Department of Computer Science & Information Technology

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Lab Record Submission

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LINUX

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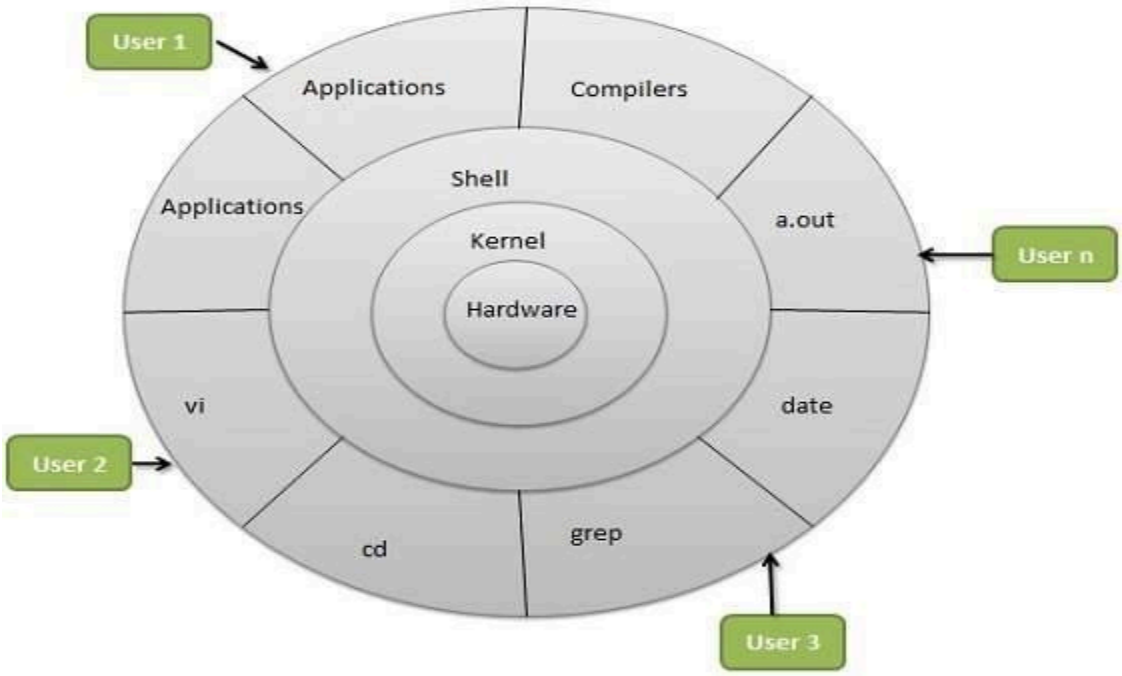
Experiment No - 3

Study of Linux Architecture and different types of Kernel and shell -

The architecture of a Linux System consists of the following layers -

- **Hardware layer** − Hardware consists of all peripheral devices (RAM/ HDD/ CPU etc).
- **Kernel** − It is the 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. The shell takes commands from the user and executes kernel's functions.
- **Utilities** − Utility programs that provide the user most of the functionalities of an operating systems.



#Kernel -

- A microkernel delegates user processes and kernel services in different address spaces.
- A monolithic kernel implements services in the same address space.
- A hybrid kernel, such as the Microsoft Windows NT and Apple XNU kernels, attempts to combine the behaviors and benefits of microkernel and monolithic kernel architectures.

- A nanokernel focuses on providing minimal services limited to low-level hardware management, delegating most other services to higher-level modules.
- An exokernel exposes hardware resources directly to applications, giving them more control over hardware.
- A multikernel uses multiple kernels to manage different hardware resources, commonly used in distributed environments.

#Types of Kernel -

There are some of the important kernel types which are mentioned below:

- Monolithic Kernel
- Micro kernels
- Exo kernels
- Hybrid kernels

1) Monolithic Kernel -

It is one of the types of kernel where all operating system services operate in kernel space. It has dependencies between system components. It has huge lines of code which is complex.

2) Micro Kernel -

It is a kernel type which has a minimalist approach. It has virtual memory and thread scheduling. It is more stable with less services in kernel space. It puts rest in user space. It is used in small os.

3) Exo Kernel -

It is the type of kernel which follows an end-to-end principle. It has fewest hardware abstractions as possible. It allocates physical resources to applications.

4) Hybrid Kernel -

It is the combination of both monolithic kernel and microkernel. It has speed and design of monolithic kernel and modularity and stability of microkernel.

Shells -

SHELL is a program which provides the interface between the user and an operating system. When the user logs in OS starts a shell for user. Kernel controls all essential computer operations, and provides the restriction to hardware access, coordinates all executing utilities, and manages Resources between process. Using kernel only user can access utilities provided by operating system.

Types of shells -

1) The C Shell -

Bill Joy created it at the University of California at Berkeley. It incorporated features such as aliases and command history. It includes helpful programming features like built-in arithmetic and C-like expression syntax. In C shell:

Command full-path name is /bin/csh,

Non-root user default prompt is hostname %,

Root user default prompt is hostname #.

2) The Bourne Shell -

It was written by Steve Bourne at AT&T Bell Labs. It is the original UNIX shell. It is faster and more preferred. It lacks features for interactive use like the ability to recall previous commands. It also lacks built-in arithmetic and logical expression handling. It is the default shell for Solaris OS. For the Bourne shell the:

Command full-path name is /bin/sh and /sbin/sh,

Non-root user default prompt is $,

Root user default prompt is #.

3) The Korn Shell -

It was written by David Korn at AT&T Bell Labs. It is a superset of the Bourne shell. So it supports everything in the Bourne shell.It has interactive features. It includes features like

built-in arithmetic and C-like arrays, functions, and string-manipulation facilities. It is faster than C shell. It is compatible with scripts written for C shell. For the Korn shell the:

Command full-path name is /bin/ksh,

Non-root user default prompt is $,

Root user default prompt is #.

4) GNU Bourne - Again Shell -

It is compatible to the Bourne shell. It includes features from Korn and Bourne shell. For the GNU Bourne-Again shell the:

Command full-path name is /bin/bash,

Default prompt for a non-root user is bash-g.gg$

(g.ggindicates the shell version number like bash-3.50$),

Root user default prompt is bash-g.gg#.