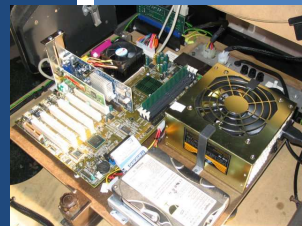


TCSS 422: OPERATING SYSTEMS

Three Easy Pieces: MLFQ, Proportional Share Scheduler, Concurrency Introduction



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April 11, 2018

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OBJECTIVES

- Assignment 0 – Introduction to Linux
- Tutorial 1 – C Tutorial: Pointers, Strings, Exec
- Quiz 2 – Chapter 7
- Feedback from 4/4
- Review: Multi-level Feedback Queue Scheduler – Ch. 8
- *NEW* - Assignment 1 – MASH Shell
- Online lectures: 4/16 and 4/18:
(Professor at IEEE IC2E Cloud Conference...)
 - Proportional Share Scheduler – Ch. 9
 - Concurrency: Introduction – Ch. 26
 - Linux Thread API – Ch. 27
 - Locks – Ch. 28

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L5.2

<h1>QUIZ 2 – IN CLASS</h1> <p>April 11, 2018</p> <p>TCSS422: Operating Systems [Spring 2018] Institute of Technology, University of Washington - Tacoma</p>	 <p>L5.3</p>
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FEEDBACK FROM 4/4		
<ul style="list-style-type: none">■ What is a batch job?■ What is the difference between a <u>batch job</u> and an <u>interactive job</u>?■ What is a preemptive (scheduler)?<ul style="list-style-type: none">■ <i>Question said “job” but believe meant to say “scheduler”</i>■ Can you go over the MLFQ scheduler again?<ul style="list-style-type: none">■ MLFQ review:		
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MLFQ

Round-Robin within a Queue

- Multiple job queues
- Adjust job priority based on observed behavior
 - Frequent I/O → keep priority high
 - Interactive jobs require fast response time (GUI/UI)
- Batch Jobs
 - Require long periods of CPU utilization
 - Keep priority low

[High Priority] Q8 → (A) → (B)

Q7

Q6

Q5

Q4 → (C)

Q3

Q2

[Low Priority] Q1 → (D)

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L5.5

FEEDBACK - 2

- Why were some charts with MLFQ, skipping over queues?
- How does the MLFQ priority boost work?

[High Priority] Q8 → (A) → (B)

Q7

Q6

Q5

Q4 → (C)

Q3

Q2

[Low Priority] Q1 → (D)

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L5.6

MLFQ: WITHOUT PRIORITY BOOST

The diagram shows three queues: Q2, Q1, and Q0. Q2 contains a long sequence of batch jobs (C, represented by vertical bars). Q1 contains a few interactive jobs (A, represented by solid black bars). Q0 contains a single interactive job (A) that is shown as a long black bar, indicating it is starved. A horizontal axis at the bottom is labeled 'Without Priority Boost' and has a 'Starvation' label at the end. A cartoon character with a knife and fork is next to the starvation label.

- Without Priority Boost
 - If too many interactive jobs fill a higher priority queue, **then** there is no time to run jobs in lower queues...
 - Batch jobs **STARVE** and receive **NO CPU time!**

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L5.7

MLFQ: WITH PRIORITY BOOST

The diagram shows three queues: Q2, Q1, and Q0. Jobs are shown moving between queues. A blue arrow on the left points upwards, indicating the direction of job movement. The word 'Boost' is written above the queue transitions. A horizontal axis at the bottom is labeled 'With Priority Boost'.

- Priority Boost
 - Reset all jobs to topmost queue after **time interval "S"**

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FEEDBACK - 3

- Drawing MLFQ Scheduler timing graph is still very confusing for me...
- How does having multi-core CPUs impact scheduling?
 - Scheduler must ensure each core has active work
 - If all threads block, core goes IDLE
 - “htop” provides a graph showing utilization of each core

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L5.9

FEEDBACK - 4

- How does having multi-core CPUs impact scheduling? (cont'd)
 - **Symmetric multiprocessing:**
Having more than one physical CPU on the system
 - Often there are multiple sockets
 - When jobs context switch, ideally they are not rescheduled on a different CPU (socket).
 - Caches would be lost
- What type of scheduling (algorithm) is used in modern day computers?
 - Linux completely fair scheduler (CFS)

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L5.10

ASSIGNMENT #1 INTRODUCTION

[HTTP://FACULTY.WASHINGTON.EDU/WLLOYD/
COURSES/TCSS422/ASSIGNMENTS/
TCSS422_S2018_A1.PDF](http://FACULTY.WASHINGTON.EDU/WLLOYD/COURSES/TCSS422/ASSIGNMENTS/TCSS422_S2018_A1.PDF)

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L5.11



QUESTIONS

