



System Administration & Security

COMP 175 | Fall 2021 | University of the Pacific | Jeff Shafer

Linux Fundamental Skills: Directories & Navigation

Overview

Recap

→ AWS

- EC2 instances
- Security Groups
- VPC networks
- Billing & alerts

This Week

→ Lecture

- Directory & navigation basics
- **Lab 4 - Web Server**

Directory Basics



Navigation Basics

pwd - Path to Working Directory – What is my current directory?

```
$ pwd  
/home/ec2-user
```

Navigation Basics

mkdir – Create new directory

```
$ mkdir directory1  
  
# No output. Silence = Success in UNIX
```

Navigation Basics

ls - List – What files are in the current directory?

```
$ ls  
folder1  
Secret_data.txt
```

Navigation Basics

ls -l – Long list format

```
$ ls -l
total 12
-rwxrwxr-x 1 ubuntu ubuntu 2910 Apr 19 08:21 fileA.py
-rwxrwxr-x 1 ubuntu ubuntu 6264 Apr 19 08:21 fileB.py
```

Navigation Basics

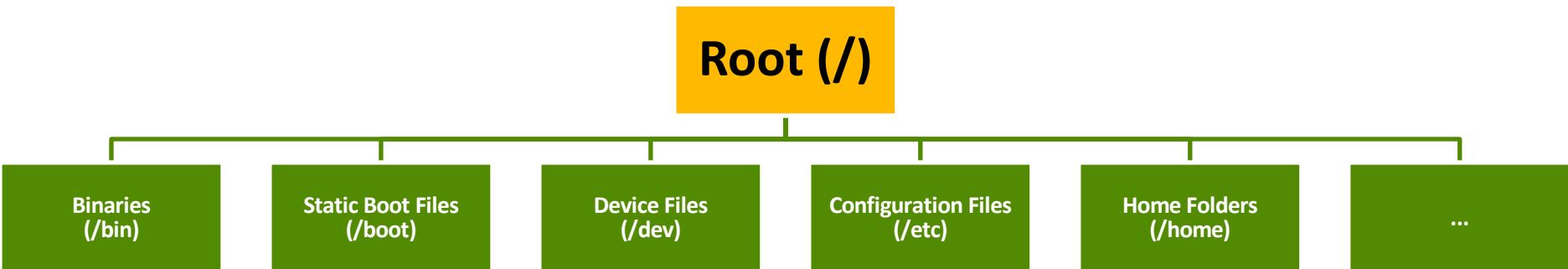
ls -al – Show all files, including hidden, AND long list format

```
$ ls -la
total 80
drwxr-xr-x 6 ubuntu ubuntu 4096 Sep  5 22:09 .
drwxr-xr-x 4 root   root   4096 Nov  1  2019 ..
-rw----- 1 ubuntu ubuntu   62 Aug 28 08:46 .Xauthority
-rw----- 1 ubuntu ubuntu 4930 Sep  5 21:56 .bash_history
-rw-r--r-- 1 ubuntu ubuntu  220 Apr  4 2018 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Apr  4 2018 .bashrc
drwx----- 2 ubuntu ubuntu 4096 Nov  1  2019 .cache
drwx----- 3 ubuntu ubuntu 4096 Nov  1  2019 .emacs.d
drwx----- 3 ubuntu ubuntu 4096 Nov  1  2019 .gnupg
...
```

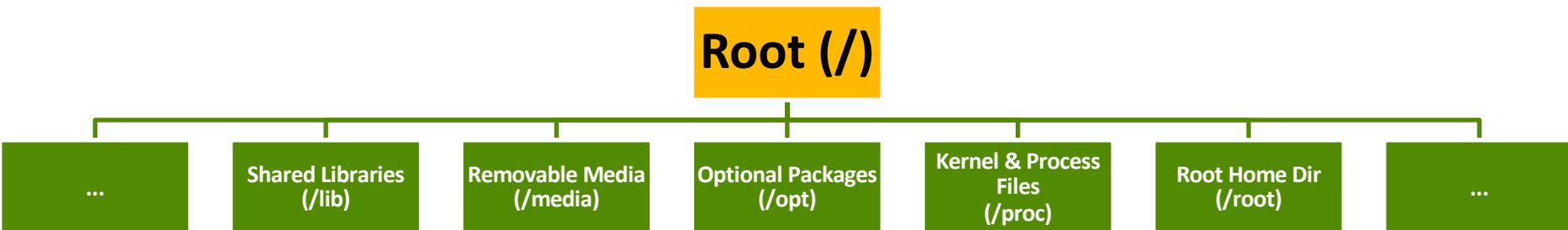
Navigation Basics

ls -l / – Long listing of all files in the root directory

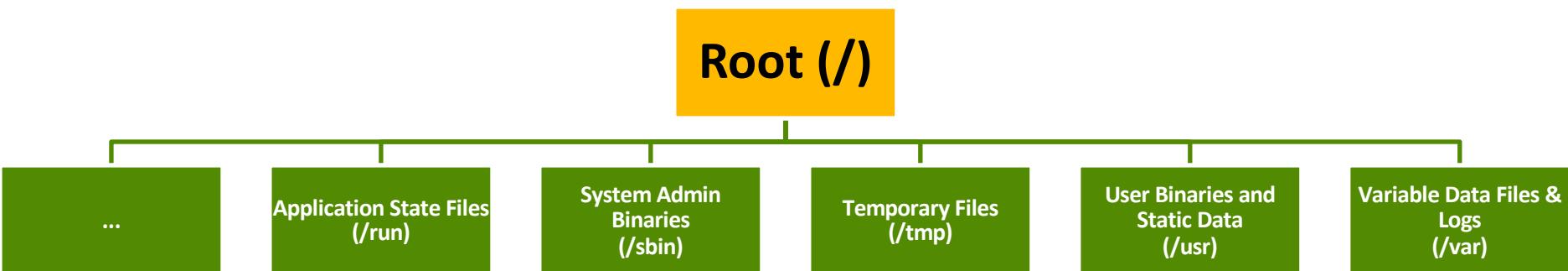
```
$ ls -ls /
total 88
4 drwxr-xr-x    2 root root  4096 Aug  6 06:29 bin
4 drwxr-xr-x    3 root root  4096 Aug 26 06:32 boot
0 drwxr-xr-x   14 root root  3180 Jul 22 01:36 dev
4 drwxr-xr-x  105 root root  4096 Aug 26 07:07 etc
4 drwxr-xr-x     4 root root  4096 Nov  1 2019 home
0 lrwxrwxrwx    1 root root     30 Aug 21 06:19 initrd.img ->
boot/initrd.img-5.3.0-1033-aws
0 lrwxrwxrwx    1 root root     30 Aug 21 06:19
initrd.img.old -> boot/initrd.img-5.3.0-1032-aws
4 drwxr-xr-x   20 root root  4096 Jul 22 2019 lib
4 drwxr-xr-x    2 root root  4096 Jul 22 00:47 lib64
...
```



- ↗ **/bin** – User binaries (programs) that must be available to the system for operation
- ↗ **/boot** – Static boot files (GRUB boot loader, kernel image)
- ↗ **/dev** – Mapping of devices (e.g. USB, TTY terminal, etc) as files, plus psedo-devices (e.g. /dev/random)
- ↗ **/etc** – System configuration files
- ↗ **/home** – User home directories



- ↗ **/lib** – Shared libraries required by programs in /bin and /sbin
- ↗ **/media** – Mount point for removable media (e.g. CD, USB) – Could also use /mnt
- ↗ **/opt** – Optional binaries (applications) that don't follow standard system file hierarchy
- ↗ **/proc** – Kernel and process files (e.g. /proc/cpuinfo lists info on all CPU cores)
- ↗ **/root** – Home directory for root user



- ↗ **/run** – State files (sockets, process IDs) for running applications that persist over time
- ↗ **/sbin** – Essential system administration binaries
- ↗ **/tmp** – Temporary files, can be deleted on startup
- ↗ **/usr** – User binaries and Read-Only data
 - ↗ /usr/bin – Non-essential binaries
 - ↗ /usr/sbin – Non-essential system administration binaries
 - ↗ /usr/local – Locally-compiled binaries
- ↗ **/var** – Variable data files (e.g. logs)



File Viewing and Editing



File Viewer: cat

cat – View text file (all at once)

```
$ cat /var/log/auth.log  
<contents of file, all at once>
```

↗ Use cases

- ↗ Dump an entire file to the terminal
- ↗ Concatenate multiple files together

```
$ cat file1 file2 file3 > combined_file
```

File Viewer: less

less – View text files screen by screen

```
$ less /var/log/auth.log  
<contents of file, 1 screen at a time>
```

- ↗ Navigation tips:
 - ↗ Page Down: Spacebar
 - ↗ Page Up: b (for *backwards*)
 - ↗ Scroll Up/Down: ↑↓ Arrow keys
 - ↗ Exit: q (for *quit*)
 - ↗ Search for a string: /pattern
(and n for future matches)

File Editors

Command-Line

- ↗ “Ancient”
 - ↗ **ed** - Written by Ken Thompson, co-creator of Unix
- ↗ “Classic”
 - ↗ **vi** – Written by Bill Joy, founder of Sun Microsystems in 1970’s
 - ↗ **emacs** – Written by Richard Stallman, founder of GNU Project and Free Software Foundation
- ↗ “Newer”
 - ↗ **nano** – Simple & effective

GUI

- ↗ **gedit**
- ↗ **mousepad / leafpad**
- ↗ *Numerous other options – Any GUI Linux distribution will come with something...*

File Editor: nano

nano – Simple text file editor

```
$ nano /etc/nginx/nginx.conf
```

- ↗ Navigation tips:
 - ↗ Help: CTRL-G
 - ↗ Save File: CTRL-O (“write-out”)
 - ↗ Exit: CTRL-X
 - ↗ Page Down: CTRL-V
 - ↗ Page Up: CTRL-Y



File Editor: nano

The screenshot shows a terminal window titled "Downloads — ubuntu@ip-172-31-52-244: ~ — ssh cyberlab.pacific.edu -l ubuntu...". The window displays the contents of the file "/etc/nginx/nginx.conf" using the "GNU nano 2.9.3" editor. The configuration file includes sections for user, worker_processes, pid, include, events, and http, with various directives like sendfile, tcp_nopush, and tcp_nodelay. The bottom of the screen shows a menu bar with keyboard shortcuts for various nano commands.

```
user www-data;
worker_processes auto;
pid /run/nginx.pid;
include /etc/nginx/modules-enabled/*.conf;

events {
    worker_connections 768;
    # multi_accept on;
}

http {

    ##
    # Basic Settings
    ##

    sendfile on;
    tcp_nopush on;
    tcp_nodelay on;
}
```

[Read 89 lines]

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line

File Editor: vi

vi – Text file editor (modern variant is vim)

```
$ vi /etc/nginx/nginx.conf
```

- ↗ Critical concepts
 - ↗ Opens in Command Mode
 - ↗ Must switch to Edit Mode to change anything
 - ↗ Switch back to Command Mode: ESC ESC
 - ↗ Want to undo? u
 - ↗ Want to abort? :q!
 - ↗ Quit now, don't save



*Will be
present on
any Unix
system!*

File Editor: vi

```
● ○ ● ○ Downloads — ubuntu@ip-172-31-52-244: ~ — ssh cyberlab.pacific.edu -l ubuntu...  
user www-data;  
worker_processes auto;  
pid /run/nginx.pid;  
include /etc/nginx/modules-enabled/*.conf;  
  
events {  
    worker_connections 768;  
    # multi_accept on;  
}  
  
http {  
  
    ##  
    # Basic Settings  
    ##  
  
    sendfile on;  
    tcp_nopush on;  
    tcp_nodelay on;  
    keepalive_timeout 65;  
    types_hash_max_size 2048;  
    # server_tokens off;  
  
    "/etc/nginx/nginx.conf" [readonly] 89L, 1527C
```

*Notice the
lack of any
helpful
menus...*

1,1

Top

Wrap-Up

↗ Questions?

↗ Concerns?

↗ This Week

- ↗ **Lab 3** – AWS Billing
- ↗ **Lab 4** – Servers: Nginx (Web)