ULI101: INTRODUCTION TO UNIX / LINUX AND THE INTERNET

WEEK 1: LESSON 1

COURSE INTRODUCTION / UNIX AND LINUX BACKGROUND
ACCESSING YOUR LINUX MATRIX SERVER ACCOUNT

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LESSON 1  TOPICS

Why I am Taking This Course? (Course Introduction)
- Instructor Information / Purpose of Course
- Foundations For Future Courses (Programming, Networking)
- Course Resources / Course Outline / Course Policies

Background and Features of UNIX and LINUX OS
- Purpose of an OS / History of Unix and Linux OS
- Features of Unix and Linux OS

Matrix Linux Server
- Purpose / Layout:
  - How to Access your Matrix Linux Account:
    - From Seneca Lab Workstation
    - From Laptop or Home Computer / From Other OS Platforms (Mac OSX, Linux)
  - How to Logout of your Matrix Linux Account
COURSE INTRODUCTION

Why am I Taking This Course?

Regardless of the IT program that you are currently registered in, there are important technical skills that you must learn in order to be successful in future courses for your program.

In this course, you will learn core utilities to work productively in a Unix / Linux operating system environment including the following topics:

- Manipulating data stored in files
- Managing files and directories
- Using Linux commands and utilities
- Writing basic shell scripts
- Configuring login accounts
COURSE INTRODUCTION

Foundation for Future Courses

Learning how to work productively in the Unix / Linux environment will help you in future courses. The following table shows the various courses based on the networking / programming streams.

<table>
<thead>
<tr>
<th>Networking Stream</th>
<th>Programming Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPS235</strong> (Intro to Linux Admin)</td>
<td><strong>IPC144</strong> (Intro to Programming)</td>
</tr>
<tr>
<td><strong>OPS335</strong> (Network Admin)</td>
<td><strong>OOP244</strong> (Object Oriented Programming I)</td>
</tr>
<tr>
<td><strong>OPS435</strong> (Linux Admin Automation)</td>
<td><strong>OOP345</strong> (Object Oriented Programming II)</td>
</tr>
<tr>
<td><strong>NDD430</strong> (Network Diagnostics &amp; Design)</td>
<td><strong>WEB322</strong> (Web Programming Tools)</td>
</tr>
<tr>
<td><strong>OPS535</strong> (Advanced Network Admin)</td>
<td><strong>WEB422</strong> (Web Programming Apps &amp; Services)</td>
</tr>
<tr>
<td><strong>OPS635</strong> (Enterprise Management)</td>
<td><strong>JAC444</strong> (Intro to Java)</td>
</tr>
</tbody>
</table>

+ Pro-Option Courses

+ Pro-Option Courses
# COURSE INTRODUCTION

## Course Resources

<table>
<thead>
<tr>
<th>Resources</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULI101 Website:</strong></td>
<td>• Course Outline / Course Policies</td>
</tr>
<tr>
<td><a href="https://ict.senecacollege.ca/~uli101/">https://ict.senecacollege.ca/~uli101/</a></td>
<td>• Weekly Schedule <em>(notes, tutorials)</em></td>
</tr>
<tr>
<td><strong>ULI101 WIKI:</strong></td>
<td>• Assignment Instructions</td>
</tr>
<tr>
<td><strong>Textbook (Not Required):</strong></td>
<td>• Reference Guide</td>
</tr>
<tr>
<td>A Practical Guide to Linux Commands,</td>
<td>• Additional Examples</td>
</tr>
<tr>
<td>Editors and Shell Programming by Mark</td>
<td>• <strong>NOTE:</strong> Available online via Seneca Library</td>
</tr>
<tr>
<td>Sobell</td>
<td></td>
</tr>
<tr>
<td><strong>The Linux Documentation Project</strong></td>
<td>• Vast online Linux Documentation</td>
</tr>
<tr>
<td><a href="http://en.tldp.org/">http://en.tldp.org/</a></td>
<td>• <strong>HOWTOs, Guides, FAQs</strong></td>
</tr>
</tbody>
</table>
COURSE INTRODUCTION

Professor Information (note and record following information in class)

- Full Name
- Office Location (How to book an appointment)
- How to Contact Professor:
  - E-mail Address
  - Instructor Web-Site
COURSE INTRODUCTION

Course Outline
Link: https://ict.senecacollege.ca/course/uli101/

Topics
• Course Description
• Modes of Instruction
• Evaluation / Promotion Policy
• Learning Outcomes / Topic Outline
COURSE INTRODUCTION

Course Policies

Link: https://wiki.cdot.senecacollege.ca/wiki/Course_Policies_for_UL1101

Topics

• Assignments
• Quizzes, Midterm Test, and Examination
• Cheating & Plagiarism
• What constitutes cheating?
• General Information
Purpose of an Operating System

An operating system basically performs 2 general tasks:

1. **Manages Resources** to provide a **platform** for application to run
2. **Interface** to allow the OS to communicate with the end-user (**Humans**)

Over time, operating systems used a **command line interface**, then evolved into a **menu-driven interface**, then finally a **graphical user interface** (**GUI**).

Modern operating systems combine the use of **ALL** the above-named types of interfaces to help accommodate all users preferences.
UNIX AND LINUX BACKGROUND AND FEATURES

History of Unix

Although Unix was not the first operating system, it made a huge impact in the 70’s and is still a popular OS today.

Interesting Facts:

• Developed in the early 70's by Ken Thompson as a platform to play a crude network strategy-based game called “space travel”.

• OS was developed at AT&T Bell labs, but it took the company a few years to realize that OS would be popular and marketed proprietary version that became Unix System V (release 4).

• While Ken Thompson took a break from work and taught at University of Berkley California, he provided students source code to OS and Shell (interface) which branched into a free version of the OS that became BSD (Berkley Software Distribution) Linux.
UNIX AND LINUX BACKGROUND AND FEATURES

History of Unix

• Unix was developed to incorporate the following features:
  • Allows for multiple users – this is performed by assigning each user a “small slice of time” to give illusion that computer is paying total attention to that user.
  • Allows for multi-tasking – allows for more than one task to be executed at the same time (e.g. via a “time-slice”).
  • Supports multi-processing (allows tasks to be performed on multiple processors).
  • Simplifies sharing of data and programs among users.

• Unix evolved at the time that ARPANET (ancestor to the Internet) was evolving which made it easier to setup computer networks and use networking and eventually Internet related utilities.
UNIX AND LINUX BACKGROUND AND FEATURES

History of Unix

• Unix was re-written using the C programming language to make the OS more portable to install and run on other types of computers.

• Hardware manufacturers modified UNIX to run on their systems and added enhancements.

• Versions of Unix (both propriety and free) became standardized to be accepted and used by industry and government organizations (e.g. POSIX standard).
UNIX AND LINUX BACKGROUND AND FEATURES

History of Linux

Richard Stallman published the GNU Manifesto in 1984, which described the need for Free Software ("Free in the sense of free speech, not free beer"). The resultant GNU project developed free, open source replacements for most of the Unix programs, but not for the Unix kernel (the core program that interacted with and controlled the hardware).

These programs were released under the GNU General Public License (GPL), which permits anyone to copy, use, and modify the software, as long as these rights are preserved for anyone receiving a subsequent copy of the software.
History of Linux

In 1991, Linus Torvalds, a Finnish computer programming student, released the Linux kernel, eventually placing it under the GPL. The Linux kernel, GNU software, and some other components can be combined into a powerful, Unix-like operating system (it can’t technically be called Unix, because it has never been certified to be Unix, but virtually everyone in the industry regards it as such).

The combined GNU and Linux system is called GNU/Linux by some but just Linux by others (much to the dismay of Richard Stallman, who feels that the simple name Linux downplays the tremendous contribution made by the GNU Project).
While attending Seneca College, you will be using many different computer systems to perform various operations. Below is a listing of a few of these servers:

- **my.senecacollege.ca** - Learning Content Management System (Student Grades / Notes / Online Quizzes)
- **ict.senecacollege.ca** - Main ICT Webserver
- **wiki.cdot.senecacollege.ca** - Course WIKIs for Seneca College Students
- **matrix.senecacollege.ca** - Linux Account for Student Practice and Assignment submission

A **shell** is an interface / interpreter to allow a user to communicate with the Linux computer system.

Although you need to study concepts throughout this course, you will also need to learn to **issue and memorize simple as well as more advanced Linux commands**. This requires that you practice issuing Linux commands on a frequent basis to become more comfortable when working the Unix and Linux command-line environments.
UNIX AND LINUX BACKGROUND AND FEATURES

Types of Interfaces:

Command Line Interface (CLI)

Allow users and administrators to only interface with the computer’s operating system by issuing commands. Useful for administrators since there may be commands that are hidden and not available.

The CLI Linux is called the “shell” most likely since the interface wraps around the Linux Kernel like an “outer shell”.

Graphical User Interface (GUI)

Allow users to interface with the computer’s operating system in a user-friendly fashion. GUI allows for graphical, menu, and CLI which accommodates most users.

For example, a file manager application would be considered a graphical shell.
The Matrix server consists of several Virtual Computers connected together to form a cluster. A cluster is a cost effective alternative to buying larger servers.

All registered students in this course have access to an account on the Matrix server. You will be using this account for the following reasons:

- Issuing Linux commands
- Practicing Linux commands at the Linux shell to be more productive
- Performing Linux Practice Tutorials
- Performing Linux Assignments (3)
- Practice Issuing Linux Command Review Questions
MATRIX LINUX SERVER

Accessing Matrix from Within College:

You can access your Matrix Linux account from a workstation located in any Seneca lab, or from your own computer (e.g. laptop or home computer).

Accessing Matrix from Lab Workstation:

MyApps is an application streaming service that lets you run software on any Seneca Workstation on demand. Any software application on the MyApps menu can be used on computers in classrooms, labs, and the Computing Commons.

Reference: https://inside.senecacollege.ca/its/software/myapps/
MATRIX LINUX SERVER

Accessing Matrix from Remote Computer:

Due to the COVID19 Pandemic, ICT students are required to learn remotely (i.e. not at Seneca College).

Therefore, you will learn how to run an application called SSH that will securely connect you to your Matrix account. You can do this by command-line (eg. ssh) or run a graphical SSH application (eg. SSH Secure Shell Client)
MATRIX LINUX SERVER

Accessing Matrix Using New Windows 10, Mac OSX or Linux Computer:

SSH from Windows 10 OS (Newer Version)

- From the start menu, type cmd and click on cmd icon to launch.
- In the command line, enter the following command: `ssh senecacusername@matrix.senecacollege.ca`
- Enter your password when prompted., answer yes to any questions it may ask you.

SSH from macOS

- In a new Finder window, open: Applications > Utilities > Terminal
- On the command line, type: `ssh senecacusername@matrix.senecacollege.ca`
- Enter your password when prompted. Answer yes to any questions it may ask you.

SSH from Linux

- Open up the "Terminal" (the command line). Choose Applications > System Tools > Terminal.
- On the command line, type: `ssh senecac username@matrix.senecacollege.ca`
- Enter your password when prompted. Answer yes to any questions it may ask you.
MATRIX LINUX SERVER

Accessing Matrix Using Graphical SSH Application in Windows

You can also install and run a free graphical SSH application in order to connect to your Matrix account. You may find it useful when running a graphical SSH application to copy and paste text.

• Click the following link to download and install application on your Windows computer: http://www.sfsu.edu/ftp/win/ssh/SSHSecureShellClient-3.2.9.exe

• After the application has been installed, it should appear as an application icon on your desktop. Double click the SSH Secure Shell Client application icon.

• The main SSH Client window will appear. Click on the Quick Connect button.
Matrix Linux Server

Accessing Your Matrix Account:

You will need to provide the domain name of the Matrix server, your username and password to access the Matrix server. Your Matrix username and password is identical to your myseneca username and password.

Note: You can use the hostname matrix since you are located inside Seneca’s network. If you were located outside Seneca’s network, then you would need to enter the full domain name: matrix.senecac.on.ca or matrix.senecacollege.ca
MATRIX LINUX SERVER

Connecting to the Seneca Global Portal

As of September 1, 2020, all Seneca College students are required to connect to the Seneca Global Portal in order to be able to connect to their Matrix Linux account. Seneca College are "rolling-out" additional measures to improve network security. One of these measures are to implement multi-factored authentication.

Multi-factor authentication is an electronic authentication method in which a computer user is granted access to a website or application only after successfully presenting two or more pieces of evidence (or factors) to an authentication mechanism: knowledge (something the user and only the user knows).

Reference: https://en.wikipedia.org/wiki/Multi-factor_authentication

NOTE: If you haven't done this yet, please perform the steps provided in the following link: https://inside.senecacollege.ca/its/services/vpn/
Instructor Demonstration:

Your instructor will demonstrate how to connect to the Matrix server.
MATRIX LINUX SERVER

Accessing Your Matrix Account:

When connecting securely for the first time, a dialog box will appear to share a "public key" with your Matrix account in order to make your interaction between your workstation and the remote Linux server secure within the network (i.e. encrypted to prevent unauthorized access by other users).

Matrix has only a Command Line Interface (CLI)

The Matrix server has been configured to allow users to only interact with the Linux OS by issuing commands. There are various reasons for this, but the main 2 reasons are to force students to learn how to issue Linux commands as well as limitations to remote access to a graphical Linux server due to large number of users (students).

Later in the course, your instructor may demonstrate other ways of accessing graphical versions of Linux, and how to launch a shell terminal.
Logging Out of Your Matrix Linux Account:

When you want to log-out of your Matrix server account, you can enter the commands `exit`, `logout`, or press the shortcut keys: `<ctrl><d>`

**NOTE:** You should exit by issuing a command or shortcut keys as opposed to closing the SSH application window.
HANDS-ON TIME / HOMEWORK

1. Get Acquainted with the ULI101 WIKI, notes, tutorials and resources.

2. Perform the following investigations in Tutorial 1:

   INVESTIGATION 1: ACCESSING YOUR MATRIX LINUX ACCOUNT
ULI101: INTRODUCTION TO UNIX / LINUX AND THE INTERNET

WEEK 1: LESSON 2

USING YOUR LINUX MATRIX SERVER ACCOUNT
GETTING PRACTICE / STUDENT LEARNING GROUPS
PERFORMING ONLINE ASSIGNMENTS

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LESSON 2 TOPICS

Using Your Matrix Account
  • Issuing Linux Commands / Arguments / Options
  • Command Line Editing
  • General Linux Commands

Getting Practice Issuing Linux Commands
  • In-class Exercises (Handout / To be Taken-up in Next Class)
  • Student Learning Groups
  • Performing Assignments

Homework
  • Perform Assignment #1 (Sections: 1 and 2)
USING YOUR MATRIX ACCOUNT

Linux Command Structure

`command argument1 argument2 ...`

Some Linux commands can be issued by entering the Linux command line without arguments (e.g. `pwd`, `date`, `ls`, `cal`), but some Linux commands can be issued with arguments (e.g. `cal 2002`, `cd /bin`, `ls -la`).

An **argument** can be a **pathname**, **text**, **option**, etc. For example:

- The `ls` command displays a listing of filenames in the current directory
- The `ls /bin` command displays a listing of filenames in the `/bin` directory (as opposed to your current directory)
- The `ls -l` command displays a detailed listing of filenames in the current directory
- The `ls -l /bin` command displays a detailed listing of files in the `/bin` directory
Getting Help with Linux Commands

With the Linux OS containing over 2500 commands and utilities, it is good for a Linux user or sysadmin to learn about how to use commands “on-the-fly”.

The `man` command can provide information on how to use a command (i.e. `usage, arguments, options, examples`). The commands are classified into sections or “volumes”.

If you do not know the name of a Linux command, the `man` utility can be used with the `-k` option to help list Linux commands that match a text pattern that is contained within the help screen for a Linux command.
USING YOUR MATRIX ACCOUNT

Getting Help with Linux Commands

You can use the following short-cut keys within the man command to help navigate throughout this utility to get help with the ls command (refer to table below):

<table>
<thead>
<tr>
<th>Keyboard Shortcut</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER</td>
<td>Move down one line</td>
</tr>
<tr>
<td>SPACEBAR</td>
<td>Move one screen down</td>
</tr>
<tr>
<td>&lt;ctrl&gt;&lt;b&gt;</td>
<td>Move one screen up</td>
</tr>
<tr>
<td>/pattern/</td>
<td>Search for Pattern</td>
</tr>
<tr>
<td>q</td>
<td>quit man utility</td>
</tr>
</tbody>
</table>
### Using Your Matrix Account

#### Command Line Editing

Learning **shortcut keys** in any OS terminal will allow you to be more productive as a sysadmin. You will focus on learning a few common Bash Shell keyboard shortcut keys and learn where you can access online help for additional shortcuts (if required).

<table>
<thead>
<tr>
<th>Shortcut Key(s)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;ctrl&gt;</code>&lt;l&gt;</td>
<td>Clear Screen</td>
</tr>
<tr>
<td><code>&lt;ctrl&gt;</code>&lt;u&gt;</td>
<td>Clear Command Line</td>
</tr>
<tr>
<td><code>&lt;Up Arrow&gt;</code> , <code>&lt;Down Arrow&gt;</code></td>
<td>Scroll Up / Down Command History</td>
</tr>
<tr>
<td><code>&lt;Backspace&gt;</code> , <code>&lt;ctrl&gt;</code>&lt;Backspace&gt; , <code>&lt;ctrl&gt;</code>&lt;h&gt;</td>
<td>Delete character before the cursor</td>
</tr>
<tr>
<td><code>&lt;ctrl&gt;</code>&lt;w&gt;</td>
<td>Delete word before the cursor</td>
</tr>
<tr>
<td><code>&lt;ctrl&gt;</code>&lt;a&gt;</td>
<td>Move cursor to beginning of command line</td>
</tr>
<tr>
<td><code>&lt;ctrl&gt;</code>&lt;e&gt;</td>
<td>Move cursor to end of command line</td>
</tr>
</tbody>
</table>
USING YOUR MATRIX ACCOUNT

General Linux Commands

Your instructor will demonstrate several basic Linux commands to get practice how to issue Linux commands and using arguments and options.

<table>
<thead>
<tr>
<th>Shortcut Key(s)</th>
<th>Arguments / Options</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>pwd</td>
<td></td>
<td>Display Current Working Directory</td>
</tr>
<tr>
<td>cd</td>
<td>dir-pathname</td>
<td>Change Directory</td>
</tr>
<tr>
<td>ls</td>
<td>-l, -a, -R, -d, dir-pathname</td>
<td>List Files of Directory</td>
</tr>
<tr>
<td>cal</td>
<td>month, year</td>
<td>Display calendar</td>
</tr>
<tr>
<td>date</td>
<td></td>
<td>Display date and time</td>
</tr>
<tr>
<td>who</td>
<td></td>
<td>List users logged into server</td>
</tr>
<tr>
<td>whoami</td>
<td></td>
<td>Display username of user logged in</td>
</tr>
<tr>
<td>clear</td>
<td></td>
<td>Clear Screen</td>
</tr>
<tr>
<td>passwd</td>
<td>username</td>
<td>Change user’s password</td>
</tr>
</tbody>
</table>
GETTING PRACTICE ISSUING LINUX COMMANDS

**Review Questions / In-class Exercises**

Your instructor may provide additional practice questions for the students to practice and may be taken up in class.

**Perform Online Assignments**

Complete online assignments sections in a timely manner. Students can perform the assignment sections more than one for reinforcement and will NOT affect the recorded completion of the assignment section performed previously.
GETTING PRACTICE ISSUING LINUX COMMANDS

The Learning Centre offers:

**ONE-ON-ONE TUTORING**
Appointments focused on your individual needs that explain course concepts.

**SUPPORTED LEARNING GROUPS (SLG)**
Student-led and collaborative study sessions that review practical examples based on the course content. Link: [https://library.senecacollege.ca/learningcentre/slg](https://library.senecacollege.ca/learningcentre/slg)

**ENGLISH LANGUAGE SUPPORT**
Offered through individual appointments or group learning sessions to focus on grammar, academic writing, conversation, and pronunciation.

**STUDY SKILLS**
Learn time management, exam preparation, critical thinking, note-taking, and reading.
HOW TO BECOME SUCCESSFUL IN THIS COURSE

Performing Online Assignments

You are required to perform 3 online assignments during this course.

Online assignment are used to teach and reinforce Linux commands and techniques as well as using Linux commands to perform tasks and test students.
HOW TO BECOME SUCCESSFUL IN THIS COURSE

Performing Online Assignments

To run your assignment 1 in your Matrix account, issue the following command: ~uli101/assign1

A screen similar to the one displayed on the right will appear.

Select the letters corresponding to the correct ULI101 section and professor and press ENTER

**WARNING**: You need to select the CORRECT section for the course which you belong to. If you do NOT select your correct section, your assignment may not be recorded for marks!
HOW TO BECOME SUCCESSFUL IN THIS COURSE

After you have selected your course section, there will be a screen that provides several important notes before proceeding. Please take a few moments to read those notes and press ENTER to proceed.

The assignment main menu will then be displayed (refer to diagram).

Near the bottom of the window, you will see "You are currently registered to" followed by the section letter and instructor name.

Double-check your course timetable to confirm that this the correct section letter. If you have selected the WRONG section, type C in the menu selection area and press ENTER. You will return back to the original window to select your correct course section.
GETTING PRACTICE ISSUING LINUX COMMANDS

Near the top of the window displays the sections to complete in the assignment. You are NOT required to complete all sections at the same time.

You can check the assignment #1 link on the ULI101 main WIKI page to note the due date for assignment #1. Sections that are NOT completed will be displayed in **reverse video**.

On the other hand, when you complete a section, then the section will appear as regular text (i.e. **not** in reverse video).
If you want to verify that you have completed sections for the assignment, look for the text "Marks earned so far for ULI101 Assignment:" and it will show how many sections have been completed. You can exit the online assignment and complete other sections at a later time.

Make certain to check each assignment in the ULI101 main WIKI for each assignment's due date.

When the assignment main window shows all sections in regular text (not reverse video), then your assignment has been completed and you should receive full marks provided you have selected your correct course section and you have completed the assignment on time.
HANDS-ON TIME / HOMEWORK

1. Get Acquainted with the **ULI101 WIKI**, **notes**, **tutorials** and **resources**.

2. Perform the following investigations in **Tutorial 1**:

**INVESTIGATION 2: USING THE LINUX SHELL / ONLINE ASSIGNMENTS**

**LINUX PRACTICE QUESTIONS** 1 – 9 (will be taken up at beginning of next class)

3. Perform following sections for **online assignment #1**:
   - **Section 1**
   - **Section 2** (Parts 1, 2 & 3)