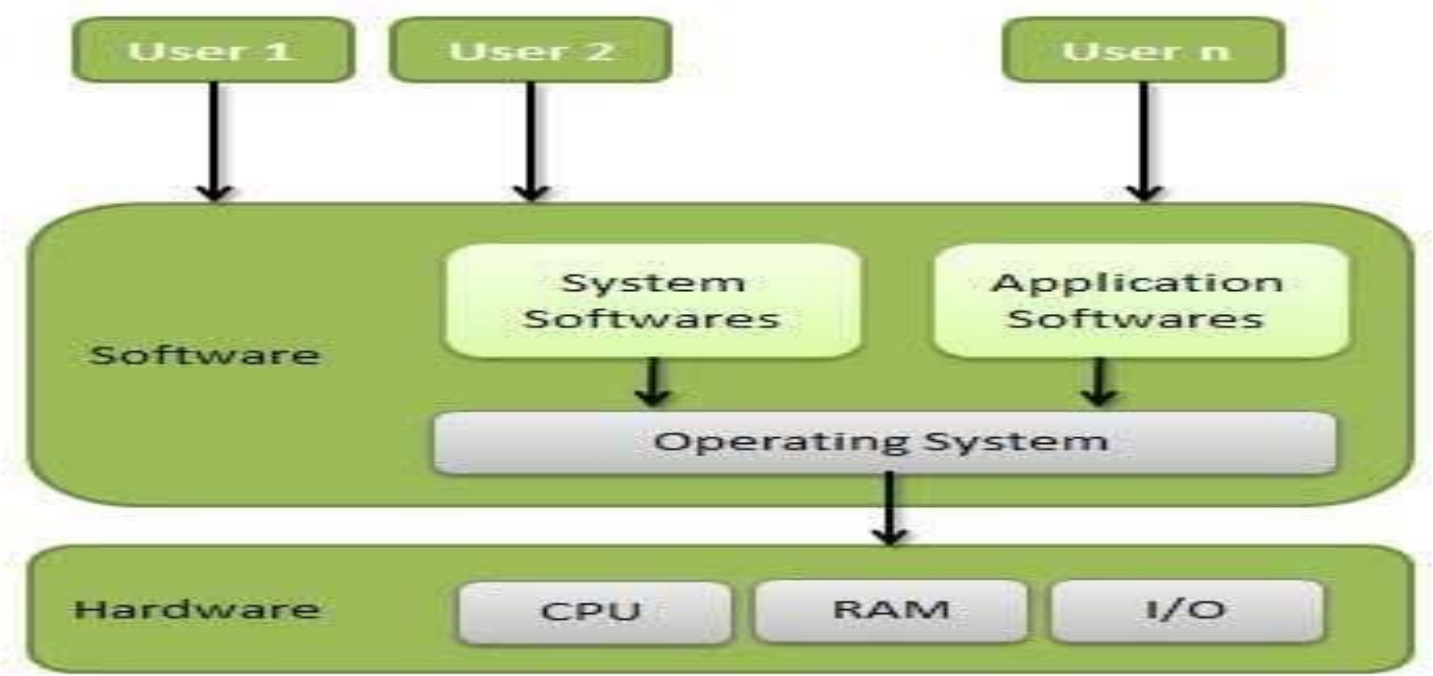
Operating System

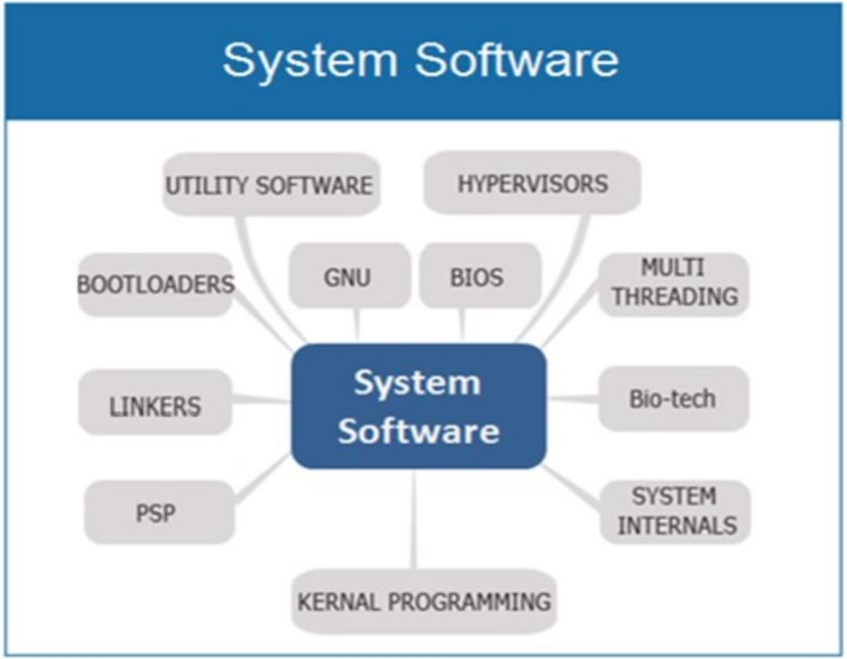
What is OS ?

- An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.
- An operating system is a software which performs all the basic tasks like
- file management, memory management, process management, handling input and output,
- controlling peripheral devices such as disk drives and printers.

Operating System Structure



System Software Vs Application Software



64 bit and 32 bit Operating System

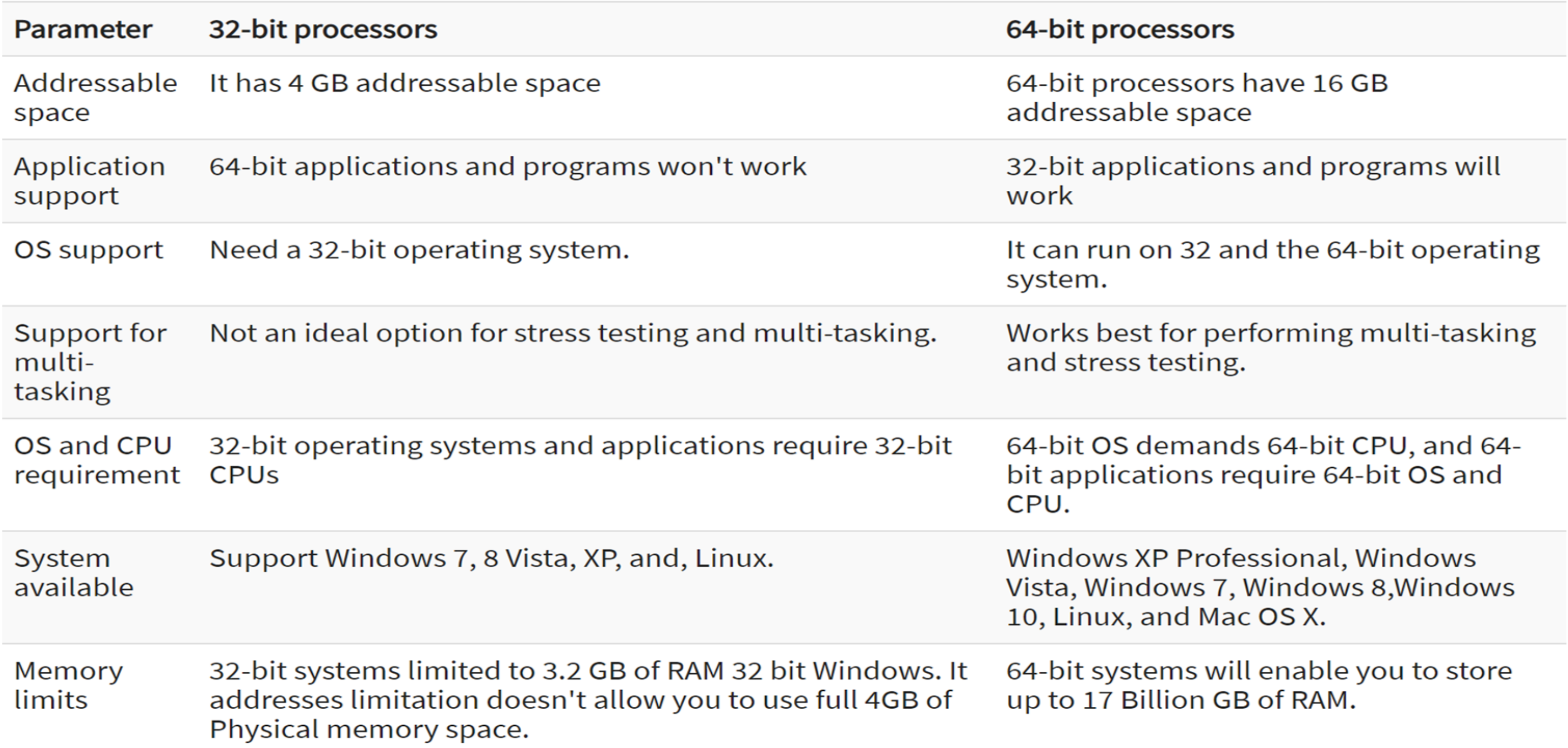
- 32-bit is a type of CPU architecture which is capable of transferring 32 bits of data.

- It is the amount of information which can be processed by your CPU whenever it performs an operation.

- A 64-bit microprocessor allows computers to process data and memory address which are represented by 64 bits.

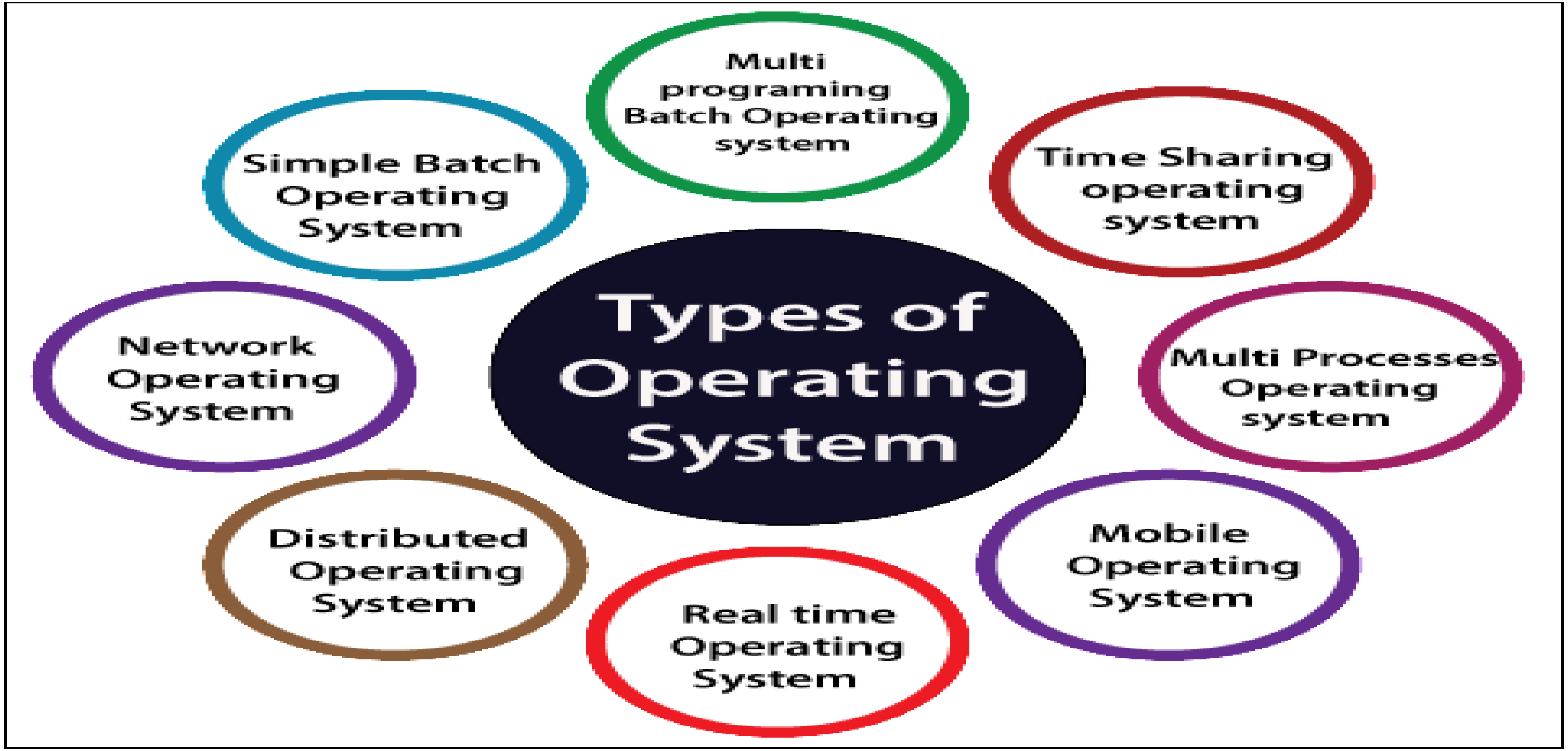
- Using 64-bit one can do a lot in multi-tasking, user can easily switch between various applications without any windows hanging problems

Difference :64 bit and 32 bit processor

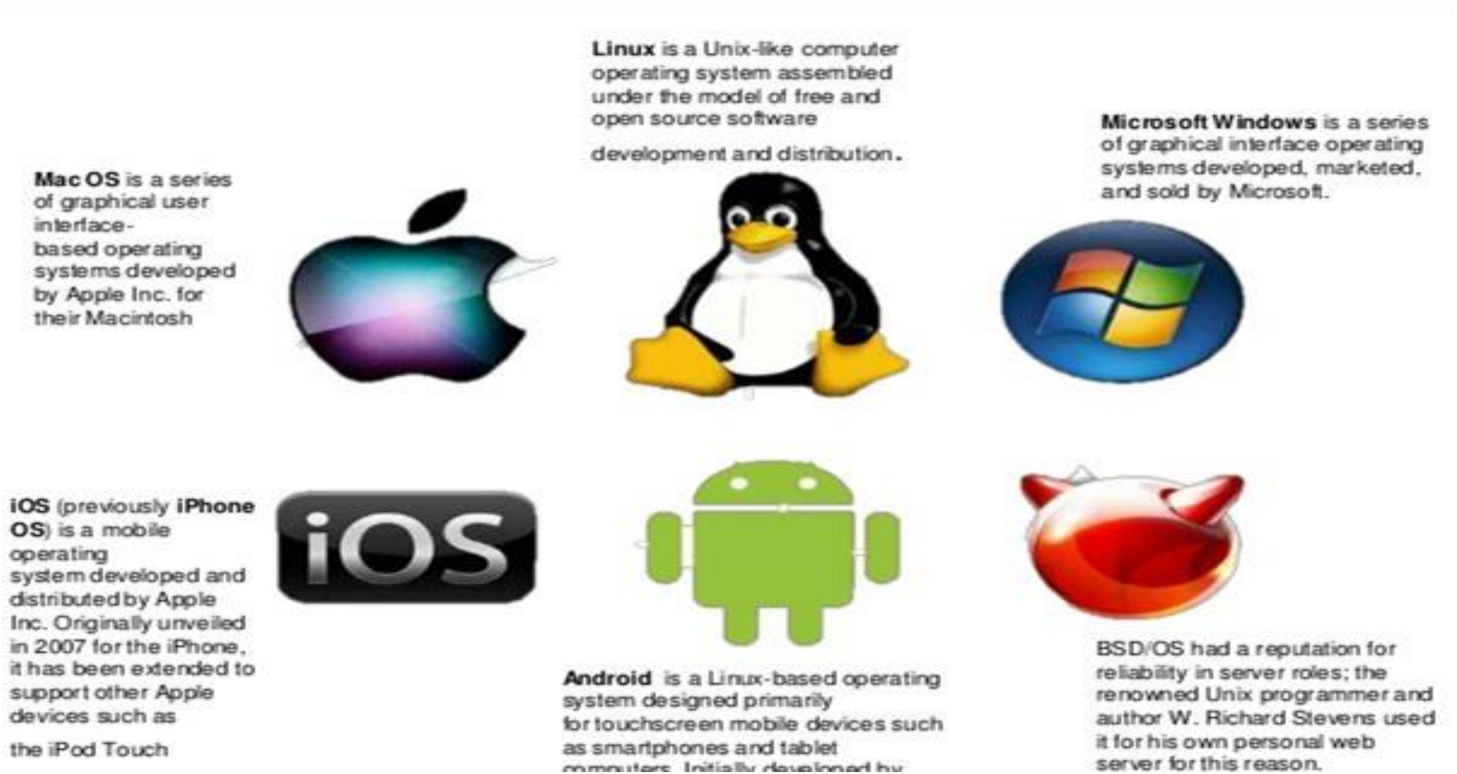


Parameter	32-bit processors	64-bit processors
Addressable space	It has 4 GB addressable space	64-bit processors have 16 GB addressable space
Application support	64-bit applications and programs won't work	32-bit applications and programs will work
OS support	Need a 32-bit operating system.	It can run on 32 and the 64-bit operating system.
Support for multi-tasking	Not an ideal option for stress testing and multi-tasking.	Works best for performing multi-tasking and stress testing.
OS and CPU requirement	32-bit operating systems and applications require 32-bit CPUs	64-bit OS demands 64-bit CPU, and 64-bit applications require 64-bit OS and CPU.
System available	Support Windows 7, 8 Vista, XP, and, Linux.	Windows XP Professional, Windows Vista, Windows 7, Windows 8,Windows 10, Linux, and Mac OS X.
Memory limits	32-bit systems limited to 3.2 GB of RAM 32 bit Windows. It addresses limitation doesn't allow you to use full 4GB of Physical memory space.	64-bit systems will enable you to store up to 17 Billion GB of RAM.

Types of Operating System


Types of Operating System
Multi programing Batch Operating system
Simple Batch Operating System
Time Sharing operating system
Network Operating System
Multi Processes Operating system
Distributed Operating System
Real time Operating System
Mobile Operating System

Example of operating System



Mac OS is a series of graphical user interface-based operating systems developed by Apple Inc. for their Macintosh

Linux is a Unix-like computer operating system assembled under the model of free and open source software development and distribution.

Microsoft Windows is a series of graphical interface operating systems developed, marketed, and sold by Microsoft.

iOS (previously **iPhone OS**) is a mobile operating system developed and distributed by Apple Inc. Originally unveiled in 2007 for the iPhone, it has been extended to support other Apple devices such as the iPod Touch

Android is a Linux-based operating system designed primarily for touchscreen mobile devices such as smartphones and tablet computers. Initially developed by

BSD/OS had a reputation for reliability in server roles; the renowned Unix programmer and author W. Richard Stevens used it for his own personal web server for this reason.

UNIX

- **Unix** is a computer Operating System which is capable of handling activities from multiple users at the same time.

- The development of **Unix** started around 1969 at AT&T Bell Labs by Ken Thompson and Dennis Ritchie.

- It is a **stable, multi-user, multi-tasking system for servers, desktops and laptops**.

- UNIX systems also have a graphical user interface (GUI) similar to Microsoft Windows which provides an easy to use environment.

Types of UNIX

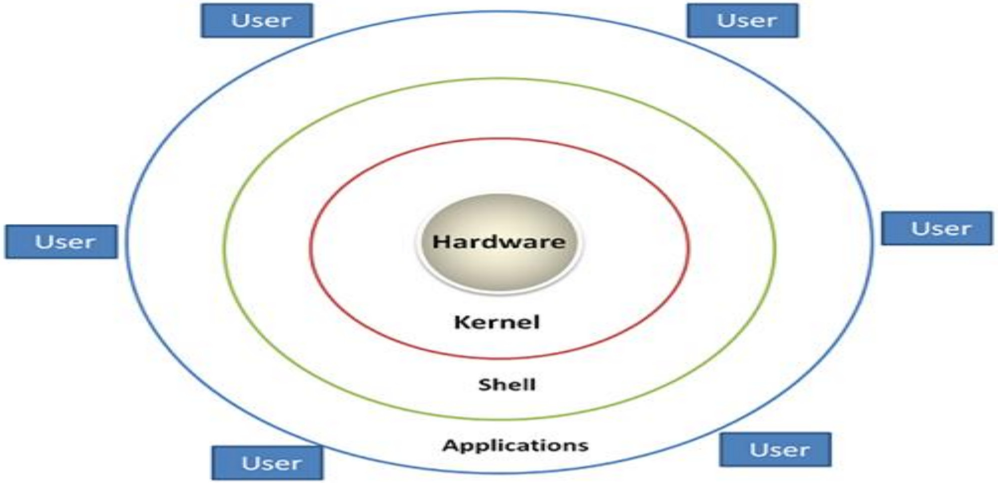
- There are many different versions of UNIX, although they share common similarities.
- The most popular varieties of UNIX are **Sun Solaris, GNU/Linux, and MacOS X**.
- Solaris used for servers and workstations, and Fedora Linux on the servers and desktop PCs
- The UNIX operating system is made up of three parts;
    - kernel,
    - shell and the programs.

LINUX

- Linux is one of popular version of UNIX operating System.
- It is open source as its source code is freely available.
- It is low cost operating system for personal computer users
- Its functionality list is quite similar to that of UNIX.
- Linux uses the **monolithic kernel** which consumes more running space whereas Windows uses the **micro-kernel** which takes less space but lowers the system running efficiency than Linux.

Linux System Architecture

- The Linux Operating System's architecture primarily has these components: the Kernel, Hardware layer, System library, Shell and System utility.



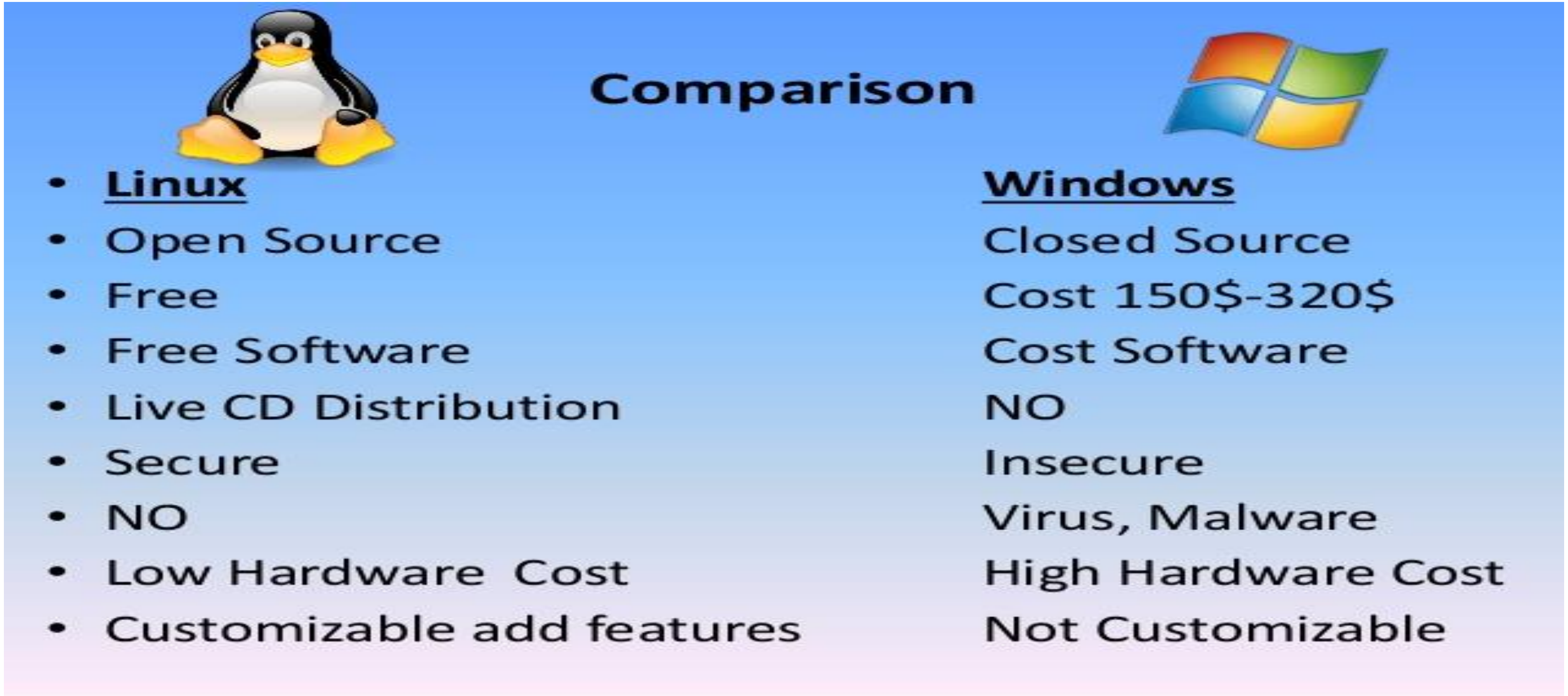
Linux System Architecture

- **Hardware layer** of the LINUX operating system consists of peripheral devices such as RAM, HDD, CPU.
- **The shell** is an interface between the user and the kernel, and it affords services of the kernel.
- The shell takes commands from the user and executes kernel's functions
- An interface to kernel, hiding complexity of kernel's functions from users.

Kernel

- Kernel is central component of an operating system that manages operations of computer and hardware.
- Kernel acts as a bridge between applications and data processing performed at hardware level using inter-process communication and system calls.
- **Objectives of Kernel :**
  - To establish communication between user level application and hardware.
  - To decide state of incoming processes.
  - To control disk management.
  - To control memory management.
  - To control task management.

Window VS Linux

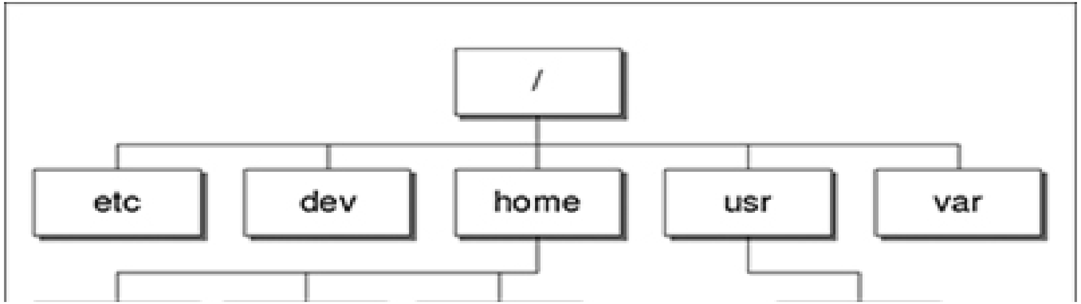


Comparison

• **Linux**	**Windows**
• Open Source	Closed Source
• Free	Cost 150-320
• Free Software	Cost Software
• Live CD Distribution	NO
• Secure	Insecure
• NO	Virus, Malware
• Low Hardware Cost	High Hardware Cost
• Customizable add features	Not Customizable

Linux File System

- The Linux filesystem is responsible for storing your system data and managing them.
- A filesystem can be defined as the mechanism behind data storing and retrieval.
- **The Symbol (/**) is called the root of the file system and is essentially the starting point of your system.



File System

- /etc : Systemwide **configuration files** for the software installed on your system are stored here.
- /dev : Each device on your system has an entry in this folder (device drivers files)
- /home : Each user account on the system has a home directory that is stored here.
- /usr : General software is installed here.(Default directory)

File System

- /var : This folder contains log files about the software on your computer.
- /boot : This folder contains important files to boot the computer, including the bootloader configuration and the kernel.
- /lib : Important system software libraries are stored here.
- /bin : Software that is vital for the system to be able to boot (executable file)is stored here.

Commands

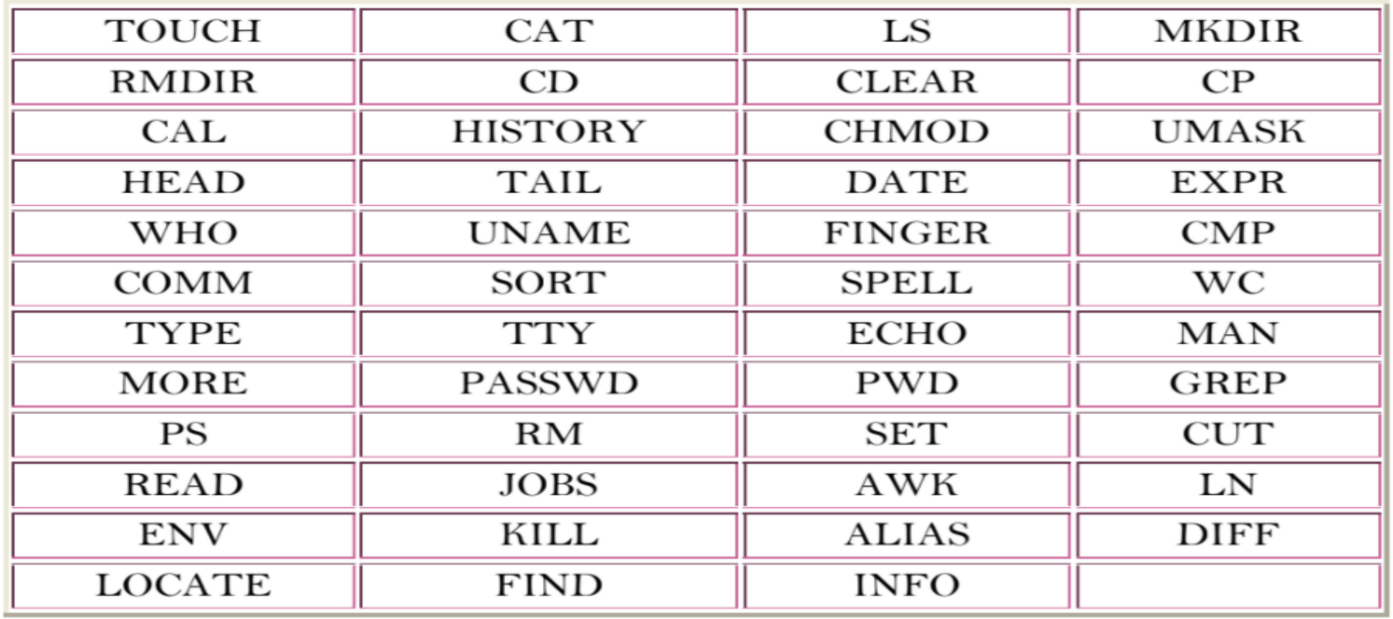
- A ***command*** is an instruction given by a user telling a computer to do something, such a run a single *program* or a group of linked programs.
- Commands are generally issued by typing them in at the *command* and then pressing the ENTER key, which passes them to the *shell*.
- A shell is a program that reads commands that are typed on a keyboard and then *executes* them.

Linux Commands

- All the Linux/Unix commands are run **in the terminal** provided by the Linux system.
- This terminal is just **like the command prompt** of Windows OS.
- Linux/Unix commands are ***case-sensitive.***
- The terminal can be used to accomplish all Administrative tasks
- Linux terminal is user-interactive.

Practical-1

- Execute Linux Commands and describe the output .



TOUCH	CAT	LS	MKDIR
RMDIR	CD	CLEAR	CP
CAL	HISTORY	CHMOD	UMASK
HEAD	TAIL	DATE	EXPR
WHO	UNAME	FINGER	CMP
COMM	SORT	SPELL	WC
TYPE	TTY	ECHO	MAN
MORE	PASSWD	PWD	GREP
PS	RM	SET	CUT
READ	JOBS	AWK	LN
ENV	KILL	ALIAS	DIFF
LOCATE	FIND	INFO	

Telnet

- **Telnet** is a network protocol **used** to virtually access a computer and to provide a two-way, collaborative and text-based communication channel between two machines.
- It follows a user command Transmission Control Protocol/Internet Protocol (TCP/IP) networking protocol for creating remote sessions.
- **Install Telnet on Windows**
  - Click **Start**.
  - Select Control Panel.
  - Choose Programs and Features.
  - Click Turn Windows features on or off.
  - Select the **Telnet** Client option.

Telnet

- **Install Telnet on Windows**
  - Click **Start**.
  - Select Control Panel.
  - Choose Programs and Features.
  - Click Turn Windows features on or off.
  - Select the **Telnet** Client option.
  - Click OK.

How to access telnet server ?

- The Run box allows the user to open a program by name

1. Window Key + R
2. Type **telnet 202.131.126.203**
3. Enter login ID and PASSWORD
4. Change Your Password

Basic commands

1. **PASSWD**
2. **help** command which as its name says help you to learn about any built-in command.
   a. $help help
3. **man** command in Linux is used to display the user manual of any command that we can run on the terminal
4. **Ls**
5. **c d**
6. **c d . .**

Touch Command

- The touch command is a standard command used in UNIX/Linux operating system which is used to Create , change and modify timestamps of a file
- **Touch –a , touch -c** : This command is used to check whether a file is created or not.
- **touch -c-d :** This is used to update access and modification time. **touch -c -d "2-jan" p1**
- **touch -m :** This is used to change the modification time only. **touch -m fileName**
- **touch -t :** This is used to create a file using a specified time

  touch -t YYMMDDHHMM fileName

cat Command

1	$cat filename	view a single file or multiple
2	$cat -n filename	view contents of a file with numbering
3	cat >newfile	Create new file
4	$cat file1 > file2	Copy content from f1 to f2
5	$cat -s geeks.txt	suppress repeated empty lines
6	$cat file1 >> file2	Append the content of files/merge file f1 f2 > f3
7	$cat -E "filename"	Highlight end of file
8	$cat *.txt	display the content of all text files

ls Command

1	ls -t	: It sorts the file by modification time
2	Ls -1	Display One File Per Line
3	Ls -l	show long listing information about the file/directory.
4	Ls -lh	display file size in easy to read format
5	Ls –l / etc	display the information about the /etc/ directory
6	Ls –ld	Display Directory Information
7	ls –a	show all the hidden files in the directory
8	Ls –F	Visual Classification of Files With Special Characters

cp Command

1	cp Src_file Dest_file
2	cp Src_file1 Src_file2 Src_file3 Dest_directory
3	cp -R Src_directory Dest_directory copies all files of the source directory to the destination directory
4	$ cp -i a.txt b.txt for Interactive copying.
5	-b(backup): creates the backup of the destination file in the same folder with the different name
6	cp *.txt Folder1

History Command

1	If you wish to view the history one page at a time history | less
2	To view just the last ten commands, you can use the following: history | tail
3	To view the last 25 commands, just use the following: history 25
4	History can also be removed using history -d event_number history -d 1996
5	The whole history can be removed using history -c
6	history | grep -i searchterm

Chmod

- chmod command is used to change the access mode of a file. The name is an abbreviation of change mode.
- Syntax :
- chmod [reference][operator][mode] file...

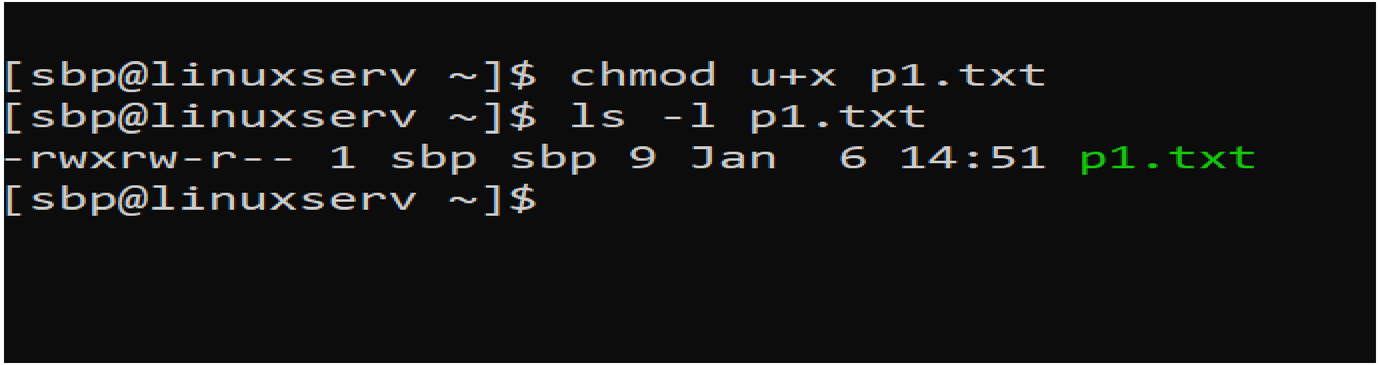
Chmod

References	Class	Description
u	Owner	File’s owner
g	Group	Users who are member of file’s group
o	Others	Users who are neither the file’s owner nor member of the file’s group
A	All	All three of the above

Operators	Description
+	Adds specified modes to specified class
-	Removes the specified modes from specified class
=	The modes specified are to be made the exact modes for the specified classes

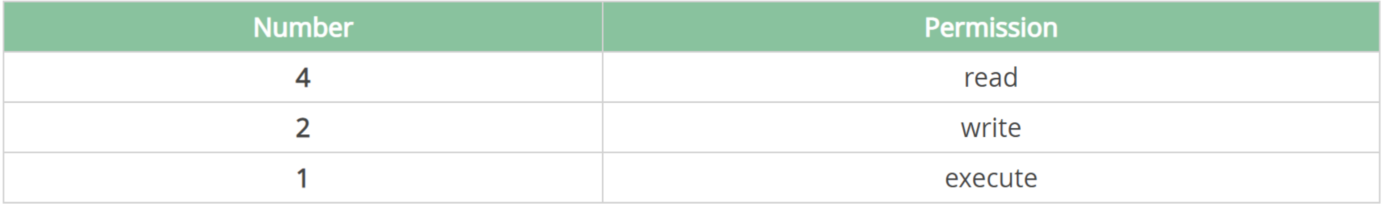
Chmod

Modes	Description
R	Permission to read file
W	Permission to write file
X	Permission to execute file, or, in case of directory , search it.

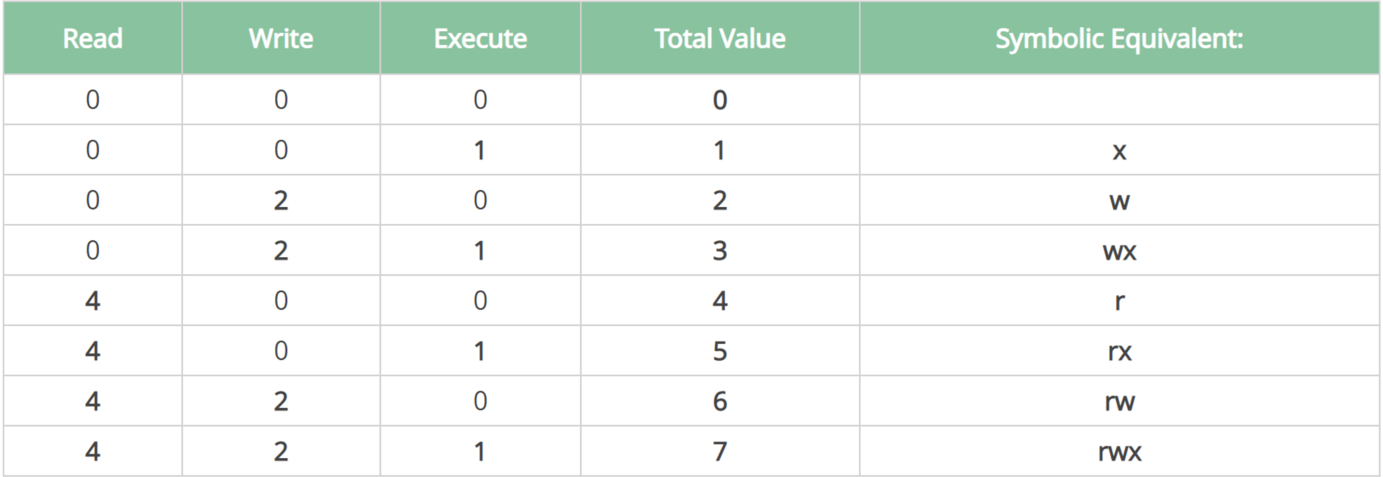


```
[sbp@linuxserv ~]$ chmod u+x p1.txt
[sbp@linuxserv ~]$ ls -l p1.txt
-rwxrw-r-- 1 sbp sbp 9 Jan  6 14:51 p1.txt
[sbp@linuxserv ~]$
```

Octal representation



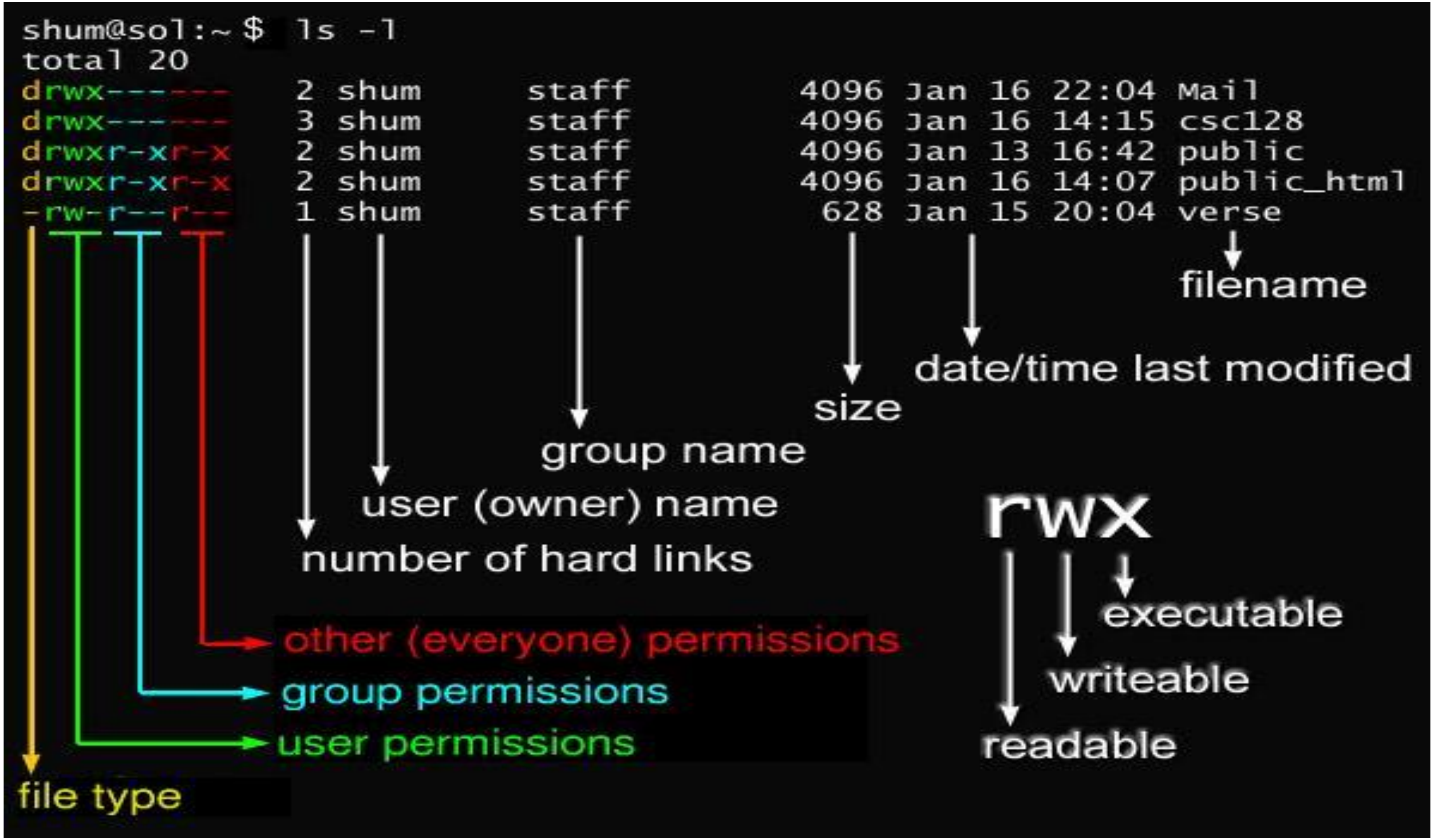
Number	Permission
4	read
2	write
1	execute



Read	Write	Execute	Total Value	Symbolic Equivalent:
0	0	0	0	
0	0	1	1	x
0	2	0	2	w
0	2	1	3	wx
4	0	0	4	r
4	0	1	5	rx
4	2	0	6	rw
4	2	1	7	rwx

Umask

- Umask, or the user file-creation mode, is a Linux command that is used to assign the default file permission sets for newly created folders and files.
- The term mask references the grouping of the permission bits, each of which defines how its corresponding permission is set for newly created files.
- User: The User, by default, is the owner or creator of a file or folder. The ownership of the new file defaults to this user.
- Group: A Group is a set of users that share the same access level or permissions to a file or folder.
- Other: The Other group is defined as any user not included in the previous two categories.



```
shum@sol:~$ ls -l
total 20
drwx------  2 shum    staff        4096 Jan 16 22:04 Mail
drwx------  3 shum    staff        4096 Jan 16 14:15 csc128
drwxr-xr-x  2 shum    staff        4096 Jan 13 16:42 public
drwxr-xr-x  2 shum    staff        4096 Jan 16 14:07 public_html
-rw-r--r--  1 shum    staff         628 Jan 15 20:04 verse
```

How Umask Works

- The umask command masks permission levels by qualifying them with a certain value.
- System’s default permissions is 666 (file)and 777 (directory)
- **Example**
- Set default permissions for all new files or folders to 644 and 755 by command

  umask 022
- write permission will be “filtered” from the system’s default permissions
- Now permission bits for a new file or directory is
- 666 – 022 = 644
- 777 – 022 = 755

Umask

Umask	System's umask as a four-digit octal number :0002
umask -S	To view this as a symbolic representation
Touch test.txt	creating a new file
ls -l test.txt	get a directory listing
umask 022	Set umask
Touch test1.txt	Create new file
Ls –l *.txt	**Umask a+r**
Touch t2.txt	**Ls –l *.txt**
umask 777	no one can read, write, or execute them.
umask 000	Make new files completely accessible (read, write, and execute) to absolutely everyone.

Head and Tail

Head –n Display first 10 line of file	**Tail -n** **last ten lines of the input file**
head -n 7filename Display first 7 line of file	tail -n 7 filename
head -n -3 filename Ignore last 3 line of file	
head -c 5 filename **print the file content by byte**	
head -n 5 filename1 filename2 output the first five lines from both files in one shot	
head -n 7filename Display first 7 line of file	

Date

- Syntax:
  - date [OPTION]... [+FORMAT]
- date + “Year: %Y , Month : %m , Day: %d”
- date -d '16 Dec 2020’ + '%A, %d %B %Y’
- Date –d “last week”`

Expr

- The **expr** command in Unix evaluates a given expression and displays its corresponding output.
- $expr 12 + 8

who

- The who command is used to get information about currently logged in user on to system.
- **Syntax : $who [options] [filename]**
- Login name of the users
- Terminal line numbers
- Login time of the users into system
- Remote host name of the user
- **Example**
- who -m -H
- who -p -H , who –T -H

Uname

- Uname command is used to display basic information about the operating system and hardware.
- Uname –s : system
- Uname –o : os
- Uname –r :relese
- Uname –v : version
- Uname –m : machine info
- Uname –I : hardware platform info

Finger

- **Finger** command is a user information lookup command which gives details of all the users logged in
- Finger
- Finger –s sbp

Cmp

- used to compare the two files byte by byte and helps you to find out whether the two files are identical or not.
- **$cmp file1.txt file2.txt**
- $cmp -b file1.txt file2.txt
- **$cmp –i 10 file1.txt file2.txt**

Comm

- **$comm -1 file1.txt file2.txt**

- **$comm -12 file1.txt file2.txt**

sort

- SORT command is used to sort a file, arranging the records in a particular order
- Cat > testfile
- Sort testfile

spell and wc

- **aspell** command is used as a spell checker in Linux.
- Aspell –option filename
- aspell -c p1.txt

- **WC** is used to find out **number of lines**, **word count**, **byte and characters count** in the files specified in the file arguments.
- Wc –option filename

Type and tty

- used to find out whether command is built-in or external binary file
- Type –options command name
- type command name
- Type –t who
- The term tty is short for teletypewriter, the terminal device that UNIX was first run from.
- The tty command writes to the standard output the name of the terminal that is open as standard input.
- Tty --help

Echo

- **echo command in linux** is used to display line of text/string that are passed as an argument .
- Echo option string
- **-e** here enables the interpretation of backslash escapes

echo -e “ aaa \b aaa”	it removes all the spaces in between the text
echo -e “ aaa \n aaa”	creates new line from where it is used.
echo -e “ aaa \t aaa”	create horizontal tab spaces
echo -e “ aaa \v aaa”	create vertical tab spaces
echo -e “ aaa \a aaa”	alert return

More

- As 'cat' command displays the file content. Same way 'more' command also displays the content of a file. Only difference is that, in case of larger files, 'cat' command output will scroll off your screen while 'more' command displays output one screenful at a time.
- Following keys are used in 'more' command to scroll the page:
- Enter key: To scroll down page line by line.
- Space bar: To go to next page.
- b key: To go to the backward page.
- / key: Lets you search the string.

grep

- **Grep** is an acronym that stands for **G**lobal **R**egular **E**xpression **P**rint.
- Grep is a Linux / Unix command-line tool used to search for a string of characters in a specified file.
- **Syntax**: grep [options] pattern [files]

```
$grep   aaa a1.txt
```

grep

grep word_to_find filename_to_be searched	
Grep WF file1 file 2 file3……	Search WF in All files
Grep –w WF filename	Find whole word only
Grep-i WF filename	Ignore case
Grep –r WF *	Search in all subdirectory
grep -v WF filename	exclude all lines that contain WF

ps

- **display or view information related to the processes running in a Linux system.**

Ps –A	All running process
Ps -T	View process associated with terminal
Ps –a	Not associated with terminal
Ps –ax	Current running process

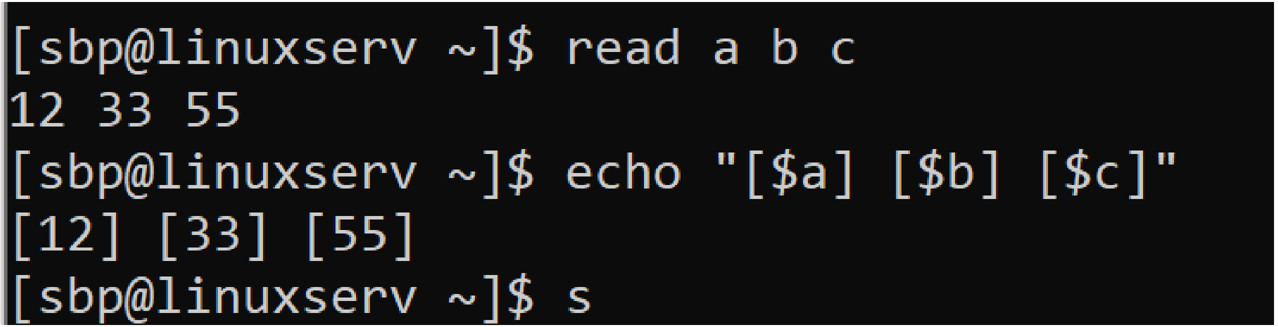
Set and Cut

- Linux set command is used to set and unset certain flags or settings within the shell environment.
- Set option
- Set –x enable debugging set +x disable debugging

- The cut command in UNIX is a command for cutting out the sections from each line of files and writing the result to standard output. It can be used to cut parts of a line by **byte position, character and field**
- **$ cut -b -3 state.txt**

read

- The Linux **read** command is used to read the contents of a line into a variable.
- This is a built-in command for Linux systems
- Read x
- 12 //Enter value
- Echo $x



```
[sbp@linuxserv ~]$ read a b c
12 33 55
[sbp@linuxserv ~]$ echo "[$a] [$b] [$c]"
[12] [33] [55]
[sbp@linuxserv ~]$ s
```

awk

- Awk is a scripting language used for manipulating data and generating reports.
- Awk ‘{print}’ filename
- $ awk ‘/match/ {print}' employee.txt
- $ awk '{print $1,$4}' employee.txt
- If the line has 4 words, it will be stored in $1, $2, $3 and $4 respectively. Also, $0 represents the whole line.

Env ,kill,alias

- **env** is used to print environment variables.

- Kill command used to terminate the process

- **alias** command instructs the shell to replace one string with another string while executing the commands.

diff

- **diff** - find differences between two files
- **SYNOPSIS**

  diff [options] from-file to-file

- **Special symbols are:**

  a : add

  c : change

  d : delet

locate

- *locate* command in Linux is used to find the files by name.
- Locate [options] patterns
- locate -c [.txt]* It will count files ending with *.txt*.
- locate "*.html" -n 20
- show 20 results for the searching of file ending with *.html*.
- Ignore Case Sensitive Locate Outputs
- Loate –i “samle.txt”

find

- *Find command is used to search and locate the list of files and directories based on conditions you specify for files that match the arguments.*