unix shell scripting

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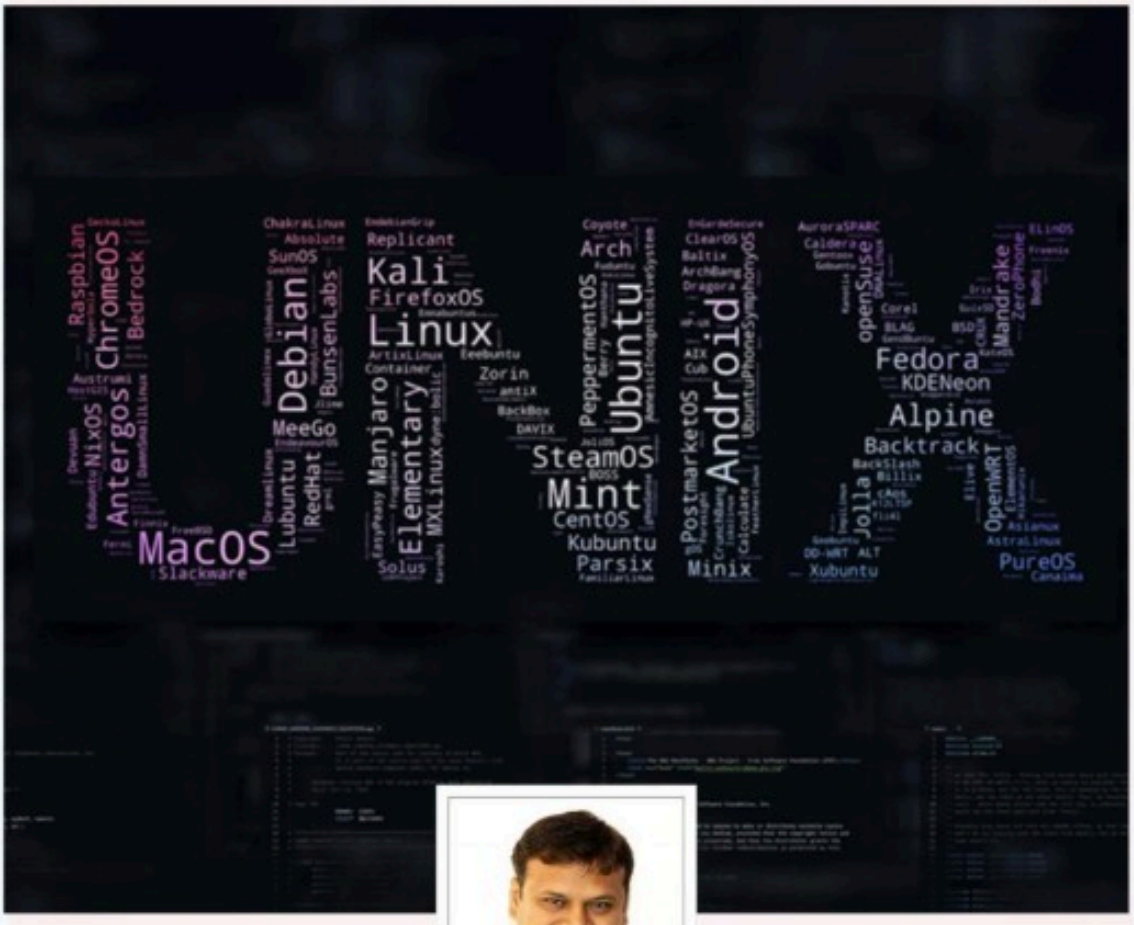
UNIX
& SHELL PROGRAMMING
CHAPTER 1 - INTRODUCTION



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UNIX Definition

The Unix operating system is a set of programs that act as a link between the computer and the user. The computer programs that allocate the system resources and coordinate all the details of the computer's internals is called the operating system or the kernel.

Users communicate with the kernel through a program known as the shell. The shell is a command line interpreter; it translates commands entered by the user and converts them into a language that is understood by the kernel.

- Unix was originally developed in 1969 by a group of AT&T employees Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna at Bell Labs.
- There are various Unix variants available in the market. Solaris Unix, AIX, HP Unix and BSD are a few examples. Linux is also a flavor of Unix which is freely available.
- Several people can use a Unix computer at the same time; hence Unix is called a multiuser system.
- A user can also run multiple programs at the same time; hence Unix is a multitasking environment.

1.1. Features of Unix OS

The following are the advantages of Unix Features.

Portability:

The system is written in high-level language making it easier to read, understand, change and, therefore move to other machines. The code can be changed and complied on a new machine. Customers can then choose from a wide variety of hardware vendors without being locked in with a particular vendor.

Machine-independence:

The System hides the machine architecture from the user, making it easier to write applications that can run on micros, mins and mainframes.

Multi-Tasking:

Unix is a powerful multi-tasking operating system; it means when a active task in in process, there can be a simultaneous background process working too. Unix handles these active and background threads efficiently and manages the system resources in a fair-share manner.

Multi-User Operations:

Unix is a multi-user system designed to support a group of users simultaneously. The system allows for the sharing of processing power and peripheral resources, white at the same time providing excellent security features.

Hierarchical File System:

Unix uses a hierarchical file structure to store information. This structure has the maximum flexibility in grouping information in a way that reflects its natural state. It allows for easy maintenance and efficient implementation.

UNIX shell:

Unix has a simple user interface called the shell that has the power to provide the services that the user wants. It protects the user from having to know the intricate hardware details.

Pipes and Filters:

Unix has facilities called Pipes and Filters which permit the user to create complex programs from simple programs.

Utilities:

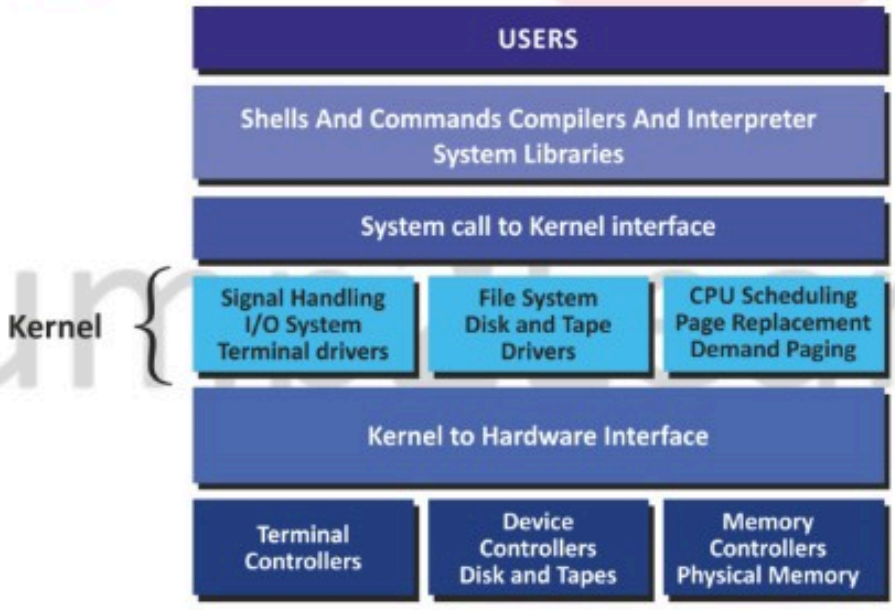
Unix has over 200 utility programs for various functions. New utilities can be built effortlessly by combining existing utilities.

Software Development Tools:

UNIX offers an excellent variety of tools for software development for all phases, from program editing to maintenance of software

1.2. System Structure

System Structure of Unix OS are as follows:



UNIX OPERATING SYSTEM STRUCTURE

As seen in the image, the main components of the Unix operating system structure are the kernel layer, the shell layer and the application layer.

Details about these are given as follows –

Kernel

The kernel provides a bridge between the hardware and the user. It is a software application that is central to the operating system. The kernel handles the files, memory, devices, processes and the network for the operating system. It is the responsibility of the kernel to make sure all the system and user tasks are performed correctly.

Shell

The program between the user and the kernel is known as the shell. It translates the many commands that are typed into the terminal session. These commands are known as the shell script. There are two major types of shells in Unix. These are Bourne shell and C Shell. The Bourne shell is the default shell for version 7 Unix.The character $ is the default prompt for the Bourne shell. The C shell is a command processor that is run in a text window. The character % is the default prompt for the C shell.

Applications

The applications and utility layer in Unix includes the word processors, graphics programs, database management programs, commands etc. The application programs provide an application to the end users.

For example, a web browser is used to find information while gaming software is used to play games. The requests for service and application communication systems used in an application by a programmer is known as an application program interface (API).

1.3. Shell & its features

The shell can easily be defined as the software program which acts as a communication bridge between kernel and user. When the user gives the commands the shell reads the commands, understands them and then sends a request to execute the program. Then when the program is executed it again sends the request to display the program to the user on-screen. The shell can also be called a command interpreter. As told above the shell calls the kernel there are all most 100 in build calls.

Various tasks which shell ask the kernel to do are

1. File opening.
2. File writing.
3. Executing programs.
4. Obtaining detailed information about the program.
5. Termination of the process.

Getting information about time and date.

There are multiple shells that are used by the UNIX OS. They include the Bourne shell (sh), the C shell (csh), the Korn shell (ksh) and the Bourne Again shell (bash). Each shell has own set of shell commands. Operating system commands are the same across all the shells.

The initial shell that the user logs into is defined by the system administrator. The user can change her default shell by using the "chsh" command. Users may want to change their shells in order to use particular features that are available in one shell or not another, or they may simply prefer a particular shell environment.

In every unix system, the user can customize his own shell, and users can use different shells on the same machine.The shell keeps a list of the commands you have typed in. If you need to repeat a command, use the cursor keys to scroll up and down the list or type history for a list of previous commands.

When you enter a command through the keyboard (Input), the unix shell thoroughly examines the input for special characters. If it finds any special characters it rebuilds a simplified command line, and finally communicates with the Kernel to verify that the command is executed.

Bourne Shell

The original Bourne shell is named after its developer at Bell Labs, Steve Bourne. It was the first shell used for the Unix operating system, and it has been largely surpassed in functionality by many of the more recent shells. However, all Unix and many Linux versions allow users to switch to the original Bourne Shell, known simply as "sh," if they choose to forgo features such as file name completion and command histories that later shells have added

C Shell

The C shell, as its name might imply, was designed to allow users to write shell script programs using a syntax very similar to that of the C programming language. It is known as "csh."

TC Shell

TC shell is an expansion upon the C shell. It has all the same features, but adds the ability to use keystrokes from the Emacs word processor program to edit text on the command line. For example, users can press Esc-D to delete the rest of the highlighted word. It is also known as "tcsh."

Korn Shell

Korn Shell was also written by a developer at Bell Labs, David Korn. It attempts to merge the features of the C shell, TC shell and Bourne shell under one package. It also

includes the ability for developers to create new shell commands as the need arises.It is known as "ksh."

Bourne-Again Shell

The Bourne-Again shell is an updated version of the original Bourne shell that was created by the Free Software Foundation for its open source GNU project. For this reason, it is a widely used shell in the open source community.

Its syntax is similar to that used by the Bourne shell, however it incorporates some of the more advanced features found in the C, TC and Korn shells.

Among the added features that Bourne lacked are the ability to complete file names by pressing the TAB key, the ability to remember a history of recent commands and the ability to run multiple programs in the background at once.It is known as "bash."

1.4. Kernel

Amongst the four layer's kernel is the most powerful one. The kernel contains mainly utilities along with the master control program. Kernel program has the power to start or stop a program and even handle the file system. It also suggests which program to be selected when two resources try to access the device at the same time for the same resource. As the kernel has special access to the OS this leads to the division of space between user-space and kernel-space.

Kernel structure is designed in such a way it should support primary UNIX requirements. Which are divided into two categories and listed below

1. Process management.
2. File management.

Process Management

The resource allocation in CPU, memory, and services are few things which will be handled under process management.

File Management

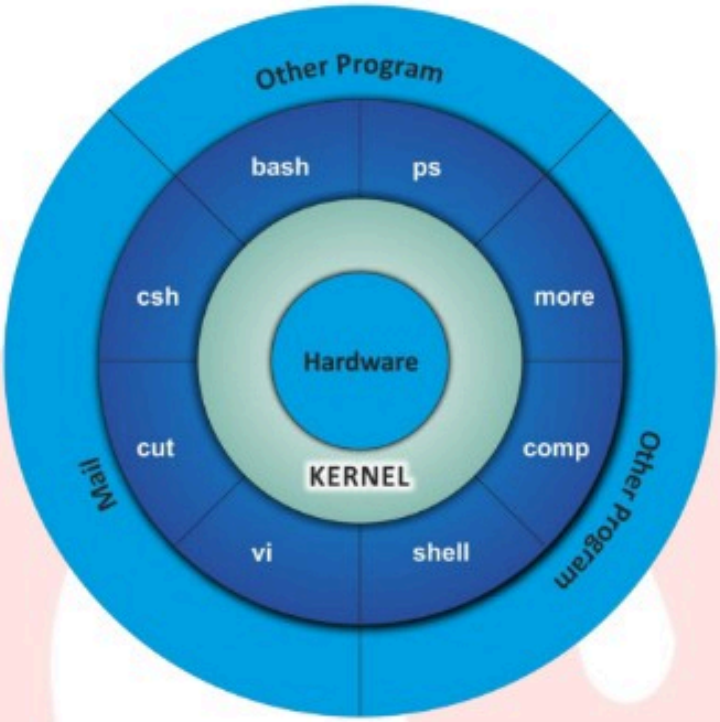
File management deals with managing all the data in files needed by the process while communicating with devices and regulating data transmission.

The main operations done by the kernel are

1. Kernel ensures the running of user-given programs is done on time.
2. Plays a role in memory allocation.
3. Manages the swapping between memory and disk.
4. Transports data between peripherals.
5. The kernel also requests service from the process.

That's the reason why the kernel is called as the heart of the UNIX system. The kernel itself can be defined as a small program that contains enough data structure to pass arguments and receive results from a call and the process them on the calling process.

1.5. Architecture of the UNIX OS



Kernel – interacts with the machine's hardware

Shell – interacts with the user

- **Kernel:**

The kernel is the heart of the operating system. It interacts with the hardware and most of the tasks like memory management, task scheduling and file management.

User programs that need to access the hardware (like hard disk or terminal) use the services of the Kernel, which performs the job on the user's behalf.

User interacts with the Kernel by using System calls. Kernel allocates memory and time to programs and handles the file store and communications in response to system calls.

As an illustration of the way that the Unix shell and the kernel work together, suppose a user types mv myfile myfile1 (which has the effect of renaming the file myfile). The unix shell searches the file store for the file containing the program mv, and then requests the kernel, through system calls, to execute the program mv on myfile. When the process mv myfile has finished running, the Unix shell then returns the UNIX prompt to the user, indicating that it is waiting for further commands.

SOME OTHER FUNCTIONS PERFORMED BY THE KERNEL IN UNIX SYSTEM ARE:

1. Managing the machine's memory and allocating it to each process and decides their priorities.
2. Scheduling the work done by the CPU so that the work of each user is carried out as efficiently as is possible.
3. Organizing the transfer of data from one part of the machine to another.
4. Accepting instructions from the Unix shell and carrying them out.
5. Enforcing the access permissions that are in force on the file system

- **Shell:**

The shell is the utility that processes your requests. When you type in a command at your terminal, the shell interprets the command and calls the program that you want. The shell uses standard syntax for all commands. C Shell, Bourne Shell and Korn Shell are the most famous shells which are available with most of the Unix variants.

- **Commands and Utilities:**

There are various commands and utilities which you can make use of in your day to day activities. cp, mv, cat and grep, etc. are few examples of commands and utilities. There are over 250 standard commands plus numerous others provided through 3rd party software. All the commands come along with various options.

- **Files and Directories:**

All the data of Unix is organized into files. All files are then organized into directories. These directories are further organized into a tree-like structure called the file system.