Introduction to UNIX

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What is Operating System?

- An operating system is a software that allows interaction with the hardware
- Manage hardware and resources

What is UNIX?

- A family of related operating system
- Different OS of this family is known as UNIX variants
- This family is built using a collection of enabling technologies were originally developed at 1970 at AT & T Bell Laboratory.
- Each variant share these set of utility programs

Why is UNIX important?

- Portability to a wide range of machine
- Its adaptability and simplicity
- The wide range of task it can perform
- Suitability for networking
- Multiuser and multitasking nature

Features of UNIX

- Open-source code

Source code for key variants of UNIX has been made available to the users and programmers

Features of UNIX

- Co-operative tools and Utilities

Simple commands to carryout specific task
Small programming language can use to build script to solve our own problem

Features of UNIX

- Multiuser and Multitasking

Can be used for computers for with many user or a single user

Features of UNIX

- Excellent Networking Environment

It offers programs and utilities that provide the services needed to build network applications- the basis for distributed and networking computing

Features of UNIX

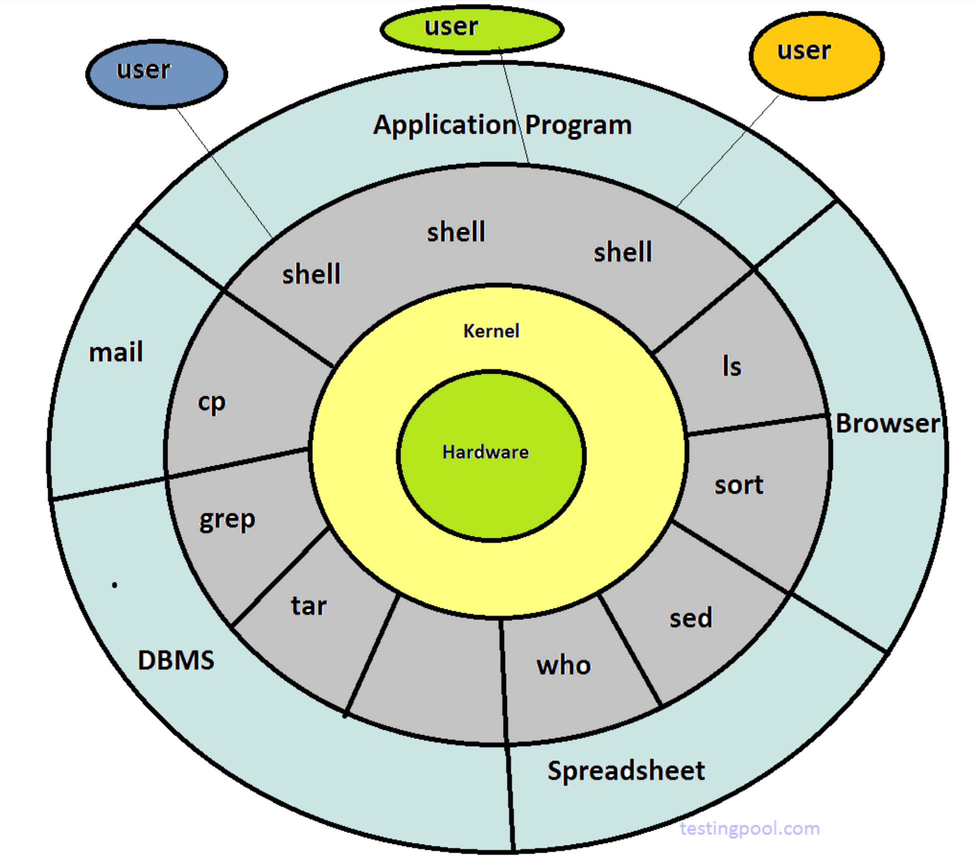
- Portability

Less work is needed to adapt it to run on a new hardware platform as it is written in C language.

Unix Architecture

UNIX architecture has four layers

- Application Program
- Shell
- Kernel
- Hardware



Application Program

- Allows user to perform a specific task
- Any software that lets you perform a task

Shell

Shell is an interpreter program that interprets the commands entered by the user and then sends the requests to the kernel to execute those commands.

Kernel

- It perform vital operations
- Lowest level of software
- Start on boot
- handles the hardware effectively by using the device drivers
- Key responsibility: memory management, process management, device management, security

Hardware

- Consists of all physical device on your PC
- It includes CPU, RAM, Storage, USBs, monitor etc

File and Process

- A file is an array of bytes that can contain virtually anything
- A file is related to another file by being part of a single hierarchical structure
- File should be located with reference to a predetermined place
- UNIX consider files directories and devices as files
- Process is the name given to a file when it is executed as program
- Process is a time image of an executable code

System Calls

- Thousand of commands in the system use a system calls to communicate with kernel
- All UNIX flavor use same system calls: POSIX specification
- The OS use different system calls, won’t be UNIX
- C program in UNIX environment has complete access to system calls but in windows environment access through library function

Birth of UNIX

- The history of the UNIX System dates back to the late 1960s when MIT, AT&T Bell Labs, and then computer manufacturer GE (General Electric) worked on an experimental operating system called Multics.
- In 1969, Ken Thompson, one of the Bell Labs researchers involved in the Multics project, wrote a game for the GE computer called Space Travel. This game simulated the solar system and a space ship. Thompson found that the game ran jerkily on the GE machine and was costly-approximately $75 per run! With help from Dennis Ritchie, Thompson rewrote the game to run on a spare DEC PDP-7.
- This initial experience gave him the opportunity to write a new operating system on the PDP-7, using the structure of a file system Thompson, Ritchie, and Rudd Canaday had designed. Thompson, Ritchie, and their colleagues created a multitasking operating system, including a file system, a command interpreter, and some utilities for the PDP-7.
- Because the new multitasking operating system for the PDP-7 could support two simultaneous users, it was humorously called UNICS for the Uniplexed Information and Computing System; the first use of this name is attributed to Brian Kernighan. The name was changed slightly to UNIX in 1970, and that has stuck ever since.

UNIX standards

- Standards steers the evaluation of the UNIX system
- Features are developed for a particular variety of UNIX, and then sometimes these features become part of a standard process
- Once a feature is standardized, different versions of UNIX include a compliant version of this feature

The System V Interface Definition(SVID)

- The System V Interface Description (SVID) is a document describing the AT&T Unix System V operating system. It is to some extent a superset of the POSIX standard.
- The GNU C Library defines most of the facilities required by the SVID that are not also required by the ISO C or POSIX standards, for compatibility with System V Unix and other Unix systems.
- The supported facilities from System V include the methods for inter-process communication and shared memory.

POSIX

- POSIX (Portable Operating System Interface) is a set of standard operating system interfaces based on the Unix operating system.
- The most recent POSIX specifications -- IEEE Std 1003.1-2017 -- defines a standard interface and environment that can be used by an operating system (OS) to provide access to POSIX-compliant applications.
- The standard also defines a command interpreter (shell) and common utility programs.
- POSIX supports application portability at the source code level so applications can be built to run on any POSIX-compliant OS.

LINUX

- In 1984 Richard Stallman began work on a free operating system called GNU
- The goal of the GNU project was to make GNU like UNIX, without using any UNIX source code.
- In 1991 Linus Torvalds, then a student at the University of Helsinki, Finland, decided to build a kernel for a new UNIX-like operating system for PCs.
- The goal of the developers of the Linux kernel is not to use any proprietary code.
- The kernel is legally protected by the GNU Public License; it is packaged with many executables making up a fully functional version of UNIX.

UNIX vs LINUX

UNIX	LINUX
Developed in the late 1960s by Ken Thompson and Dennis Ritchie of AT&T Bell Labs; modified over time by nonprofit organizations and commercial vendors.	Developed by Linus Torvalds in the 1990s, and the Linux community of developers continues to develop it.
Core assembly language: C	Core assembly language: C
Versions include but are not limited to AIS, BSD, Iris, and HP-UX.	Versions include but are not limited to Ubuntu, Debian, Solaris, and Redhat.
Smaller user community that focuses heavily on enterprise computing	Large, active, open-source community of users and contributors
Includes a graphical user interface (GUI) similar to Windows, but is compatible with other GUIs such as Gnome.	Many graphical user interface (GUI) options, including Gnome, KDE, Unity, and Mate.
Default shell is Bourne Shell.	Supports multiple command interpreters, but BASH is the default shell for Linux. Initially designed to support Intel's X86 hardware processors, but evolved to be compatible with other software.
Historically used for academic and enterprise applications.	Created to be an alternative, free version of the MINIX operating system.

Linux Distribution

- A specific flavor of Linux OS
- Linux kernel is the core component
- there are hundreds of Linux distribution

Linux Distribution: Debian

- First release in 1993, first stable release in 1996
- stable, reliable, fully open source
- supports many architectures

Linux Distribution: Ubuntu

- first release in 2004
- Debian based
- developed and managed by Canonical
- Three edition

➢Ubuntu desktop

➢Ubuntu server

➢Ubuntu core

Linux Distribution: Red Hat

- Core linux distro
- stable, reliable, fully open source
- Managed by Red Hat
- Red Hat Enterprise Linux

Linux Distribution: Fedora

- Support many architectures
- Very reliable and secure
- Actively developed, large community
- Sponsored by Red Hat

Linux Distribution: SUSE

- Support Many architecture
- Two edition

➢Server(SLES)

➢Desktop(SLED)

Internal and External Command

- Internal Command

➢shell will not look in its PATH to locate it, it will execute form its own set of built-in commands that are not stored as separate files.

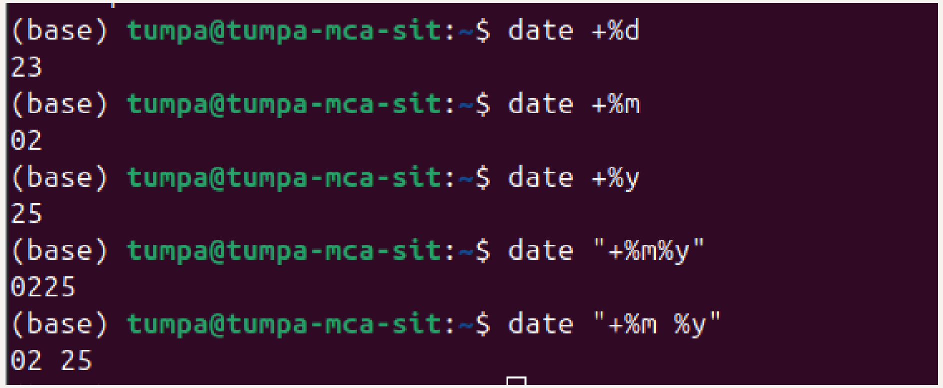
- External Command

➢is a program or file having an independent existence in the /bin directory

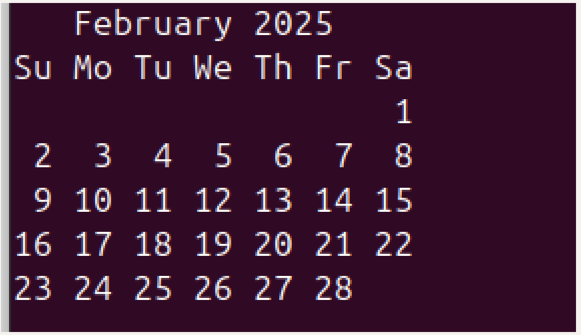
➢most commands are external in nature

Utilities of UNIX

- cal- shows a calendar of the current month.
- date- shows the current date and time.
- echo- print value or variable
- bc- acts as a scientific calculator.
- password- change your password, which you should do regularly (at least once a year).



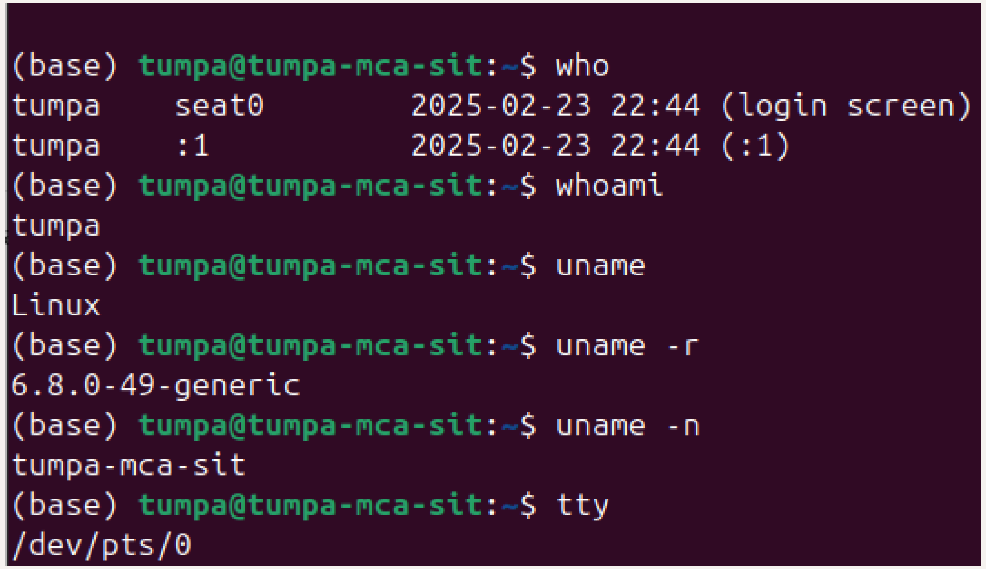
```
(base) tumpa@tumpa-mca-sit:~$ date +%d
23
(base) tumpa@tumpa-mca-sit:~$ date +%m
02
(base) tumpa@tumpa-mca-sit:~$ date +%y
25
(base) tumpa@tumpa-mca-sit:~$ date "+%m%y"
0225
(base) tumpa@tumpa-mca-sit:~$ date "+%m %y"
02 25
```



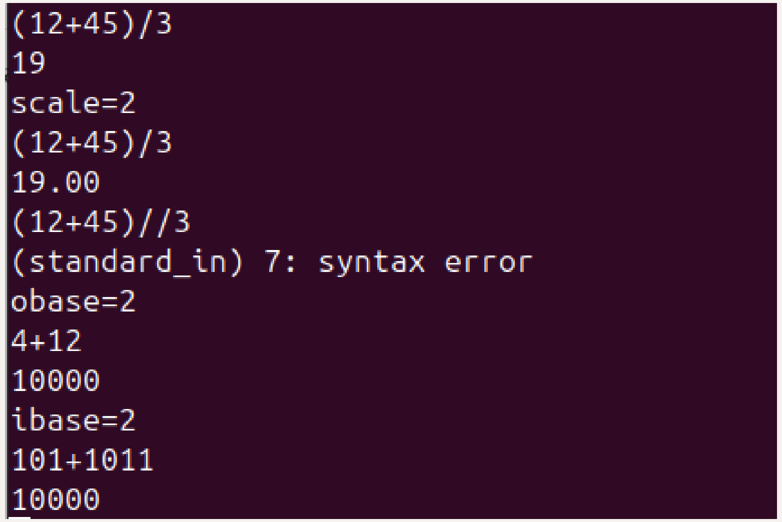
```
   February 2025
Su Mo Tu We Th Fr Sa
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28
```

Utilities of UNIX

- who- tells you who's logged on, and where they're coming from. Useful if you're looking for someone who's actually physically in the same building as you, or in some other particular location.
- uname- print Unix system information
- tty- print the file name of the terminal connected to standard input

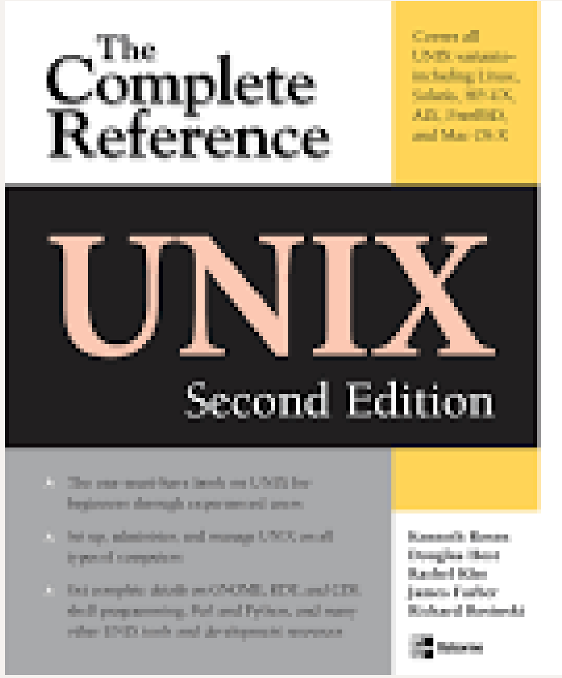


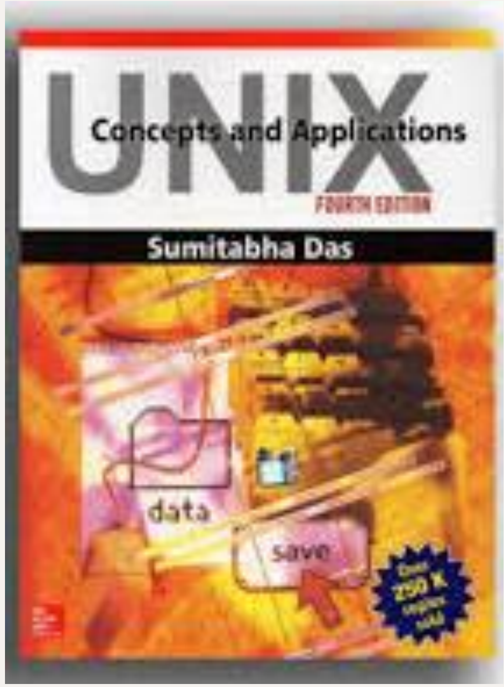
```
(base) tumpa@tumpa-mca-sit:~$ who
tumpa    seat0        2025-02-23 22:44 (login screen)
tumpa    :1           2025-02-23 22:44 (:1)
(base) tumpa@tumpa-mca-sit:~$ whoami
tumpa
(base) tumpa@tumpa-mca-sit:~$ uname
Linux
(base) tumpa@tumpa-mca-sit:~$ uname -r
6.8.0-49-generic
(base) tumpa@tumpa-mca-sit:~$ uname -n
tumpa-mca-sit
(base) tumpa@tumpa-mca-sit:~$ tty
/dev/pts/0
```



```
(12+45)/3
19
scale=2
(12+45)/3
19.00
(12+45)//3
(standard_in) 7: syntax error
obase=2
4+12
10000
ibase=2
101+1011
10000
```

Reference


The Complete Reference
Covers all UNIX variants including Linux, Solaris, HP-UX, AIX, FreeBSD, and Mac OS X
UNIX
Second Edition
Kenneth Rosen
Douglas Host
Rachel Klee
James Farber
Richard Rosinski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