Experiment Design:

The test was done using 8 threads/processes on top of the parent one.

6 of these threads/processes were used for mainly **CPU usage**, so they all consisted of running a function that will find all the divisors for a very long number. This type of calculation is really intensive on the CPU and good for testing how fast it works depending on if there are threads or processes.

On top of that since most calculations were really straight forward there were some memory allocations added inside the loop so on every run inside the loop it will allocate 400 bytes of data and then free it. This increases the memory I/O and makes for an even better sample because nowadays most programs will make heavy use of the memory.

2 of these threads/processes were used for mainly **Disk I/O**, these consisted of running a function that will copy a file over into a new file the size tested was a medium one of around 30MB, this test proves really important in order to check how each thread/process works with the Disk and the difference between these.

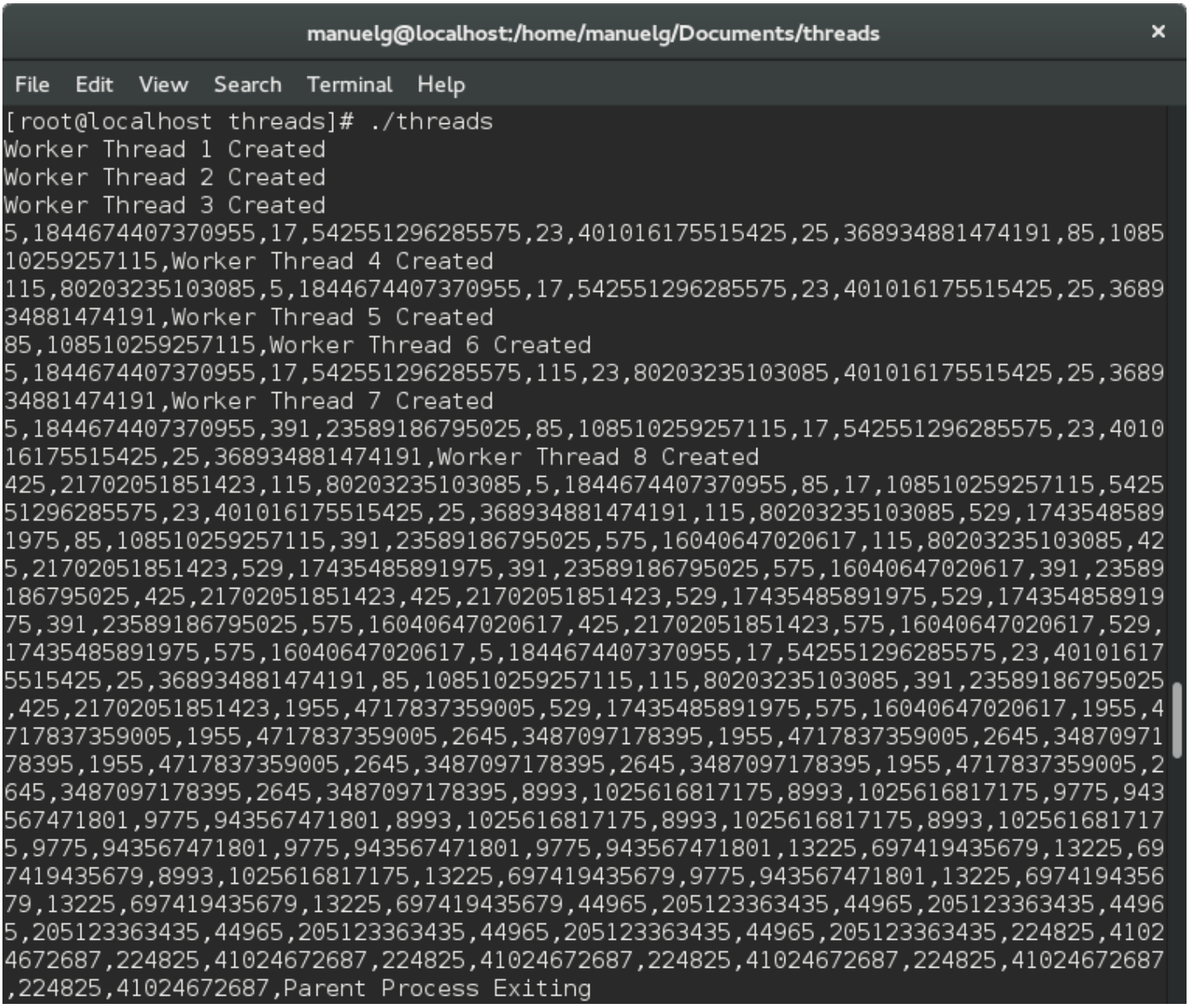
Testing:

The testing during the implementation of the program was not documented. After completion both programs were run in 2 different environments one with 4 logical processors and one with 8. Results were really similar on both environments. During the test of an early version without the use of memory allocation in the loop different results were found, these will be omitted from the testing document and explained in the report. Furthermore, besides taking only the time into consideration for performance, some memory tools were used; nevertheless, because the use of these tools would slow the program dramatically they were omitted from the report but shown here. The testing of both programs (multithreaded and multi-processes) were successful.

TEST LIST

MT = Multithreaded Program
MP = Multi-Processes Program

Test #	Feature Being Tested	Outcome	Pass / Fail	Figure
1	Parent Process has to wait before exiting (MT)	Waits for all joint threads	Pass	Fig 1
2	Parent Process has to wait before exiting (MP)	Waits for child processes	Pass	Fig 2
3	Function Completes File Transfer (MT)	Copy created	Pass	Fig 3
4	Function Completes File Transfer (MP)	Copy created	Pass	Fig 4
5	Function prints Divisors (MT)	Numbers printed	Pass	Fig 1
6	Function prints Divisors (MP)	Numbers printed	Pass	Fig 2
7	Data is saved to the log file (MT)	Log complete	Pass	Fig 5,6
8	Data is saved to the log file (MP)	Log complete	Pass	Fig 7,8
9	Check for Memory Leaks (MT)	0 leaks	Pass	Fig 9
10	Check for Heap(MT)	Transfer were really slow while running **valgrind**	Fail	Fig 10
11	CPU Usage(MT)	Use of all cores	Pass	Fig 11,12
12	CPU Usage(MP)	Use of all cores	Pass	Fig 13,14
13	Disk Usage(MT)	High write speed	Pass	Fig 15
13	Disk Usage(MP)	Hard to Follow its speed	Pass	Fig 16


manuelg@localhost:/home/manuelg/Documents/threads
File Edit View Search Terminal Help
[root@localhost threads]# ./threads
Worker Thread 1 Created
Worker Thread 2 Created
Worker Thread 3 Created
5,1844674407370955,17,542551296285575,23,401016175515425,25,368934881474191,85,1085
10259257115,Worker Thread 4 Created
115,80203235103085,5,1844674407370955,17,542551296285575,23,401016175515425,25,3689
34881474191,Worker Thread 5 Created
85,108510259257115,Worker Thread 6 Created
5,1844674407370955,17,542551296285575,115,23,80203235103085,401016175515425,25,3689
34881474191,Worker Thread 7 Created
5,1844674407370955,391,23589186795025,85,108510259257115,17,542551296285575,23,4010
16175515425,25,368934881474191,Worker Thread 8 Created
425,21702051851423,115,80203235103085,5,1844674407370955,85,17,108510259257115,5425
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78395,1955,4717837359005,2645,3487097178395,2645,3487097178395,1955,4717837359005,2
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567471801,9775,943567471801,8993,1025616817175,8993,1025616817175,8993,102561681717
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7419435679,8993,1025616817175,13225,697419435679,9775,943567471801,13225,6974194356
79,13225,697419435679,13225,697419435679,44965,205123363435,44965,205123363435,4496
5,205123363435,44965,205123363435,44965,205123363435,44965,205123363435,224825,4102
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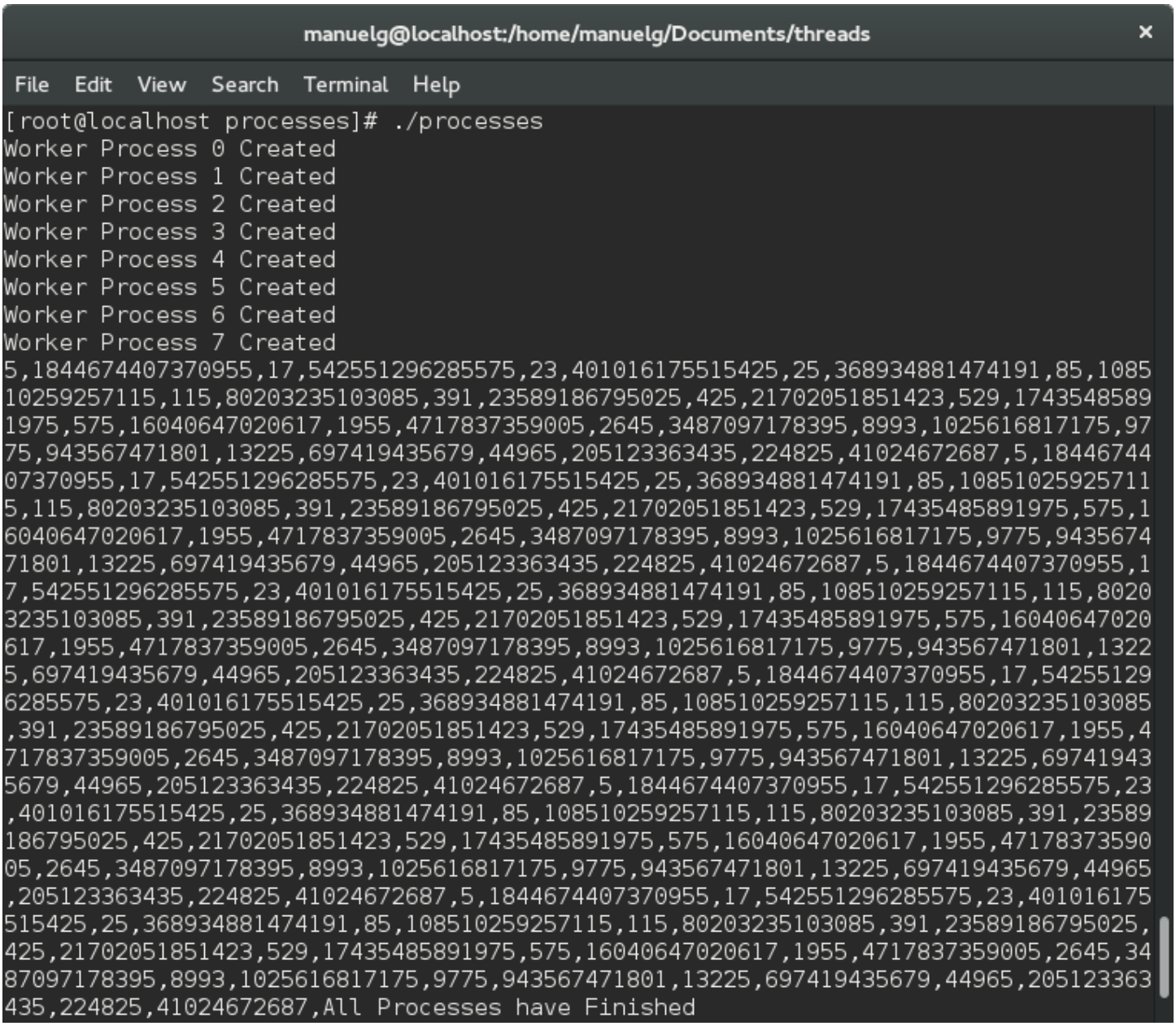
,224825,41024672687,Parent Process Exiting

Figure 1


manuelg@localhost:/home/manuelg/Documents/threads
File Edit View Search Terminal Help
[root@localhost processes]# ./processes
Worker Process 0 Created
Worker Process 1 Created
Worker Process 2 Created
Worker Process 3 Created
Worker Process 4 Created
Worker Process 5 Created
Worker Process 6 Created
Worker Process 7 Created
5,1844674407370955,17,542551296285575,23,401016175515425,25,368934881474191,85,1085
10259257115,115,80203235103085,391,23589186795025,425,21702051851423,529,1743548589
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75,943567471801,13225,697419435679,44965,205123363435,224825,41024672687,5,18446744
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5679,44965,205123363435,224825,41024672687,5,1844674407370955,17,542551296285575,23
,401016175515425,25,368934881474191,85,108510259257115,115,80203235103085,391,23589
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,205123363435,224825,41024672687,5,1844674407370955,17,542551296285575,23,401016175
515425,25,368934881474191,85,108510259257115,115,80203235103085,391,23589186795025,
425,21702051851423,529,17435485891975,575,16040647020617,1955,4717837359005,2645,34
87097178395,8993,1025616817175,9775,943567471801,13225,697419435679,44965,205123363
435,224825,41024672687,All Processes have Finished

Figure 2

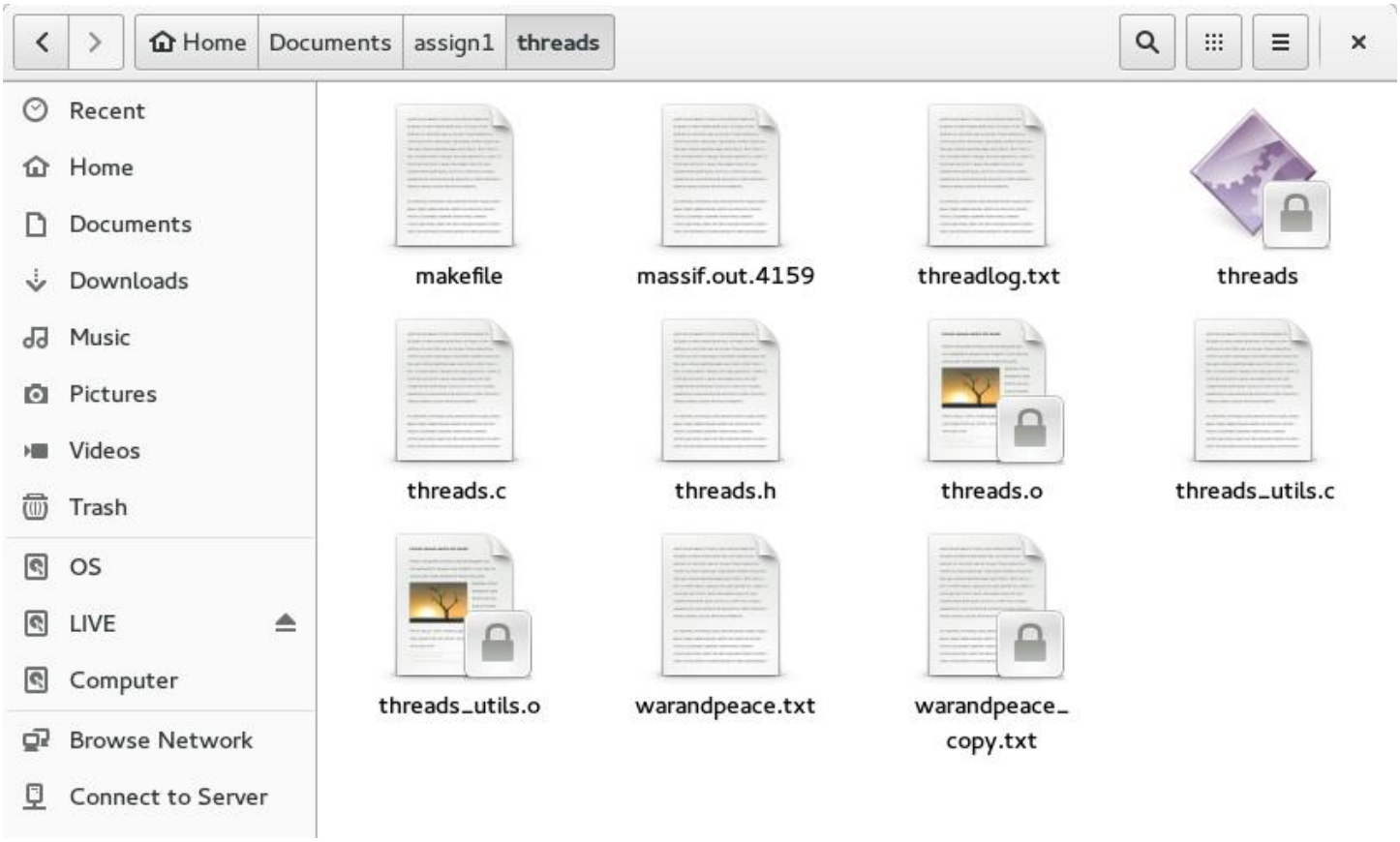

Home
Documents
assign1
threads
Recent
Home
Documents
Downloads
Music
Pictures
Videos
Trash
OS
LIVE
Computer
Browse Network
Connect to Server
makefile
massif.out.4159
threadlog.txt
threads
threads.c
threads.h
threads.o
threads_utils.c
threads_utils.o
warandpeace.txt
warandpeace_copy.txt

Figure 3

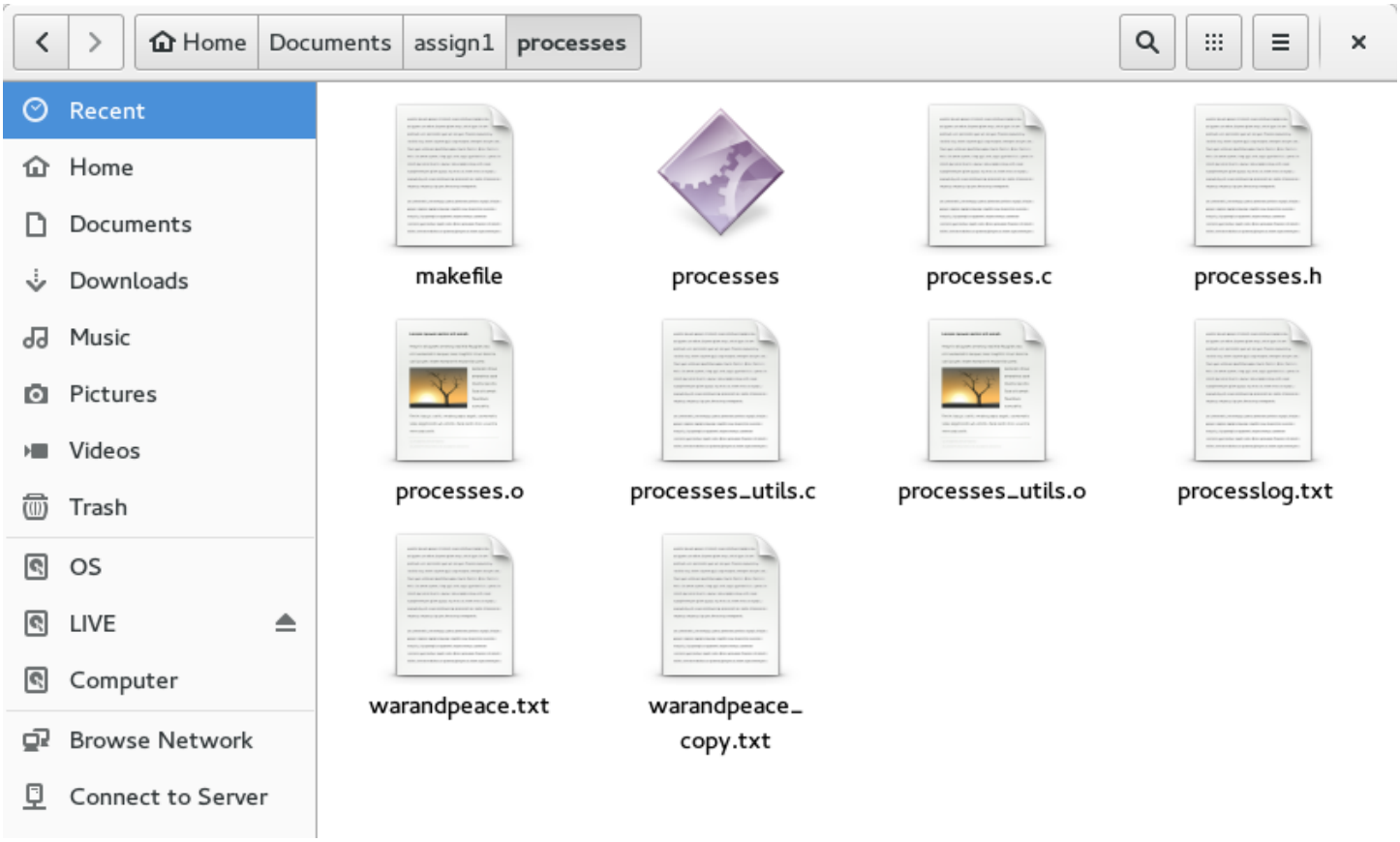

Home
Documents
assign1
processes
Recent
Home
Documents
Downloads
Music
Pictures
Videos
Trash
OS
LIVE
Computer
Browse Network
Connect to Server
makefile
processes
processes.c
processes.h
processes.o
processes_utils.c
processes_utils.o
processlog.txt
warandpeace.txt
warandpeace_
copy.txt

Figure 4

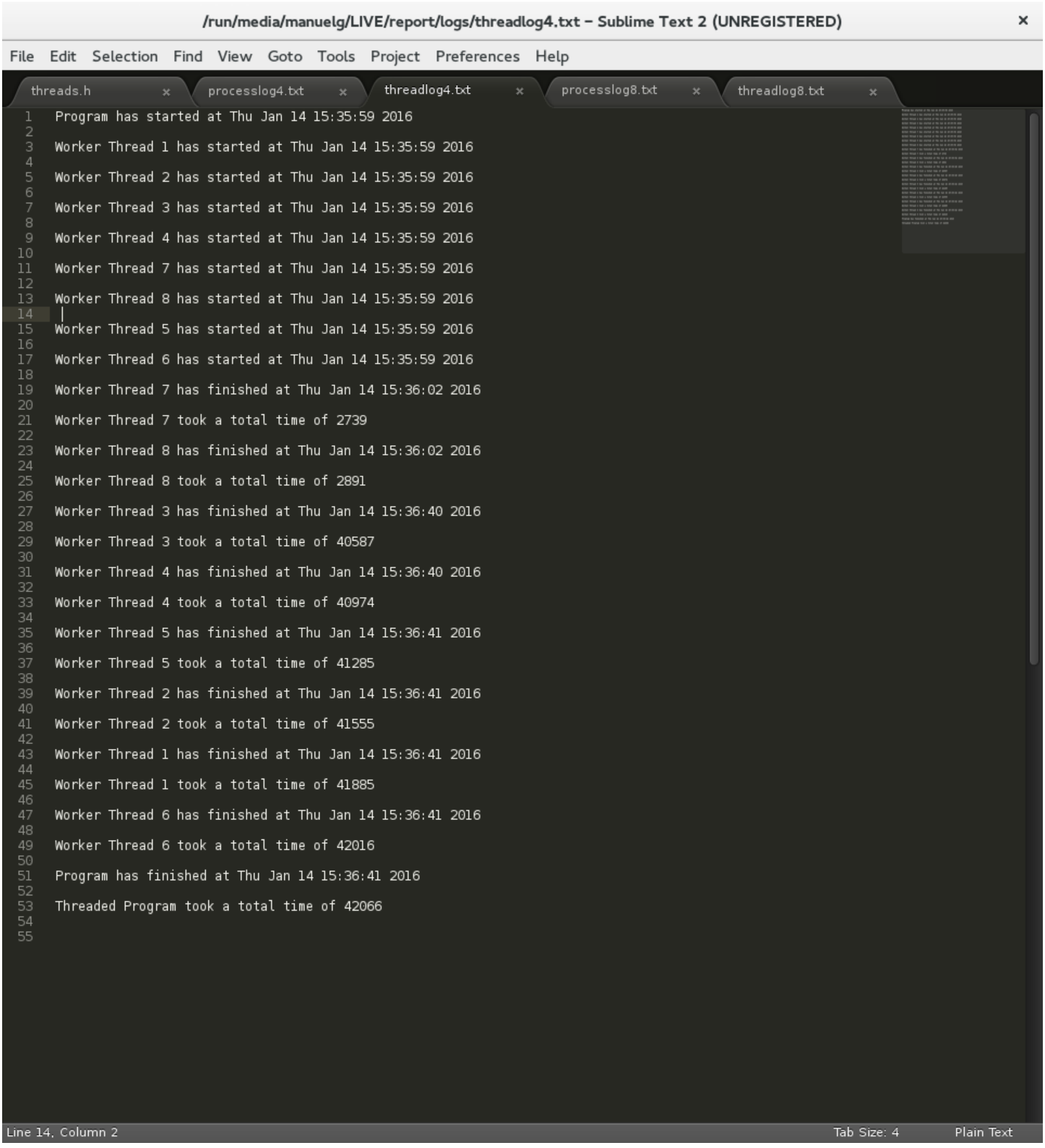

/run/media/manuelg/LIVE/report/logs/threadlog4.txt – Sublime Text 2 (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
threads.h
processlog4.txt
threadlog4.txt
processlog8.txt
threadlog8.txt
Program has started at Thu Jan 14 15:35:59 2016
Worker Thread 1 has started at Thu Jan 14 15:35:59 2016
Worker Thread 2 has started at Thu Jan 14 15:35:59 2016
Worker Thread 3 has started at Thu Jan 14 15:35:59 2016
Worker Thread 4 has started at Thu Jan 14 15:35:59 2016
Worker Thread 7 has started at Thu Jan 14 15:35:59 2016
Worker Thread 8 has started at Thu Jan 14 15:35:59 2016
Worker Thread 5 has started at Thu Jan 14 15:35:59 2016
Worker Thread 6 has started at Thu Jan 14 15:35:59 2016
Worker Thread 7 has finished at Thu Jan 14 15:36:02 2016
Worker Thread 7 took a total time of 2739
Worker Thread 8 has finished at Thu Jan 14 15:36:02 2016
Worker Thread 8 took a total time of 2891
Worker Thread 3 has finished at Thu Jan 14 15:36:40 2016
Worker Thread 3 took a total time of 40587
Worker Thread 4 has finished at Thu Jan 14 15:36:40 2016
Worker Thread 4 took a total time of 40974
Worker Thread 5 has finished at Thu Jan 14 15:36:41 2016
Worker Thread 5 took a total time of 41285
Worker Thread 2 has finished at Thu Jan 14 15:36:41 2016
Worker Thread 2 took a total time of 41555
Worker Thread 1 has finished at Thu Jan 14 15:36:41 2016
Worker Thread 1 took a total time of 41885
Worker Thread 6 has finished at Thu Jan 14 15:36:41 2016
Worker Thread 6 took a total time of 42016
Program has finished at Thu Jan 14 15:36:41 2016
Threaded Program took a total time of 42066
Line 14, Column 2
Tab Size: 4
Plain Text

Figure 5

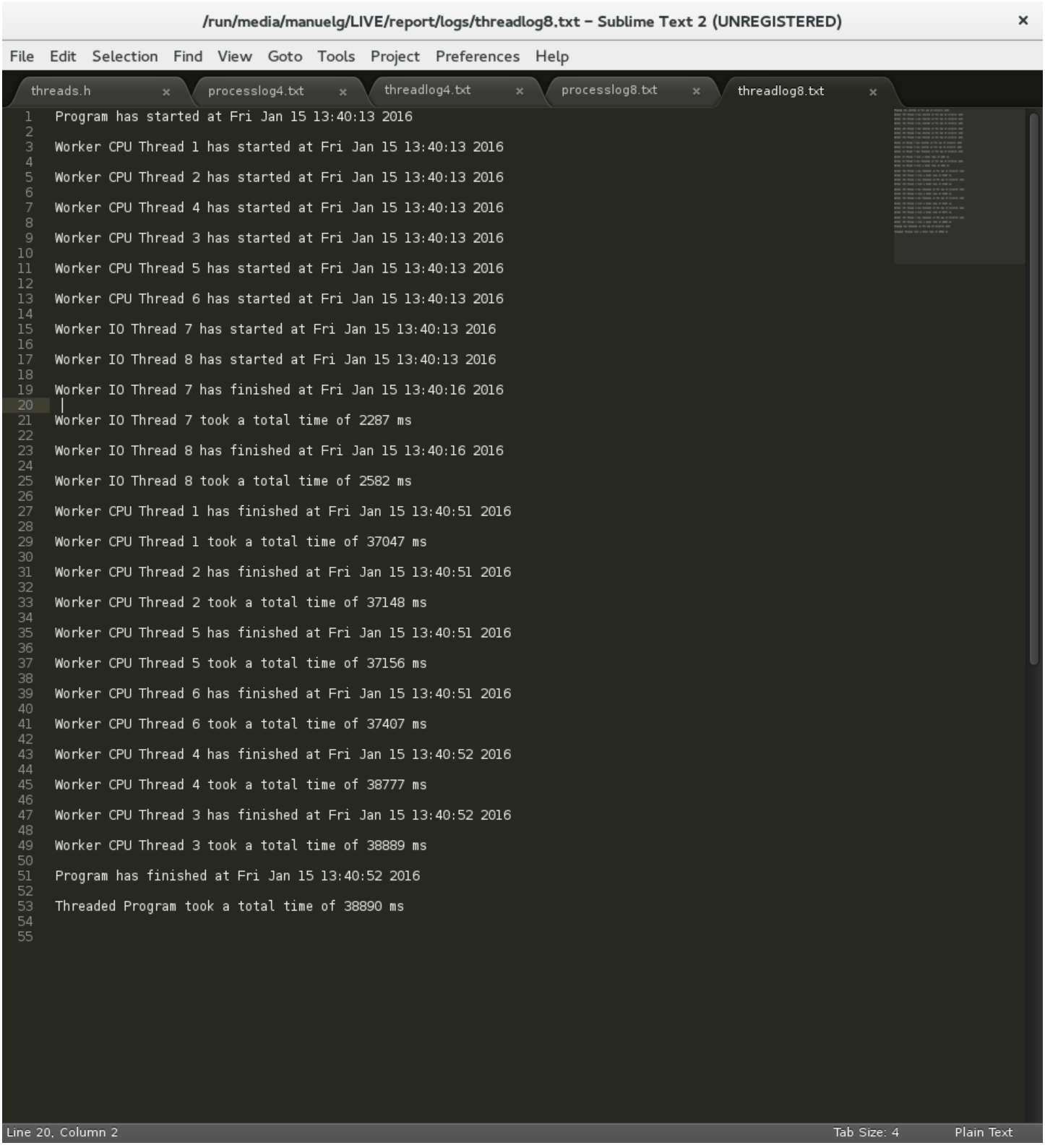

/run/media/manuelg/LIVE/report/logs/threadlog8.txt – Sublime Text 2 (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
threads.h
processlog4.txt
threadlog4.txt
processlog8.txt
threadlog8.txt
Program has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 1 has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 2 has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 4 has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 3 has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 5 has started at Fri Jan 15 13:40:13 2016
Worker CPU Thread 6 has started at Fri Jan 15 13:40:13 2016
Worker IO Thread 7 has started at Fri Jan 15 13:40:13 2016
Worker IO Thread 8 has started at Fri Jan 15 13:40:13 2016
Worker IO Thread 7 has finished at Fri Jan 15 13:40:16 2016
Worker IO Thread 7 took a total time of 2287 ms
Worker IO Thread 8 has finished at Fri Jan 15 13:40:16 2016
Worker IO Thread 8 took a total time of 2582 ms
Worker CPU Thread 1 has finished at Fri Jan 15 13:40:51 2016
Worker CPU Thread 1 took a total time of 37047 ms
Worker CPU Thread 2 has finished at Fri Jan 15 13:40:51 2016
Worker CPU Thread 2 took a total time of 37148 ms
Worker CPU Thread 5 has finished at Fri Jan 15 13:40:51 2016
Worker CPU Thread 5 took a total time of 37156 ms
Worker CPU Thread 6 has finished at Fri Jan 15 13:40:51 2016
Worker CPU Thread 6 took a total time of 37407 ms
Worker CPU Thread 4 has finished at Fri Jan 15 13:40:52 2016
Worker CPU Thread 4 took a total time of 38777 ms
Worker CPU Thread 3 has finished at Fri Jan 15 13:40:52 2016
Worker CPU Thread 3 took a total time of 38889 ms
Program has finished at Fri Jan 15 13:40:52 2016
Threaded Program took a total time of 38890 ms
Line 20, Column 2
Tab Size: 4
Plain Text

Figure 6

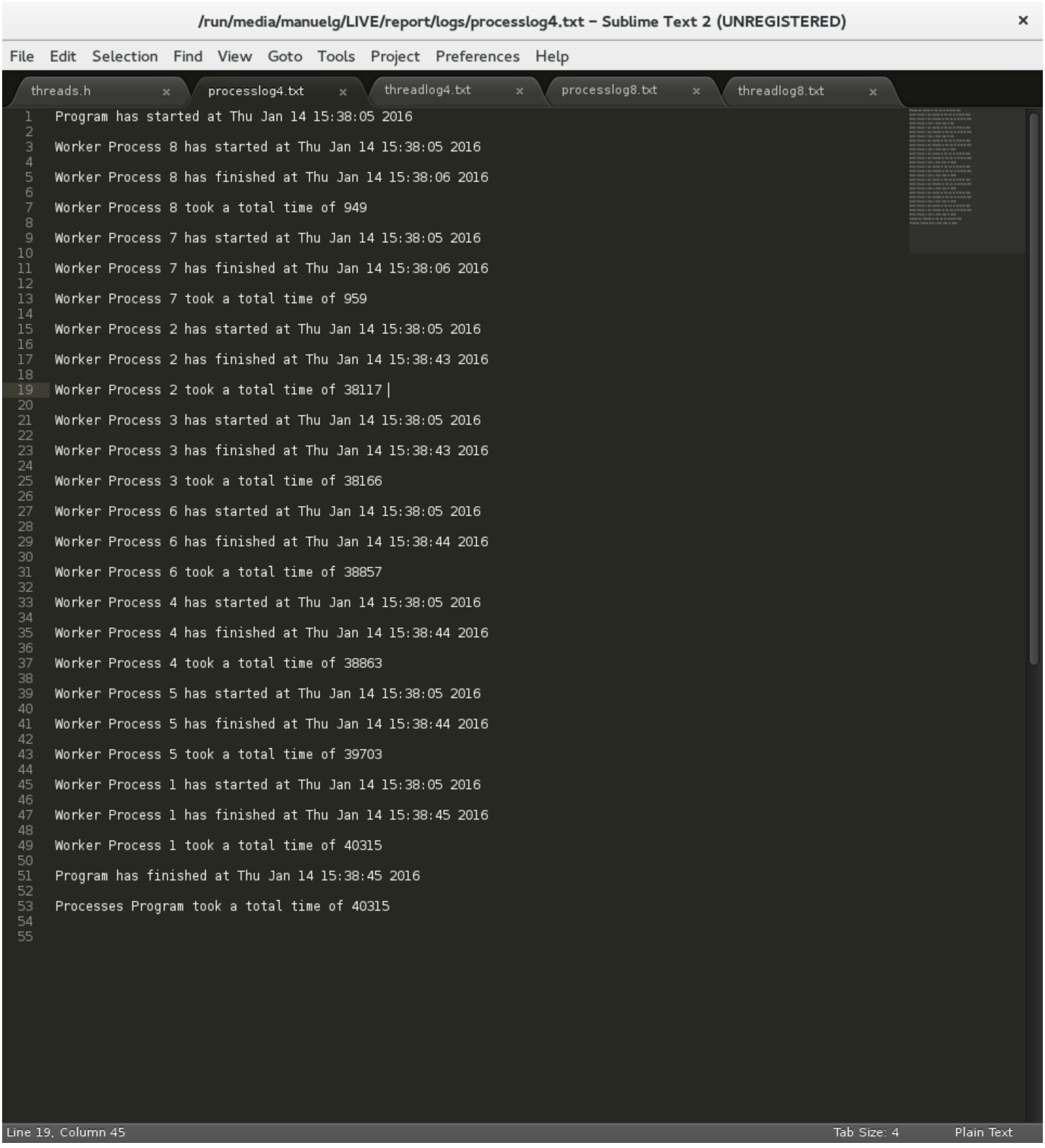

/run/media/manuelg/LIVE/report/logs/processlog4.txt – Sublime Text 2 (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
threads.h
processlog4.txt
threadlog4.txt
processlog8.txt
threadlog8.txt
Program has started at Thu Jan 14 15:38:05 2016
Worker Process 8 has started at Thu Jan 14 15:38:05 2016
Worker Process 8 has finished at Thu Jan 14 15:38:06 2016
Worker Process 8 took a total time of 949
Worker Process 7 has started at Thu Jan 14 15:38:05 2016
Worker Process 7 has finished at Thu Jan 14 15:38:06 2016
Worker Process 7 took a total time of 959
Worker Process 2 has started at Thu Jan 14 15:38:05 2016
Worker Process 2 has finished at Thu Jan 14 15:38:43 2016
Worker Process 2 took a total time of 38117
Worker Process 3 has started at Thu Jan 14 15:38:05 2016
Worker Process 3 has finished at Thu Jan 14 15:38:43 2016
Worker Process 3 took a total time of 38166
Worker Process 6 has started at Thu Jan 14 15:38:05 2016
Worker Process 6 has finished at Thu Jan 14 15:38:44 2016
Worker Process 6 took a total time of 38857
Worker Process 4 has started at Thu Jan 14 15:38:05 2016
Worker Process 4 has finished at Thu Jan 14 15:38:44 2016
Worker Process 4 took a total time of 38863
Worker Process 5 has started at Thu Jan 14 15:38:05 2016
Worker Process 5 has finished at Thu Jan 14 15:38:44 2016
Worker Process 5 took a total time of 39703
Worker Process 1 has started at Thu Jan 14 15:38:05 2016
Worker Process 1 has finished at Thu Jan 14 15:38:45 2016
Worker Process 1 took a total time of 40315
Program has finished at Thu Jan 14 15:38:45 2016
Processes Program took a total time of 40315
Line 19, Column 45
Tab Size: 4
Plain Text

Figure 7

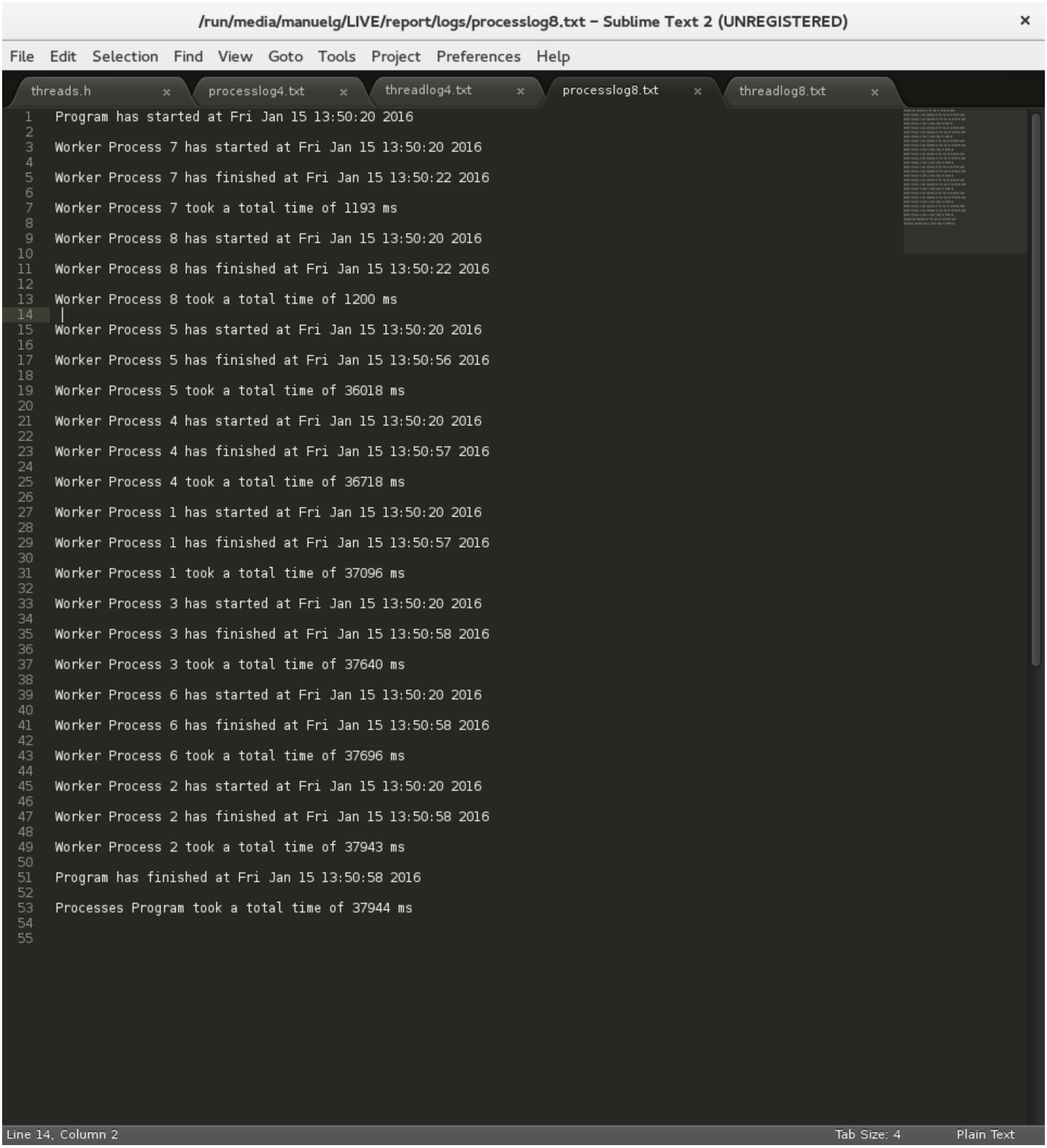
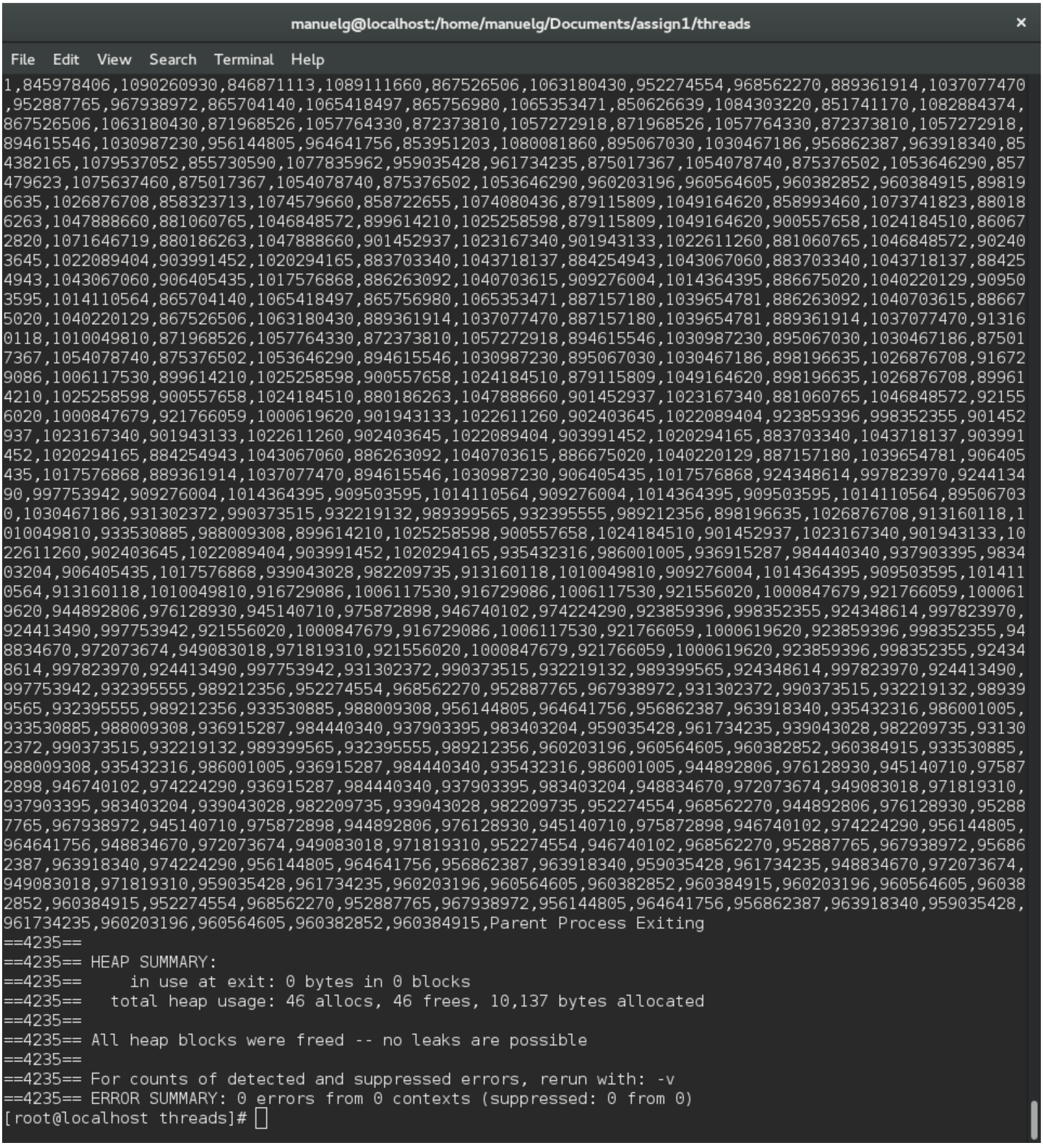

/run/media/manuelg/LIVE/report/logs/processlog8.txt – Sublime Text 2 (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
threads.h
processlog4.txt
threadlog4.txt
processlog8.txt
threadlog8.txt
Program has started at Fri Jan 15 13:50:20 2016
Worker Process 7 has started at Fri Jan 15 13:50:20 2016
Worker Process 7 has finished at Fri Jan 15 13:50:22 2016
Worker Process 7 took a total time of 1193 ms
Worker Process 8 has started at Fri Jan 15 13:50:20 2016
Worker Process 8 has finished at Fri Jan 15 13:50:22 2016
Worker Process 8 took a total time of 1200 ms
Worker Process 5 has started at Fri Jan 15 13:50:20 2016
Worker Process 5 has finished at Fri Jan 15 13:50:56 2016
Worker Process 5 took a total time of 36018 ms
Worker Process 4 has started at Fri Jan 15 13:50:20 2016
Worker Process 4 has finished at Fri Jan 15 13:50:57 2016
Worker Process 4 took a total time of 36718 ms
Worker Process 1 has started at Fri Jan 15 13:50:20 2016
Worker Process 1 has finished at Fri Jan 15 13:50:57 2016
Worker Process 1 took a total time of 37096 ms
Worker Process 3 has started at Fri Jan 15 13:50:20 2016
Worker Process 3 has finished at Fri Jan 15 13:50:58 2016
Worker Process 3 took a total time of 37640 ms
Worker Process 6 has started at Fri Jan 15 13:50:20 2016
Worker Process 6 has finished at Fri Jan 15 13:50:58 2016
Worker Process 6 took a total time of 37696 ms
Worker Process 2 has started at Fri Jan 15 13:50:20 2016
Worker Process 2 has finished at Fri Jan 15 13:50:58 2016
Worker Process 2 took a total time of 37943 ms
Program has finished at Fri Jan 15 13:50:58 2016
Processes Program took a total time of 37944 ms
Line 14, Column 2
Tab Size: 4
Plain Text

Figure 8


manuelg@localhost:/home/manuelg/Documents/assign1/threads
File Edit View Search Terminal Help
1,845978406,1090260930,846871113,1089111660,867526506,1063180430,952274554,968562270,889361914,1037077470
,952887765,967938972,865704140,1065418497,865756980,1065353471,850626639,1084303220,851741170,1082884374,
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6263,1047888660,881060765,1046848572,899614210,1025258598,879115809,1049164620,900557658,1024184510,86067
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9086,1006117530,899614210,1025258598,900557658,1024184510,879115809,1049164620,898196635,1026876708,89961
4210,1025258598,900557658,1024184510,880186263,1047888660,901452937,1023167340,881060765,1046848572,92155
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8834670,972073674,949083018,971819310,921556020,1000847679,921766059,1000619620,923859396,998352355,92434
8614,997823970,924413490,997753942,931302372,990373515,932219132,989399565,924348614,997823970,924413490,
997753942,932395555,989212356,952274554,968562270,952887765,967938972,931302372,990373515,932219132,98939
9565,932395555,989212356,933530885,988009308,956144805,964641756,956862387,963918340,935432316,986001005,
933530885,988009308,936915287,984440340,937903395,983403204,959035428,961734235,939043028,982209735,93130
2372,990373515,932219132,989399565,932395555,989212356,960203196,960564605,960382852,960384915,933530885,
988009308,935432316,986001005,936915287,984440340,935432316,986001005,944892806,976128930,945140710,97587
2898,946740102,974224290,936915287,984440340,937903395,983403204,948834670,972073674,949083018,971819310,
937903395,983403204,939043028,982209735,939043028,982209735,952274554,968562270,944892806,976128930,95288
7765,967938972,945140710,975872898,944892806,976128930,945140710,975872898,946740102,974224290,956144805,
964641756,948834670,972073674,949083018,971819310,952274554,946740102,968562270,952887765,967938972,95686
2387,963918340,974224290,956144805,964641756,956862387,963918340,959035428,961734235,948834670,972073674,
949083018,971819310,959035428,961734235,960203196,960564605,960382852,960384915,960203196,960564605,96038
2852,960384915,952274554,968562270,952887765,967938972,956144805,964641756,956862387,963918340,959035428,
961734235,960203196,960564605,960382852,960384915,Parent Process Exiting
==4235==
==4235== HEAP SUMMARY:
==4235==   in use at exit: 0 bytes in 0 blocks
==4235==   total heap usage: 46 allocs, 46 frees, 10,137 bytes allocated
==4235==
==4235== All heap blocks were freed -- no leaks are possible
==4235==
==4235== For counts of detected and suppressed errors, rerun with: -v
==4235== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
[root@localhost threads]#

Figure 9

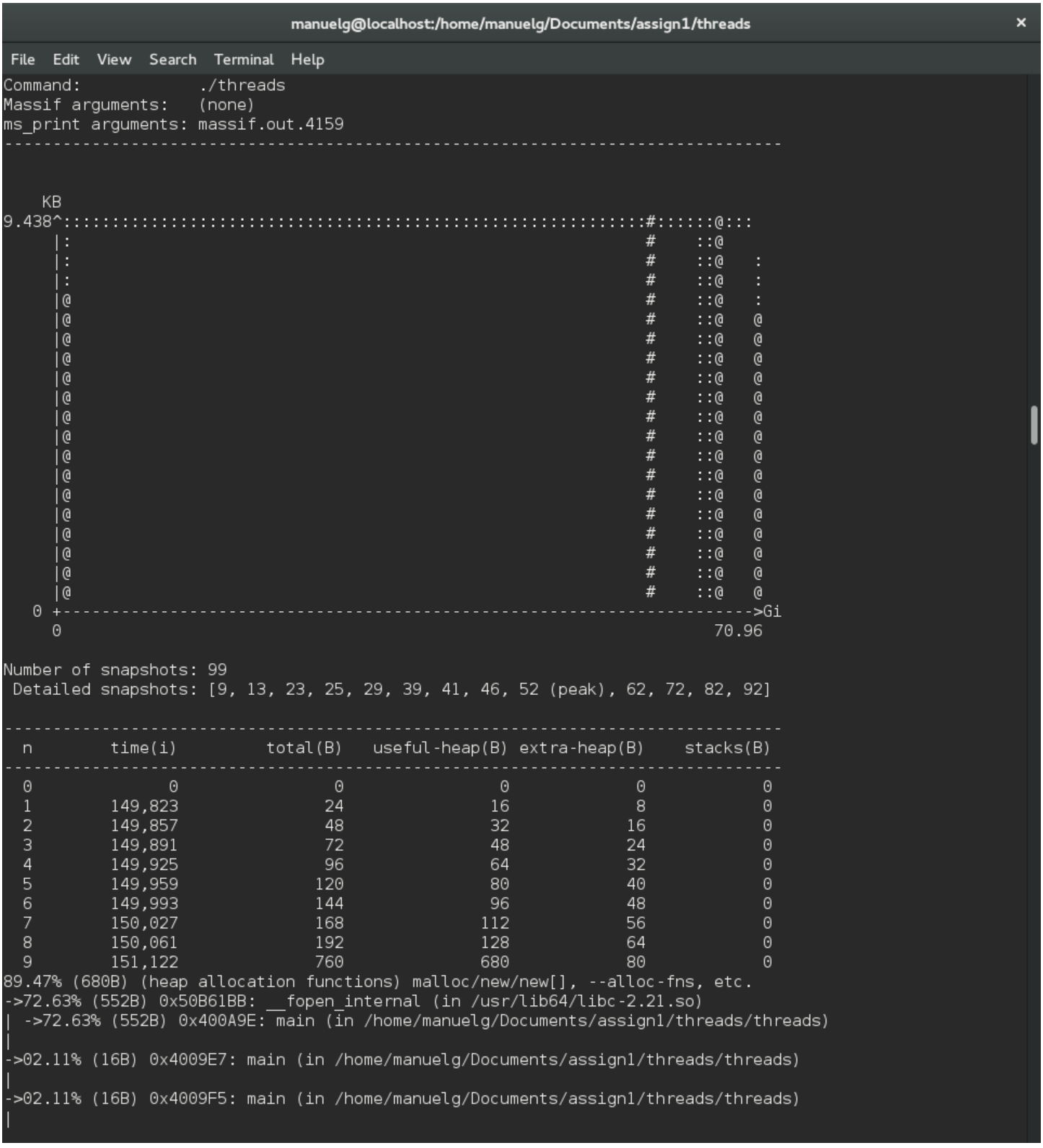
manuelg@localhost:/home/manuelg/Documents/assign1/threads
File Edit View Search Terminal Help
Command: ./threads
Massif arguments: (none)
ms_print arguments: massif.out.4159
KB
9.438^
0 +
0
70.96
Number of snapshots: 99
Detailed snapshots: [9, 13, 23, 25, 29, 39, 41, 46, 52 (peak), 62, 72, 82, 92]
n time(i) total(B) useful-heap(B) extra-heap(B) stacks(B)
0 0 0 0 0 0
1 149,823 24 16 8 0
2 149,857 48 32 16 0
3 149,891 72 48 24 0
4 149,925 96 64 32 0
5 149,959 120 80 40 0
6 149,993 144 96 48 0
7 150,027 168 112 56 0
8 150,061 192 128 64 0
9 151,122 760 680 80 0
89.47% (680B) (heap allocation functions) malloc/new/new[], --alloc-fns, etc.
->72.63% (552B) 0x50B61BB: __fopen_internal (in /usr/lib64/libc-2.21.so)
| ->72.63% (552B) 0x400A9E: main (in /home/manuelg/Documents/assign1/threads/threads)
|
->02.11% (16B) 0x4009E7: main (in /home/manuelg/Documents/assign1/threads/threads)
|
->02.11% (16B) 0x4009F5: main (in /home/manuelg/Documents/assign1/threads/threads)
|

Figure 10

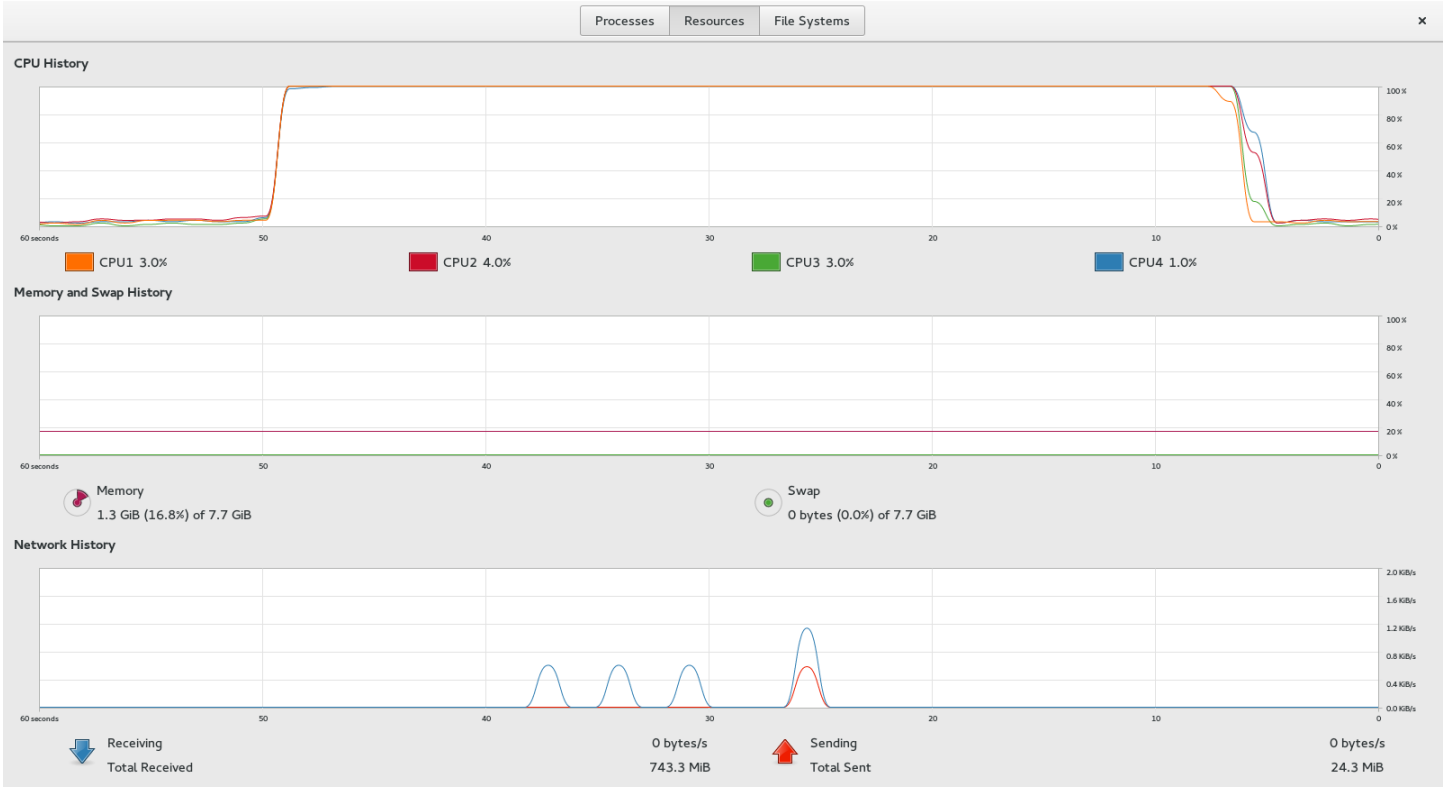
Processes
Resources
File Systems
CPU History
100 %
80 %
60 %
40 %
20 %
0 %
60 seconds
50
40
30
20
10
0
CPU1 3.0%
CPU2 4.0%
CPU3 3.0%
CPU4 1.0%
Memory and Swap History
Memory
1.3 GiB (16.8%) of 7.7 GiB
Swap
0 bytes (0.0%) of 7.7 GiB
Network History
2.0 KiB/s
1.6 KiB/s
1.2 KiB/s
0.8 KiB/s
0.4 KiB/s
0.0 KiB/s
Receiving
0 bytes/s
Total Received
743.3 MiB
Sending
0 bytes/s
Total Sent
24.3 MiB

Figure 11

Processes
Resources
File Systems
CPU History
100 %
80 %
60 %
40 %
20 %
0 %
60 seconds
50
40
30
20
10
0
CPU1 3.0%
CPU2 0.0%
CPU3 6.9%
CPU4 0.0%
CPU5 1.0%
CPU6 3.9%
CPU7 6.0%
CPU8 3.0%
Memory and Swap History
Memory
1.2 GiB (16.0%) of 7.7 GiB
Swap
0 bytes (0.0%) of 7.7 GiB
Network History
3.0 KB/s
2.4 KB/s
1.8 KB/s
1.2 KB/s
0.6 KB/s
0.0 KB/s
Receiving
0 bytes/s
Total Received
806.6 MB
Sending
0 bytes/s
Total Sent
23.5 MB

Figure 12

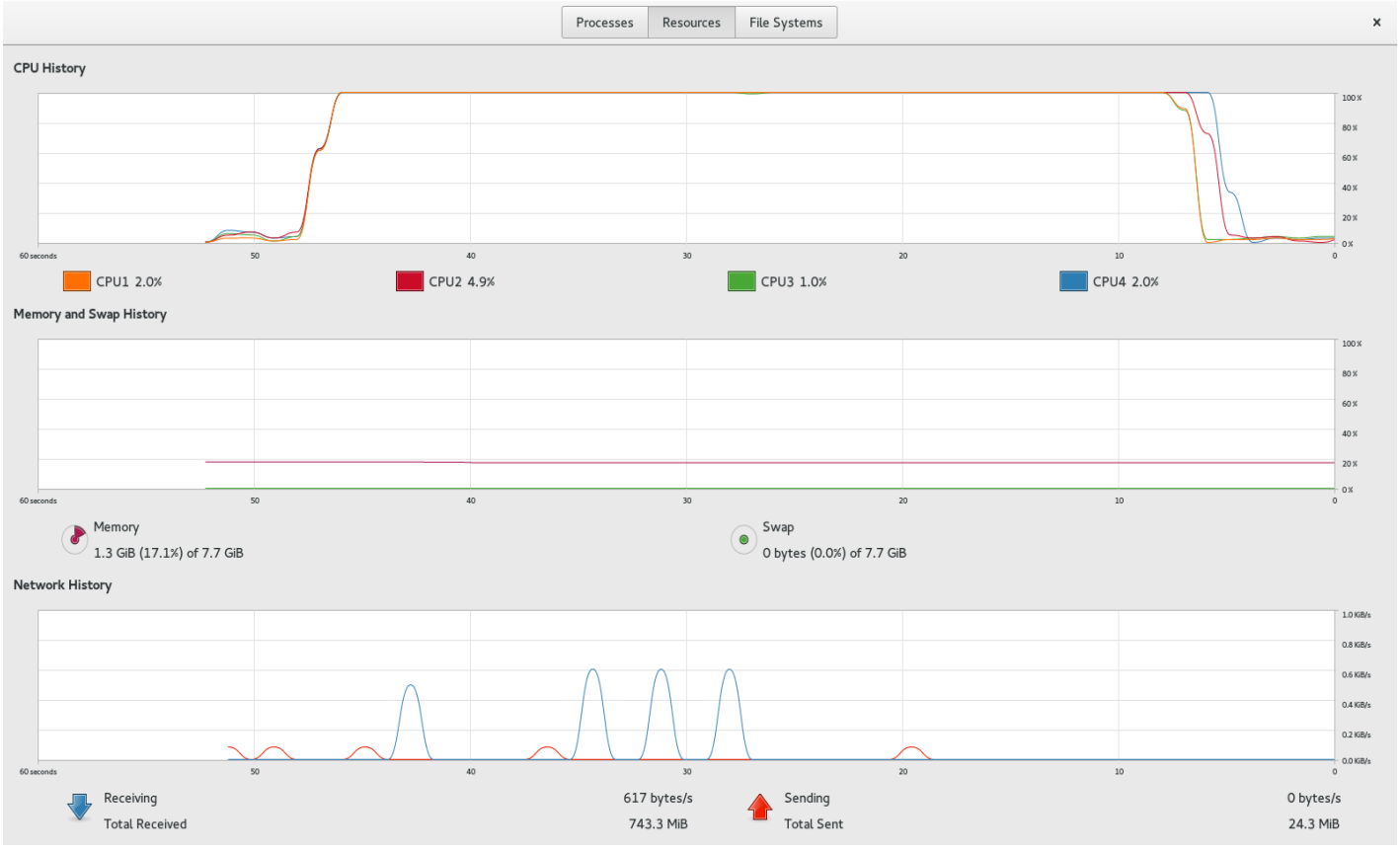
Processes
Resources
File Systems
CPU History
100 %
80 %
60 %
40 %
20 %
0 %
60 seconds
50
40
30
20
10
0
CPU1 2.0%
CPU2 4.9%
CPU3 1.0%
CPU4 2.0%
Memory and Swap History
Memory
1.3 GiB (17.1%) of 7.7 GiB
Swap
0 bytes (0.0%) of 7.7 GiB
Network History
1.0 KiB/s
0.8 KiB/s
0.6 KiB/s
0.4 KiB/s
0.2 KiB/s
0.0 KiB/s
Receiving
Total Received
617 bytes/s
743.3 MiB
Sending
Total Sent
0 bytes/s
24.3 MiB

Figure 13

Processes
Resources
File Systems
CPU History
100 %
80 %
60 %
40 %
20 %
0 %
60 seconds
50
40
30
20
10
0
CPU1 4.0%
CPU2 2.0%
CPU3 3.0%
CPU4 7.0%
CPU5 3.0%
CPU6 0.0%
CPU7 5.0%
CPU8 0.0%
Memory and Swap History
Memory
1.2 GiB (15.7%) of 7.7 GiB
Swap
0 bytes (0.0%) of 7.7 GiB
Network History
2.0 KB/s
1.6 KB/s
1.2 KB/s
0.8 KB/s
0.4 KB/s
0.0 KB/s
Receiving
0 bytes/s
Total Received
806.6 MB
Sending
0 bytes/s
Total Sent
23.5 MB

Figure 14

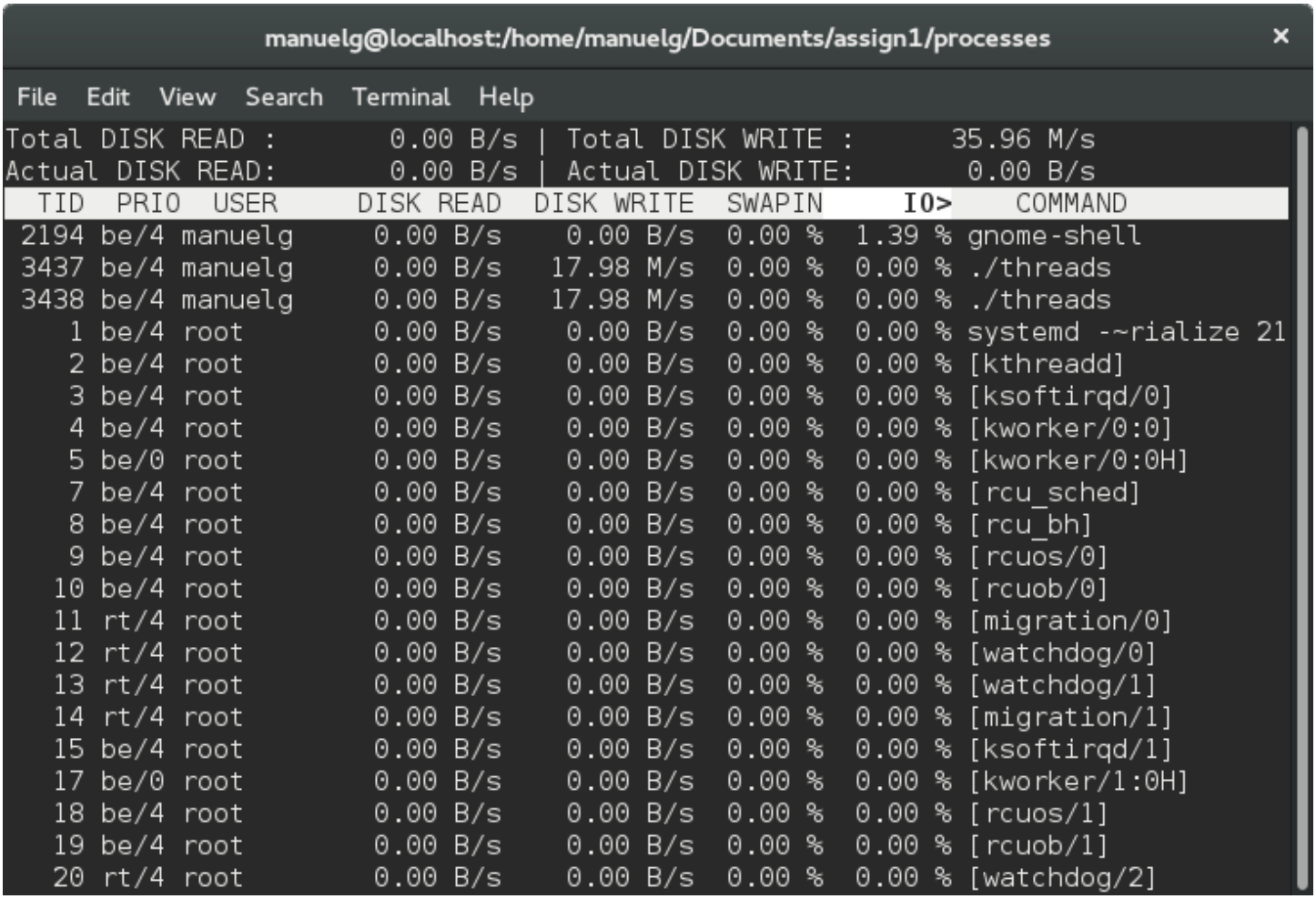
manuelg@localhost:/home/manuelg/Documents/assign1/processes
File Edit View Search Terminal Help
Total DISK READ : 0.00 B/s | Total DISK WRITE : 35.96 M/s
Actual DISK READ: 0.00 B/s | Actual DISK WRITE: 0.00 B/s
TID PRIO USER DISK READ DISK WRITE SWAPIN IO> COMMAND
2194 be/4 manuelg 0.00 B/s 0.00 B/s 0.00 % 1.39 % gnome-shell
3437 be/4 manuelg 0.00 B/s 17.98 M/s 0.00 % 0.00 % ./threads
3438 be/4 manuelg 0.00 B/s 17.98 M/s 0.00 % 0.00 % ./threads
1 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % systemd -~rialize 21
2 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kthreadd]
3 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [ksoftirqd/0]
4 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/0:0]
5 be/0 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/0:0H]
7 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcu_sched]
8 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcu_bh]
9 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuos/0]
10 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuob/0]
11 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [migration/0]
12 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/0]
13 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/1]
14 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [migration/1]
15 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [ksoftirqd/1]
17 be/0 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/1:0H]
18 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuos/1]
19 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuob/1]
20 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/2]

Figure 15

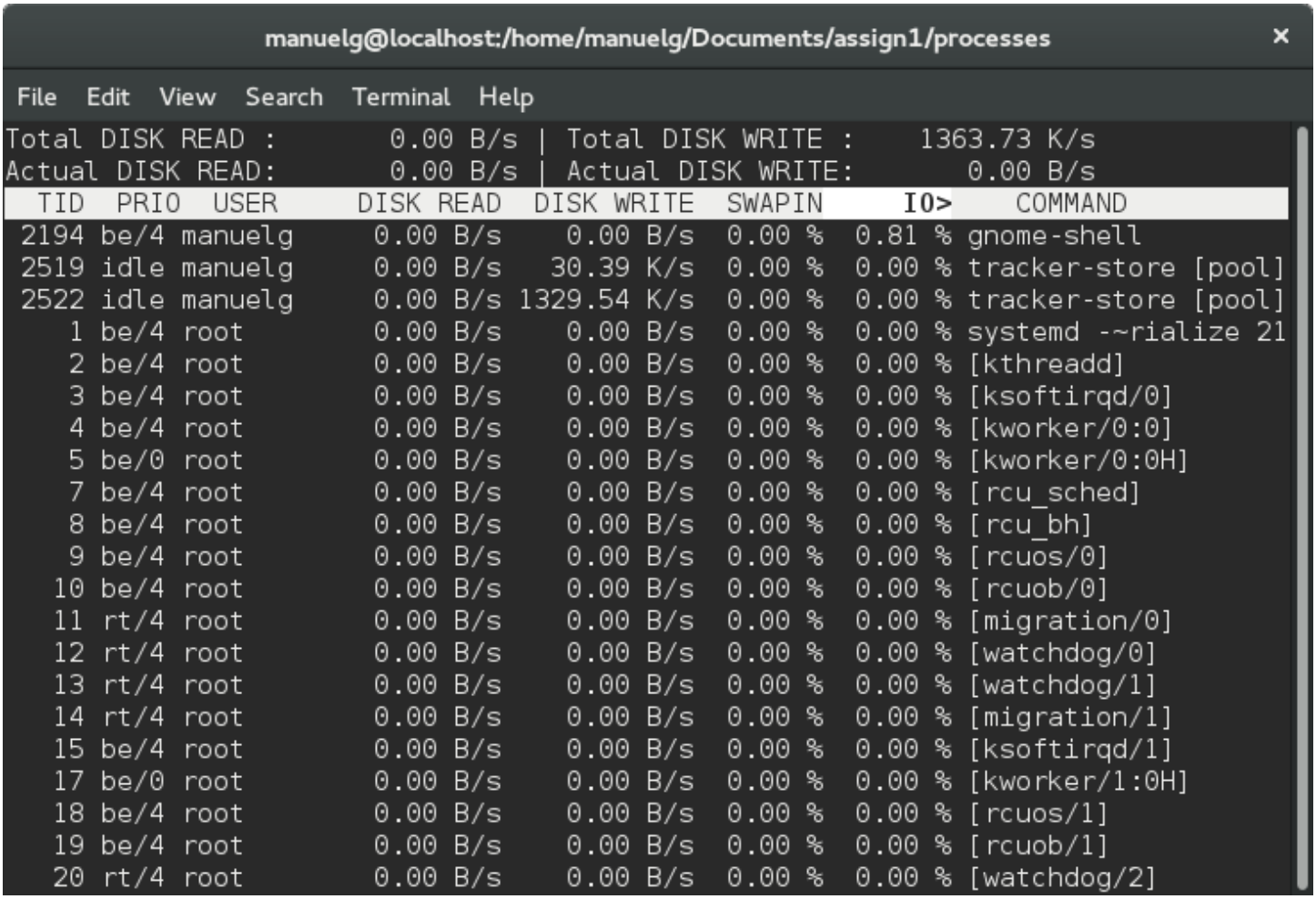
manuelg@localhost:/home/manuelg/Documents/assign1/processes
File Edit View Search Terminal Help
Total DISK READ : 0.00 B/s | Total DISK WRITE : 1363.73 K/s
Actual DISK READ: 0.00 B/s | Actual DISK WRITE: 0.00 B/s
TID PRIO USER DISK READ DISK WRITE SWAPIN IO> COMMAND
2194 be/4 manuelg 0.00 B/s 0.00 B/s 0.00 % 0.81 % gnome-shell
2519 idle manuelg 0.00 B/s 30.39 K/s 0.00 % 0.00 % tracker-store [pool]
2522 idle manuelg 0.00 B/s 1329.54 K/s 0.00 % 0.00 % tracker-store [pool]
1 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % systemd -~rialize 21
2 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kthreadd]
3 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [ksoftirqd/0]
4 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/0:0]
5 be/0 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/0:0H]
7 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcu_sched]
8 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcu_bh]
9 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuos/0]
10 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuob/0]
11 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [migration/0]
12 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/0]
13 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/1]
14 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [migration/1]
15 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [ksoftirqd/1]
17 be/0 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [kworker/1:0H]
18 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuos/1]
19 be/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [rcuob/1]
20 rt/4 root 0.00 B/s 0.00 B/s 0.00 % 0.00 % [watchdog/2]

Figure 16