CS 695

Topics in virtualization and cloud computing

Course Overview

Spring 2023-24

Instructor

- **Puru** (Purushottam Kulkarni)
  - ~~Sir Puru, Puru Sir, Sir, *Sir*, …~~
  - puru@cse.iitb.ac.in
  - http://www.cse.iitb.ac.in/~puru

- Office hours
  - Knock-on-door policy
  - Will announce slot(s) as well once time-table stabilizes

About CS695

- https://www.cse.iitb.ac.in/~puru/courses/spring23/

- Meeting times
  - **Slot 5 or Slot 6, Wed. & Fri : 9.30 am or 11 am**
  - **Venue: ???**
  -
- Mailing list, announcements, submissions
  - Moodle

- TAs
  - K Ashwin, Debo, Sameer, Nadesh, Sandeep

Pre-requisites

- CSE UG/DD students — CS224, CS 252, CS333, CS347
- CSE PG students —
  CS744, undergraduate courses in computer networks and OS
- No audit offering
- If do you not meet above criteria but still want to take course
  Meet me!

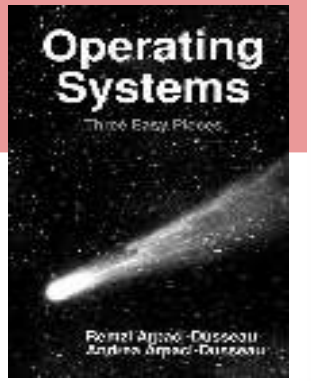
Course goals

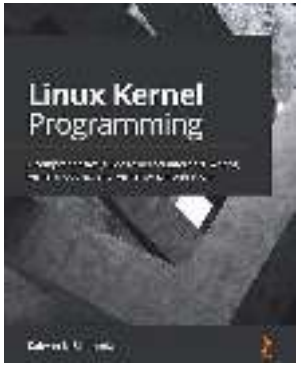
- Develop an understanding of *Systems issues/under-the-hood* topics
- Topics list (incomplete)
  - Virtual machine basics and techniques to design VMMs
  - CPU, memory, I/O virtualization (for VMs)
  - VM-enabled mechanisms —
    - ballooning, live migration, snapshots, record-replay, resource management
  - Containers from the ground-up
  - Serverless computing basics and frameworks
  - Networking techniques for the modern-era
  - Acceleration-as-a-service models
  - Classic/latest research papers in above topics
- Hands-on experience
- Familiarity with how to read/interpret/use research papers
- Identify new/open research/problem directions

Course components

- In-class teaching
  - Textbook, papers, online notes
  - Paper discussions
- Programming assignments/project
- Paper reviews (?)
- Guest lectures
- Exams

Course material





No single textbook
- OS Three Easy Pieces
- xv6 book
- Linux Kernel Development, Linux Device Drivers
- Virtual Machines: Versatile Platforms for Systems and Processes
- The Definitive Guide to the Xen Hypervisor

Research papers
- ~10 papers over the semester

Online material
- https://linux-kernel-labs.github.io/refs/heads/master/index.html
- https://0xax.gitbooks.io/linux-insides/content/
- https://www.kernel.org/doc/html/latest/
- https://sysprog21.github.io/lkmpg/

Assignments and Projects

- Non-trivial component of the course
  - Assignment every ~3 weeks
  - Needs continuous and consistent effort
  - Design, system building, experimentation, demos, report, …
  - 4 assignments
- Project (?)
  - Open-ended or could be large assignment
- 1 : x rule
  - Value of **x** in most/all cases is 3+

Evaluation

- Class participation : 100%

  answers, questions, explanations from papers, new ideas/problems …

- Components
  - Quizzes ~10%
  - Exams ~50%
  - Assignments ~40%
  - Project ~15%

Things to remember!

- An interactive/open-ended course
  - several self-learning components
- Do not cut-copy-paste anything!
- Start early
  - Paper readings, exercises, project, …
- Systems for *all*, all for systems

Addendum

- ***How to read paper?***
  Srinivasan Keshav
  ACM SIGCOMM Computer Communication Review,
  Volume 37 , Issue 3, July 2007.

- **Programming assignment #1**

  Will be available online: before 9th Jan, Tuesday.

  Linux kernel modules + ioctl