



Module Code & Module Title

Level 5 – Choose a Module

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Semester

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Introduction-:

Modern computer is made up of complex architecture which contains processors, main memory, disks, printers, keyboard, mouse, display, network interfaces and various input/output devices. For this reason, computers are equipped with a layer of software called operating system which provides user a better, simpler, cleaner, model of computer and handle all the resources. The program that user interact with, usually called the shell in the text based and GUI when it uses icons. Most computers have two modes kernel mode and user mode. The most fundamental piece of software runs in kernel mode also known as supervisor mode. In kernel mode it has complete access to the hardware and can execute instructions on the machine which the machine is capable of and rest of software runs in user mode.

Some of the functions of kernel are-:

1. Process Management
 - Kernel schedules the execution process of different tasks,
 - It is responsible to start and stop processes for example-: opening a browser the OS creates a new process that involves several key steps such as memory allocation,
2. Memory Management
 - It handles memory protection and sharing of memory,
 - A process doesn't access the physical RAM directly first the process uses virtual address later which are mapped to physical address in RAM kernel handles the virtual memory,
3. Device Management
 - Kernel manages the input and output operations between hardware devices,
 - Kernel also manages device driver communications,
4. File System Management
 - Kernel implements different security protocols to protect files,
 - Handles mounting and unmounting of different files needed for OS.
5. Resource Management
 - Kernel manages system resource like CPU time, storage and network bandwidth,
 - Kernel also monitors resource usage.
6. Security
 - Kernel manages user login system to allow only authorized users to access resources,
 - It also ensures system security and integrity.

Types of kernel-:

Generally, there are five types of kernel which are given bellow:

In this section we are going to discuss about Monolithic kernels and microkernel

i) Monolithic

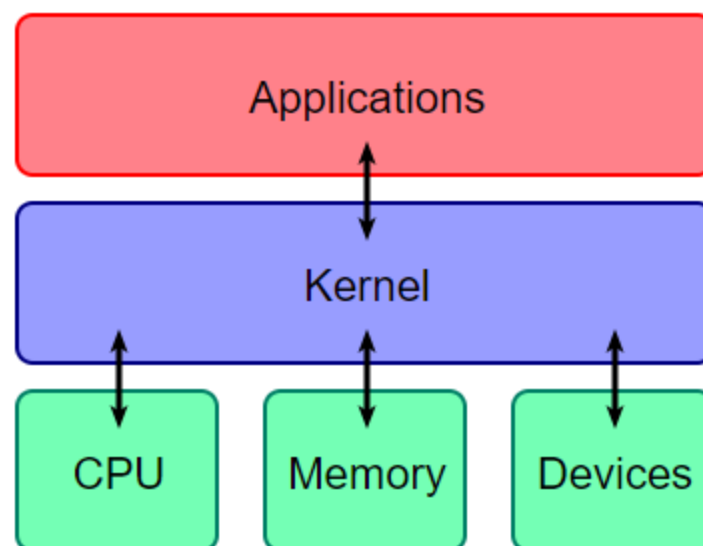
In this type of system, the OS runs as a single program in kernel mode. OS is written as a collection of procedures which are linked together into a single large executable program. The execution time of this kernel is faster than other kernel as it uses same memory space. Some of the examples are:- Unix, Linux, Open VMS

Advantages:-

- Execution process is faster than other kernels,
- It is single piece of software services running in the kernel can easily communicate each other.

Disadvantages:-

- These kernel does not follow the concept of vendor-locked in so for every hardware architecture kernels must be rewritten,
- Modifying or adding new service is difficult because whole OS needs to be modified.



ii) Microkernel:-

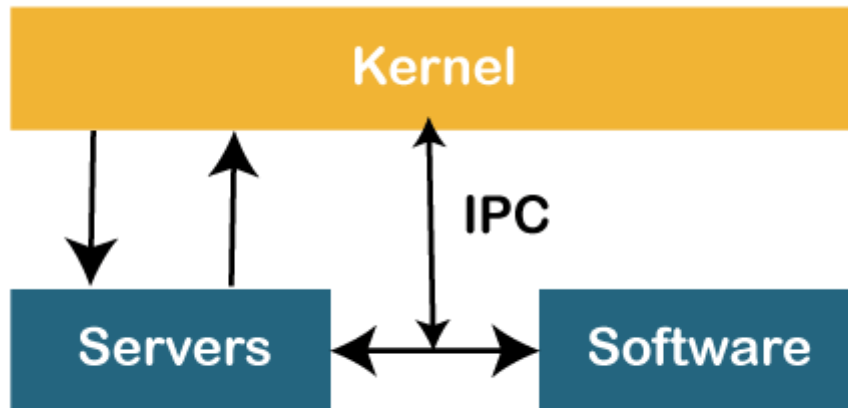
These type of kernel are different from monolithic kernel. In micro Kernel services are divided into different address user space and kernel space. So that the size of OS and micro Kernel is decreased. They are easier to manage or update any new services. They are much slower than microkernel because two different memory space. Services such as networking are not provided by kernels. Examples of these type of kernel are:- L4, AmigaOS, Minix

Advantages-:

- They can be managed easily than the monolithic kernel,
- If one of the process of micro kernel crashes, we can still prevent the whole system from crashing.

Disadvantages-:

- Requirements of more interface software which reduces the system performance,
- If any system bugs occur debugging the bugs are very difficult.



Popular Kernels and their history-:

Kernels used by some of the famous OS like ios, windows and Ubuntu are:

- i) IOS**
IOS is based on XNU kernel it is a type of hybrid kernel. It is built upon Mach micro kernel. It has both monolithic and microkernel architectural components. It contains elements found in monolithic kernels like device drivers, file system support as well as elements of micro kernel like task and thread management, inter-process communication and memory management.
XNU was developed by NeXT for the NeXTSTEP os. It is a hybrid kernel which was derived from the mach kernel.
- ii) Windows**
Similar to iOS kernel windows system also has hybrid kernel named Windows NT kernel. Because it is also hybrid kernel it has similar functions as IOS kernel. It also has element of monolithic as well as micro kernel that maintain modularity in the system. The first version of windows NT was produced for server computers. Later in time windows cooperation made it available for personal computers.
- iii) Ubuntu**
Ubuntu uses Linux kernel. Linux is an open source kernel. It is basically classified as monolithic kernel that means it manages system resources

and gives different resources like file system, device drivers, memory management. The community of Linux kernel is very wide in world.

Boot Process-:

Every computer contains a parent board called motherboard. On the mother board there is a program called BIOS. Bios contains low-level input output software. When the computer is booted the BIOS is started. It first checks the capacity of RAM and other basic hardware components are connected or not. Then it starts scanning PCIe and PCL buses to detect all the devices. Then the BIOS determines the boot device by trying a list of devices stored in the CMOS memory. First sector from the boot device is read into memory and executed. It contains a program that examines the partition table at the end of the boot sector to determine which partition is active. Then a secondary boot loader is read from that partition which reads operating system from the active partition and starts it.

Conclusion-:

In conclusion, we can say kernel has a major role in the functioning of an OS. It manages essential tasks such as process and memory management, device communication, file system, and networking. Boot process begins with the BIOS in the parent board which is mother board which activates kernel. After the kernel is activated kernel takes control of the system from BIOS.

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