Campus Network Design Workshop

Introduction to Linux

UNIVERSITY OF OREGON

NSRC
Network Startup Resource Center

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 sysadm@pc1-campusX.ws.nsrc.org

or

ssh pc1-campusX.ws.nsrc.org with user sysadm

- where “X” is the number of your group
- 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

Execute a Command as Another User

- sudo:
  - executes 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

Become Another User (like root)

- Use the sudo command
- To become **root**:
  - sudo –s
- To become another user:
  - sudo –s –u user
- When you no longer need to be **root**, go back to being a normal user:
  - exit
- Do this as soon as you can!

Shells

- Command Line Interface (CLI) for executing programs
  - Windows equivalent: command.com or command.exe or powershell
- 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

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

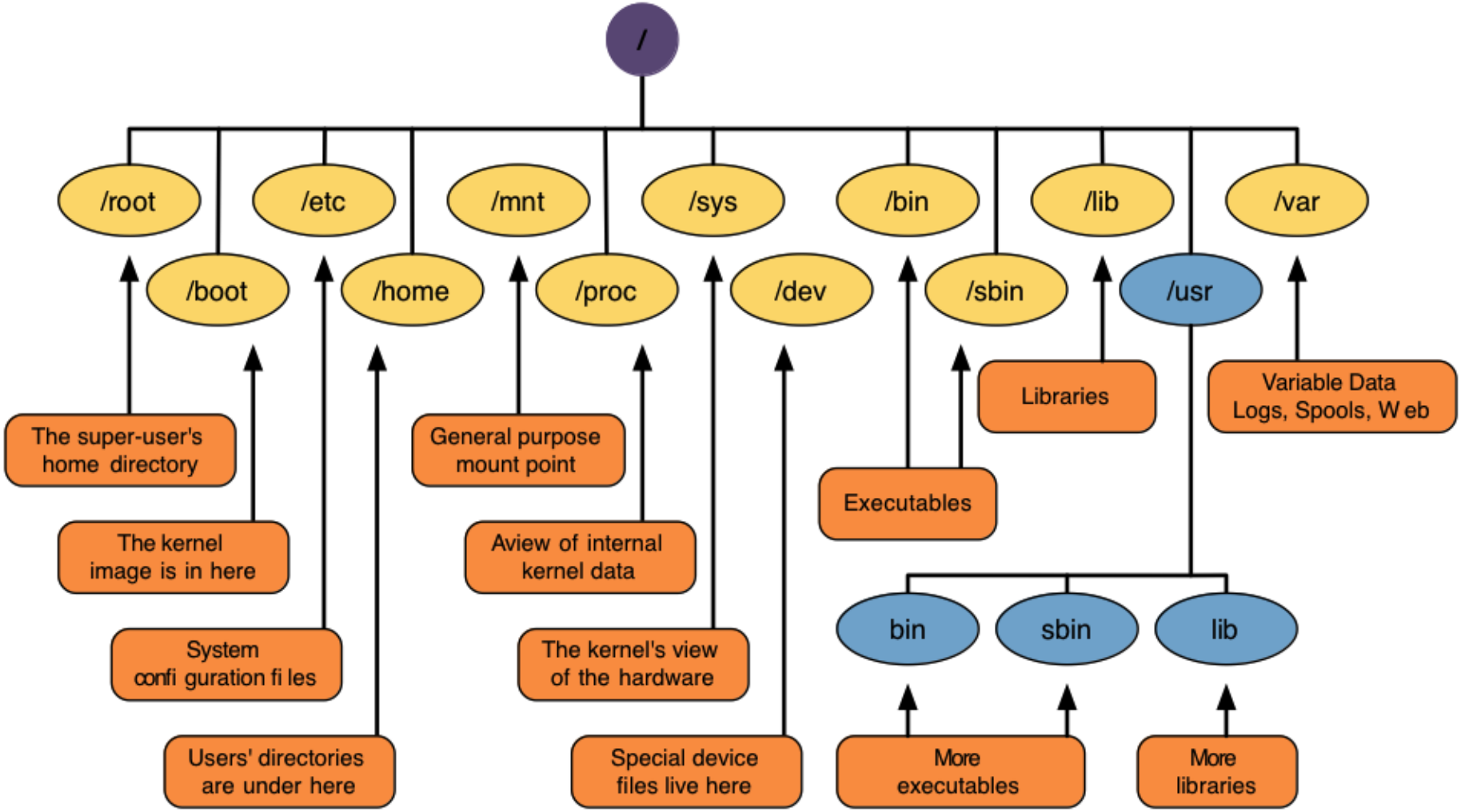
```
root@librenms:~# ping nsrc.org
PING nsrc.org (128.223.157.19) 56(84) bytes of data.
64 bytes from nsrc.org (128.223.157.19): icmp_seq=1 ttl=51
time=161 ms
64 bytes from nsrc.org (128.223.157.19): icmp_seq=2 ttl=51
time=159 ms
^C
--- nsrc.org ping statistics ---
4 packets transmitted, 4 received, 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
  - ; is used in DNS zone files
  - 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
- **Don't use an editor to read files** – you could make a change by accident!

Linux Editors

- We will be editing text files in CLI mode
- You can use any editor you want
  - ee, emacs, joe, nano, vi, vim, jed
- 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, ee, jed, vi

Linux Editors

- If you are not familiar with any of these editors, choose **ee**
- You can find a tutorial at:
  - man ee
- You should experiment with other editors after the workshop to find the one you like best

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

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

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

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

Review

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Questions?

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