Linux Systems Administration
Getting Started with Linux

Network Startup Resource Center
www.nsrc.org

Who Are We Teaching?

- You have experience with Linux or Unix
- Real-world experience
- You have an Intermediate level of knowledge
- **Are we right?**

Objectives

- Review Core Concepts & Terminology
  - System Access
  - Users: Types, Changing, Acting as Others
  - Shells
  - User Processes
  - File System Layout
  - Editors
  - Editing Configuration Files
  - Software Management
  - Managing Services & Processes
  - Checking System & Memory Load

Log into your Systems

- ssh host***N*.ws.nsrc.org** user **sysadm**
  - where ***"N"*** is the number of your host
  - lab password is written on the board
- Windows Users: use puTTY
- Mac and Linux Users: from your terminal

System Access

- Logging In Locally
  - With a “GUI” or Graphical User Interface
  - With a “CLI” or Command Line Interface
- Logging in Remotely
  - From Windows, with puTTY
  - From Linux or Mac, with ssh
- Requirements:
  - You need a username and password
  - These were given out in class

Types of Users

- Root User
  - The Super User
- Normal User
  - The sysadm account
- System User
  - An account used by an application

The Super User

- By default, one account can do anything: **root**
- Some Linux distributions disable logging in as this user
- Root is powerful
  - It can change (or delete) any file
  - It can perform any function
- Root is dangerous
  - Inexperienced users can break a system
  - Root can be exploited by attackers
- Limit what Root can do remotely – if you allow at all.

Normal Users

- A standard user account
- Can log in and access a home directory
- Can have group permissions
- Can read/write/execute in its home directory
- Cannot start or stop the system
- Cannot start or stop system services
- Standard user accounts are safer than root

System Users

- A user account used by a program
  - ftp, www-data, postgres, ntp
- Typically cannot log in interactively
- May or may not have shell access
- Can have group permissions
- System Users are safer than other users
  - Don't run applications as root
  - Don't run applications as a normal user

Become Another User (like root)

- su: “substitute user identity”
- Syntax: su [options] [username]
  - If no username, “root” is assumed
- su will ask you for the target user's password
- A new shell is opened as that user
- Quit the shell by typing “exit”

Execute a Command as Another User

- sudo:
  - executs a single command as another user
- sudo syntax:
  - Sudo [options] [-u user] command
- If no user is specified, root is assumed
- New shell opens with other user's privileges
- The specified command is executed
- The shell is exited

Shells

- Command Line Interface (CLI) for executing programs
  - Windows equivalent: command.com or command.exe
- Also programming languages for scripting
  - DOS/Windows equivalent: batch files, VBScript
  - Linux/Unix: Perl, php, python, etc.
- You have a choice of similar shells
    - sh: the “Bourne Shell”. Standardized in POSIX
    - bash: the “Bourne-Again Shell”. POSIX + command history
    - Others: csh, ksh, tcsh, zsh

User Processes

- Programs you run, typically interactively
  - *including the shell!*
- Often-used programs have short, cryptic names
  - ls, cp, rm, pwd, cd, cat, less, mkdir, mv, rm, man
- Hundreds of programs included in base systems
  - In embedded Linux and Linux routers, sometimes these are combined into a single binary called BusyBox
- Thousands of programs can be downloaded, free
- Thousands more can be purchased

Common Commands

- **ls**: list the contents of a directory
- **pwd**: print working directory
- **cd**: change directory
- **mkdir**: make a directory
- **cp**: copy
- **mv**: move
- **rm**: remove
- **man**: display the manual

Software Management @ the CLI

- dpkg is the Debian/Ubuntu software manager
  - **dpkg --get-selections**: see what's installed
  - **dpkg-reconfigure**: reconfigure a package
  - **dpkg --purge**: remove software & its config files
- apt is the best way to use dpkg
  - **apt-cache search**: see what's available
  - **apt-get update**: get a new list of what's available
  - **apt-get install**: install software & its dependancies

The Format of a Command

command [options] parameters

- Commands are programs
- Options modify commands
  - Typically a dash followed by a letter (-v)
  - Some utilities also allow dash dash word (--verbose)
- Commands act on Parameters (ls -al /etc)
- Spaces are critical “-- help” != “--help”

Command Examples

- Display a list of files in the current directory:
  - **`ls`**
- Display a list of files in a long listing format:
  - **`ls -al`**
- Display a list of files in another directory:
  - **`ls -al /etc`**
- What else can you do with ls?
  - **`man ls`** to find out

Command Examples

- Equivalent ways to use: ls -alh
  - **`ls -lah`**
  - **`ls -l -a -h`**
  - **`ls -l -all --human-readable`**
- There is no -- option for **`-l`**
- Read the man page, or type **`ls --help`**

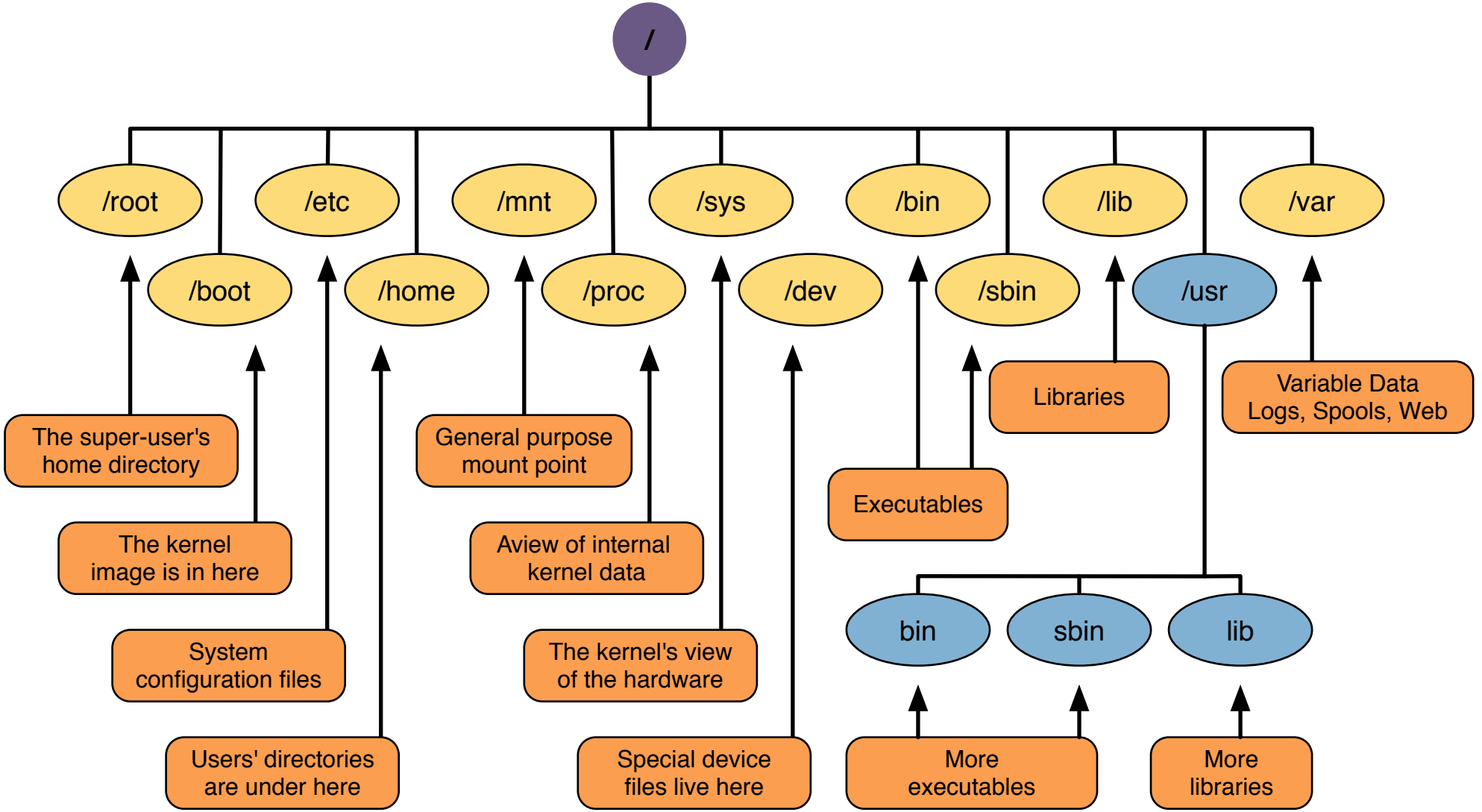
Stopping Command Output

- A command keeps going?
- Stop it with ctrl-c
  - `root@librenms:~# ping nsrc.org`
  - `PING nsrc.org (128.223.157.19) 56(84) bytes of data.`
  - `64 bytes from nsrc.org (128.223.157.19): icmp_seq=1 ttl=51 time=161 ms`
  - `64 bytes from nsrc.org (128.223.157.19): icmp_seq=2 ttl=51 time=159 ms`
  - `^C`
  - **`--- nsrc.org ping statistics ---`**
  - `4 packets transmitted, 4 received, 0% packet loss, time 3005ms`
  - `rtt min/avg/max/mdev = 159.827/161.459/164.534/1.902 ms`
- Stuck in less or another paging application?
  - Press the “q” key

Find & Edit Past Commands

- Try your up arrow
- Now type `history`
- Run a past command by typing `!number`
- Looking for something in particular?
  - `history |grep command-name`
- Don't retype commands
  - It takes longer
  - It can lead to errors

Linux File System



Linux File System

- Today usually a single partition
- Can be spread across multiple partitions
- Partitions can be mounted at various levels
  - /var and /tmp are sometimes different partitions
  - this is safer for experimental or unstable code
  - filling /tmp should not crash your computer!
- Attached or Network drives can be mounted
  - /mnt is a good place for these

Configuration Files

- Text files that tell programs how to operate
- Typically plain text, sometimes XML or similar
- Often are case sensitive
- Sometimes have comments and instructions
  - # is the most common character for comments
  - /* … */, or // are other common comment delimiters
  - Other, less common patterns exist

Configuration File Patterns

- Options are sometimes turned off by default

  ## a description of the option

  ## remove the # below to enable the option

  # default setting = off

- Quotes are used...
  - “sometimes like this”
  - 'sometimes like this'
- Caps and CamelCase can be important

Viewing Configuration Files

- If you want to look, but not touch
  - `cat <filename>` displays a files contents
  - `more <filename>` displays with pagination
  - `less <filename>` paginates with search & more
- Changing files usually requires an editor

Linux Editors

- We will be editing text files in CLI mode
- You can use any editor you want
  - ed, emacs, joe, nano, vi, vim
- Set your favourite program as “editor”
  - **`sudo update-alternatives --config editor`**
- Don't have the editor you want? Install it!
  - **`sudo apt-get install program`**
- We can help you with nano or vi

Linux Editors

- Go to line 99 in a file
  - nano = `ctrl _ 99`
  - vi = `:99`
- Find a string “hello” in a file
  - nano = ctrl w hello
  - vi = /hello (then “n” for next or “N” for previous)
- Save and quit
  - nano = `ctrl o ctrl x`
  - vi = `esc + :wq`
- Use your **Home** and **End** Keys
- Clicking your mouse will not move your cursor

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Services Management

- Startup Scripts
  - /etc/init.d/
  - /etc/init/
- Controlling Services
  - **`sudo service servicename action`**
  - ***start, stop, restart, reload, status***
  - **`/etc/init.d/service action`**

Process Management

- **`ps aux`** see all processes
- **`ps aux |grep apache`** see just apache
- **`sudo kill 1234`** kill process 1234
- **`sudo kill -9 1234`** force kill process 1234
  - If it's hung or stuck and won't quit

Check on the System

- **`cat /etc/*-release`** : find your Linux version
- **`top`** : a real-time view of a running system
- **`free -h`** : show the free memory
- **`df -h`** : show the disk utilisation
- **`netstat -anp |more`** : show net connections
- **`ifconfig -a |grep inet`** : find your IP addresses
- **`sudo iftop -i eth0`** : show network utilisation

Reviewing

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