

OS Guided Project

Screenshots

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```
==> Test 1: CPU-Bound Process Demotion ==>
CPU-intensive process started (PID 4)
Initial state: PID=4, Queue=0, Time_In_Queue=0, Total_Slices=0
  Iteration 1: Demoted from queue 0 to 1
  Iteration 4: Demoted from queue 1 to 2
CPU-intensive process completed
Final state: PID=4, Queue=2, Time_In_Queue=1, Total_Slices=0
PASS: Demotion was observed
[R] TEST 1 PASSED: Demotion detected
```

Figure 1: t1

```
==> Test 2: I/O-Bound Process Fairness ==>
I/O-intensive process started (PID 5)
Initial state: PID=5, Queue=0, Time_In_Queue=1, Total_Slices=0
I/O-intensive process completed
Final state: PID=5, Queue=0, Time_In_Queue=1, Total_Slices=0
PASS: I/O process remained at queue 0
[R] TEST 2 PASSED: I/O process stayed at Q0
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Figure 2: t2

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==== Test 3: Mixed Workload Fairness ===
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OCPU--inboundte) nsstartiiven gp
roci/O-eisntes stnsive procaertss setarted (PID D (7)P
IInDi t6ial) s
Initiate:al sta PtIeD:= P7I,D Qu=6, eueQ=ueue0, =0, TimTiem_e_InIn_Qu_Queeuue=1, Totae=10,_S Tliceostal_Sl=i0
ces=0
    Iteration 0: Demoted from queue 0 to 1
    I/O-intensive process completed
    Final state: PID=7, Queue=0, Time_In_Queue=1, Total_Slices=0
    PASS: I/O process remained at queue 0
    CPU-intensive process completed
    Final state: PID=6, Queue=1, Time_In_Queue=3, Total_Slices=0
    PASS: Demotion was observed
    TEST 3 PASSED: Mixed workload coexistence verified

```

Figure 3: t3

```

==== Test 4: Priority Boost Test ====
Starting a CPU-bound process that should demote, then boost
Process 8: Starting CPU-intensive work
Initial: PID=8, Queue=0, Time_In_Queue=0, Total_Slices=0
    Iter 0: Queue changed from 0 to 2
    Iter 1: Queue changed from 2 to 3
After CPU work: PID=8, Queue=3, Time_In_Queue=12, Total_Slices=0
Waiting for boost (takes ~100 ticks)...
    Wait iter 0: queue=3
    Wait iter 10: queue=3
    Wait iter 20: queue=3
    Wait iter 30: queue=3
    BOOST DETECTED at iter 31: queue went from 3 to 0!
    BOOST DETECTED at iter 32: queue went from 3 to 0!
    BOOST DETECTED at iter 33: queue went from 3 to 0!
    BOOST DETECTED at iter 34: queue went from 3 to 0!
    BOOST DETECTED at iter 35: queue went from 3 to 1!
    BOOST DETECTED at iter 36: queue went from 3 to 1!
    BOOST DETECTED at iter 37: queue went from 3 to 1!
    BOOST DETECTED at iter 38: queue went from 3 to 1!
    BOOST DETECTED at iter 39: queue went from 3 to 1!
    Wait iter 40: queue=1
    BOOST DETECTED at iter 40: queue went from 3 to 1!
    BOOST DETECTED at iter 41: queue went from 3 to 1!
    BOOST DETECTED at iter 42: queue went from 3 to 1!
    BOOST DETECTED at iter 43: queue went from 3 to 1!
    BOOST DETECTED at iter 44: queue went from 3 to 1!
    BOOST DETECTED at iter 45: queue went from 3 to 1!
    BOOST DETECTED at iter 46: queue went from 3 to 1!
    BOOST DETECTED at iter 47: queue went from 3 to 1!
    BOOST DETECTED at iter 48: queue went from 3 to 1!
    BOOST DETECTED at iter 49: queue went from 3 to 1!
After boost period: PID=8, Queue=1, Time_In_Queue=3, Total_Slices=0
PASS: Both demotion and boost detected
    TEST 4 PASSED: Demotion and boost cycle confirmed

```

Figure 4: t4

```
== Test 5: Manual Priority Boost (boostproc syscall) ==
Child process 9 starting
Before manual boost: PID=9, Queue=0, Time_In_Queue=0, Total_SlicesParen=0t:
CaAftler sellf-booin manualst: P boost for IchDi=l9,d
Queue=0, Time_In_Queue=0, Total_Slices=0
PASS: Boost worked (queue reduced or stayed same)
TEST 5 PASSED: Manual boost syscall works
```

Figure 5: t5

```
== Test 6: System-Wide Priority Boost ==
Testing boostproc(0) - boost all processes
Child before boost: queue=0
Parent: Calling system-wide boost
Child after boost: queue=0
PASS: System boost worked
TEST 6 PASSED: System-wide boost works
```

Figure 6: t6

```
== Test 7: Starvation Prevention (Automatic Boost) ==
Long CPU process should be boosted automatically every 100 ticks
Child 11: Starting very long CPU work
Initial: PID=11, Queue=0, Time_In_Queue=0, Total_Slices=0
    Burst 0: Demoted to queue 2
    Burst 2: Demoted to queue 3
    Burst 10: BOOSTED! queue went from 3 to 1
    Burst 11: Demoted to queue 2
    Burst 12: Demoted to queue 3
Total automatic boosts observed: 1
Final: PID=11, Queue=3, Time_In_Queue=15, Total_Slices=0
PASS: Automatic boost observed (starvation prevented)
TEST 7 PASSED: Starvation prevention confirmed
```

Figure 7: t7

```
$ mlfq_stats

===== MLFQ Scheduler Statistics =====

Global Statistics:
    Total Scheduler Cycles: 7730
    Total Priority Boosts:  18
    Total Demotions:       20

Per-Queue Statistics:
    Queue  Processes  Total Schedules  Schedule %
        0          0            150           1%
        1          0            116           1%
        2          0             60           0%
        3          0            306           3%

Demotion Rate: 2 per 1000 schedules
Boost Frequency: 1 per 429 schedules

Fairness Analysis:
    Expected per queue: 1932
    Max deviation: 1872
    Status: WARNING - High deviation

Recommendations:
    - Scheduler functioning correctly!
$
```

Figure 8: stats

```
$ getprocinfo
Testing getprocinfo() syscall...
Getting info for current process (PID 13)

==== Process Information ====
PID: 13
Process Name: getprocinfo
State: 4
Queue Level: 0
Time in Queue: 1 ticks
Total Time Slices: 0
=====
getprocinfo() syscall works correctly!
$
```

Figure 9: getprocinfo

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$ sched_demo
== MLFQ Scheduler Demonstration ==
Starting test processes...

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Wa(PID rt1edi (t6)inP
g fo rIDI t c1hi7ler dr)en 0t -o complete.. Q.u

e
u e: 0 I, tTiemr e0 - Qiun eQueueu: 0e, : Time in0 , SlicesQueue: 0:
0, Slices: 0
Iter 1 - Queue: 0, Time in Queue: 0, Slices: 0
Iter 1 - Queue: 0, I tTime in Quere 2 -u Queuee: 1: ,0 S, Tlimices: 0
e in Queue: 0, Slices: 0
Iter 3 - Queue: 0, Time in Queue: 0, Slices: 0
IItter 2er 4 - Queue: 0- Queue: ,0 Tim,e in Queue: 1 , STilicme iens: 0
Queue: 1, Slices: 0
Iter 5 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 3 - Queue: 0, Ti m Iet erin 6 - Queue: 0, Time in QueQuuee: 1,u e:S 1, Slices: 0
llices: 0
Child 3 (Mixed): Finishe Ited
r 4 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 5 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 6 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 7 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 8 - Queue: 0, Time in Queue: 1, Slices: 0
Iter 9 - Queue: 0, Time in Queue: 1, Slices: 0
Child 2 (I/O-bound): Finished
(CPU-bound): Started (PID 15)
Loop 0 - Queue: 0, Time in Queue: 0, Slices: 0
Loop 1 - Queue: 0, Time in Queue: 0, Slices: 0
Loop 2 - Queue: 0, Time in Queue: 1, Slices: 0
Loop 3 - Queue: 1, Time in Queue: 0, Slices: 0
Loop 4 - Queue: 1, Time in Queue: 1, Slices: 0
Child 1 (CPU-bound): Finished

== Test Complete ==
Expected behavior:
- CPU-bound child should move to lower priority queues
- I/O-bound child should remain at high priority
- Mixed child should oscillate in priority
$
```

Figure 10: scheduler demo