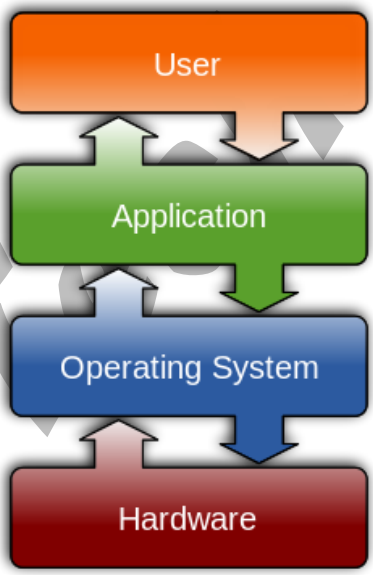
Handout: Operating System (Computer Operator)

OPERATING SYSTEM

Introduction

An operating system (OS) is a software that controls the overall operations of computer system. It controls and directs the flow of data and instructions from one part of computer to another. An operating system acts a mediator between user and computer hardware. It provides interface to computer user and platform to other programs.



Functions of Operating System

- Process Management
- Memory Management
- File Management
- Device Management
- Security Management
- User Interface
- Job Management
- Data Management
- Controlling Resources
- Program execution
- I/O operations
- File System manipulation
- Communication
- Error Detection
- Resource Allocation
- Protection

Types of OS

Based on Interface:

- CLI (Character Line Interface): Work with commands
- GUI (Graphic User Interface): Windows with graphic and symbols

Based on User:

- Single User: It can be used by single user at a time. E.g. Windows
- Multiuser: It allows two or more users to run programs at a time. It is also known as Time Sharing OS. E.g. Unix, Linux

Based on operation:

- Single Task: Allows to run only one program at a time. E.g.:DOS
- Multitask: Allows more than one program to run concurrently. E.g.:Windows

Some other types of OS:

Multiprocessing: Supports running a program on more than one CPU. The technique of using more than one process is often called parallel processing. E.g. MVS, UNIX

Networking OS: They are multi user, time sharing and multiprogramming operating system used for server computer to control computers in computer network. For e.g. UNIX, Novel, Windows NT, Windows 2000/2003/2005/2008/2012 Server etc.

Embedded OS: Operating system that is self contained in the device and resident in ROM. Used in ATM, Traffic Lights etc.

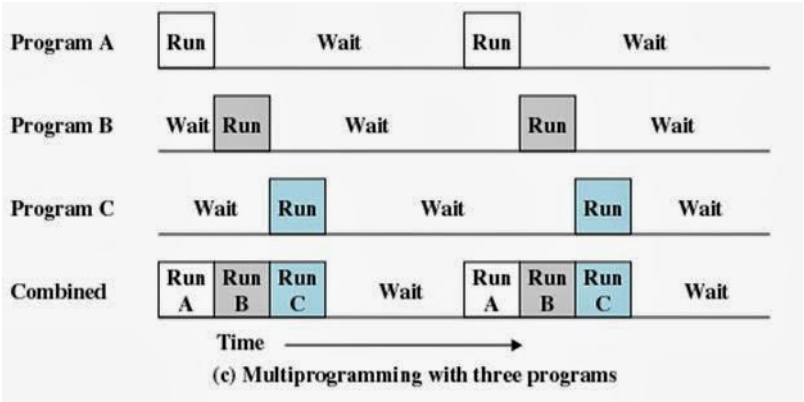
Multithreading: Allows different parts of the single program to run concurrently.

Real-time: Responds to input instantly.

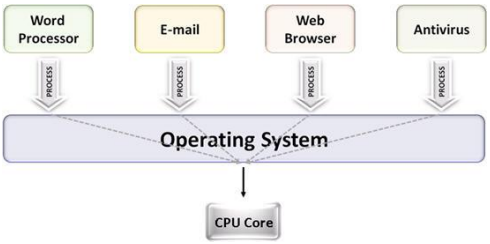
Multi Programming, Multi Tasking, Multi Processing and Multi Threading

Multiprogramming

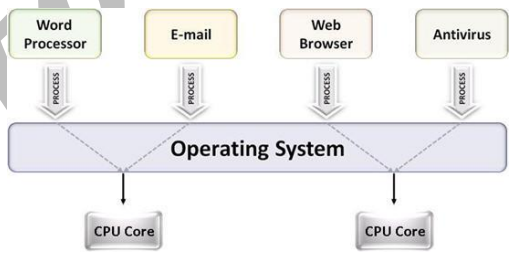
Multiprogramming system allows multiple processes to reside in main memory where only one program is running. The running program keeps executing until it blocks for IO and the next program in line takes the turn for execution.



Multitasking



Multitasking is the ability of an operating system to execute more than one task simultaneously on a single processor machine. Though we say so but in reality no two tasks on a single processor machine can be executed at the same time. Actually CPU switches from one task to the next task so quickly that appears as if all the tasks are executing at the same time. More than one task/program/job/process can reside into the same CPU at one point of time.



Multiprocessing

Multiprocessing is the ability of an operating system to execute more than one process simultaneously on a multi processor machine. In this, a computer uses more than one CPU at a time.

Multithreading

Multithreading is the ability of an operating system to execute the different parts of a program called threads at the same time. Threads are the light wait processes which are independent part of a process or program. In multithreading system, more than one threads are executed parallel on a single CPU.

BATCH PROCESSING

Batch processing is the execution of a series of programs ("jobs") on a computer without manual intervention. Jobs are set up so they can be run to completion without human interaction. All input parameters are predefined through scripts, command-line arguments, control files, or job control language.

Batch processing is particularly useful for operations that require the computer or a peripheral device for an extended period of time

Benefits of batch processing:

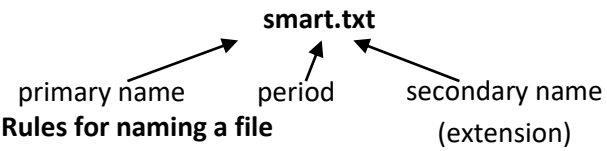
- It can shift the time of job processing to when the computing resources are less busy.
- It avoids idling the computing resources with minute-by-minute manual intervention and supervision.
- It allows the system to use different priorities for interactive and non-interactive work.
- Rather than running one program multiple times to process one transaction each time, batch processes will run the program only once for many transactions, reducing system overhead.

Disk Operating System (DOS)

DOS stands for Disk Operating System. It acts as a translator between man and computer. It is associated with the disk operations. It is stored in ROM that is usually called **bootstrap loader** because when we switch on the computer the program reads the very first part of the system diskette where DOS startup program is written, which is called **Boot Reader**.

FILE

Set of informations stored in a computer with a unique name is called a file. File name contains two parts i.e. **primary name and secondary name**. e.g. Smart.txt. Here, smart , bofore the period (.) is called primary name and txt, after the period (.) is called seconadary name (extension).



Rules for naming a file

- Primary name cannot have more than 8 characters.
- Extension should have 3 characters.
- 0-9, a-z are valid characters for file name.
- / , . \ are invalid characters for file name.
- File name is not case sensitive.
- Dollar ($), exclamation point (!), hash (#), percentage (%), ampersand (&), underscore(_), caret(^), tilde(~), at sign (@), braces ({}), hyphen (-), single quotation mark (') and paranthesis (()) are allowed in file name.

FILE TYPES

- **Data file**: Collection of data that is used by computer program.
- **Program file**: Collection of instructions to perform specific task by computer
- **Information file**: collection of information produced by computer as output which can be used by user for future reference.
- **System file**: Special program files needed to start or boot computer. They are:
  MSDOS.SYS: It controls and provides OS interface
  COMMAND.COM: It interprets the user command. It stores the commands needed to perform different tasks.
  IO.SYS: It controls the input and output

Directory: Directory is the location or space where we store files.

Volume Label: Volume Label is the name of any disk, to identify it.

Himem.sys: It is the MSDOS device driver that configured extended memory and High Memory Area (HMA), so that the programs conforming to be extended memory specification (XMS) can access it.

Config.sys: It is DOS ASCII text file in the root directory that contains configuration commands about system to obtain maximum performance. The file contains Himem.sys, smartdrive etc.

Extended Memory Specification (XMS): A set of standards and an operating environment that enables all the programs to access extended memory. XMS requires a utility program known as an extended memory manager such as himem.sys.

Batch File: A file containing a series of DOS commands executed one after other as their sequence. The batch file should have .bat extension because the .bat extension is one of the executable (program) file's extensions.

Autoexec.bat: It is a special batch file containing instructions that DOS executes when user starts the system. The file commonly includes path or any startup routine (session).

EMM386.exe: The EMM386.exe is required for DOS running in a computer with 80386 or highter microprocessor and extended memory, an expanded memory emulator that enables DOS applications to the extended memory.

Booting Process

Booting means starting computer. It is the process of initiating an automated routine that clears the memory, load operating system and prepares the computer for use. During the booting process ROMBIOS (a program of ROM) that starts the POST (Power On Self Test) checking and boot-startup process.

Types of Boot

- **Cold Boot**: Process of starting computer by pressing powre button (on/off switch).
- **Warm Boot**: Process of starting computer by pressing Reset button or by pressing 'Ctrl+Alt+Del' keys.

Drive Name/Default Drive

A complete drive name consists of a drive letter followed by a colon. A: and B: referred to floppy drive and C:, D: usually refer to hard disk drive.

Changing the default drive

To change the default drive just type the letter of desired drive followed by colon and press 'Enter'
C:\> D: ↵ (Changes the drive to D:)

COMMANDS

Commands are instructions to computer to perform any task.

Types of commands

- Internal Commands
- External Commands

Internal Commands

They are parts of command.com files and loads in computer memory while booting computer.

CD	CHDIR	CLS	COPY	COLOR	DATE	DEL
DIR	ECHO	ERASE	EXIT	MD	MKDIR	MOVE
PATH	PAUSE	PROMPT	RD	REN	RENAME	RMDIR
SET	START	TIME	TYPE	VER	VERIFY	VOL

External Commands

They are not the parts of command.com file and do not load in computer memory while botting computer. They behave as they are separate programs.

ATTRIB	BACKUP	CHKDSK	CHOICE	DEBUG	DEFRAG
DELTREE	DISKCOMP	DISKCOPY	DOSKEY	EDIT	EDLIN
EXTRACT	FC	FDISK	FIND	FORMAT	HELP
LABEL	MEM	MODE	MORE	MOVE	MSBACKUP
PRINT	RESTORE	RECOVER	SCANDISK	SCANREG	SETVER
SHARE	SORT	SUBST	START	SYS	TREE
UNDELETE	UNERASE	UNFORMAT	XCOPY		

Attrib

Sets special attribute to the file by which we can protect our file from being deleted or edited. Wildcards can be used to specify a group of files.

+r: read only attribute
+s: system attribute
+h: hide attribute
+a: archive attribute
[+ for set and – for clear attribute]

Syntax: Attrib [±r] [±s] [±h] [±s] [±a] [drive:] pathname [/s]

e.g. attrib +r +s +a +h smart.txt
or
attrib nmsag.txt +r +s +a +h

Backup

used to backupf one or more files from one disk to another idisk with special format (.bak).

Syntax:C:\> Backup C:\dir1*.* D: ↵

CHDIR (CD)

Used to change the working directory

Syntax: CD [path]↵

Example: C:\> CD computer ↵

CLS

Clears the screen

Syntax: CLS ↵

Example: C:\> CLS ↵

COPY

Copies one or more files to another location. It also appends files.

Syntax: COPY [Source path\FileName] [Destination Path\FileName] ↵

Example: C:\> COPY C:\Smart\computer.txt D:\desktop.txt ↵

Appending files

Syntax: COPY [Destination Path\FileName] + [Source Path\FileName] ↵

COPY CON

Creates a file

Syntax: COPY CON [drive\directory\file name] ↵

Example: C:\> COPY CON D:\smart.txt ↵
[Press 'Ctrl+Z' or 'F6' to save]
[Note: maximum character in a line is 127]

CHKDSK

Checks disk for error

Syntax: CHKDSK [drive] [/F][/V]

/F: Fixes errors on the disk

/V: Displays the full path and name of every file on the disk (only in FAT/FAT32)

DATE

To display and set the current system date. System date is in Americal format.

Syntax: DATE ↵

To set date: DATE 2/25/2013↵

DEL

Deletes the specified file. /p causes to prompt to delete file

Syntax: DEL [File Name][/p] ↵

Example: C:/> DEL smart.txt ↵

DIR

List the files and folders in the working directory

Syntax: DIR[Drive\Directory] ↵

Attributes:

/P: Pauses after each screenful of information

/W: Uses wide list format

/S: Dispalys sub directories also

/A: displays file with specfied attributes

D: Directories

R: Read only

H: Hidden files

A: Files ready for archiving

S: System files

-: prefix meaning not

/-h: not hidden

/-r: not read only

Example: to display read only files

C:\> DIR /AR↵

O/: List files in order

N: by name

S: by size

E: by extension

D: date and time

G: group directories first

-: prefix to reverse order

e.g: to display files in descending order by name:

C:\> DIR/O-N ↵

/S: Displays files in specified directory and all subdirectories.

/B: Uses bare format (without any information)

/L: Uses lowercase

/V: Verbose mode (additional information)

DISKCOMP

Compares the contents of the disk in the source drive to the disk in the target drive.

Example: C:\> DISKCOMP A: B: ↵

DISKCOPY

Copies the contents of the floppy disk in the source drive to target drive. The size

Example: DISKCOPY A: B: ↵

EXIT

Exits from MS-DOS

EDIT

To edit the existing file

FIND

Looks for string(text) in file

Syntax: FIND[/v][/c][/n] "string" [drive\filename]

Example: C:\> FIND "computer" smart.txt ↵

/V: Displays all lines NOT containing the specified string

/C: Displays only the count of lines contaning the string

/N: Displays line numbers with line

/I: Ignores the case of characters when searching for the string.

FDISK

This command is used to configure a hard disk for use with MS-DOS

FORMAT

Used to format the drive

Syntax: FORMAT [drive] ↵

LABEL

Creates, deletes or changes the volume label of the disk.

Syntax: Label [drive] [label name] ↵

MEM

Gives memory information: used and free memory

MKDIR (MD)

To create a directory

Syntax: MD [drive]\[directory name] ↵

Example: MD computer ↵

MOVE

Moves file to another location

Syntax: MOVE [Source path\FileName] [Destination Path] ↵

Example: C:\> MOVE C:\Smart\computer.txt D: ↵

MORE

More is a filter that reads from standard input (from a pipe redirected file) and displays one screen of information at a time. More is commonly used to view long files.

Syntax: DIR Drive|More ↵

Example: DIR D:|More ↵

PATH

Gives the path of executable file, also set and removes the path

Example:

C:\>PATH; ↵ removes the path

C:\>PATH ↵ see the path

C:\> PATH=C:\windows; ↵

PROMPT

Lets to change the MS DOS system prompt

Syntax: PROMPT <prompt character> ↵

Some special characters for prompt:

$$= $ $1= blank

$t= current time $d= current date

$p=working directory of the default drive

$v= version $n=default drive

$g=> $b=| $l=<

$q=equal sign $v= dos version

pg: original prompt

PRINT

prints the document

Syntax: PRINT <file name> ↵

REN

Renames the file/folder

Syntax: REN <old name> <new name> ↵

RESTORE

Used to restore backup files

Syntax: Restore [drive\path\file name] ↵

RMDIR (RD)

Removes empty directory

Syntax: RD [Drive\Path\Directory name] ↵

SCANDISK

Detects and fixes disk problem

Syntax: [Drive] ↵

START

Opens windows base file from windows.

Syntax: Start<file name> ↵

SYS

Copies system files from default drive to specified drive.

It will copy io.sys, command.com and msdos.sys files. **Syntax**: SYS <drive> ↵

TIME

To display and set the current system time in 24 hour format

Syntax: TIME ↵

To set time: TIME 12:00:00 ↵

TYPE

Displays the content of the file on the screen.

Syntax: TYPE <file name> ↵

TREE

Displays directory in tree structure

Syntax: TREE ↵

UNDELETE

Restores deleted files.

Syntax: UNDELETE <file name> ↵

VER

Displays the version of the operating system

Syntax: VER ↵

VOL

Displays the disk volume label and serial number

Syntax: VOL ↵

XCOPY

Copies files and directories to desired drive

/a copies source files that have their archive bit set.

/e copies empty directory

/s copies the sub-directories also

/v copies and verifis that the directory is correctly copied or not.

Syntax: XCOPY[drive/path] [drive/path][/a][/e][[/s][/v] ↵

Wild Cards

Wild cards are special characters which represent other characters.

? = represents only one character

* = displays one or more characters

1. To display files and folder starting with letter 'a'
   C:\> DIR a*.* ↵
2. To display files starting with 'p' and having only 3 characters
   C:\> DIR p??.* ↵
3. To display all files with extension txt
   C:\> DIR*.txt ↵

MS-DOS Versions

MS-DOS has been around for a very long time. It started off as QDOS (Quick and Dirty Operating System) which was developed by Seattle Computer Products to run on IBM's new PC. This list covers most versions up to Windows 9x although a number of the more obscure versions of DOS have been omitted.

The latest stand alone version of MS-DOS is 6.22. Microsoft Windows 95 and 98 included a version of MS-DOS known as 7.0. While a user is capable of utilizing MS-DOS 7.0 through Microsoft Windows, MS-DOS 7.0 cannot be purchased as a stand alone version and requires Microsoft Windows be installed to run.

Version		Date
1.0	-	1981
1.25	-	1982
2.0	-	1983
2.11	-	1983
3.0	-	1984
3.1	-	1984
3.3	-	1987
4.0	-	1988
4.01	-	1989
5.0	-	1991
5.0	-	1992/3
6.0	-	1993
6.2	-	1993
6.21	-	1993
6.22	-	1994
7.0	-	1995
7.1	-	1997

WINDOWS OPERATING SYSTEM

Windows is a GUI (Graphical User Interface) single user multi tasking operating system developed, marketed, and sold by Microsoft.

Some important terms in windows

Folder: a folder is a named collection of related file s that can be retrieved, moved, and otherwise manipulated as one entity.

Compress: *Computers* To encode (data) to minimize the space required for storage.

Briefcase: n Microsoft Windows, the **Briefcase** is a special folder that supports a simple two-way file synchronization between itself and another folder. The Briefcase is designed for mobile PC users so that they may transfer it to a removable drive and have it synchronize with the computer to which the removable drive is attached

Desktop: first screen displayed on screen after computer is booted.

Taskbar: long horizontal bar at the bottom of desktop which contains

System Tray: lies at the right side of the taskbar which displays date, time and other utilities. Also known as notification area

Start button: It provides access to application, accessories, documents, system tools etc.

Recycle Bin: It holds the items deleted from computer.

[Press 'Shift+Delete' to delete file permanently without sending to Recycle Bin]

Window: framed area on the desktop within which a program executes and display information

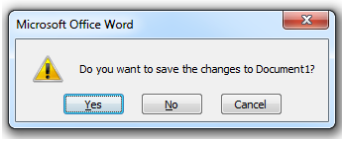
Types of window:

1. Application window/ Parent window: It displays the executable program. An application window an be opened, closed, resized and moved around the desktop. The title bar appears on the top of the application window. A program has only one application window. Press 'Alt+F4' to close application window.

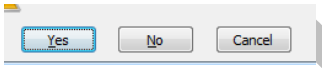
2. Doument window/ Child window: It appears inside the application window. A document window is the area where we work. An application can have more than one document window. Press 'Ctrl+W' to close document window.

Windows dialog box and GUI controls

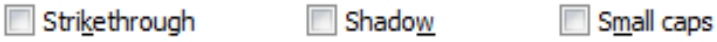
A window dialog box is a rectangular box that appears temporarily to infrom a user about some message (error message, warning etc.)



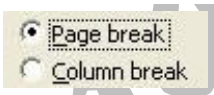
Button:



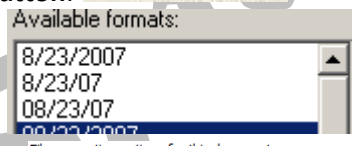
Checkbox:



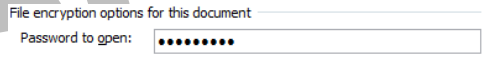
Radio Button:



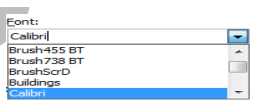
Lis Box:



Text Box:

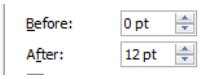


Combo Box:

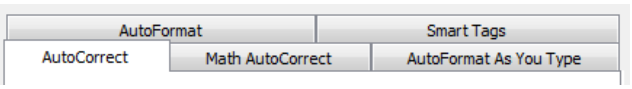


It is combination of list box and text box

Spin Button:



Tab sheet:



Control Panel

It contains the options to change the computer settings and other options

- Start > (Settings) > Control Panel
  OR
- Start > Run > Type 'control' > OK

Keyboard: to change the character repeat rate and cursor blinking rate
Mouse: to change the mouse speed, pointer options and cursor style
Display: to change the desktop wallpaper, screen saver and appearance of computer
Security Center: to change the security and update options of computer
Scanner and Cameras: to set up scanner and camera
Printer and Faxes: to set up printer and faxes
Windows Firewall: a **firewall** is a network security system that controls the incoming and outgoing network traffic based on an applied rule set
Taskbar and Start Menu: to set the options of taskbar and start menu
Regional and Language Settings: to change the language setting of computer
Automatic Update: option to set windows update
Control Panel: Fonts
To inst new fonts

- Open 'fonts'
- File > Inst new fonts
- Select drive/folder of fonts
- Select the fonts to install > OK

Folder Options: To show/ hide hidden files
Scheduled Task: To add program in schedule
Add and Remove Programs: To add (install) or remove (uninstall) program from computer
User Accounts: To create new user, manage user and delete user
Devices and Printers: To add printer, scanner and other peripheral devices
Display: To change desktop, screen saver, resolution and other display properties
Important run commands

- **Calculator** : calc
- **Command Prompt**: cmd
- **Character Map**: charmap
- **Check Disk** : chkdsk
- **Control Panel**: control
- **Computer Management**: compmgmt.msc
- **Date and Time properties**: timedate.cpl
- **Device manager**: devmgmt.msc
- **Disk Defragment**: dfrg.msc
- **Disk Management**: diskmgmt.msc
- **Display Properties**: desk.cpl
- **Disk Partition Manager**: diskpart
- **Help and support**: helpctr
- **Internet Explorer**: iexplore
- **Group policy editor:** gpedit.msc
- **Registry editor:** regedit
- **Diagnostic tool:** dxdiag

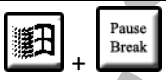
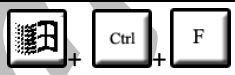
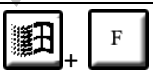
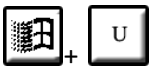
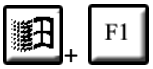
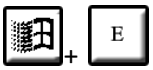
MS WINDOW HISTORY

Windows 1.0 : 1985
Windows 2.0 : 1987 first OS to use word and excel
Windows 3.0 : 1990
Windows 3.1 : 1991 last version which looks like MS DOS
Windows 95 : 1995 introduced desktop and icons with recycle bin, start button
Windows 98 : 1998
Windows ME (Millennium Edition) : 2000
Windows for pocket pc : 2000 base on windows CE
Windows XP : 2001 (First consumer version of window)
Windows mobile 5 : 2005
Windows vista : 2006
Windows mobile 6 : 2007, February
Windows 7 : 2009
Windows phone : 2010
Windows 8 : 2012
Windows phone 8 : 2012
Windows 8.1 : 2014
Windows 10 : 2015

Windows Shortcuts

- **Ctrl+C** (Copy)
- **Ctrl+X** (Cut)
- **Ctrl+V** (Paste)
- **Ctrl+Z** (Undo)
- **Delete** (Delete)
- **Shift+Delete** (Delete the selected item permanently)
- **Ctrl while dragging an item** (Copy the selected item)
- **Ctrl+Shift while dragging an item** (Create a shortcut to the selected item)
- **F2** (Rename the selected item)
- **Shift with any arrow key** (Select more than one item in a window or on the desktop, or select text in a document)
- **Ctrl+A** (Select all)
- **F3** (Search for a file or a folder)
- **Alt+Enter** (View the properties for item)
- **Alt+F4** (Close the active item, or exit the active program)
- **Alt+Spacebar** (Open the shortcut menu for the active window)
- **Ctrl+F4** (Close the active document in programs that enable multiple documents to be open at the same time)
- **Alt+Tab** (Switch between the open items)
- **Alt+Esc** (Cycle through items in the order in which they were opened)
- **F6** (Cycle through the screen elements in a window or on the desktop)
- **F4** (Display the Address bar list in My Computer or in Windows Explorer)
- **Shift+F10** (Display the shortcut menu for the selected item)
- **Ctrl+Esc** (Display the Start menu)
- **Alt+Underlined letter in a menu name** (Display the corresponding menu)
- **F10** (Activate the menu bar in the active program)
- **Right Arrow** (Open the next menu to the right, or open a submenu)
- **Left Arrow** (Open the next menu to the left, or close a submenu)
- **F5 key** (Refresh/Update the active window)
- **Backspace** (View the folder one level up in My Computer or Windows Explorer)
- **Esc** (Cancel the current task)
- **Shift when you insert a CD into the CD drive** (Prevent the CD from automatically playing)
- **Ctrl+Shift+Esc** (Open Task Manager): Ctrl + Alt + Del

Some shortcuts with Windows key

	START Menu
	SYSTEM PROPERTIES
	RUN Window
	Locks Computer
	SEARCH FOR COMPUTERS
	SEARCH
	Minimize or Restore All Windows
	Undo Minimize All Windows
	Utility Manager
	Help & Support
	Windows Explorer

Standby, Hibernate and Sleep

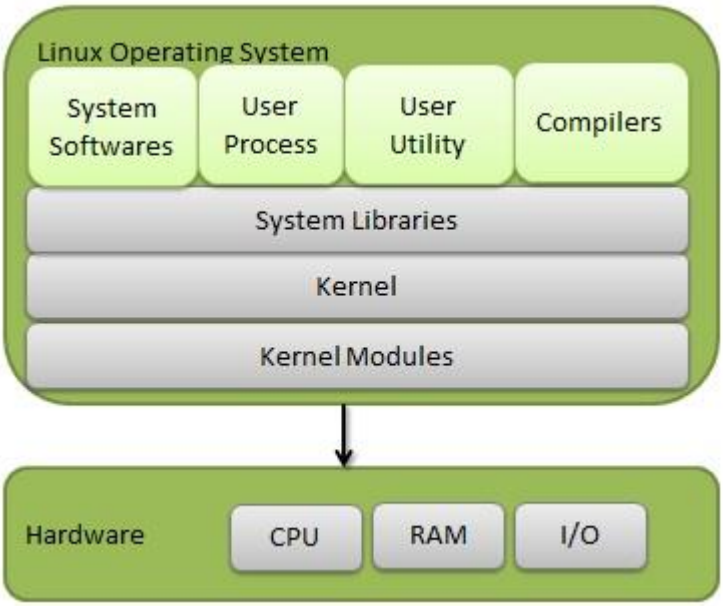
Standby puts your computer into energy-saving mode, where it uses very little power.
Hibernate saves your workspace (all your open windows), then turns the computer *off.*
The difference is that hibernate saves more energy because the computer goes off completely, but it takes longer for the computer to wake up from hibernation, so it's not as convenient.
Sleep is more complicated, because it means different things on different computers.
Mostly sleep initially means standby, but it switches to Hibernate if the battery level drops too low.
Energy use: Standby → 1-6 watts 1, Hibernate → 0 watts
Time to sleep/wakeup: Standby→ a few seconds, Hibernate → 30 sec. to 3 min.

LINUX OPERATING SYSTEM

Components of Linux System

Linux Operating System has primarily three components

- **Kernel** - Kernel is the core part of Linux. It is responsible for all major activities of this operating system. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
- **System Library** - System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features.
- **System Utility** - System Utility programs are responsible to do specialized, individual level tasks.



Kernel Mode vs User Mode

Kernel component code executes in a special privileged mode called **kernel mode** with full access to all resources of the computer.

User programs and other system programs works in **User Mode** which has no access to system hardwares and kernel code.

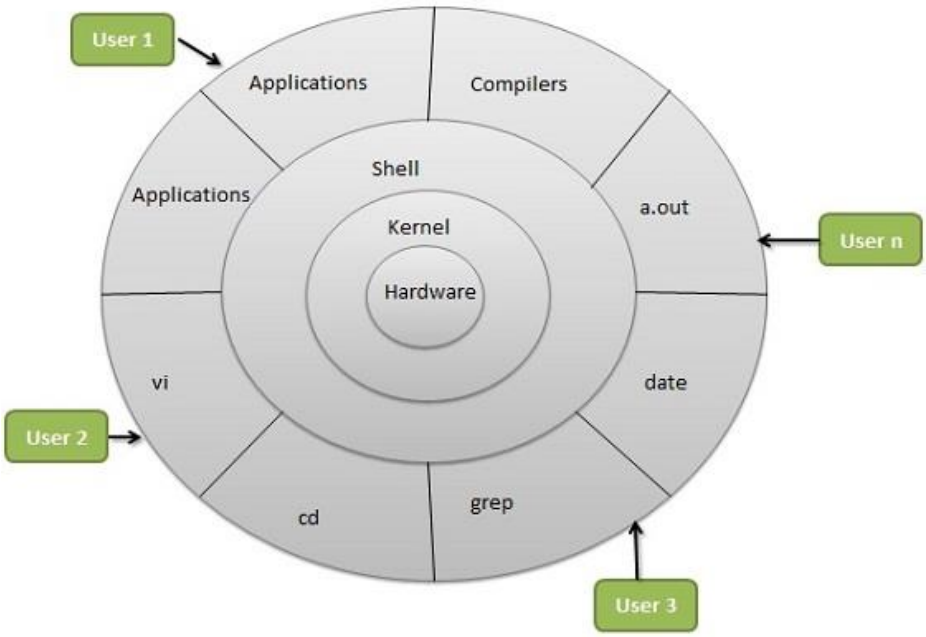
Basic Features

Following are some of the important features of Linux Operating System.

- **Portable**
- **Open Source**
- **Multi-User**
- **Multiprogramming**

- **Hierarchical File System** - Linux provides a standard file structure in which system files/ user files are arranged.
- **Shell** - Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs etc.
- **Security**

ARCHITECTURE



Linux System Architecture is consists of following layers

- **Hardware layer** - Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).
- **Kernel** - Core component of Operating System, interacts directly with hardware, provides low level services to upper layer components.
- **Shell** - An interface to kernel, hiding complexity of kernel's functions from users. Takes commands from user and executes kernel's functions.
- **Utilities** - Utility programs giving user most of the functionalities of an operating systems

FILE ACCESS MECHANISMS

File access mechanism refers to the manner in which the records of a file may be accessed. There are several ways to access files

- Sequential access
- Direct/Random access
- Indexed sequential access

Sequential access

A sequential access is that in which the records are accessed in some sequence i.e the information in the file is processed in order, one record after the other. This access method is the most primitive one. Example: Compilers usually access files in this fashion.

Direct/Random access

- Random access file organization provides, accessing the records directly.

- Each record has its own address on the file with by the help of which it can be directly accessed for reading or writing.
- The records need not be in any sequence within the file and they need not be in adjacent locations on the storage medium.

Indexed sequential access

- This mechanism is built up on base of sequential access.
- An index is created for each file which contains pointers to various blocks.
- Index is searched sequentially and its pointer is used to access the file directly.

SPACE ALLOCATION

Files are allocated disk spaces by operating system. Operating systems deploy following three main ways to allocate disk space to files.

- Contiguous Allocation
- Linked Allocation
- Indexed Allocation

Contiguous Allocation

- Each file occupy a contiguous address space on disk.
- Assigned disk address is in linear order.
- Easy to implement.
- External fragmentation is a major issue with this type of allocation technique.

Linked Allocation

- Each file carries a list of links to disk blocks.
- Directory contains link / pointer to first block of a file.
- No external fragmentation
- Effectively used in sequential access file.
- Inefficient in case of direct access file.

Indexed Allocation

- Provides solutions to problems of contigous and linked allocation.
- A index block is created having all pointers to files.
- Each file has its own index block which stores the addresses of disk space occupied by the file.
- Directory contains the addresses of index blocks of files.