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Subject-name: Operating System

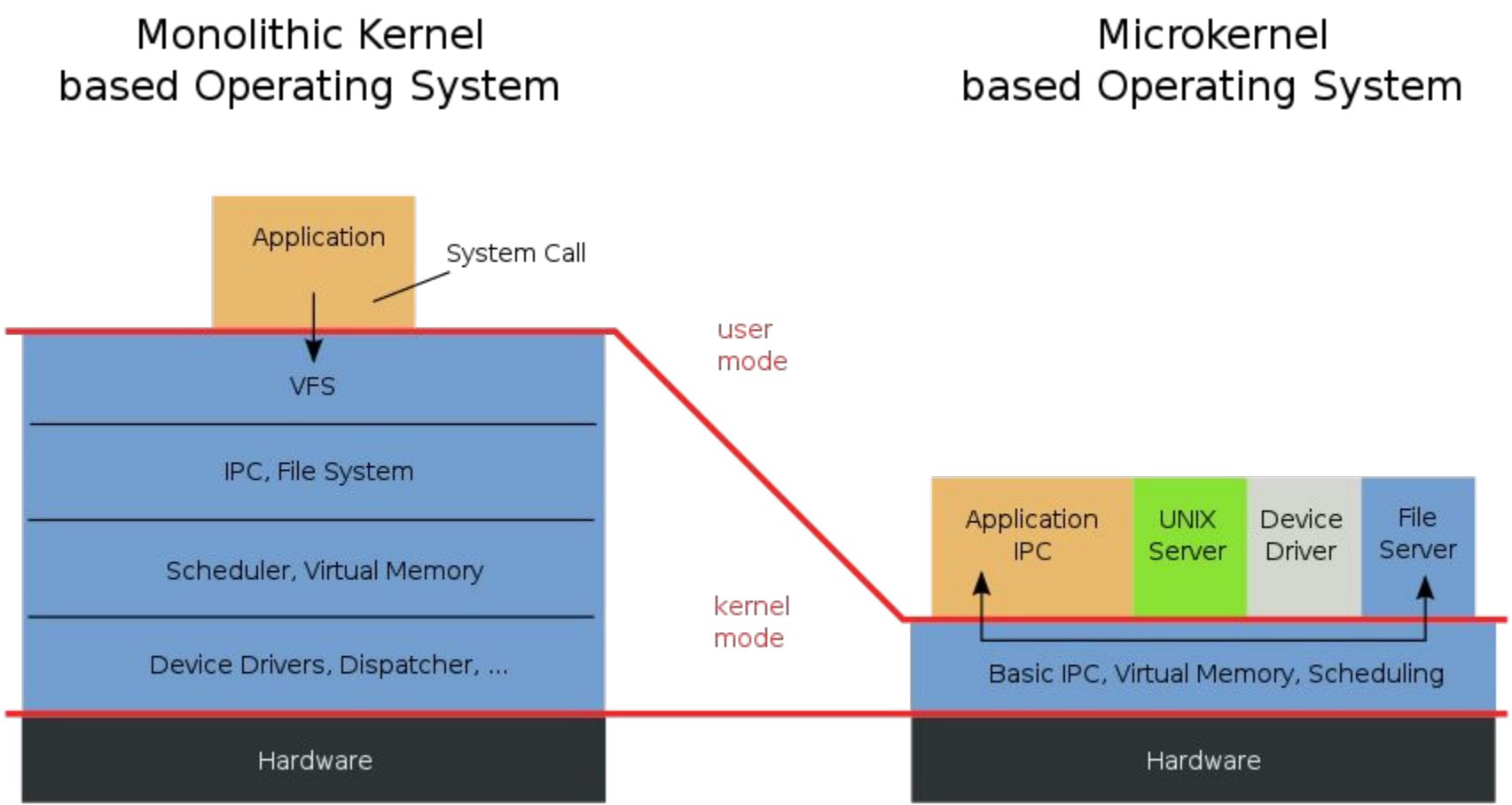
Topic: **Microkernel Operating System**

Microkernel

In computer science, a **microkernel** (often abbreviated as **µ-kernel**) is the near-minimum amount of software that can provide the mechanisms needed to implement an operating system (OS). These mechanisms include low-level address space management, thread management, and inter-process communication (IPC).

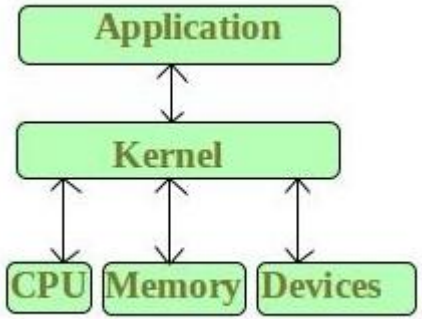
If the hardware provides multiple rings or CPU modes, the microkernel may be the only software executing at the most privileged level, which is generally referred to as supervisor or kernel mode. Traditional operating system functions, such as device drivers, protocol stacks and file systems, are typically removed from the microkernel itself and are instead run in user space.

Structure of monolithic and microkernel-based operating systems, respectively



Microkernel in os

Kernel is the core part of an operating system which manages system resources. It also acts like a bridge between application and hardware of the computer. It is one of the first programs loaded on start-up (after the Bootloader).



Kernel mode and User mode of CPU operation

The CPU can execute certain instruction only when it is in the kernel mode. These instruction are called privilege instruction. They allow implementation of special operation whose execution by the user program could interface with the functioning of operating system or activity of another user program. For example, instruction for managing memory protection.

- The operating system puts the CPU in kernel mode when it is executing in the kernel so, that kernel can execute some special operation.
- The operating system puts the CPU in user mode when a user program is in execution so, that user program cannot interface with the operating system program.
- User-level instruction does not require special privilege. Example are ADD,PUSH,etc.

Microkernel Architecture –

Since kernel is the core part of the operating system, so it is meant for handling the most important services only. Thus in this architecture only the most important services are inside kernel and rest of the OS services are present inside system application program. Thus users are able to interact with those not-so important services within the system application. And the microkernel is solely responsible for the most important services of operating system they are named as follows:

- Inter process-Communication
- Memory Management
- CPU-Scheduling

Inter-process communication

Inter-process communication (IPC) is any mechanism which allows separate processes to communicate with each other, usually by sending messages. Shared memory is, strictly defined, also an inter-process communication mechanism, but the abbreviation IPC usually refers to message passing only, and it is the latter that is particularly relevant to microkernels.

Servers

Microkernel servers are essentially daemon programs like any others, except that the kernel grants some of them privileges to interact with parts of physical memory that are otherwise off limits to most programs. This allows some servers, particularly device drivers, to interact directly with hardware.

Nanokernel

The term *nanokernel* or *picokernel* historically referred to:

- A kernel where the total amount of kernel code, i.e. code executing in the privileged mode of the hardware, is very small. The term *picokernel* was sometimes used to further emphasize small size. The term *nanokernel* was coined by Jonathan S. Shapiro in the paper *The KeyKOS NanoKernel Architecture*. It was a sardonic response to Mach, which claimed to be a microkernel while Shapiro considered it monolithic, essentially unstructured, and slower than the systems it sought to replace. Subsequent reuse of and response to the term, including the picokernel coinage, suggest that the point was largely missed. Both *nanokernel* and *picokernel* have subsequently come to have the same meaning expressed by the term microkernel.
- A virtualization layer underneath an operating system, which is more correctly referred to as a hypervisor.
- A hardware abstraction layer that forms the lowest-level part of a kernel, sometimes used to provide real-time functionality to normal operating systems, like Adeos.

Reference

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Thank You