AIR FORCE ASSOCIATION'S

CYBERPATRIOT

NATIONAL YOUTH CYBER EDUCATION PROGRAM

UNIT SEVEN

Introduction to Linux and Ubuntu

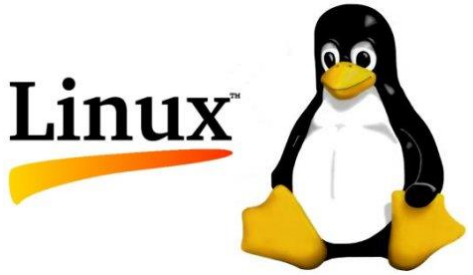
www.uscyberpatriot.org

SECTION ONE

What is Linux?

A Family of Operating Systems

- Linux refers to a family of operating systems modeled off of Unix
- Can perform many of the same functions as Windows or OS X
- Built in a collaborative, open-source environment
  - Anyone may use, modify, or distribute the Linux kernel
  - Anyone can develop software to run on the Linux kernel
  - Many programmers collaborate to develop or improve Linux programs
  - Many Linux operating systems and add-on programs are free



Source: http://scienceblogs.com/gregladen/category/technology/linux/

Sources: http://www.linuxfederation.com/linux-everywhere/, http://techland.time.com/2012/06/19/what-exactly-is-a-supercomputer/, http://www.unixmen.com/why-do-super-computers-use-linux/

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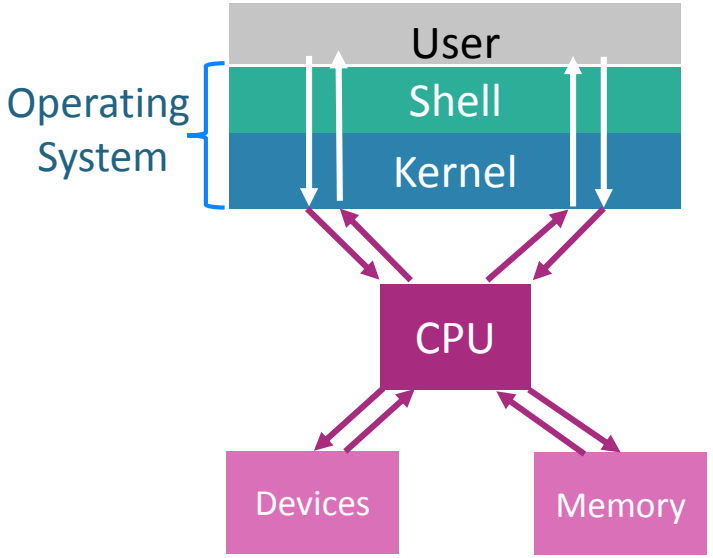
Linux Kernel

- A kernel is the core component of an OS
  - Windows operating systems have kernels, but since they are not open-source or packaged separately for programmers to build off, they are less-often discussed
- Manages system resources (Memory, Processes, Input and Output Devices)
- When a user does something in the shell (the OS's user interface and applications), the kernel translates the command and prioritizes it against other requests for resources, so that it can be understood and executed by the CPU



Source: https://help.ubuntu.com/8.04/serverguide/C/user-management.html

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Different Linux Operating Systems

- There are many different flavors (OSs) built off the Linux kernel
  - Ubuntu: Most popular flavor. It is free and is the most user-friendly.
  - Mint: A popular variation of Linux
  - Red Hat: Designed by a company that develops specialized flavors for government and big business
  - Fedora: An open-source, free version of Red Hat. Used frequently as a test bed for Red Hat programs.
- These flavors are similar at the basic level, but can have very different interfaces and specialized commands.

Source: http://www.ubuntu.com/

Source: http://www.linuxmint.com/

Source: https://fedoraproject.org/

Source: http://www.redhat.com/

Sources: http://distrowatch.com/dwres.php?resource=major, http://www.sitepoint.com/unix-style-operating-systems/

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Differences with Windows

- Cheaper
  - Because Linux is open-source, there is often no cost for flavors or their applications
  - Still many more Windows programs because programmers have a financial incentive to develop them
- Graphical User Interface (GUI) can be changed on Linux
  - Windows and Linux both have GUIs to make it easier for users to navigate them
  - Linux menus, icons, and other components can be more customized than Windows ones
- Some tasks can only be run in the command line
  - Command line is a GUI alternative that allows users to execute commands by text
- Less malware on Linux
  - Since most organizations still use Windows, those systems are more lucrative targets for attackers
  - The open-source Linux community sometimes develops and distributes patches more quickly than Microsoft and Apple
- Certain hardware is not built to work with Linux
  - Hardware developers are not as likely to make their products compatible with Linux, as many more people use Windows

Source: http://learntowriteblog.blogspot.com/2011/04/differences-and-similarities-between.html

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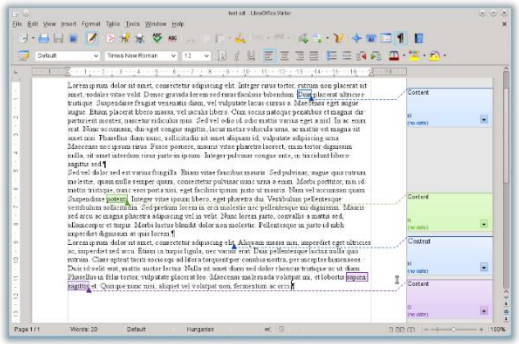
Similarities to Windows

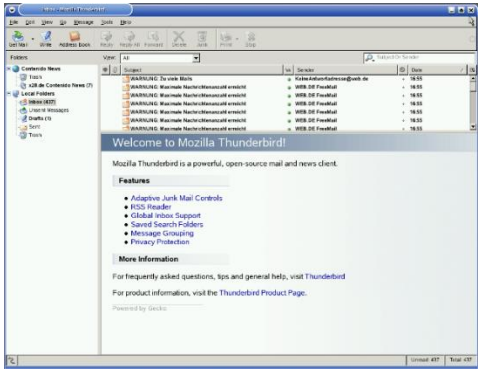
- Can be servers and workstations
  - Linux servers and workstations are more similar than Windows ones. Linux servers come pre-installed with server applications
- Can complete similar tasks
  - There are Linux programs that function like to Microsoft Office (LibreOffice), Outlook (Thunderbird), etc.
- Are stable and have significant support
- Subject to very similar vulnerabilities
  - Linux systems are targeted less frequently by malware, but still have many of the same vulnerabilities and patches (firewalls, password policy, etc.)

LibreOffice



Source: http://es.libreoffice.org/assets/Uploads/EN-Project_images/4.0NewFeatures/Writer/Comment-text-range.png?r=45758

Mozilla Thunderbird



Source: http://commons.wikimedia.org/wiki/File:Mozilla_thunderbird_empty_screenshot.png

Sources: https://help.ubuntu.com/community/ServerFaq#What.27s_the_difference_between_desktop_and_server.3F, http://blog.computerlagoon.com/2013/04/07/similarities-of-windows-and-linux/

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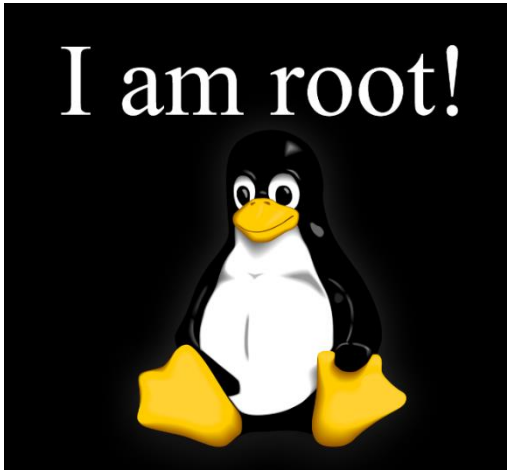
SECTION TWO

Ubuntu Terminology and Concepts

The Root Account

- Account types: User and Root
- Root – the Linux Administrator account
  - Like the built-in Administrator in Windows, Linux comes with a built-in root account
  - A system can have multiple root accounts
  - Users can switch whether their actions are carried out as a user or root
  - When someone enacts root permissions, he or she can access all of the files and run all commands on a system, as well as set policies for other users
- Root actions require a password in both GUI and command line
- Authentication vs. Authorization
  - Root users are authorized to do many different tasks, but they must first authenticate their identity by entering their password



Source: http://eswalls.com/wp-content/uploads/2014/01/i-am-root.png

Source: http://www.cyberciti.biz/faq/authentication-vs-authorization/

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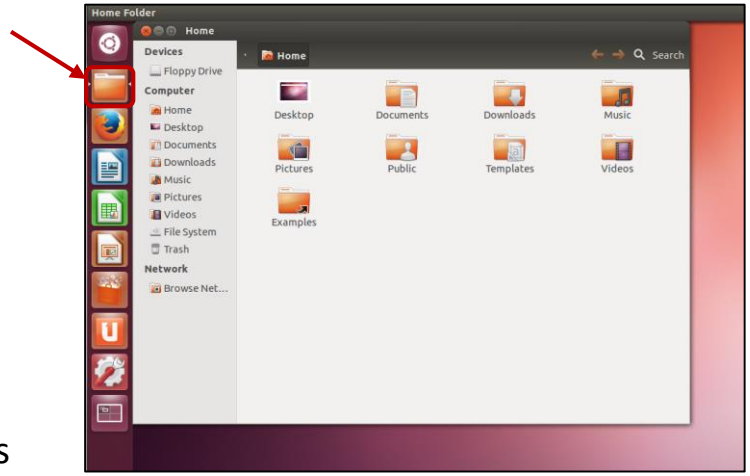
Ubuntu File System

- Different than the Windows file system
  - Does not specify on which drive a folder is stored and uses forward slashes (/) to identify root directories
- Example:
  - Windows: C:\Documents\hello.txt
  - Linux: /home/CyberPatriot/hello.txt
- Important folders:
  - /home: stores each user's documents, media files, etc. Users can only access their own folders, unless they have enacted root permissions
  - /boot: contains startup files and kernel files. Should not be modified unless you are an expert user.
- The file system can be accessed by clicking the orange folder on your Ubuntu menu bar



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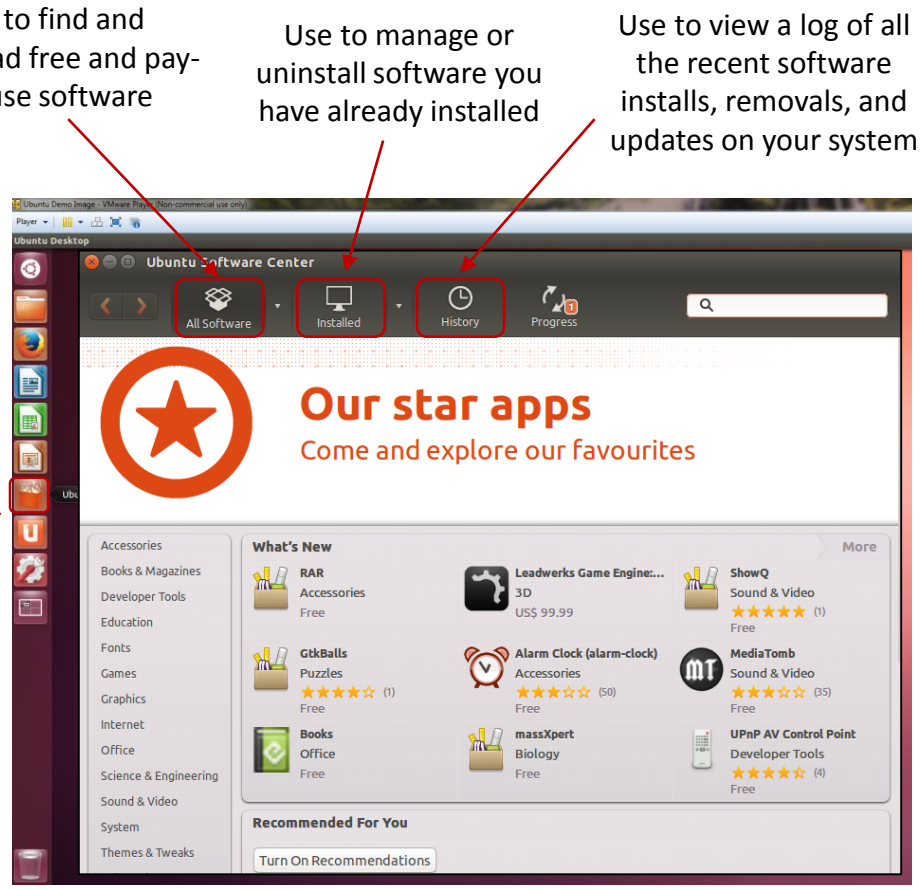
Adding and Removing Software

- Linux software is bundled into packages
- Packages are managed by package managers
  - In Ubuntu, the package manager is called “Ubuntu Software Center.”
  - It looks and functions a lot like Mac’s App Store
  - Many programs are free
- To access Ubuntu Software Center, click the shopping bag on your Ubuntu menu bar
- Users must enact root permissions to install, uninstall, or modify software.



Source: https://help.ubuntu.com/community/InstallingSoftware

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SECTION THREE

Introduction to Ubuntu Command Line

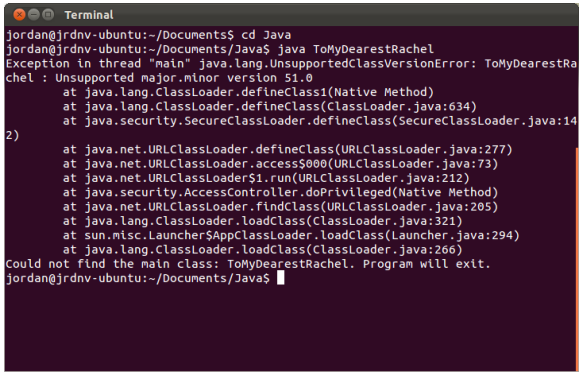
Command Line Pros and Cons

Pros

- Provides the user more control
  - Unlike the GUI, which pre-programs certain tasks, command line allows you to send more detailed and customized commands
- Only option for some tasks in Ubuntu
- Saves clicking time because it just requires a keyboard
- Uses less of the computer's processing power than the GUI (no animations or graphical processing)
- Can be made easier with scripting
  - Scripts are sequenced lists of commands that allow users to send multiple commands at once
  - Can be used for routine tasks like backing up files, monitoring a system, and quickly gathering information about memory and processes

Cons

- Not as user-friendly
  - Requires memorizing commands or using a reference
- Harder to multitask
  - Having multiple command line windows open at once can be confusing, since they look nearly identical



Source: http://i.stack.imgur.com/2hBJf.png

Source: http://www.computerhope.com/issues/ch000619.htm

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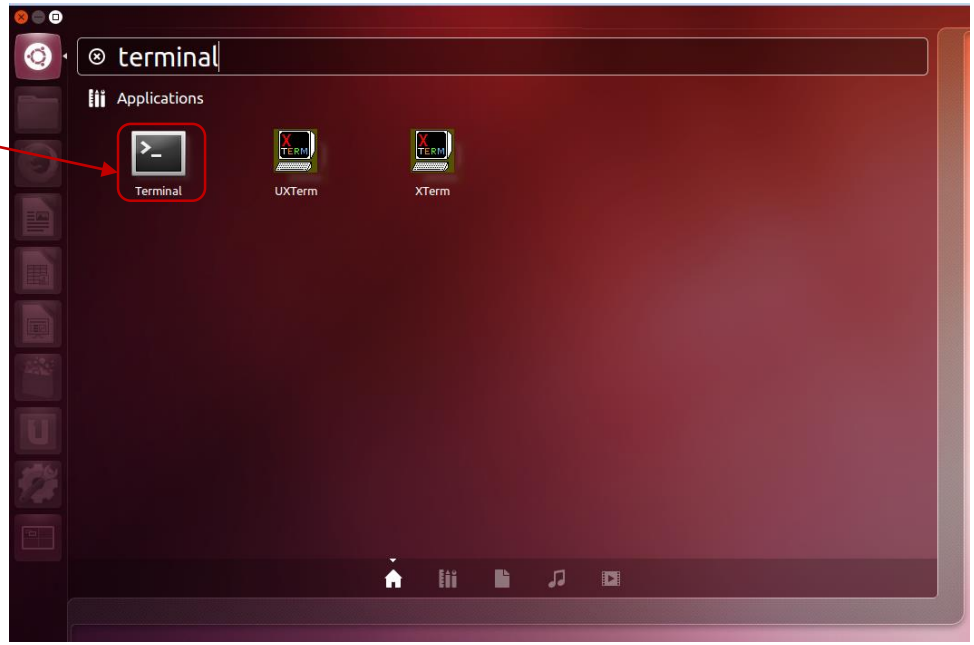
Accessing Terminal

- Command line is accessed through a program called Terminal
- Click the Ubuntu Button on the Ubuntu menu bar→ Search "Terminal" → Open Terminal



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Using Terminal

- When typing commands in Terminal, it is very important to pay attention to capitalization and spaces
- Hitting Enter will execute your command and hitting Ctrl+D will close any commands you have running or exit the Terminal
- There are numerous Ubuntu command databases and command line tutorials online. Here are a few sites:
  - https://help.ubuntu.com/community/UsingTheTerminal
  - http://ryanstutorials.net/linuxtutorial/
  - http://manpages.ubuntu.com/
  - http://ubuntu-manual.org/

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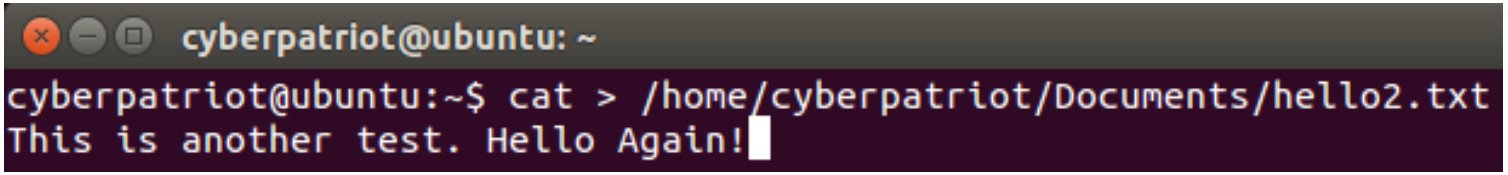
Sample Command

1. In Terminal, type

   `cat -n > /home/cyberpatriot/Documents/hello2.txt`

   **Make sure to capitalize Documents and to put the spaces before –n, >, and /home

2. Hit `Enter` to execute the command
3. Type `This is another test. Hello Again!`



4. Hit `Enter` to execute the command
5. Type `Ctrl+D` to close your commands

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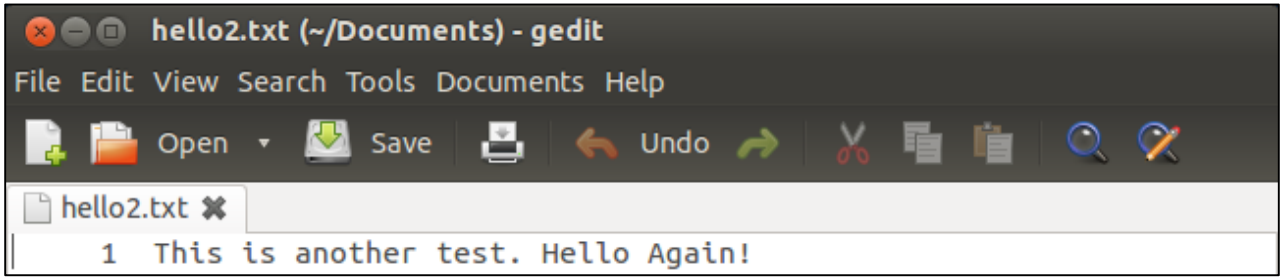
Sample Command (cont.)

1. Close Terminal and open the Home Folder by clicking the orange folder on the Ubuntu menu bar
2. Navigate to the Documents folder
3. Double-click the hello2.txt file



- The commands you just entered created this text document
  - It includes the file name you selected, the text typed, and a “1” at the beginning of the line of text. The next few slides will examine why.

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Command Syntax

- Rules that govern how command are written
  - Writing commands requires some memorization. However, commands all have common components.
- Similar to English grammar in that there are different components and they must be in a certain order to be understood by the audience

English Grammar Example:
The boy pet the dog.

Subject – The boy

Verb - pet

Object – the dog.

- We know that the subject (the boy) is performing an action (petting) and that action is happening to the object of the sentence (the dog).
- A different order (e.g. Verb+Subject+Object) does not make sense
- Command Syntax similarly dictates meaning and governs sequencing

Source: http://www.linfo.org/cat.html

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Command Syntax

(First command from Slide 15)

- Command: tells computer what you want it to do
  - All other components of the syntax depend on what the command is
  - The “cat” command creates, displays, or copies files
- Option: customizes the output of the command
  - “-n“ told the computer to add a number to each line of text in the file you created
  - The effect an option has varies by command
  - Not required for all commands
- Operator: directs the output of the command
  - Not required for all commands
- File Name/Location: Tells the OS to which file you want the command and options to happen
- Like English sentences, Command Syntax can get very complex

Source: http://www.linfo.org/cat.html

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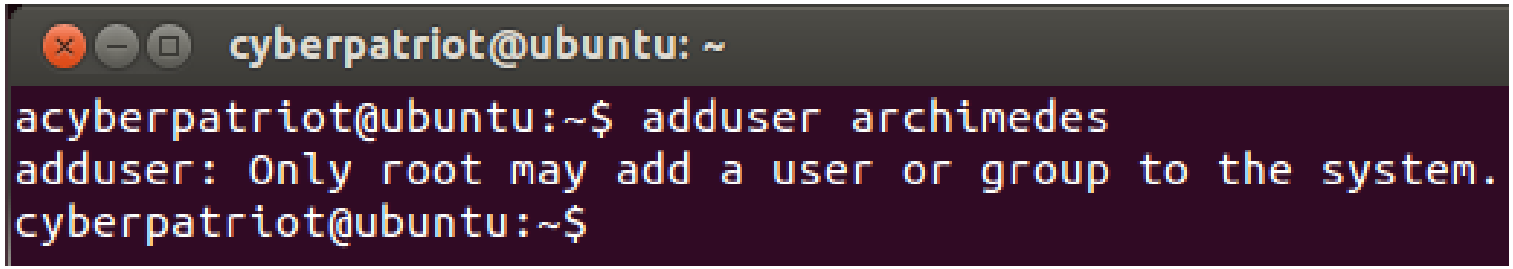
The sudo Command

- Allows an authorized user (one with root permissions) to temporarily elevate their privileges using their own password instead of having to know the password belonging to the built-in root account
- This command must be used to perform administrative tasks (e.g. adding a user account)
  - Example: To add “archimedes“ as a user on your system, type `adduser archimedes` and hit `Enter`
  - You will get the error message below because you have not authenticated yourself
  - Note: user names must be lower case



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The sudo Command (cont.)

- Now try adding “archimedes” as a user by entering the sudo command first:
  - Type `sudo adduser archimedes`
  - Hit `Enter`
  - When prompted, type in your password and hit `Enter`
    - Note: Your password will not be visible when you type. This is an Ubuntu security feature.
    - Remember, the sudo command will only work if your are using an account with root permissions
  - When prompted, type a password and any other details you wish to add to the user account
  - Hit `Enter`

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The sudo su Command

- The sudo su command is a variation of the sudo command
  - It tells the command line that you want to run all of the subsequent commands in your current session as root, so that you do not have to enter the sudo command and your password each time
- Try adding “riemann“ as a user on your system using the sudo su command:
  - Exit the Terminal and then restart it
  - Type `sudo su`
  - Hit `Enter`
  - When prompted, type in your password
  - Type `adduser riemann`
  - Hit `Enter`
  - Type a password and any other details you want to add to the user’s account
  - Hit `Enter`

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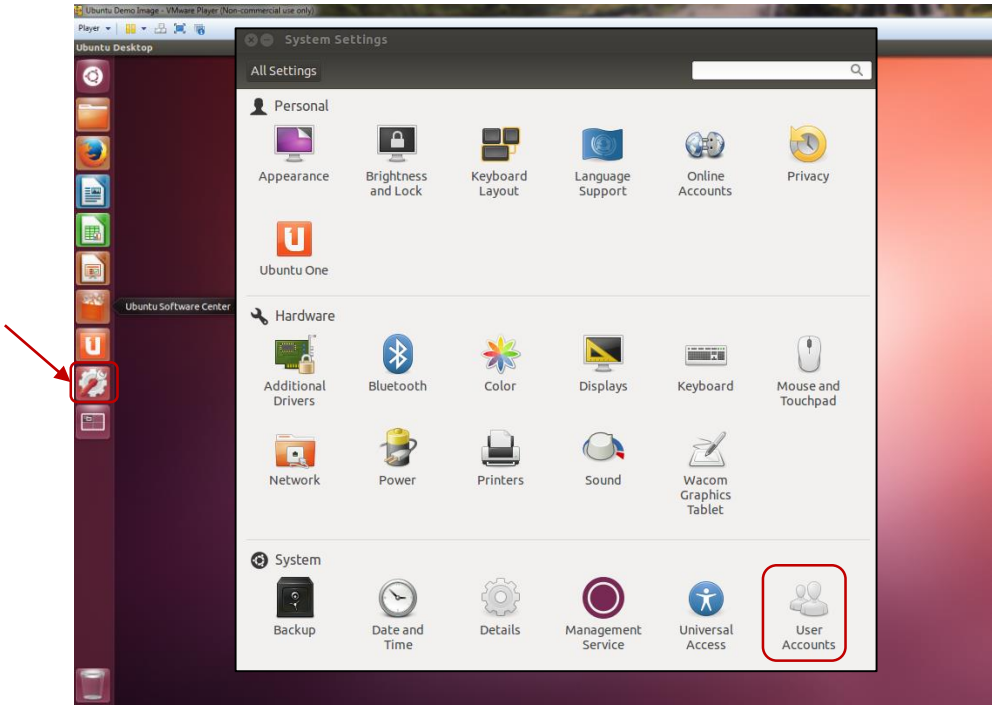
Confirm Creation of User Accounts

- To check that accounts for “archimedes” and “riemann” were created when you entered your commands, click the gear icon on your Ubuntu menu bar and click the User Accounts button



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