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*
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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.