

Linux Systems Administration

Getting Started with Linux

Network Startup Resource Center
www.nsrc.org



These materials are licensed under the Creative Commons Attribution-NonCommercial 4.0 International license (<http://creativecommons.org/licenses/by-nc/4.0/>)

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 **pcN.ws.nsrc.org** user **sysadm**
 - where “**N**” is the number of your pc
 - 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

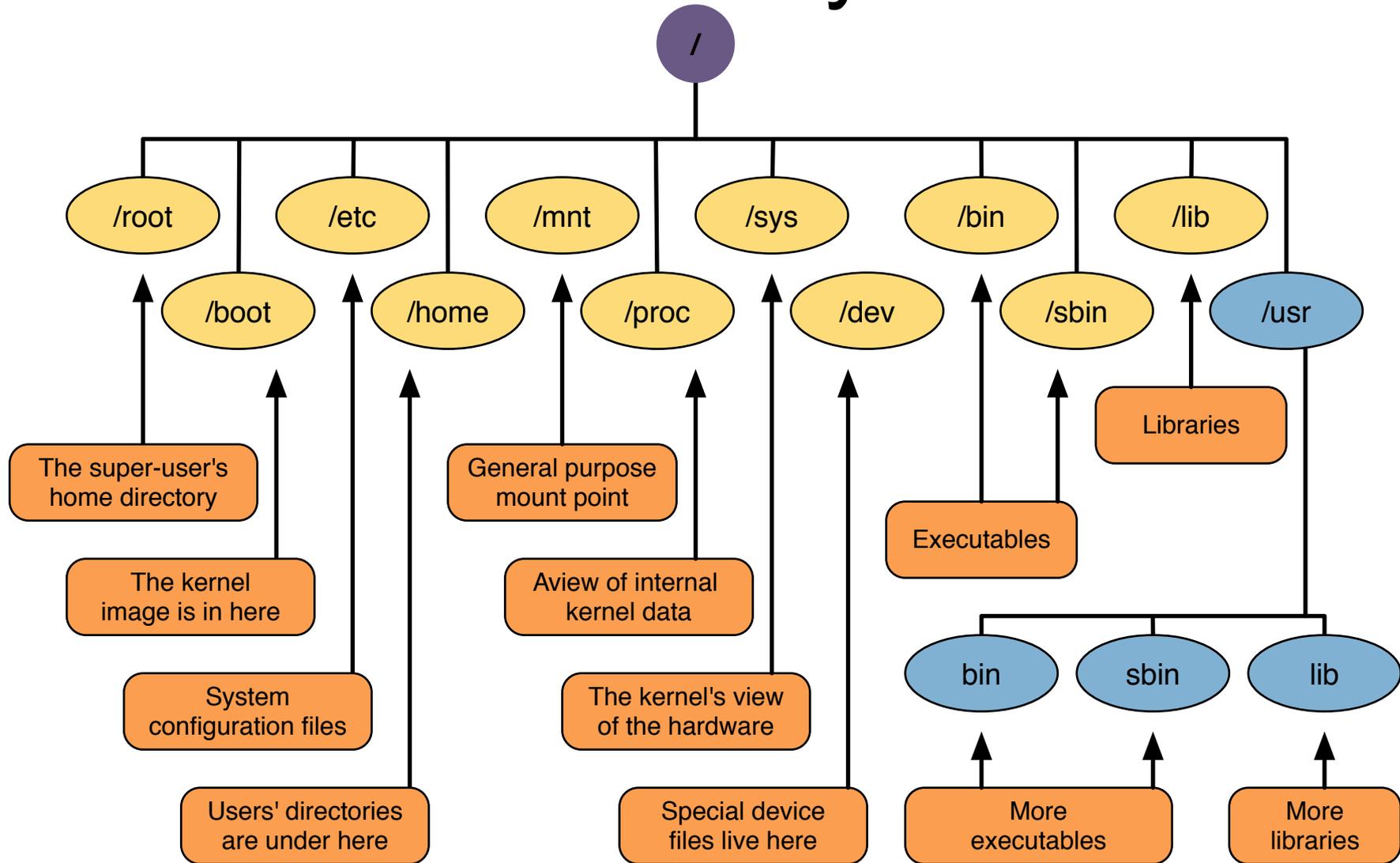
System Users

- 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”

Linux File System



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

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
```

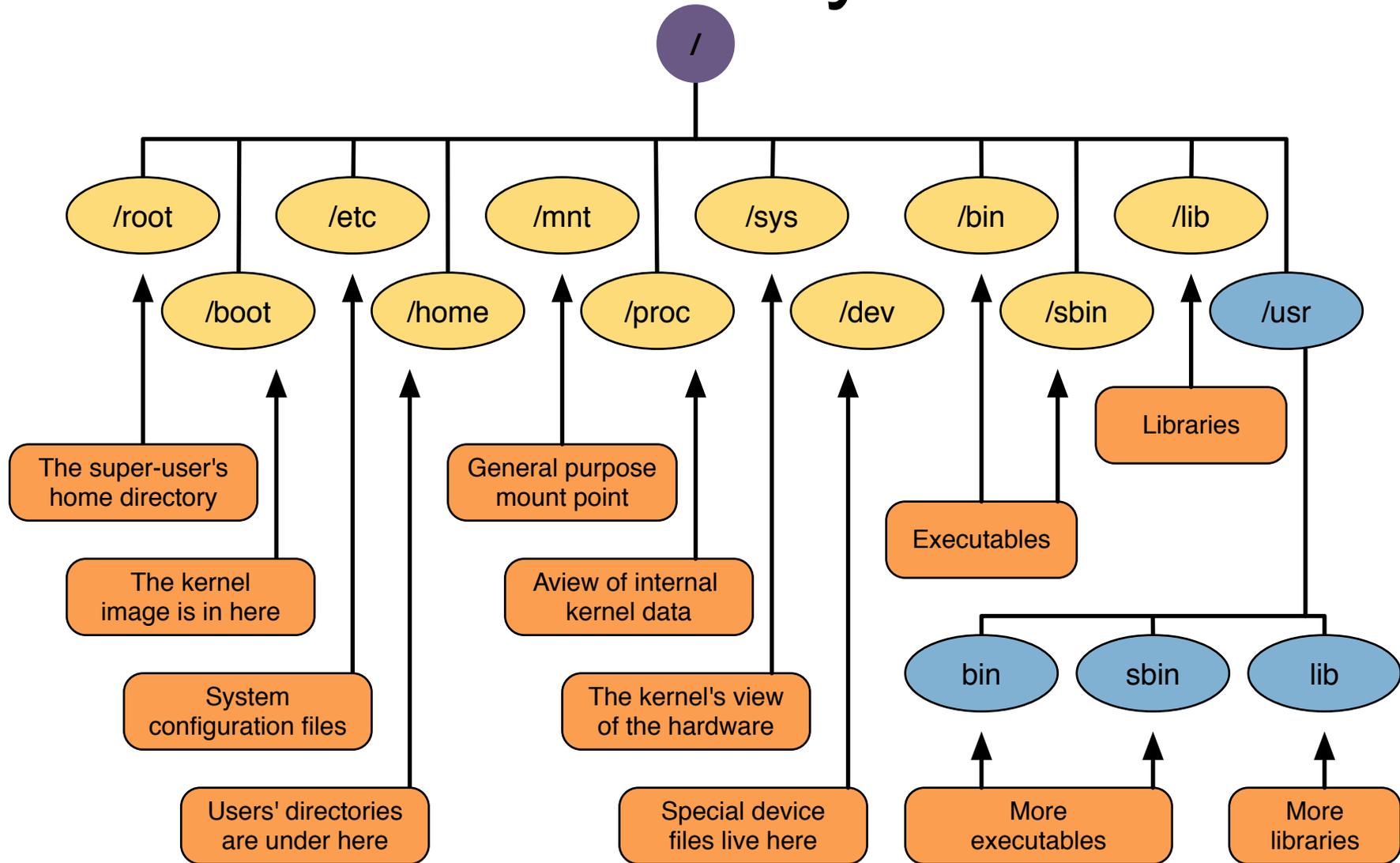
- Stuck in less or another paging application?

- 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

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

- `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

- 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