95-799 Linux & Open Source - Syllabus

Fall 2024 Mini Z2 – October 23 – December 11
Wednesday 6:00pm weekly lecture release

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Description

This course covers the Linux operating system, its related applications, and the Open Source Software (OSS) model. Emphasis is on how Linux is different from other systems.

Objectives

The focus of the course is two-fold. One component is developing hands-on technical experience with installing, configuring, and administering Linux systems and Open Source applications. This will be done partly through in-class lectures, but the hands-on lab work will generally be done by the students outside of class time.

The other component of the course is to developing an understanding of how Linux & Open Source fit into enterprise IT environments, their strengths and weaknesses, and the economic, social, political, and legal forces acting on them. This will be covered primarily through classroom lectures & Canvas discussions.

Skills and knowledge students will gain in this course:
- Install Red Hat and Debian based Linux distributions;
- Maintain operating system updates;
- Install and configure useful application software (LAMP stack apps, SAMBA, and others);
- Interoperate between Linux and Windows;
- Understanding of each of the following:
  - Basics of Linux security;
  - Major issues involved in Open Source licensing;
  - Basics of Linux scripting and be able to write a simple script;
  - Pros & cons of Linux & be able to decide where it makes sense to use it or not;
- A sufficient knowledge framework of Linux upon which they can build if desired.

Prerequisites

An x86-based computer with a 64-bit Intel/AMD CPU and hardware virtualization, on which to run the Lab exercises. M* Apple Silicon based Macs are not compatible. Having a laptop in class is best but not required. A minimum of 4GB RAM is required, 8GB preferred. You will need at least 30GB of free disk space, SSD is highly recommended rather than spinning hard drive. If you have a non-Windows computer, that is OK, but you will need to get access to a Windows machine (physical or virtual) in order to complete the last Lab. A Windows virtual machine is the simplest option and will be provided, but will require about 40GB of additional free disk space.

A basic understanding of PC hardware/software architecture/networking (such as BIOS boot order, disk partitions, IP addresses).

Understanding of computer programming concepts in any language.

Use of LibreOffice Writer and Impress for class documents and presentations, in both your host and guest OS's.

Use of VirtualBox to run Linux virtual machines.

Some familiarity with any version of Unix (Linux, Solaris, AIX, HPUX, etc) is helpful but not required.

Textbook

The Linux Command Line: A Complete Introduction, 5th Internet Edition by William Shotts Jr. Available online in PDF at linuxcommand.org/tlcl.php (also my local copy).

Schedule

Week 1: Oct 23	*In The Beginning*: Introduction, Linux background & history. Understanding Open Source.	
Week 2: Oct 30	*Pieces & Parts:* Structure of the operating system. Unix survival guide.	Lab 0 Due. (installs) Bio post Due.
Week 3: Nov 6	*Will The One True Linux Please Stand Up:* Understanding the major Linux distributions. Repositories and package management systems for adding software.	Lab 1 Due. (commands)
Week 4: Nov 13	*So What Is It Good For?:* Common applications for Linux. Installing and configuring services (web, ftp, file/print, etc). *Profits from Freedom:* Open Source licensing & business models.	Lab 2 Due. (packages) Quiz 1.
Week 5: Nov 20	*Barbarians at the Gate:* using Linux for network security. *If I Had A Hammer:* Unix scripting languages. (VIDEO)	Lab 3 Due. (apps)
Nov 27	Thanksgiving Break – no class	
Week 6: Dec 4	*Plays Nice With Others:* Integrating Linux into other environments.	Lab 4 Due. (security) License Analysis Due Quiz 2.
Week 7: Dec 11	*Feel the Power:* Linux in the cloud, system & network management demos, configuration management, Linux on non-PC platforms, recompiling the kernel.	Lab 5 Due. (integration) Lab 6 Due. (scripting) Quiz 3.

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Software

VirtualBox

Each student will use a copy of VirtualBox in order to run multiple versions of Linux non-destructively on their computer. VirtualBox is a cross-platform "virtual PC" program that emulates a complete separate additional system within your host computer. The program and documentation can be downloaded from virtualbox.org or locally at linuxclass.heinz.cmu.edu/virtualbox.

You are required to use VirtualBox for this class, both for consistency with the instructor's and other students' environments, and to experience an Open Source-based virtualization system. The labs are verified and known to work on VirtualBox 7.0.20 on Windows 10, and should be compatible with Intel-based Macs as well (not M* Apple Silicon based Macs though).

Virtualbox will coexist with most other virtualization software you may have installed though you should not run VMs in both at the same time. There is a compatibility issue with Windows 10 Hyper-V and several Windows features like Credential Guard, Device Guard, Memory Integrity, etc. See the post in the Technical Forum for details.

The versions of Linux used in the class are distributed as .ISO files for using as a VirtualBox virtual optical disk, and can be downloaded from linuxclass.heinz.cmu.edu/iso-images/. You should use those exact versions so you are in sync with the lectures, labs, and the other students.

LibreOffice

We use the free & open source LibreOffice office suite for all class documents – syllabus, lab assignments, lecture slides, and so forth. Windows and Mac installers for LibreOffice are available at linuxclass.heinz.cmu.edu/libreoffice or libreoffice.org. There is another older variant called OpenOffice – if you have that installed you can use it instead.

Assignments:

Due Dates: Assignments are released Wednesdays at 6:00pm along with the lecture. For the on-campus class they are due in one week, before the start of the next lecture. But to provide some additional flexibility for this distance ed mini, the due dates are Sunday midnight (11:59pm) of the following week, 4 days later than on-campus would be. so you have 11 days from when the assignment is released to complete it, spanning two weekends. This results in the next week's assignment being released before the previous one is due, which hopefully will not be too confusing.

For Labs 5 & 6 we can't push them the full 4 days out since the assignments have to get graded and final grades computed. So those are due Friday 12/13 by noon.

All times are Eastern Time as in Pittsburgh.

Biographical Post: The first assignment is to make a video post to the Canvas bio discussion folder with the following information:
   • Your name, how to pronounce it if not obvious to native English speakers, and any shortened or alternate name that you prefer.
   • Where you are from, and where you are located now.
   • A brief description of your school/work history.
   • A quick summary of your level of technical knowledge/experience with PC hardware & software, networks, the Internet, Unix in general, and Linux.
   • Any topics of particular interest that you would like to see covered in this class.
   • Anything else you'd like the instructor and other students to know about you.

You do not need to reveal any information that you are uncomfortable sharing with the other students. The video should be at most a few minutes in length. Value: 1 point.

Open Source License Analysis: There are dozens of different Open Source software licenses, each with their own legal terms and conditions. You will analyze and review a license of your choice (other than GPL, LGPL, BSD, & MIT) and submit it via the class Canvas site. A standardized review template will be provided. See the initial License Analysis forum post for details. 10 points (9+1). (est time 3 hours)

Labs: The bulk of the assignments are the hands-on labs. The instructor will discuss the main steps of the lab during class, but students are not expected to begin or complete the labs in class. Students will work on the labs in their own time until they achieve the intended result. Each lab will have some final step (screenshot, writeup, etc) demonstrating successful completion, submitted to Canvas via each lab's page.
95 points (6 @ 15pts each (three labs are 14+1), 1 at 5 pts; est time 1-5 hours each).

Quizzes: There are three brief quizzes conducted via Canvas. These will address technical architecture topics, the non-technical economic/social/political/legal topics, and lab experiences. They will not cover details of individual installation or configuration steps.
   These will be graded on a completion basis – if you attempt each question you will get full points for the quiz, independent of the correctness of your answers. With this approach you can take the quiz to assess your knowledge without feeling the need to go look up the right answers. When you submit you will see the numeric

grade out of 13 points that you would have earned for an on-campus, in-class, closed-book quiz. But it will not be included in the grade calculation, rather I will separately assign 3 points for completion of each quiz. 9 points (3 @ 3 pts each).

Participation: There is a participation grade based on activity in the class forums. You are expected to post your own problems and also assist other students with their technical problems. Non-technical (social/political/economic/legal) posts are encouraged also. Consider the forums as the substitute for in-class and after-class discussions that would happen with an on-campus course. Minimum expected activity for the discussion groups, to receive an average grade, is one *meaningful* post per week per student. See the entry "Discussion posting guidelines" in the Course Information module of Canvas for required reading on what constitutes a meaningful post. 10 points.

Grading

Total points: 126, made up of all the assignments listed above including participation and a 1-point syllabus acknowledgment quiz. According to Heinz School grading guidelines, the course grade average will be targeted at 3.5. The grading scale will be curved as needed to reach this average, so it may vary from the typical 90+%:A 80+%:B scale.

What "14+1" means: Assignment submissions that adequately meet the assignment requirements receive 14 out of 15 points for that assignment (or 9 out of 10 on the license analysis). Sometimes there is a wide disparity between those that simply satisfy the requirements and a few submissions that are of much higher quality - much more thorough and thoughtful analysis, much greater care and polish. These submissions are noticeably better than the "adequate" ones, and it seems appropriate to have some small way to recognize that extra effort. That's what the 1 extra possible point is for. It is not "extra credit", it is part of the base 15 points of the assignment. Typically between zero and three student submissions fall into this category for a given assignment, and are awarded an extra amount between ¼ and 1 point. This aspect of the grading is necessarily somewhat subjective.

Course Material Hosting

The course Canvas site is the main site for course-related materials. The slides used for the lectures are posted here before the start of class. Assignment documents are on Canvas as well, and submissions are done through Canvas's Assignment feature.

Supplemental large files and other miscellany are hosted on a separate site maintained by the instructor – linuxclass.heinz.cmu.edu. The Linux OS ISO images are here, along with the VirtualBox software. The first week's lecture/lab files are also available here for students who may not have access to Canvas yet due to waitlisting.

Teaching Assistant(s)

TL:DR; - don't just email the instructor when you have a problem.

TA(s) for the course have three roles – help students with technical or conceptual problems with their Linux virtual machines & related software; monitor the online discussions (along with the instructor) to respond where useful; and assist the instructor with some grading.

Also see Course Information→Technical Support Process for more information about the role of the TA(s) in helping you with technical issues.

Course Policies

Generative AI

To best support your own learning, you must complete all graded assignments in this course yourself, without using AI tools to generate any content for an assignment. Passing off any AI generated content as your own (e.g.,

cutting and pasting content into written assignments, or paraphrasing AI content) constitutes a violation of CMU's academic integrity policy.

You are welcome to use AI tools to create study guides, try to solve technical problems with your lab exercises, get general information, and so forth, so long as neither directly copied nor paraphrased content from the AI tool is included in your assignment.

Collaboration and Original Work

Students are welcome to collaborate and share information on lab assignments. Each student must complete and submit each lab themselves, but you may discuss any aspects of the labs (problems, steps, useful tricks, etc) with others.

The license analysis, lab assignment text, and online discussion post text must be in your own words. Any direct quotation from another source must be clearly attributed to the source, and the use of direct quotations should be kept to a minimum. Mark any copied text with quotation marks (" "). Plagiarism will not be tolerated.

The quizzes, while conducted online via Canvas, are intended to be closed book / closed notes as a way for you to assess your absorbed knowledge. You can consult the slides/videos/notes/etc if you wish, but it will not affect your quiz grade since it is completion-based rather than correctness-based.

Original Work policies will be strictly enforced, and any students found cheating or plagiarizing will fail at least the assignment and possibly the whole course, and additional disciplinary actions may apply up to and including expulsion from the university. Think about explaining that to your family and to your funding agency. It's not worth it - just don't do it.

Recording

Lectures are recorded and made available to students for their academic use. Recordings may be shared with other current students of this class only. Recordings are not allowed to be further copied, distributed, published, posted, or otherwise used for any other purpose without the express written consent of the instructor.

A Canvas Announcement will be posted when each week's lecture recording becomes available. This will typically be each Wednesday at 6:00pm.

Missed assignments

Many students at Carnegie Mellon are extremely busy and overcommitted, so requests for due date extension due to other workloads and activities will not be granted. You will need to plan your efforts accordingly and start early enough that you have time to handle any problems that occur while working on the Labs, which are by nature somewhat unpredictable. TA(s) are available to assist you with Lab problems – make use of them, but don't wait until the last minute. Late assignments will have a 10% penalty per week assessed.