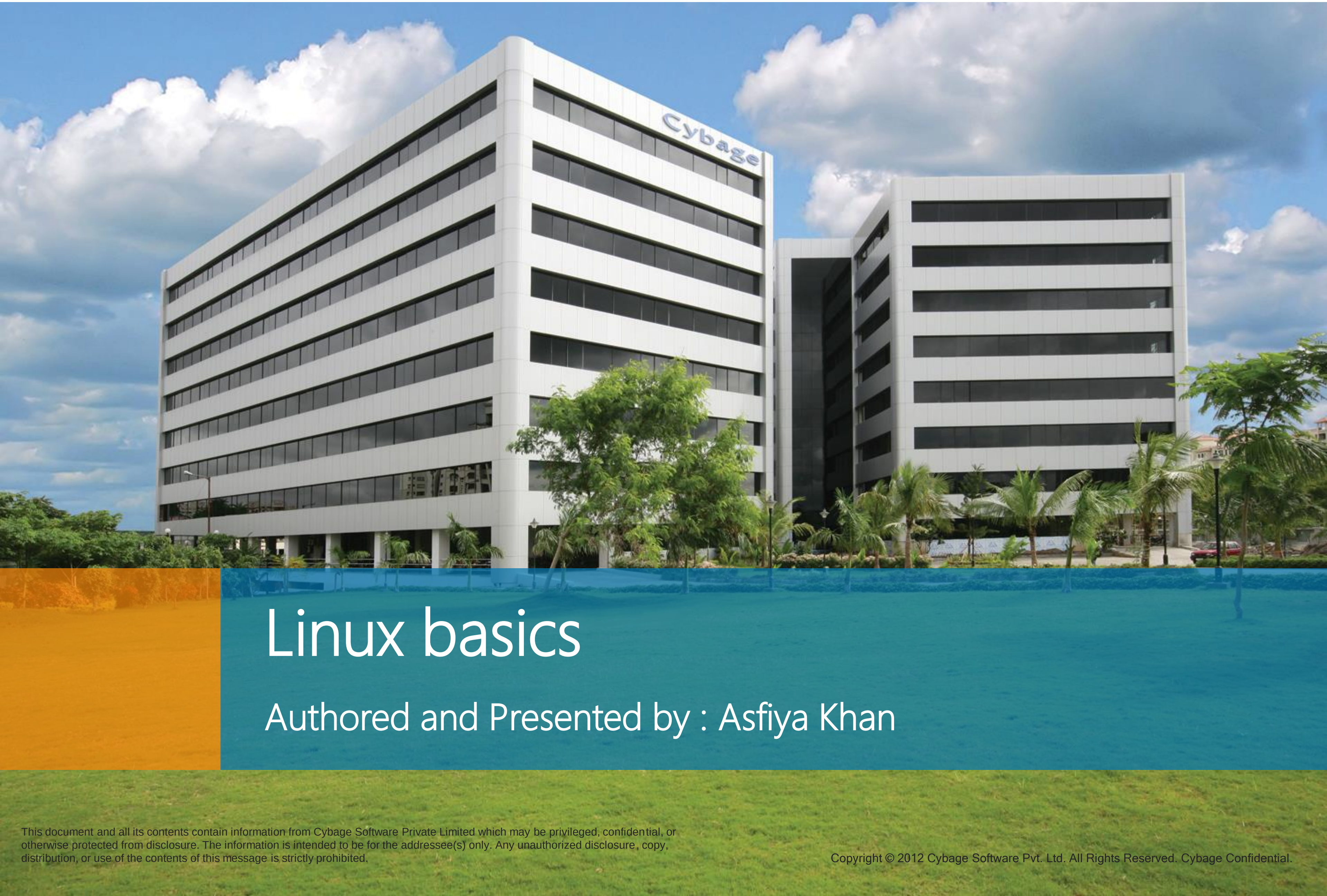

Linux basics

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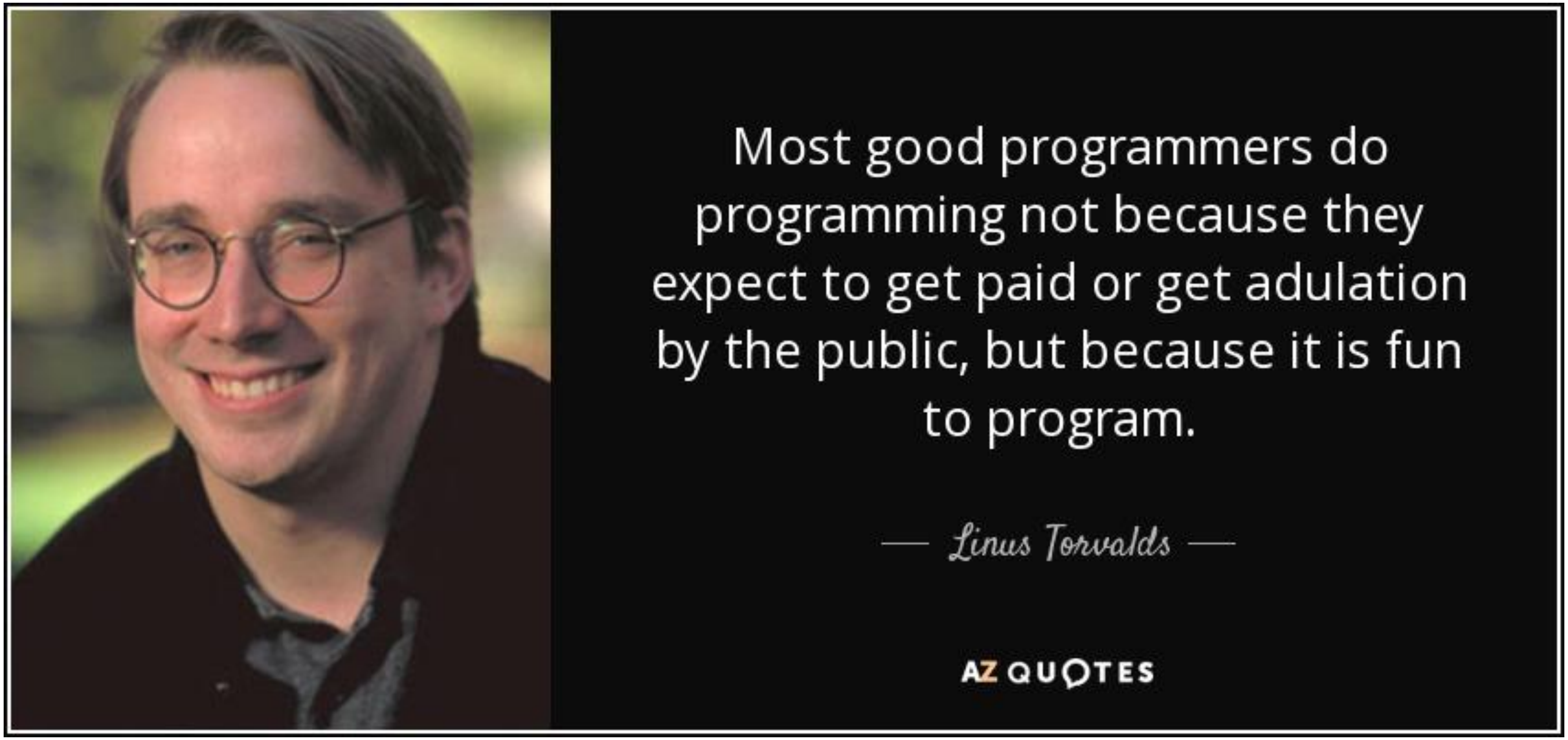
Agenda

- History
- Linux vs. Windows
- The Kernel
- Console
- Filesystem & FHS
- Path
- Commands
- Permissions
- Vi editor

Linus Torvald



Most good programmers do programming not because they expect to get paid or get adulation by the public, but because it is fun to program.

— Linus Torvalds —

History

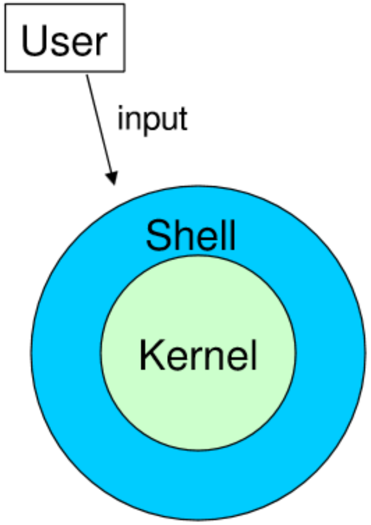
- First version of Unix was created in Bell Labs in 1969
- Thereafter many Unix flavors emerged with its new name, IBM – AIX, HP-UX etc..
- Linus Torvald, a Finnish college student in 1991 created Linux kernel
- And when Linux kernel combined with GNU applications, complete free UNIX-like OS possible
- It is open source development model – Free software!
- Various Linux distribution – RHEL, Fedora, CentOS, SUSE, Ubuntu, Debian, Kali Linux

Linux vs. Windows

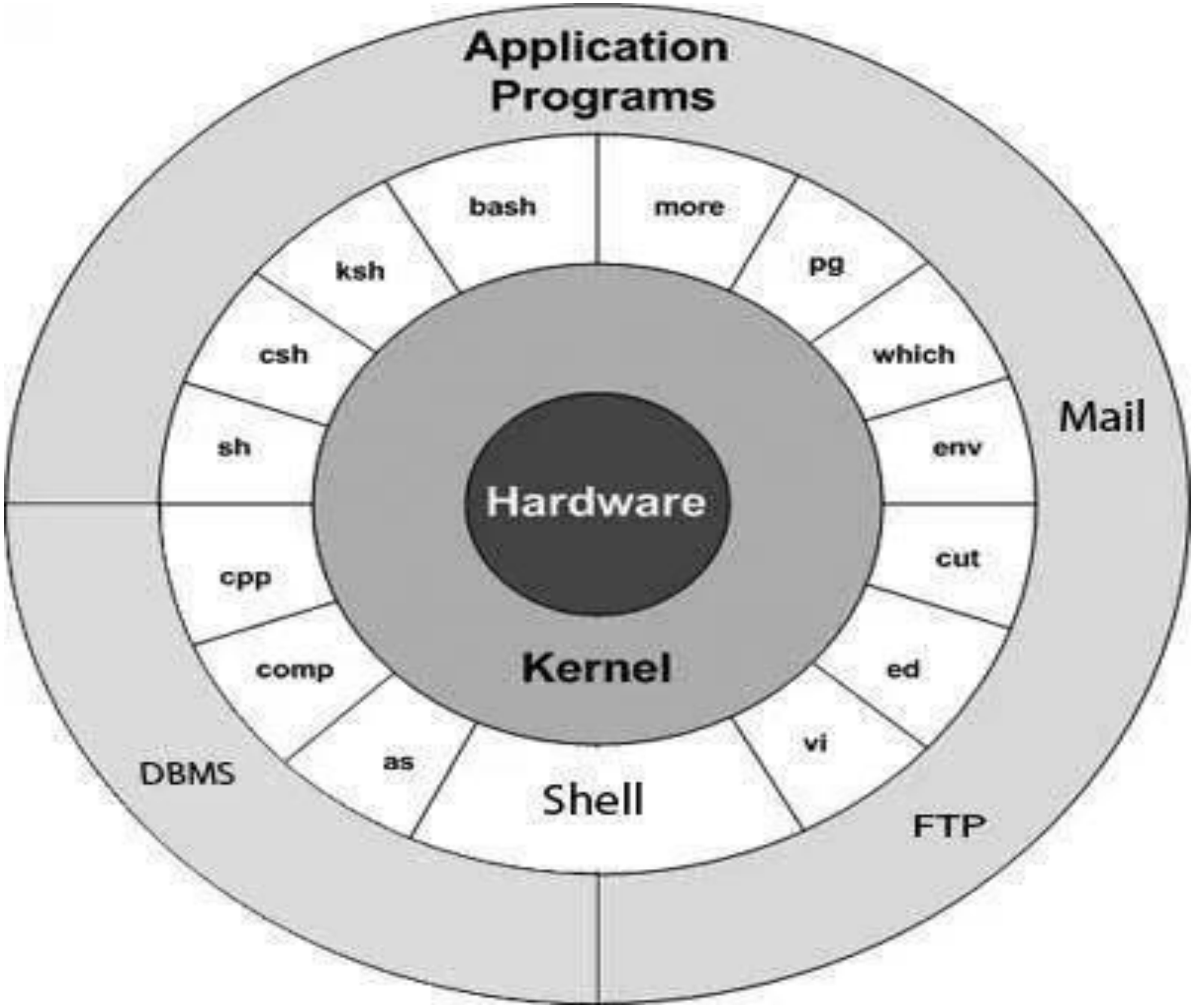
- Practical differences
  - Directory structure
  - Case sensitivity
  - Backslashes vs. Forward slashes
  - No Drive letters – Its all under /
  - You can delete or modify open files
- Comparison chart available on - http://www.diffen.com/difference/Linux_vs_Windows

The Kernel

- The primary part of Operating system
- Most important responsibilities – Process/Memory/File/IO Management
- On hard disk, it is represented by file /vmlinuz
- Kernel & Shell



Kernel Structure

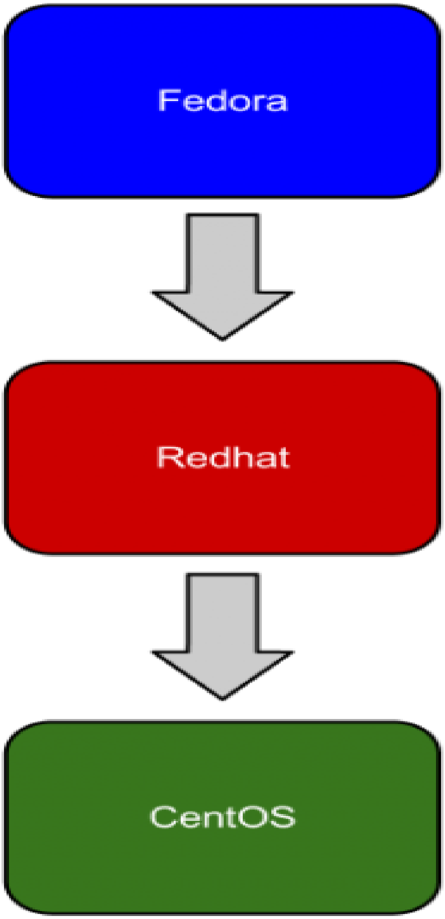


Linux Distribution

- A Linux distribution (often abbreviated as distro) is an operating system made from a software collection, which is based upon the Linux kernel and, often, a package management system.

- **Fedora** is the main project, and it's a communitity-based, free distro focused on quick releases of new features and functionality.
- **Redhat** is the corporate version based on the progress of that project, and it has slower releases, comes with support, and isn't free.
- **CentOS** is basically the community version of Redhat. So it's pretty much identical, but it is free and support comes from the community as opposed to Redhat itself.

Linux Distribution



- Run by Redhat (company)
- Community driven
- Focused on quick releases (~6 Months)
- Stresses features and functionality
- Free

- Based on Fedora
- Run by Redhat (company)
- Released corporately by Redhat
- Focused on long releases for stability
- Stresses stability over features
- Commercial (non-free)

- Based off of commercial releases of Redhat (distro)
- Run by the community
- Basically Redhat without the cost or support

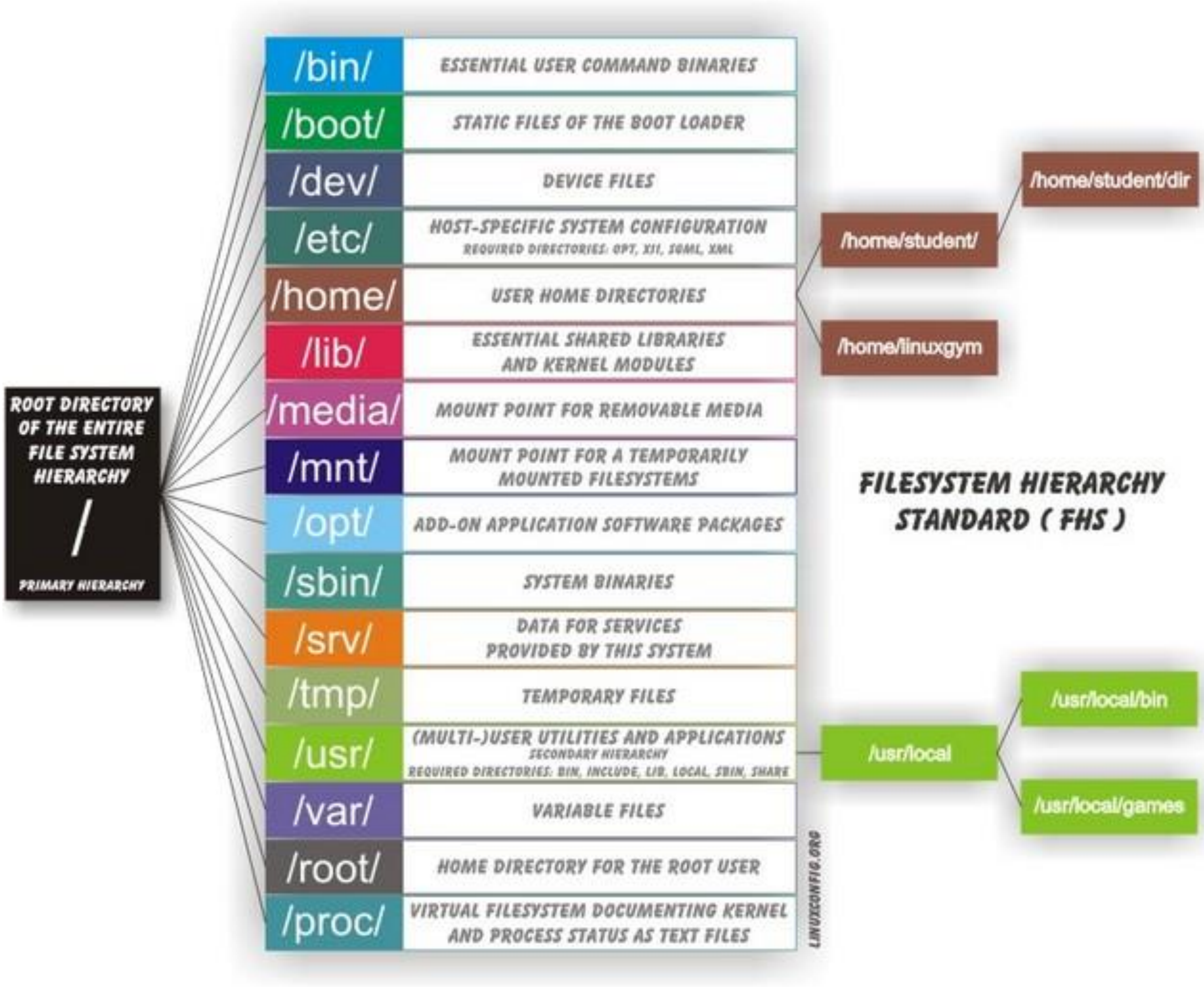
Console

- In simple term – Where we see boot messages and login prompt
- Multiple virtual consoles
  - tty1
  - tty2
  - tty3
  - tty4..

Filesystem

- On a UNIX system, everything is a file; if something is not a file, it is a process.
- Used to control how data is stored and retrieved
- Linux file system – ext2, ext3
- Windows filesystem – FAT, FAT32, NTFS
- Network filesystem – Samba, NFS
- Filesystem Hierarchy Standard (FHS)
  - Defines main directories and their contents in most Linux based systems

Linux FHS



ROOT DIRECTORY OF THE ENTIRE FILE SYSTEM HIERARCHY

/

PRIMARY HIERARCHY

/bin/	ESSENTIAL USER COMMAND BINARIES
/boot/	STATIC FILES OF THE BOOT LOADER
/dev/	DEVICE FILES
/etc/	HOST-SPECIFIC SYSTEM CONFIGURATION REQUIRED DIRECTORIES: OPT, X11, SGML, XML
/home/	USER HOME DIRECTORIES
/lib/	ESSENTIAL SHARED LIBRARIES AND KERNEL MODULES
/media/	MOUNT POINT FOR REMOVABLE MEDIA
/mnt/	MOUNT POINT FOR A TEMPORARILY MOUNTED FILESYSTEMS
/opt/	ADD-ON APPLICATION SOFTWARE PACKAGES
/sbin/	SYSTEM BINARIES
/srv/	DATA FOR SERVICES PROVIDED BY THIS SYSTEM
/tmp/	TEMPORARY FILES
/usr/	(MULTI-)USER UTILITIES AND APPLICATIONS SECONDARY HIERARCHY REQUIRED DIRECTORIES: BIN, INCLUDE, LIB, LOCAL, SBIN, SHARE
/var/	VARIABLE FILES
/root/	HOME DIRECTORY FOR THE ROOT USER
/proc/	VIRTUAL FILESYSTEM DOCUMENTING KERNEL AND PROCESS STATUS AS TEXT FILES

/home/student/

/home/student/dir

/home/linuxgym

FILESYSTEM HIERARCHY STANDARD (FHS)

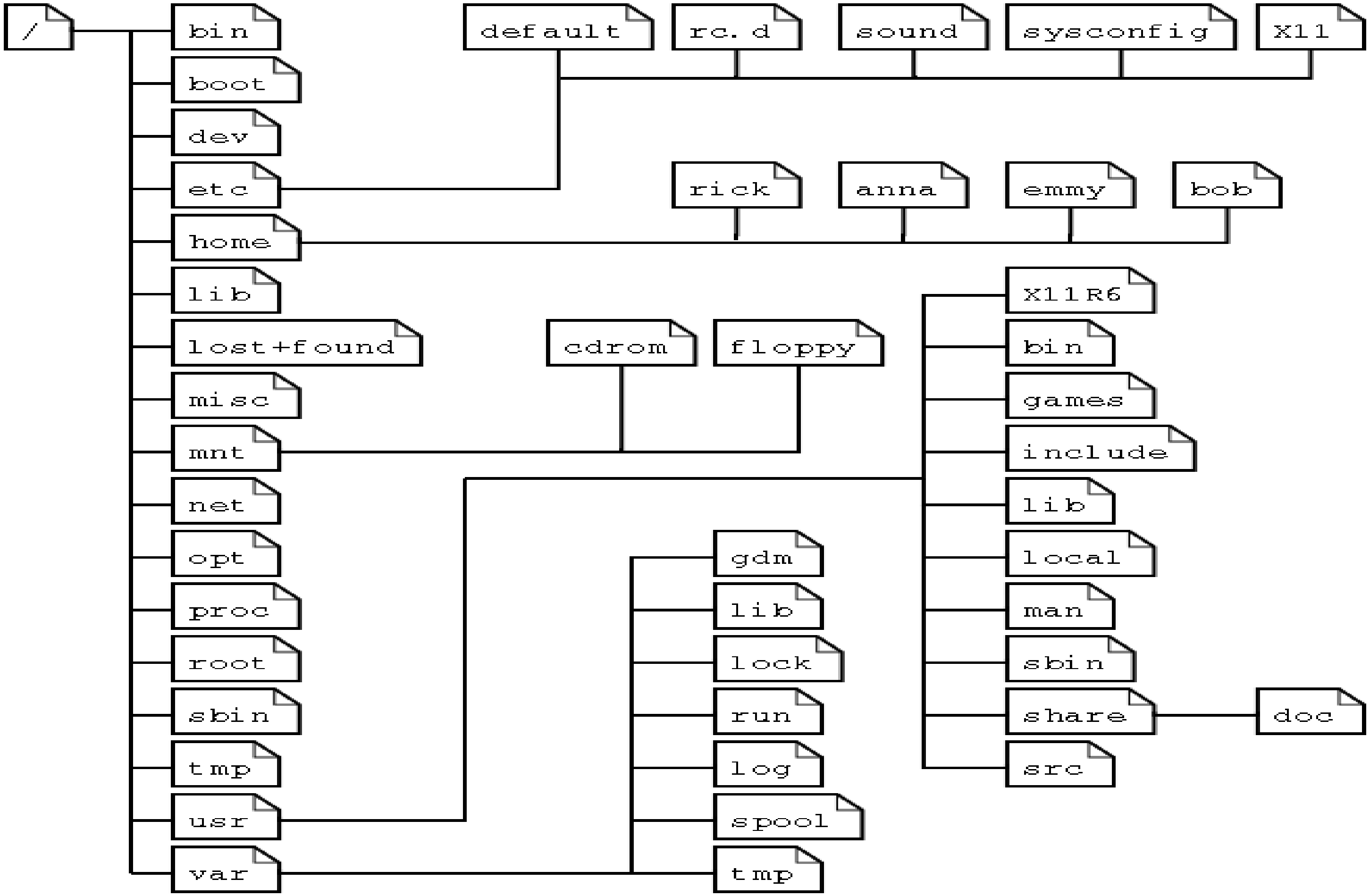
/usr/local

/usr/local/bin

/usr/local/games

LINUXCONFIG.ORG

File System Hiearchy



Path

- A path is a unique location to a file or a folder in a file system of an OS. A path to a file is a combination of / and alpha-numeric characters.
- An absolute path is defined as the specifying the location of a file or directory from the root directory(/).
- Eg: /var/ftp/pub
- /boot/grub/grub.conf
- Relative path is defined as path related to the present working directory(pwd).
- Eg: Suppose I am located in /var/log and I want to change directory to /var/log/kernel . /var/log

  cd kernel
- If you observe there is no / before kernel which indicates it's a relative directory to present working directory.

Few Commands

- Linux commands syntax – <command> [options] [arguments]
- Getting help in Linux – man, info, <cmd> --help
- File handing cmds – ls, cd, mkdir, pwd, cp, mv, rm find, history, cat, less, head, tail
- System administration cmds – chmod, chown, su, useradd, passwd
- Network cmds – ping, ifconfig, service, ssh, scp
- Miscellaneous cmds – ps, kill, tar, zip, unzip, mount, umount, du, df, reboot, shutdown

Cat Command

- Cat(concatenate) command is very frequently used in Linux.

- General Syntax

```
cat [OPTION] [FILE]...
```

Cat command

Syntax	Description
cat /etc/passwd	Display Contents of File
cat test test1	View Contents of Multiple Files in terminal
cat >test2	Create a File with Cat Command
cat song.txt | more cat song.txt | less	Use Cat Command with More & Less Options
cat test >> test1	Appending Standard Output with Redirection Operator
cat test test1 test2 > test3	Redirecting Multiple Files Contain in a Single File
cat test test1 test2 test3 | sort > test4	Sorting Contents of Multiple Files in a Single File

Ls(long listings) command

Syntax	Description
ls	To show the contents of a directory
ls -a	To show hidden files and folders
ls –F	to append file types to listings
ls -l	to show a long listing
ls -lu	to sort by access time
ls -lS	to sort by size
ls -lt	to sort by modification time

Grep Command

- Linux like operating system provides a searching tool known as g/re/p (globally search a regular expression and print).
- grep command is useful for searching the content of one more files based on the pattern.
- A pattern may be a single character, bunch of characters, single word or a sentence..

Syntax:

The syntax for the grep command is:

```
grep [options] pattern [files]
```

Options of Grep

Option	Description
-b	Display the block number at the beginning of each line.
-c	Display the number of matched lines.
-h	Display the matched lines, but do not display the filenames.
-i	Ignore case sensitivity.
-l	Display the filenames, but do not display the matched lines.
-n	Display the matched lines and their line numbers.
-s	Silent mode.
-v	Display all lines that do NOT match.
-w	Match whole word.

File Operations

- We can perform number of operations on files in linux, few of which are stated as below:
- mkdir : use to make a directory.
- rm: Remove/delete a file(s) or directories(s).
- rmdir: Remove an empty directory
- mv: Move a file or a directory to a new location or rename a file/directory.
- touch: This command is used to create empty files, simply do touch file_name. It is also used to update the timestamps on files
- cp: Copy a file
- file: Attempts to find out what type of file it is

runlevel

0 – System halt *i.e* the system can be safely powered off with no activity.

1 – Single user mode.

2 – Multiple user mode with no NFS(network file system).

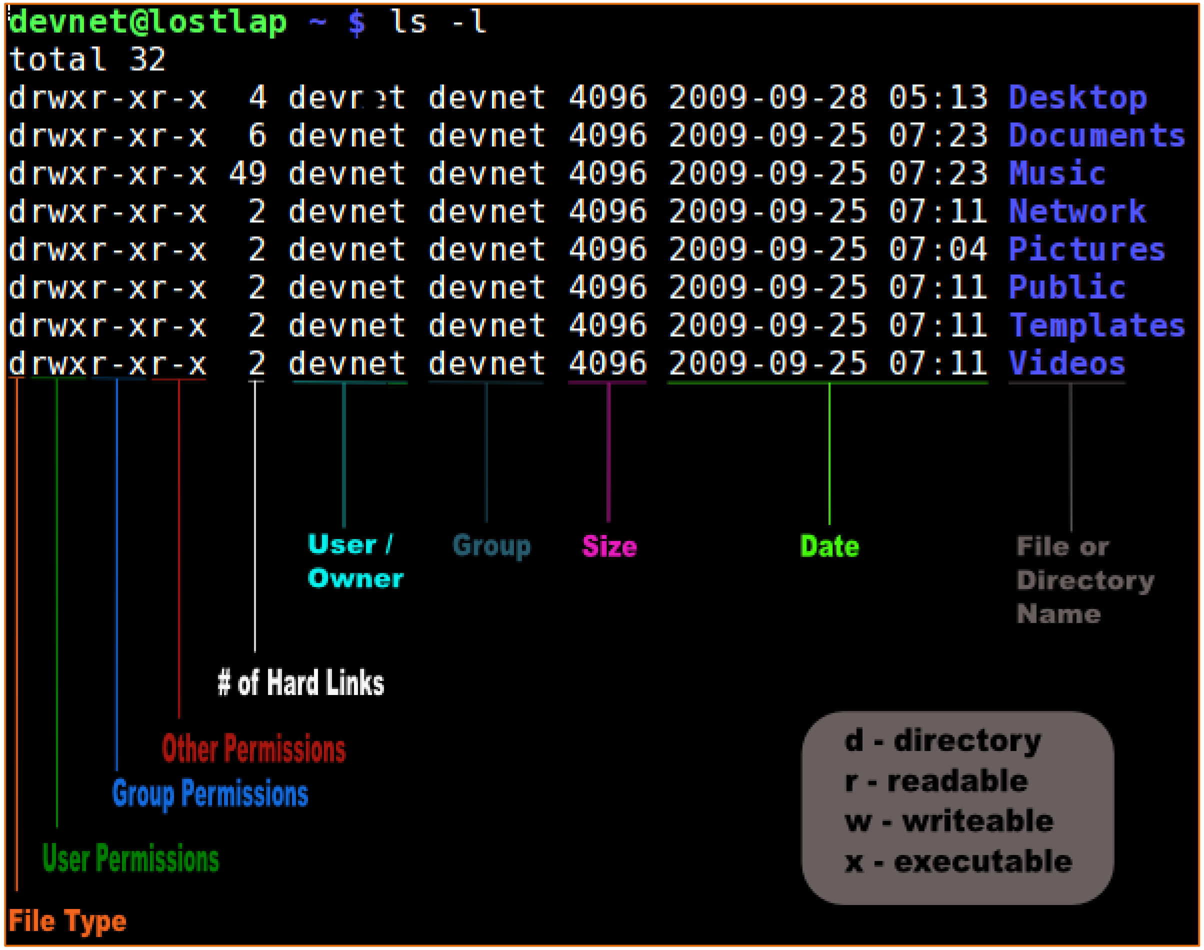
3 – Multiple user mode under the command line interface and not under the graphical user interface.

4 – User-definable.

5 – Multiple user mode under GUI (graphical user interface) and this is the standard runlevel for most of the LINUX based systems.

6 – Reboot which is used to restart the system.

Permissions



```
devnet@lostlap ~ $ ls -l
total 32
drwxr-xr-x  4 devnet devnet 4096 2009-09-28 05:13 Desktop
drwxr-xr-x  6 devnet devnet 4096 2009-09-25 07:23 Documents
drwxr-xr-x 49 devnet devnet 4096 2009-09-25 07:23 Music
drwxr-xr-x  2 devnet devnet 4096 2009-09-25 07:11 Network
drwxr-xr-x  2 devnet devnet 4096 2009-09-25 07:04 Pictures
drwxr-xr-x  2 devnet devnet 4096 2009-09-25 07:11 Public
drwxr-xr-x  2 devnet devnet 4096 2009-09-25 07:11 Templates
drwxr-xr-x  2 devnet devnet 4096 2009-09-25 07:11 Videos
```

File Type

- : regular file

d : directory

c : character device file

b : block device file

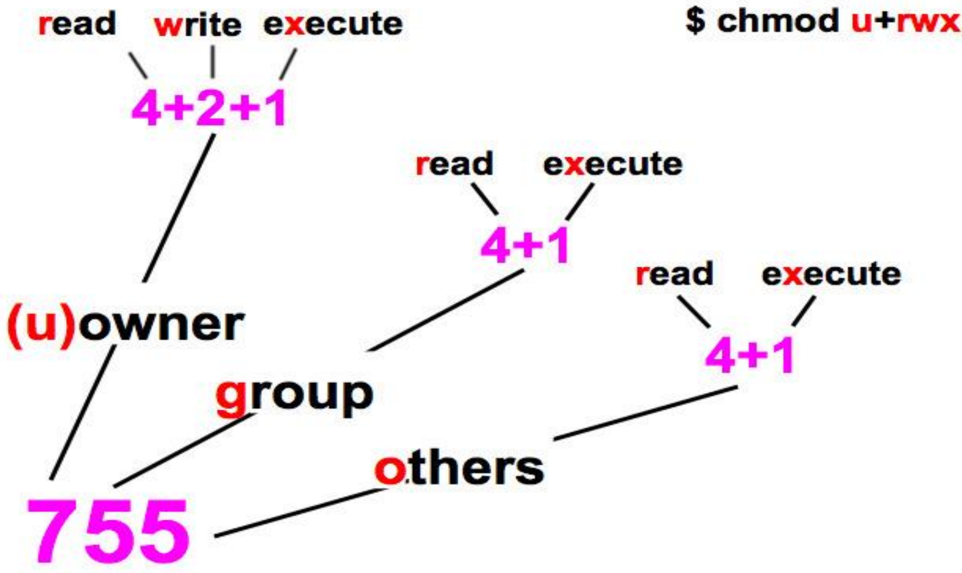
s : local socket file

p : named pipe

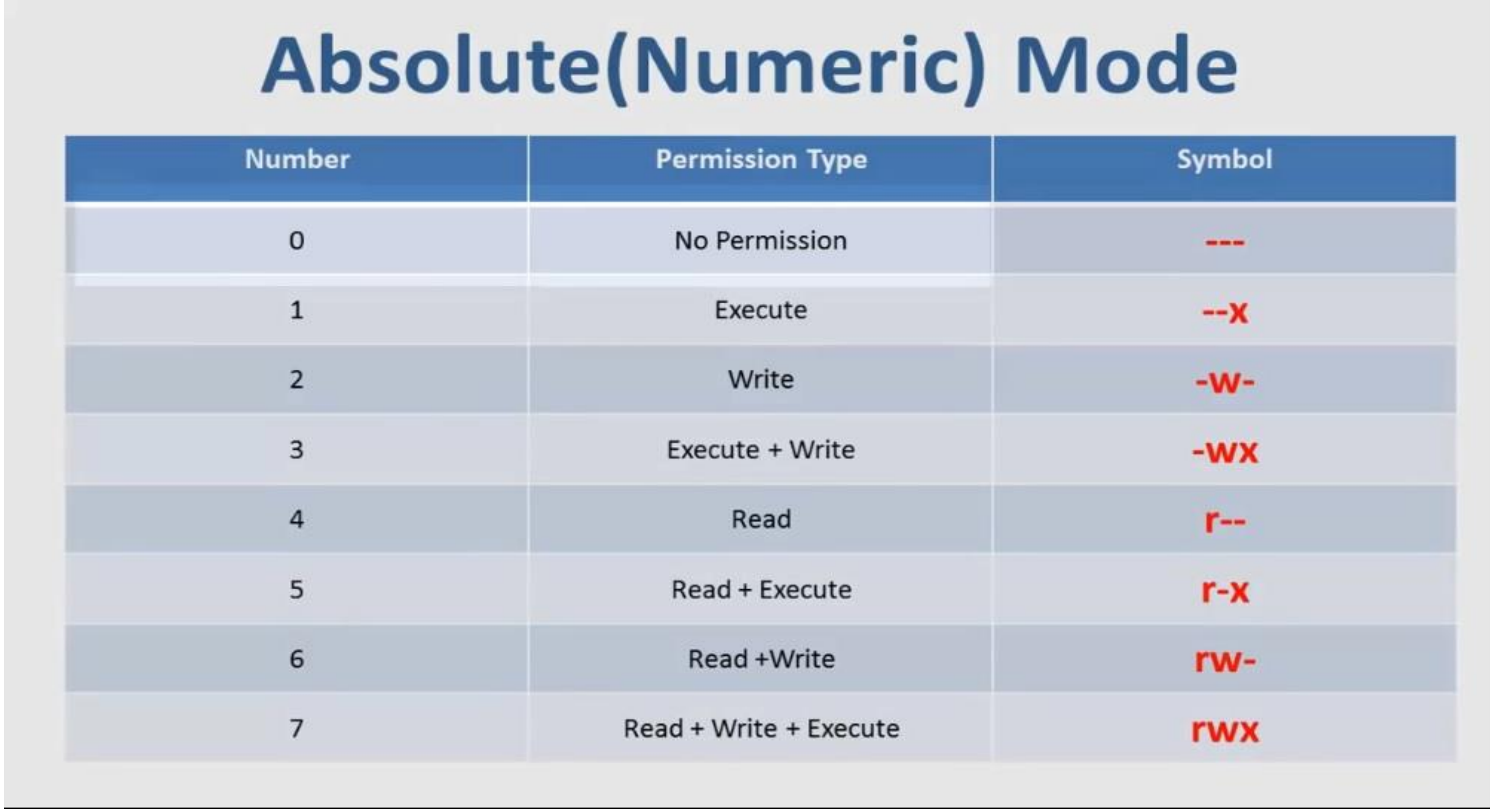
l : symbolic link

Permissions..

```
$ chmod 755 file
$ chmod u+rwx,g+rx,o+rx file
```



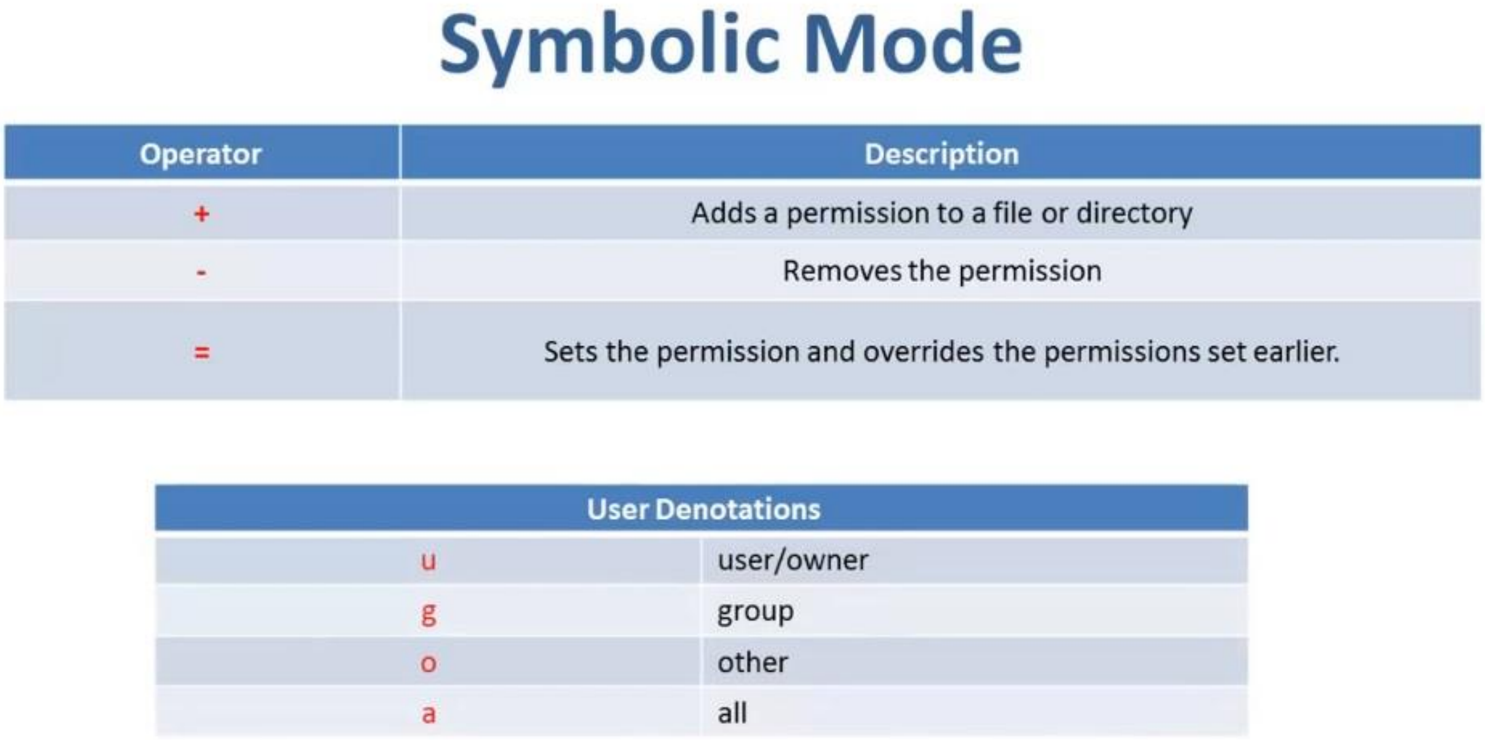
chmod



Absolute(Numeric) Mode

Number	Permission Type	Symbol
0	No Permission	---
1	Execute	--x
2	Write	-w-
3	Execute + Write	-wx
4	Read	r--
5	Read + Execute	r-x
6	Read +Write	rw-
7	Read + Write + Execute	rwx

chmod



Symbolic Mode

Operator	Description
+	Adds a permission to a file or directory
-	Removes the permission
=	Sets the permission and overrides the permissions set earlier.

User Denotations	
u	user/owner
g	group
o	other
a	all

Vi Editor

- vi is a “visual editor”, standard Linux and Unix editor
- vim: the “vi improved” editor
- vi command invokes vim
- To start vim: vi <filename>
- file will be opened, if it exists
- vi creates file when the edits are saved for the first time, if it doesn’t exist

Three modes of Vi

- Command mode
  - Cursor movement
  - Change, delete, yank, put, search
- Insert mode
  - Type in new text
  - Return to command mode with <ESC>
- ex mode
  - Configuring, exiting, saving
  - Search and replace

Command Mode

- Cursor Movement : Use arrow keys or

H	L	K	J
Left	Right	Up	Down

- Change, delete and copy (yank)

	Change	Delete	Copy
Line	cc	dd	yy
Letter	cl	dl	yl
Word	cw	dw	yw

Put (paste) & Undoing Changes

- Use p or P to put (paste)
- For line oriented data:
  - p puts the data below the current line
  - P puts the data above the current line
- For character oriented data:
  - p puts the data after the cursor
  - P puts the data before the cursor

- u undo most recent change
- U undo all changes to the current line since the cursor landed on the line
- <Ctrl-r> redo last “undone” change

Searching for Text & Some Tricks

/<keyword>	search downwards for “<keyword>”
? <keyword>	search upwards for “<keyword>”
n	continue search in the same direction
N	continue search in the opposite direction
dts	delete from cursor to the letter s (it does not span lines)
2dd	delete two lines
x	delete a character
rx	replace a character with x
R	replace character-for-character until <esc>
G	End of file
10G	10th line of file

Insert Mode

a	append after the cursor
i	insert before the cursor
o	open a line below
A	append to end of line
I	insert at beginning of line
O	open a line above
<Esc>	Leaving Insert Mode

Saving and Exiting: ex mode

	Save changes	Abandon changes
Exit	:wq	:q or q!
Do not exit	:w	:e!
Forcing changes		
Exit	:wq!	
Do not exit	:w!	

Thank you!