MODULE 2: File System and Basic File attributes.

UNIX system has thousands of files. If you write a program, you add one more file to the system. When you compile it you add some more. Files grow rapidly, and if they are not organized properly, you will find it difficult to locate them. So UNIX has a file system (UFS) to manage or organizes its own files in directory.

1. UNIX FILES AND BASIC FILE TYPES/CATEGORIES

FILES SUPPORTED BY UNIX FILE SYSTEM

File is a collection of records. So, files are divided into three categories

a. Ordinary file

b. Directory file

c. Device file

The UNIX file system contains several different types of files:

a.Ordinary Files or regular files

It contains only data as a stream of characters.

An ordinary files itself divided into 2 types

Text file: contains only printable characters, and you can often view the contents and make sense out of them. All C and Java files are example of text file. A text file contains lines of characters where every line is terminated with the newline character, also known as **linefeed** (LF) when you press Enter while inserting text, the LF character is appended to every line. You won't see this character normally, but there is command (od) which can make it visible.

Binary file: it contains both printable and unprintable characters that cover the entire ASCII range(0 to 255).most UNIX commands are example of binary files.

b. Directory files

i. Contains no data, but keeps some details of the files and subdirectories that it contains.

ii. A directory file contains an entry for every file and sub directory that it houses. Each entry has two components

- The filename
- A unique Identification number for the file or directory(called the inode number)

iii. A directory contains the filename but not the contents of file.

iv. When you create or remove a file the kernel automatically updates its corresponding directory by adding or removing the enter i.e inode number associated with that file.

c. Device files

i. Used to represent a real physical device such as a printer, tape drive or terminal, used for Input/Ouput (I/O) operations

ii. Unix considers any device attached to the system to be a file - including your terminal:

iii. By default, a command treats your terminal as the standard input file (stdin) from which to read its input

iv. Your terminal is also treated as the standard output file (stdout) to which a command's output is sent.

v. stdin and stdout will be discussed in more detail later

vi. Two types of I/O: character and block

vii. Usually only found under directories named /dev

2. NAMING FILES OR WHAT'S IN A (FILE) NAME

a. UNIX permits file names to use most characters, but avoid spaces, tabs and characters that have a special meaning to the shell, such as:

& ; ( ) | ? \ ' " ` [ ] { } < > $ - ! /

b. It is recommended that only the following characters be used in filenames.

c. Alphabetic characters and numerals

d. The period(.), the hyphen(-) and underscore(_)

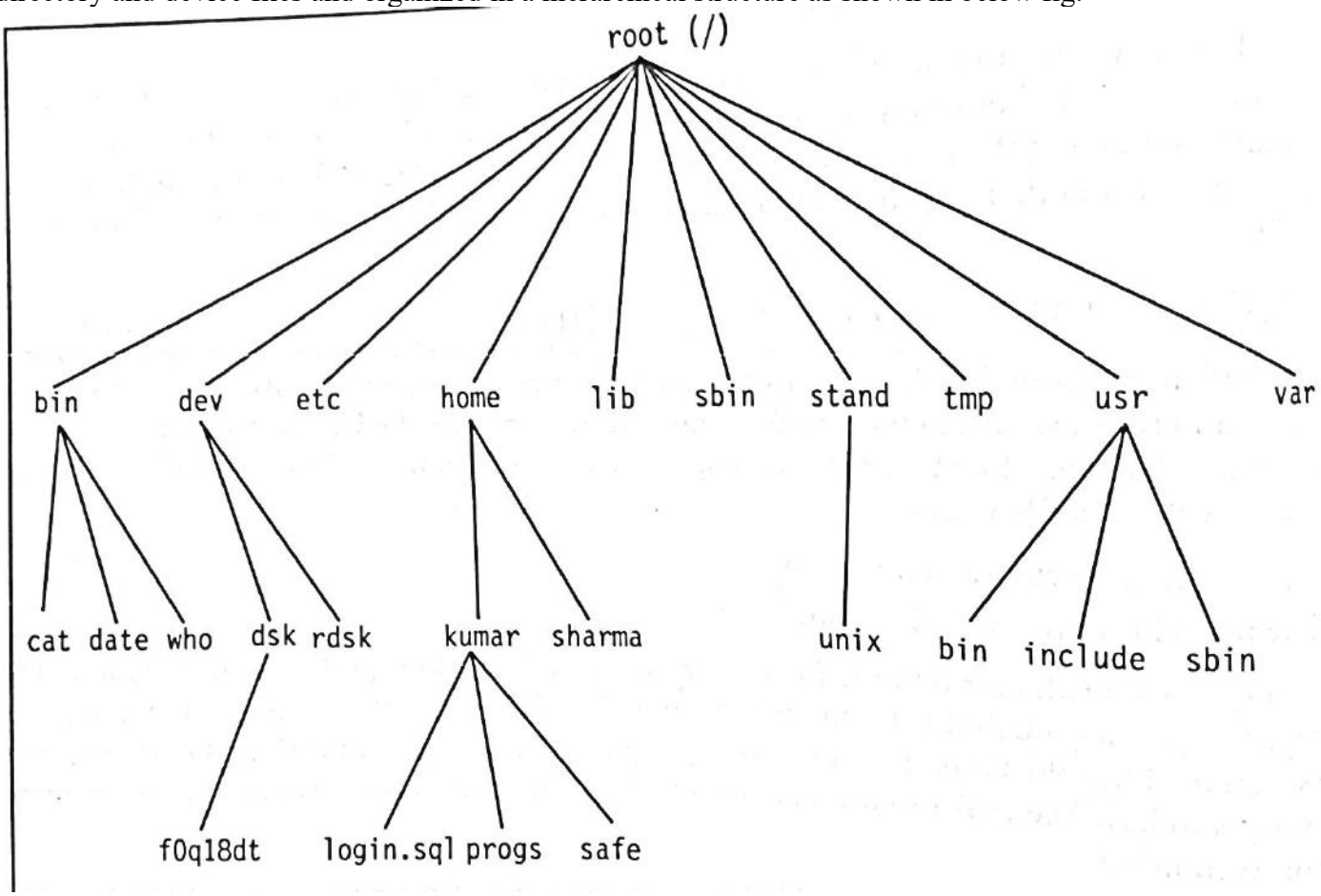
e. Case Sensitivity: uppercase and lowercase are not the same! These are three different files:
NOVEMBER November november

f. Length: can be up to 256 characters

g. Extensions: may be used to identify types of files
libc.a - *archive, library file*
program.c - *C language source file*
alpha2.f - *Fortran source file*
xwd2ps.o - *Object/executable code*
mygames.Z - *Compressed file*

3. PARENT CHILD RELATIONSHIP/ UNIX FILE SYSTEM

All files in UNIX are related to one another. The file system in unix is a collection of all ordinary, directory and device files and organized in a hierarchical structure as shown in below fig.



The implicit feature of every UNIX file system is that there is a top which serves as reference point for all files.This top is called **root** & is represented by a /(front slash). Root is actually a directory. The root

directory has a number of sub directories under it. These sub directories in turn have more sub directories and others files under them.
For instance bin and usr are two directories directly under root, while a second bin and kumar are sub directories under usr.
Every file apart from root must have a parent. Thus the home directory is the parent of kumar , while / is the parent of home and grandparent of kumar. If you create a file login.sql under the kumar directory ,then kumar will be the parent of this file.
The first group contains the files that are made available during system installation

- **/bin and /usr/bin:** these are the directories where all the commonly used UNIX commands are found.
- **/sbin and /usr/sbin:** If there's a command that you can't execute but the system administrator can execute, it would be probably in one of these directories.
- **/etc:** this directory contains the configuration files of the system. You can change a very important aspect of system functioning by editing a text file in this directory. Your login name and password are stored in files /etc/passwd and etc/shadow
- **/dev:** This directory contains all device files. These files don't occupy space on disk.there could be more sub directories like pts, dsk and rdsk in this directory
- **/lib and /usr/lib:** Contains shared library files and sometimes other kernel-related files.
- **/usr and /include:** contains the standard header files used by C programs. The statement #include<stdio.h> used in most C programs referes to the file stdio.h in this directory.
- **/usr/share/man:** this is where the man pages are stored. There are separate subdirectories here(like man1,man2 etc) that contains the pages for each section. For instance, the man page of **ls** can be found in /usr/share/man/man1

User also work with their own files, they write programs, send and receive mail and also create temporary files. These files are available in the second group shown below

- **/tmp:** the directory where users are allowed to create temporary files. These files are wiped away regularly by the system
- **/var:** The variable part of the file system. Contains all your print jobs and your outgoing and incoming mail.
- **/home:**On many systems users are housed here.Kumar would have his home directory in /home/kumar

4. THE HOME VARIABLE and THE PATH VARIABLE
HOME DIRECTORY : When log on to the system, UNIX automatically places you in a directory called the **home directory.**

- It is created by the system when user account is opened.
- If you log in using the login name sharma , you will land up in a directory that could have the pathname
  /home/sharma
- The shell variable HOME known's yours home directory
  $echo $HOME
  /home/sharma
  You will be doing much of your work in your home directory and subdirectories.
- Home variable: it is also called environment variables. **Environment variables** are a set of dynamic named values that can affect the way running processes will behave on a computer.
- Here **$HOME** is a environment variable it indicates the home directory of the current user: the default argument for the cd built-in command.

5. PATH VARIABLE:

- The PATH environment variable is a colon-delimited list of directories that your shell searches through when you enter a command.
- Program files (executables) are kept in many different places on the Unix system. Your path tells the Unix shell where to look on the system when you request a particular program.
- To find out what your path is, at the Unix shell prompt echo $PATH
- Your path will look something like the following.

```
/usr2/username/bin:/usr/local/bin:/usr/bin:.
```

You will see your username in place of username. Using the above example path, if you enter the ls command, your shell will look for the appropriate executable file in the following order: first, it would look through the directory /usr2/username/bin, then /usr/local/bin, then /usr/bin, and finally the local directory, indicated by the . (a period).

6.DIRECTORY COMMANDS – PWD, CD, MKDIR, RMDIR COMMANDS

6.1 pwd (PRINT WORKING DIRECTORY) (checking your current directory)

As the name states, command '**pwd**' prints the current working directory or simply the directory user is, at present. It prints the current directory name with the complete path starting from root (/). This command is built in shell command and is available on most of the shell – bash, Bourne shell, ksh,zsh, etc.

Basic syntax

$pwd [option]

Options	Description
-L (logical)	Use PWD from environment, even if it contains symbolic links
-P (physical)	Avoid all symbolic links
–help	Display this help and exit
–version	Output version information and exit

If both '**-L**' and '**-P**' options are used, option '**L**' is taken into priority. If no option is specified at the prompt, pwd will avoid all symlinks, i.e., take option '**-P**' into account.

6.2 cd: CHANGING THE CURRENT DIRECTORY

- The **cd** command, which stands for "change directory", changes the shell's current working directory.
- The **cd** command is one of the commands you will use the most at the command line in UNIX.
- It allows you to change your working directory. You use it to move around within the hierarchy of your file system.

Ex 6.2.1 When used with an argument it changes the current directory to the directory specified as argument for example assume gmit is a directory under user directory Kumar.To change from Kumar directory to gmit directory , issue the command as follows

$pwd
/home/kumar
$cd gmit
$pwd
/home/kumar/gmit

Ex 6.2.2:When cd used without arguments: cd when used without arguments reverts to home directory

$pwd
/home/kumar/gmit
$cd
cd without argument will change directory from gmit to its home directory Kumar
$pwd
/home/kumar

Ex 6.2.3: If your present working directory is /home/Kumar and you need to switch to /bin directory directly, use absolute pathname i.e /bin wd cd command
$pwd
/home/kumar
$cd /bin
$pwd
/bin

6.3 mkdir: "making directory".

- **mkdir** is used to create directories on a file system.
- If the specified *DIRECTORY* does not already exist,**mkdir** creates it.
- More than one *DIRECTORY* may be specified when calling **mkdir**.

mkdir syntax
mkdir [*OPTION* ...] *DIRECTORY* ...

Ex 6.3.1: To create a directory named gmit, issue the following command**.**

$mkdir gmit

gmit directory is created under present working directory.
Assume that pwd is /home/kumar , then gmit directory is created under kumar directory.

Ex 6.3.2: To create three directories at a time, named patch, dbs, doc, pass directory names as arguments.

$mkdir patch dbs doc

Ex 6.3.3:To create a directory tree:
To create a directory named gmit and create two subdirectories named cse and ise under gmit, issue the command. gmit is a parent directory.
$mkdir parent directory sub-directories
$mkdir gmit gmit/cse gmit/ise

Ex 6.3.4: Error while creating a directory tree
$mkdir gmit/cse gmit/ise
mkdir: Failed to make a directory “gmit/cse”; no such file or directory
mkdir: Failed to make a directory “gmit/ise”; no such file or directory

Error is due to the fact that the parent directory named gmit is not created before creating sub directories cse and ise.

Ex 6.3.5: **$mkdir test**

mkdir: Failed to make directory “test”; Permission denied.

This can happen due to:

a. The directory named test may already exist

b. There may be an ordinary file by the same name in the current directory.

c. The permissions set for the current directory do not permit the creation of files and directories by the user.

6.4 rmdir: REMOVING DIRECTORIES

The **rmdir** utility removes the directory entry specified by each directory argument, provided the directory is empty.

Ex 6.4.1: **$rmdir progs**

removes the directory named progs

Arguments are processed in the order given. To remove both a parent directory and a subdirectory of that parent, the subdirectory must be specified first, so the parent directory is empty when **rmdir** tries to remove it.

The reverse logic of mkdir is applied.

$rmdir subdirectories parent directory

$rmdir gmit/cse gmit/ise gmit

- You cant delete a directory with rmdir unless it is empty.In this example gmit directory cannot be removed until the sub directories cse and ise are removed.
- You cant remove a sub directory unless you are place in a directory which is hierarchically above the one you have chosen to remove.

6.5 ABSOLUTE PATHNAMES:

- If the first character of a pathname is / the files location must be determined with respect to root(/) . Such a pathname is called absolute pathname.

  cat /home/kumar
- When you have more than one / in a pathname for such / you have to descend one level in the file system. Thus Kumar is one level below home and two levels below root.
- When you specify a file y using frontslashes to demarcate the various levels,you have a mechanism of identifying a file uniquely.No two files in a UNIX system can have same absolute pathnames.
- When you specify the date command, the system has to locate the file date from a list of directories specified in the PATH variable and then execute it.
- However if you know the location of a command in prior, for example date is usually located in /bin or /usr/bin . Use absolute pathname i,e precede its name with complete path

  $/bin/date

  For example if you need to execute program **less** residing in /usr/local/bin you need to enter the absolute pathname

  $/usr/local/bin/less

6.6 RELATIVE PATHNAMES

- Pathnames that don't begin with / specify locations relative to your current working directory.
- Uses either the current or parent directory as reference and specifies path relative to it.
- A relative pathname uses one of these cryptic symbols.
  . (a single dot)-→ this represents the current directory.
  .. (two dots)→this represents the parent directory

Command	Function
cd	Returns you to your login directory
cd ~	Also returns you to your login directory
cd /	Takes you to the entire system's root directory
cd /root	Takes you to the home directory of the root or superuser,account created at installation, you must be root user to access this directory.
cd /home	Takes you to the home directory where user login directories are usually stored
cd ..	Moves you up one directory
cd ~otheruser	Takes you to the otheruser's login directory
cd /dir/subdirfoo	Regardless of which directory you are in, the absolute path takes you directly to subdirfoo, a subdirectory of dir.

Ex .6.6.1: Assume the current directory is /home/kumar/progs/data/text, using cd .. will move one level up

$pwd
/home/kumar/progs/data/text
$ cd ..
$pwd
/home/kumar/progs/data

Ex 6.6.2 : To move two levels up

$pwd
/home/kumar/progs
$ cd ../..
$pwd
/home

Ex 6.6.3: My present location is /etc/samba and now I want to change directory to /etc.
Using relative path: $ **cd ..**
Using absolute path: $**cd /etc**

Ex 6.6.4: My present location is /var/ftp/ and I want to change the location to /var/log
Using relative path: **cd ../log**
Using absolute path: **cd /var/log**

Ex 6.6.5: My present location is /etc/lvm and I want to change my location to /opt/oradba
Using relative path: **cd ../../opt/oradba**
Using absolute path: **cd /opt/oradba**

7. ls : listing directory contents:

To obtain a list of all filenames in the current directory.

Numerals first

Uppercase next

Lowercase Then

$ls

Output:08_packets.html

calendar

dept.lst

emp.lst

helpdir

uskdsk06

ls options:

- Output in multiple columns(-x):

$ls -x

08_packets.html	**calendar**	**dept.lst**	**emp.lst**
helpdir	**progs**	**usdsk07**	**usdsk07**

- **I**dentifying directories and executables(-F)

$ ls –Fx

08_packets.html	**calendar***	**cptodos.sh***	**dept.lst**
emp.lst	**helpdir /**	**progs /**	**usdsk07**

The * indicates the file contains the executable code and / refers to directory

- Showing Hidden files also(-a):

$ls –axF

.profile	**.exrc**	**.kshrc**	**.xinitrc**
08_packets.html	**calendar***	**cptodos.sh***	**dept.lst**
emp.lst	**helpdir /**	**progs /**	**usdsk07**

The hidden files are indicated by **.** (dot) displayed before filename.

- Listing directory contents:

$ls –x helpdir progs

helpdir:

forms.obd graphics.obd

progs:

array.pl n2words.pl

If we specify two directories named helpdir and progs , the contents of the directory i,e filenames are listed out.

- Recursive listing(-R)

The recursive option lists all sub-directories and files in a directory tree structure.

$ls -xR

08_packets.html calendar cptodos.sh dept.lst
emp.lst helpdir progs usdsk07
./helpdir
forms.hlp graphics.hlp
./progs
arrays.pl n2words.pl

8.Cat command : Displaying and creating files

cat is one of the most well known commands of UNIX system.
Cat is useful for creating a file .
Its mainly used to display the contents of a small file on the terminal.

- **Using cat to create a file:**
  Enter the command cat, followed by >(right chevron) character and the filename.
  Example: take a filename named foo
  $ cat > foo
  > Symbol following command means that the output goes to filename following it.
  [ctrl+d] /* to terminate or to signify end of the input.
  $
- **Using cat to display a file**
  Enter the cat command followed by filename
  $ cat foo
  Symbol following command means that the output goes to filename following it.

Cat options (-v and -n)

Displaying Non printing characters(-v)
cat is normally used for displaying text files only. If you have non-printing ASCII characters in your input , you can see cat with -v option to display these characters

Numbering lines(-n)
The -n option numbers lines.

Cat with more than one filename as arguments:

cat filename1 filename2 ....
cat chap01 chap02
The contents of second file are displayed immediately after the first file without any header information.

9. cp: copying a file

- cp command copies a file or a group of files.it creates an exact image of the file on the disk with the different name.
- The syntax requires atleast two filenames to be specified in the command line.
- When both are ordinary files, the first is copied to second file.
  cp source file destination file

cp chap01 unit1

if destination file i.e unit1 does not exist, first it will be created before copying.if not it will be simply overwritten without any warning.

- Copying a file to another directory
  ex: assume there is a file named chap01 and it has to be copied to progs directory
  cp chap01 progs
  output: chap01 is now copied to directory named progs with the same name chap01.
- Copying a file to another directory with different name
  ex: assume there is a file named chap01 and it has to be copied to progs directory with chap01 file renamed as unit1
  cp chap01 progs/unit1
  output: chap01 is now copied to directory named progs with the same name unit1

- Copy more than one file with a single command.
  cp chap01 chap02 chap03 progs
  chap01, chap02, chap03 files are copied to directory named progs.
- Copy all files beginning with chap
  cp chap* progs

9.1 cp options:

Interactive copying (-i): the -i option warns the user before overwriting the destination file.

Ex: **$ cp -i chap01 unit1**
cp: overwrite unit1(yes/no)? y
A y at this prompt will overwrite the file.

Copying directory structure(-R) : the -R command behaves recursively to copy an entire directory structure say progs to newprogs.

Ex say progs directory contains three files kernel, bash, korn. To copy all three files under progs to newprogs directory

$ cp -R progs newprogs

---

10. rm : deleting files

The rm command deletes one or more files.

Ex 1: The following command deletes three files chap01, chap02, chap03.

$ rm chap01 chap02 chap03

Ex 2: to delete files named chap01 and chap02 under progs directory

$ rm progs/chap01 progs/chap02

Ex 3: to remove all file

$ rm*

10.1 rm options:

Interactive deletion (-i): the –i optin makes the command ask the user for confirmation before removing each file.

$rm -i chap01 chap02 chap03
rm: remove chap01(yes/no)?y
rm: remove chap01(yes/no)?y
rm: remove chap01(yes/no)?y

Recursive deletion(-r or -R) deletes all subdirectories and files recursively. Rm wont normally

remove directories but when used with -r or -R option it will.

$ rm -r *

Forcing removal: rm prompts for removal, if a file is write protected. The -f option overrides this minor protection and forces removal.

$ rm -rf * /*(deletes everything in the current directory and below)

---

11. mv: RENAMING FILES.

The mv command renames or moves files. It has two distinct functions:

a. It renames a file or directory

b. it moves a group of files to a different directory

To rename a file chap01 to man01

$ mv chap01 man01

mv replace the filename in the existing directory entry with the new name.

No additional space is consumed on disk during renaming.

To rename a directory:

$ mv pts perdir

pts directory is renamed as perdir

To move group of files to a directory

mv chap01 chap02 chap03 progs

to move three files chap01, chap02, chap03 to directory named progs

12.wc command: COUNTING LINES,WORDS,CHARACTERS

wc command takes one or more filenames as arguments and displays four columnar output.

First we will create a file named infile

```
$ cat > infile
I am the wc command
I count characters,words and lines
[ctrl+D]
```

$wc infile

2 10 55 infile

wc counts lines in first column ,words in second column,characters in third column and filename in fourth column..

A line is any group of characters not containing a newline

A word is group of characters not containing a space tab or newline.

A character is the smallest unit of information and includes a space, tab and newline

wc options:

$ wc -l infile

2

$wc -w infile

10

$wc -c infile

55

- When two filenames are passed as wc argument

```
[vizion@localhost ~]$ cat > chap01
unix is a multitasking os
its is a multiuser os
[vizion@localhost ~]$ cat > chap02
who cal date
ls rm mv
[vizion@localhost ~]$ wc chap01 chap02
 2 10 48 chap01
 2  6 22 chap02
 4 16 70 total
```

First line : number of lines, words and characters of chap01
Second line: number of lines, words and characters of chap02
Third line: Total number of lines, words and characters of both.

13. od Command: DISPLAYING DATA IN OCTAL.

$ cat odfile
White space includes a
The ^G character rings a bell

$ od -b odfile

The -b option displays the octal values for each character.
000000 127 150 151 164 145 040 163 160 141 143 145 040 151 156 143 154
000000 165 144 145 163 040 141 040 011 012 124 150 145 040 007 040 143
Each line displays 16 bytes of data in octal , preceded by the offset in the file of the first byte in the line.

$od -bc odfile

The -b and -c option combined
Each line is now replaced with two.
The octal values are shown in first line and printable characters and escape sequences are shown in second line

000000	127	150	151	164	145	040	163	160	141	143	145	040	151
	W	h	i	t	e		s	p	a	c	e		i
	156	143	154										
	n	c	l										
000000	165	144	145	163	040	141	040	011	012	124	150	145	040
	u	d	e	s		a		\t	\n	T	h	e	
	007	040	143										
	007		c										

The octal equivalent of characters are displayed ex for W- 127, i-151, \t (tab)-011, \n(newline)-012 ^G(Bell character)- 007

BASIC FILE ATTRIBUTES

1. **ls –l: LISTING FILE ATTRIBUTES**

ls command is used to obtain a list of all filenames in the current directory. The output in UNIX lingo is often referred to as the listing. Sometimes we combine this option with other options for displaying other attributes, or ordering the list in a different sequence. ls look up the file's inode to fetch its attributes. It lists seven attributes of all files in the current directory and they are:

1.1File type and Permissions

1.2 Links
1.3 Ownership
1.4 Group ownership
1.5 File size
1.6 Last Modification date and time
1.7 File name

1.1 The file type and its permissions*:* The first column shows the type and permissions associated with each file.The first character in this column is mostly a **–** which indicates that the file is an ordinary one. In unix, file system has three types of permissions- read, write and execute.

1.2 Links: The second column indicates the number of links associated with the file. This is actually the number of filenames maintained by the system of that file.
1.3 Ownership: The third column shows the owner of files. The owner has full authority to tamper with files content and permissions. Similarly, you can create, modify or remove files in a directory if you are the owner of the directory.

1.4 Group ownership: The fourth column represents the group owner of the file. When opening a user account, the system admin also assigns the user to some group. The concept of a group of users also owning a file has acquired importance today as group members often need to work on the same file.

1.5 File size: The fifth column shows the size of the file in bytes. The important thing to remember here is that it only a character count of the file and not a measure of the disk space that it occupies.

1.6 Last modification time: The sixth, seventh and eighth columns indicate the last modification time of the file, which is stored to the nearest second. A file is said to be modified only if its content have changed in any way.If the file is less than a year old since its last modification time, the year won't be displayed.

1.7 Filename: The last column displays the filename arranged in ASCII collating sequence.
For example, $ ls –l

```
total 72
 -rw-r--r--    1  kumar   metal   19514   may   10 13:45   chap01
-rw-r--r--     1  kumar   metal   4174    may   10 15:01   chap02
 -rw-rw-rw-    1  kumar   metal   84      feb   12 12:30   dept.lst
 -rw-r--r--    1  kumar   metal   9156    mar   12 1999    genie.sh
 drwxr-xr-x    2  kumar   metal   512     may   09 10:31   helpdir
 drwxr-xr-x    2  kumar   metal   512     may   09 09:57   progs
```

2. LISTING DIRECTORY ATTRIBUTES (-d option)

- **ls -d** will not list all subdirectories in the current directory
  For example,
  $ls –ld helpdir progs

```
drwxr-xr-x    2  kumar   metal   512   may   9 10:31   helpdir
drwxr-xr-x    2  kumar   metal   512   may   9 09:57   progs
```

- Directories are easily identified in the listing by the first character of the first column, which here shows a **d.**

- To see the attributes of a directory rather than the files contained in it, use **ls –ld** with the directory name.

3. FILE OWNERSHIP

- When you create a file, you become its **owner** and it shows up in the third column of the files listing.
- Group name is seen in the fourth column; your group is the **group owner** of the file.
- Every owner is attached to a group owner. Several users may belong to a single group, but the privileges of the group are set by the owner of the file and not by the group members.
- When the system administrator creates a user account, he has to assign these parameters to the user:
  The **user-id (UID)** – both its name and numeric representation
  The **group-id (GID)** – both its name and numeric representation

4. FILE PERMISSIONS

- UNIX has a simple and well defined system of assigning permissions to files.
- Lets issue the ls –l command once again to view the permissions of a few lines .

```
$ls  -l  chap02  dept.lst  dateval.sh
-rwxr-xr--  1  kumar  metal  25000  May 10  19:21  chap02
-rwxr-xr-x  1  kumar  metal  890  Jan  10  23:17  dept.lst
-rw-rw-rw-  1  kumar  metal  84  Feb  18  12:20  dateval.sh
```

Consider the first column.

- rwx r-x r—

Each group here represents the category and contain three slots representing the read, write and execute permissions of the file.

r indicates the read permission; **w** indicates write permission; **x** indicates execute permission

- (hyphen) indicates the absence of the corresponding permission.

In the above example, the file permissions of chap02 file is

-	**rwx**	**r-x**	**r - -**
File	**owner/user**	**group**	**others**

First group(rwx) has all the three permissions.

- The file is readable, writable and executable by the **owner** of the file, kumar.
- The third column shows the owner of the file.
- The first permissions group applies to kumar.
- You have to login with the name kumar for the privileges to apply to you.

Second group(r-x):

- has a hyphen in the middle slot, which indicates the absence of write permissions by the **group** owner of the file.
- The group owner is metal and all users belonging to group metal has only read and execute permissions.

Third group(r--):

- has the write and execute bits absent.
- This set is applicable to **others** i,e those who are neither the owner nor group.
- This category is referred to as the world.

5. CHANGING FILE PERMISSIONS- chmod command.

A file or a directory is created with a default set of permissions, which can be determined by umask. Let us assume that the file permission for the created file is -rw-r--r--. Using chmod command, we can change the file permissions and allow the owner to execute his file. The command can be used in two ways:

5.1 In a relative manner by specifying the changes to the current permissions
5.2 In an absolute manner by specifying the final permissions

5.1 RELATIVE PERMISSIONS

chmod only changes the permissions specified in the command line and leaves the other permissions unchanged.

Its syntax is:

chmod category operation permission filename(s)

chmod takes an expression as its argument which contains:

user category (user, group, others)
operation to be performed (assign or remove a permission)
type of permission (read, write, execute)

The below shows the abbreviations used by **chmod** command

Category	**operation**	**permission**
u - user	+ assign	r - read
g – group	- remove	w - write
o - others	= absolute	x - execute
a - all (ugo)		

Ex 1:

$ls –l xstart

-**rw-**r--r-- 1 kumar metal 1906 sep 23:38 xstart

Here user is having the only read and execute permission .

Using relative file permission need to add the execute permission to user

chmod	category	operation(+,-)	permission	filename.
$chmod	u	+	x	xstart

$chmod u+x xstart

$ ls –l xstart

-**rwx**r--r-- 1 kumar metal 1906 sep 23:38 xstart

After executing the **chmod** command, the command assigns (+) execute (x) permission to the user (u), other permissions remain unchanged.

Ex 2: To remove execute permission from all and assign read permission to group and others

$chmod a-x, go+r xstart /*to remove execute permission from all(a)ie user, group, others
/*to assign read permission to group and others (go+r)

Ex 3: To assign write and execute permissions for others.

$chmod o+wx xstart

5.2 ABSOLUTE PERMISSIONS

A string of three octal digits is used as an expression. The permission can be represented by one octal digit for each category. For each category, we add octal digits. If we represent the permissions of each category by one octal digit, this is how the permission can be represented:

- Read permission – 4 (octal 100)
- Write permission – 2 (octal 010)
- Execute permission – 1 (octal 001)

Octal	Permissions	Significance
0	- - -	no permissions
1	- - x	execute only
2	- w -	write only
3	- w x	write and execute
4	r - -	read only
5	r - x	read and execute
6	r w -	read and write
7	r w x	read, write and execute

We have three categories and three permissions for each category, so three octal digits can describe a file's permissions completely. The most significant digit represents user and the least one represents others. chmod can use this three-digit string as the expression.

Ex 1: To assign read,write permissions to all .Using **relative** permission, we have,

$chmod a+rw xstart

Using **absolute** permission, we have,

$chmod 666 xstart /* 6 for r-w

/* first digit 6 for user, second 6 for group and third 6 for others

Ex 2:

To assign read and write for user and remove write, execute permissions from group and others

- Here to assign rw- corresponds to digit 6
- Remove write , execute permissions is nothing but assigning only read option to group and others
- Only read permission is r—corresponds to 4

$chmod 644 xstart

Ex 3:

To assign all permissions to the owner, read and write to group and only execute for others.

$chmod 761 xstart

Ex 4

To assign all permissions to all categories.

$chmod 777 xstart

5.3 The Security Implications

Let the default permission for the file xstart is

-rw-r—r--

$chmod u-rw, go-r xstart or
$chmod 000 xstart
After Executing above any one command the output will be removes the all permission from all categories as shown below
----

This is simply useless but still the user can delete this file
On the other hand,
chmod a+rwx xstart or
chmod 777 xstart
After Executing either of the one command it adds the all permission to all categories as shown below
-rwxrwxrwx

The UNIX system by default, never allows this situation as you can never have a secure system. Hence, directory permissions also play a very vital role here.

5.4 use chmod Recursively.(-R)

- It possible to make **chmod** descend directory hierarchy and apply the expression to every file and sub directory it finds. This is done by using -R option
  $chmod -R a+x shell_scripts

This makes all the files and subdirectories found in the shell_scripts directory, executable by all users.

6. DIRECTORY PERMISSIONS

- Directories also have their own permissions and the significance of these permissions differ from those of ordinary files.
- The default permissions of a directory are,
  rwxr-xr-x (755)
- A directory must never be writable by group and others

Ex1:
$mkdir c_progs ; ls –ld c_progs
drwxr-xr-x 2 kumar metal 512 may 9 09:57 c_progs
Here the c_progs directory is created (mkdir c_progs) and then the attributes of directory is listed out(ls –ld c_progs)

If a directory has write permission for group and others also, be assured that every user can remove every file in the directory. As a rule, you must not make directories universally writable unless you have definite reasons to do so.

7. CHANGING FILE OWNERSHIP
There are two commands meant to change the ownership of a file or directory.
chown changing file owner and
chgrp changing group owner

7.1 chown : Changing file owner

- The syntax is
  chown options owner [:group] file(s)
- For changing ownership requires super user permission. So let's first change our status to that of super user with the **su** command:
  $su
  Password: ******
  #_
- After the password is successfully entered, **su** returns a **#** prompt, the prompt used by root. **su** lets us acquire super user status if we know the root password.
- Consider the file note owned by kumar.To now renounce the ownership of the file note to Sharma, use **chown** in the following way:
  # ls -l note
  -rwxr----x 1 kumar metal 347 may 10 20:30 note

  #chown sharma note; ls -l note
  -rwxr----x 1 sharma metal 347 may 10 20:30 note

Once ownership of the file has been given away to sharma, the user file permissions that previously applied to Kumar now apply to sharma. Thus, Kumar can no longer edit *note* since there is no write privilege for group and others. He cannot get back the ownership either. But he can copy the file to his own directory, in which case he becomes the owner of the copy.

7.2 chgrp :Changing Group Owner

- This command changes the file's group owner. No superuser permission is required.

$ ls –l dept.lst
-rw-r--r-- 1 kumar **metal** 139 jun 8 16:43 dept.lst
Here the group owner of dept.lst is metal

$chgrp dba dept.lst; ls –l dept.lst
-rw-r--r-- 1 kumar **dba** 139 jun 8 16:43 dept.lst

The group owner of the file dept.lst is changed from metal to dba by issuing the command
$chgrp dba dept.lst

The file attributes of dept.lst is listed by issuing the command
$ls –l dept.lst

- ***Using chown to change both file owner and group :***
  The syntax requires two arguments to be separated by :
  chown sharma:dba dept.lst
  Here the ownership of dept.lst is changed to sharma and group to dba