Real Time Embedded System
Assignment-1
Real Time Scheduling of Threads

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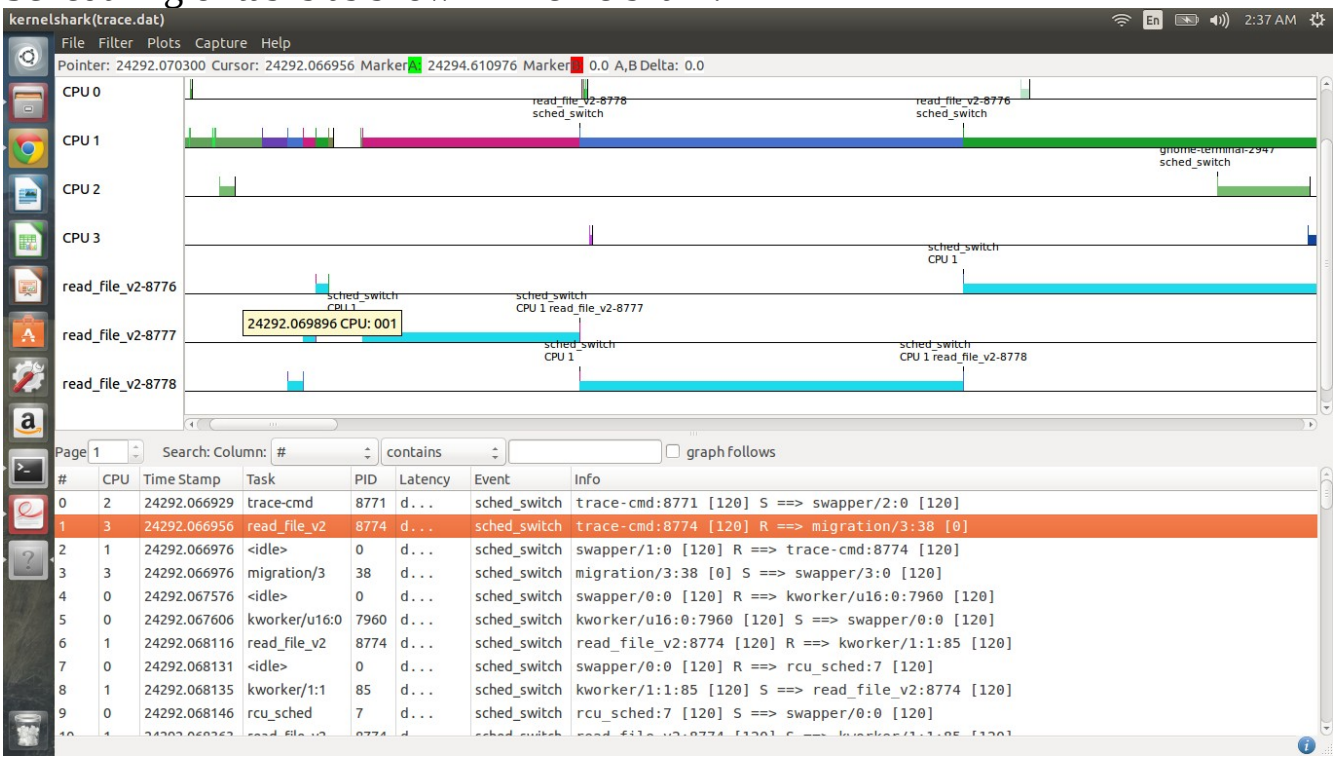
the input file is as follows:

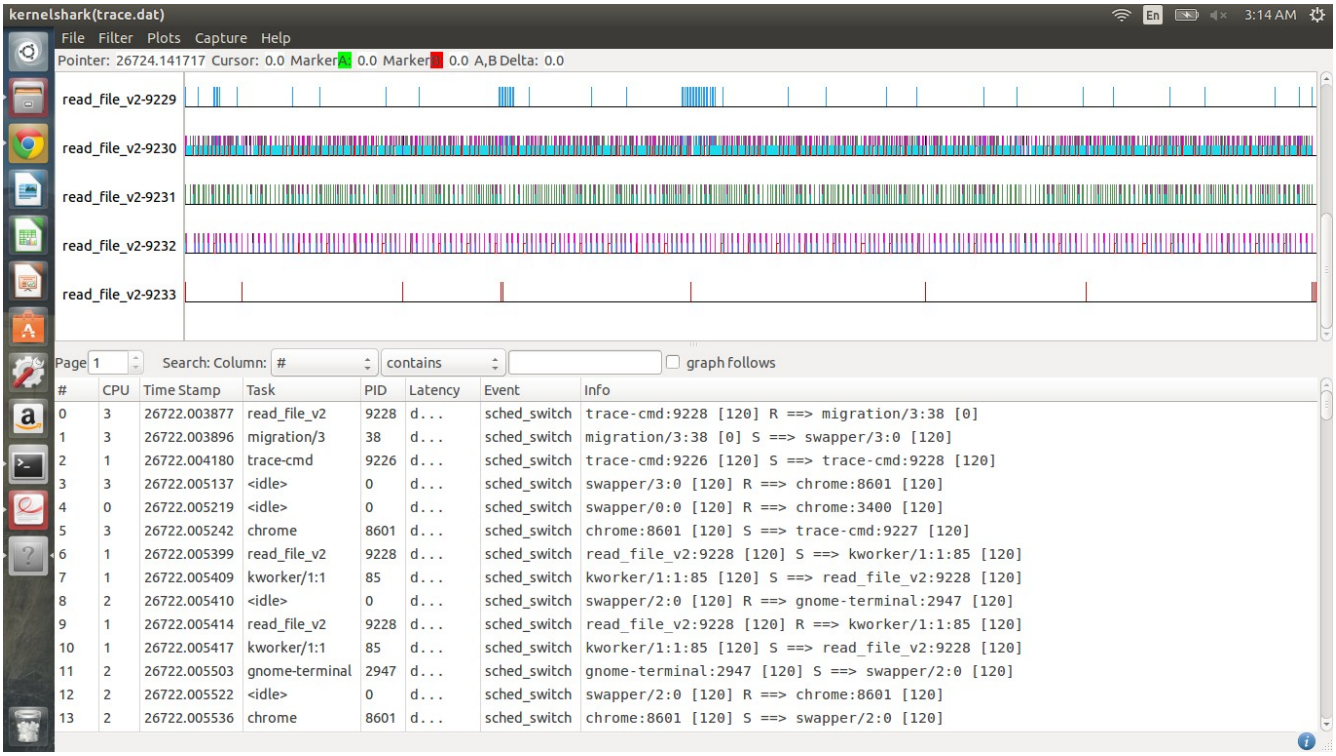
4 6000
P 20 20 10 L1 1995000 U1 300
P 80 25 40 L1 200000 U1 100
P 40 30 20 L2 400000 U2 100
A 10 0 500

Scheduling of tasks as shown in kernelshark:



in the image pid-8777 has the highest priority hence is scheduled immediately then comes 8778 with priority as 40 and then comes 8776 with priority as 20.

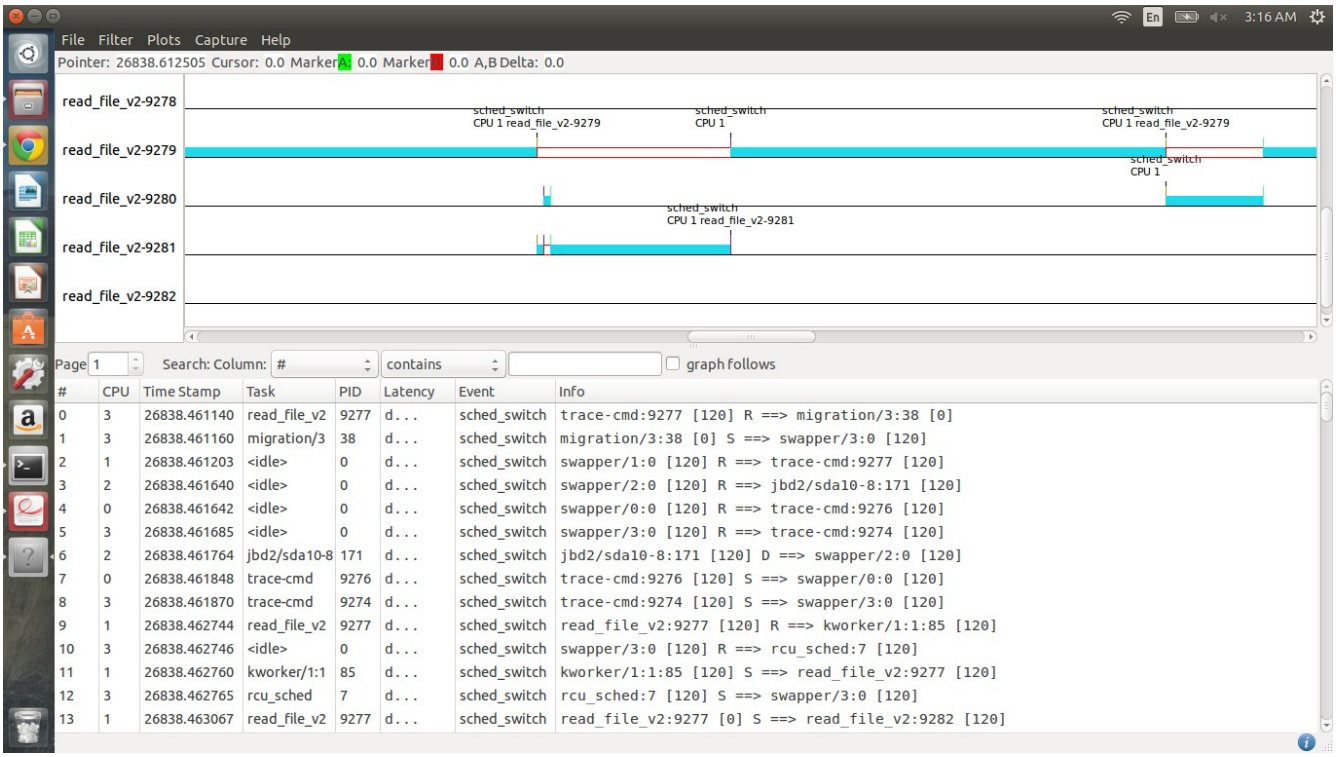
complete execution image:



Task overrun condition occuring:

In this image pid-8776 is overrunning due to preemption by 8777 and 8778 pid.

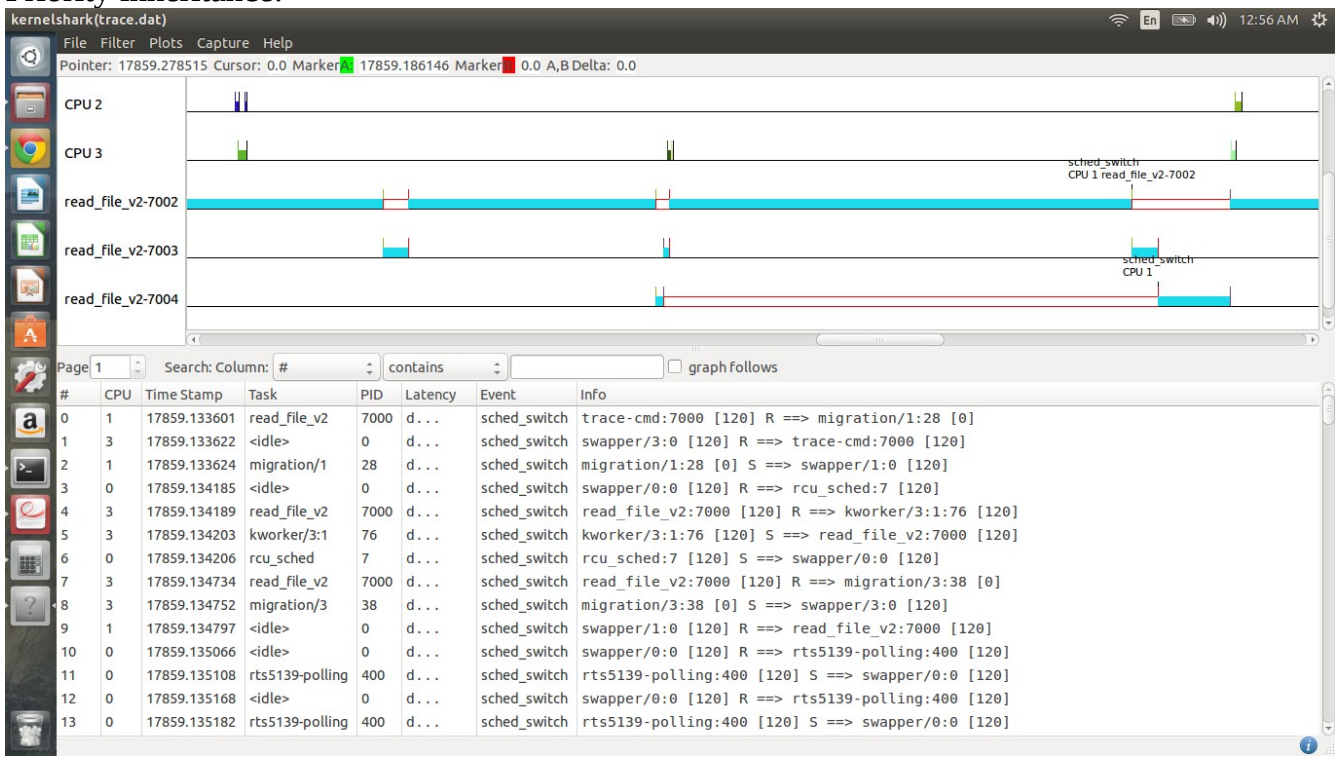
Priority inversion observation:



#	CPU	Time Stamp	Task	PID	Latency	Event	Info
0	3	26838.461140	read_file_v2	9277	d...	sched_switch	trace-cmd:9277 [120] R ==> migration/3:38 [0]
1	3	26838.461160	migration/3	38	d...	sched_switch	migration/3:38 [0] S ==> swapper/3:0 [120]
2	1	26838.461203	<idle>	0	d...	sched_switch	swapper/1:0 [120] R ==> trace-cmd:9277 [120]
3	2	26838.461640	<idle>	0	d...	sched_switch	swapper/2:0 [120] R ==> jbd2/sda10-8:171 [120]
4	0	26838.461642	<idle>	0	d...	sched_switch	swapper/0:0 [120] R ==> trace-cmd:9276 [120]
5	3	26838.461685	<idle>	0	d...	sched_switch	swapper/3:0 [120] R ==> trace-cmd:9274 [120]
6	2	26838.461764	jbd2/sda10-8	171	d...	sched_switch	jbd2/sda10-8:171 [120] D ==> swapper/2:0 [120]
7	0	26838.461848	trace-cmd	9276	d...	sched_switch	trace-cmd:9276 [120] S ==> swapper/0:0 [120]
8	3	26838.461870	trace-cmd	9274	d...	sched_switch	trace-cmd:9274 [120] S ==> swapper/3:0 [120]
9	1	26838.462744	read_file_v2	9277	d...	sched_switch	read_file_v2:9277 [120] R ==> kworker/1:1:85 [120]
10	3	26838.462746	<idle>	0	d...	sched_switch	swapper/3:0 [120] R ==> rcu_sched:7 [120]
11	1	26838.462760	kworker/1:1	85	d...	sched_switch	kworker/1:1:85 [120] S ==> read_file_v2:9277 [120]
12	3	26838.462765	rcu_sched	7	d...	sched_switch	rcu_sched:7 [120] S ==> swapper/3:0 [120]
13	1	26838.463067	read_file_v2	9277	d...	sched_switch	read_file_v2:9277 [0] S ==> read_file_v2:9282 [120]

Here task 9279 is running and is holding lock L1 now 9280 with priority 80 tries to acquire L1 but is unable to acquire hence moves to blocked state and at the same time 9281 with priority 40 enters and preempts 9279.

Priority inheritance:



#	CPU	Time Stamp	Task	PID	Latency	Event	Info
0	1	17859.133601	read_file_v2	7000	d...	sched_switch	trace-cmd:7000 [120] R ==> migration/1:28 [0]
1	3	17859.133622	<idle>	0	d...	sched_switch	swapper/3:0 [120] R ==> trace-cmd:7000 [120]
2	1	17859.133624	migration/1	28	d...	sched_switch	migration/1:28 [0] S ==> swapper/1:0 [120]
3	0	17859.134185	<idle>	0	d...	sched_switch	swapper/0:0 [120] R ==> rcu_sched:7 [120]
4	3	17859.134189	read_file_v2	7000	d...	sched_switch	read_file_v2:7000 [120] R ==> kworker/3:1:76 [120]
5	3	17859.134203	kworker/3:1	76	d...	sched_switch	kworker/3:1:76 [120] S ==> read_file_v2:7000 [120]
6	0	17859.134206	rcu_sched	7	d...	sched_switch	rcu_sched:7 [120] S ==> swapper/0:0 [120]
7	3	17859.134734	read_file_v2	7000	d...	sched_switch	read_file_v2:7000 [120] R ==> migration/3:38 [0]
8	3	17859.134752	migration/3	38	d...	sched_switch	migration/3:38 [0] S ==> swapper/3:0 [120]
9	1	17859.134797	<idle>	0	d...	sched_switch	swapper/1:0 [120] R ==> read_file_v2:7000 [120]
10	0	17859.135066	<idle>	0	d...	sched_switch	swapper/0:0 [120] R ==> rts5139-polling:400 [120]
11	0	17859.135108	rts5139-polling	400	d...	sched_switch	rts5139-polling:400 [120] S ==> swapper/0:0 [120]
12	0	17859.135168	<idle>	0	d...	sched_switch	swapper/0:0 [120] R ==> rts5139-polling:400 [120]
13	0	17859.135182	rts5139-polling	400	d...	sched_switch	rts5139-polling:400 [120] S ==> swapper/0:0 [120]

In this image task 7002 is holding L1 and now 7003 tries to acquire it but cannot acquire the lock so gets blocked now task 7004 with priority 40 tries to run but is preempted by 7002 which is now of temporary priority 80.