## Introduction to Linux



"Linux at the Command Line"

Don Johnson of BU IS&T

### About the class...

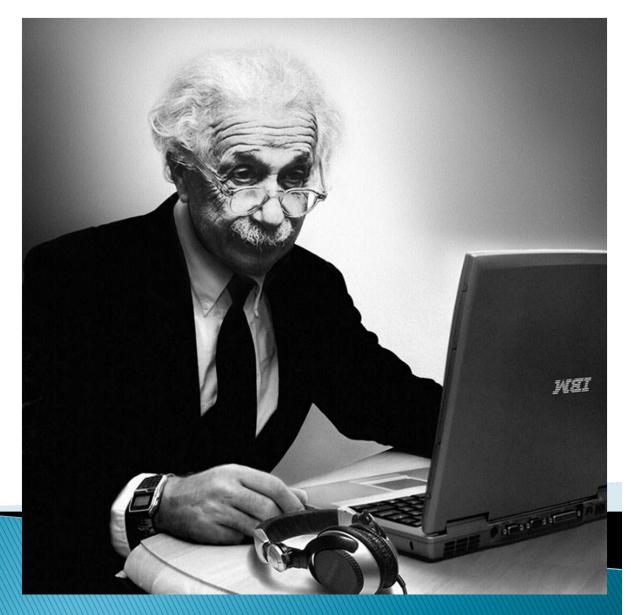
- We'll start with a sign in sheet.
- We'll end with a class evaluation.
- We'll cover as much as we can in the time allowed; if we don't cover everything, you'll pick it up as you continue working with Linux.
- This is a hands-on, lab class; ask questions at any time.
- Commands for you to type are in BOLD

# What is Linux?



The Most Common O/S Used By BU

Researchers When Working on a Server or Computer Cluster



### What is Linux?

- Linux is a Unix clone begun in 1991 and written from scratch by Linus Torvalds with assistance from a loosely-knit team of hackers across the Net.
- 64% of the world's servers run some variant of Unix or Linux. The Android phone and the Kindle run Linux.

# What is Linux? Linux + GNU Utilities = Free Unix



Linux is an O/S core written by Linus Torvalds and others AND



a set of small programs written by Richard Stallman and others. They are the GNU utilities.

http://www.gnu.org/

#### What is Linux?

"Small programs that do one thing well" (see unix-reference.pdf)

- Network: ssh, scp
- Shells: BASH, TCSH, clear, history, chsh, echo, set, setenv, xargs
- System Information: w, whoami, man, info, which, free, echo, date, cal, df, free
- Command Information: man, info
- ▶ Symbols: |, >, >>, <, ;, ~, ., ..</p>
- Filters: grep, egrep, more, less, head, tail
- Hotkeys: <ctrl><c>, <ctrl><d>
- File System: Is, mkdir, cd, pwd, mv, touch, file, find, diff, cmp, du, chmod, find

File Editors: gedit, nedit

# Connecting to a Linux Host – Windows Client Software

You need a "xterm" emulation – software that emulates an "X" terminal and that connects using the "SSH" Secure Shell protocol.

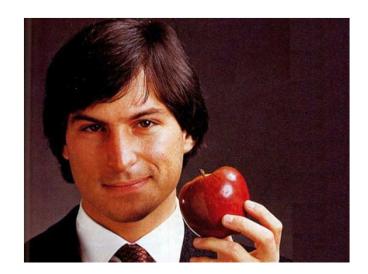


- Windows
  - Use StarNet "X-Win32:" http://www.bu.edu/tech/support/desktop/ distribution/xwindows/xwin32/



# Connecting to a Linux Host – Mac OS X Client Software

- Mac OS X
  - "Terminal" is already installed
  - Why? Darwin, the system on which Apple's Mac OS X is built, is a derivative of 4.4BSD-Lite2 and FreeBSD. In other words, the Mac is a Unix system!



## Let the Linux Lab Begin!





Your Instructor Today

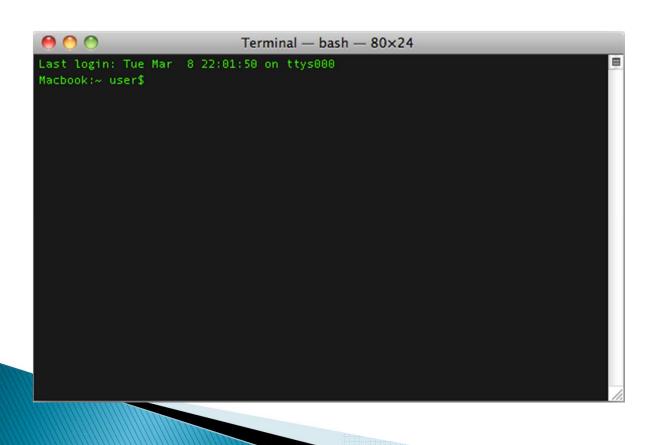
The Ideal Lab Facility

# Connecting to a Linux Host – Windows Client

- X-Win32/X-Config
  - Wizard
    - Name: scc1
    - Type: ssh
    - Host: scc1.bu.edu (Off-campus, must include domain "bu.edu")
    - Login: <userlD>
    - Password: <password>
    - Command: Linux
  - Click "scc1" then "Launch"
    - Accept the host server public key (first time only)

# Connecting to a Linux Host – Mac OS X Client

- Terminal
  - Type ssh –Y scc1.bu.edu (less secure)



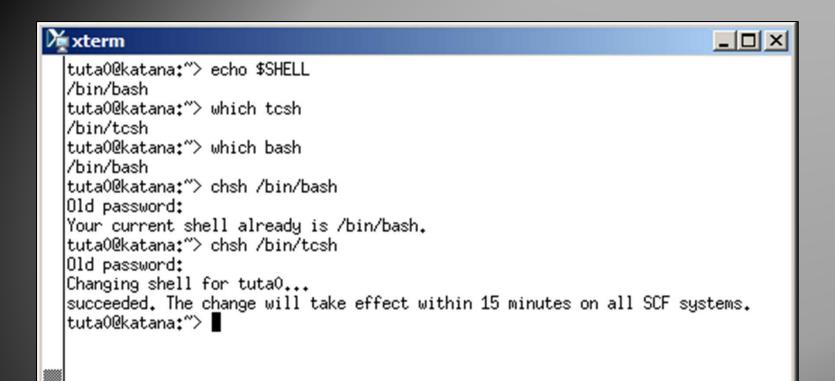


## Obtaining the Course Material

- From the lab computer
  - Using File Explorer, copy the directory "\\scvfiles.bu.edu\SCV\Training\2013 fall tutorials\linux\_class" to "My Documents" on your lab machine
- Linux
  - Connect to scc1.bu.edu using X-Win32 and run this command:
    - cp –Rv /project/earth/linux\_class ~/
- From a browser, download: http://ssrc.bu.edu/linux\_class

### The Shell

- A shell is a computer program that interprets the commands you type and sends them to the operating system. Secondly, it provide a programming environment consisting of environment variables.
- Most BU systems, including the BU Linux Cluster, support at least two shells: TCSH and BASH. The default shell for your account is TCSH. The most popular and powerful Linux shell today is BASH.
- To determine your shell type:
  - echo \$SHELL (shell prints contents of env
  - echo "\$SHELL" (shell still processes env. variable)
  - echo '\$SHELL' (shell treats env. variable as simple literal)
- The complete environment can be printed with set, setenv (TCSH) and set (BASH).
- ▶ To determine the path to the shell program, type:
  - which bash
  - which tcsh
- Change the shell with "chsh /bin/bash" (provide path to new shell as a "parameter," meaning to be explained soon)



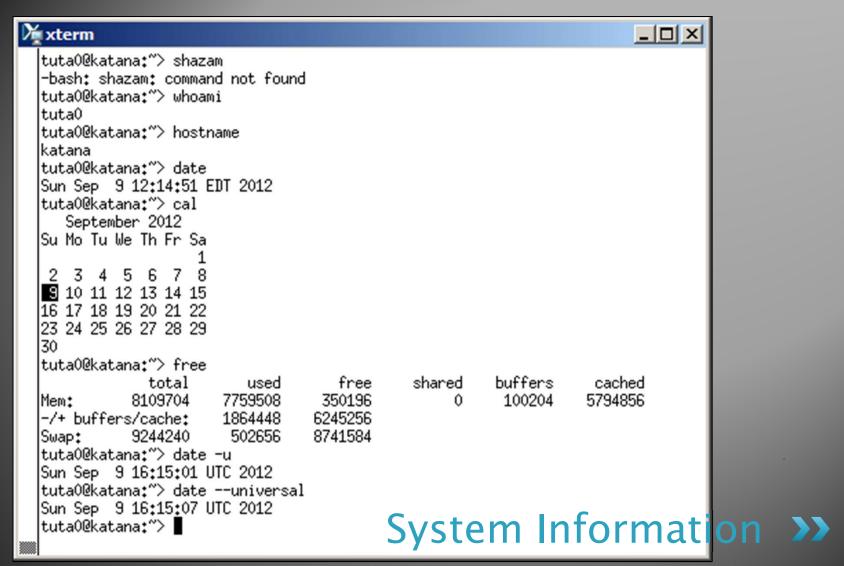
The Shell >>>

Output of the echo, which and chsh commands

### System Information

- After you connect, type
  - shazam
  - whoami
  - hostname
  - date
  - cal
  - free
- Commands have three parts; *command*, *options* and *parameters*. Example: **cal** -j 3 1999. "cal" is the command, "-j" is an option (or switch), "3" and "1999" are parameters.
- Options have long and short forms. Example:
  - date -u
  - data --universal

What is the nature of the prompt?
What was the system's response to the command?



Output of the whoami, hostname, date, cal and free

# Command History and Simple Command Line Editing

- Try the history command
- Try <Ctrl><r> (only works in BASH shell)
- Choose from the command history by using the up ↑ and down ↓ arrows
- What do the left ← and right → arrow do on the command line?
- Try the <Del> and <Backspace> keys

### Help with Commands

- Type
  - hostname --help
  - man hostname
  - info hostname (gives the same or most information, but must be paged)
- And "Yes," you can always Google it

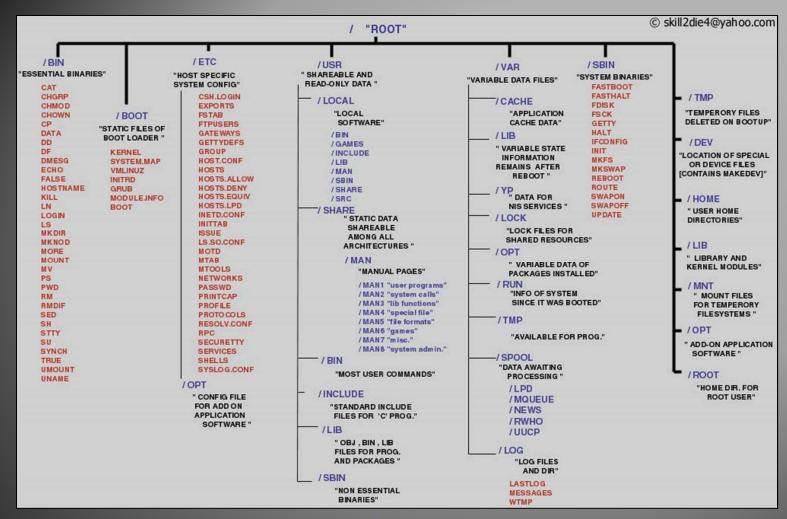


# Connect Commands Together with the Pipe Symbol "|" and Using Filters

- The pipe "|" feeds the OUTPUT of one command into the INPUT of another command. Our first example will use the pipe symbol to filter the output of a command. Try:
  - W
  - w | grep 'root'
  - ps -e -o ruser,comm | grep 'tut'
- The ps command is using both "options (dash)" and parameters
- Try both "man grep" and "info grep". See the difference?

## The Linux File System

- The structure resembles an upside down tree
- Directories are collections of files and other directories.
- Every directory has a parent except for the root directory.
- Many directories have children directories.
- Unlike Windows, with multiple drives and multiple file systems, a \*Nix system only has ONE file system.



#### The Linux File System >>>

A Typical Linux File System

### Examining the File System

#### Try

- tree -L 3 -d / | less
- tree -L 3 / | less
- file /bin/alsac then press <tab>
- cd ~; pwd (This is your home directory where application settings are kept and where you have write privileges)
- S
- mkdir myPics;mkdir myPics/work;mkdir myPics/friends;mkdir myPics/friends/BU; mkdir myPics/friends/MIT
- tree myPics

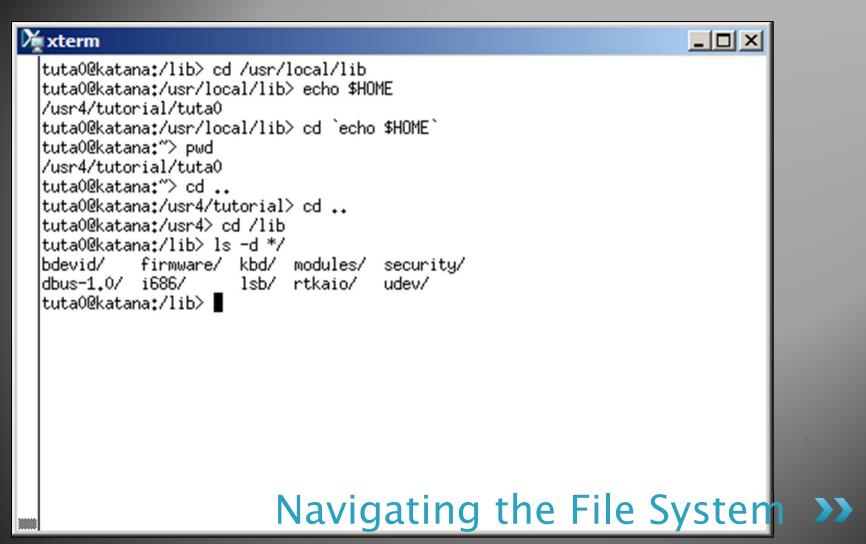
```
_ | N
xterm
  katana: " % tree -L 3 -d / I head -3
  I-- bin
  I-- boot.
  katana:" % tree -L 3 / 1 head -3
  I-- bin
     I-- alsacard
  katana: " % file /bin/alsacard
  /bin/alsacard: ELF 64-bit LSB executable, AMD x86-64, version 1 (SYSV), for GNU/
  Linux 2.6.9, dynamically linked (uses shared libs), for GNU/Linux 2.6.9, strippe
  katana:" % cd " ; pwd
  /usr4/tutorial/tuta0
  katana:" % ls
  Desktop/
                  bupage.html
                                  helloworld.c
                                                 untitled folder/
  bin/
                  helloworld*
                                  test.sh*
  katana:" % mkdir myPics ; mkdir myPics/work ; mkdir myPics/friends ; mkdir myPic
  s/friends/BU ; mkdir myPics/friends/MIT
  katana:" % tree myPics
  myPics
  I-- friends
      I-- BU
      `-- MIT
   -- work
  4 directories, 0 files Examining the File System >>>
  katana:" %
```

Output from the tree, file, pwd and Is commands

Demonstration of using the mkdir command

## Navigating the File System

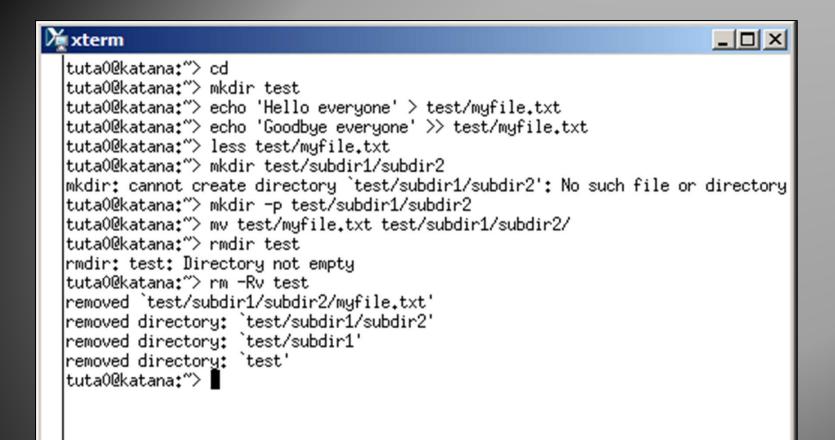
- There are two types of pathnames
  - Absolute (Abs) the full path to a directory or file;
     begins with the root symbol /
  - Relative (Rel) a partial path that is relative to the current working directory
- Examples
  - Abs cd /usr/local/lib
  - echo \$HOME (one of may environment variables maintained by the shell)
  - Abs cd `echo \$HOME`
  - pwd
  - Rel cd ...
  - Rel cd ..
  - Abs cd /lib (location OS shared libraries)
  - Is -d \*/ (a listing of only the directories in /lib)



Moving around the file system using the cd command

## Modifying the Linux File System

- More useful commands
  - cd (also takes you to your home directory like cd ~)
  - mkdir test
  - echo 'Hello everyone' > test/myfile.txt
  - echo 'Goodbye all' >> test/myfile.txt
  - less test/myfile.txt
  - mkdir test/subdir1/subdir2 (FAILS)
  - mkdir –p test/subdir1/subdir2 (Succeeds)
  - mv test/myfile.txt test/subdir1/subdir2
  - rmdir test (FAILS)
  - rm –Rv test (Succeeds)



### Modifying the Linux File System >>>

Demonstration of the mkdir, less, mv, rmdir and rm commands

### The List Command

- Useful options for the "Is" command:
  - Is -a List all file including hidden file beginning with a period "."
  - Is -Id \*/ List details about a directory and not its contents
  - Is -F Put an indicator character at the end of each name
  - Is –I Simple long listing
  - Is -Ih Give human readable file sizes
  - Is –IS Sort files by file size
  - Is –It Sort files by modification time

### File Editors

- Emacs
- Vim
- Nedit
- Gedit
- Emacs and Vim are powerful editors used by most programmers. Nedit and Gedit and easy to learn editors useful for new users on a Linux system.

# Finis

