Operating Systems Project #2 - xv6 MLFQ Scheduler

SWE3004-42 Introduction to Operating Systems - Spring 2018

Due date: Apr 18 (Wed) 11:59pm

1 Goal

In this project, you will implement a new scheduling policy MLFQ in xv6. The detail algorithm is described in chapter 8 of the OSTEP book, but you will be implementing a simple version.

The objectives for this project are as follows:

- To gain further knowledge of a real OS kernel
- To familiarize yourself with the CPU scheduling
- To make a graph to show your scheduler behaves appropriately

2 Details

You need the setnice and getnice system calls that you implemented for project #1 to verify your scheduling policy. But, let's limit the number of priority levels to four (0,1,2, and 3). The top queue (numbered 0) has the highest priority and the bottom queue (numbered 3) has the lowest priority. In addition, you need to implement `int getpinfo(struct pstat*)` to get information about how many times each process has been chosen to run. This system call should return 0 if successful, and -1 otherwise, for example, if a bad or NULL pointer is passed. The structure `pstat` is defined as follows:

```
#ifndef _PSTAT_H_
#define _PSTAT_H_

#include "param.h"

struct pstat {
  int inuse[NPROC];   // whether this slot of the process table is in use (1 or 0)
  int nice[NPROC];    // the nice value of each process
  int pid[NPROC];     // the PID of each process
  int ticks[NPROC];   // the number of ticks each process has accumulated
};

#endif // _PSTAT_H_
```

3 How to Start Project

Download xv6 source code by running the following git command. Note that you should rename your first project directory (xv6-skku) to something else such as 'proj1' before cloning the second project file.

```
git clone https://github.com/jinsoox/xv6-skku.git -b pa2
```

4 Details about MLFQ

When a process is first created, it should be placed at the end of the highest priority queue. When a process uses up its time-slice, it should be downgraded to the next priority level.

The time slice for priority 0 should be 1 timer tick while the time slice for priority 1 is 2 timer ticks. For priority 2 and 3, the time slices are 4 timer ticks and 8 timer ticks.

To make your life easier, this project does not require priority boost (section 8.3) nor better accounting (section 8.4). Thus, we let a process game the scheduler by giving up its CPU before the time slice expires.

If a process wakes up after voluntarily giving up the CPU (due to I/O or sleep), it has to be placed at the end of the same priority queue.

For the lowest level priority queue, we use the round-robin policy always.

5 How to Submit

To submit your project, you must run `make tarball` command in xv6-skku directory to compress your source codes into one .tar.gz file. This .tar.gz file must be uploaded to the iCampus assignment submission menu so that grading TAs can download it.

Note: Please don't forget writing your ID and project number in the Makefile before creating a tarball.

For any questions, please post them in Piazza so that we can share your questions and answers with other students and TAs. Again, this is the first time that I manage xv6 projects. So, there can be some mistakes and unclear requirements in the project. Please feel free to raise any issues and post any questions. Also, if you can answer other students' questions, you are welcome to do so. You will get some credits for posting questions and answering other students' questions.

6 Late Submission Policy

Late submissions will be accepted but with 20% penalty per day. That is, if you submit 2 days late and test score is 80 points, your penalized score will be 48 points (80 x 60%).

7 Help Session

I understand this project is challenging to many of you, especially those of you who have not submitted the first project. So, let's schedule help sessions. The first help session in on this Friday 7pm, when I will explain how to implement system calls in xv6. If you succeeded the first project, you should not come to this session. Another session will be on the next Thursday (12th) 7pm, which is to help your second project. I expect you try as much as you can by next Thursday and bring your questions. The class room will be announced as soon as I reserve the room. And, don't forget bringing your laptop to the help session.