority: 0
aman@aman-laptop:~$ chrt -p 5453
pid 5453's current scheduling policy: SCHED_BACKGROUND
pid 5453's current scheduling priority: 0
aman@aman-laptop:~$
end_sys.tv_usec)
start sys.tv use
133 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kswapd0
176 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 aio/0
1360 root 15 -5 0 0 0 S 0.0 0.0 0:01.14 ata/0
root@aman-l...
test - File Bro...
test2.c (~/De...
aman@aman...
aman@aman...

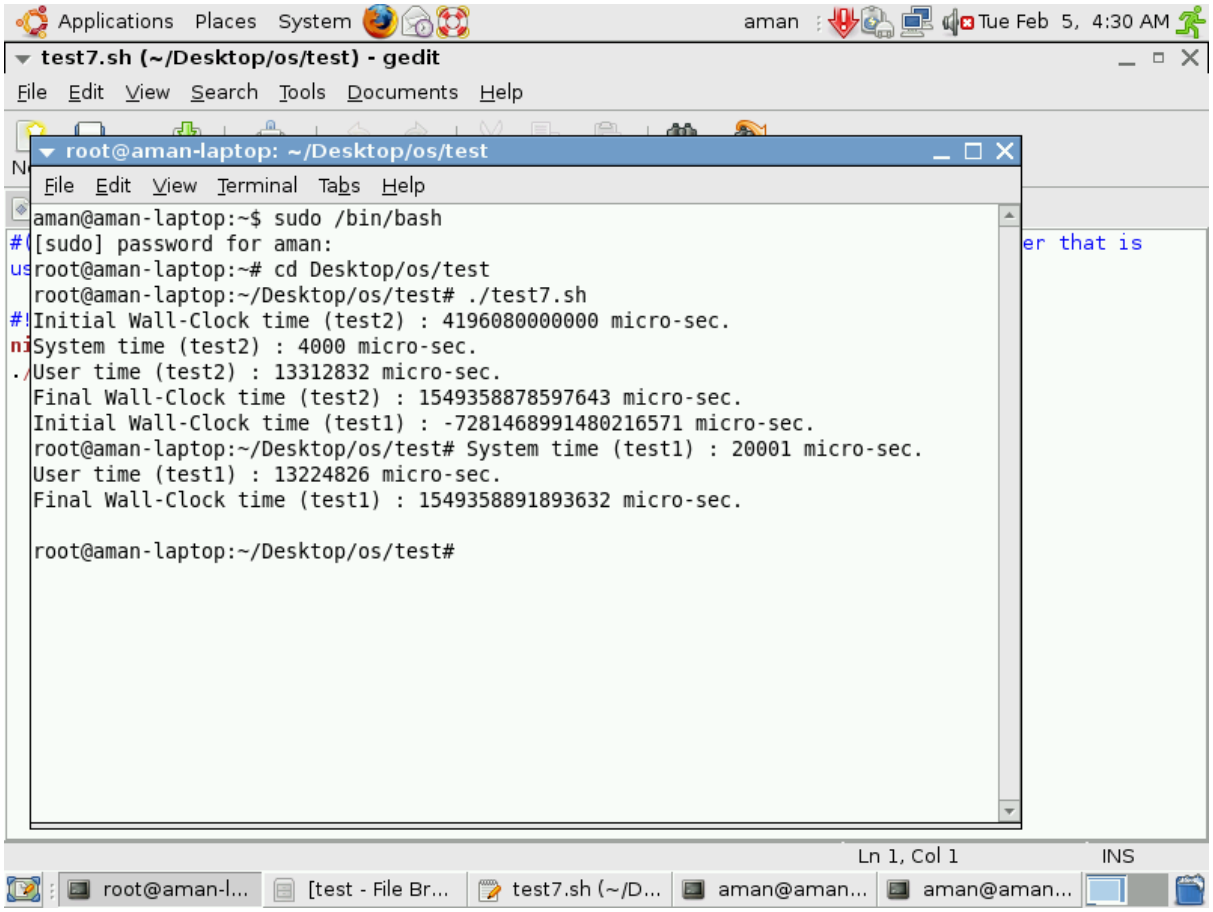

Applications Places System
aman
Tue Feb 5, 1:13 AM
test2.c (~/Desktop/os/test) - gedit
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test5.sh
Initial Wall-Clock time (test1) : -6926679451640216571 micro-sec.
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
root@aman-laptop:~/Desktop/os/test# System time (test2) : 4000 micro-sec.
User time (test2) : 14204887 micro-sec.
Final Wall-Clock time (test2) : 1549347216178771 micro-sec.
System time (test1) : 12000 micro-sec.
User time (test1) : 14708919 micro-sec.
Final Wall-Clock time (test1) : 1549347231051618 micro-sec.
root@aman-laptop:~/Desktop/os/test#
end_sys.tv_usec)
start sys.tv use
133 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kswapd0
176 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 aio/0
1360 root 15 -5 0 0 0 S 0.0 0.0 0:01.14 ata/0
root@aman-l...
test - File Bro...
test2.c (~/De...
aman@aman...
aman@aman...

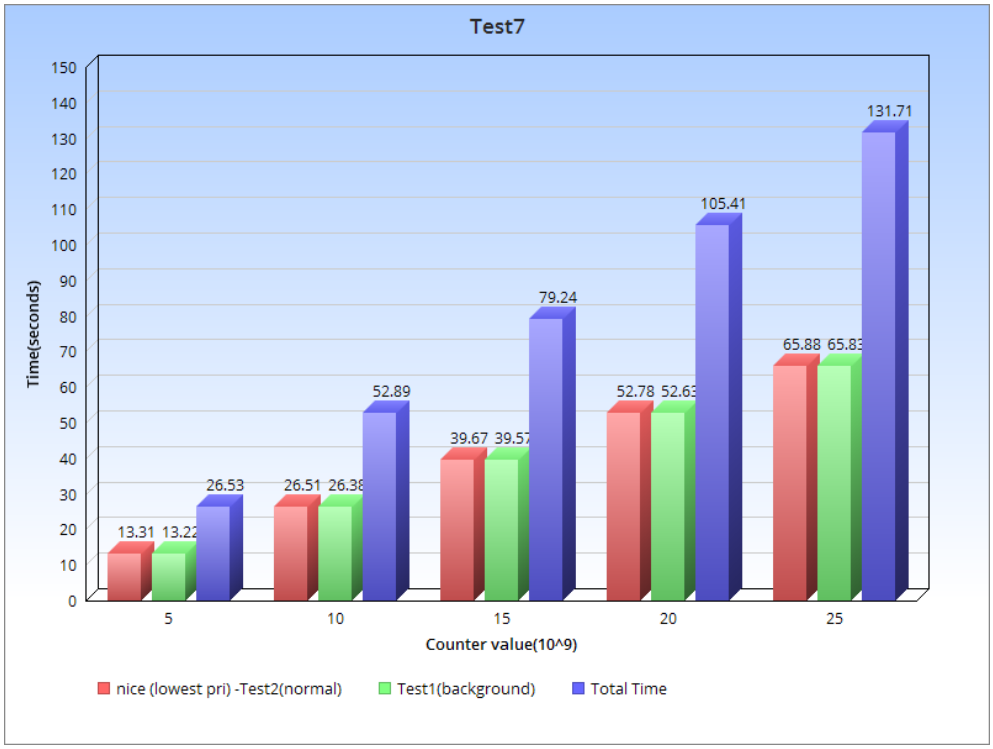


6.) Run your counter as a SCHED_BACKGROUND process, simultaneously with another counter that is running using nice (do a man nice for more information) at the lowest priority. How long does your SCHED_BACKGROUND process take to count?

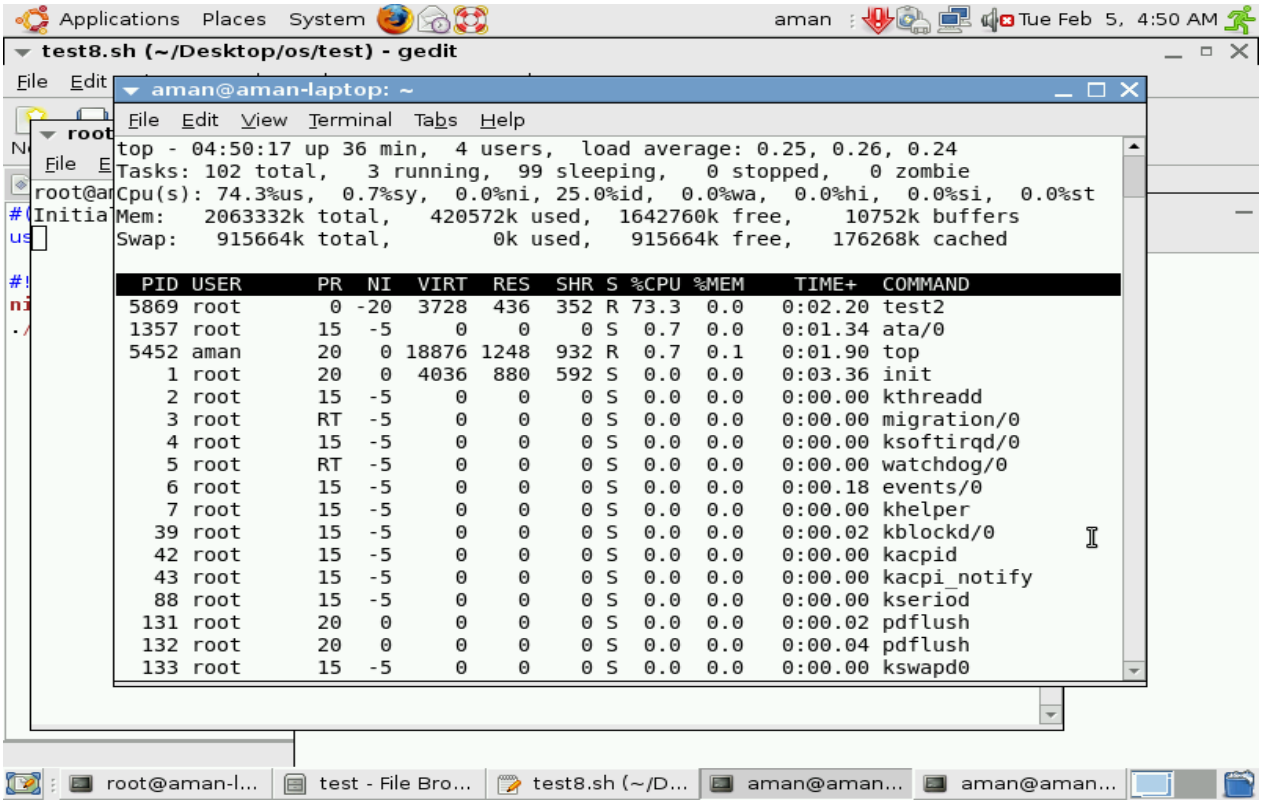


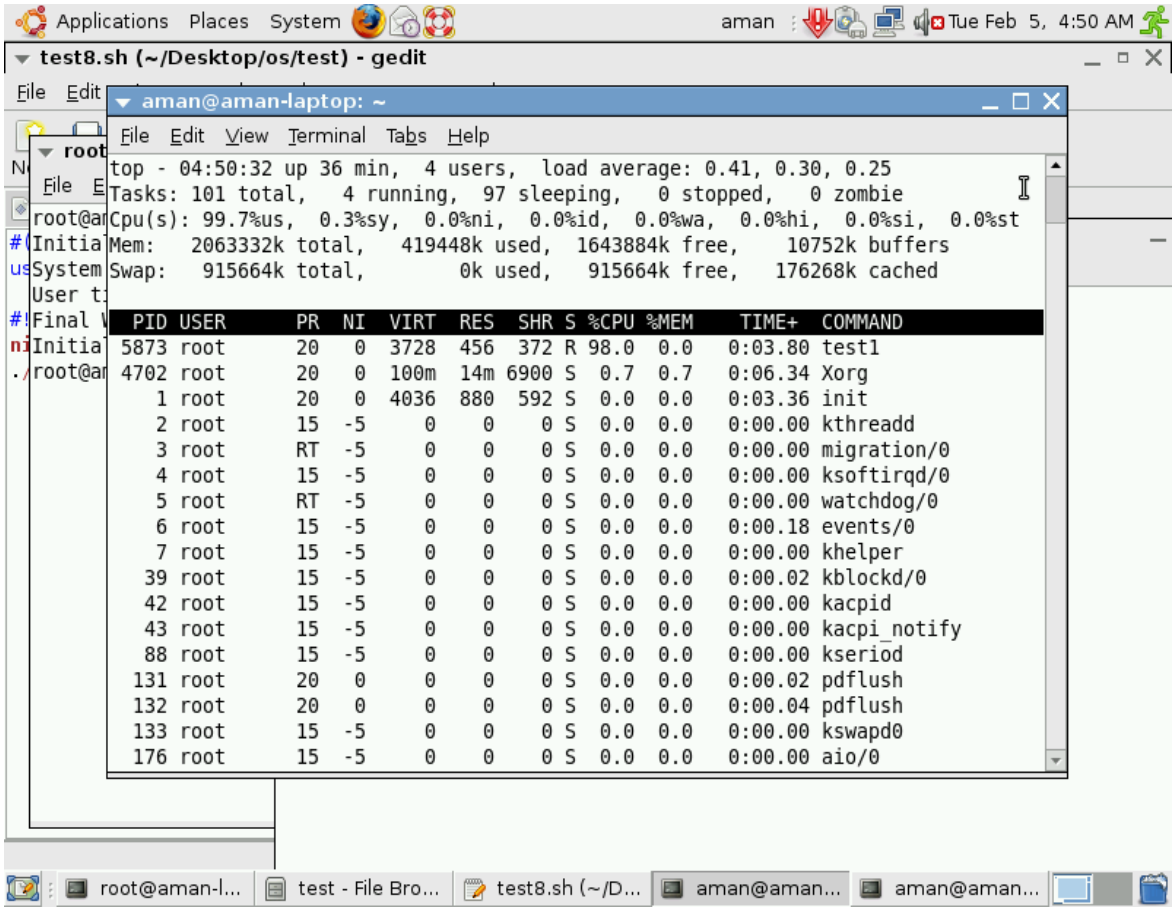

Applications Places System
aman
Tue Feb 5, 4:27 AM
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
top - 04:27:55 up 14 min, 4 users, load average: 0.15, 0.07, 0.08
Tasks: 103 total, 3 running, 100 sleeping, 0 stopped, 0 zombie
Cpu(s): 0.7%us
Mem: 2063332
Swap: 915664
PID USER
5497 root
5202 aman
1 root
2 root
3 root
4 root
5 root
6 root
7 root
39 root
42 root
43 root
88 root
131 root
132 root
133 root
176 root
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
aman@aman-laptop:~$ chrt -p 5497
pid 5497's current scheduling policy: SCHED_OTHER
pid 5497's current scheduling priority: 0
aman@aman-laptop:~$
root@aman-l...
[test - File Br...
[test7.sh (~/...
aman@aman...
aman@aman...

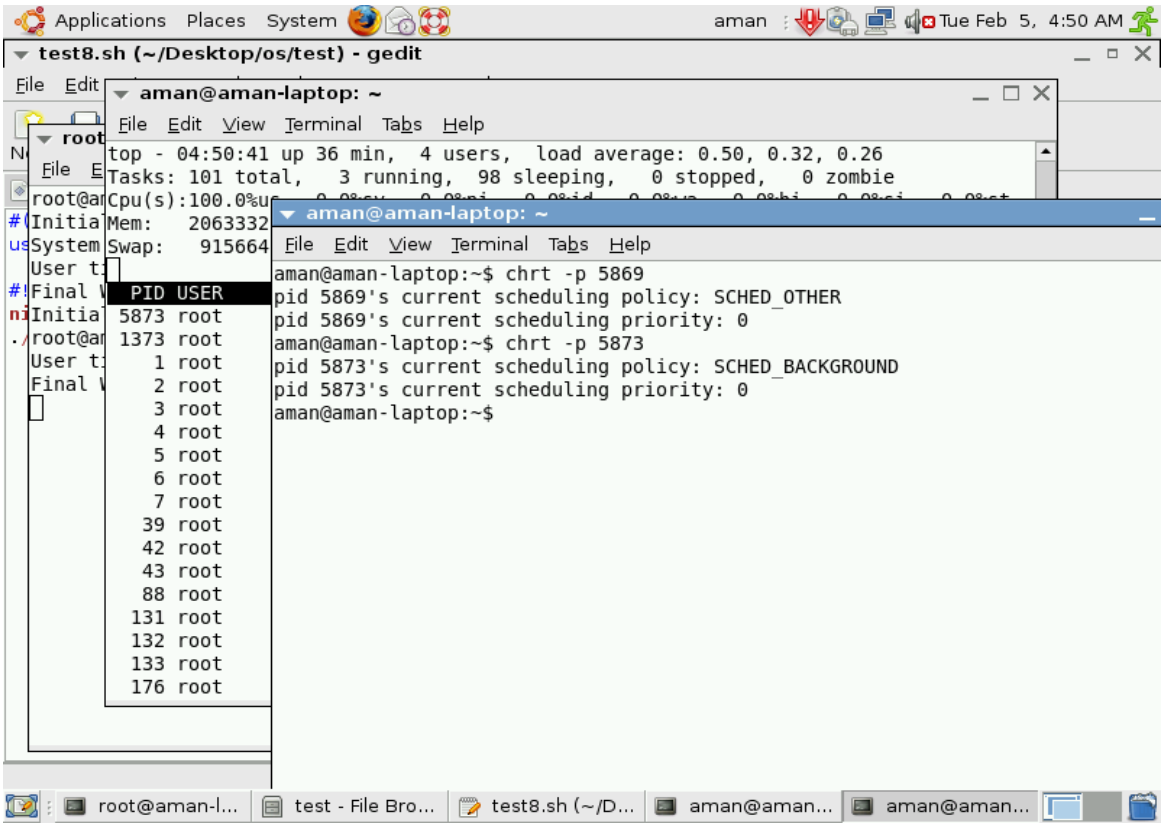

Applications Places System
aman
Tue Feb 5, 4:30 AM
test7.sh (~/Desktop/os/test) - gedit
File Edit View Search Tools Documents Help
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
aman@aman-laptop:~$ sudo /bin/bash
[sudo] password for aman:
root@aman-laptop:~# cd Desktop/os/test
root@aman-laptop:~/Desktop/os/test# ./test7.sh
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
System time (test2) : 4000 micro-sec.
User time (test2) : 13312832 micro-sec.
Final Wall-Clock time (test2) : 1549358878597643 micro-sec.
Initial Wall-Clock time (test1) : -7281468991480216571 micro-sec.
root@aman-laptop:~/Desktop/os/test# System time (test1) : 20001 micro-sec.
User time (test1) : 13224826 micro-sec.
Final Wall-Clock time (test1) : 1549358891893632 micro-sec.
root@aman-laptop:~/Desktop/os/test#
er that is
Ln 1, Col 1
INS
root@aman-l...
[test - File Br...
test7.sh (~/D...
aman@aman...
aman@aman...

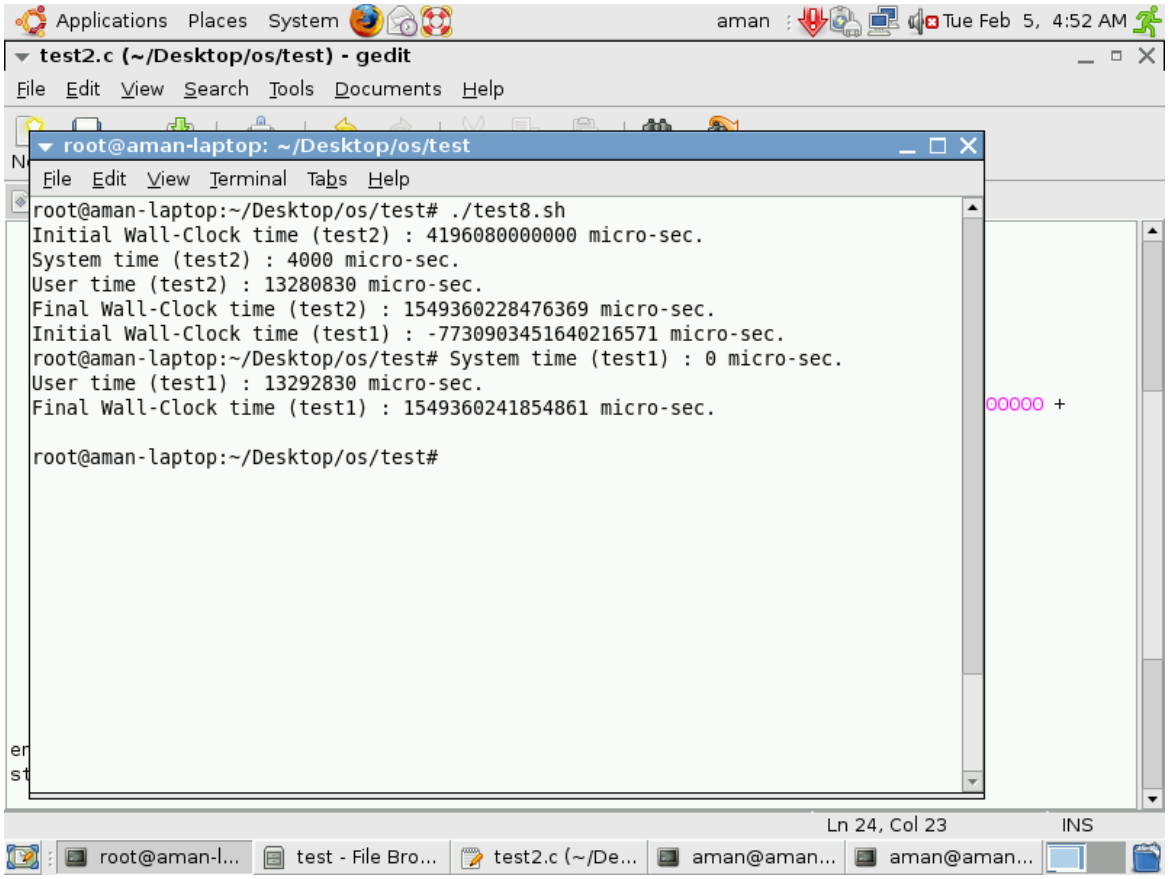


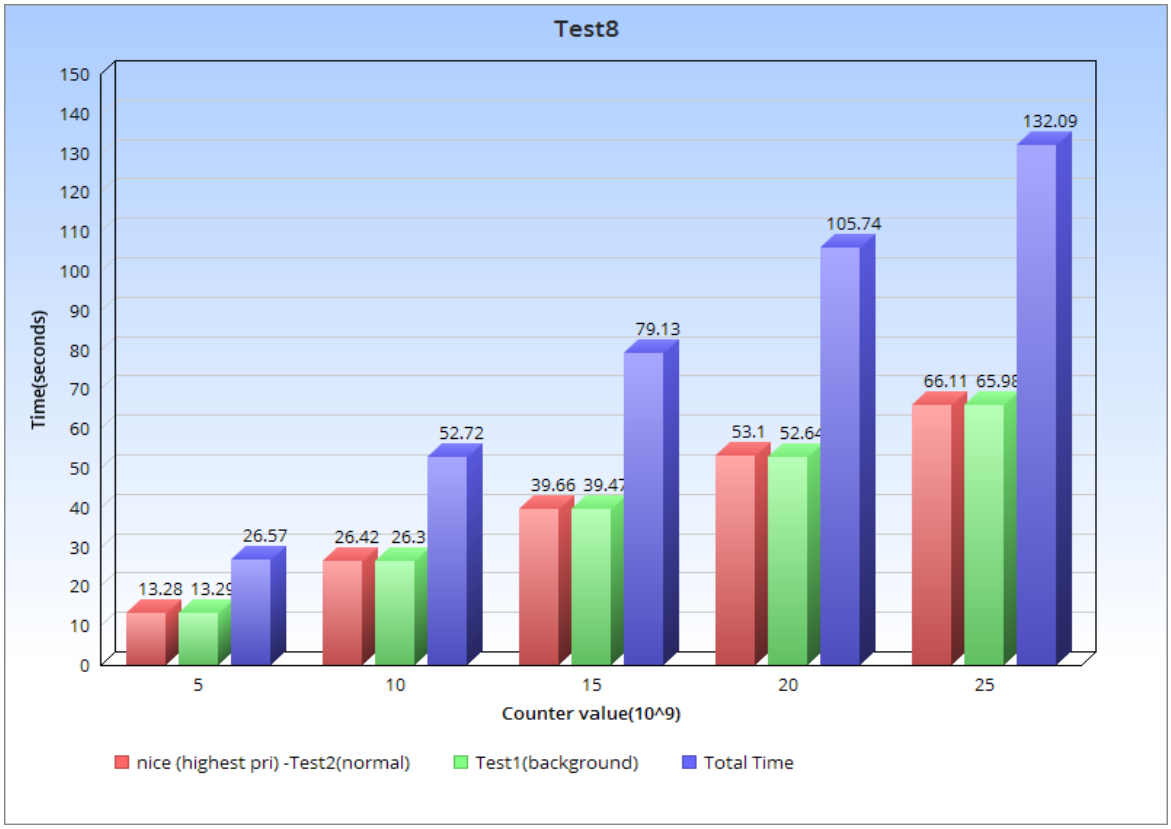
7.) Run your counter as a SCHED_BACKGROUND process, simultaneously with another counter that is running using nice at the highest priority (you will need to use sudo to do this). How long does your SCHED_BACKGROUND process take to count?




Applications Places System
aman
Tue Feb 5, 4:50 AM
test8.sh (~/Desktop/os/test) - gedit
File Edit
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
top - 04:50:32 up 36 min, 4 users, load average: 0.41, 0.30, 0.25
Tasks: 101 total, 4 running, 97 sleeping, 0 stopped, 0 zombie
Cpu(s): 99.7%us, 0.3%sy, 0.0%ni, 0.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 2063332k total, 419448k used, 1643884k free, 10752k buffers
Swap: 915664k total, 0k used, 915664k free, 176268k cached
PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
5873 root 20 0 3728 456 372 R 98.0 0.0 0:03.80 test1
4702 root 20 0 100m 14m 6900 S 0.7 0.7 0:06.34 Xorg
1 root 20 0 4036 880 592 S 0.0 0.0 0:03.36 init
2 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kthreadd
3 root RT -5 0 0 0 S 0.0 0.0 0:00.00 migration/0
4 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/0
5 root RT -5 0 0 0 S 0.0 0.0 0:00.00 watchdog/0
6 root 15 -5 0 0 0 S 0.0 0.0 0:00.18 events/0
7 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 khelper
39 root 15 -5 0 0 0 S 0.0 0.0 0:00.02 kblockd/0
42 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kacpid
43 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kacpi_notify
88 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kseriod
131 root 20 0 0 0 0 S 0.0 0.0 0:00.02 pdflush
132 root 20 0 0 0 0 S 0.0 0.0 0:00.04 pdflush
133 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 kswapd0
176 root 15 -5 0 0 0 S 0.0 0.0 0:00.00 aio/0
root@aman-l...
test - File Bro...
test8.sh (~/D...
aman@aman...
aman@aman...


Applications Places System
aman
Tue Feb 5, 4:50 AM
test8.sh (~/Desktop/os/test) - gedit
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
top - 04:50:41 up 36 min, 4 users, load average: 0.50, 0.32, 0.26
Tasks: 101 total, 3 running, 98 sleeping, 0 stopped, 0 zombie
aman@aman-laptop: ~
File Edit View Terminal Tabs Help
aman@aman-laptop:~$ chrt -p 5869
pid 5869's current scheduling policy: SCHED_OTHER
pid 5869's current scheduling priority: 0
aman@aman-laptop:~$ chrt -p 5873
pid 5873's current scheduling policy: SCHED_BACKGROUND
pid 5873's current scheduling priority: 0
aman@aman-laptop:~$
root@aman-l...
test - File Bro...
test8.sh (~/D...
aman@aman...
aman@aman...


Applications Places System
aman
Tue Feb 5, 4:52 AM
test2.c (~/Desktop/os/test) - gedit
File Edit View Search Tools Documents Help
root@aman-laptop: ~/Desktop/os/test
File Edit View Terminal Tabs Help
root@aman-laptop:~/Desktop/os/test# ./test8.sh
Initial Wall-Clock time (test2) : 4196080000000 micro-sec.
System time (test2) : 4000 micro-sec.
User time (test2) : 13280830 micro-sec.
Final Wall-Clock time (test2) : 1549360228476369 micro-sec.
Initial Wall-Clock time (test1) : -7730903451640216571 micro-sec.
root@aman-laptop:~/Desktop/os/test# System time (test1) : 0 micro-sec.
User time (test1) : 13292830 micro-sec.
Final Wall-Clock time (test1) : 1549360241854861 micro-sec.
root@aman-laptop:~/Desktop/os/test#
Ln 24, Col 23
INS
root@aman-l...
test - File Bro...
test2.c (~/De...
aman@aman...
aman@aman...


Test8
Time(seconds)
Counter value(10^9)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25
13.28
13.29
26.57
26.42
26.3
52.72
39.66
39.47
79.13
53.1
52.64
105.74
66.11
65.98
132.09
nice (highest pri) -Test2(normal)
Test1(background)
Total Time

REFERENCES :-

- https://askubuntu.com/
- https://elixir.bootlin.com/linux/v2.6.24/ident
- https://stackoverflow.com/
- https://www.howtoforge.com/linux-nice-command/
- https://manpages.ubuntu.com/manpages/trusty/man1/nice.1.html?fbclid=IwAR27dh0uwOjBRHyAhvOSMcTmmfFjXbrU0JFyhudWCzoxrxAiZEahEnhVrFE
- https://unix.stackexchange.com/questions/397567/kernel-beginner-getting-kernel-source-code-ubuntu?fbclid=IwAR0vc15xJ1wgJvigZ3801u1dK3AGOUPVaz3IiyNYwBkODNUauOyrOtc91aE
- https://launchpad.net/ubuntu/hardy/i386/linux-headers-2.6.24-26-generic/2.6.24-26.64?fbclid=IwAR3oc4YFSILtF51cSX1ffSYrb8_w3_v9eHlR3pgxaTpyBzWSWNU5ndgNZX0
- http://pubs.opengroup.org/onlinepubs/009696699/functions/sched_setscheduler.html
- https://unix.stackexchange.com/questions/114643/chrt-failed-to-set-pid-xxxs-policy-on-one-machine-but-not-others
- https://www.howtogeek.com/howto/ubuntu/how-to-customize-your-ubuntu-kernel/?fbclid=IwAR0DfGBNRnuAmWIWuka7E6JhBAPft5PECvgMRD2DgQFbtT5z-Cnm2Awjsvg