

# System Admin

## Class 1 - Introduction

---

By Ian Robert Blair, M.Sc.

# Introduction

---



- Ian Robert Blair, M.Sc., LPIC-2, MCSE, CCNA
- Email: [ian.robertblair@icloud.com](mailto:ian.robertblair@icloud.com)
- QQ: 2302412574
- New York City
- Teaching at Universities in China for 7 years
- Former Senior IT Administrator in Merrill Lynch's Global Technology Department
- Prior to that I worked as a IT consultant

# Goals

---

- Be able to administer Linux in networked environment
- Learn to use the shell
- Be able to read and write Bash Scripts
- Install and configure software
- Understand and configure linux networking and security

# Agenda

---

- Introduction
- Class Rules, Grading, and Assignments
- Linux Install
- Linux History
- Basic Commands and Utilities
- Su and Sudo

# Class Rules

---

- Please try to come to class on time
- Put your cellphones on vibrate or silent
- Take your calls in the hall
- Please don't talk during lectures
- Please do all homework, reading, and assignments
- You must come to all classes! Attendance will be taken every day.

# Semester Plan

---

1. Introduction and Basic Utilities
2. File System Administration
3. Shell Scripting
4. System Administration
5. Networking, DNS, and DHCP
6. Security, Web and FTP
7. File Sharing and Email
8. Review for Final Exam

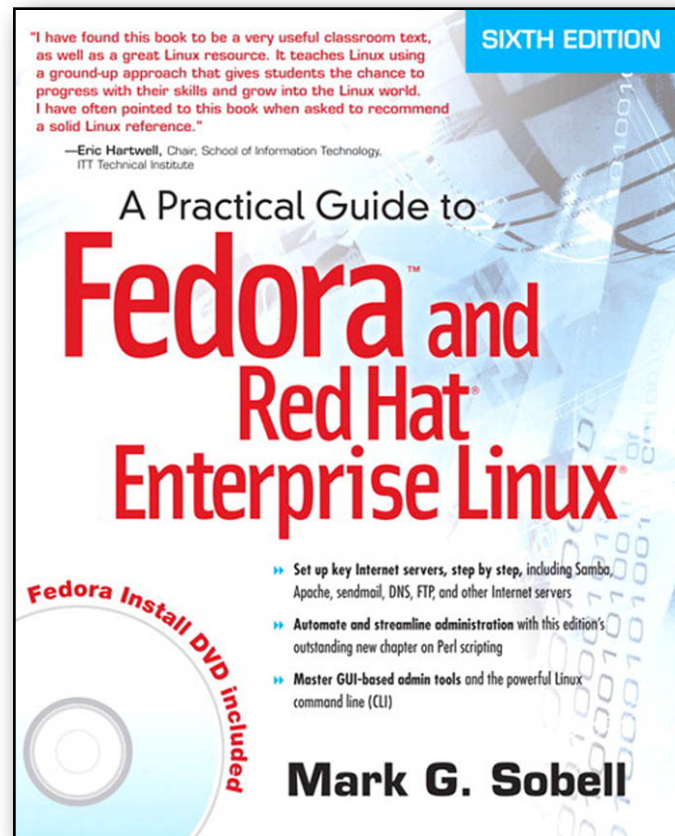
# Grading

---

- Midterm Exam 40%
- Final Exam 40%
- Attendance 20%

# The Book and Tools

---



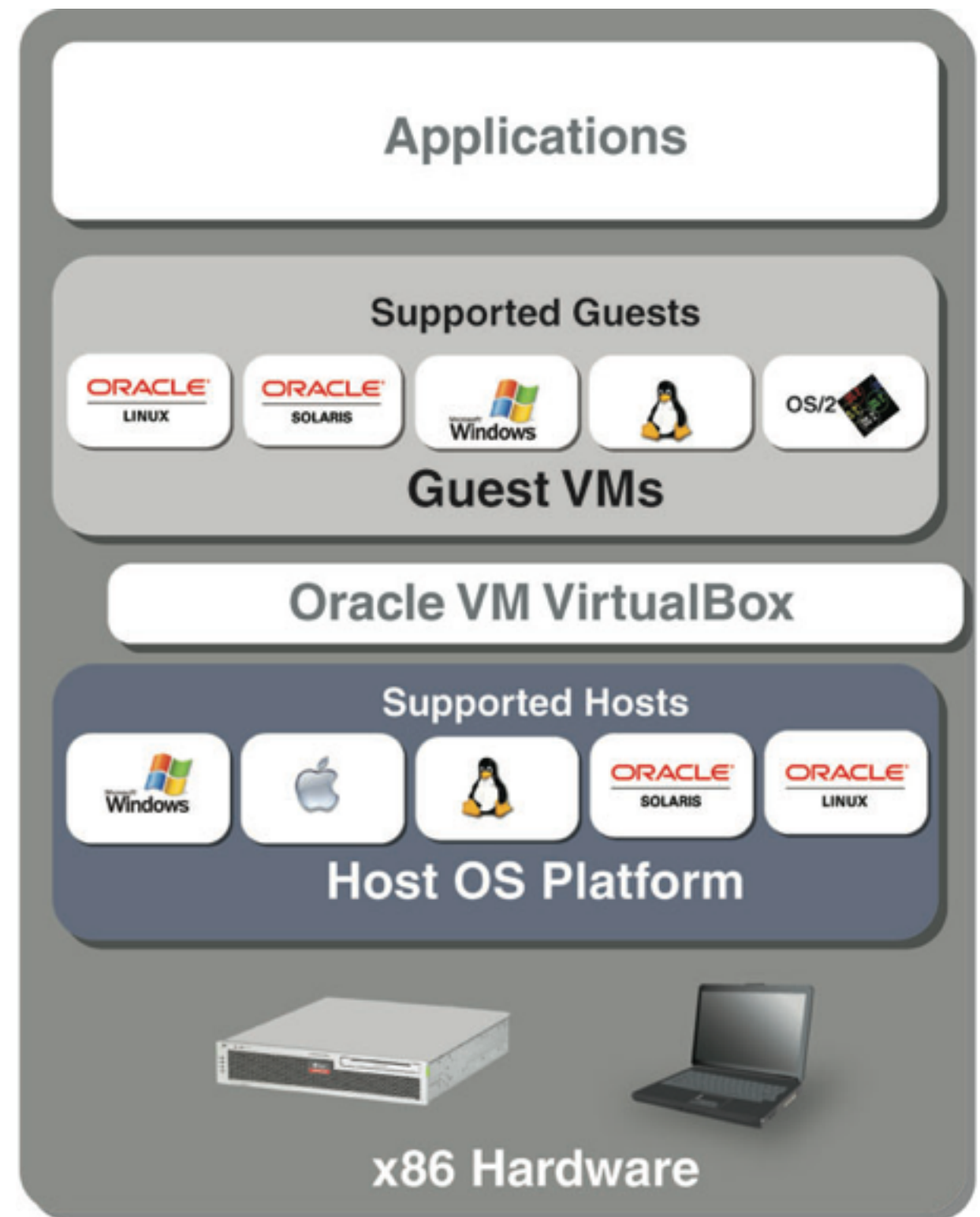
- **A Practical Guide to Fedora and Red Hat Enterprise Linux** by Mark G. Sobell (ebook)
- **CentOS or Fedora** - download dvd(.iso)
- **Virtual Box**, [www.virtualbox.org](http://www.virtualbox.org)
- **Putty**, [www.putty.org](http://www.putty.org) (Windows)



# Oracle Virtual Box

---

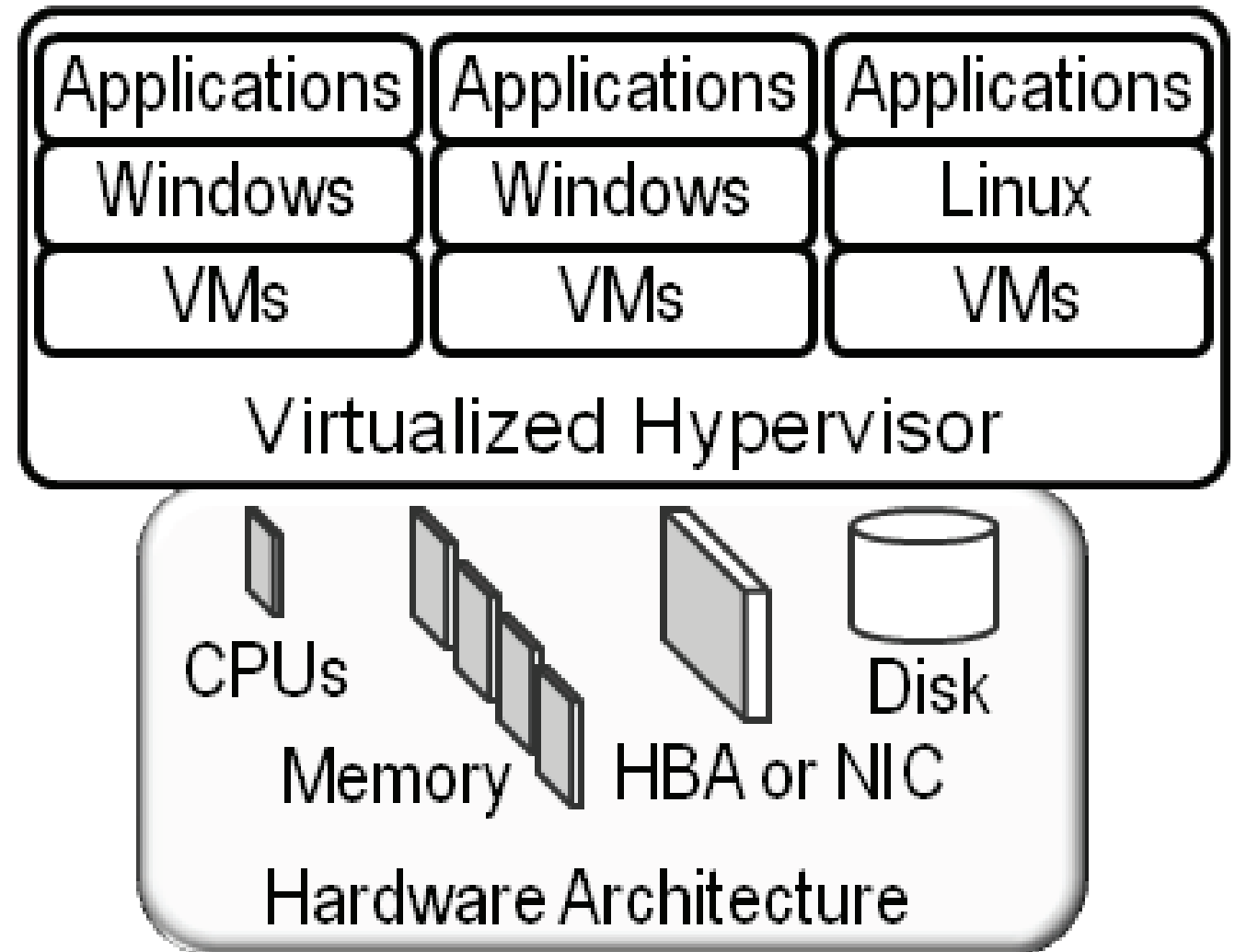
- 32bit and 64bit support
- Runs on desktops as well as servers
- Runs on computers both with and without hardware assisted virtualization
- Supports some advanced features like virtual networking, snapshots, and SMP
- Its open source and free software
- <https://www.virtualbox.org>



# Virtualization

---

- **Private cloud** is cloud virtualized infrastructure for a single organization
  - Vmware
  - Citrix Xen
  - Microsoft Hyper-V)
- **IaaS** (Infrastructure as a Service) is infrastructure that is provided by a service provider
  - Windows Azure
  - Amazon Elastic Compute Cloud

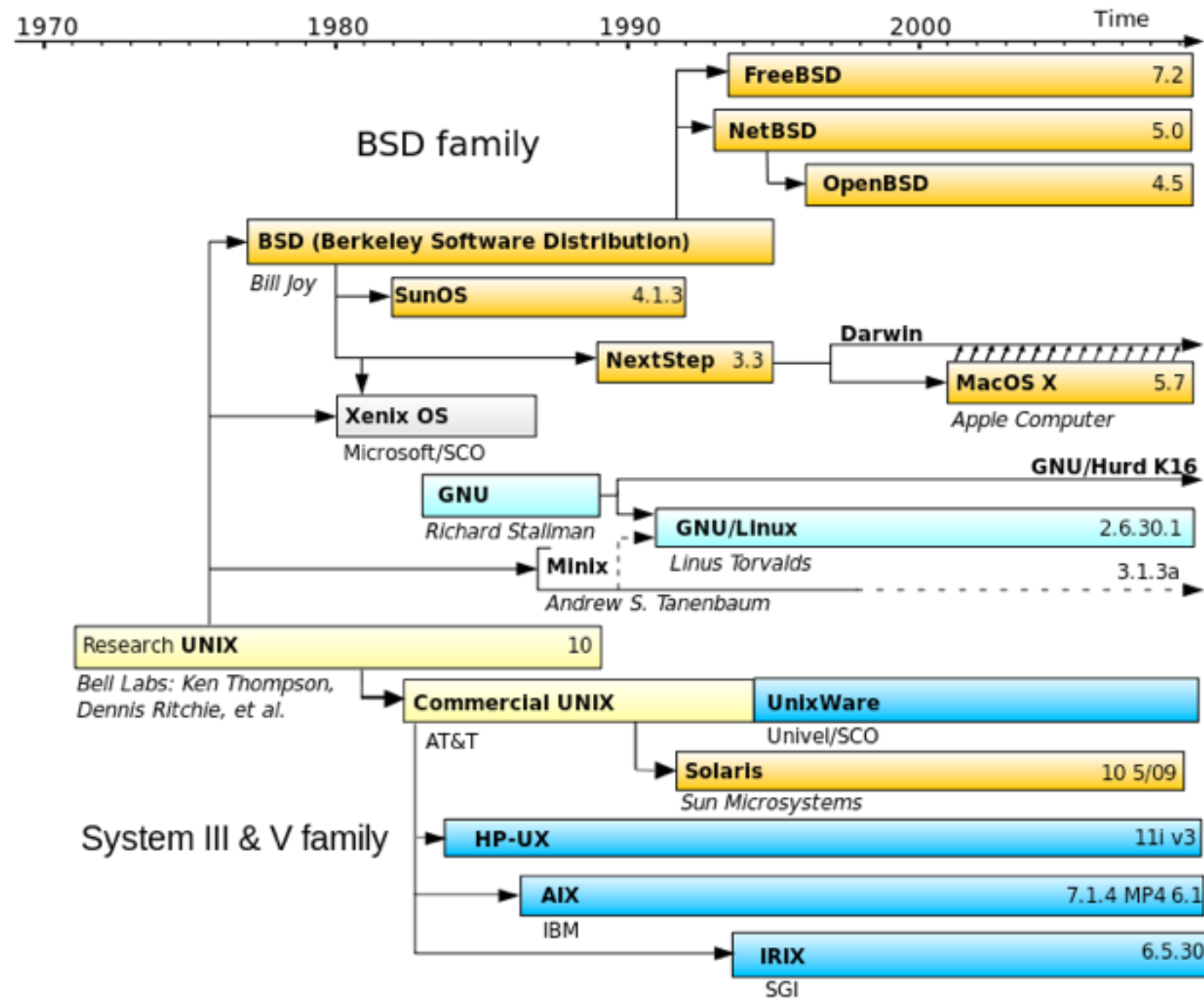


# DVD Install Demo

---

- Demonstration, DVD Install of Fedora on Virtual Box virtual machine.
- For this course you can install Fedora, RHEL, or CentOS
- Virtual Box and Install

# Unix/Linux Timeline



# Linux History

---

- The Linux kernel was originally developed by 21 year old Finnish, undergraduate student **Linus Torvalds**, who used the Internet to make the source code immediately available to others for free
- Torvalds released Linux version 0.01 in September 1991
- In 1983, **Richard Stallman** ([www.stallman.org](http://www.stallman.org)) announced the GNU Project for creating an operating system, both kernel and system programs
- Today's Linux is a combination of Linux Torvalds linux kernel and Richard Stallman's GNU software and utilities

# Linux Benefits

---

- A rich selection of **applications** is available for Linux—both free and commercial (graphical, word processing, networking, security, administration, web server, and many others)
- Supports an amazing range of **peripherals**
- It's been **ported** to and runs on the Power PC, Alpha-based machines, MIPS-based machines, Motorola's 68K-based machines, various 64-bit systems, and IBM's S/390
- More than **95 percent** of the Linux operating system is written in the **C programming language**

## Linux Benefits, cont.

---

- Linux is used in **embedded computers**, such as the ones found in cellphones, PDAs, and the cable boxes on top of many TVs
- Linux runs on **mainframes, clusters, and supercomputers**
- Linux is a fully protected **multitasking operating system**, allowing each user to run more than one job at a time

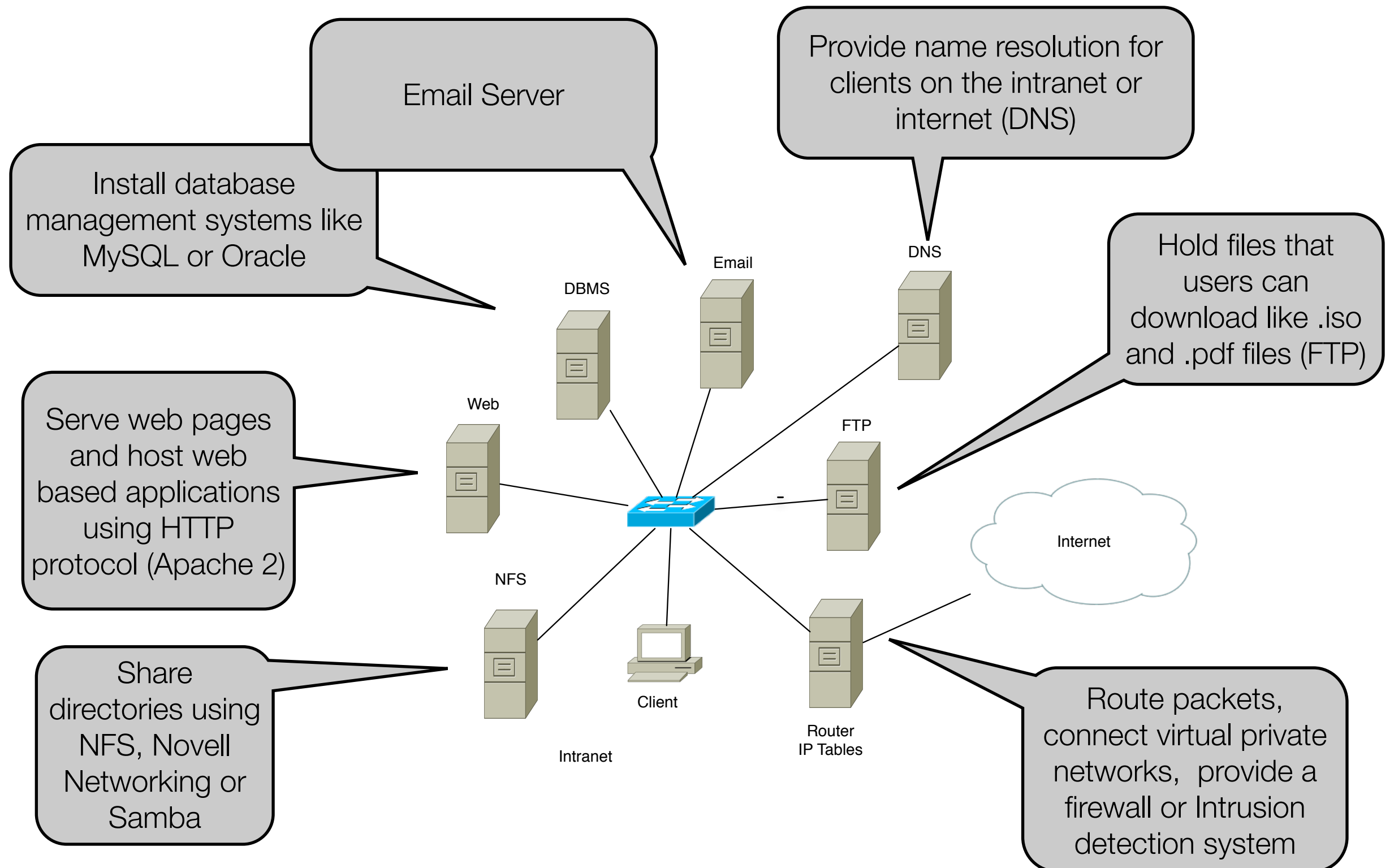
# Some Recent Linux Facts

---

- **90%** of the world's most powerful supercomputers use GNU / Linux (top ten of supercomputers use Linux)
- **33.8%** of the world runs on Linux servers compared to 7.3% does so in a Microsoft operating system
- Linux is present in highly critical applications such as Japan's bullet trains, traffic control in San Francisco, the New York Stock Exchange, CERN, many air traffic control systems
- World known companies such as Google, Cisco, Facebook, Twitter, and Linked-in use Linux as their main operating system



# What can we use Linux for?



# The System Administrator

---

- Build, install, and decommission systems
- Edit the Operating Systems and software configurations
- Install and update software
- Back up and restore files, and manage such system facilities as printers, PCs, servers, and a local network
- Responsible for setting up accounts for new users in centralized directories or on systems
- Monitor the system, and take care of any problems that arise



# The Future

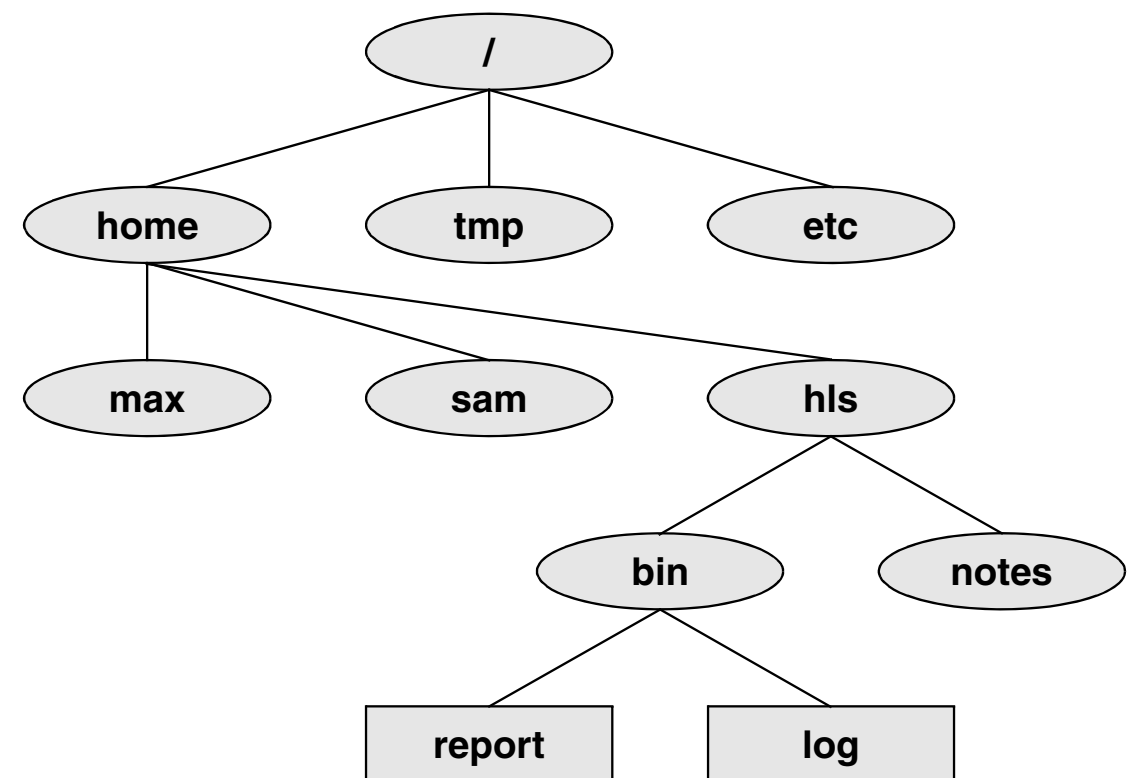
---

- What would you like to do in the future?

# Linux File System, pt. 1

---

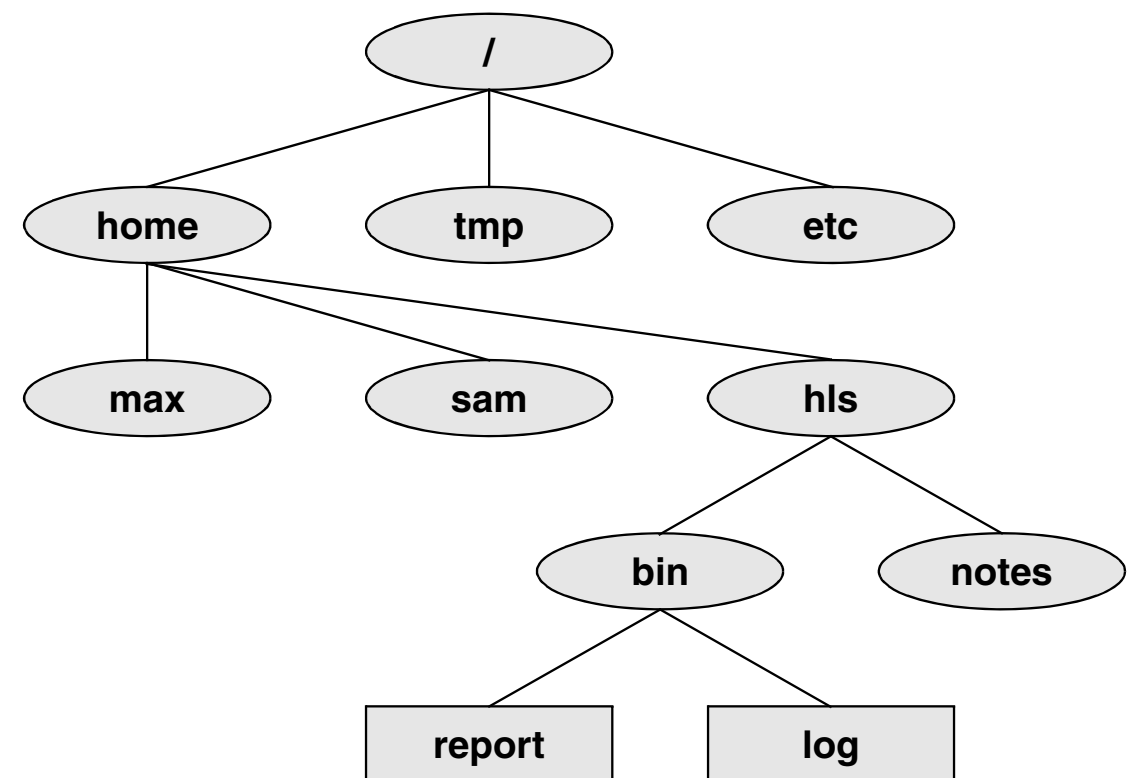
- The **Linux filesystem** provides a hierarchal structure whereby files are arranged under directories, which are like folders or boxes
- Each **directory** has a name and can hold other files and directories
- Security is provided by **file access permissions** (read, write, execute)
- **Access Control Lists (ACL)** give users and administrators finer-grained control over file access permissions



# Linux File System, pt. 2

---

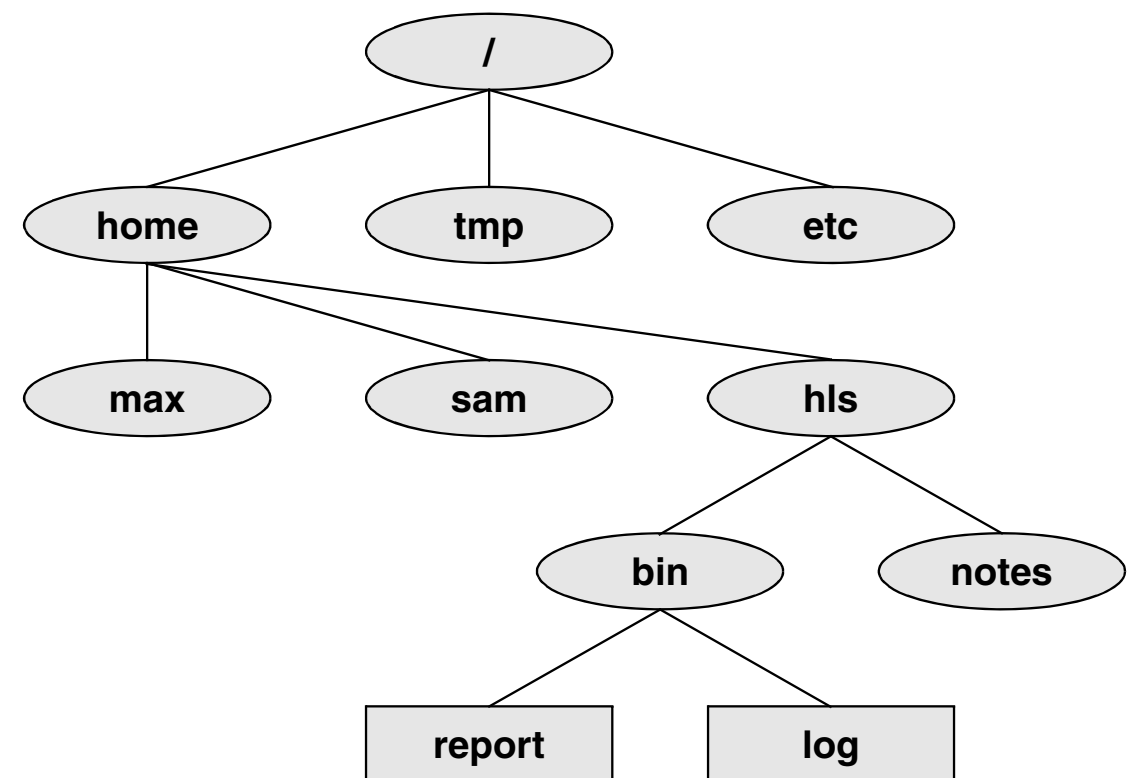
- In Linux, the single system namespace is rooted at /, which is the **root** directory
- Linux files can be a maximum of 255 characters long
- Can contain uppercase/lowercase letters (A-Z, a-z), numbers (0-9), underscore (\_), period (.), or comma (,)
- No two files in same directory can have the same name
- Hidden files and directories begin with “.”, i.e. .ssh, .bash\_profile
- Linux is **case-sensitive**



# Linux File System, pt. 3

---

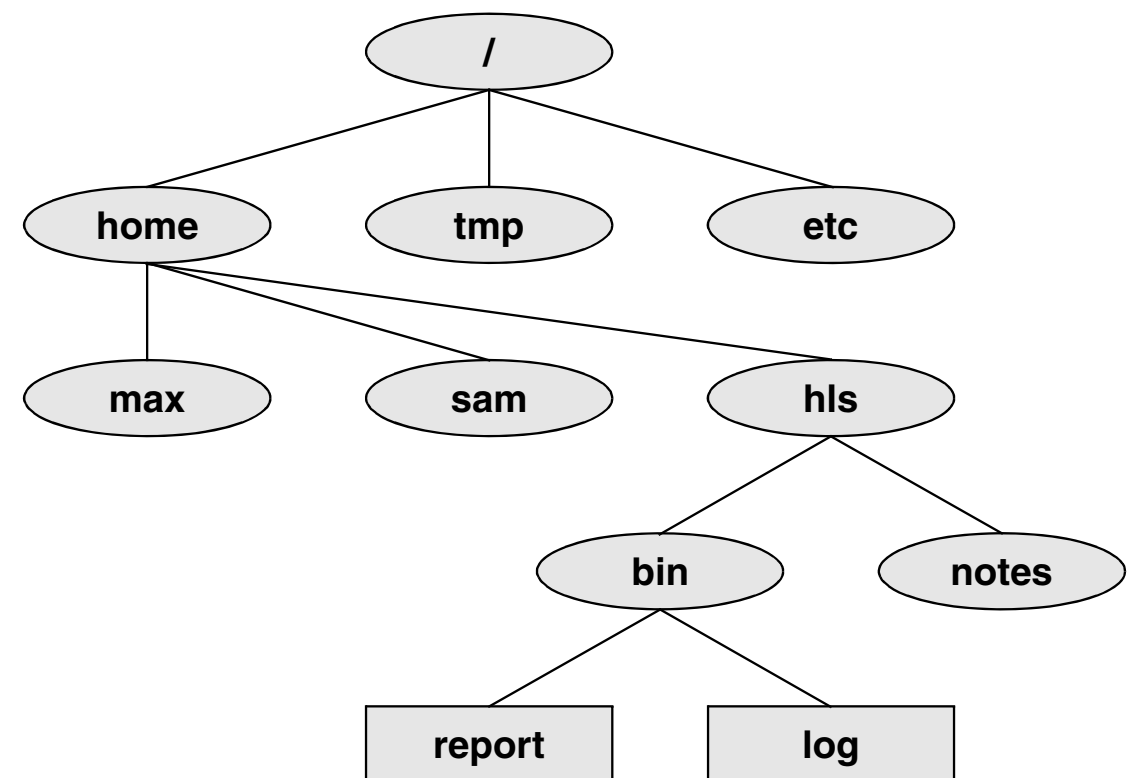
- The **pwd** command shows your current directory
- After logging in, users are placed into their home directory
- “~” with a path name refers to the current users home directory (ie. ~/notes is the same as /home/his/notes)
- Relative vs. Absolute path names
- “.” refers to current directory and “..” to the parent directory



# Linux File System, pt. 4

---

- A **inode** data structure defines a file's existence and is identified by an inode number
- An **inode** contains critical information about a file, such as the UID of the owner, where it is physically located on the disk, and how many hard links point to it



# Directory Commands

---

Usage	Description	Popular Options
<b>pwd</b>	Show the current working directory	
<b>mkdir</b> folder [folder 2..]	Create one or more directories	-p (create parents)
<b>cd</b> path	Change the current working directory	~ (home dir.), - (previous dir.)
<b>rmdir</b> directory	Remove empty directory	
<b>touch</b> file	Create and empty file, update access time	



# File Commands

---

Command	Description	Popular Options
<b>cp</b> source destination	Copies one for more files  Examples: cp -va /home/lisa /srv/nfs	-R (recursive), -a (archive), -v (verbose)
<b>file</b> filename	Displays information about the contents of a file	
<b>rm</b> file	Removes a file or folder	-i (interactive), -R (recursive), -f (force, no questions!)
<b>less</b> file	Pager to view the contents of text file	
<b>mv</b> source destination	Moves for renames files or directories	
<b>cd</b> destination	Change your current working directory	~ (home dir.), - (prev. dir.)

# Information and Location Commands

---

Usage	Description	Popular Options
<b>man/info</b> command	Command help	
<b>apropos</b> keyword	Searches for the keyword in the short description line of all man pages	
<b>ls</b> pathname	List files, ex. (ls -ltr)	-l (long listing), -a (hidden files), -R (recursive), -d (directories), -h (human readable), -t (sort by time), -r (reverse order) *ll same as ls -l
<b>locate</b> file	Searches for files on the local system via database	
<b>find</b> [path] file	Locate files	-name (search string), -iname
<b>whereis/which</b> command	Displays the full pathnames of a utility, source code, or man page	

# Find

---

- `find $HOME -name "*.html" -print`
- `find /bin -size +60 -type f -ls`
- `find /usr -type f -user $USER -perm +u=w`
- `find . -type f -exec file '{}' \;`

# Wildcards and Globbing

---

- The **question mark (?)** wildcard matches any single character in the name of an existing file
- The **asterisk (\*)** wildcard matches any number of characters, including zero characters, in a filename
- A pair of **brackets[ ]** surrounding a list of characters causes the shell to match filenames containing the individual characters, A hyphen within brackets defines a range of characters within a character-class definition [a-z], [1-5]
- The process that the shell performs on these filenames is called **pathname expansion** or **globbing**, for example:

ls -l a\*

ls report1?.txt

ls report[123].txt or ls report[1-3].txt

# Command Line Expansion

---

- The shell expands the comma-separated strings inside the **braces { }**

```
$ cp /usr/local/src/C/{main,f1,f2,tmp}.c .
```

```
mkdir backup_{1,2,3,4}
```

# Archive and Compression Commands

---

Command	Description	Popular Options
<b>tar</b>	Creates or extracts files from an archive file  Examples: tar jvcf all_etc.`date +%F`.tar.bz2 /etc	x (extract), c (create), j (bzip2), z (gzip), t (list), v (verbose), f (file), p (preserve permissions)
<b>cpio</b>	Creates or extracts archives  Examples: find /bin -print   cpio -o > bin.cpio.bak	-o (output), -i (input)
<b>bzip2, bunzip2, bzip2, bzip2, bzip2</b>	Returns a file compressed with bzip2 to its original size and format	-k (keep original)
<b>gzip, gunzip, zcat</b>	compress file	-C
<b>zip, unzip</b>	zip archives compatible with Windows	

# Communication and Misc. Commands

---

Command	Description	Popular Options
<b>date</b>	Displays the current date and time	+%F, +%T

# Additional Utilities

---

- The **uname** utility displays information about the system
  - `uname -a`



# Command Completion

---

- If you are typing the name of a command, pathname, or variable, pressing **TAB** initiates:
  - command completion
  - Pathname completion
  - Variable completion

# Command History

---

- The **history** mechanism maintains a list of recently issued command lines in a file (`~/.bash_history`)
- Enter the command **history** to display the events in the history list
- `!!`, `!num`, `!-num`, `!string`, `!?string?` will also run previous commands
- `ctr-r` for reverse searching

# Login Messages

---

- **/etc/motd** - Contains the message of the day, which can be displayed each time someone logs in using a textual login
- **/etc/issue** - Message displayed before login

# User Management 1

---

- The **system-config-users** utility displays the User Manager window and enables you to add, delete, and modify system users and groups
- To display the User Manager window, enter **system-config-users** on a command line or select **Main menu: Applications->Other->Users and Groups** or **Main menu: System->Administration->Users and Groups (RHEL)**



The image shows a 'User Properties' dialog box with four tabs: 'User Data', 'Account Info', 'Password Info', and 'Groups'. The 'User Data' tab is selected. It contains the following fields:

Field	Value
User Name:	zach
Full Name:	Zach Brill
Password:	*****
Confirm Password:	*****
Home Directory:	/home/zach
Login Shell:	/bin/bash

At the bottom right of the dialog are 'Cancel' and 'OK' buttons.

# User Management 2

---

- The **useradd** utility adds a user account to the system (adds entries to the `/etc/passwd` and `/etc/shadow` files)
  - `useradd -g 1105 -c "Max R." max`
- Based on the `/etc/login.defs` and `/etc/default/useradd` files, `useradd` creates a home directory for the new user
- When doing so, it copies the contents of `/etc/skel` to that directory.
- The **userdel** utility deletes a user account (`—remove` (`-r`) option removes the home directory)
  - `userdel --remove max`
- **usermod** to make changes to an account
  - `usermod -G wheel user`
- The **passwd** utility is used to change passwords
  - `passwd lisa`

# User Management 3

---

- Use **chage** to view and modify account expiry information; **-l** option displays information about password expiration and the **-E** option changes the date an account expires
  - `chage -E "12/31/10" max`
- **groupadd** adds a new group by adding an entry to `/etc/group` (use the **-g** option to assign a group ID)
  - `groupadd -g 1024 pubs`
- **groupdel** deletes groups and **groupmod** modifies groups
  - `groupmod -g 1025 pubs`
  - `groupmod -n manuals pubs`
- **gpasswd** allows you change membership of groups
  - `gpasswd -a mary projects`

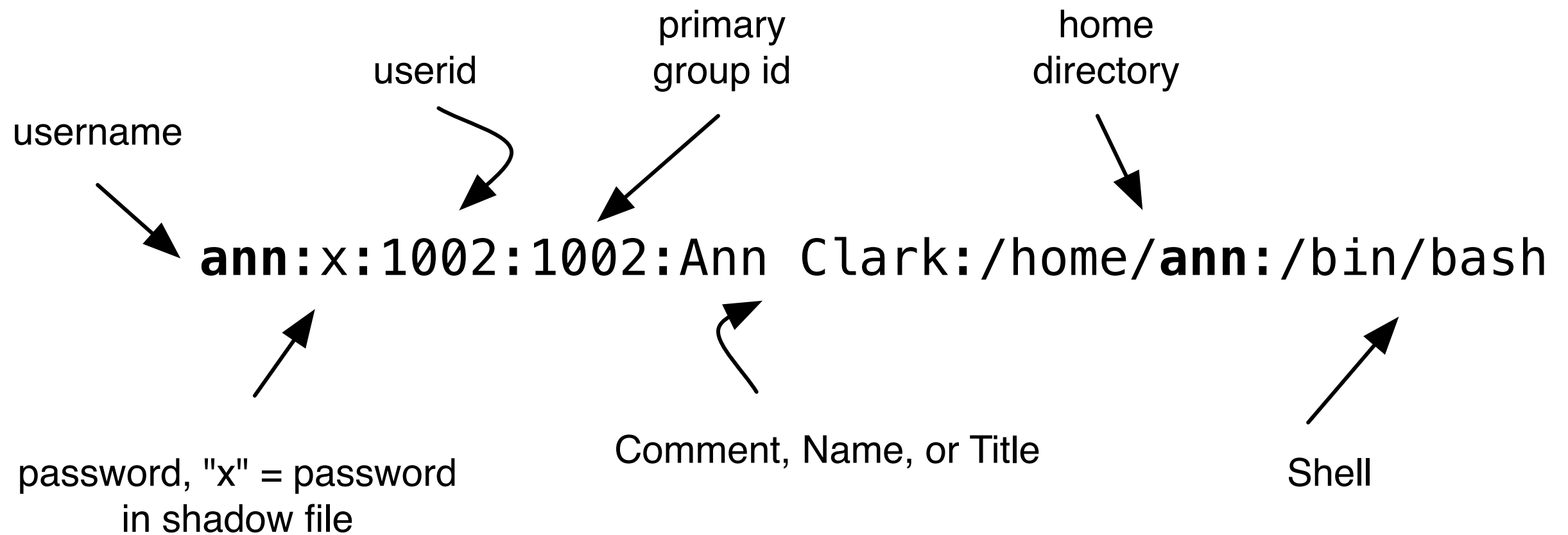
# Important Files

---

- **/etc/passwd** - users on the system
- **/etc/group** - file associates one or more usernames with each group (number)
- **/etc/shadow** - hashed user passwords, depending on system configuration

# /etc/passwd

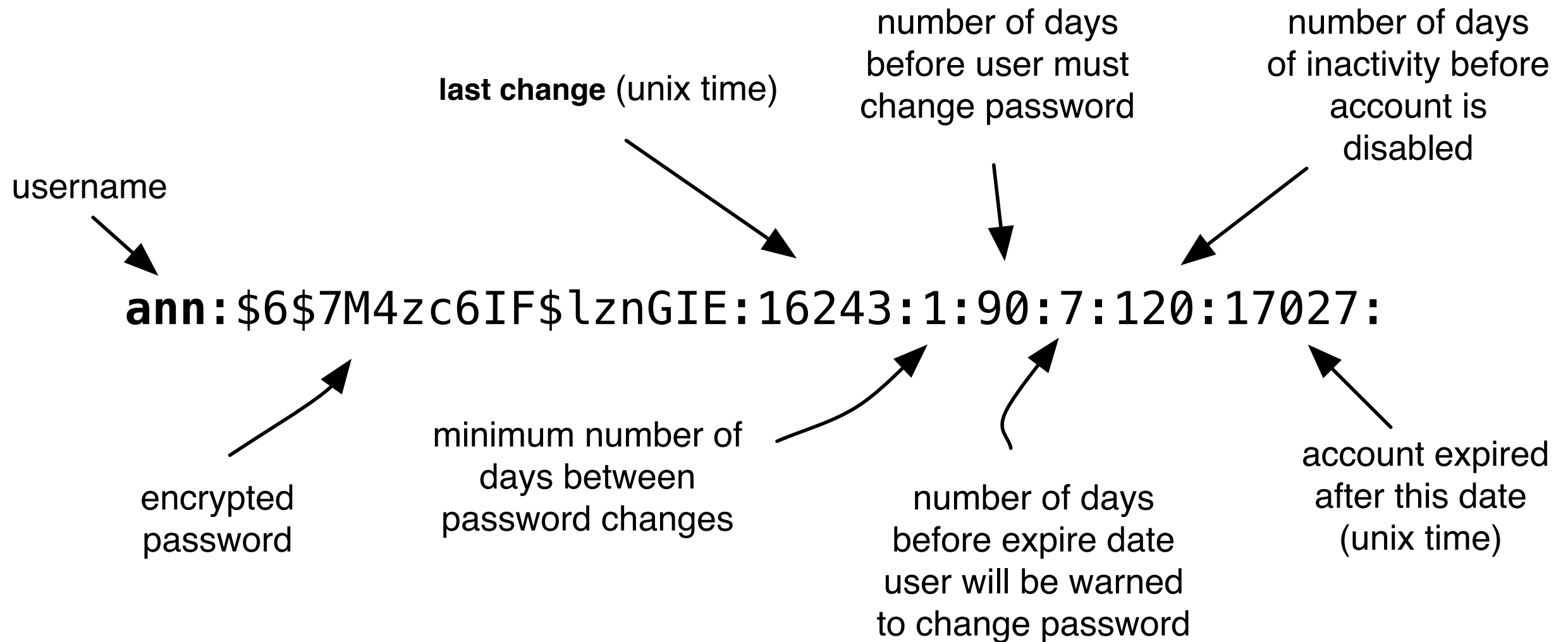
---





# /etc/shadow

---



# Root User

---

- Linux restricts certain privileges that are powerful enough to cause damage to a **super user** or **root user**
- By default the root can:
  - Add new users and groups,
  - Partition hard drives
  - Change system configuration files
  - Read, write, and execute all files
  - Examine and work in all directories
- Some distributions (including Fedora) lock the root account by not assigning a root password (unlock by running: `sudo passwd root`)

# Basic Security

---

Command	Description	Popular Options
<b>sudo</b>	gain root or other users privileges using your password	-s, -i, -u user
<b>su -</b>	gain root or other users privileges using root or other users password	-c

# Su

---

- **su (username) -c “command”**
- **su - (-l or —login)**
- Root is assumed if don't specify user
- No auditing by default

# Sudo 1

---

- The **sudo** utility logs all commands it executes and the username of a user who issues an **sudo** command in **/var/log/secure**
- The sudo utility allows implementation of a finer-grained security policy than does the use of su and the root account
- Privileges for sudo are set in the **/etc/sudoers** file

# Sudo 2

---

- Only use the **visudo** command to edit this file
- Sudo asks for your password when you first use it (5 minutes of privileges)
  - `-l` option checks which commands sudo will allow a user to run
  - `-i` spawns a new root shell
  - `-s` spawns a shell without modifying the current environment and variables

# Sudoers File 1

---

- The format of a line in the **/etc/sudoers** file:
  - *user\_list host\_list = [(runas\_list)] command\_list*
- **user\_list**: usernames, groups (prefixed with %), user aliases, or ALL (all users)
- **host\_list**: one or more hostnames, IP addresses, host aliases, or ALL
- **runas\_list**: usernames, groups (prefixed with %), user aliases, or ALL (when sudo is called with the -u option )
- **command\_list**: specifies a comma-separated list of utilities, directories holding utilities, and command aliases

# Sudoers File 2

---

- An **alias** in the sudoers file enables you to rename group users, hosts, or commands:
  - *alias\_type alias\_name = alias\_list*
- **Alias\_type** is the type of alias (User\_Alias, Runas\_Alias, Host\_Alias, Cmnd\_Alias), **alias\_name** is the name of the alias (by convention in all uppercase letters)
- **Alias\_list** is a comma-separated list of one or more elements that make up the alias



# Sudoers File 3

---

- Preceding an element of an alias with an exclamation point (!) negates it
  - User\_Alias OFFICE = zach, sam, sls
  - Runas\_Alias SM = sam, sls
  - Host\_Alias LCL = guava, plum
  - Cmnd\_Alias BASIC = /bin/cat, /usr/bin/vi, /bin/df, /usr/local/safe/

# Shutdown

---

- The **reboot** and **shutdown** utilities perform the tasks needed to bring the system down safely
- The **halt** and **poweroff** utilities are links to reboot
- -h halts systems and -r reboots system
- You must tell shutdown when you want to bring the system down (ie. now)
  - shutdown -h 09:30 Going down 9:30 to install disk, up by 10am.
- Pressing the CONTROL-ALT-DEL keys simultaneously on the console causes systemctl to reboot the system

# Linux Websites, pt. 1

---

- [www.ibm.com/developerworks/linux](http://www.ibm.com/developerworks/linux) - Provides information on Linux, Linux resources, and Linux development.
- [www.howtogeek.com](http://www.howtogeek.com) - Includes help, tutorials, tips and how-to guides for Linux.
- [www.linuxquestions.org](http://www.linuxquestions.org) - LinuxQuestions.org offers a free Linux forum where Linux newbies can ask questions and Linux experts can offer advice. Topics include security, installation, networking and much more.
- [www.tldp.org](http://www.tldp.org) - The Linux Documentation Project is working towards developing free, high quality documentation for the Linux operating system. The overall goal of the LDP is to collaborate in all of the issues of Linux documentation.
- [www.linux.org](http://www.linux.org) - Comprehensive information and resources about the Linux Operating System.
- [www.linux.com](http://www.linux.com) - Our goal is to provide all the information necessary to make your use of Linux a success.

# Linux Websites, pt. 2

---

- [www.linuxtoday.com](http://www.linuxtoday.com) - News related to Open Source software and community
- [www.tuxmachines.org](http://www.tuxmachines.org) - Do you waddle the waddle?-Linux guides, tutorials and howtos
- [www.howtoforge.org](http://www.howtoforge.org) - HowtoForge – Linux Howtos and Tutorials
- [www.lowfatlinux.com](http://www.lowfatlinux.com) - Short tutorials for people who want to learn the basics of using Linux, and thereby Unix, without getting bogged down in too much detail.
- [www.tuxfiles.org](http://www.tuxfiles.org) -Linux command line tutorials, help and tips for the new Linux users, helping them to get familiar with the Linux command line and shell.
- [www.linux-tutorial.info](http://www.linux-tutorial.info) -The place where you learn Linux. Hundreds of articles, “Test Your Knowledge” quizzes, popup glossary, and much, much more help you learn Linux the easy way

# Linux Websites, pt 3

---

- [www.linuxforums.org](http://www.linuxforums.org) - The Linux Software Resource, providing Linux Forums, Linux Server Distro info, Linux Training, Linux Help, Articles, Tutorials, News, Downloads and more!
- [www.lwn.net](http://www.lwn.net) - Linux Weekly News: Covering the Linux and free software communities since 1998. Provides information from the development community in an objective manner.
- [www.linuxjournal.com](http://www.linuxjournal.com) - The monthly magazine of the Linux community, promoting the use of Linux worldwide.
- [www.linuxcommand.org](http://www.linuxcommand.org) - LinuxCommand.org is a web site devoted to helping users of legacy operating systems discover the power of Linux.
- [www.linuxplanet.com](http://www.linuxplanet.com) - LinuxPlanet — a world of premium information for Linux newcomers! We welcome people jumping from Windows and other Operating Systems to the latest sensation based on the Open Source software model.
- [www.ostatic.com](http://www.ostatic.com) - OStatic's goal is to increase the adoption of Open Source Software by helping users find viable projects and applications that fulfill specific needs

# Lab Assignments

---

- Download and install Virtual Box
- Download the Fedora or Centos DVD image (.iso)
- Install 2 Linux virtual machines using the DVD image
- as root, run 'yum update', to update system

# Homework

---

- Read 1-3, Optional (Instructions on Install)
- Preview Chapters 5, 6, 12, Appendix B
- Answer the following Questions:
  - Why is Linux so popular?
  - What is the difference between the “find” and “locate” command?
  - What is the difference between “su” and “sudo”?
  - How do I change the primary group of a user?
  - What’s difference between “cp” and “cp -Rvp”?
  - What’s the difference between “ls -l” and “ls -a”?
  - How do I configure an account to expire 1 year from now?
  - Write the command to backup all the files in your home directory to a compressed tar ball

# Contact

---

Ian Robert Blair, MSc.

[ian.robertblair@icloud.com](mailto:ian.robertblair@icloud.com)

QQ: 2302412574