CSCI 5573: Advanced Operating Systems
Fall 2022

Instructor

- Name: Shivakant Mishra
- Office: ECCR 1B22
- Office Hours: *tbd*
- Phone: (303) 492-4686
- Email: *mishras@colorado.edu*

Short Description

This is a graduate course in operating systems intended to create a foundation for operating systems research or advanced professional practice. Topics include Linux kernel programming, virtualization, light-weight virtualization and OS for small devices.

Prerequisite

- CSCI 3753 and CSCI 4593 or equivalent undergraduate course work in operating systems and computer architecture. These are reasonably firm prerequisites. If you have not taken these courses, you should discuss your situation with me before you enroll in CSCI 5573.

Reading Material

Selected articles and other materials from the Internet.

Class webpage

See the course page on Canvas

Grading (*Weights assigned are tentative*)

- Homework and programming assignments: 50%
- Course project: 20%
- Quizzes and Exams: 30%

Policies

Coming up soon

CSCI 5573: Advanced Operating Systems
Fall 2022
Course Content

- Introduction: Review of fundamental concepts
  - Processor mode, system calls
  - Context switch: *schedule*( ) and *switch_to*( ) functions
  - Virtual memory layout
  - Symbol table: *System.map* file
  - System Boot
- Linux Internals
  - */proc* directory
  - *printk( ), dmsg, klogd,* kernel *oops* and *panic*
  - Loadable Kernel Modules: hello world, device drivers
  - Kernel probes: *kprobes, jprobes, kretprobes*
  - System call interception and manipulation
  - Linux hotplugging
  - USB Subsystem; USB device drivers
  - Interrupt handlers – Short IRQ, Long IRQ, *softirqs, tasklets*
  - Work queues
  - Keyboard interrupt handler
  - Scheduling tasks in kernel
- Virtualization
  - Virtual Machine Monitors
  - Machine Virtualization
  - Challenges with Virtualization
  - Full Virtualization: Binary Translation, Shadow Page Tables
  - Paravirtualization: Hypercalls
  - Hardware Assisted Virtualization – *VT-x, VMX*
  - Xen, VMWare, Denali, Terra
- Lightweight virtualization
  - *chroot, cgroups, namespaces*
  - Containers: LXC, Dockers
- Edge computing
  - Micro-service based architecture
  - EdgeX, Kura
  - Serverless computing
- Library OS
  - Microkernels vs Exokernels
  - Aegis, EXOS, SPIN
- OS for small devices
  - Android OS
- Current research topics

Note: *The course content will be updated over the semester based on class discussions and student interests.*