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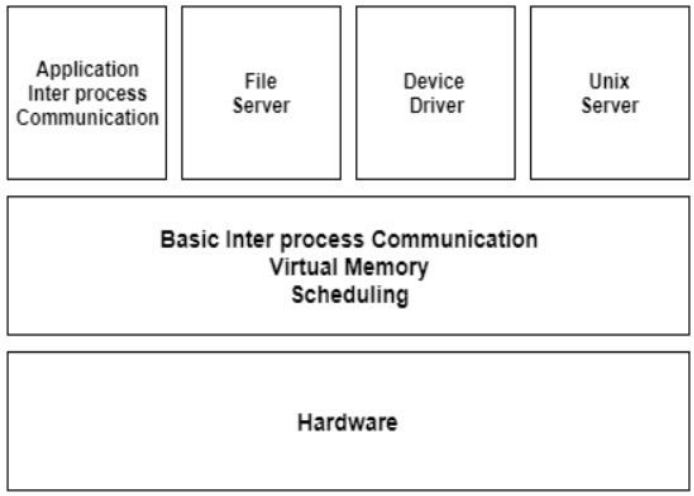
OPERATING SYSTEM ASSIGNMENT

MICROKERNALS

A microkernel is the minimum software that is required to correctly implement an operating system. This includes memory, process scheduling mechanisms and basic inter-process communication.
Microkernel is one of the classification of the kernel. Being a kernel it manages all system resources. But in a microkernel, the **user services** and **kernel services** are implemented in different address space. The user services are kept in **user address space**, and kernel services are kept under **kernel address space**, thus also reduces the size of kernel and size of operating system as well.

It provides minimal services of process and memory management. The communication between client program/application and services running in user address space is established through message passing, reducing the speed of execution microkernel. The Operating System **remains unaffected** as user services and kernel services are isolated so if any user service fails it does not affect kernel service. Thus it adds to one of the advantages in a microkernel. It is easily **extendable** i.e. if any new services are to be added they are added to user address space and hence requires no modification in kernel space. It is also portable, secure and reliable.

A diagram that demonstrates the architecture of a microkernel is as follows:



Microkernel Based Operating System

In the above diagram, the microkernel contains basic requirements such as memory, process scheduling mechanisms and basic interprocess communication. The only software executing at the privileged level i.e. kernel mode is the microkernel. The other functions of the operating system are removed from the kernel mode and run in the user mode. These functions may be device drivers, file servers, application interprocess communication etc.

The microkernel makes sure that the code can be easily managed because the services are divided in the user space. This means that there is less code running in the kernel mode which results in increased security and stability.

Essential Components in a Microkernel

A microkernel contains only the core functionalities of the system. A component is included in the microkernel only if putting it outside would disrupt the functionality of the system. All the other non-essential components are put in the user mode.

The minimum functionalities included in the microkernel are:

- Memory management mechanisms like address spaces are included in the microkernel. This also contains memory protection features.
- Processor scheduling mechanisms are also necessary in the microkernel. This contains process and thread schedulers.
- Interprocess communication is important as it is needed to manage the servers that run their own address spaces.

Performance of a Microkernel System

Providing services in a microkernel system are much more expensive than in a normal monolithic system. The service is obtained by sending an interprocess communication message to the server and getting one in return. This means a context switch or a function call if the drivers are implemented as processes or procedures respectively.

So performance can be complicated in microkernel systems and may lead to some problems. However, this issue is reducing in the modern microkernel systems created such as L4 microkernel systems.

Advantages of Microkernel

Here, are the pros/benefits of using Microkernel

- Microkernel architecture is small and isolated therefore it can function better.
- Microkernels are secure because only those components are included that disrupt the functionality of the system otherwise.
- The expansion of the system is more accessible, so it can be added to the system application without disturbing the Kernel.
- Microkernels are modular, and the different modules can be replaced, reloaded, modified without even touching the Kernel.
- Fewer system crashes when compared with monolithic systems.
- Microkernel interface helps you to enforce a more modular system structure.
- Without recompiling, add new features
- Server malfunction is also isolated as any other user program's malfunction.
- Microkernel system is flexible, so different strategies and APIs, implemented by different servers, which can coexist in the system.
- Increased security and stability will result in a decreased amount of code which runs on kernel mode

Disadvantage of Microkernel

Here, are drawback/cons of using Microkernel:

- Providing services in a microkernel system are expensive compared to the normal monolithic system.
- Context switch or a function call needed when the drivers are implemented as procedures or processes, respectively.
- The performance of a microkernel system can be indifferent and may lead to some problems.

Summary:

- A kernel is an important part of an OS that manages system resources.
- A microkernel is a software or code which contains the required minimum amount of functions, data, and features to implement an operating system.
- In Monolithic Kernel approach, the entire operating system runs as a single program in kernel mode
- A Microkernel is the most important part for correct implementation of an operating system.
- A microkernel comprises only the core functionalities of the system.
- A monolithic kernel is a large process running in a single address space, whereas Microkernel can be broken down into separate processes called servers.
- Microkernel architecture is small and isolated therefore it can function better
- Providing services in a microkernel system are expensive compared to the normal monolithic system

Eclipse IDE is a good example of Microkernel Architecture.