Central Calcutta Polytechnic

21, Convent Rd, Philips, Sealdah, Kolkata - 700014

Department: *Computer Science and Technology*

Name: *Priyanshu Maitra*

Registration No: *D202121269*

Roll: *DCCPCSTS5*

No: *10021424*

Subject: *Operating System*

Semester: *5*

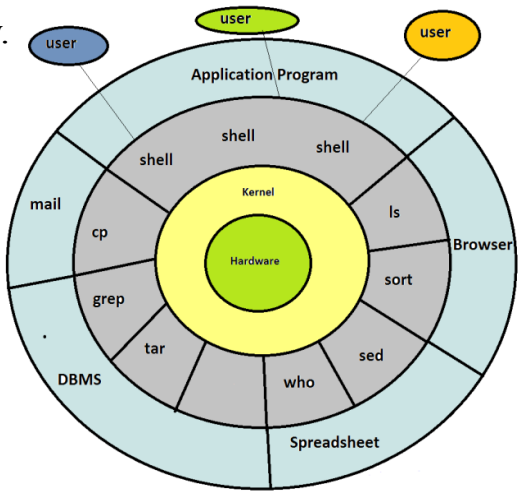
Year: *3rd*

2021-22

1. Architecture of UNIX Operating System:

Unix is an Operating System that is truly the base of all Operating Systems like Ubuntu, Solaris, POSIX, etc. It is a powerful Operating System initially **developed by Ken Thompson, Dennis Ritchie** at AT&T Bell laboratories in 1970.

This is the block diagram of UNIX operating system below.



The Unix OS architecture consists of four layers.

I. Hardware Layer.
II. Kernel Layer.
III. Shell Commands.
IV. Application Program Layer.

A. Hardware Layer: This layer of UNIX operating system consists of all hardware related information.

B. Kernel Layer: The core/heart of the operating system that's responsible for maintaining the full functionality is named the kernel. It acts as an interface between user and hardware and most of the tasks like memory management, task scheduling, and management are done by the kernel.

C. Shell Commands: Shell commands act as an interface between the user and the kernel. When you type in a command at the terminal, the shell interprets the command and calls the program that you want. There are more than 250 commands along with some 3rd party commands. There are various commands like cp, mv, cat, grep, id, wc, nroff, a.out and more.

D. Application Program Layer: It is the outermost layer that executes the given external applications. UNIX distributions typically come with several useful applications programs as standard. For Example: emacs editor, StarOffice, xv image viewer, g++ compiler etc.

2. ***Features of UNIX Operating System:***

Unix is an operating system, so it has all the features that the OS must-have. UNIX also looks at a few things differently than other OS. Features of UNIX are listed below:

- ***Multiuser System:*** UNIX operating system supports more than one user to access computer resources like main memory, hard disk, tape drives, etc. Hence, it is called a multiuser system.

- ***Multitasking System:*** A UNIX operating system is a multitasking operating system that allows you to initiate more than one task from the same terminal so that one task is performed as a foreground and the other task as a background process. **Example:** Editing a file, printing another on the printer & sending email to a person, and browsing the net too at the same time. The Kernel is designed to handle user's multiple needs.

- ***Portability:*** This feature makes the UNIX work on different machines and platforms, with the easy transfer of code to any computer system. Unix allows users to transfer data from one system to another.

- ***Programming Facility:*** Unix shell can be used as a programming /shell scripting. Many functions of the system can be controlled and managed by these shell scripts.

- ***Security:*** Unix has system level security controlled by system administrator and file level security controlled by owner of the file.

- ***Tools and Utilities:*** UNIX system provides various types of tools and utilities facilities for software development. Some general-purpose tools are compilers, interpreters, network applications, etc. It also includes various server programs which provide remote and administration services.

- ***Open Source:*** UNIX operating system is open source, it means it is freely available to all and is a community-based development project.

3. ***Difference Between UNIX, Windows & DOS:***

Features	***UNIX***	***WINDOWS***	***DOS***
Development	UNIX is Open Source.	It is developed by Microsoft.	It is also developed by Microsoft.
Interface	It supports both Command-line interfaces/Graphical user interfaces.	It supports Graphical User Interface	It supports a Text-Based/ Command-line interface.
Multitasking	UNIX supports multitasking	Windows supports multitasking	DOS is unable to run multiple processes at the same time
Customization	One can rewrite the code for Linux so that it can be customized further.	It is possible to change the background and general color schemes and fonts for Windows desktops.	Expansions for DOS can be downloaded so that one can customize them.
Management	Difficult to manage.	Easy to manage.	DOS is not very easy to manage
Cost	It is free to download.	It is paid.	DOS is free of charge to download.
User-Support	UNIX is a multi-user operating system.	Windows is a multi-user operating system.	DOS is a single-user operating system.

4. Booting Process of an Operating System:

Step 1: Once the computer system is turned on, BIOS performs a series of activities or functionality tests on programs stored in ROM, called on POST (Power-on Self Test) that checks to see whether peripherals in the system are in perfect order or not.

Step 2: After the BIOS is done with pre-boot activities or functionality test, it read bootable sequence from CMOS (Common Metal Oxide Semiconductor) and looks for master boot record in the first physical sector of the bootable disk as per boot device sequence specified in CMOS. For example, if the boot device sequence is:

1. Floppy Disk
2. Hard Disk
3. CD-ROM

Step 3: After this, the master boot record will search first in a floppy disk drive. If not found, then the hard disk drive will search for the master boot record. But if the master boot record is not even present on the hard disk, then the CD-ROM drive will search. If the system cannot read the master boot record from any of these sources, ROM displays "No Boot device found" and halted the system. On finding the master boot record from a particular bootable disk drive, the operating system loader, also called Bootstrap loader, is loaded from the boot sector of that bootable drive· into memory. A bootstrap loader is a special program that is present in the boot sector of a bootable drive.

Step 4: The bootstrap loader first loads the IO.SYS file. After this, MSDOS.SYS file is loaded, which is the core file of the DOS operating system.

Step 5: After this, MSDOS.SYS file searches to find Command Interpreter in CONFIG.SYS file, and when it finds, it loads into memory. If no Command Interpreter is specified in the CONFIG.SYS file, the COMMAND.COM file is loaded as the default Command Interpreter of the DOS operating system.

Step 6: The last file is to be loaded and executed is the AUTOEXEC.BAT file that contains a sequence of DOS commands. After this, the prompt is displayed. We can see the drive letter of the bootable drive displayed on the computer system, which indicates that the operating system has been successfully on the system from that drive.

5. ***Use Different Commands & Output:***

- **ls** – list names of files in a directory

```
priyanshu@priyanshu:~/Desktop/example-folder$ ls
1  2  3  image1  image2
priyanshu@priyanshu:~/Desktop/example-folder$
```

- **rm** – remove files or directories

```
priyanshu@priyanshu:~/Desktop/example-folder$ rm image1
priyanshu@priyanshu:~/Desktop/example-folder$ ls
1  2  3  image2
priyanshu@priyanshu:~/Desktop/example-folder$
```

- **mv** – move or rename files or directories

```
priyanshu@priyanshu:~/Desktop/example-folder$ mv image2 1
priyanshu@priyanshu:~/Desktop/example-folder$ ls
1  2  3
priyanshu@priyanshu:~/Desktop/example-folder$ cd 1
priyanshu@priyanshu:~/Desktop/example-folder/1$ ls
image2
priyanshu@priyanshu:~/Desktop/example-folder/1$
```

- **cp** – copy a file

```
priyanshu@priyanshu:~/Desktop/example-folder/1$ ls
folder2  image2
priyanshu@priyanshu:~/Desktop/example-folder/1$ cp image2 folder2
priyanshu@priyanshu:~/Desktop/example-folder/1$ cd folder2/
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ ls
image2
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **cat** – concatenate and display files.

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cat hello.txt
hello worldpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **comm** – select or reject lines common to two files

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ comm file1.txt file2.txt
I read in college
        I read in school
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **chmod** – change the permissions of a file or a directory

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ ls -l world.txt
-rw-rw-r-- 1 priyanshu priyanshu 8 Mar  2 20:14 world.txt
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ chmod u=rw,og=r world.txt
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ ls -l world.txt
-rw-r--r-- 1 priyanshu priyanshu 8 Mar  2 20:14 world.txt
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **mkdir** – make a directory

```
priyanshu@priyanshu:~/Desktop/example-folder/1$ mkdir folder2
priyanshu@priyanshu:~/Desktop/example-folder/1$ ls
folder2  image2
```

- **rmdir** – remove a directory

```
priyanshu@priyanshu:~/Desktop/example-folder$ ls
1  2  3
priyanshu@priyanshu:~/Desktop/example-folder$ rmdir 3
priyanshu@priyanshu:~/Desktop/example-folder$ ls
1  2
priyanshu@priyanshu:~/Desktop/example-folder$
```

- **cd** – change directory

```
priyanshu@priyanshu:~/Desktop$ cd example-folder/
priyanshu@priyanshu:~/Desktop/example-folder$
```

- **pwd** – display the name of your current directory

```
hello worldpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ pwd
/home/priyanshu/Desktop/example-folder/1/folder2
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **cmp** – compare two files; see also diff

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cmp hello.txt image2
hello.txt image2 differ: byte 1, line 1
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **sort** – sort, merge, or sequence check text files

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ sort -d hello.txt
hello world
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **grep** – searches files for a specified string or expression

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ grep -i 'hello' hello.txt world.txt image2
hello.txt:hello world
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **whoami** – show your username

```
priyanshu@priyanshu:~$ whoami
priyanshu
priyanshu@priyanshu:~$
```

- **date** – show current date and time

```
priyanshu@priyanshu:~$ date
Wednesday 02 March 2022 08:17:35 PM IST
priyanshu@priyanshu:~$
```

- **time** – Time a simple command that print the real time

```
priyanshu@priyanshu:~$ time

real    0m0.000s
user    0m0.000s
sys     0m0.000s
priyanshu@priyanshu:~$
```

- **cal** – The cal utility writes a Gregorian calendar to standard output

```
priyanshu@priyanshu:~$ cal
     March 2022
Su Mo Tu We Th Fr Sa
        1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
```

- **clear** – clears the entire terminal
- **man** – view manual pages for Unix commands

- **join** – merges two sorted text files based on the presence of a common field

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cat file1.txt
1 Shyam
2 Rameshpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cat file2.txt
1 103
2 104
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ join file1.txt file2.txt
1 Shyam 103
2 Ramesh 104
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **split** – split files into pieces

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ split world.txt
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ ls
hello.txt  image2  world.txt  xaa
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **head** – show the first 10 lines of text file (you can specify any number of lines)

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cat companies.txt
Apple
Samsung
Alphabet
Foxconn
Microsoft
Huawei
Dell Technologies
Meta
Sony
Hitachi
Intel
IBM
Tencent
Panasonic
Lenovo
HPpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ head companies.txt
Apple
Samsung
Alphabet
Foxconn
Microsoft
Huawei
Dell Technologies
Meta
Sony
Hitachi
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **tail** – shows the last part of a file

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ cat companies.txt
Apple
Samsung
Alphabet
Foxconn
Microsoft
Huawei
Dell Technologies
Meta
Sony
Hitachi
Intel
IBM
Tencent
Panasonic
Lenovo
HPpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ tail companies.txt
Dell Technologies
Meta
Sony
Hitachi
Intel
IBM
Tencent
Panasonic
Lenovo
HPpriyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```

- **diff** – display differences between text files

```
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$ diff hello.txt world.txt
1c1
< hello world
\ No newline at end of file
---
> good bye
\ No newline at end of file
priyanshu@priyanshu:~/Desktop/example-folder/1/folder2$
```