

CST8177

Linux Operation Systems II

aka

Linux II

Course Objectives

- To add to your knowledge of Linux tools
- To learn basic system administration
- To learn how to design, write, and debug a script
- To provide the required background for the successor courses in later semesters

For more information on this course, please get and read the current Course Outline. There's a .pdf on this course in Blackboard.

NOTE: At our level of study, Linux and UNIX are basically identical. Assume both when either is mentioned.

Prerequisite Course

CST8207, Linux I

Yet to Come

CST8213, Linux III

CST8230, IT Security Fundamentals

CST8231, Network Services

... and perhaps more

Brief Course Outline

1. Control system processes

the kernel process table; the boot process; log system services; user processes; runlevel tools; task scheduling

2. Control user access to system resources

user and group accounts; a password policy; file permissions (including ACLs)

3. Setup and maintain file systems

volumes; single and multiple file systems; file system integrity

Note: Course material will be found on my College web page, along with my semester timetable, at:

elearning.algonquincollege.com/coursemat/allisor

Brief Course Outline

4. Automate administrative tasks using scripting
operating system interface; program logic
using Program Description Language (PDL); process
automation bash scripts

5. Other automation tools (time permitting)
stream editor (**sed**) and **awk**

Note: Course material will be found on my College web
page, along with my semester timetable, at:

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Administrivia

- My name is Robert Allison, and my office is T319
- Because I don't use voicemail, you should choose email at **<allisor@algonquincollege.com>** instead of using the telephone, because email is better.
- You can try phoning X 5949 to reach me, but I may not answer even if I'm there. Use email.
- I am normally in from 10 to noon and 1 to 5, excluding lab and classroom hours (and other stuff).
- Office Hours are posted on my timetable
- Don't expect total co-operation during my lunch break.
- Note that I never listen to voicemail.
- I check email routinely throughout the day, as well as once (or more) in the evening and most weekends on my home email address:

<allisor.algonquincollege@pine-ridge.ca>

- It can sometimes be difficult to “drop in” on me except during my scheduled Office Hours. You might want to arrange to see me at a particular time.
By email, right?
- By the way, I never listen to voicemail.
- Check my timetable on my door or the course web page. If you can't keep an appointment, let me know ahead of time by some means (except voicemail).
- Did I mention that I never listen to voicemail?
Sometime I won't even answer a ringing telephone, especially if I'm talking to someone in my office.
- Emailed HTML is an abomination encouraged by Those People (aka The Evil Empire). Friends don't let friends use HTML in email!
- And finally, don't rely on my voicemail since I never (ever!) use it.

Grading scheme

You must achieve a passing grade on each of these parts in order to pass this course.

I. Practical

a) Your lab assignments (normally 3 or 4) contribute 25% to your total mark. A complete solution is not necessary (but recommended); partial marks may be given.

b) Each lab period includes an in-lab exercise. You do this exercise in the lab and demo it. There are 10 to 12 exercises (plus your lab book) that contribute 25% to your total mark.

NOTE: An assignment or exercise that is not completed on time (unless an extension has previously been allowed, unlikely as that may be!) will not be marked and will receive a mark of 0 (zero). You do not have to hand in all assignments and/or exercises, but it's to your own benefit to complete them anyway, marks or not.

You must achieve a passing grade on each of these parts in order to pass this course.

II. Theory

a) The two mid-term tests are spaced about 5 weeks apart. Each test may include questions from all material covered to date, but each one will focus on the material from the preceding weeks. They contribute 25% to your total mark, 10% from the first and 15% from the second.

b) There will be a final exam at the end of the semester covering the whole course, for 25% of your total mark. Note that the final may be different in style from the mid-terms, since there is more time available (2 hours).

NOTE: You cannot “make up” an exam or test, either for a poor grade or missing the examination entirely.

In summary,
you must pass each section :

Practical – you must pass the total

Lab assignments	25%
In-lab exercises	25%
Total-P	<u>50%</u>

Theory – you must pass the total

Mid-term exam 1	10%
Mid-term exam 2	15%
Final exam (2 hours)	25%
Total-T	<u>50%</u>

Grand Total	<u><u>100%</u></u>
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Lectures

- Attendance at lectures is not required – unless you plan to pass the course, that is. Yes, I take attendance at lectures. Just because, that's why.
- Arrive on time; it's not nice for your classmates to have someone interrupt their lecture.
- Come prepared: pen and paper would be handy. Some students print out the lecture notes ahead of time, and make brief notes right on them! How brilliant!
- Sleep, read, play games, listen to music, whatever, just don't distract anyone but yourself.
- If your cellphone rings, leave to answer it. Don't bother to return (see “interruptions” above).

Labs

- I will be the lab instructor for all of the lab sections.
- Every section will have identical assignments and due dates, and every section will have identical exercises.
- Both assignments and exercises will be graded in the same manner for each section.
- If you're having difficulty, see me. Don't delay!
- Attendance is not mandatory, but is required if you want to pass. You will sign-in using your page that I will circulate in a folder each week; if you miss seeing it, come and find it.
- Your lab exercise marks (each out of 5) will be recorded in the lab sign-in book on your page.
- You will keep your marked exercises in your own Lab Book (neat, tabbed, complete) which will be graded.

Lab Assignments

- Normally, labs are due by noon on the date given, usually Monday. Labs not handed in on time get a mark of **zero**.
- **You can work in pairs and submit a single copy of the assignment** (but not the lab exercises) **with both names on it**. If you don't both work on all parts of the assignment together, then one of you will have trouble on the exams.
- They must be cleanly printed on 8½ x 11-inch paper and clearly labelled. An envelope is **not** usually necessary.
- An electronic copy is **not** required unless it is specifically requested – paper only.
- If I can't read it I can't mark it. No hand-writing, do use labels on sections and files, and be reasonable (I don't need a book).
- Write your name, student number, course name/number and section, and the assignment name/number clearly on a cover page, along with a brief table of contents and the dates due and submitted.

Lab Exercises

- Lab attendance is not mandatory, but it's a good idea.
- At each lab, there will be a relevant lab exercise. They don't always use all the lab time, but they may require extra time, too.
- **Prepare for them. Read them over before you come to lab, and research as necessary. You can even start early if you wish.**
- If you don't demo your work in the lab when requested, then there's no mark for it. Zero. Don't be late.
- At the start of each lab, get the lab sign-in book, find your page, and sign in for the appropriate week. Then get started on the exercise. You did prepare for it, right?
- I may put hints or clues on the board from time to time, but I will not normally lecture in the labs.

The 7 Habits of Highly Effective Students

1. Lectures: Attend them all. Arrive on time. Stay alert and attentive. Sit close to the front where you can easily see and hear. Print lecture notes ahead of time and bring them. Read the topic the night or morning before each lecture. Actively participate in the lecture by considering the material being presented, asking relevant questions, and taking notes on important areas and examples.

2. Labs: Attend them all. Arrive on time. Prepare for labs in advance by reading the lab material and doing the lab preparation work. Start working as soon as possible. Prepare for any demo of your work well before the end of the lab. If there is a lecture portion in the lab, see Lectures above.

The 7 Habits of Highly Effective Students

3. Assignments: Avoid delay; start at once. Read the requirements very carefully. Ask questions of your professor so you understand the entire assignment. Meet target dates. Follow all submission requirements. Review comments on marked assignments. Ask your professor for clarification if you don't understand them. If you should have done better, make sure you understand where and why you were wrong.

4. Study: Establish a routine. Choose good times and locations. Set achievable goals. Start immediately. Review course material regularly by topic. Study from your lecture notes, your lab work and notes, and previous tests and assignments. Understand where you lost marks. Keep a file for each course with all your notes, lab preparation material, completed lab work, and returned assignments, tests, and quizzes. Increase your study hours before a test, especially on recent topics.

The 7 Habits of Highly Effective Students

5. Tests: Read over the test instructions carefully before starting to write. Answer the questions in any order, but first read over the whole test. Budget your time, by marks. When an answer takes too long, switch to another and return to it later. Bring spare pens or pencils, an eraser, and a short ruler.

6. Timing: Work every day to your defined schedule. Plan to spend at least 1 to 1½ times as much time on study and assignments as you spend in class. See your program flowchart for a time estimate (x/y/z: x, lecture hours; y, lab hours; z, study hours; all times are per week). Stick to your schedule but if you fall behind do extra work to catch up. Your professor can help you make the best use of your time.

The 7 Habits of Highly Effective Students

7. Professors: Learn their office hours, whether they take appointments, and their use of email. Ask for help when you need it, with prepared questions. You should meet with your Academic Advisor at least annually about your progress in your program.

CST8177 (Linux II) is a 3/2/4 course:

- lectures are 3 hours weekly;
- labs 2 hours;
- study 4 hours weekly for an average student;
- you may need a little more or a little less;
- remember that C is an average grade.

Textbooks and stuff

The textbook (used in Linux I):

"A Practical Guide to Red Hat Linux Administration"
College edition (or later), by Mark Sobell, Prentice Hall,
ISBN 0-13-714295-1

Or equivalent, such as:

"A Practical Guide to Fedora and Red Hat Enterprise Linux"
4th edition (or later), by Mark Sobell, Prentice Hall,
ISBN 0-13-706088-2

And if you wish, the optional:

"Unix Shells by Examples"
4th edition (or later), by Ellie Quigley, Prentice Hall,
ISBN 0-13-147572-X

Please get it/them as soon as possible. You will start using them soon, and I will be suggesting readings from them.

You will also need your disk caddie from level 1 with a base OS (Windows or Linux, suit yourself) that has VMware installed and at least 2 VM partitions with Linux (Fedora 14).

There are also many excellent online resources, but remember Sturgeon's Law: "90% of everything is crud".

- There is a lot of misleading, poor, or downright bad information out there, so check and re-check.
- As an example, you can go and visit the Jargon File at <http://catb.org/~esr/jargon/html/>, specifically the entry [B/bullschildt.html](http://catb.org/~esr/jargon/html/B/bullschildt.html), which says:

bullschildt: /bul´shilt/, n.

[comp.lang.c on USENET] A confident, but incorrect, statement about a programming language.

This immortalizes a very bad book about C, Herbert Schildt's C - The Complete Reference. One reviewer commented "The naive errors in this book would be embarrassing even in a programming assignment turned in by a computer science college sophomore."

man Pages

- All Linux and UNIX systems have a set of online documentation called the **man** pages – ***man*** for *man*ual, naturally.
- Some systems will also have other information sources and may have a viewer available from the GUI desktop.
- Man pages are also being supplanted by newer sources of information, like **info**. There are often still referred to as **man** pages, though.
- Use the **man** pages, often. In other words, **RTFM**.
“Read The Fine Manual”
- Use this command to learn about using the **man** pages:
man man
- Don't ask a question of your neighbour in the lab (or me) until you have checked the relevant **man** pages.

- You can do a keyword search by entering either of the following two commands (they are equivalent):
man -k <some keyword>
or
apropos <some keyword>
- You can search for strings by entering **/string[ENTER]**, where **string** is what you want to find. To search again, simply enter **/** alone. To search backwards, use **?**
- See **man less** (really! **less** is now **more**) for details.
- The general statement for **man** is of this form:
man [-<options>] [section] title

Find out about the **man** section numbers, what the main sections identifiers are and what they mean.

For example, **crontab** is found in both sections 1 and 5, so you must use **man 1 crontab** or **man 5 crontab** to select it (1 is the default here). Reference to one particular form of a command is usually shown in a form like **crontab(1)**, **crontab(5)**, or even **crontab(1p)** for some purposes.

How to read technical material

- **Read the words**
 - What a concept!
 - No, really: **read** them

How to read technical material, 2

- **Take some notes**

- Did you come across a key item?
- Is it useful, interesting, or likely of future value?
- Does it seem puzzling or contradictory?

How to read technical material, 3

- **Re-read sections**

- Look at your notes for issues and concerns
- Can you resolve an apparent contradiction?
- What does the relevant **man** page have to say?
- Test it on a computer if appropriate
- Check another textbook or try googling for more information

How to read technical material, 4

- **Answer the questions in the Exercises (in writing!) for each chapter**
 - If the question requires writing a script, then write and debug it completely.
 - Don't just read the questions, actually answer them
 - Yes, in writing: it's now part of your notes!

What is an operating system?

"The operating system manages the resources of the computing environment by providing a hierarchical file system, process management, and other housekeeping functions [so that the user is not burdened with these tasks]."

-- "The UNIX System",
S. R. Bourne, 1983

What is an operating system?

Practically speaking, the operating system manages:

- **Processes**
user application programs as well as essential services, such as the **cron** service running as **crond** and known as the **cron daemon**;
- **Resources**
the allocation of processor time, memory, and I/O devices among the various processes which use them;
- **File System**
including all I/O devices and some things made to look like devices (such as **/dev/kmem** or **/proc** in Linux);
- **Security Services**
to protect against inadvertent as well as malicious damage to the file system and other resources (**login** is only the beginning).

An Operating System Structure

- Three software layers are typically used to describe the Unix or Linux system:
- The **kernel** layer: This runs the hardware and allocates resources, sharing them where necessary. The **file system** is often a separate process, as are other parts of the kernel and various service **daemons**.
- The **shell** and other basic utilities layer: When you type in a command, it's to the shell at the command-line interface (or CLI). Some commands are built-in to the shell (e.g., **cd** for change directory) and others are programs or filters (like **grep**, global regular expression print). All will use **system calls** to get kernel services, and some will use X Window services for graphics.
- The **applications** layer: Where programs like **firefox** and **vi** (actually **vim** in our lab) will run, also using system calls to request services from the kernel.